Chapter I 1.5T GDI Engine Introduction

1.1 Technical parameter andprotection part mark of 1.5T GDI engine

1.1.1 Engine technical parameter

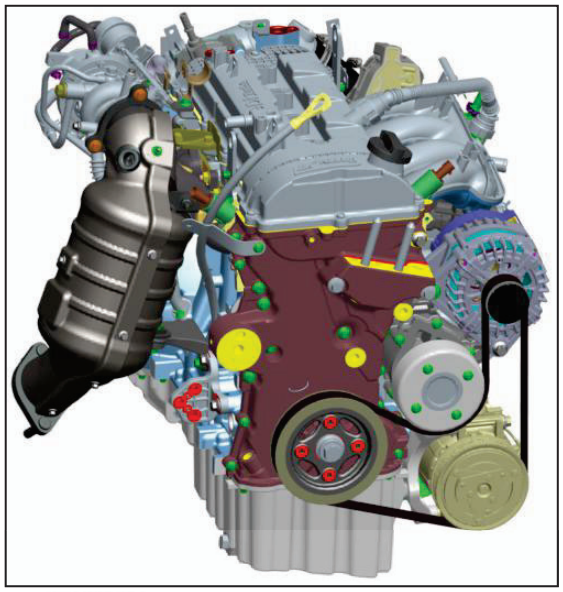
Engine model		HFC4GC1.6E
Engine type		Inline four cylinders, double overhead camshafts, 16 air valves, DVVT
Working method		Four-stroke, turbocharging water cooling, gasoline direct injection, homogeneous combustion
Emission Standard		Euro-6b
Fuel type		Gasoline
Fuel oil No.		92# or above
Main Performance Parameters	Idling rotation speed（r/min ）	700~30
	Max exhaust gas temperature (℃)	≤950
	Net power(kW)	120
	Rated rotation speed（r/min ）	4850-5500
	Noise when in full speed and full load (dB（A）)	97@5500
	Low-end torque(N•m)	150
	Low-end torque speed（r/min）	1000
	Maximum torque(N•m)	251
	Maximum torque speed（r/min）	1500-4500
	Universal characteristic minimum	245

	fuel consumption ratio (g/kW·h)	
	Total load minimum fuel consumption(g/kW·h)	275
	2000@2bar fuel consumption rate （g/kW·h）	380
	Engine oil consumption amount at rated power (g/h)	≤46.8
Main structural parameters	Location type	In-line
	Cylinder number	4
	Valve number	16
	Displacement（ml）	1499
	Displacement of each cylinder （ml）	374.8
	Compression ratio	9.7
	Cylinder diameter(mm)	75
	Stroke (mm)	84.8
	Engine cylinder core distance (mm)	83
	Crankshaft offset amount(mm)	8
	Thermodynamics detonation pressure (Mpa)	9.5
	Crankshaft Rotating Direction	Counterclockwise(face to engine power output end)
	Ignition sequence	1-3-4-2
	Driving mode	Electrical power start
	Lubrication method	Pressure and splash composite
	Cooling form	Water cooling
	Outside dimension (L×W×H) mm	645×703×714
	Whole machine weight (kg)	About 145

1.1.2 Environmental protection key component identification

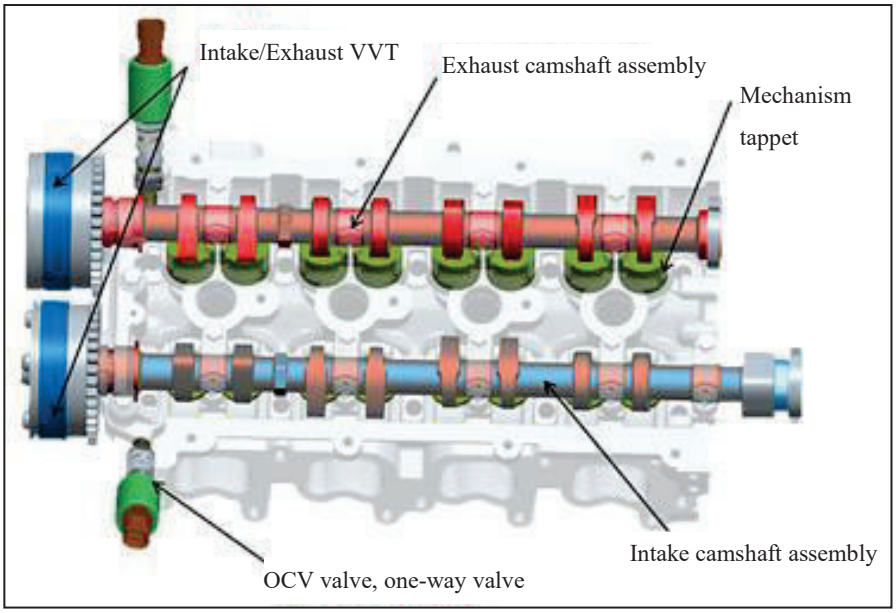
Environmental protection key parts	Label
Catalytic converter	Notification No.: 1200105 Factory: Youmeike Packaging: Suzhou Shenda Painting layer: Youmeike Carrier: NGK
Front oxygen sensor	Notification No.: OSL Manufacturer: DELPHI
Rear oxygen sensor	Notification No.: RE94 Manufacturer: DELPHI
PCV valve	Notification No.: 1014104 Manufacturer: XF
ECU	Notification No.: MT92.1 Manufacturer: DELPHI
Turbocharger	Notification No.: NGT14Z Factory: HONEYWELL
Fuel guide rail	Notification No.: RE10K0 Manufacturer: DELPHI

1.2 Main technical characteristic of 1.5T GDI engine



1.5T GDI engine adopts homogeneous in-cylinder direct injection technology, and integrates DVVT and TCI technology to give full play to the advantages of each technology. At the same time, it also makes the engine small, replacing the large displacement engine, achieving the purpose of energy saving and emission reduction, and meeting the requirements of China-6B emission regulations.

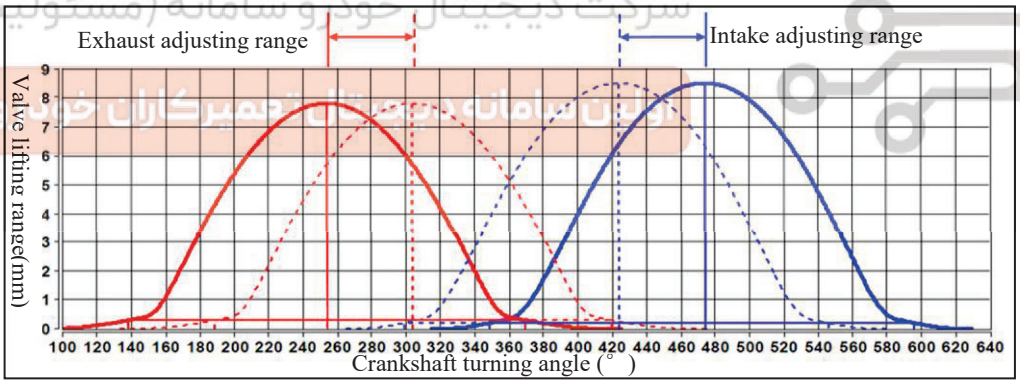
1.2.1 Dual VVT (Variable Valve Timing) Technology



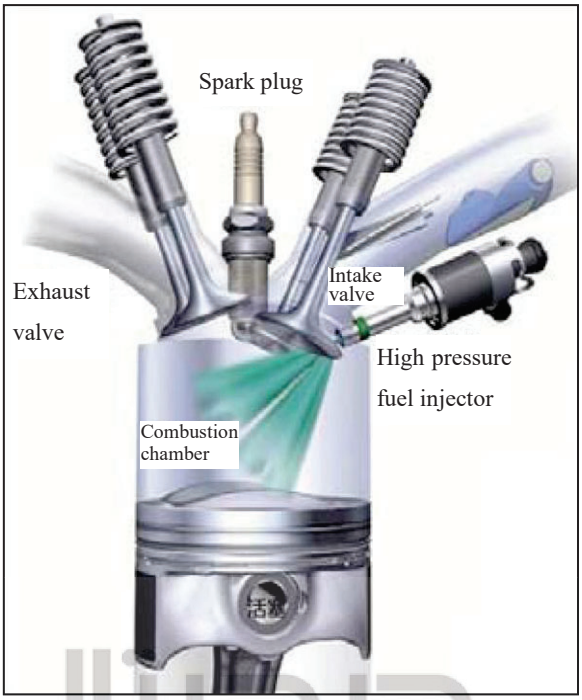
The principle of VVT technology is to adjust the phase of the engine camshaft according to engine running condition and through the equipped control and execution system, so as to adjust the intake and exhaust valve opening/closing time and angle, so as to achieve the optimal value of air entering amount, improve the combustion efficiency and increase the engine power.

The dual VVT technology used in 1.5T GDI engine can simultaneously control the intake and exhaust camshaft, using reasonable valve timing and intake and exhaust overlap angle, the maximum adjustment angle up to 50°, so that the engine in the best "breathing" state.

At the same time, dual VVT technology can be used to increase the valve overlap angle, so as to realize the scavenging energy (GDI+DVVT+Turbo combined derivative technology), so that the fresh air partly can be swept out of the combustion chamber. After passing the turbocharger, the response of the turbocharger can be accelerated to achieve the purpose of improving the engine torque response in a short time.



1.2.2 In-cylinder Direct Inspection Technology



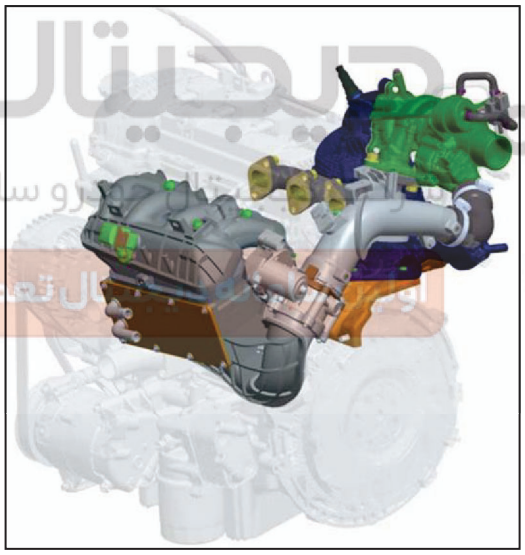
The in-cylinder direct injection technology is to install the fuel injector in the cylinder and directly inject the fuel into the cylinder to mix with the intake air. The injection pressure is also further increased, making the fuel atomization more detailed, truly realizing the accurate proportional control of the injection and mixing with the intake air, eliminating the shortcomings of the injection out of the cylinder.

At the same time, the control of the spray shape and the intake air flow, as well as the special design of the fuel injector position, piston top shape and others, can make the mixture be fully and evenly mixed in the entire cylinder, so as to make the fuel fully combustion, energy conversion efficiency is higher. Combined with the sharp progress in recent years on the electrical system control technology, the identification and control of the intake amount and the injection time of the computer is also more accurate, therefore, in combination with direct injection (GDI) technology to make the engine combustion efficiency is improved, besides allows the engine to produce more power, the technology for environmental protection, energy conservation and also has positive influence.

The 1.5T GDI engine uses the in-cylinder direct injection technology, which is

mainly characterized by reducing the phenomenon of fuel wet wall, good transient response and high thermal efficiency. Fuel injection pressure can be up to 150Bar, improving fuel atomization quality and atomization rate. On this basis, the engine also uses 6 holes of different pore diameter fuel injector, in order to improve the fuel atomization effect, strengthen the control of fuel bundle, and make the mixture formed more stable. At the same time, the gasoline injected into the cylinder vaporizes and absorbs heat, reducing the combustion chamber temperature to a certain extent, inhibiting the occurrence of super knock and improving fuel economy.

1.2.3 A new generation of electronically controlled recirculation valve high-efficiency turbocharger



Turbo, is a kind of technology that waste gas driving air compressor by using the internal combustion engine running, used in automobile engine. Its main effect is to raise the engine air intake amount, so as to improve the power and torque of engine, provide the vehicle with strong power, but also improve fuel economy and reduce emissions.

1.5 T GDI as a high-end engine of JAC independent research and development, has adopted the turbo technology, and equipped with a new generation of Honeywell turbocharger, the turbocharger turbo with high efficiency, low speed torque

characteristics of fast response. And at the same time, it adopted a new generation of electric control recirculation valve, solve the traditional fuel and gas turbo engine acceleration noise problem.

During the design of 1.5T GDI engine, by optimizing the turbocharger matching technology and increasing the scavenging energy, the engine can reach the maximum torque of 80% at 1250rpm and the maximum torque at 1500rpm. Further improve the power of the engine, so that it can replace the large displacement engine, to achieve the purpose of fuel conservation.

At the same time, the 1.5T GDI engine is also equipped with an integrated water-cooled intercooler, which reduces the intercooler piping and improves the pressurization response. According to the requirements of different working conditions, ECU will directly control the cooling flow, maintain constant intake temperature, maintain stable engine power output and economy, and improve thermal efficiency.

1.2.4 Low friction technology

1. 1.5T GDI engine adopts crankshaft eccentricity design of 8mm, which effectively reduces the high friction work on the main thrust surface. The friction work is reduced by thermal spraying on piston and other surfaces.
2. Small journal crankshaft journal, connecting rod journal and camshaft journal are used to eliminate friction consumption of the moving system as much as possible.
3. Mechanical tappet: Mechanical tappet coated with DLC layer can make the friction coefficient of coating surface as low as 0.02-0.1 (ordinary glass is 0.3), which can effectively reduce the friction loss work and improve the mechanical efficiency of engine.
4. Connecting rod bearing shell: Due to the requirement of engine starting and stopping times, polymer coating is added on the alloy surface of connecting rod bearing shell to improve the wear resistance.

1.2.5 Variable oil pump technology

Variable oil pump for the vane type variable displacement pump, its main variable displacement process by the main oil hydraulic feedback control, lead the main oil oil and reduction pressure zone, when the interval pressure generated by the torque is more than provide pre-tightening torque spring swing, the eccentric annulus started around the swing swing pin clockwise, the oil pump is less eccentricity, thus reducing emissions.

1.3 1.5T GDI Engine Structure Introduction

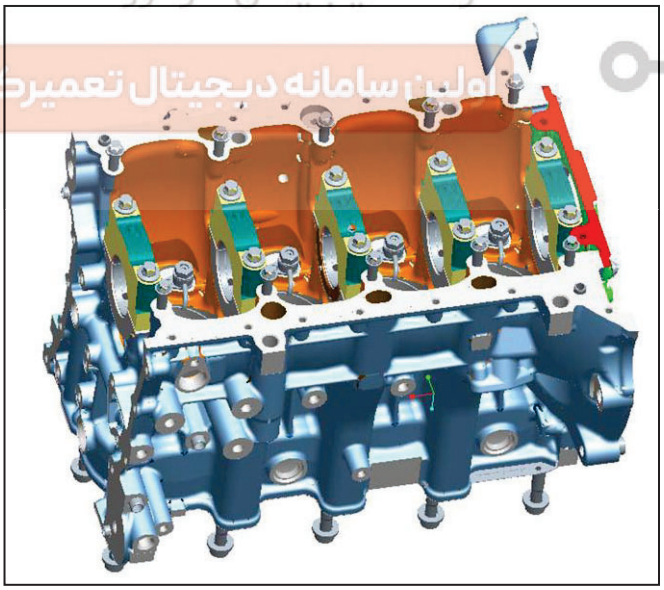
1.3.1 Engine body assembly

To enhance the strength of the 1.5T GDI engine, the cylinder block is made of cast iron and weighs 37kg.

Adopt three-layer cylinder cushion, the check ring at the cylinder hole is stamping forming, the height is variable, the front and rear ends are stamping check rings, increase the pre-deformation of cylinder head, improve the sealing reliability, can provide more than 150bar sealing pressure.

Inside the body, there is die-cast aluminum alloy maxi skirt reinforcing plate, which further enhances the rigidity of the cylinder block and acts as oil baffle.

Inside the crankcase of 1.5T GDI engine, plunger type piston cooling fuel injector is installed, which has the advantages of stable opening pressure, good sealing when closed, stable oil delivery and significantly reduced engine working noise.



1.3.2 Cylinder head assembly

The 1.5T GDI engine cylinder head assembly uses the high reliability 16 valves and the direct drive valve system construction mechanical tappet. The fuel injector

hole is arranged on the intake side of the cylinder head, and the spark plug is arranged vertically in the middle of the cylinder head.

Compared with the traditional engine, the 1.5T GDI engine adopts the independent cylinder head water jacket design, each cylinder has independent water inlet/outlet, to prevent the occurrence of dead zone of water flow. Smaller volume, higher cooling and thermal efficiency.

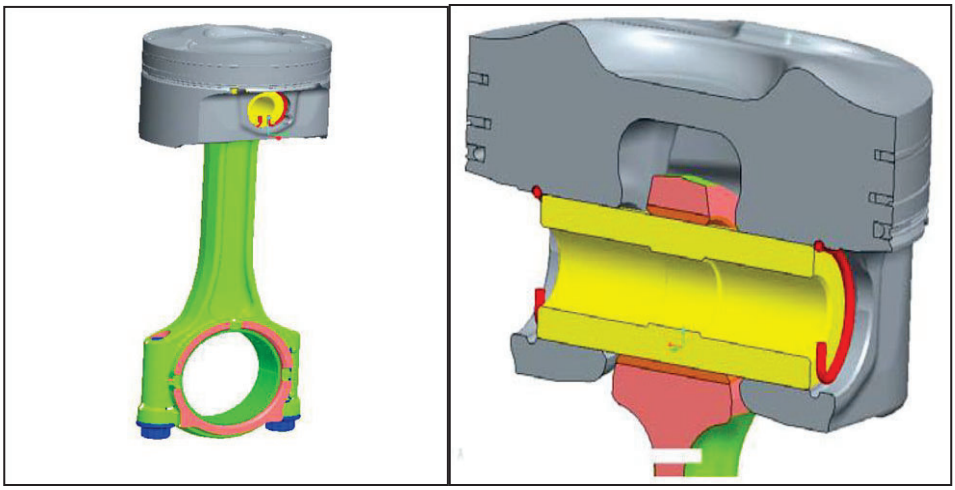
On the cylinder head, the engine is equipped with special oil return hole and air escape hole, which can meet the engine maximum inclination angle of ±15° at the same time, and can adapt to the layout requirements of a variety of models. At the same time, the air inlet with both high flow coefficient and high roll ratio ensures the full mixing of fuel and air, so as to achieve better homogeneous combustion.

On the choice of the exhaust valve, the engine uses sodium exhaust valve, effectively reduce the exhaust temperature, to prevent overheating valve damage. At the same time, the engine uses the three slot valve lock clip. When the engine is running, the valve can rotate, making the valve and valve seat, valve guide even wear and grinding each other, eliminating the carbon deposit between them, and preventing the "gas leakage" and "stuck" phenomenon, making the valve evenly heating, cooling, and preventing the valve plate "distorted" and "warp", extending the life of the valve more than 3 times.

1.3 Piston Connecting Rod Assembly

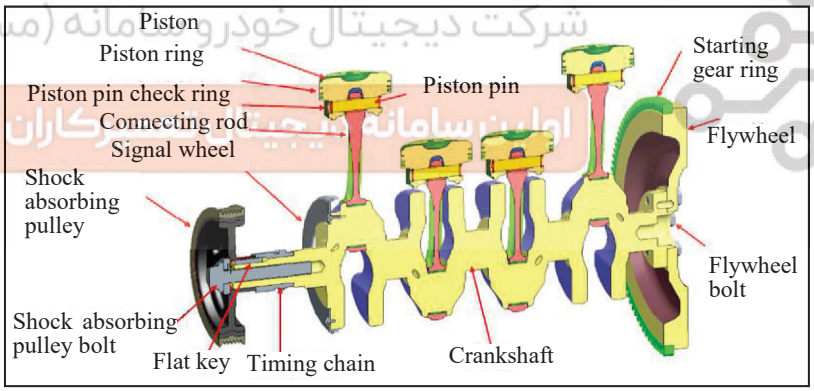
The piston of 1.5T GDI engine adopts bowl combustion chamber and special head design to adapt to the formation of direct-injection mixture in the cylinder, which is lightweight in mass and weighs only 230g. The material of skirt adopts printing resin to reduce the friction coefficient.

Adopt full floating piston pin, characterized by better small-head lubrication, suitable for larger in-cylinder burst pressure.



1.3.4 Crankshaft flywheel assembly

The crankshaft is made of 8 balancing blocks and the main bearing journal is 45mm. Use flanged signal teeth, with large width, are not easy to lose signal. The crankshaft damping pulley is fitted with the 8 balance blocks crankshaft to make the crankshaft torsional vibration close to the level of natural intake.



1.3.5 Camshaft Assembly

1.5T GDI engine adopts double overhead camshaft to shorten the distance between camshaft and valve, omits valve tappet, simplifies thetransmission mechanismbetween camshaft and valve, and makes the structure of the engine more compact. More importantly, this installation can reduce the quality of the whole system reciprocating motion, improve transmission efficiency, more suitable for high-speed engine.

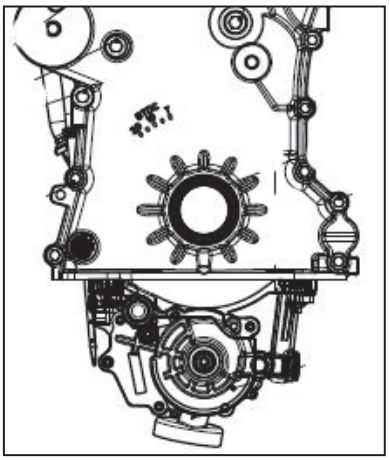
The inlet and exhaust camshaft adopt hollow design, and the oil duct is designed on the camshaft, which can not only reduce the complexity of the oil duct on the cylinder head, but also reduce the weight of the camshaft. High pressure fuel pump camshaft is integrated at the rear end of the intake camshaft to drive the high pressure fuel pump. The rear end of the exhaust camshaft is provided with flat keyway to drive the vacuum pump.

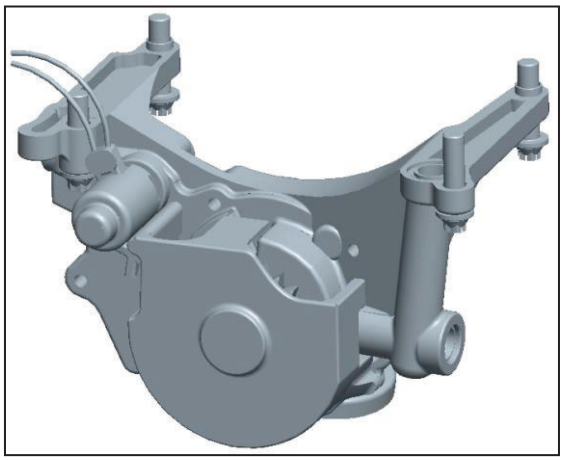
1.3.6 Lubricating System

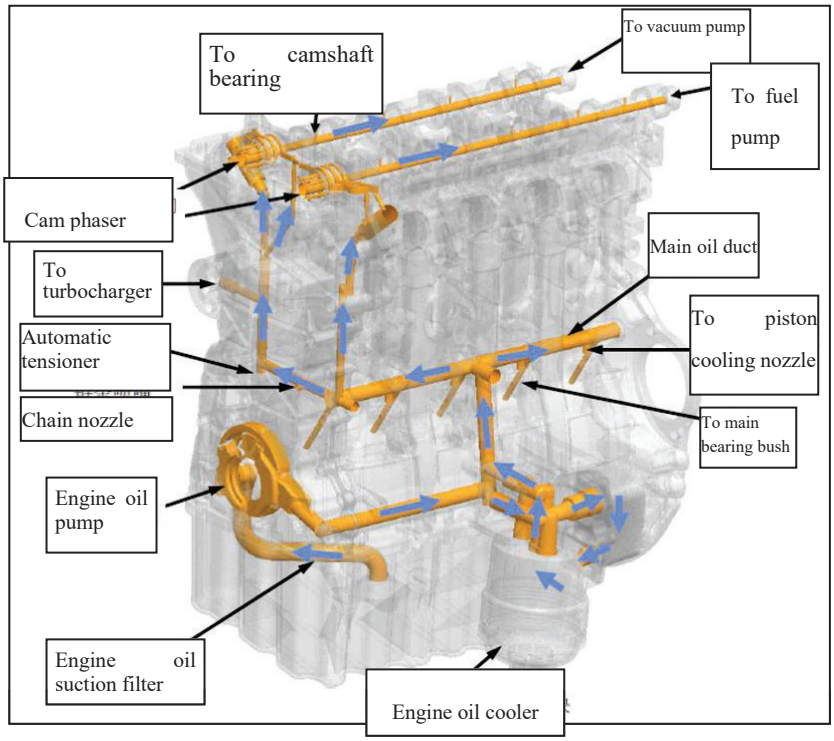
The oil filter, oil cooler and oil filter bracket constitute the filter system assembly.

The oil pump is changed from integrated on the front end cover to integrated on the crankcase reinforcement plate, and the driving mode is changed from direct drive of crankshaft to chain drive.

Variable oil pump is controlled by electromagnetic valve two-stage variable type oil pump, variable oil pump is the vane type variable displacement pump, its main variable displacement process by the main oil hydraulic feedback control, lead the main oil duct oil and reduction pressure zone, when the interval pressure generated by the torque is more than provide pre-tightening torque spring swing, the eccentric annulus started around the swing pin clockwise, the oil pump is less eccentricity, and implemented to reduce emissions.





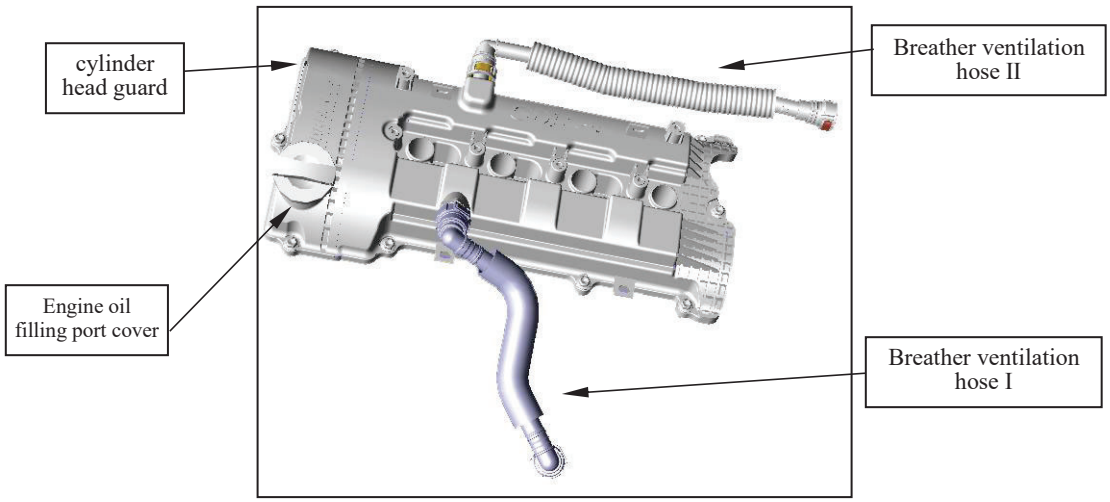


1.3.7 Breathing system

1.5T GDI engine adopts integrated oil and gas separator design, screw exchangeable PCV valve, high reliability, simple maintenance, integrated inlet and exhaust arrangement of two oil and gas separator, high and low load independent separation.

T - shaped sealing ring is adopted to reduce the structural deformation and ensure the sealing.

Semi-floating bolts are adopted to ensure the sealing and reduce the structural noise. No external separation device to prevent freezing in severe winter.

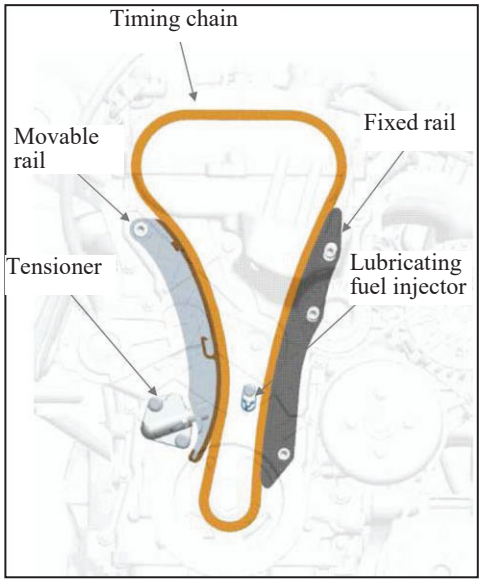


1.3.8 Chain Transmission system

1.5T GDI engine adopts the maintenance-free silent chain (toothed chain) drive, which effectively reduces the NVH (noise, vibration and sound roughness) of timing system, and reduces the oscillation and impact of VVT.

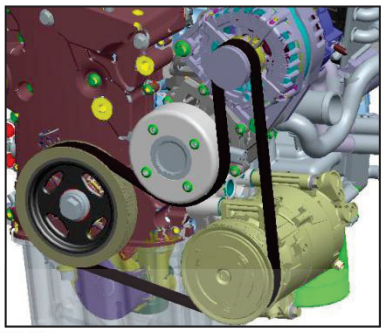
The engine also uses hydraulic tensioner device. Compared with the previous tensioner device, this tensioner device optimizes the layout position, eliminates the ratchet design, and reduces the chain swing and impact, especially the impact of cold start.

The floating dynamic rail and fixed rail are adopted to avoid the chain distortion caused by abnormal stress and keep the excellent performance of the chain even after wear.



1.3.9 Front auxiliary drive system

All front-end accessories of 1.5T GDI engine are driven by a belt, the tensioner and idler are eliminated, and only elastic belt is used to simplify the front-end gear system, reduce the driving cost of accessories and friction loss of accessories, ensure the belt has a reasonable tensioning force, effectively alleviate the attenuation of belt tensioning force, and also reduce noise.

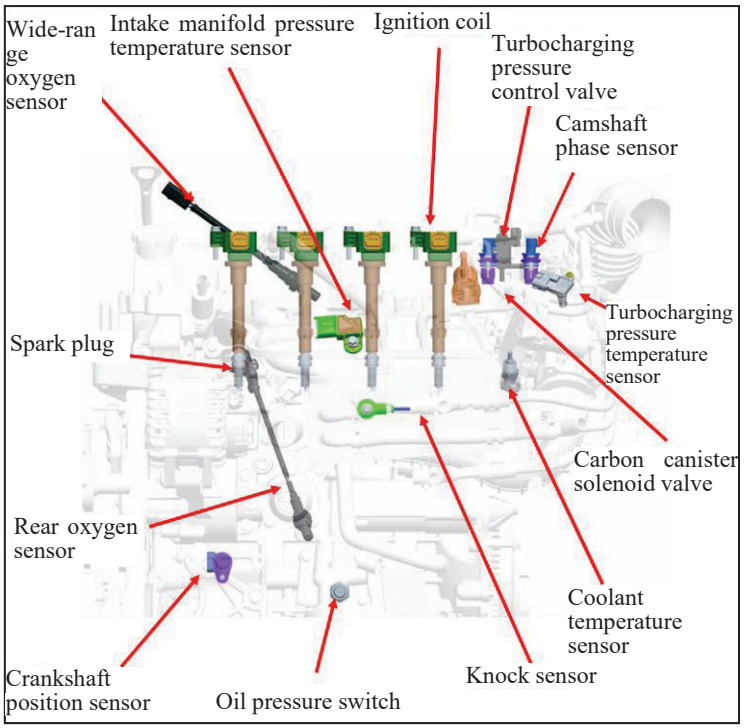


1.3.10 Electronic control system

The electric control system of 1.5T GDI engine adopts Delphi MT92.1 control system, which has faster response speed and higher precision compared with the traditional control system.

In strengthen the function of electronic pump control system (that is, according to the requirements of inlet temperature, automatically adjust the electronic pump flow volume, keep constant inlet temperature), PWM fan control function (according to engine coolant temperature, adjust the whole vehicle radiator fan speed, maintaining higher economy), PWM turbocharger control function (according to the different load demand, adjust the turbocharger by-pass valve opening, to provide different pressurization degrees), scavenging function.

The fuel closed-loop control mode with wide-area oxygen sensor feedback input can adapt the control system to the correction of the air fuel ratio of the direct injection engine.



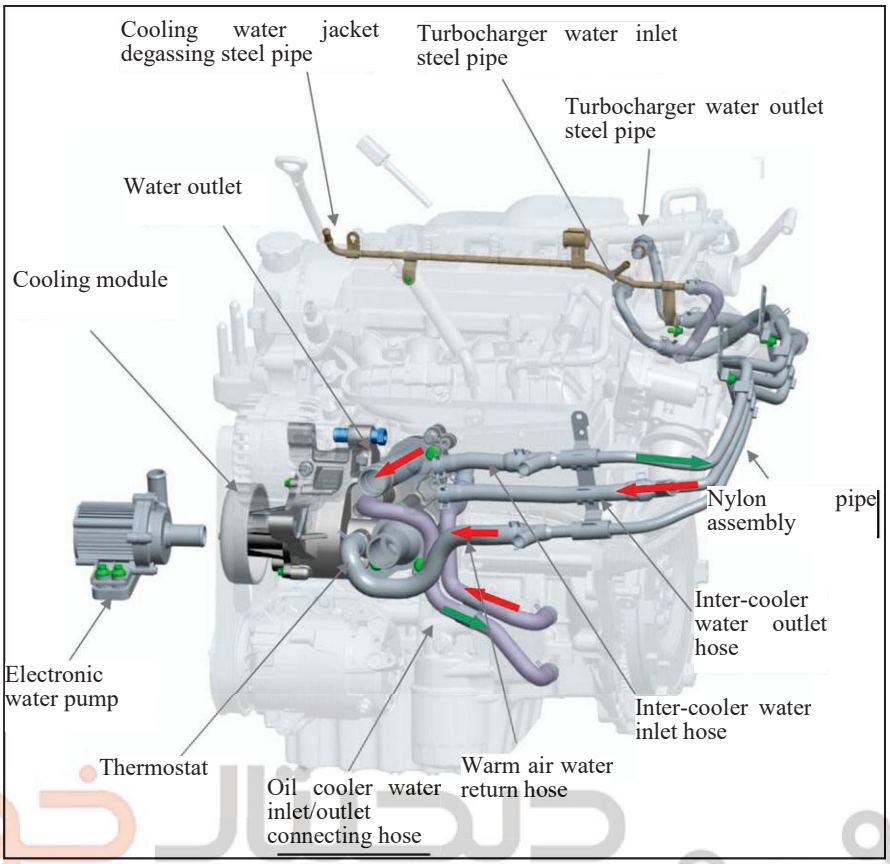
1.3.11 Cooling System

The 1.5T GDI engine uses two separate cooling systems:

The main water pump is mechanical pump that provides coolant to the cylinder block, cylinder head and warm air system. The auxiliary water pump is electronic water pump, which provides coolant to the intercooler and the turbocharger. When the engine stops running, the turbocharger is delayed in cooling to prevent damage to the turbocharger due to overheating.

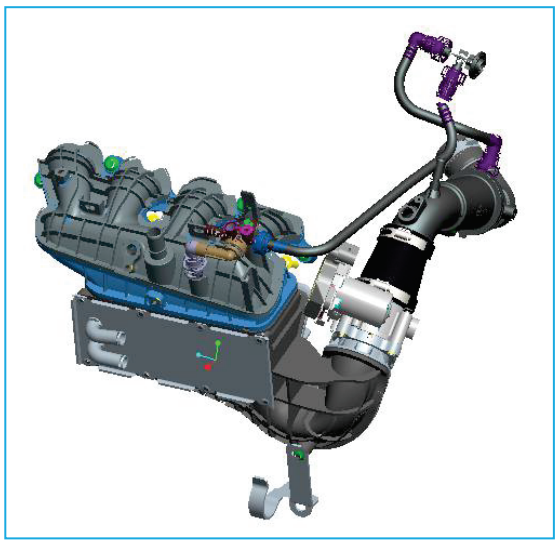
At the same time, the engine also adopts integrated cooling module, which includes drive cooling water pump, dual channel thermostat, lubricating oil cooling inlet and outlet, radiator return outlet, and provides fixed support for the generator. The assembly process is simple and reliable.

The electronic water pump adopts LIN bus control to realize the functions of stepless adjustable pump speed and self-diagnosis, and adjust the power of the electronic water pump according to the requirements of cooling amount under different loads to reduce energy consumption to the maximum extent.



1.3.12 Air inlet system

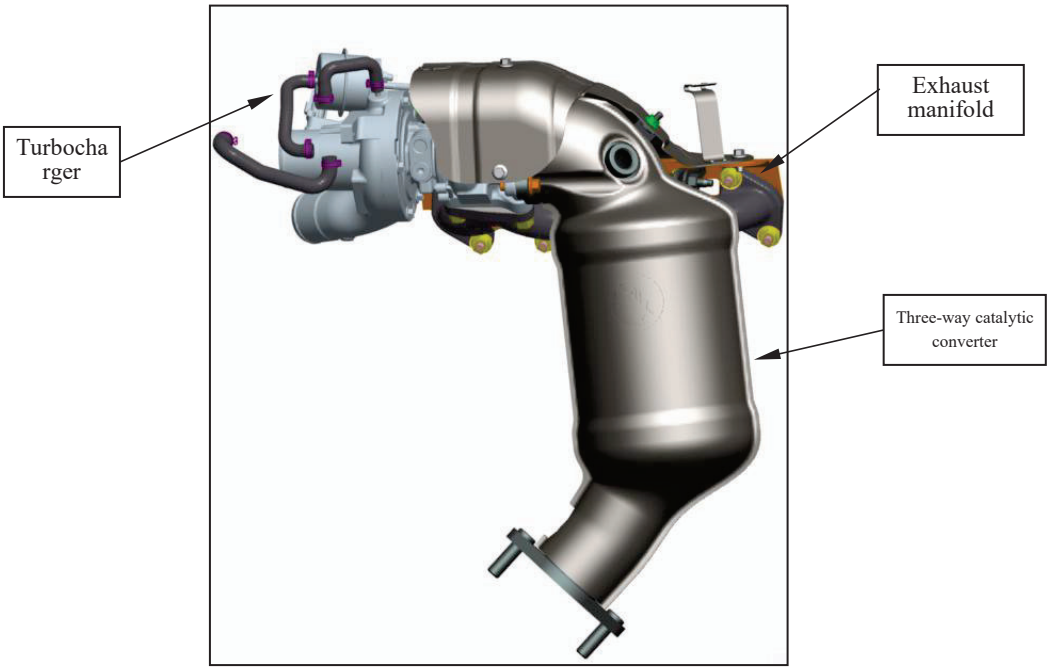
1.5T GDI engine adopts plastic intake manifold with low flow resistance, which improves engine intake efficiency and reduces weight. At the same time, the intake manifold is also integrated with water-cooled pressurized intercooling system, which reduces the intercooling pipeline and reduces acceleration delay of the turbocharged engine.



1.3.13 Exhaust system

1.5T GDI engine uses a new generation of small turbocharger, electronic control exhaust bypass valve and electronic RCV valve, high response, low torque, at 1500rpm can reach the maximum engine torque.

The exhaust system is supported by the exhaust manifold and three supports, which can effectively improve the NVH characteristics of the exhaust system. The two-stage catalytic converter is adopted to meet the emission requirements of China-VI. Adopt high temperature exhaust manifold, can withstand 950℃ high temperature exhaust. At the same time, the 1.5T GDI engine is integrated with partial heat shield exhaust manifold gasket, effectively utilizing the space and preventing damage from thermal radiation to other components.



Chapter Two Maintenance instruction

2.1 Engine general maintenance

General maintenance includes those items which should be checked and maintained during the normal day-to-day operation of the vehicle. They are essential if the vehicle is to continue operating properly. The owners can perform checks and inspections themselves or have their JAC dealers do them. Engine general maintenance includes the following:

Carry out the inspection and maintenance items every day:

Item	Check
Coolant level	When the engine is cold, check the coolant level in the expansion kettle.
Oil level	Park the vehicle on flat ground and check the oil level after the engine has stopped running for more than ten minutes.
Air Filter element	Open the air filter cover to see that there is no blockage or opening on the surface of the air filter.
Failure Light	Check whether the fault indicator on the instrument panel is on during driving.
Battery	Check the connection and fastening condition of battery voltage and electrode.
Fluid leakage	Check under the vehicle for fuel, oil, water or other fluid leaks after the vehicle has been parked for a while. Drips are normal after using A/C. If there is obvious leakage or gasoline odor, find the cause and contact the dealership for repair immediately.

2.2 Periodic Maintenance of 1.5T GDI engine

Regular maintenance is the maintenance that must carry out after the vehicle running for a period of time, otherwise it will cause serious damage to the vehicle, and greatly reduce the service life of the vehicle. Under general running condition, the engine related periodic maintenance intervals and items are shown in the table below. These maintenance should be carried out by JAC exclusive stores.

Maintenance operation code: I - Check, adjust or clean or replace if necessary; R - replac; C - clean;

Item /	service period (subject to the figure (either the mileage or the number of month) that reaches the specified data.)											
	1000km	1	10	20	30	40	50	60	70	80	90	100
	month	—	6	12	18	24	30	36	42	48	54	60
1	The drive belt	I：every 10,000km or 6 months R：every 60,000km or two years										
2	Check if crankshaft ventilation system is normal					I				I		
3	Spark plug		I	R	I	R	I	R	I	R	I	R
4	Replace engine coolant			R		R		R		R		R
5	Air filter element — Common use condition	C: Every 7,500km R: 15,000km										
	Air filter element — Extreme use condition	C: Every 5,000km R: 10,000km										
6	Engine oil and engine oil filter — Common use condition	R：every 10,00km or 6 months										
	Engine oil and engine oil filter — Extreme use condition	R：every 5,000km or 3 months										
7	JAC specified gasoline additive	Add one bottle when the vehicle driving for 1500km, and then add one bottle every 2,500km.										
8	Engine idling speed carbon monoxide		I	I	I	I	I	I	I	I	I	I
9	Ignition timing			I		I		I		I		I
10	Hose		I	I	I	I	I	I	I	I	I	I
11	Whether the exhaust pipe connector has air leakage		I	I	I	I	I	I	I	I	I	I
12	Throttle valve			C		C		C		C		C
13	Valve clearance	I		I		I		I		I		I
14	Check harness layout and connector		I	I	I	I	I	I	I	I	I	I

※ “Extreme use condition” specification, only applicable to vehicle used under

severe conditions of use “extreme use condition” includes the following items ※

① Driving in dusty areas, or cars are often exposed to salty air or seawater.

② Travel on bumpy roads, ponding roads or mountain roads.

③ Drive in the cold areas.

④ In the cold season, the engine runs at an idle speed for a long time or the vehicle frequently runs in short distance.

⑤ The brake is frequently used and frequently sudden brake.

⑥ The vehicle is used as a towing trailer.

⑦ The vehicle is used as taxi or rental vehicle.

⑧ The time that the vehicle runs in the jammed downtown at a low speed when the temperature is above 32℃ takes up more than 50% of the overall running time.

⑨ At temperatures above 30°C, travel time at 120 km/h or higher exceeds 50% of

total travel time.

⑩ Over-load driving.

2.3 Recommended oil and lubricant of 1.5T GDI engine

JAC recommended oil and lubricant, see the table below:

Recommended oil and lubricant table

Item	Volume (L)	Recommended Fluids/Lubricants
Cooling System	Depending on the matching vehicle model	High-quality glycol-based coolant

Engine oil type	Environment temperature	Maintenance interval	Remark
JAC G02 5W-30	-30℃～40℃	100，00km or 6 months	Environment temperature lower than -30℃, please use JAC G02 0W-30
JAC G03 5W-30	-30℃～40℃	100，00km or 6 months	Environment temperature lower than -30℃, please use JAC G03 0W-30

The engine oil is efficient and energy saving product, accord with the enterprise

standard Q/JQ 1200-2018 requirements. It can greatly reduce friction coefficient and engine's mechanical loss, and improve engine's fuel economy. It has great cleaning dispersability, and greatly prevent the accumulation of carbon deposition, paint film and oil mud, which can make engine clean and efficient. The oil is applicable for all seasons, and can meet the area with environmental temperature above -30℃. It has excellent quality retention, and has passed rigorous driving tests with a long oil refilling cycle Using JAC high-efficiency and energy-saving oil can guarantee JAC passenger vehicle's engine to work efficiently and smoothly.

2.4 1.5T GDI Engine Structure Maintenance

2.4.1 Check drive belt

Visually inspect if there is damage, wear and crack inside and around edges of belt.

The drive belt adopts elastic belt technology, and there is no need to adjust the belt tensioning force. Elastic belt after the engine is running around 15 min, the tension will decay 30%-40% to reach stability at (510-714N), if it continues to decay more than 10% after reaching stability , the skid appears, the belt has reached the limit, the belt should be replaced.

Attention:

■ ***Make sure it meshes properly with the belt wheel groove。***

■ ***Do not let engine oil and engine coolant splash on the belt.***

■ ***Do not twine or bend the belt too much.***

2.4.2 Replace Engine Coolant

Warning:

■ ***To avoid burns, do not replace the coolant when the engine temperature is high.***

■ ***Cover the radiator cap with a thick cloth and unscrew it carefully. First***

release the pressure in the radiator, and then totally unscrew the cover.

■ ***Be careful not to spill engine coolant on the drive belt.***

1) Discharge the engine coolant

① Open the radiator drain plug at the bottom of the radiator and open the radiator cap.

② If necessary, disassemble the reservoir, drain the engine coolant and clean the reservoir before reinstallation.

③ Check if there is iron rust, incrustation and other impurities or discoloration in the engine coolant.

■ If contaminated, flush engine cooling system. ***Use clean water to clean.***

2) Refill the engine coolant

① Install the removed tank and radiator drain plug.

Attention:

■ ***Be sure to clean the drain plug and install a new O-shape sealing ring.***

② Confirm that each hose clamp is firmly tightened.

③ Fill the radiator and reservoir with coolant to the specified level.Slowly add the engine coolant so that the air in the system is gradually discharged.

Attention:

■ ***Use the original JAC engine coolant or comparable products with similar performance. Refer to "Recommended oil/liquid and lubricants".***

④ Install the radiator cover.

⑤ Warm until the thermostat is open.

■ Make sure the thermostat is open by touching the radiator down pipe to feel if there is any warm water coming out.

⑥ Turn off the engine, and let the water temperature decrease.

■ Using fan can shorten the cooling time.

⑦ Fill engine coolant in tank to MAX.

⑧ Repeat ③～⑦ more than twice until the engine coolant level no longer decreases.

⑨ Run engine check cooling system for leaks.

2.4.3 Check Cooling System

Warning:

■ ***Do not remove the radiator cap when the engine is hot. Otherwise, high-pressure and high-temperature engine coolant escaping from the radiator can cause serious burns.***

■ ***When the engine is hot, you can wrap the radiator cover with thick cloth, first turn 1/4 turn to release the pressure in the radiator, and then completely unscrew the cover.***

1) Check Cooling System Hose

■ ***Check the hose for installation error, crack, damage, loose connection, wear or aging.***

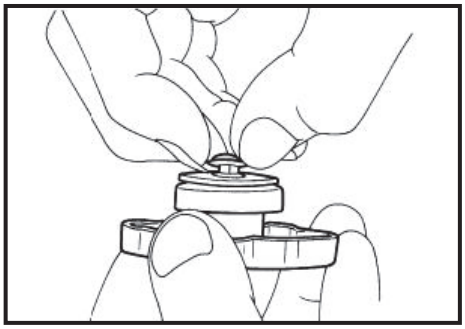
■ ***If necessary, repair or replace damaged parts.***

2) Check radiator cover

① Check the appearance of radiator cover valve seat.

■ ***Check valve seat for outward expansion so that plunger ends are not visible when the plunger rises vertically from the top.***

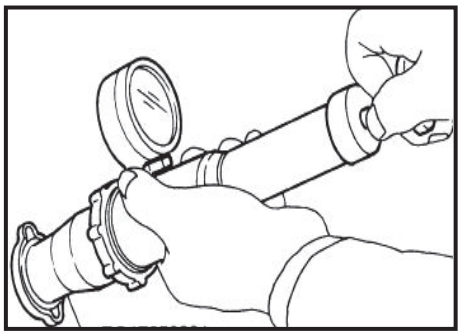
② Pull out the negative pressure valve and open it. Check to see if it can shut down completely after the pressure is released.



■ ***Make sure there is no dirt or damage to the seat of the radiator cover negative pressure valve.***

■ ***Confirm that the opening and closing of the negative pressure valve is normal.***

③ Check the releasing pressure of the radiator cover.



■ ***If the above inspection found abnormal, please replace the radiator cover.***

Attention:

■ ***When installing the radiator cover, carefully wipe the radiator filler opening and remove all foreign matters.***

3) Check radiator

Check whether there is mud or blockage in the radiator. If necessary, clean the radiator surface as follows.

■ ***Don't bend or damage the radiator core.***

■ ***If cleaning is done without removing the radiator, remove all accessories such as cooling fan, hood and horn. Wrap wire harnesses and electrical connectors with adhesive tape to prevent water ingress.***

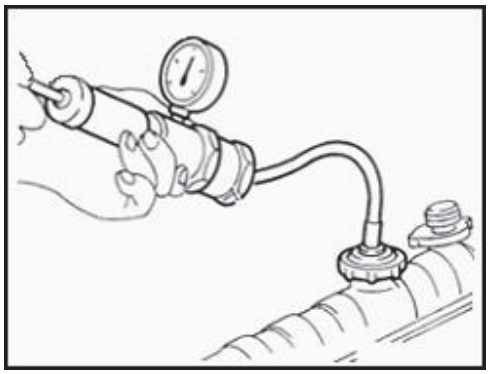
① Use a hose to flush the back of the radiator core vertically from the top down to the radiator.

② Wash and clean every surface of the radiator core in every 1 minute.

③ If contamination cannot be flushed from the radiator, stop flushing.

④ Use compressed air to blow vertically down the back of the radiator core. Use compressed air at pressure less than 490kPa and maintain a distance of 30cm or more.

⑤ Blow every surface of the radiator core in every minute until no water exists.



4) Check cooling system for leakage

① Use radiator cover leakage detector to exert pressure on cooling system to check whether there is leakage.

■ Testing pressure： 150KPa

Warning:

■ ***Do not remove the radiator cap when the engine is hot. Otherwise, high-pressure engine coolant escaping from the radiator can cause serious burns.***

Attention:

■ ***Exceeding test pressure may damage the radiator.***

■ ***When engine coolant decreases, please check the reason for the coolant decreasing, add engine coolant to the expansion kettle. And check the coolant level every day, confirm the leakage is repaired.***

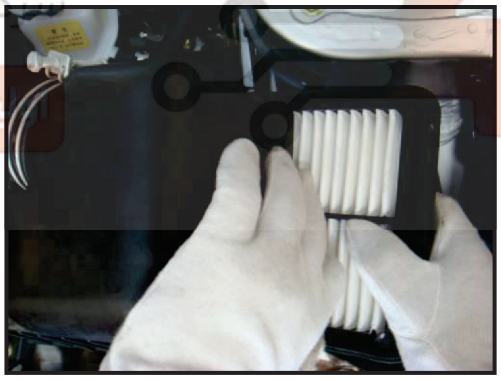
② If parts are found large leakage, please repair or replace them.

2.4.4 Replace Air filter

1） Removal

① Loosen the air filter upper cover lock buckle,

and lift the upper cover.



② Take out the air filter element.

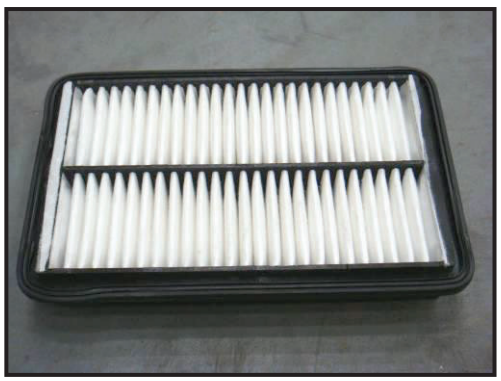
2） Inspection after disassembly

① Check the dust condition on the surface of air filter element and clean

it if necessary.

② Check whether there is debris accumulation or

blockage of the air inlet.



■ According to the recommended time cycle, regularly clean or replace the air filter. Please refer to "2.2 1.5T GDI Engine Regular Maintenance".

■ Use compressed air to blow in from the back of the air filter core until nothing is blown out.

3) Installation

Follow the opposite sequence of the demounting sequence.

■ There should be no gap between the air filter element and the housing.

2.4.5 Replace engine oil

Attention:

■ ***The engine oil is very hot after the engine running for a period of time, be careful not to get scalded.***

■ ***Avoid direct contact with skin and waste oil for a long time. If contact the oil, wash thoroughly with soap or detergent as soon as possible.***

1) Start the engine and run to working temperature, visually check engine oil for leakage.

2) Turn off the engine and wait for 10min.

3) Loosen the engine oil filling cover, and remove the oil drain bolt.

4) Discharge the engine oil.

5) Install the oil drain bolt with new gasket.

Attention:

■ ***Be sure to clean the iron filings and other impurities on the oil drain bolt and install new gasket.***

■ ***Oil drain bolt tightening Torque: 40～45N·m***

6) Fill new engine oil

Oil specification and viscosity, please refer to “Recommended oil/liquid and lubricant”.

■ Oil amount: 5.1L

Attention:

■ ***There is slight difference in the temperature and discharging time of the random oil filling volume. The above is for reference only.***

■ ***Always use oil level gauge to check if the oil amount is proper.***

7) Warm the engine, and check if there is oil leakage around the oil drain bolt and oil filter.

8) Turn off the engine and wait for 10min.

9) Check the oil level.

10) If not between the upper and lower scale line, repeat 6)～9).

2.4.6 Replace Engine Oil Filter

1) Disassembly

① Remove the oil pan drain screw plug, and discharge the oil inside the engine. (Refer to “Engine oil replacement”)

② Use oil filter wrench to remove the oil filter.

Attention:

■ ***The temperature of the engine and oil that has just stopped running is very high. You must wait for the engine to cool down before carrying out relevant operations to prevent burns.***

■ ***When disassembling, prepare a cloth to dry the leaking or splattering engine oil.***

■***Do not let the engine oil stick to the drive belt.***

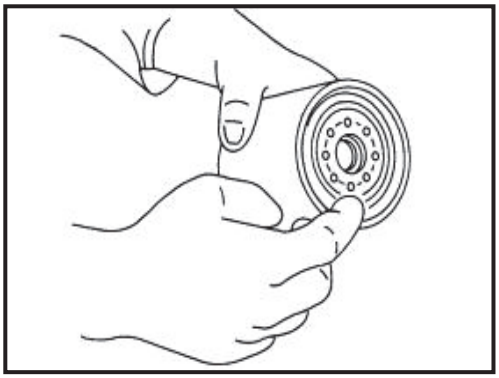
■ ***Thoroughly dry the engine oil spilled on the engine and the vehicle.***

2)Installation

① Clear the attached foreign matter on the oil filter installation surface.

② Spread proper amount engine oil on the sealing ring surface of the new oil filter.

③ Tightenoil filter.



■ Tighten requirement: When sealing ring contacts, tighten 3/4

ring.

④ Fill the engine oil.

Attention:

■ ***Use JAC genius oil filter spare part.***

■ ***The oil filter must be tightened with the filter wrench.***

■ ***If the filter is tightened by hand, oil may leak due to insufficient tightening torque.***

3. Inspection after installation

① Check the oil level, if not enough, fill the engine oil. Refer to "Replace the engine oil".

② Start the engine and check if there is oil leakage.

③ Turn off the engine and wait for 10ming.

④ Check the oil level again.

2.4.7 Replace spark plug

1) Disassembly

① It should be carried out when the engine is cold, or it has been shut down for 30min.

② Disconnect the ignition coil connector.

③ Remove the ignition coil.

④ Use spark plug sleeve to remove spark plug

■ ***Please do not drop or shake spark plug.***

2)Inspection After Removal

✓ Check the spark plug side electrode for broken, damaged or melted, and replace the spark plug if any.

✓ Check the ceramic body outside the center electrode of spark plug for crack, fracture or damage. If there is any, replace the spark plug.

✓ Check the spark plug clearance and replace the spark plug if it exceeds the

standard clearance.

Attention:

■ ***Do not drop or shake spark plug.***

■ ***Don't use the steel bush to clean.***

■ ***If there is carbon deposition in the spark plug end, use spark plug cleaner to clean it.***

■ ***Check the spark plug clearance as appropriate during the replacement period.***

Spark plug clearance: 0.7～0.8mm。

3) Installation

During assembly, please follow the opposite sequence of disassembly procedures. Spark plug tightening torque: ***25～30N·m***,ignition coil bolt tightening torque: ***9～11N·m***.

■ ***Use the spark plug recommended by the engine factory. Customers are not allowed to choose by themselves, otherwise it may cause serious damage to the engine.***

■ ***It is strictly prohibited that excessive torque will easily lead to spark plug damage and thread damage***

2.4.8 Clean electronic throttle valve

1) Removal

① Remove the intake pipe connecting with the electronic throttle valve.

② Check whether there is carbon deposition or sludge on the inner wall of the throttle valve and the valve plate, and determine whether it needs to be cleaned.

③ Disassemble the throttle valve fixing bolt, take down the electronic throttle valve.

■ ***Please don't drop or bump against the electronic throttle valve.***

2) Check clean

(1) Clean the inner and outer surfaces of the throttle body assembly and throttle

plates with non-metallic tools and non-corrosive solvents.

② in the clearance of aluminum alloy machining surface dirt, not to use any sharp tools, in order to prevent damage to the sealing surface.

③ Use relevant detergent to clean the outer edge of the throttle valve piece and the throttle valve wall. Detergents shall not contain substances corrosive to body parts.

■ ***Avoid the electronic part of the throttle valve being stained with cleaning liquid during the cleaning process.***

■ ***After cleaning the throttle, be sure to wipe it clean.***

■ ***Please don't drop or bump against the electronic throttle valve.***

3）Installation

Install the electronic throttle valve according to the reverse sequence of removal, throttle valve fastening bolt tighten torque:

9～11N·m.

■ ***It is necessary to carry out throttle valve self-learning after cleaning the throttle valve. After the learning, start the vehicle and observe whether it works normally.***

2.4.9 Idle status inspection

The following conditions shall be achieved before inspection and adjustment:

Engine coolant temperature: (80～95)℃

All electrical equipment: OFF

Transmission：in neutral

1) Check whether the oil indicator lam[, fault indicator lamp and charging indicator lamp on the instrument are on. If on, repair it immediately.

2) Use diagnostic instrument to read the engine speed, and check whether it is the same as the speed indicated on the instrument. If different, repair or replace vehicle tachometer.

2.4.10 Hose inspection

1) Check the hose surface for signs of scald or mechanical damage.

2) Check whether the hose line is in relative movement or in partial contact with some other heat sources and sharp objects. If the hose or line is damaged, it should be replaced immediately.

3) Check all hose connections, such as clamps and couplings, to ensure safety without leakage, and replace them immediately if there is any sign of corrosion or damage.

2.4.11 Air leakage inspection

Start the engine in idle state, open the engine hood, listen to the engine intake and exhaust whether there is leakage issued by the "sizzle" sound, if there is abnormal sound, appropriate press accelerator pedal, and carefully confirm.

Note that the car must be in neutral parking during inspection. When opening the engine hood, it is not allowed to stand near the rotation direction of the rotating parts.

2.4.12 Using method of JAC specified gasoline additive

When the fuel tank is about to run out (don’t have too much fuel left in the tank), add gasoline additive to the fuel tank and fill the fuel tank to make sure the additive mix is even.

Attention:

① Be sure to add the gasoline additive according to the mileage and dosage requirement in the maintenance instruction, in order to ensure the use of additives effect.

② Be sure to add gasoline additives before refueling.

2.5 Tightening torque list of 1.5T GDI engine

Standard Part Tightening Torque Table

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
1002	**Body assembly**				
1002023GH030	Cylinder head bolt	M10×1.5×112	10	（32.5±2）N·m +（180±4）° Spread oil, and tighten at the same time	(Only use once)
Q1841025	Hex flange bolt		1	（35～45）N·m	Drive shaft bracket bolt
Q1840830	Hex flange bolt		6	（22.5±2.5）N·m	Crankshaft box reinforcement bolt
1002300GH030	Piston cooling nozzle	M10×1.5×10	4	（30±3）N·m	
1002031GH090	Crankshaft rear oil seal bracket bolt		8	(10±1)N·m	
1002102GH030	Main bearing cover bolt	M10×1.5×85	10	（40±2）N·m +（90±2）° Spread oil, and tighten at the same time	(Only use once)
1002012GH030	Main oil duct plug I	M18×1.5×10	1	（50～70）N·m	
1002014GH030	Main oil duct plug II		2	(30～40)N·m	
1003	**Cylinder head assembly**				
Q1840820	Hex flange bolt		4	（22.5±2.5）N·m	Front/Rear lifting lug bolt
1003107GG010	Camshaft bearing cover bolt	M6×1×35	18	（10±1）N·m spread oil	
Q1840850	Hex flange bolt		3	（19～21）N·m spread oil	Camshaft front bearing cover bolt
Q1840625	Hex flange bolt		7	（10±1）N·m	Fuel pump bracket bolt
1004	**Piston connecting rod assembly**				
1004012G	Connecting rod	M8×1×40	8	（20±2）N·m +（90±2）	(Only use

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
H030	bolt			° Spread oil, and tighten at the same time	once)
1005	**Crankshaft flywheel assembly**				
1005017GD053	Crankshaft flywheel bolt		8	（20±1）N·m +（72°±2°）Tighten at the same time	(Only use once)
1005013GH030	Crankshaft belt pulley bolt	M15×1.5×90	1	（ 150±10 ） N·m+（170±4）° Spread oil	(Only use once)
1005015GG010	Crankshaft signal wheel bolt		3	(12.5±2.5)N·m	
1006	**Camshaft assembly**				
1006011GH030	Air valve timing regulator bolt	M12×1.25×58	2	（100±6）N·m spread oil	(Only use once)
Q1840512	Hex flange bolt		2	（6±1）N·m	OCV valve bolt
1008	**Air inlet manifold assembly**				
1008201GH030	Intercooler bolt	M4×10	8	（4～6）N·m	
Q1840830	Hex flange bolt		5	（22.5±2.5）N·m	Air inlet manifold bolt
Q1840625	Hex flange bolt		2	（10±1）N·m	Turbo-charging pressure pipe bolt
Q1840620	Hex flange bolt		2	（10±1）N·m	Air inlet manifold bracket bolt I
Q1840616	Hex flange bolt		1	（10±1）N·m	Air inlet manifold bracket bolt II
1008302GH030	Turbo-charging pressure connecting pipe		1	（4～5）N·m	Clamp ring
Q1840612	Hex flange bolt		3	（10±1）N·m	Engine cover bracket bolt Air inlet manifold bracket bolt III Reinforcing bracket bolt

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
1009	**Oil pan assembly**				
Q1840620	Hex flange bolt		16	（10±1）N·m	Oil pan bolt I
Q1840880	Hex flange bolt		2	（22.5±2.5）N·m	oil pan bolt II
Q1840625	Hex flange bolt		2	（10±1）N·m	Oil pan bolt III
<1009018 GA	Oil drain screw plug	M14×1.5×17	1	（40～45）N·m	
1010	**Lubrication system**				
Q1841065	Hex flange bolt		1	（45±5）N·m	Front cover bolt I
Q1840625	Hex flange bolt		7	（10±1）N·m	Front cover bolt II
Q18408\45	Hex flange bolt		1	（22.5±2.5）N·m	Front cover bolt III
Q1840620	Hex flange bolt		1	（10±1）N·m	Oil suction filter bolt
Q1840616	Hex flange bolt		2	（10±1）N·m	Turbocharger oil return pipe bolt
1010030GH030	Supercharger oil inlet assembly	M12×1.25×21	1	（22.5±2.5）N·m	
1010204GH030	Suspension stud bolt	M12×1.75×30 - M12×1.25×67	2	（30±5）N·m	
Q1840612	Hex flange bolt		2	（10±1）N·m	Oil dipstick sleeve bolt
1014	**Crankcase ventilation control system**				
1014104GH030	Cylinder head guard bolt	M6×1×13	15	（10±1）N·m	
1017	**Engine oil filter and oil cooler assembly**				
Q1840665	Hex flange bolt		2	（10±1）N·m	Oil filter bolt I
Q1840620	Hex flange bolt		2	（10±1）N·m	Oil filter bolt II
1017110GH030	Oil filter	M22×1.5	1	When sealing ring contacts, tighten 3/4 ring	
1021	**Timing sprocket mechanism**				
Q1840630	Hex flange bolt		2	（10±1）N·m	Automatic

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
					tensioner bolt
1021013GH030	Movable track bolt	M8×1.25×16	1	（22.5±2.5）N·m	
1021014GH030	Fixed track I bolt	M8×1.25×14	3	（22.5±2.5）N·m	
Q1840512	Hex flange bolt		1	（6±1）N·m	Fuel injector bolt
1025	**Front auxiliary drive system**				
Q1840830F61	Hex flange bolt	M8×1.25	4	（25±5）N·m	Compressor bracket bolt
Q218B0630F61	Hex flange bolt	M6×1.0	2	（10±1）N·m	Vacuum pump short bolt
Q218B0655F61	Hex flange bolt	M6×1.0	1	（10±1）N·m	Vacuum pump long bolt
1026	**Electronic control system**				
1026604GK030	Coolant temperature sensor		1	（11～30）N·m	Spread thread sealing adhesive
1026605GH030	Wide region front oxygen sensor		1	（40～60）N·m	
1026609GM011	Oxygen sensor		1	（40～60）N·m	
1026080GH030	Spark plug	M12×1.25	4	（25～30）N·m	
Q1840630F61	Hex flange bolt		4	（10±1）N·m	Ignition coil bolt
Q1840616F61	Hex flange bolt		3	（10±1）N·m	Air inlet manifold pressure temperature sensor, camshaft position sensor bolt
Q1840830F61	Hex flange bolt		1	（22.5±2.5）N·m	Knock sensor bolt
Q1840612F61	Hex flange bolt		1	（10±1）N·m	Crankshaft position sensor bolt
Q215B0616F61	Inner hexagonal panhead bolt		1	（8～10）N·m	High desorption

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
					pipe pressure sensor bolt
Q1840512	Hex flange bolt		2	（6±1）N·m	Turbocharger pressure control solenoid valve bolt
1026201GH030	Turbocharger pressure and temperature sensor bolt	M4×1×16	1	（4～5）N·m	
1041	**Cooling System**				
Q1840825	Hex flange bolt		5	（22.5±2.5）N·m	Water inlet/outlet bolt
1041027GH030	Water pump bracket bolt I	M8×1.25×55	6	（22.5±2.5）N·m	
1041026GH030	Water pump bracket bolt II	M8×1.25×75	1	（22.5±2.5）N·m	
Q1840610	Hex flange bolt		2	（10±1）N·m	Cooling water jacket degassing steel tube bolt
Q1840625	Hex flange bolt		4	（10±1）N·m	Electronic water pump bolt
Q1840620	Hex flange bolt		5	（10±1）N·m	Water pump bolt, electronic water pump bracket bolt
Q1840612	Hex flange bolt		2	（10±1）N·m	Water pump belt wheel bolt, water pipe bracket I bolt
1041230GH030	Turbocharger water inlet steel tube assembly		1	（30±5）N·m	
1041220GH030	Turbocharger water outlet steel tube assembly		1	（30±5）N·m	
1042	**fuel supply system**				
Q1420620	Hexagon bolt,		2	（8.6±0.7）N·m	High pressure

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
	spring washer and flat washer assembly			Pre-tightening first, and then symmetrical cross-tightening	fuel pump bolt
Q1840665	Hex flange bolt		4	（10±1）N·m	Throttle valve bolt
Q1840835	Hex flange bolt		4	（22.5±2.5）N·m	Oil pressure guide rail bolt
1042500GH030	High pressure oil pipe assembly		1	（28±2）N·m	
1043	**Electrical system**				
Q1841080	Hex flange bolt		1	（47±5）N·m	Generator long bolt
Q1841065	Hex flange bolt		1	（47±5）N·m	Generator short bolt
1044	**Exhaust manifold assembly**				
Q32006F61	Hexagon flange nut		1	（10±15）N·m	Fix the turbocharger thermal insulation cover
1044201GH030	Turbocharger nut	M10×1.25	3	（50～55）N·m	
1044202GH030	Turbocharger outlet double stud	M10×1.25×11-M10×1.25×17	3	（10±1）N·m	
1044011GG010	Exhaust manifold nut	M8×1.25	8	（30～35）N·m	
1044012GH030	Exhaust stud bolt	M8×1.25×11-M8×1.25×17	8	（10±1）N·m	
1044017GG010	Thermal insulation cover bolt	M6×1×12	5	（10±1）N·m	
1044018GH030	Reinforcing bracket bolt	M8×1.25×16	2	（22.5±2.5）N·m	
1044024GH031	Catalyst bolt II	M8×1.25×12	1	（22.5±2.5）N·m	
1044301GH030	Catalytic converter bolt	M8×1.25×25	3	（30～35）N·m	
Q1840816	Hex flange bolt		1	（22.5±2.5）N·m	Turbocharger reinforcement bracket bolt I
Q1840616	Hex flange bolt		1	（10±1）N·m	Turbocharger reinforcement

Part No.	Name	Specification	Quantity	Tightening Torque	Remark
					bracket bolt II
Q1841020	Hex flange bolt		2	（35～45）N·m	Three-way catalytic bracket bolt II
1200	**Outer purification system assembly**				
Q1840616 F61	Hex flange bolt		3	（9-11）N·m	Air inlet steel tube bracket keep plate bolt, pressure differential sensor fixing bracket bolt
1200022F A300	Fastening nut		2	（24～30）N·m	Air inlet steel tube connector fastening nut
Q1840625 F61	Hex flange bolt		2	（7.6～8.4）N·m	Differential pressure sensor fixing bolt, differential pressure sensor connecting hose assembly fixing bolt

2.6 Special tool of 1.5T GDI engine

No.	Tool name	Usage
1	**Piston’s assembly guide sleeve**	Install the piston.
2	**Bowl plug mounting tool**	Install the bowl plug
3	**Assembly tool of valve oil-seal**	Install the air valve oil seal
4	**Assembly tool of crankshaft’s rear oil-seal**	Install the crankshaft rear oil seal
5	**Assembly tool of crankshaft’s front oil-seal**	Install crankshaft front oil seal
6	**Wrench for oil filter**	Remove and install the oil filter

No.	Tool name	Usage
7	**Oxygen sensor sleeve**	Remove and install the oxygen sensor
8	**Spark plug sleeve**	Remove and install the spark plug sleeve
9	**Cylinder pressure test connector**	Test the cylinder pressure
10	**Flywheel lock tool**	Fixed flywheel
11	**Coolant tester**	Test coolant
12	**Compression tool for valve spring**	Compression air valve spring
13	**Forcep of valve's oil-seal**	Remove the valve oil seal
14	**Piston ring squeezer**	Remove and install the piston ring
15	**Departure tool for oil pan**	Separate the oil pan, cylinder block
16	**Assembly tool for elastic belt**	Install the elastic belt

Chapter III Engine Machinery

3.1 Belt inspection

Inspection on vehicle

Visually inspect if the drive belt has obvious excessive wear, if the core wire has chafing, cracking or oil attachment, etc. If find any damage, replace the drive belt.

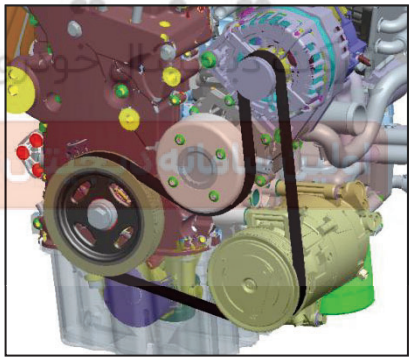
a. Belt raptured

b. Belt worn, exposing the core

c. Belt edge serious defects or even completely off

d. Belt aging, Lack of flexibility

Dismantling



① Remove the engine cover.

② Loosen the water pump belt wheel, and then remove the belt.

Attention

■ ***When removing the pump belt pulley, loosen all the bolts at one time, then remove the bolts, and then carefully remove the pump belt pulley.***

Installation

① Stack the belt onto the wheels.

② Place the special tool for elastic belt on the shock absorbing belt wheel, and jam the elastic belt.

③ Rotate the shock absorbing pulley, and use special tools to load the belt onto

the shock absorbing pulley.

■ ***After installation, turn 2 to 3 turns to check whether the belt is installed into the groove.***

3.2 Valve clearance

Valve clearance measurement and adjustment

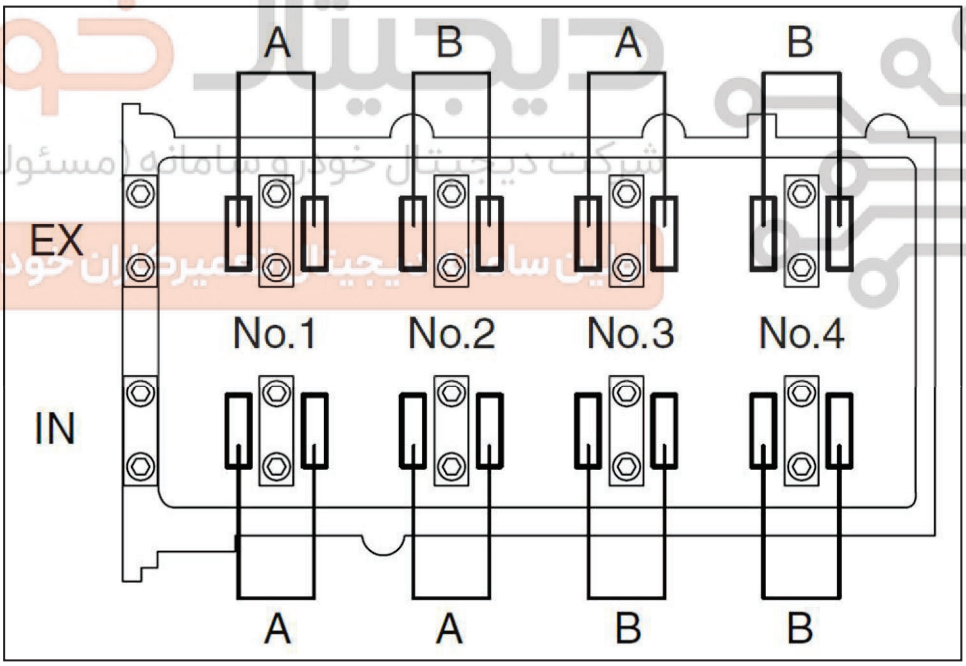
① Remove the engine cover.

② Disassemble the ignition coil.

③ Disassemble cylinder head guard assy.

④ Rotate crankshaft , let cylinder-1 piston stay at the stop point of compression.

5 Measure valve clearance.



✓ The valve clearance is measured at position A in the figure

✓ If valve clearance does not meet the standards, it needs to be adjusted.

■ ***It is important to note the measurement value as an important parameter to calculate the proper tappet label.***

Table 2-1 Standard valve clearance (Cooling engine state)

Item	Specified state

Air inlet	0.17mm～0.23mm
Exhaust	0.27mm～0.33mm

⑥ Turn the crankshaft 360º clockwise to let cylinder-4 piston stay at the stop point of compression.

⑦ Measure valve clearance.

✓ Measure the valve clearance at position B in the figure.

■ ***It is important to note the measurement value as an important parameter to calculate the proper tappet label.***

⑧ Remove engine front end belt and shock absorbing belt pulley.

⑨ Remove the oil pan, crankshaft reinforcement plate.

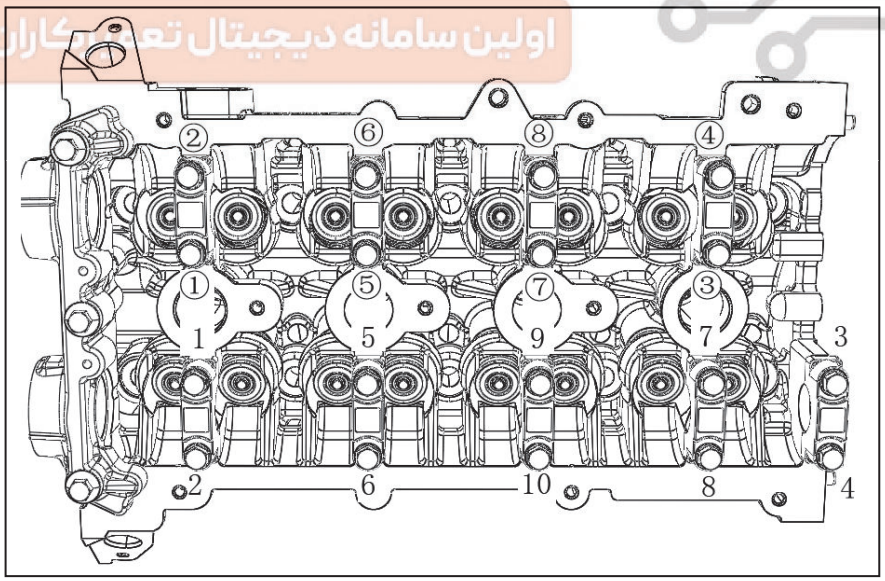
⑩ Remove the sprocket chamber cover, timing chain, oil pump drive chain and oil pump.

11 Remove the high pressure fuel pump, vacuum pump and fuel pump bracket.

12 Remove the air inlet and exhaust camshaft.

✓ Remove the camshaft front bearing cover in order from two sides to middle.

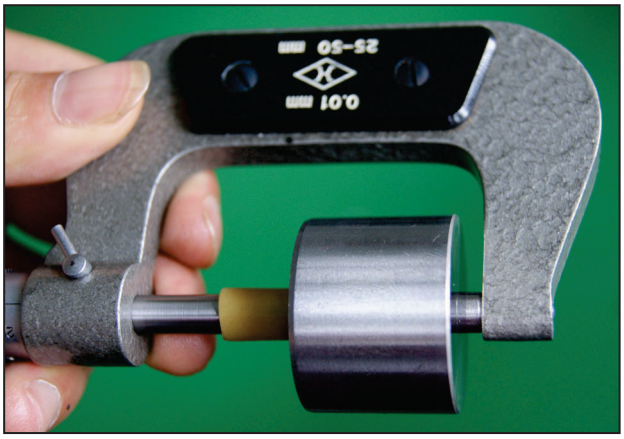
✓ Remove other bearing cover, the disassembly procedures are as follows.



⑬ Remove the mechanical tappet in the unqualified valve clearance and adjust the valve clearance.

■ ***Mark the removed tappet and the corresponding installation position to prevent forgetting the position of the column.***

a. Measure the thickness of the removed mechanical tappet with a screw micrometer.



b. According to the measured valve clearance and the thickness of the old tappet,Calculate the thickness of the new tappet to make the valve clearance reach the specified range. Refer to Table 2-2.

Table 2-2 New tappet thickness

Item	Specification
Air inlet	New tappet thickness=old tappet thickness+[measured valve clearance-0.20mm]
Exhaust	New tappet thickness=old tappet thickness+[measured valve clearance-0.30mm]

※ **Example**

✓ Measured intake valve clearance＝0.26mm, marked as A.

✓ Measured old tappet thickness＝2.79mm, marked as B.

✓ Measured intake valve clearance+Measured old tappet thickness ＝ The clearance between the camshaft and the valve tappet, marked as C. C＝3.05mm.

✓ **C** ＝ Intake valve clearance standard value+Ideal new tappet thickness. So Ideal new tappet thickness＝3.05mm-0.20mm＝2.85mm.

■ ***When calculating the thickness of the exhaust side tappet, the above equation should be replaced with exhaust valve clearance standard value.***

c. The closest new tappet thickness ＝2.84mm or 2.86mm. --Select tappet No. 84 or tappet No. 86.

d. Select a new tappet with the closest thickness to the calculated value.

■ ***The available tappets have 31 sizes, ranging from 2.70 to 3.30mm, increasing by 0.02mm (namely 2.70, 2.72, 2.74……3.28, 3.30), refer to Table 2-3.***

■ ***The identification number in the mechanical tappet indicates the two digits after the decimal point of the tappet (namely, 70 indicates the tappet thickness is 2.70mm, 80 indicates the tappet thickness is 3.08mm).***

Table 2-3 Tappet grouping installation table

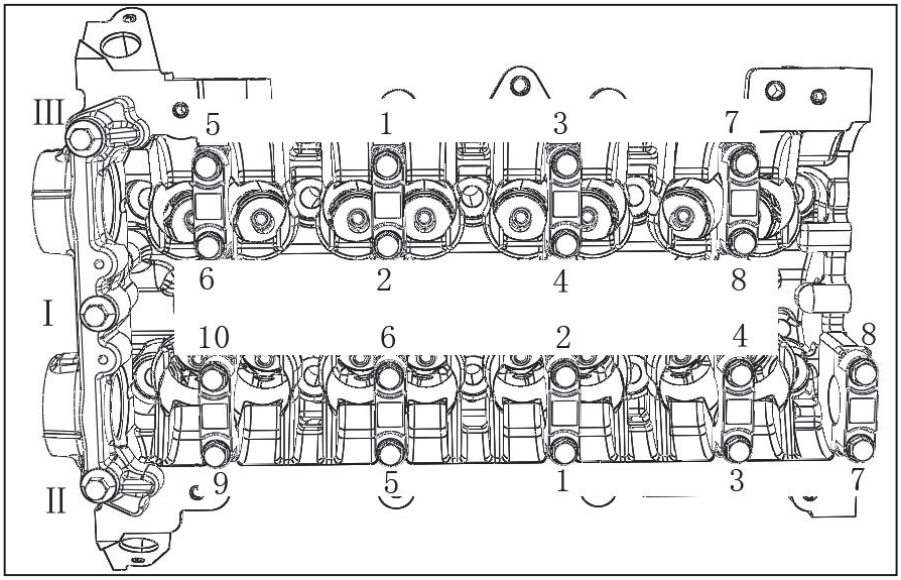
Tappe	Thickness /mm	Tappe	Thickness /mm	Tappe	Thickness /mm
70	2.70	92	2.92	14	3.14
72	2.72	94	2.94	16	3.16
74	2.74	96	2.96	18	3.18
76	2.76	98	2.98	20	3.20
78	2.78	00	3.00	22	3.22
80	2.80	02	3.02	24	3.24
82	2.82	04	3.04	26	3.26
84	2.84	06	3.06	28	3.28
86	2.86	08	3.08	30	3.30
88	2.88	10	3.10		
90	2.90	12	3.12		

e. Install the new tappet selected after the calculation.

■ ***Confirm the specific position of each new tappet selected after calculation (corresponding to the mounting hole), preferably mark the new tappet.***

f. Install the camshaft and bearing cover and tighten the bolts in order , first pre-tighten the bolt in the order of I～III, 1～8, 1～10, and then tighten in this order. Camshaft front bearing cover bolts (3) tightening torque: 19～21N.m, camshaft

bearing cover bolt (18) tightening torque：9～11N.m.



g. Measure again whether or not the valve clearance after adjustment meets the standard. If it is beyond the standard range, first check whether the tightening torque of bearing cover bolts

✓ meets the requirements. Continue to operate according to step a～f.

✓ If the tightening torque of bolts does not meet the requirements, loosen all the bolts on this camshaft and tighten them to the specified torque in order. Measure the valve clearance again, if still not proper, continue to operate according to step a～f.

14 Install timing chamber, sprocket chamber cover plate. (Refer to “Installation of timing chain”)

⑮ Install the oil pump and oil pan. (Refer to “Installation of oil pan”)

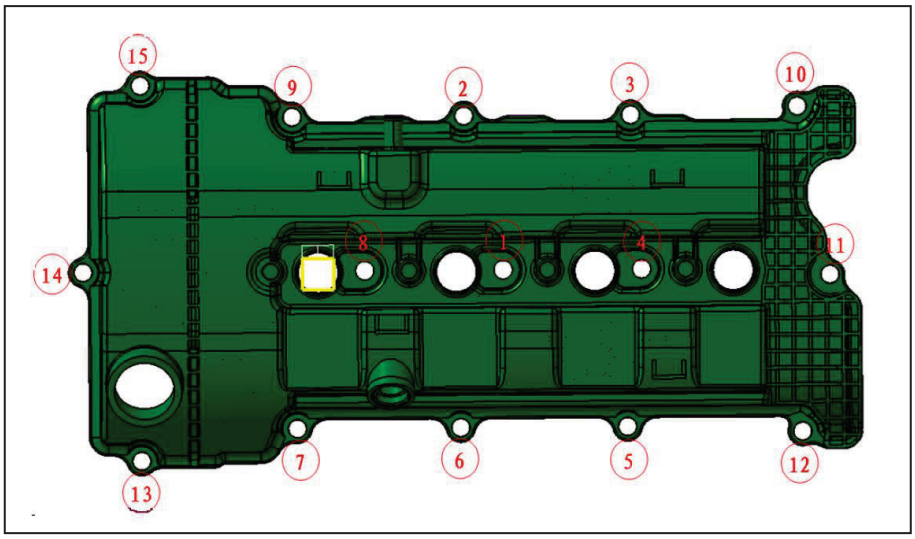
⑯ Install the fuel pump bracket and vacuum pump. (Refer to “Installation of camshaft”)

⑰ Install front-end power accessory and drive belt.

⑱ Install the cylinder head guard and ignition coil.

■ ***Check the sealing ring of cylinder head guard before installation to ensure no loss, no damage, no scratch, no crease and other defects, so as to ensure its sealing performance.***

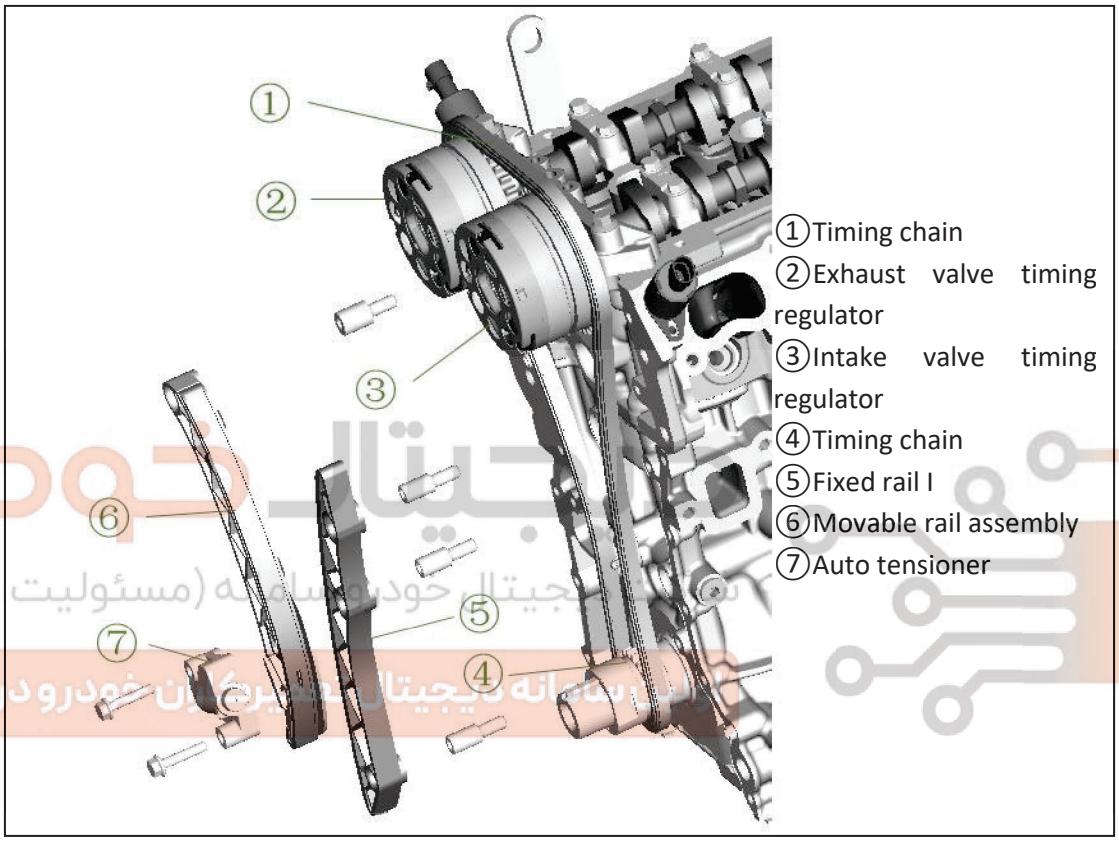
■ ***The cylinder head guard bolts must be tightened in the order shown in the figure with tightening torque: 9～11N.m***



3.3 Cylinder block group

3.3.1 Timing chain

1) Constitute diagram



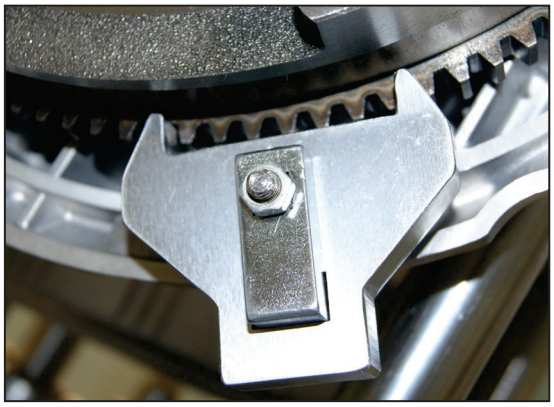
2）Dismantling

① Remove the engine cover.

② Loosen the water pump belt wheel, and then remove the belt.

■ ***When removing the pump belt pulley, loosen all the bolts at one time, then remove the bolts, and then carefully remove the pump belt pulley.***

✓ Use special tool (flywheel stopper) to fix the flywheel, and don't make the crankshaft rotate.



✓ Remove the shock absorber belt pulley fixing bolt.

③ Remove the cylinder head guard.

④ Remove the oil pan. (Refer to “Removal and installation of oil pan”)

⑤ Remove the chain chamber cover, automatic tensioner, movable rail, fixed rail I, timing chain.

⑥ Remove the chain chamber cover cap, torsion spring tensioner, oil pump chain, oil pump and crankshaft chain.

■ ***Place the automatic tensioner carefully to prevent the spring in the automatic tensioner from popping off and falling off.***

■ ***Automatic tensioning device, moving rail, fixed rail, chain, crankshaft chain, oil pump should be placed in a clean container.***

3) Installation

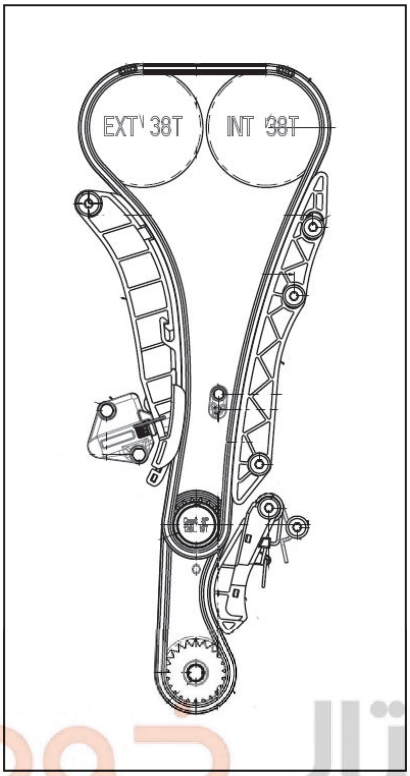
(1) Adjust the crankshaft so that the 1st cylinder piston is in the top dead center position, the button sleeve is up a little over 12 o’clock position, about 2.4º.

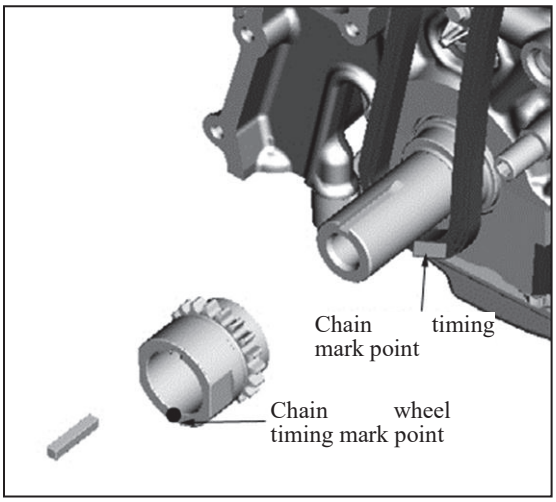
(2) Install crankshaft timing sprocket and locating button, and ensure that another timing chain on the chain is aligned with the timing marker on the crankshaft sprocket.

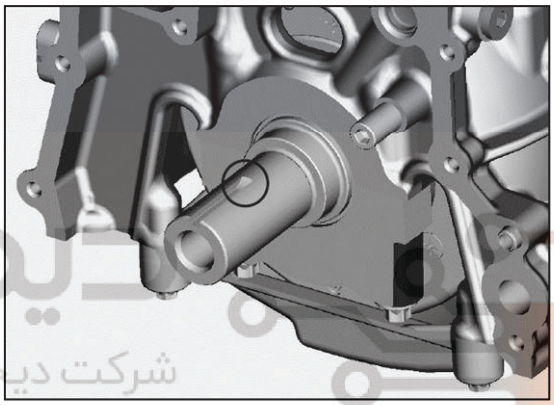
(3) Install the oil pump. Bolt tightening torque: 20～25N.m.

(4) Install the oil pump chain.

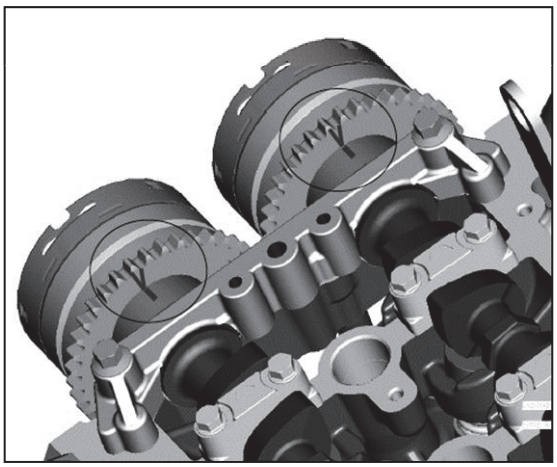
(5) Install the torsion spring tensioner, install the chain cover cap.





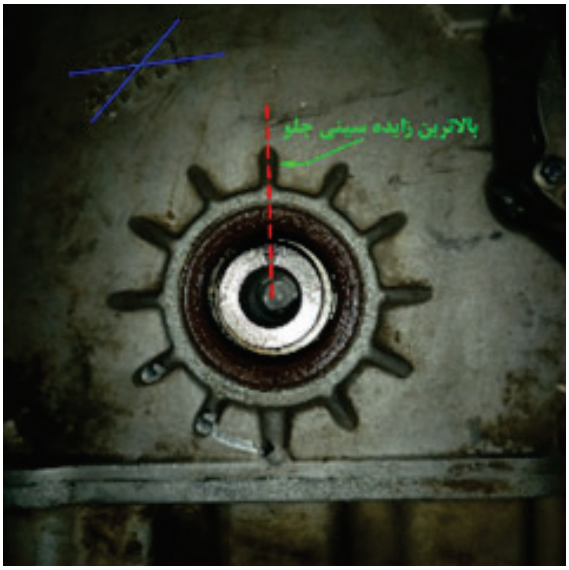


(3) Adjust the intake and outlet camshaft, to make the timing mark point on the VVT actuator back align with the mark on the camshaft front bearing cover.

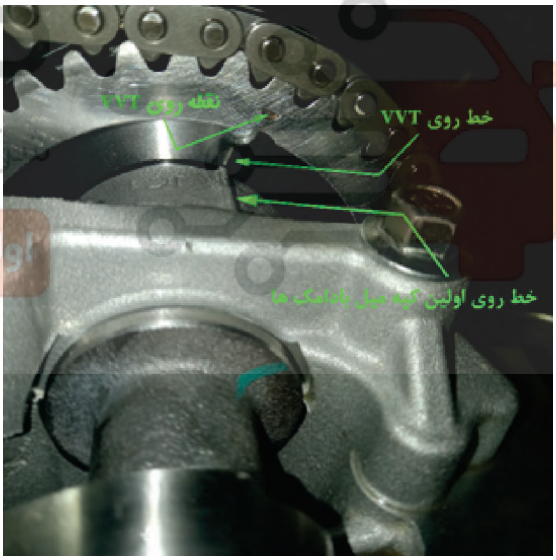


(4) Install the timing chain, to make the two closer timing marks on the chain with the timing marks on the inlet and outlet VVT actuators.

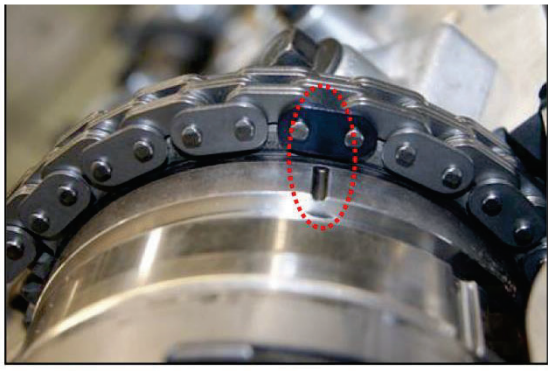
بکس، میل لنگ را بچرخانید تا خار میل لنگ رو به بالا و مطابق با شکل زیر با نشان مشخص شده روی سینی جلو در یک خطا راست قرار گیرند:

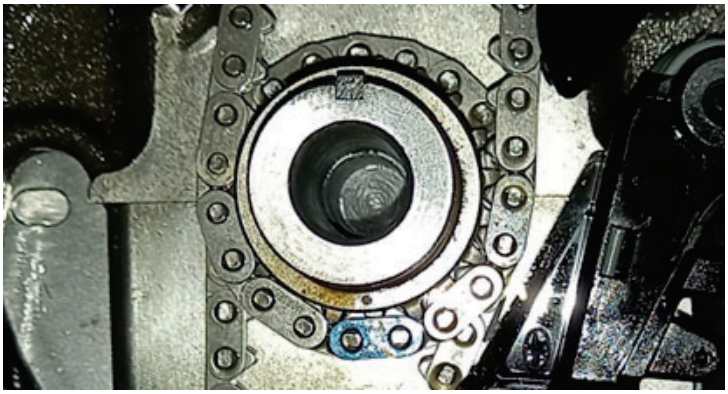


پس از تنظیم میل لنگ مطابق با دستور العمل فوق، درب سوپاپ را باز نمایید. علایم روی پشتVVT و کپه بزرگ میل بادامک ها باید مطابق با تصاویر ذیل باشند:



اگر زنجیر تایم باز است و می خواهید زنجیر تایم را نصب نمایید، مطابق با علایم روی زنجیر، نقطه روی چرخدنده میل لنگ و علایم VVT، مانند تصاویر زیر نصب نمایید:





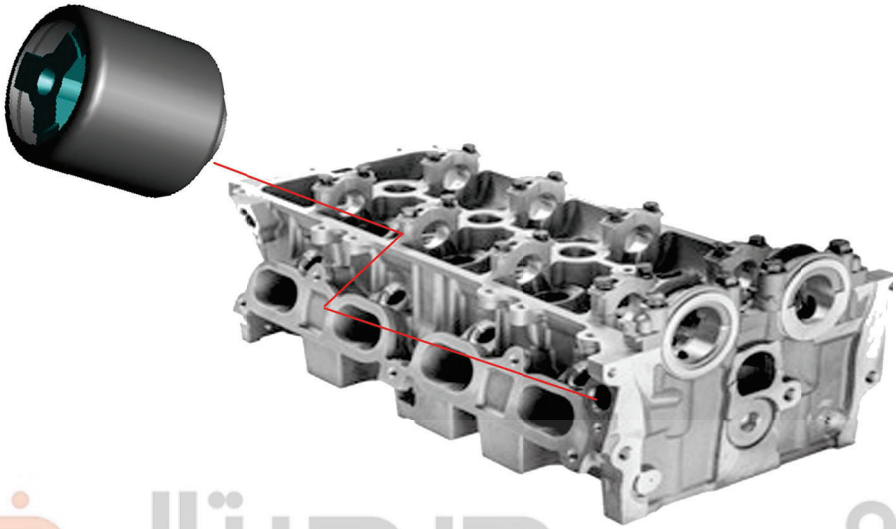
توجه فرمایید علایم روی سینی جلو و پولی میل لنگ، متعلق به موتور 7K نمی باشد و ملاک تعیین تایم قرار نگیرد:

شیوه نصب VVT روی میل بادامک ها:

روی میل بادامک ها 5 حفره تعبیه شده است. 4 عدد از آن ها مربوط به مجراهای روغن و یک حفره مربوط به محل نصب خار VVT است. توجه شود انتهای حفره مربوط به خار VVT مسدود است.

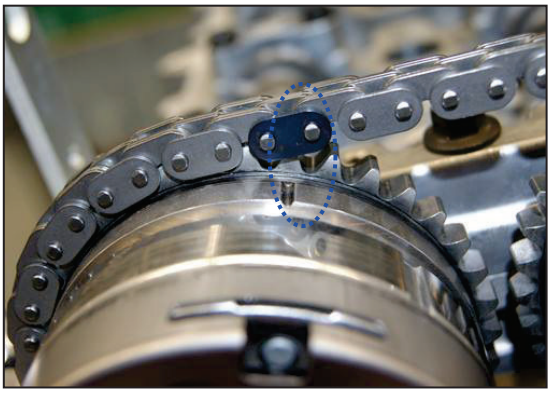
توجه فرمایید در انتهای میل سوپاپ دود حفره ی روغنی وجود دارد که با قطعه زیر مسدود می شود. قطر بزرگ این قطعه درون حفره میل سوپاپ نصب می شود. پیش از نصب، اورینگ های هر دو سمت را آغشته به روغن نمایید:

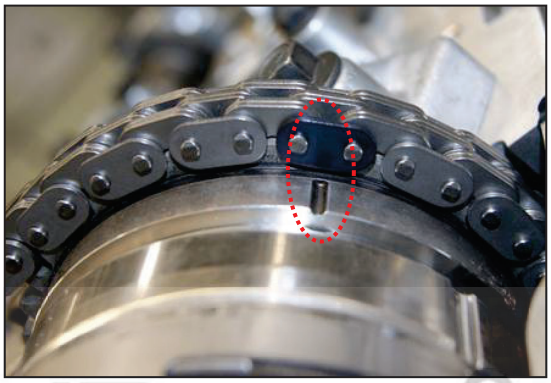
روی سرسیلندر و در انتهای حفره مربوط به شیرهای OCV، سوپاپ یک طرفه قرار می گیرد. در صورت تعویض سرسیلندر، وجود این سوپاپ ها را روی سرسیلندر بررسی نمایید.



سوپاپ یک طرفه 1006400GH110 - دو عدد

هنگام نصب دیسک سنسور دور موتور وجود هر گونه ایرادی روی دیسک، میل لنگ، بغل یاتاقانی و بلوکه را بررسی نمایید. در صورت وجود آسیب/خمیدگی روی دیسک یا تغییر در فاصله بین سنسور دور موتور و دندانه های دیسک، موتور روشن نخواهد شد یا موتور حین حرکت خاموش می شود. اگر سنسور دور میل سوپاپ سالم باشد، پس از استارت های مکرر، خطای سیگنال سنسور دور موتور در ECU ثبت می شود.





(5) Install the fixed rail I and movable tail fixing bolt. Bolt tightening torque: 20～25N.m.

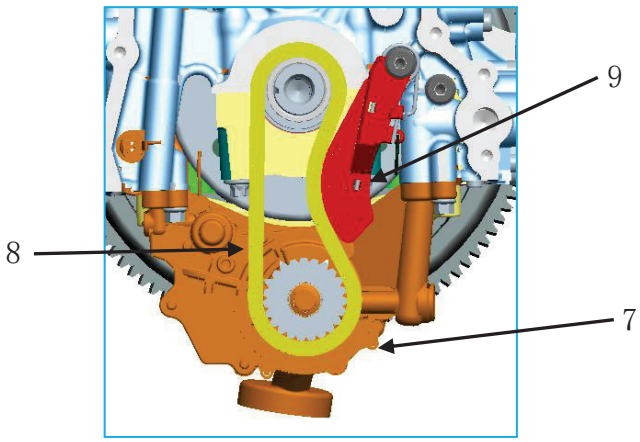
(5) Install the fixed rail I and movable tail.

(10) Install the automatic tensioner.

✓ Press the automatic tensioner piston, to make it be in bottom dead center and lock it.

✓ Install and fix the automatic tensioner. Tightening torque of automatic tensioner fastening bolt: 9～11N.m.

(11) Check whether the chain is located in the middle area of the moving and fixed rail guide groove, and the chain shall not have any distortion. Pull out the automatic tensioner lock pin. Spray a small amount of lubricating oil on the meshing part of the chain and sprocket and the contact area of fixed and moving rail. Rotate the crankshaft to check if there is block phenomenon.



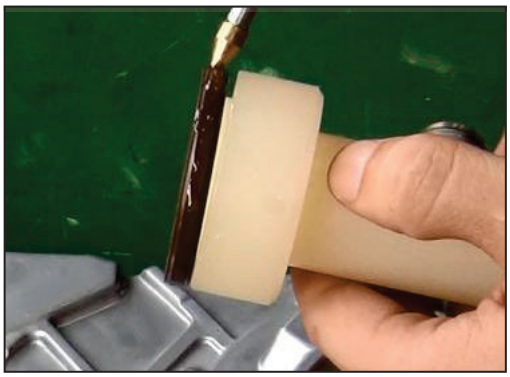
(12) Install the sprocket chamber cover.

✓ Clear the sealant in the fitting surface of cylinder body and sprocket chamber cover.

✓ Install the new crankshaft front oil seal.

■ ***Apply lubricating oil to the outer wall of the oil seal before installation.***

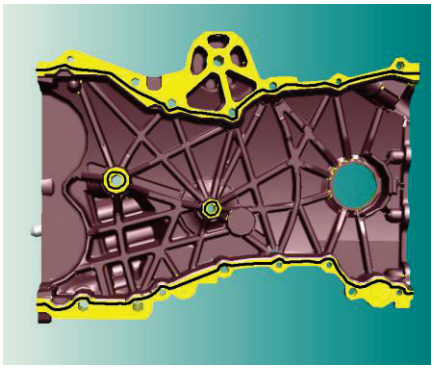
■ ***Using special tool, slowly knock the oil seal into the sprocket chamber cover.***



■ ***After installing, ensure the oil seal is installed well, no crack.***

✓ Spread sealant to the sprocket chamber cover.

■ ***Use Letai -5900H plane sealant or equivalent performance products.***

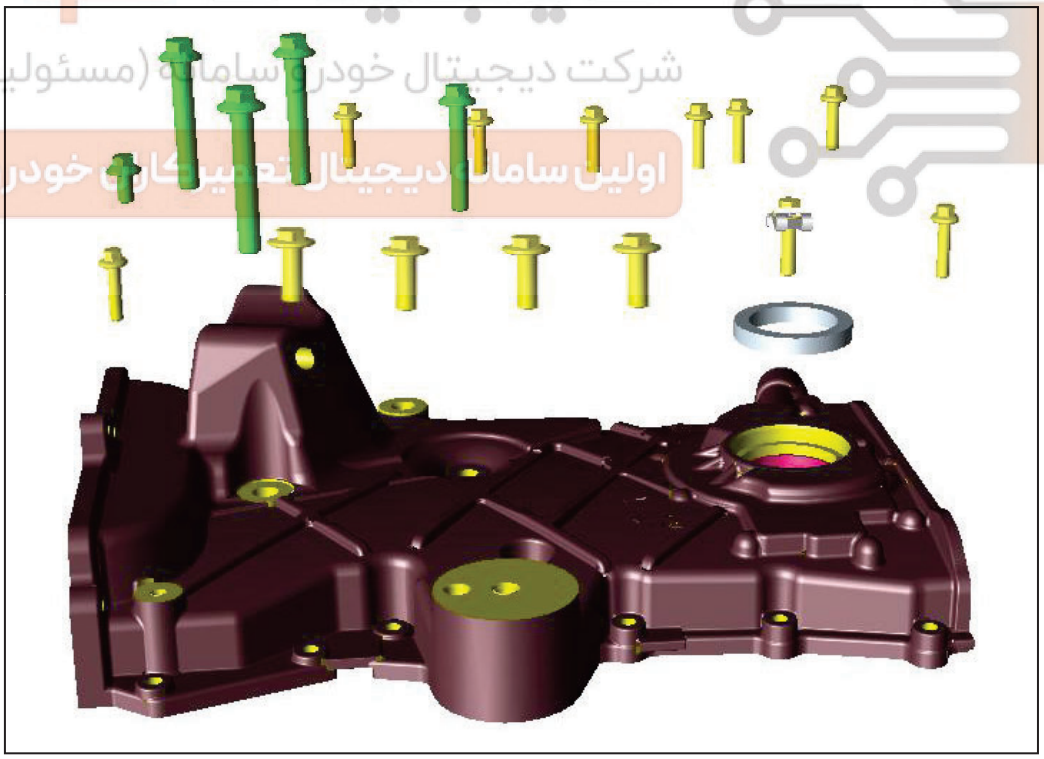


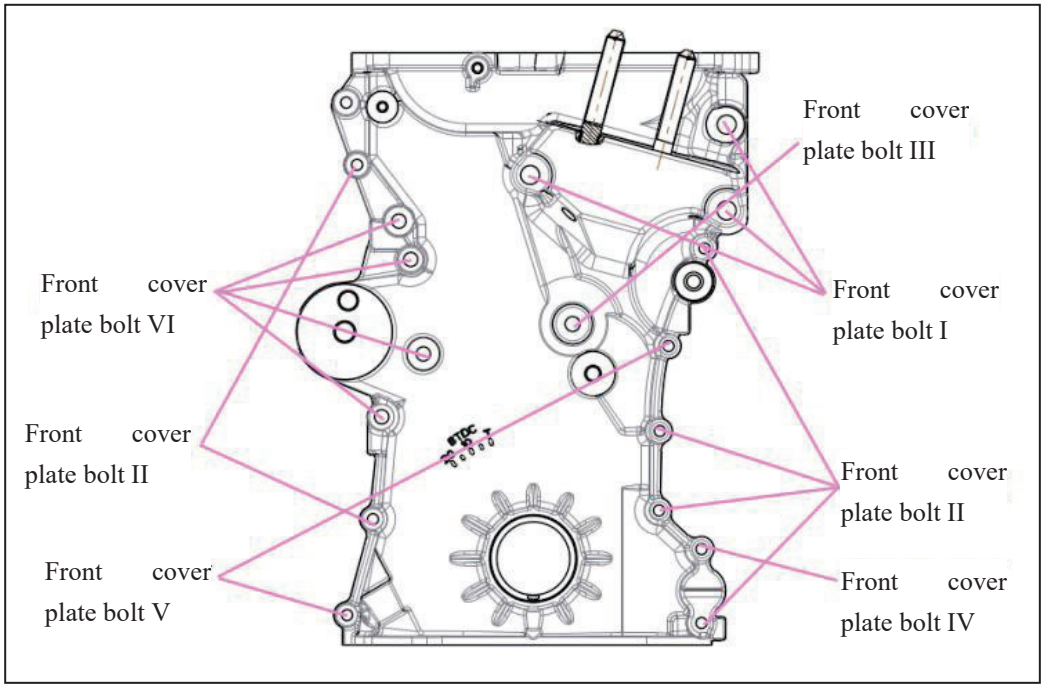
■ ***Sealant strip diameter: 2±0.5mm, the center of sealant strip is 2mm from the inner edge of the sealing surface.***

✓ Install the sprocket chamber cover.

■ ***Ensure that the O-ring on the cover of the sprocket chamber is free from falling off, damage, scratch, crease and other defects.***

■ ***Tighten the sprocket chamber cover bolt according to the principle of pre-tightening first, then from middle to both sides and cross tightening. Tighten the bolt with larger diameter first and then tighten the bolt with smaller diameter.***





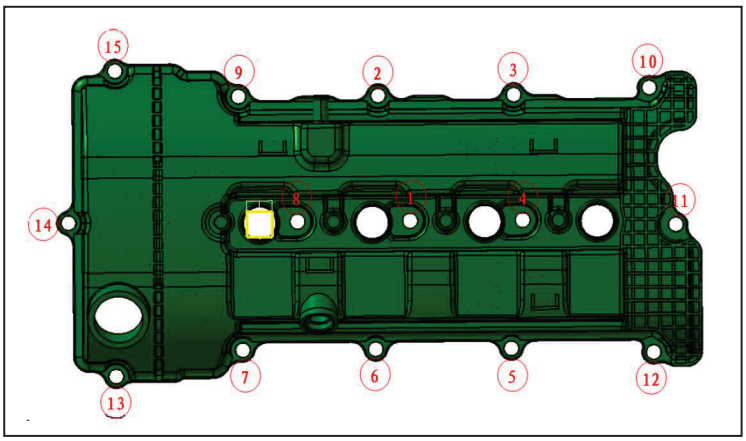
■ ***Front cover bolt I (3) tightening torque: 40～50N.m. Front cover bolts II (6), IV (1), V (2) tightening torque: 9～11N.m. Front cover bolts III (1), VI (4) tightening torque: 20～25N.m.***

(13) Install the oil pan. (Refer to "Removal and installation of oil pan")

(14) Install the cylinder head guard.

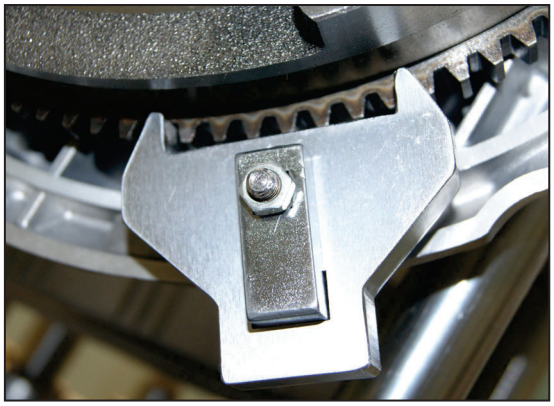
■ ***Check the sealing ring of cylinder head guard before installation to ensure no loss, no damage, no scratch, no crease and other defects, so as to ensure its sealing performance.***

■ ***The cylinder head guard bolts must be tightened in the order shown in the figure with tightening torque: 9～11N.m***



(15) Install the shock absorber belt pulley.

✓ Use special tool to fix the flywheel, and don't make the crankshaft rotate.



✓ Spread oil on the fastening bolt of the shock absorbing belt pulley, and tighten it in the following way: （150±10）N.m＋（170±4）º.

(16) Install the front end drive belt.

Stack the belt onto the wheels.

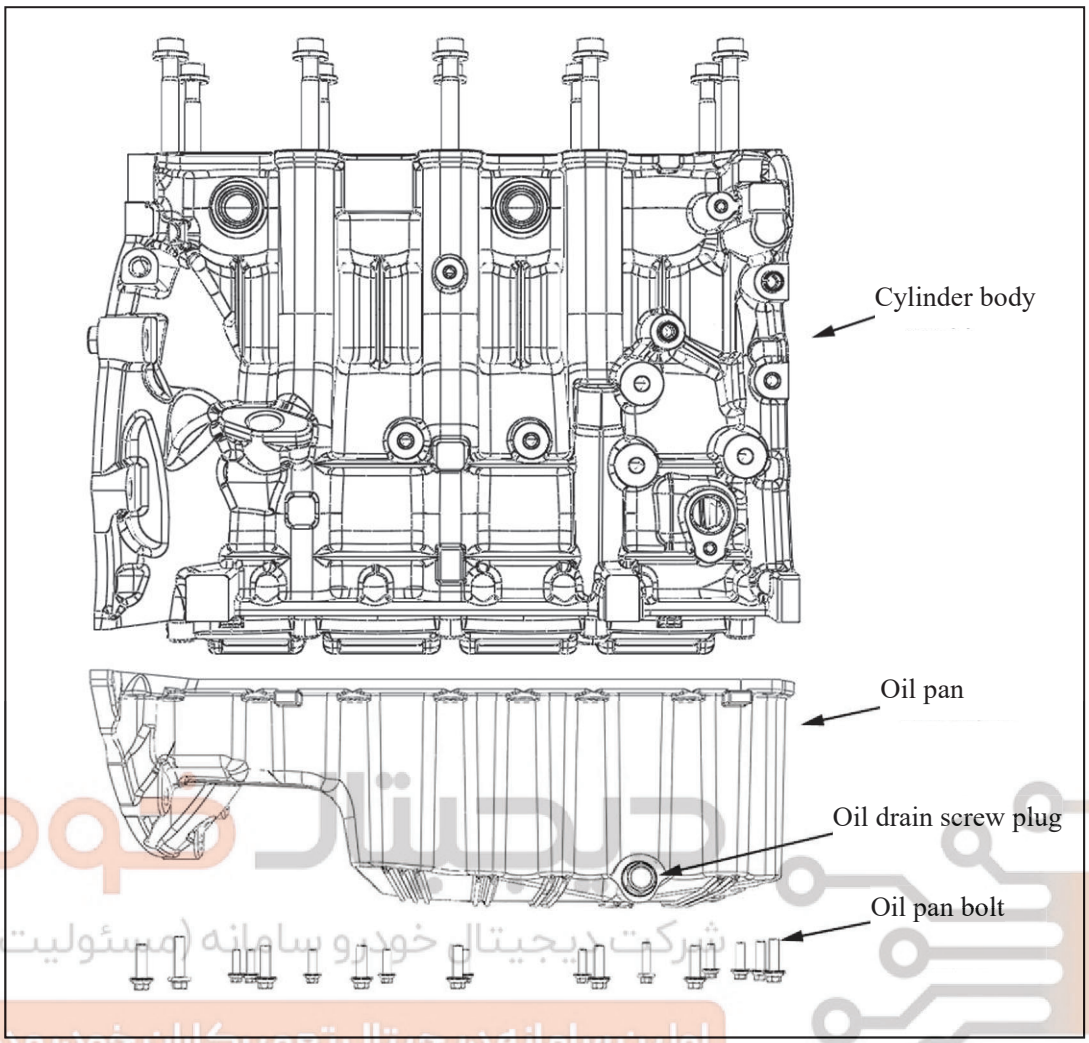
Place the special tool for elastic belt on the shock absorbingbeltwheel, and jam the elastic belt.

Rotate the shock absorbing pulley, and use special tools to load the belt onto the shock absorbing pulley.

■ ***After installation, turn 2 to 3 turns to check whether the belt is installed into the groove.***

3.3.2 Oil pan

1)Constitute diagram



2) Dismantling

1 Remove the oil pan drain screw plug, and discharge the oil inside the engine.

■ ***The oil temperature is very high after the engine has been running for a period of time. Before removing, cool for 30 minutes.***

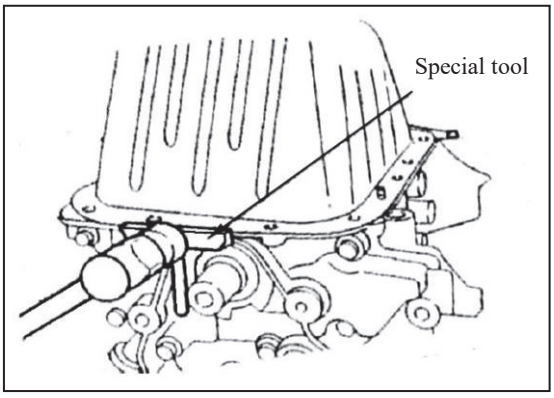
■ ***Avoid direct contact with skin and waste oil for a long time. If contact the oil, wash thoroughly with soap or detergent as soon as possible.***

② Remove the oil pan.

a. Loosen and remove the oil pan bolts.

b. Use special tool or screwdriver to slowly tap the gap between the cylinder block and the oil pan.

c. Tap the side of the special tool and move the tool along the oil pan/cylinder block sealing face, then remove the oil pan.

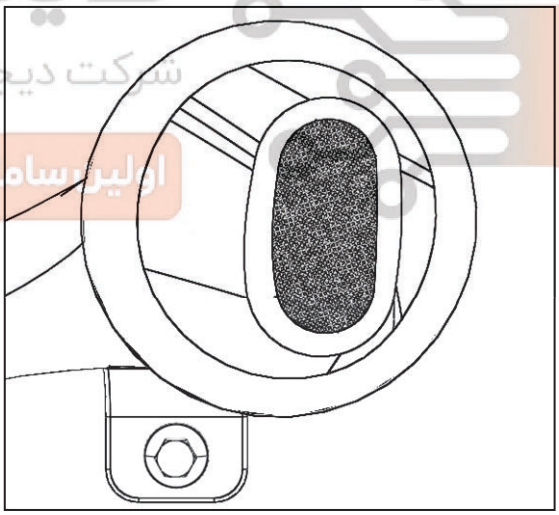


3) Check

✓ Check if there is residual particulate matter in the oil pan. If there are more residual particulate matter, clean the oil line before filling new oil.

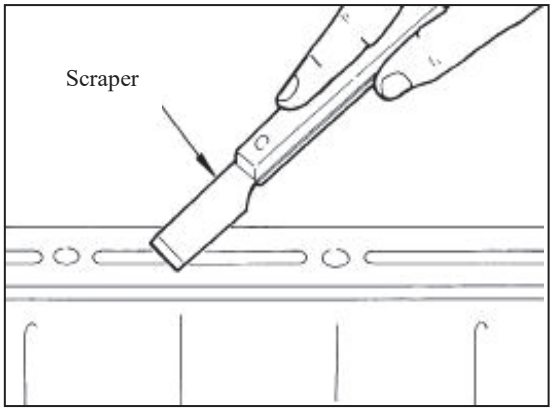
✓ Check whether the filter strainer is covered by sundries, and clean it if necessary.

✓ Check whether the rotation of the oil pump is stuck, if stuck, you need to replace the oil pump assembly.



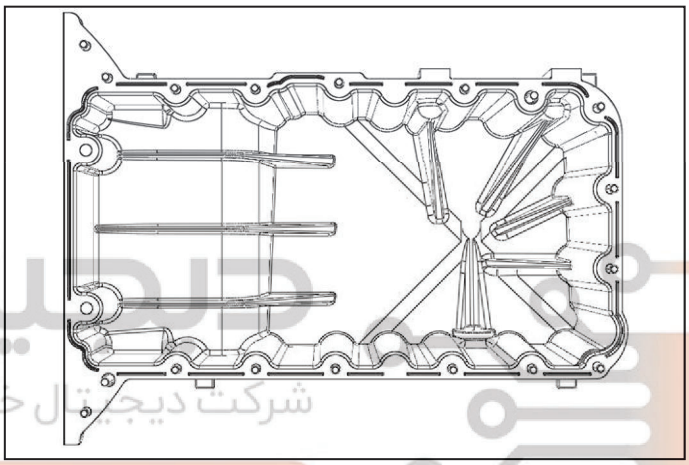
4) Installation

① Clear cylinder block and the old sealant on the oil pan.



■ ***Don't damage the mounting surface of the oil pan and the cylinder block.***

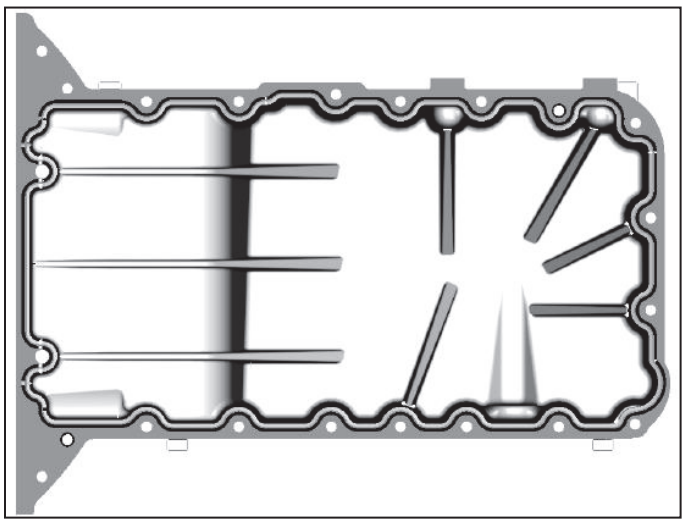
■ ***Remove the sealant inside the groove and bolt hole.***



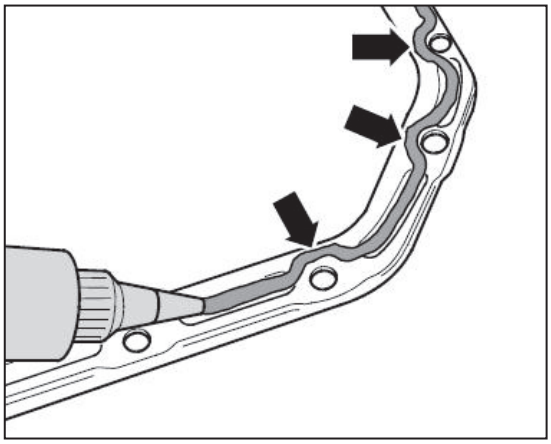
■ ***Wipe clean the fitting surface of the cylinder body and oil pan by unleaded gasoline, clear the attached water, grease and foreign matter.***

2 Install the oil pan.

✓ Apply sealant to the oil pan.



✓ Spread sealant along the inside of the oil pan bolt hole.



■ ***Use Corning 3-0115 surface sealant or equivalent products.***

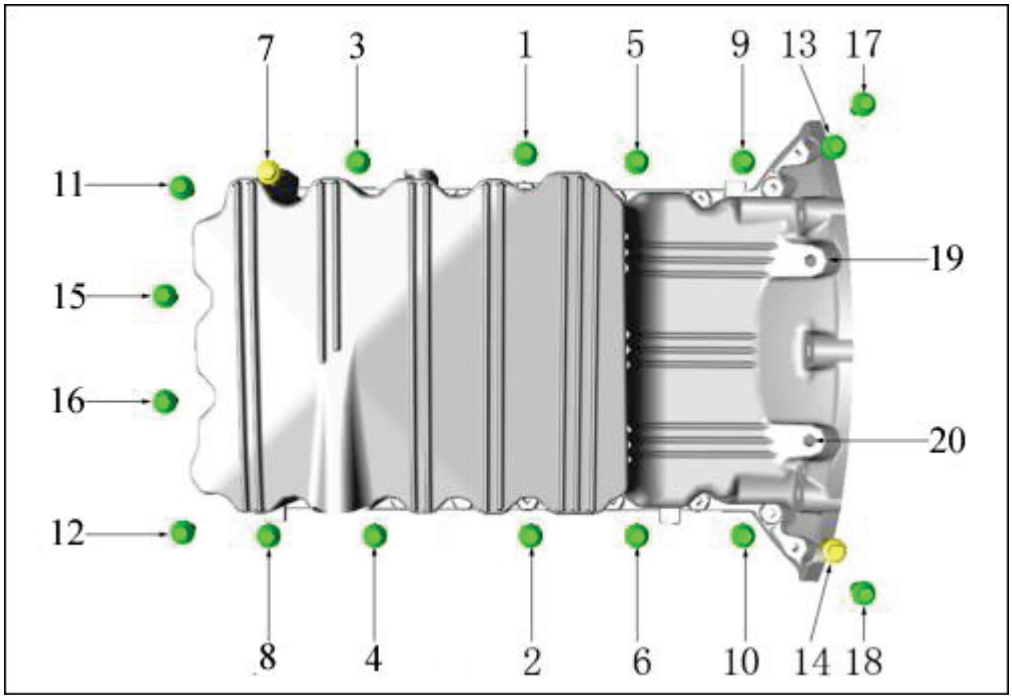
■ ***Pay attention to the expiry date of sealant to avoid poor sealing caused by the use of expired sealant.***

■ ***Sealant strip diameter: 3±0.5mm, the center of sealant strip is at least 2mm from the inner edge of the sealing surface. Sealant strip should be uniform and continuous, so as not to affect the sealing performance.***

■ ***Sealant strip diameter must not exceed specified size, otherwise excess sealant may enter the oil pan and clog the strainer in the oil suction filter.***

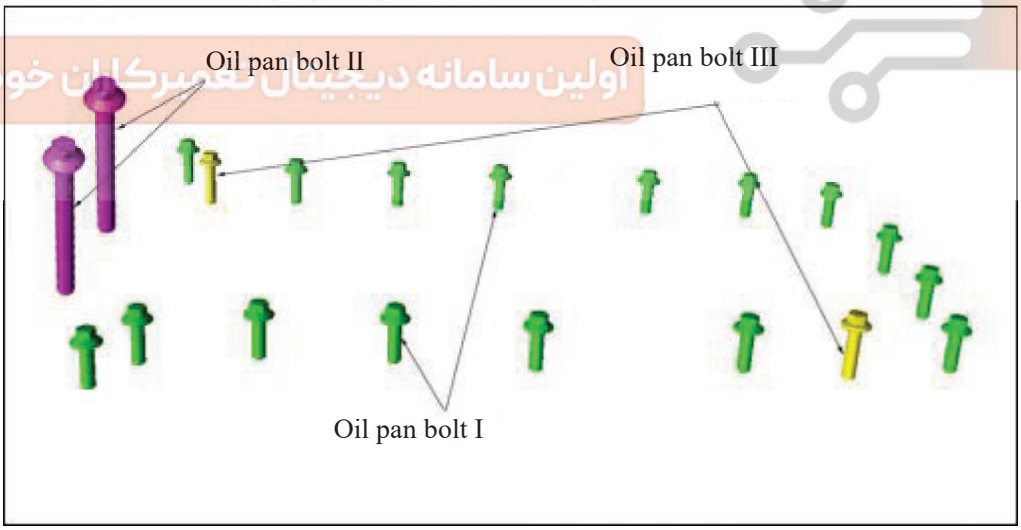
■ ***Install the oil pan within 15 minutes after applying the sealant, otherwise the sealing may be poor due to the sealant surface hardening.***

✓ Install the oil pan, and tighten the oil pan fixing bolt according to the sequence as shown in the figure.



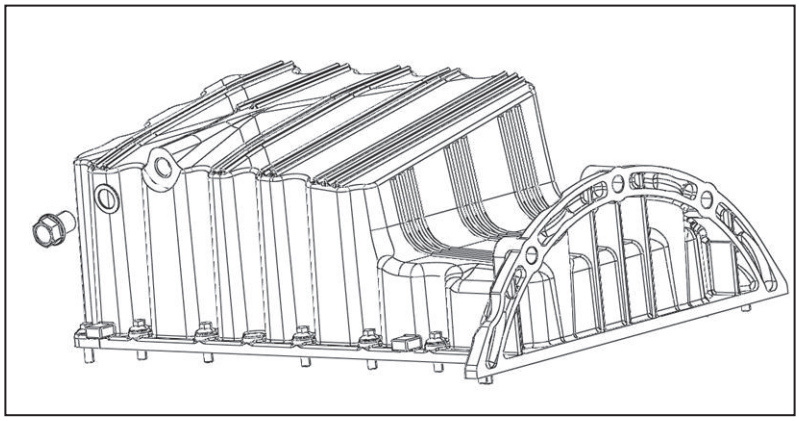
■ ***Tighten the oil pan bolt according to the principle of pre-tightening first, then from middle to both sides and cross tightening.***

■ ***Oil pan bolt I tightening torque: 9～11N.m; Oil pan bolt II tightening torque: 20～25N.m; Oil pan bolt III tightening torque: 9～11N.m.***



■ ***Oil pan bolt I quantity: 16; Oil pan bolt II quantity: 2; Oil pan bolt III quantity: 2.***

③ Install the oil pan oil drain bolt.



■ ***Replace new oil drain bolt washer, and clear the strain on the mounting thread hole and oil drain bolt.***

■ ***Oil drain screw plug tightening torque: 40～45N.m.***

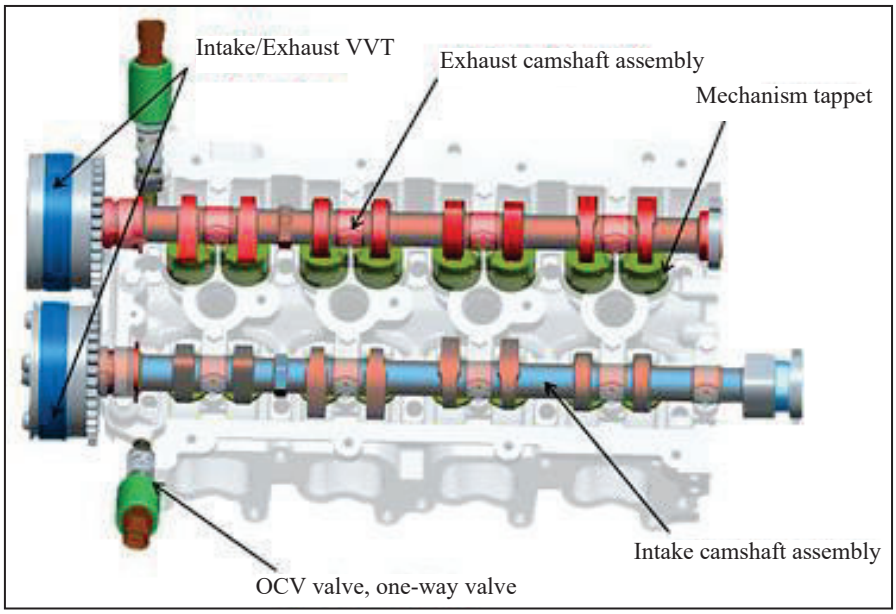
④ Clear the redundant sealant on the fitting surface of oil pan and cylinder block.

⑤ Fill the engine oil. (Refer to “Maintenance-engine oil replacing”)

■ ***After installing the oil pan, wait for more than two hours until the oil pan sealant is curdled. Then you can fill the engine with oil.***

3.3.3 Camshaft

1）Constitute diagram

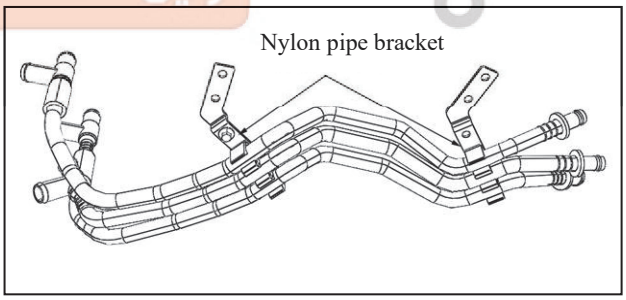


2）Dismantling

① Unplug wiring harness connector of ignition coil, charcoal canister solenoid valve, camshaft position sensor, coolant temperature sensor, high pressure oil pump, electronic throttle valve and other connectors.

② Remove the breather ventilation hose I, breather ventilation hose II and charcoal canister solenoid valve.

③ Remove the nylon tube bracket (2 brackets) and the nylon tube assembly.



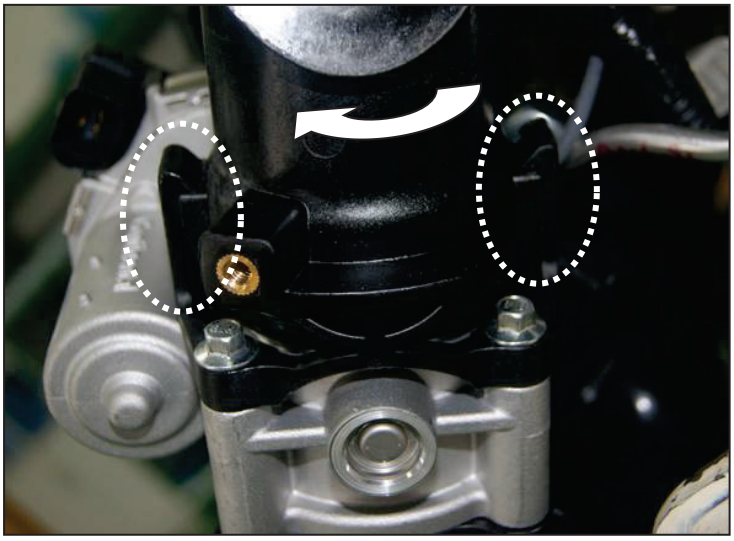
■ ***Lay a dry towel under the pipeline to absorb the liquid flowing out during removal.***

④ Remove the turbocharging pressure connecting pipe.

⑤ Remove the turbocharging pressure pipe.

✓ After unscrewing the turbocharging pressure pipe fastening bolt, turn the turbocharging pressure pipe clockwise (arrow direction as shown below) and remove the turbocharging pressure pipe.

■ ***Be careful not to damage the turbocharging pressure clamp.***



⑥ Remove the high pressure fuel pump connecting to the fuel pump and fuel rail.

■ ***Dust cap shall be applied to the fuel rail fuel and hgh-pressure fuel pump oil outlet to prevent foreign matter from entering.***

Remove the fuel pump.

■ ***Pay attention to ensure the cleanliness of the parts and prevent foreign matter from entering the parts.***

7 Remove the cylinder head guard.

8 Remove the oil pan. (Refer to “Removal and installation of oil pan”)

9 Remove the front end drive belt and timing chain. (Refer to “Removal and installation of timing chain”)

⑩ Remove the vacuum pump and fuel pump bracket.

⑪ Measure valve clearance.

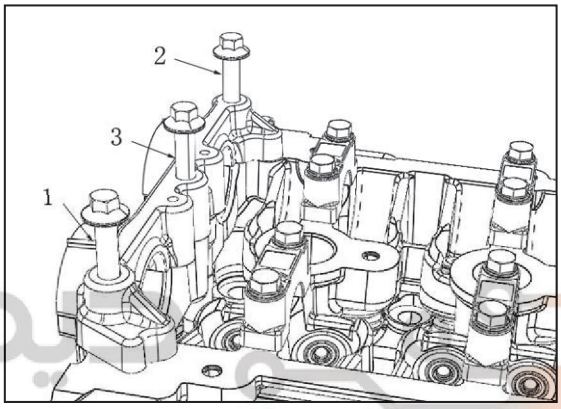
⑫ Remove the camshaft.

✓ Remove the valve timing regulator on the air inlet/outlet camshaft.

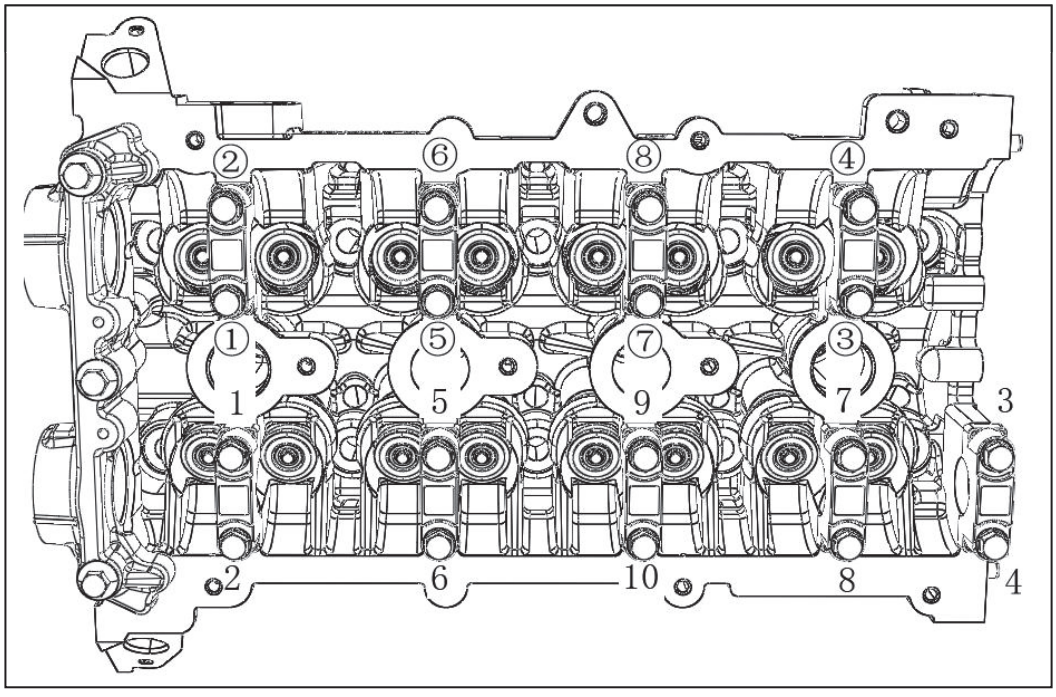
■ ***If the old camshaft continues to be used, measure the valve clearance and record the value before removal.***

■ ***Loosen the valve timing regulator fastening bolts while fixing the camshaft with wrench.***

✓ Remove the camshaft front bearing cover according to the sequence as shown in the figure.



✓ According to the sequence as shown in the figure below, evenly loosen and remove the intake camshaft bearing cover fastening bolts and the exhaust camshaft bearing cover fastening bolts step by step.



✓ Remove the 5 intake camshaft bearing covers and the 4 exhaust camshaft

bearing covers.

■ ***Place the camshaft bearing cover in clean container in sequence.***

✓ Remove the camshaft.

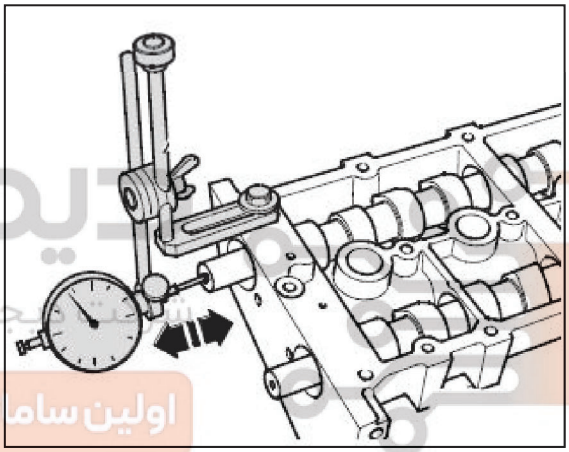
⑬ Remove the mechanical tappet which need to adjust the valve clearance, and place in order.

3）Check

① Measure the camshaft axial clearance.

a. Install the camshaft, and fasten according to the standard torque.

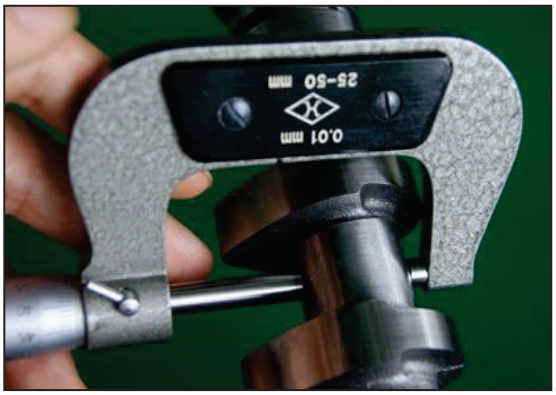
b. Use dial gauge to measure the axial clearance when the camshaft is moved axially.



■ ***Camshaft axial clearance standard value: 0.10～0.20mm. Maintenance limit value: 0.40mm***

■ ***If the axial clearance is larger than the maximum, replace the cylinder head. If the camshaft thrust surface is damaged, replace the camshaft.***

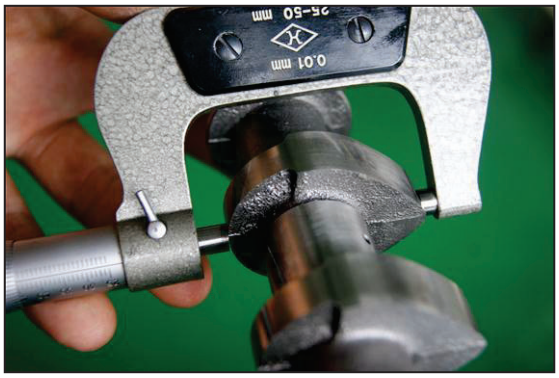
② Measure the camshaft journal diameter.



■ ***Measured standard value: φ23.965～φ23.980mm.***

■ ***If the camshaft journal size is not accord with the specification, replace the camshaft.***

③ Measure the camshaft cam height.



■ ***Measured standard value: intake cam height: 45.5±0.1mm.***

Exhaust cam height: 44.8±0.1mm.

■ ***If the cam height is not accord with the specification, replace the camshaft.***

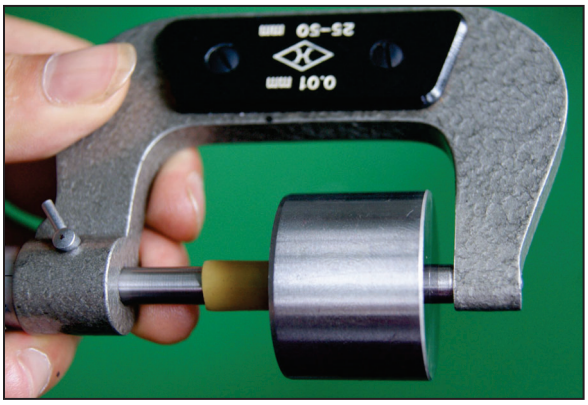
4）Mechanical tappet selecting method when installing old camshaft

① According to the measured valve clearance before removing the camshaft, adjust the unqualified valve clearance. Standard valve clearance, see Table 3-1.

Table 3-1 Valve clearance standard value

Item	Specified state
Air inlet	0.17mm～0.23mm
Exhaust	0.27mm～0.33mm

② Measure the old mechanical tappet thickness in the valve clearance to be adjusted.



③ Select the new mechanism tappet, and install it to the corresponding

position, computational formula, see Table 3-2.

Table 3-2 New tappet thickness computational formula

Item	Specification
Air inlet	New tappet thickness=old tappet thickness+[measured valve clearance-0.20mm]
Exhaust	New tappet thickness=old tappet thickness+[measured valve clearance-0.30mm]

■ ***For more details, please refer to "Adjustment of valve clearance".***

5）Mechanical tappet selecting method when installing new camshaft

■ ***When assembling with new camshaft, all valve clearances need to be re-adjusted.***

① Remove all the old mechanical tappet.

② Install the 16 mechanical tappets, whose mark number is 90 (namely the tappet thickness is relatively thin).

③ Install the camshaft and camshaft cover, and fasten according to the standard torque.

④ Measure the valve clearance, and record, see Table 3-3.

Table 3-3 Mechanical tappet choosing record table

Mechanical tappet choosing record table									
		1	2	3	4	5	6	7	8
Measure the valve clearance after installing 290 tappet	IN	0.28	0.28	0.28	0.24	0.28	0.22	0.22	0.18
	EX	0.38	0.36	0.34	0.36	0.38	0.36	0.32	0.3
Choosing tappet number after calculating	IN	98	98	98	94	98	92	92	88
	EX	98	96	94	96	98	96	92	90
Actual valve clearance (after installing)	IN								
	EX								

⑤ Remove the camshaft.

⑥ According to the standard clearance value, calculate the ideal tappet

thickness, the formula is shown below.

Ideal tappet thickness = Measured valve clearance+2.90mm - Standard valve clearance.

■ If the tappet number chosen in step 2 is not 90 but 80, change 2.90mm to 2.80mm in the formula above.

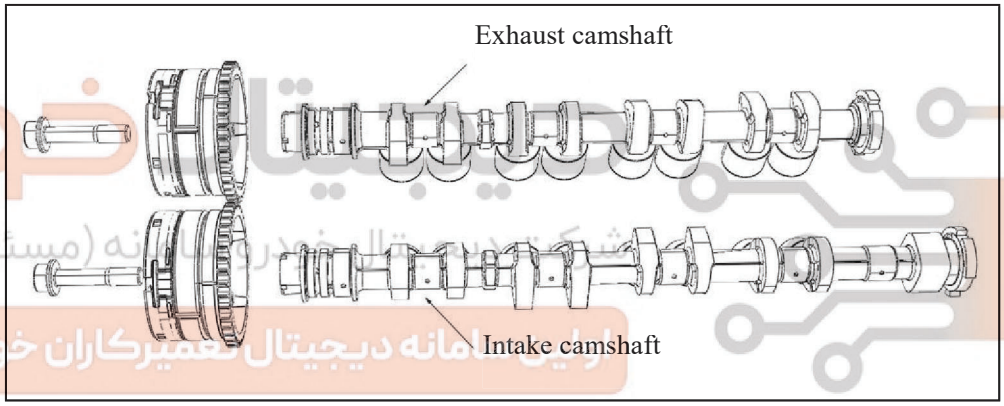
⑦ Choose the mechanical tappet whose thickness is closest to the ideal tappet.

6）Installation

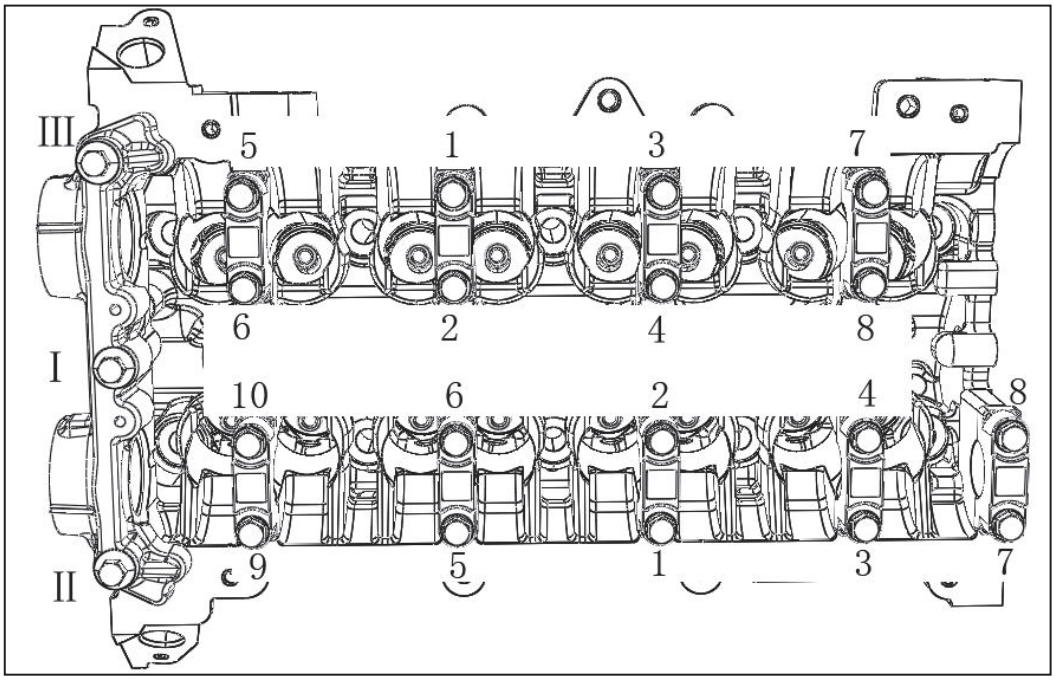
① Install the new mechanism tappet, and install the camshaft.

✓ Spread engine oil on the camshaft journal.

✓ Install the intake camshaft on the intake side, and install the exhaust camshaft on the exhaust side.



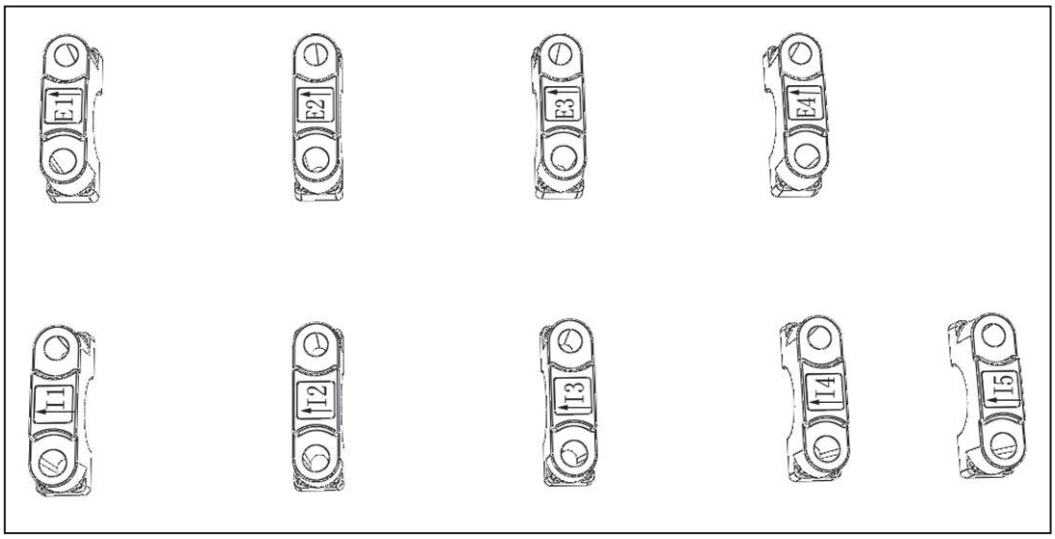
✓ The axial clearance of the inlet and exhaust camshaft is located by the front camshaft bearing cover. Therefore, the front camshaft bearing cover should be installed first. Install the other camshaft bearing covers in order.



■ ***Before installing the camshaft bearing cover fastening bolt, spread engine oil on the thread.***

■ ***Camshaft front bearing cover tightening torque: 19～21N.m; camshaft bearing cover bolt tightening torque：9～11N.m.***

■ ***Pay attention to the mark on the camshaft bearing cover when installing it (see figure below). The arrow on the camshaft bearing cover should point to the front end of the engine when installing; the marked letter I is the intake camshaft bearing cover, and the marked letter E is the exhaust camshaft bearing cover; the numbers in I1, I2, I3, I4 and I5 indicate that the bearing cover is mounted on the which gear journal behind the camshaft front bearing cover (count from the engine front end to rear end).***

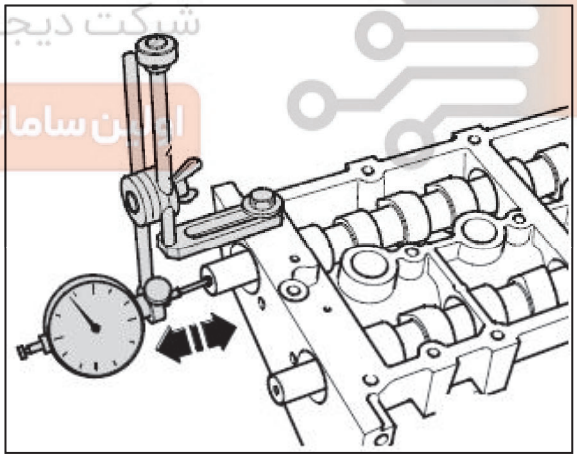


② Check the installed camshaft.

✓ Rotate the camshaft, it should be flexible, and there is no abnormal phenomena such as stuck.

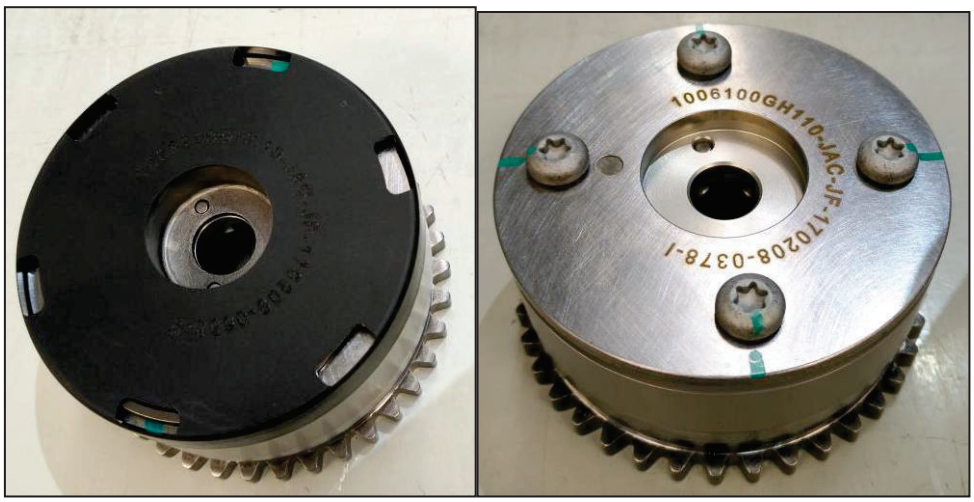
■ ***When rotating the camshaft, pay attention not to make the valve against to the piston.***

✓ Measure the camshaft axial clearance, it should be in ***（0.10～0.20）mm***.

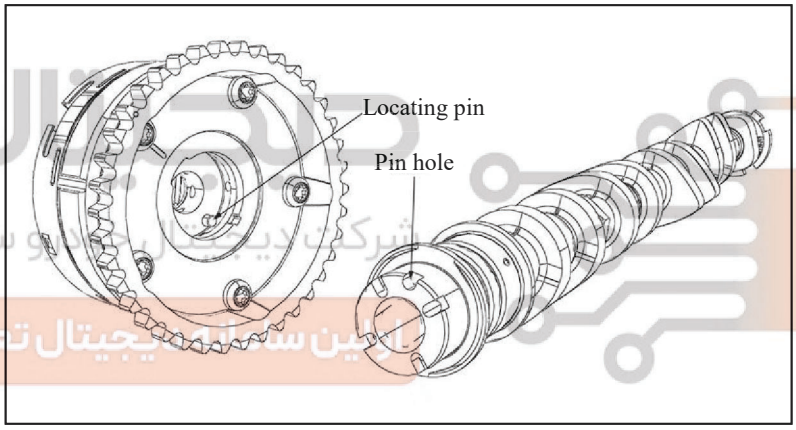


③ Install the intake and exhaust valve timing regulator.

■ ***Install the intake and exhaust valve timing regulator, don't mixed installing. Silver housing is the inlet valve timing regulator; black housing is the exhaust valve timing regulator.***



✓ Press the timing regulator gently against the corresponding camshaft, at the same time, turn the timing regulator so that the pin hole on the camshaft matches the positioning pin on the timing regulator.



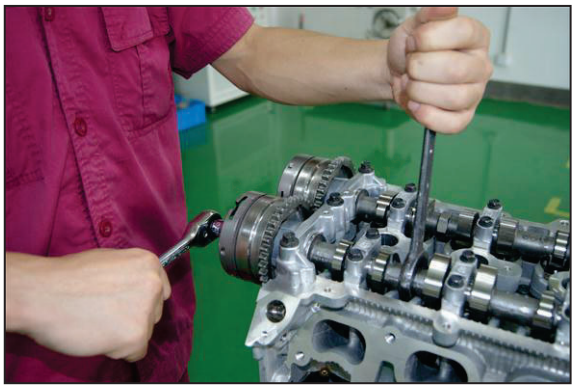
■ ***The correctly installed timing regulator will not produce relative displacement with the camshaft when rotating the regulator housing.***

✓ Tighten the valve timing regulator bolt. Tightening torque: 100 ± 6N.m.

■ ***Apply appropriate amount of oil to the threaded part of the valve adjusting bolt before assembly.***

■ ***Valve timing regulator bolt can only be used once, please use new bolt when installing again.***

■ ***Fix the camshaft by wrench, tighten the valve timing regulator fastening bolt to the specified torque.***



④ Install the fuel pump bracket assembly.

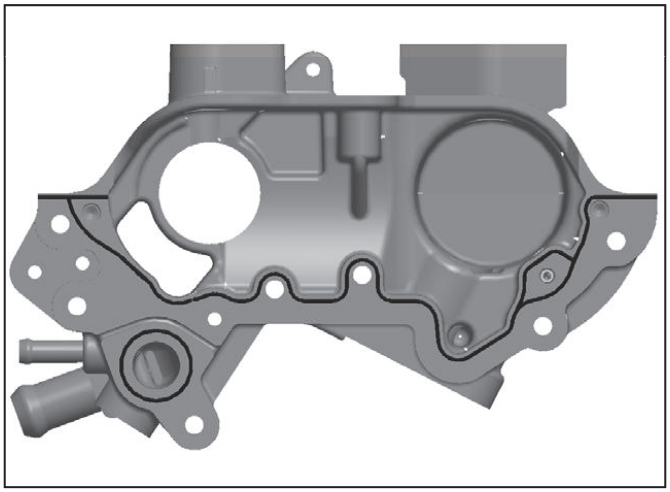
✓ Clear the old sealant on the fitting surface of cylinder head and fuel pump bracket.

✓ Precoat new sealant to the fuel pump support matching surface. The gluing path is shown in the figure below.

■ ***Use Letai 5188 plane sealant or equivalent performance products.***

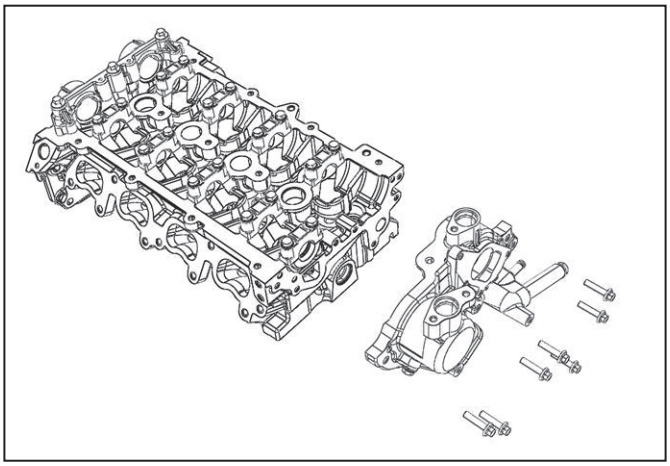
■ ***Sealant strip diameter: 1.5±0.5mm, the center of sealant strip is at least 1.5mm from the inner edge of the sealing belt. The strip is uniform and continuous.***

■ ***Pay attention to the expiry date of sealant to avoid poor sealing caused by the use of expired sealant.***



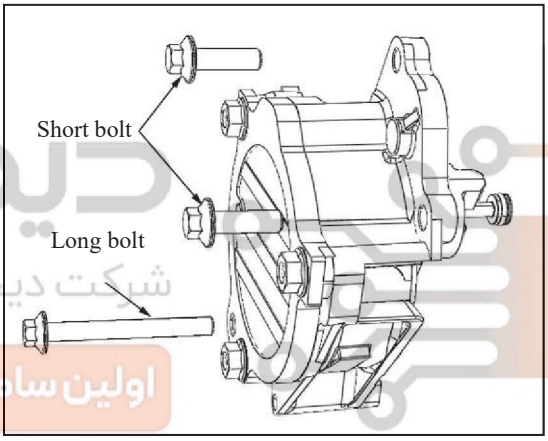
✓ Install the fuel pump bracket fastening bolt, and tighten to the specified torque.

■ ***Fuel pump bracket bolt tightening torque: 9～11N.m.***



⑤ Install the vacuum pump assembly.

■ ***Vacuum pump short bolt tightening torque: 9～11N.m; Vacuum pump long bolt tightening torque：9～11N.m.***

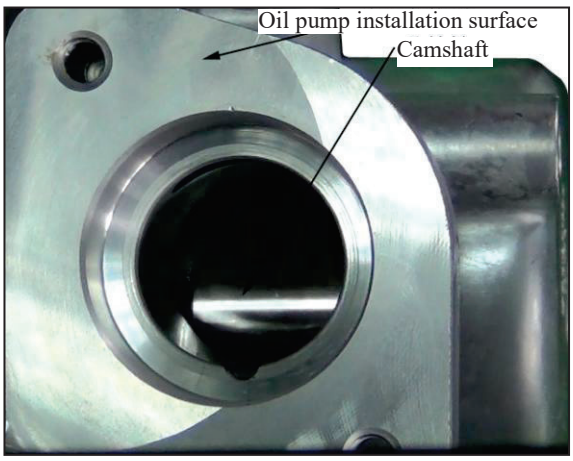


⑥ Install the high pressure fuel pump and high pressure fuel pipe.

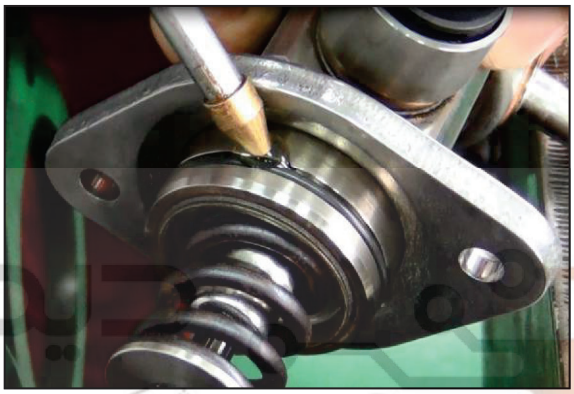
a. Rotate the intake camshaft so that the high pressure fuel pump cam plane on the camshaft is facing the fuel pump mounting port.

b. Install the high pressure fuel pump roller tappet.

■ ***The end with the roller faces to the camshaft.***



c. Spread engine oil on the high pressure fuel pump sealing ring.



d. install and tighten the fuel pump fixing bolt.

■ ***Pre-tightening first, and then symmetrical cross-tightening. Tightening torque: （8.6±0.7）N.m***

⑦ Install the timing chamber and sprocket chamber cover. (Refer to “Removal and installation of timing chain”)

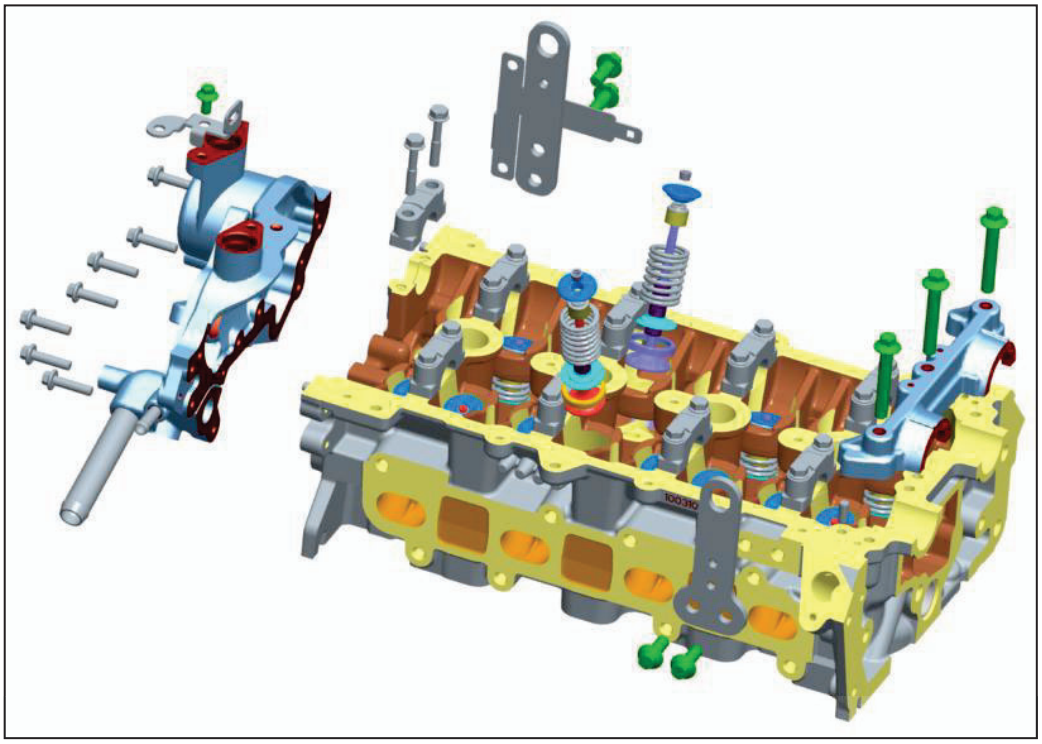
⑧ Install the oil pan. (Refer to “Removal and installation of oil pan”)

⑨ Install the cylinder head guard.

⑩ Install the periphery accessory.

3.3.4 Cylinder Head

1）Constitute diagram



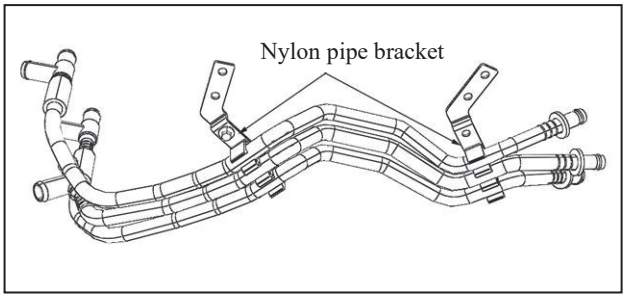
2）Dismantling

① Unplug wiring harness connector of ignition coil, charcoal canister solenoid valve, camshaft position sensor, coolant temperature sensor, high pressure oil pump, knock sensor, electronic throttle valve and other connectors.

② Remove the air inlet manifold assembly.

✓ Remove the breather ventilation hose I, breather ventilation hose II and charcoal canister solenoid valve.

✓ Remove the nylon tube bracket (2 brackets) and the nylon tube assembly.



■ ***Lay a dry towel under the pipeline to absorb the liquid flowing out during removal.***

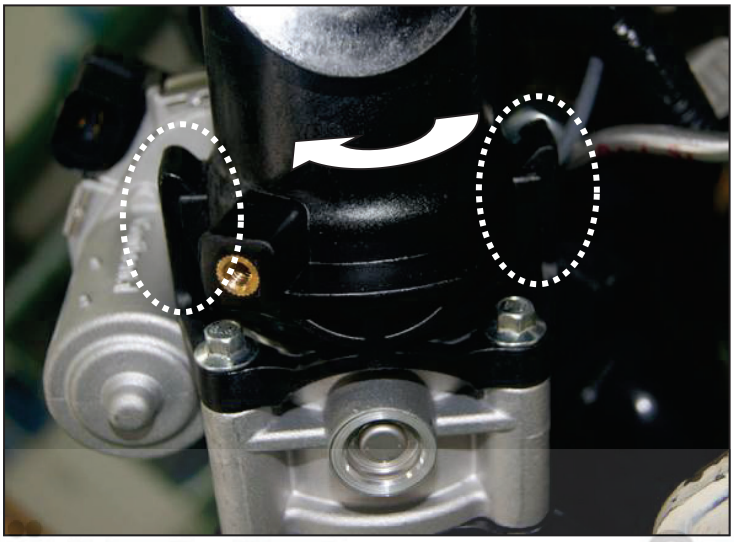
✓ Remove the water inlet/outlet hose connecting the turbocharger.

✓ Remove the turbocharging pressure connecting pipe.

✓ Remove the turbocharging pressure pipe.

✓ After unscrewing the turbocharging pressure pipe fastening bolt, turn the turbocharging pressure pipe clockwise (arrow direction as shown below) and remove the turbocharging pressure pipe.

■ ***Be careful not to damage the turbocharging pressure clamp.***



✓ Remove the electronic throttle valve.

✓ Remove the air inlet manifold.

3 Remove the high pressure oil tube and fuel guide rail assembly.

■ ***Install the dust cap cover on the fuel pressure guide rail and high pressure fuel pump inlet/outlet port, to avoid foreign matter entering into parts and causing parts damage.***

④ Remove the fuel pump.

■ ***Pay attention to ensure the cleanliness of the parts and prevent foreign matter from entering the parts.***

⑤ Remove the exhaust thermal insulation cover.

⑥ Remove the three-way catalytic converter assembly.

⑦ Remove the turbocharger assembly.

⑧ Remove the exhaust manifold assembly.

⑨ Remove the cooling water jacket degassing steel tube.

⑩ Remove the front-end power accessory and drive belt. (Refer to “Removal and installation of timing chain”)

⑪ Remove the cylinder head guard.

⑫ Disassemble the oil pan assembly (Refer to “Removal and installation of oil pan”)

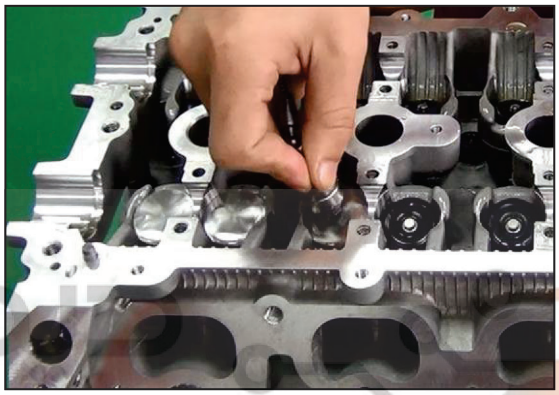
⑬ Remove the sprocket chamber cover and timing chain. (Refer to “Removal and installation of timing chain”)

⑭ Remove the vacuum pump and fuel pump bracket.

⑮ Remove the camshaft. (Refer to “Removal and installation of camshaft”)

⑯ Remove the mechanical tappet.

■ ***Draw mechanical tappet with magnetic tool.***

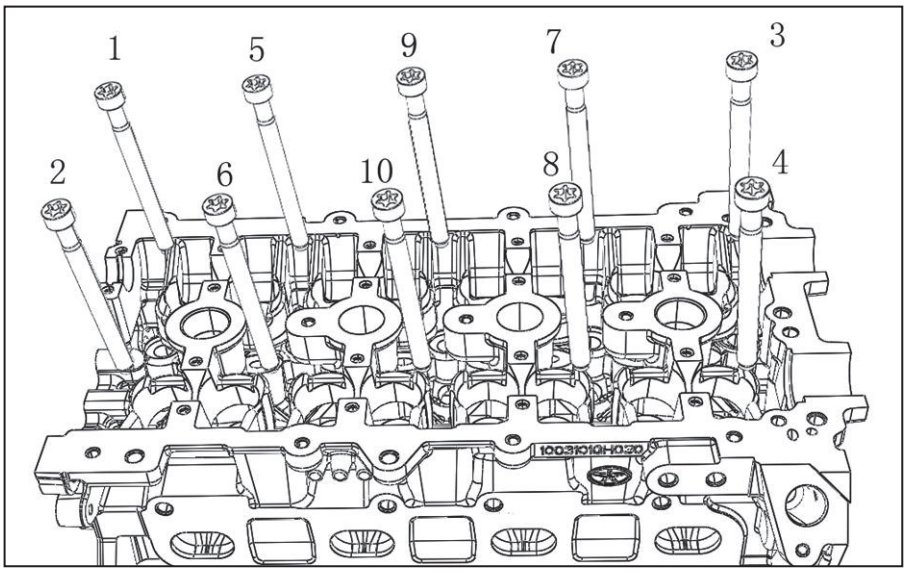


17 Remove the intake/exhaust OCV valve.

18 Remove the cylinder head assembly.

✓ According to the order as shown below, and in order and evenly to remove the 10 cylinder head fixing bolts and 10 flat gaskets.

■ ***Improper removal order of cylinder head bolts can cause the cylinder head to warp or break.***

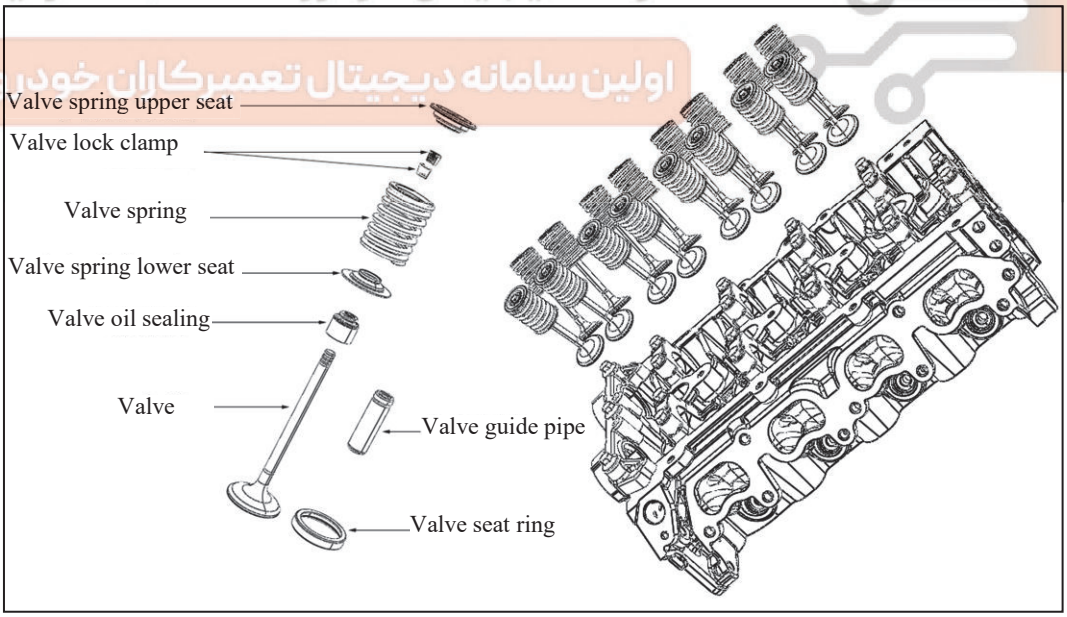


✓ Using flat screwdriver with tape wrapped around the head, pry the head into the cylinder head and cylinder block, and remove the cylinder head.

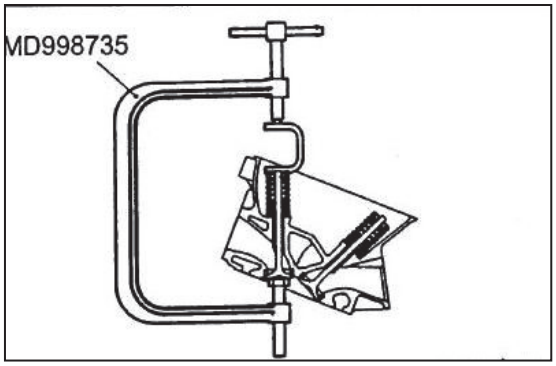
■ ***Be careful not to damage the cylinder head and the contact surface of the cylinder block.***

19 Remove the cylinder head liner.

20 Disassembly of cylinder head cover

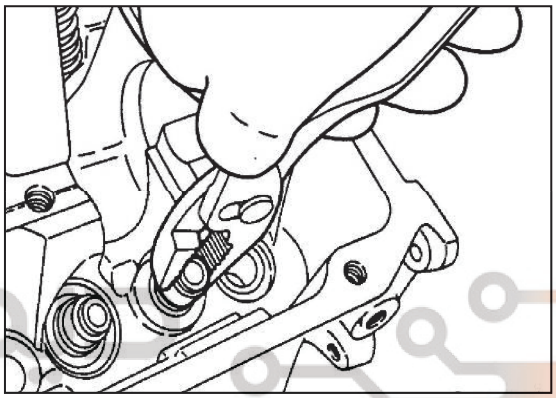


a. Use special tool, compress the valve spring, and remove the lock clip on the valve spring.



b. Remove the valve spring upper seat, valve spring and valve.

c. Use special tool, remove the valve oil seal.



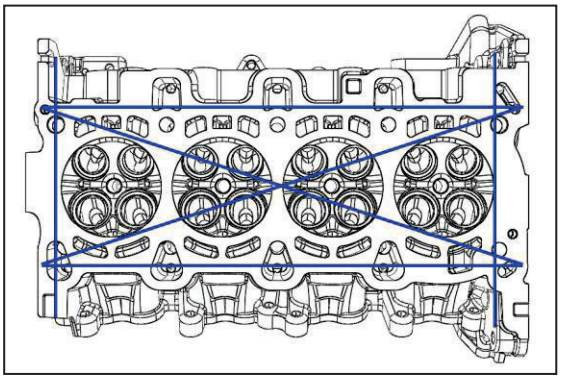
d. Remove the valve spring lower seat.

■ ***Use compressed air and magnetic bar to remove the lower seat of valve spring.***

4）Check

① Check if the cylinder head is warped.

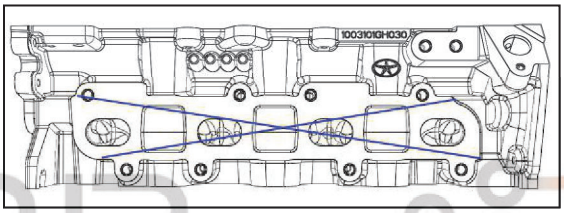
a. Use precision ruler and feeler gauge, to measure the warping of the cylinder head fire surface.



Standard value: 0.03mm

■ ***Maintenance limit value: 0.1mm***

b. Use precision ruler and feeler gauge, to measure the warping of the cylinder head exhaust side.



Standard value: 0.03mm

■ ***Maintenance limit value: 0.1mm***

c. If the warping is greater than the maximum, replace the cylinder head.

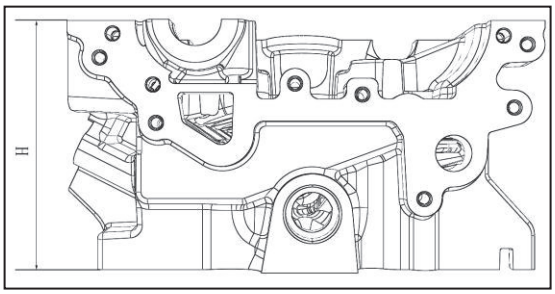
2 Check if the cylinder head is broken.

a. Use dye penetration, to check if there is crack on the inlet/outlet and cylinder surface.

b. If there is any defects, replace the cylinder head.

③ Measure the cylinder head thickness.

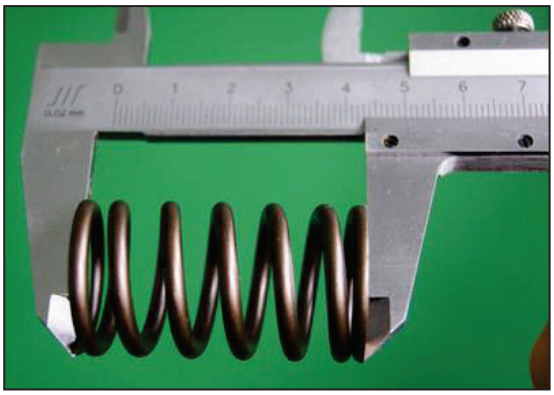
a. Use vernier caliper to measure the cylinder head thickness, if exceeds the limit value range, replace the cylinder head.



■***Standard: 116±0.1mm.***

④ Check the air valve spring.

a. Use vernier caliper to measure the free length of the valve spring.



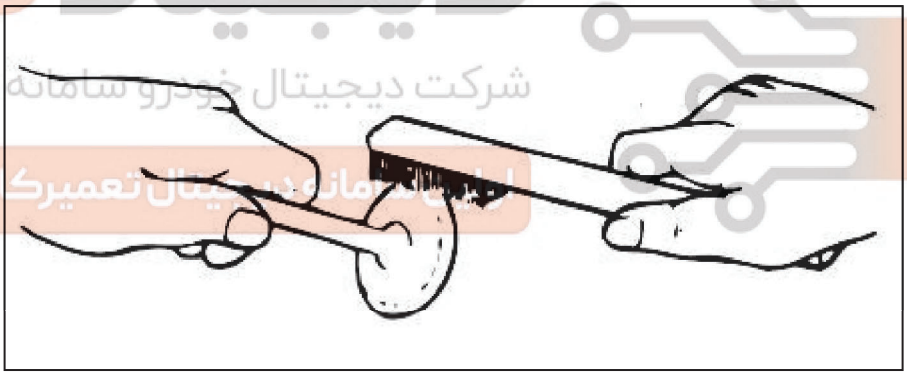
■***Standard free length: 45.1mm***

■***Limit value: 44.6mm***

b. If the free length is not up to the specification, replace the valve spring.

5 Check the valve.

a. Cleaning the valve carbon deposition. When using scraper and wire brush, be careful not to damage the sealing cone.



b. Use vernier caliper to measure the total length of the valve.

■ ***Intake valve standard length: 91.25mm***

■ ***Exhaust valve standard length: 90.74mm***

■ ***Intake valve permitted min length: 90.75mm***

■ ***Exhaust valve permitted min length: 90.24mm***

■ ***If the measured value is less than the min length, replace the valve.***

c. Use the helical micrometer to measure the diameter of the valve rod.

■ ***Standard intake valve rod diameter: φ5.465～φ5.480mm.***

■ ***Standard exhaust valve rod diameter: φ5.455～φ5.470mm.***

■ ***If the valve rod diameter is not up to the specification, replace the valve.***

d. Use vernier caliper to measure the edge thickness of the valve head.

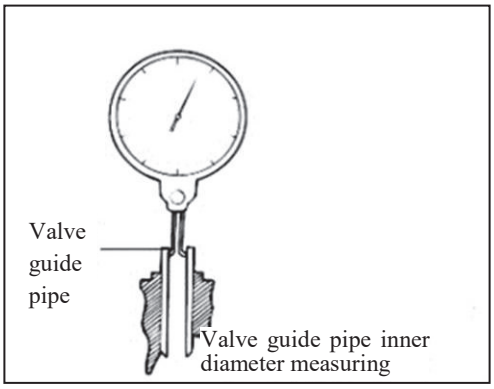
■ ***Standard edge thickness: 1.5mm (intake valve), 1.6mm (exhaust valve).***

■ ***Min edge thickness: 0.8mm (intake valve), 0.9mm (exhaust valve).***

■ ***If the edge thickness is less than the min value, replace the valve.***

⑥ Check the valve guide pipe.

a. Use diameter gauge, to measure the inner diameter of the guide pipe.



■ ***Standard pipe inner diameter: φ5.5～φ5.512mm.***

b. The clearance between the valve rod and the valve guide tube is obtained by subtracting the measured value of the guide pipe inner diameter from the measured value of the corresponding valve rod diameter.

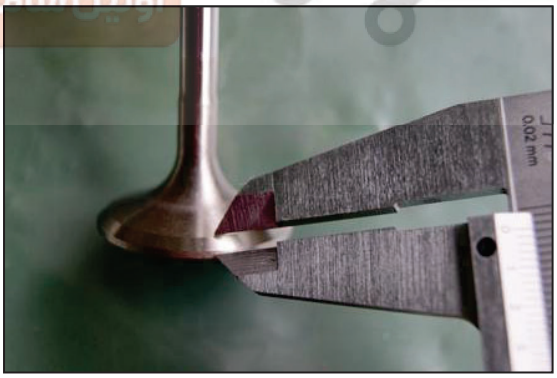
■ ***Clearance value of valve rod and valve guide pipe: 0.02～0.047mm, exhaust: 0.03～0.057mm.***

■ ***Limit clearance: intake 0.1mm; exhaust: 0.15mm.***

■ ***Replace the valve and valve guide if the clearance is greater than maximum.***

⑦ Check the valve seat ring.

a. Check the valve conical surface and valve seat ring sealing surface width.



■ ***If the sealing surface width on the valve cone is inconsistent, replace the valve.***

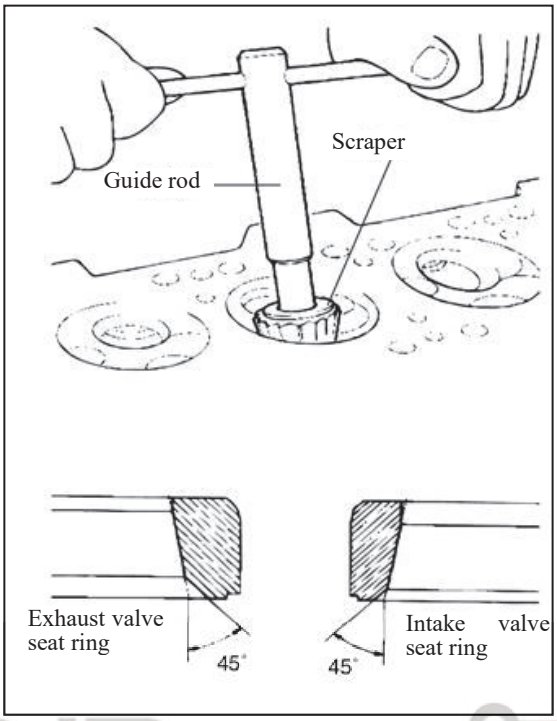
■ ***Repair valve seat ring if the sealing surface width is inconsistent.***

■ ***Intake valve cone contact width: 1.0～2.0mm. Exhaust valve cone contact width: 1.0～1.6mm.***

b. Repair the valve seat.

✓ Trim the valve seat surface with 45º reamer, so that the valve can touch the

entire circumference of the valve seat.



c. Use abrasive agent to manually ground the valve and valve seat.

d. Check the valve seat position.

4）Replacement of air valve guide pipe

① Remove the valve guide pipe.

a. Heat the cylinder head to ***80～100℃.***

b. Place the cylinder head on the wood block.

c. Use special too, knock the old air valve guide pipe toward the direction of the cylinder head top part.

② Install the valve guide pipe.

a. Use diameter gauge, to measure the clearance of the air valve guide installation hole on the cylinder head.

■ ***Cylinder head valve guide pipe mounting hole standard diameter: φ10.550～φ10.568mm.***

b. If the diameter of the valve guide pipe mounting hole exceeds the standard diameter, the valve guide pipe mounting diameter shall be processed according to the outer diameter of the valve guide pipe (at this time, the valve guide pipe with the enlarged outer diameter shall be selected and the enlarged diameter shall be

0.05mm).

■ ***Ensure that the outer diameter of the valve guide pipe shall be 0.05mm larger than the installation aperture.***

■ ***The cylinder head assembly is recommended to be replaced if there is no enlarged valve guide pipe.***

c. If the valve guide pipe mounting hole diameter exceeds the standard diameter and is too large to repair, replace the cylinder head.

d. Heat the cylinder head to ***80～100℃.***

e. Using special tool, knock the new valve guide pipe in.

f. Using sharp reamer, trim the inner diameter of the valve guide pipe to achieve the standard clearance between the valve guide pipe and the valve rod.

■ ***Standard clearance value of intake air valve rod and air valve guide pipe: 0.020～0.047, limit value: 0.10mm.***

■ ***Standard clearance value of exhaust air valve rod and air valve guide pipe: 0.030～0.057, limit value: 0.15mm.***

■ ***Clearance between air valve rod and air valve guide pipe=internal diameter of guide pipe-outer diameter of air valve rod.***

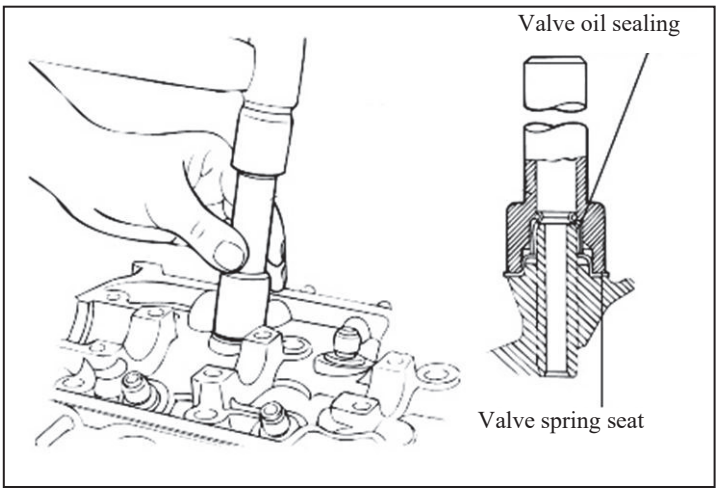
5）Pre-installation of cylinder head

① Install the valve spring lower base ring.

② Install the valve oil seal.

a. Spread engine oil on the new oil sealing.

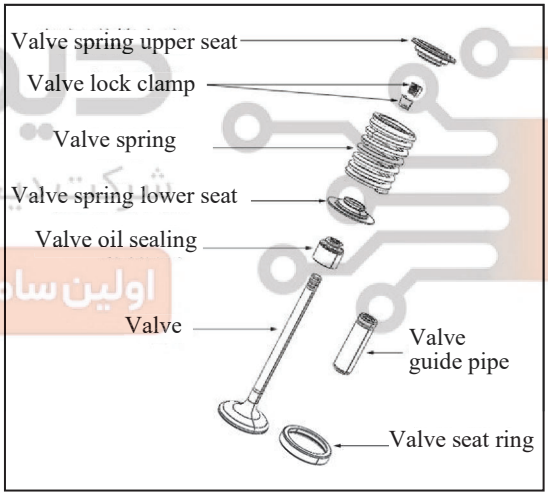
b. Use special tool, and press the oil sealing.



③ Install the valve.

✓ Spread enough engine oil on the top area of air valve.

✓ Install the air valve, valve spring and valve spring upper seat ring to the cylinder head.

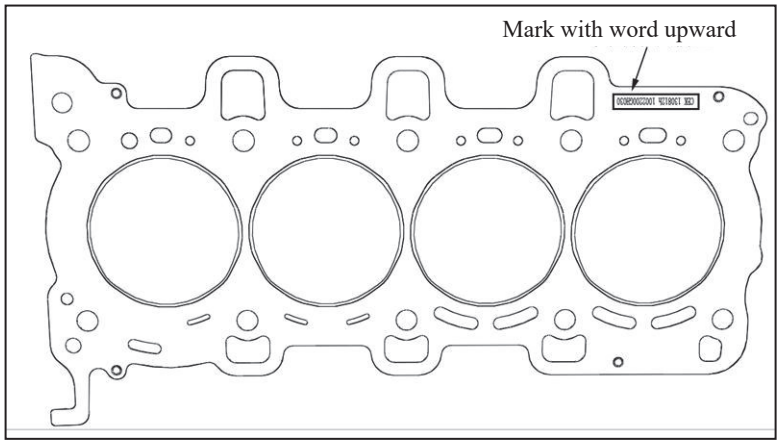


✓ Use special tool to compress the valve spring and install the 2 valve lock clips.

✓ Use plastic hammer, and slightly knock the top part of the air valve rod to ensure correct installation.

6）Installation

① Install the cylinder head gasket, and make the surface printed with batch number face to the cylinder head.



■ ***Remove all oil and debris from the mounting surface, and pay attention to the installation direction of the cylinder head gasket.***

② Install the cylinder head assembly.

a. Place the pre-installed cylinder head on the cylinder head liner.

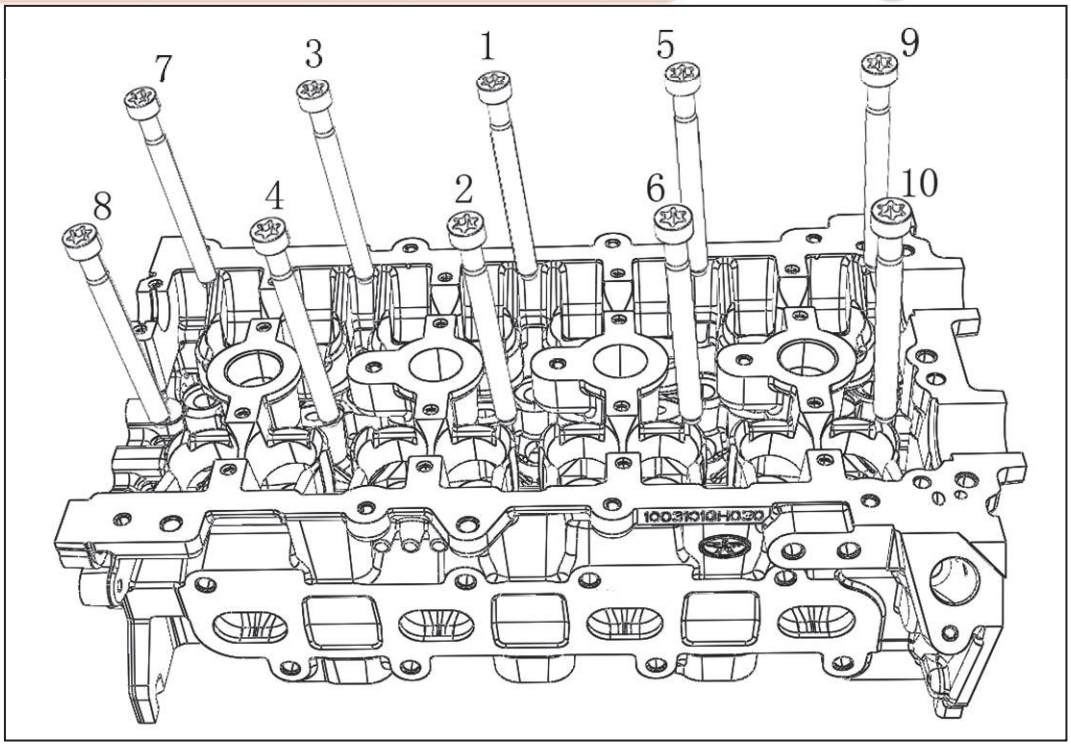
■ ***Slightly place the cylinder head, to avoid damaging the cylinder head liner.***

b. Install the cylinder head bolt gasket.

c. Install the cylinder head bolt.

✓ Spread engine oil to the thread of cylinder head fixing bolt.

✓ According to the order as shown below, and in order and evenly to install and tighten the 10 fixing bolts of the cylinder head.

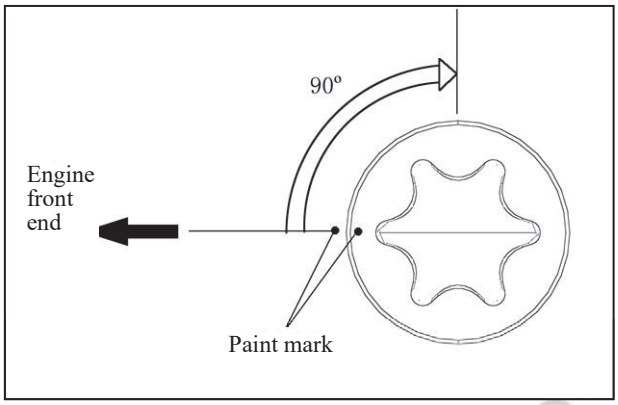


■ ***Three steps tightening method of cylinder head bolt:***

Step 1: Initially tighten all cylinder head bolts to (32.5±2) N.m with fixed twist wrench.

Step 2: Mark the front end of the cylinder head bolts with paint and tighten the cylinder head bolts 90 degrees.

Step 3: Tighten the cylinder head bolts 90 degrees again. (Total 180 degree)



■ ***Check and confirm that the paint marks on the cylinder head and the paint marks on the bolts are made at 180 degree angle.***

3 Install the spark plug.

■ ***Tightening torque: （25～30）N.m***

■ ***It is strictly prohibited that excessive torque will easily lead to spark plug damage and thread damage***

■ Select and install the mechanical tappet. (Refer to “Removal and installation of camshaft”)

■ Install the camshaft. (Refer to “Removal and installation of camshaft”)

■ Install the intake and exhaust timing regulator. (Refer to “Removal and installation of camshaft”)

■ Install the fuel pump bracket. (Refer to “Removal and installation of camshaft”)

■ Install timing chamber, sprocket chamber cover. (Refer to “Removal and installation of timing chain”)

■ Install engine oil suction filter.

■ Install the oil pan assembly. (Refer to “Removal and installation of oil pan”)

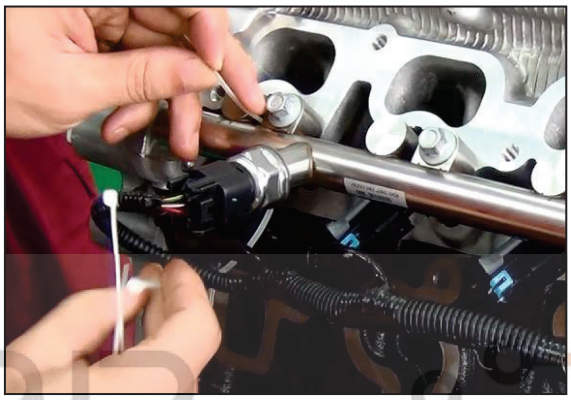
■ Install the cylinder head guard assembly. (Refer to “Adjustment of valve clearance”)

■ Install the ignition coil.

■ Install the fuel guide rail assembly and connect the fuel injector wiring harness connector and rail pressure sensor connector.

■ ***Tightening torque: （20～25）N.m***

■ ***Fuel injector wiring harness needs to be binded on the fuel rail with strap.***



④ Install the high pressure fuel pump and vacuum pump. (Refer to “Installation of camshaft”)

⑤ Install the air inlet manifold.

a. It is preferred to install the intake manifold bracket on the cylinder block, do not tighten.

b. Install the air inlet manifold, and tighten.

■ ***Tightening torque: （22.5±2.5）N.m***

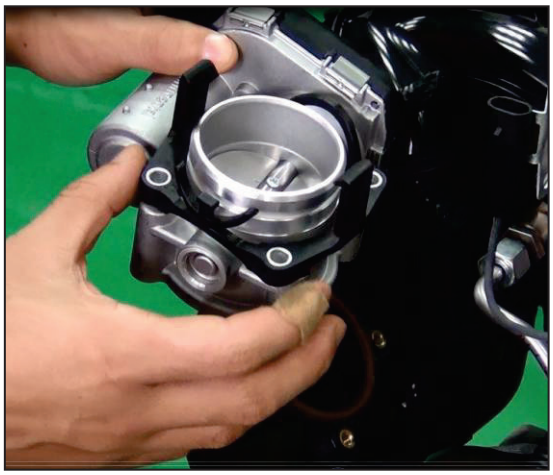
c. Install the air inlet manifold bracket connecting bolt.

d. Tighten the bracket fixing bolt, and then tighten the connecting bolt of the manifold and bracket.

■ ***Tightening torque: （10±1）N.m***

⑥ Install the electric throttle valve and turbocharging pressure pipe.

a. Install the electric throttle valve and turbocharging pressure pipe clamp.

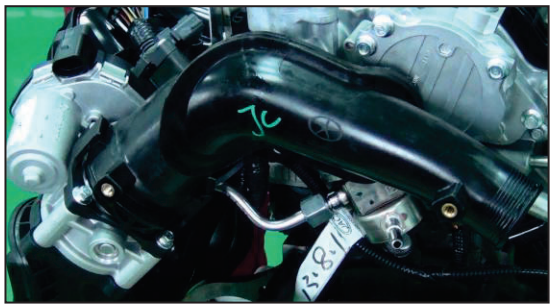


■ ***Tightening torque:*** ***（9～11）N.m***

b. Install the turbocharging pressure pipe.

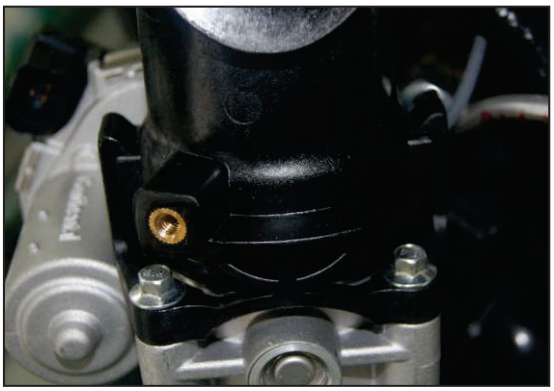
✓ Spread engine oil on the electronic throttle valve sealing ring.

✓ Install the turbocharging pressure pipe, and tighten the fixing bolt of turbocharging pressure pipe.



■ ***Tightening torque:*** ***（9～11）N.m.***

■ ***Be careful not to overexert yourself so as not to damage the buckle.***



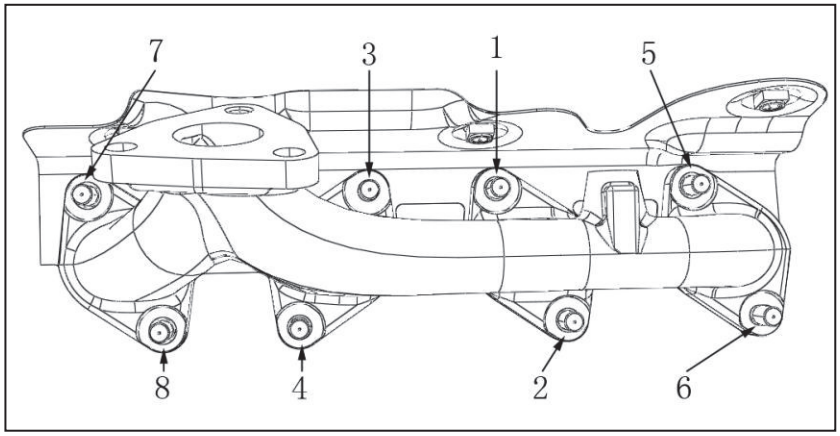
⑦ Install the exhaust manifold.

a. Spread KESAIXIN 1243 thread sealant or other sealant of similar properties to the manifold stud bolt.

■ ***Stud bolt tightening torque: （10±1）N.m***

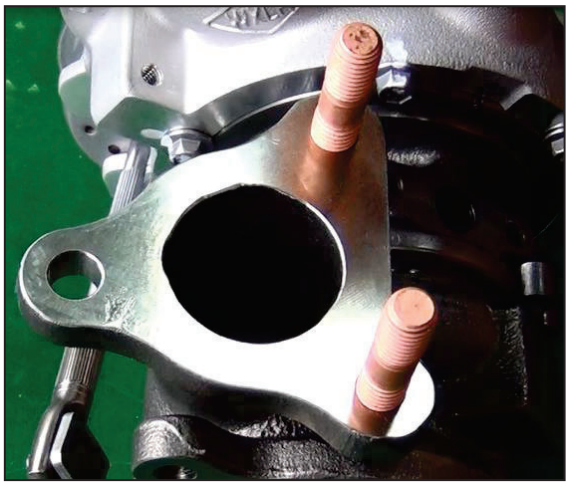
b. Install the washer and exhaust manifold, and tighten the exhaust manifold nut.

■ ***Follow the principle of cross-tightening from the middle to both sides to prevent air leakage. Tightening torque: (9～11)N.m***



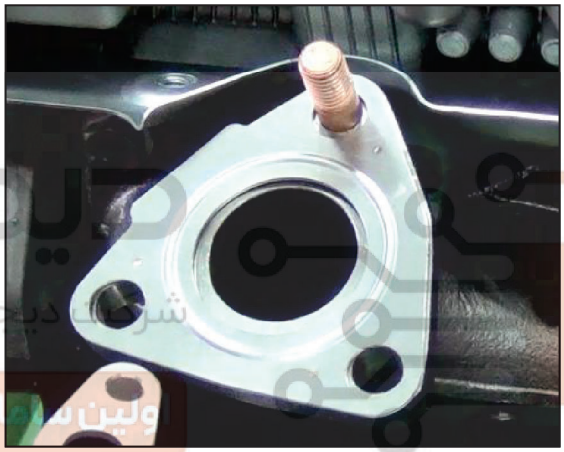
⑧ Install the turbocharger and turbocharger inlet pipe and return steel pipe.

a. Pre-install the turbocharger stud bolt.



■ ***Tightening torque:　（10±1）N.m***

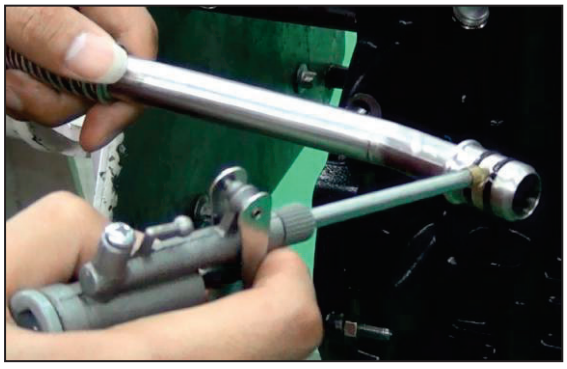
b. Install the remaining stud bolt in the exhaust manifold, and install the gasket.



■ ***The washer bulge face to the turbocharger, the stud tightening torque:***

（10±1）N.m.

c. Spread the engine oil on the oil return steel tube sealing ring, and install the oil return steel tube.

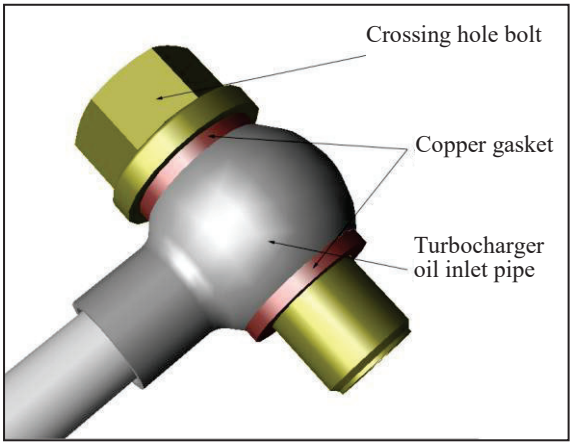


d. Install the turbocharger, and evenly tighten the turbocharger bolt

■ ***Tightening torque:　（50～55）N.m***

e. Connect the oil return pipe, and install the turbocharger reinforcement bracket bolt.

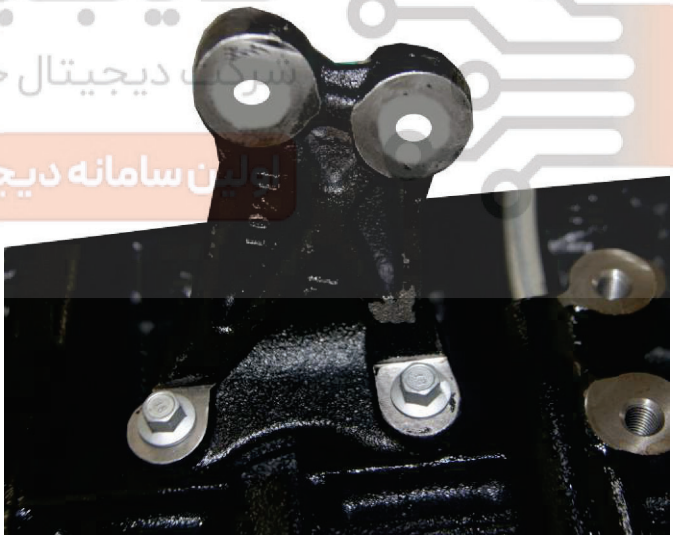
f. Install the oil inlet tube.



■ ***Must replace new copper washer, tightening torque: （22.5±2.5）N.m***

⑨ Install the three-way catalytic converter assembly.

a. Install the catalytic converter bracket.



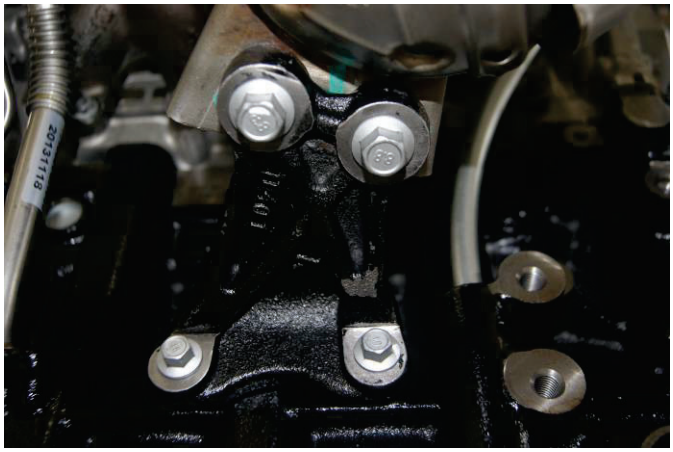
■ ***Please don't tighten the bracket fixing bolt first.***

b. Install the catalytic converter assembly.

■ ***To prevent incorrect installation of catalytic converter, please tighten the bolts according to the sequence below.***

✓ Pre-install the 3 fixing bolts connecting catalytic converter and turbocharger.

✓ Install the connecting bolt of the three-way catalytic converter and bracket, and please don't tighten.



✓ Tighten the fixing bolt of catalytic converter bracket and cylinder block.

■ ***Tightening torque: （20～25）N.m***

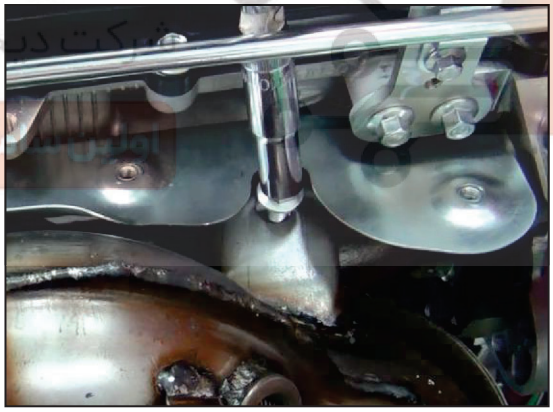
✓ Tighten the connecting bolt of the catalytic converter and turbocharger.

■ ***Tightening torque: （30±35）N.m***

✓ Tighten the connecting bolt of the catalytic converter and bracket.

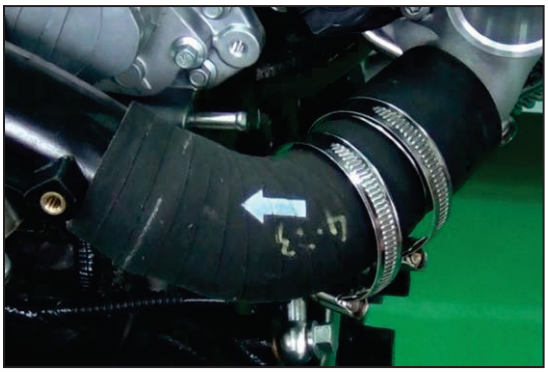
■ ***Tightening torque: （35~45）N.m.***

✓ Install and tighten the catalytic converter bolts II.



■ ***Tightening torque: （20~25）N.m***

⑩ Install the turbocharging pressure connecting pipe.



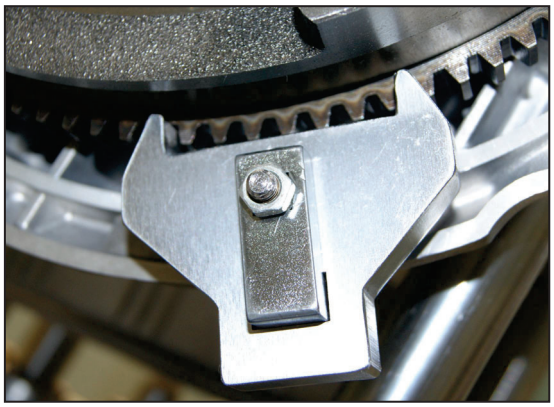
■ ***Note that the direction of connecting pipe arrow should be consistent with***

the direction of airflow.

⑪ Install the nylon pipe assembly, and connect the water pipe.

⑫ Install the shock absorber belt pulley.

✓ Use special tool to fix the flywheel, and don't make the crankshaft rotate.

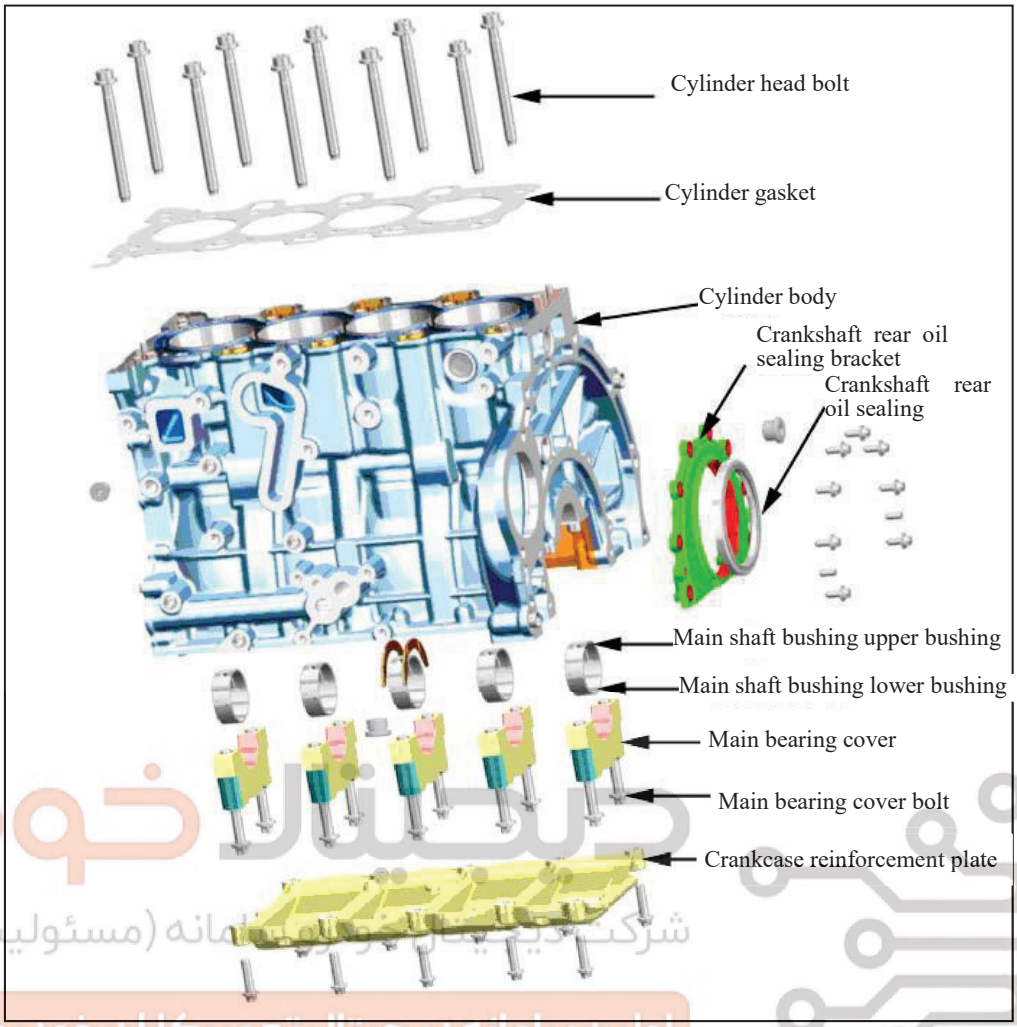


✓ Spread oil on the shock absorbing belt pulley, and install the shock absorbing belt pulley and bolts. Tightening torque: ***（150±10）N.m＋（170±4）°***

⑬ Install front-end power accessory and drive belt. (Refer to "Removal and installation of timing chain")

3.3.5 Cylinder block

1. Constitute diagram



2. Disassembly

1 Remove the engine assembly from the vehicle, and separate the transmission from the engine.

② Fix the engine overall.

③ Discharge engine oil Please refer to “Replace the engine oil”.

④ Unplug wiring harness connector of ignition coil, charcoal canister solenoid valve, camshaft position sensor, coolant temperature sensor, high pressure oil pump, knock sensor, OCV valve, electronic throttle valve and other connectors.

⑤ Remove the air inlet manifold assembly. (Refer to “Removal and installation of cylinder head”)

⑥ Disassemble the engine oil cooler and oil filter assembly.

■ ***Lay a dry towel under the oil filter to absorb the oil flowing out during removal.***

⑦ Remove the high pressure oil tube and fuel guide rail assembly.

■ ***Install the dust cap cover on the fuel pressure guide rail and high pressure fuel pump inlet/outlet port, to avoid foreign matter entering into parts and causing parts damage.***

⑧ Remove the fuel pump.

■ ***Pay attention to ensure the cleanliness of the parts and prevent foreign matter from entering the parts.***

⑨ Remove the exhaust thermal insulation cover.

⑩ Remove the three-way catalytic converter assembly.

⑪ Remove the turbocharger assembly.

⑫ Remove the exhaust manifold assembly.

13 Remove the cooling water jacket degassing steel tube.

14 Remove the front-end power accessory and drive belt. (Refer to "Removal and installation of timing chain")

15 Remove the cylinder head guard.

16 Remove the oil pan assembly and oil pump. (Refer to "Removal and installation of oil pan")

17 Remove the sprocket chamber cover and timing chain. (Refer to "Removal and installation of timing chain")

⑱ Remove the vacuum pump and fuel pump bracket.

⑲ Remove the camshaft. (Refer to "Removal and installation of camshaft")

⑳ Remove the mechanical tappet.

■ ***Draw mechanical tappet with magnetic tool.***

㉑ Remove the intake/exhaust OCV valve.

㉒ Remove the cylinder head assembly. (Refer to "Removal and installation of cylinder head")

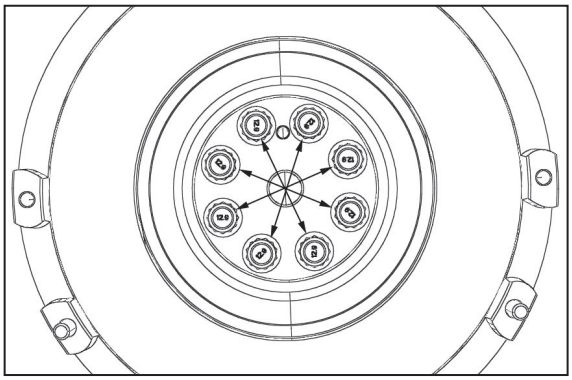
■ ***Be careful not to damage the cylinder head and the contact surface of the cylinder block.***

㉓ Remove the cylinder head liner.

㉔ Remove flywheel assembly. Please use the special tool to fix the flywheel

and then remove the fixing bolt.

■ ***Fixing bolts should be loosened in diagonal order.***



㉕ Remove the crankshaft rear oil seal bracket.

■ ***Insert the screwdriver between the crankshaft and the rear oil sealing bracket housing, pry to loosen the rear oil sealing bracket.***

■ ***Once the rear oil sealing is disassembled, it cannot be used again. Please replace new oil sealing.***

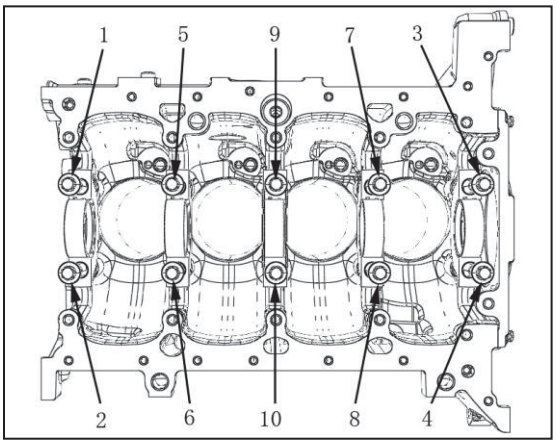
26 Remove the knock sensor and crankshaft position sensor.

■ ***Note: Do not drop or tap the sensor.***

27 Remove crankshaft.

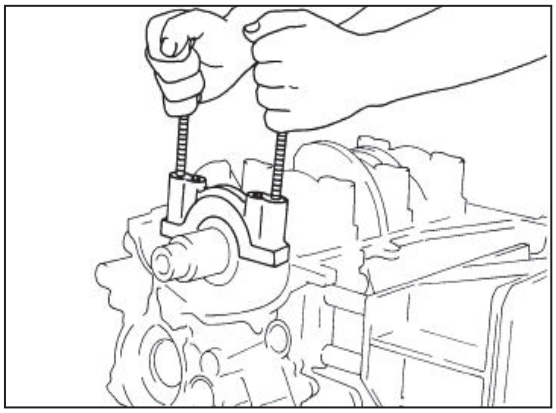
a. Before releasing the crankshaft bearing cover, measure the crankshaft axial clearance and connecting rod big head side clearance. Refer to “Inspection" below.

b. Please loosen the crankshaft bearing cover bolts as shown in the figure below.



c. When disassembling, the crankshaft bearing cover bolts can be used to shake

the crankshaft bearing cover backwards and forwards to disassemble it.



■ ***Place the removed main bearing cover in sequence with the arrows on them aligned.***

d. Remove the connecting rod big end cover.

■ ***Make corresponding marks on the connecting rod and the connecting rod big end cover before removing, so as to prevent later misassembly.***

■ ***Be careful not to damage the contact surface of the big end cover and the connecting rod.***

e. Remove the crankshaft.

f. Remove the upper and lower main shaft bushing.

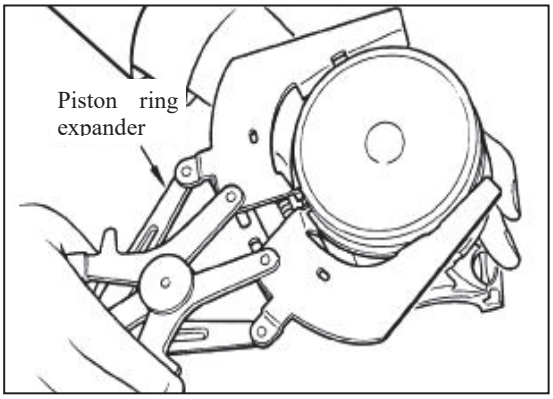
■ ***Mark the bearing bush and the corresponding installation position, and place the main shaft bushing in order.***

㉘ Remove the piston and connecting rod assembly.

a.Use a rubber hammer or similar tool to push the piston and connecting rod assembly out of the cylinder block, and remove the connecting rod piston assembly from the oil pan mounting side.

b.Remove the connecting rod bush, do well the upper and lower bush marks and the corresponding cylinder marks.

㉙ Remove piston ring from piston.



■ ***Using piston ring expander.***

㉚ Remove piston from connecting rod.

a.Remove piston pin clamp spring with needle-needle pliers.

b. Take out piston pin and remove piston.

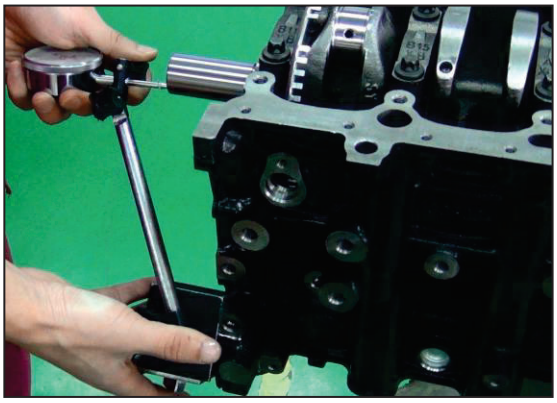
■ *After removing piston pin, put the piston, piston pin, snap pin and connecting rod together in the same cylinder. Do not mix with the piston, piston pin and connecting rod of other cylinders.*

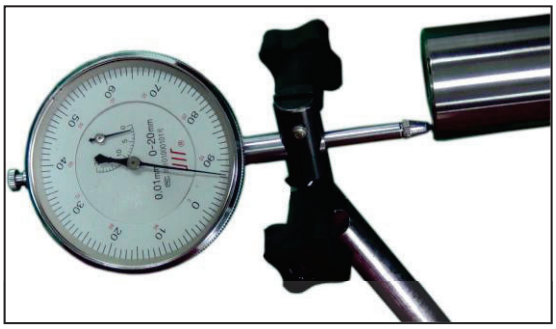
㉛ Remove piston cooling nozzle.

3. Inspection

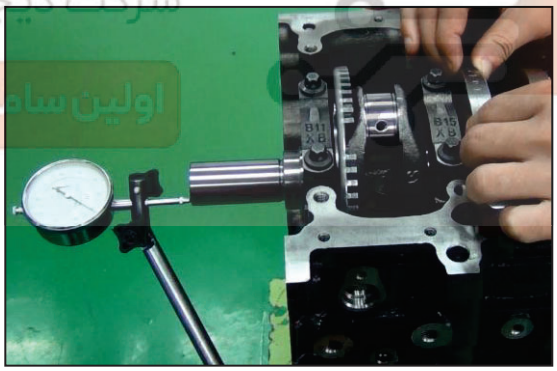
① Measure the crankshaft axial clearance.

a. Use dial indicator.





b. Use the screwdriver to pry backward and forward or push the crankshaft backward and forward by hands, record the reading of the dial indicator at the same time.

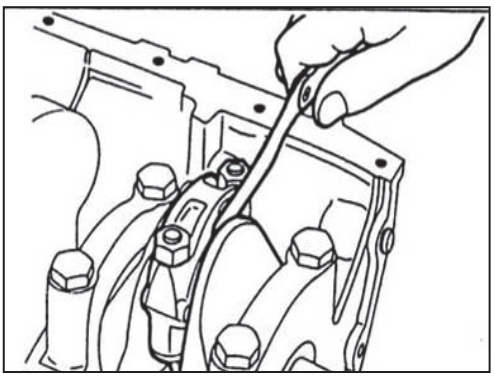


■ *Standard value: 0.1~0.3mm, limit value: 0.3mm.*

c. If the measured value is not within the standard value, please replace the thrust plate and remeasure it. If the limit is still exceeded, replace the crankshaft.

② Measure the connecting rod big end side clearance

a. Measure the clearance between the connecting rod and the crankshaft arm with a feeler gauge.



■*Standard: 0.10～0.25mm*

■ *Limit value: 0.4mm*

b. If the measured value exceeds the limit, replace the connecting rod and measure again. If the limit is still exceeded, replace the crankshaft.

③ Check the piston

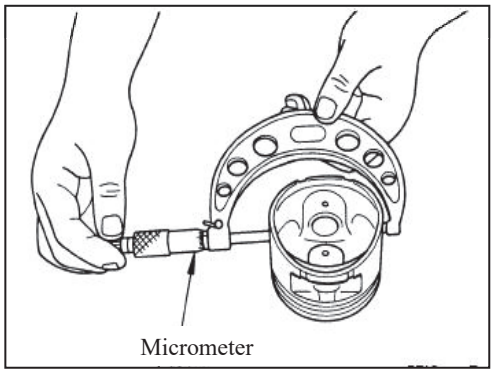
a. Use scraper to clear the carbon deposition of piston top.

b. Use the ring groove cleaning tool or the broken piston ring to clean the piston ring groove.

c. Clean the piston thoroughly with brush and solvent.

■ ***Don't use the steel bush.***

d. Make the screw micrometer (micrometer) at right angle to the piston pin hole to measure the piston diameter.

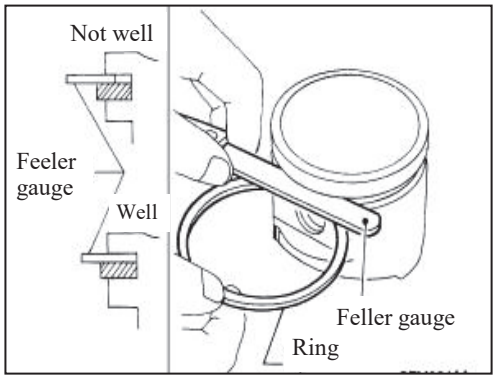


■*Standard piston diameter: 74.965mm～74.995mm*

e. If the hole diameter is not specified, replace the piston.

④ Measure the piston ring side clearance

a. Measure the clearances between piston ring and piston ring grooves with feeler gauge.



■***Standard value: first ring: 0.02～0.07mm; Second ring: 0.02～0.06mm.***

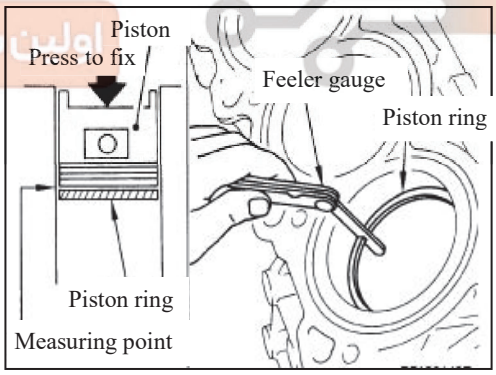
■***Limit value: first ring: 0.1mm; Second ring: 0.1mm.***

b. If the measured value exceeds the limit, replace piston ring and measure again. If the limit is still exceeded, replace the piston ring.

⑤ Measure the piston ring end clearance

■ ***Before measuring, make sure the cylinder inner diameter is within the specified range. Please refer to "measure the cylinder inner diameter".***

a. Lubricate the piston and piston ring with new engine oil and insert the piston ring until the piston reaches the middle of the cylinder,and use feeler gauge to measure piston ring end clearance.



■***Standard value: first ring: 0.2～0.35mm; Second ring: 0.35～0.55mm; Oil ring: 0.25～0.50mm.***

■***Limit value: first ring: 0.8mm; Second ring: 0.8mm; Oil ring: 1.0mm.***

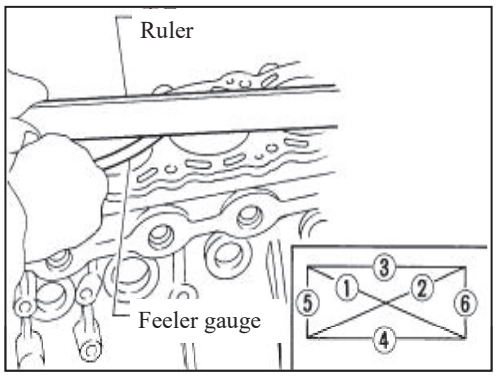
b. If the measured value exceeds the limit, replace piston ring and measure again. If the limit value is still exceeded, boring large cylinder inner diameter, and according to the boring after matching the corresponding piston and piston ring.

⑥ Measure the cylinder block flatness

a. Clean the liner residue on the cylinder block surface, as well as engine oil, scale carbon or other contaminants.

■ ***Be careful not to let foreign matter fall into the engine oil path or engine water path.***

b. The flatness of cylinder block is measured with a ruler and a feeler gauge in six different directions.

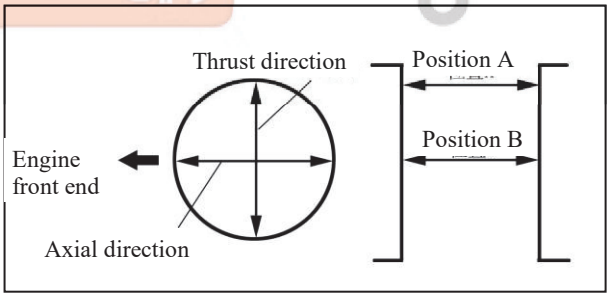


■ ***Standard value: below 0.05mm; Limit value: 0.1 mm.***

c. If the limit is exceeded, replace the cylinder block.

7 Measure cylinder inner diameter

a. Use the cylinder bore gauge, measure the thrust direction and the cylinder axial bore diameter at positions A and B.



■***Standard value: 75.000mm～75.030mm***

b. If the average cylinder diameter of the four positions is greater than the maximum value, the cylinder block is replaced.

⑧ Measurement of piston oil clearance

a. Calculate by the actual measured piston skirt size and cylinder bore.

(Oil clearance) = (Cylinder inner diameter) - (Piston skirt diameter)

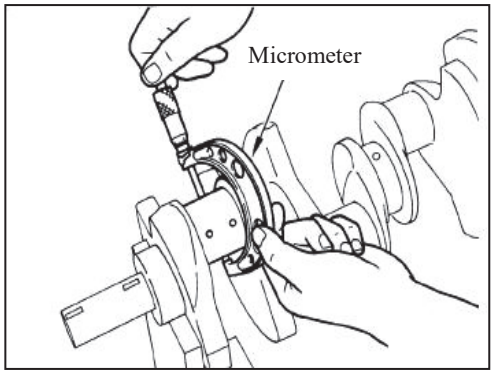
■***Standard value: 0.005mm～0.035mm Limit value: 0.080mm***

b. If the limit is still exceeded, replace the piston. Replace the cylinder block if

necessary.

⑨ Crankshaft measurement

a. Use the outer diameter micrometer to measure the crankshaft main journal diameter and the connecting rod main journal diameter.



b. Standard value of crankshaft main journal diameter and the connecting rod main journal diameter, see Table 3-4, the unit is mm.

Table 3-4 Crankshaft main journal standard size

Mark number	Crankshaft main journal diameter	Crankshaft connecting rod journal diameter
1	44.994～45.000	43.994～44.000
2	44.988～44.994	43.988～43.994
3	44.982～44.988	43.982～43.988

c. If the measured value is within the standard range, select the corresponding mark number according to the measured value, and select the bearing bush according to the mark number.

d. If exceeding the standard, check the oil film gap of main journal or connecting rod.

⑩ Measurement of connecting rod journal clearance

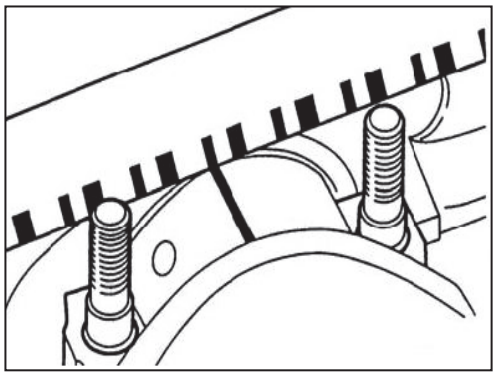
a. Remove all engine oil from the connecting rod journal and the connecting rod bearing bush.

b. Place the plastic wire gauge on the connecting rod journal and cut it into the same length as the width of the bearing bush. Plastic wire gauge must be at the center of connecting rod big head and parallel to its axis.

c. Gently place the connecting rod cover in its position and tighten the bolts to the specified torque.

d. Remove the bolts and slowly remove the connecting rod cover.

e. Measure the extruded part of the plastic wire gauge at the widest point using a ruler printed on the plastic wire gauge bag.



Standard value: 0.027～0.053mm, limit value: 0.1mm

■ ***Remove the plastic clearance gauge completely after measurement.***

f. If the oil clearance is greater than the limit, replace the connecting rod earing bush. Replace the crankshaft if necessary.

⑪ Measurement of main journal oil clearance

a. Clean the engine oil of crankshaft journal and inner surface of bearing bush.

b. Install the bearing bush.

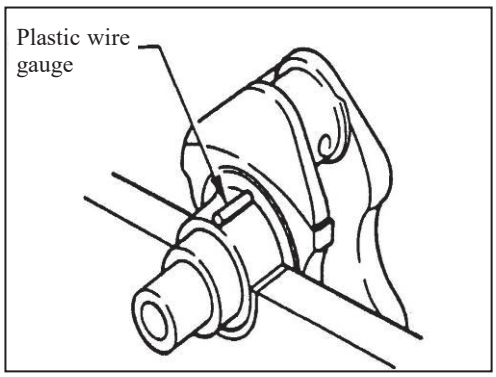
c. Cut the length of the plastic gauge to match the width of the bearing. Then place it on the journal along

the axis of the journal.

d. Lightly install the crankshaft main journal cover and tighten the bolts to the specified torque.

e. Remove the bolts and gently remove the crankshaft main journal cover.

f. Measure the extruded part of the plastic wire gauge at the widest point using a ruler printed on the plastic wire gauge bag.



Standard value: 0.02～0.04mm, limit value: 0.1mm

■ ***Remove the plastic clearance gauge completely after measurement.***

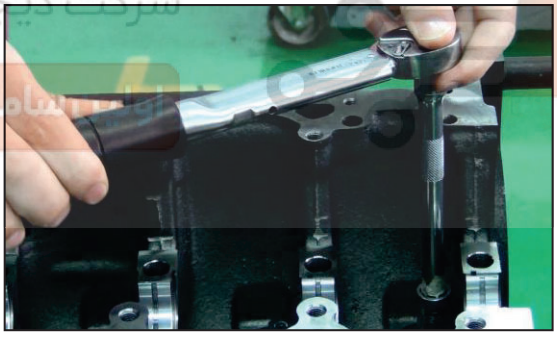
g. If the oil clearance is greater than the limit, replace the main bearing bush. Replace the crankshaft if necessary.

3. Installation

① Blow engine coolant and engine oil out of cylinder block, cylinder diameter and crankshaft box ,remove foreign matter.

■ ***Use goggles to protect your eyes.***

② Install the piston cooling fuel injector.



■***Tightening torque: 27～33N.m***

③ Install the upper lower main bearing bush.

■ ***If the crankshaft is new, select the main bearing bush according to the main journal size number on the crankshaft and the main bearing hole size number on the cylinder block (Refer to Table 3-5). If it is the old crankshaft, measure the crankshaft journal, and select the corresponding bearing bush to match it. (Refer to "Crankshaft measurement").***

Table 3-5 Main bearing bush selecting

Crankshaft grouping mark / Main bearing hole grouping mark	1	2	3
1 (up / down)	Red / Red	Red / Yellow	Yellow / Yellow
2 (up / down)	Red / Yellow	Yellow / Yellow	Yellow/Blue
3 (up / down)	Yellow / Yellow	Yellow/Blue	Blue/Blue

a. Clear the dust, dirt and engine oil from the matching surface of the cylinder block and main bearing cover.

b. When installing the bearing bush, pay attention to the direction.

■ ***The bearing bush with oil hole and groove is mounted on the side of the cylinder block. For bearing bush without oil hole and groove, it is installed on the main bearing cover side.***

■ ***When installing the bearing bush, follow the principle of first cleaning, rubbing, and then installation.***

■ ***When installing, aim the protrusion of the bearing bush at the cutting of the cylinder block and the main bearing cover.***

4 Pre-install the crankshaft signal disc.

a. Check if there is defect on the signal wheel of crankshaft signal disc.

b. Pre-install the crankshaft signal disc.

c. Use the rubber hammer to hit the signal disc evenly to ensure that the signal disc is installed correctly.

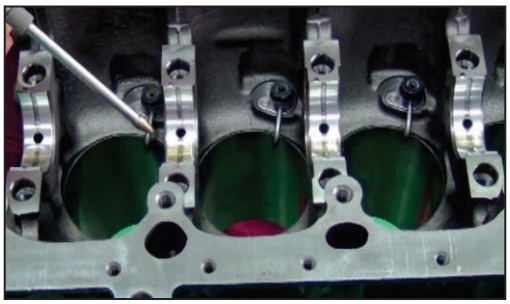
d. Spread Letai 262 or other equivalent product sealant to the signal disc bolt. And tighten all the three bolts evenly.

■***Fastening torque: 10~15N·m***

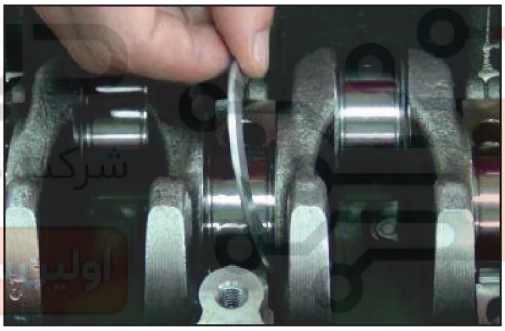
⑤ Install the crankshaft and the thrust plate.

a. Install crankshaft to cylinder block. Turn the crankshaft by hand to see if it can be turned flexibly.

■ ***Before installing crankshaft, appropriate amount of engine oil should be applied to the inner part of upper bearing bush.***

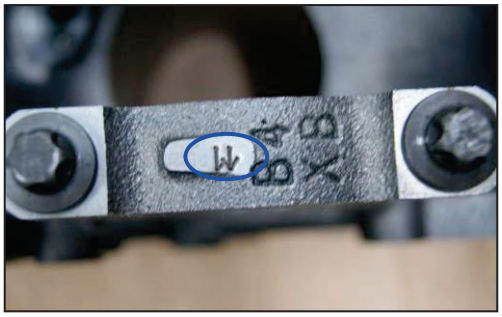


b. Install the thrust plate, noting that the oil groove of the thrust plate faces the crankshaft counterbalance.



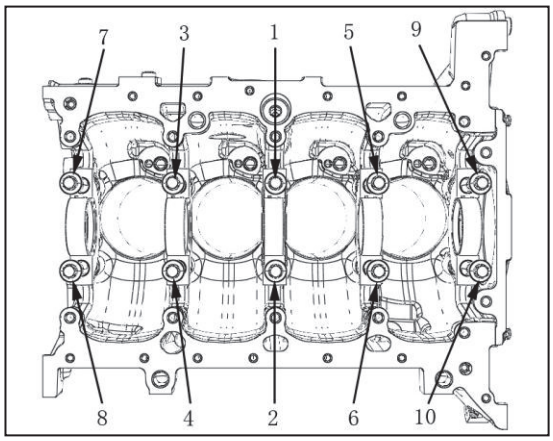
6 Install the main bearing cover.

a. Correctly recognize the mark on the main bearing cover. The arrow indicates the direction of installation, that is, the arrow is facing the front end of the engine during installation; the number on the side of the arrow indicates which position the bearing cover should be mounted on the main journal, counting from the front end of the engine.



b. Starting from the engine front end, install the main bearing cover in order.

c. Tighten the main bearing cover bolts according to the sequence as shown in the figure below.

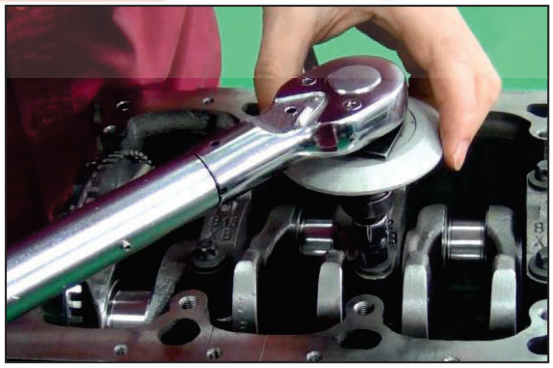


■ ***Apply new oil to the threads and fixing surfaces of the main bearing cap bolts.***

■ Tighten the main bearing cover bolts in multiple steps. The tightening method is as follows: first, tighten the bolts in sequence to 40±2N·m, and then tighten them in sequence to 90-94°.

■ ***The main bearing cover bolt can only be used once and cannot be reused.***

■ ***Be sure to use angle wrench or mark it well (refer to the cylinder head bolt tightening method) to ensure that the tightening angle is within the standard range.***



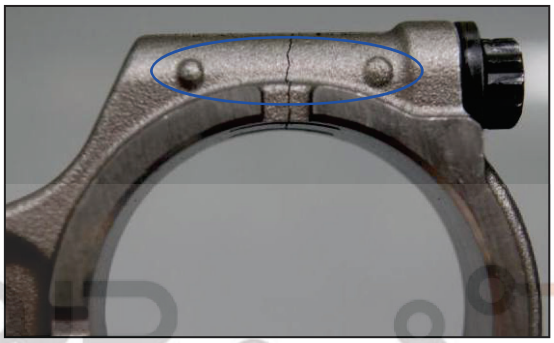
d. After installing the main bearing cover bolts, make sure the crankshaft can be rotated flexibly by hand.

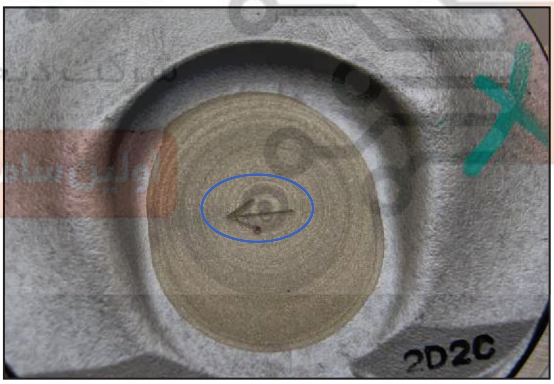
e. Check crankshaft axial clearance. Refer to “Measurement of crankshaft axial clearance”.

⑦ Pre-assemble the piston connecting rod assembly.

a. Spread engine oil to the piston pin, and install the piston pin.

■ ***When installing the piston pin, make sure the top of the piston marked forward and the connecting rod marked forward are the same.***





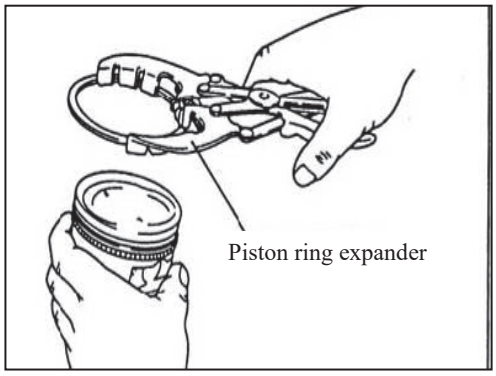
b. Install the piston pin snap ring.

■ ***When installing the piston pin snap ring, the opening of the snap ring should stagger the gap in the piston.***

⑧ Install piston ring.

■ ***Be careful not to damage the piston when installing piston rings.***

■ ***Be careful not to damage the piston ring because of overextending.***



a. Install the oil ring.

✓ Install the oil liner ring into the piston ring groove. Then install the oil ring body.

✓ When installing the ring body, put one end of the ring body into the groove by hand, and then press the rest into the position.

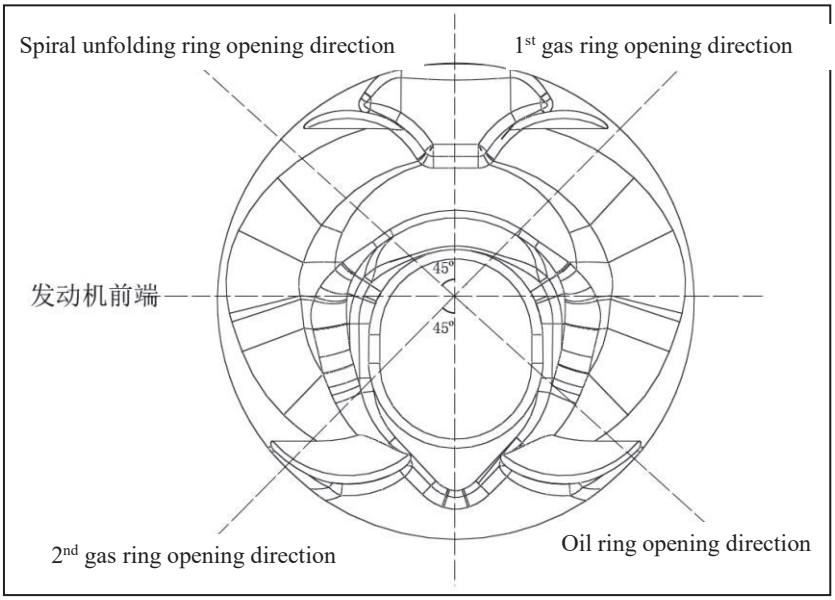
■ ***Do not use piston ring expander to install ring body, otherwise it may lead to wiper blade fracture.***

✓ After installing the combined oil ring body, check whether it can move smoothly in both directions.

b. Install1st and 2nd air ring.

✓ Install the air ring with the piston ring expander. The identification mark on the air ring should be toward the top of the piston.

c. Piston ring opening direction.



⑨ Install the connecting rod bearing bush

■ ***Thoroughly clean to the surface of the connecting rod bearing bush before installing it.***

■ ***Connecting rod bush of different thickness can be distinguished by color. Pay attention to the color of connecting rod bush when installing.***

✓ According to the connecting rod big hole size marking and the connecting rod journal marking on the crankshaft, select connecting rod bush according to Table 3-6.

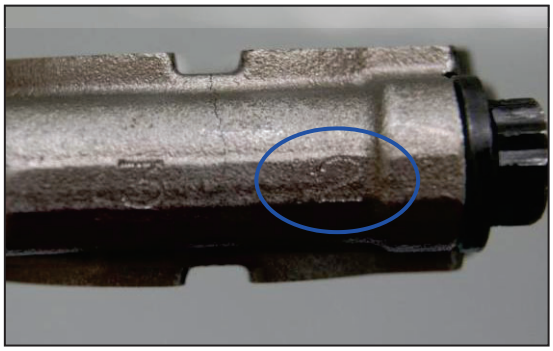


Table 3-6 Connecting Rod Bearing Bush Matching

Connecting rod grouping mark / Connecting rod wide size mark	1	2	3
1 (upper bush / lower bush)	Red / Red	Red / Yellow	Yellow / Yellow
2 (upper bush / lower bush)	Red / Yellow	Yellow / Yellow	Yellow/Blue
3 (upper bush / lower bush)	Yellow / Yellow	Yellow/Blue	Blue/Blue

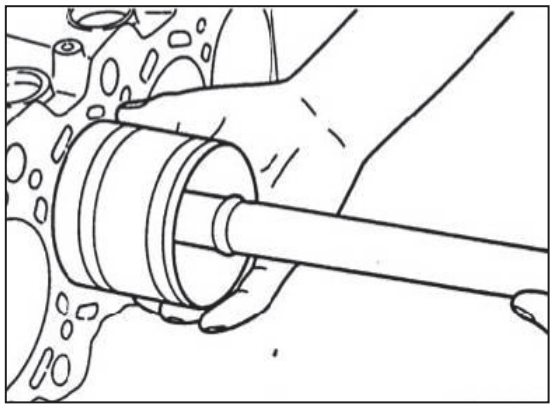
■ ***There is blue coating on the connecting rod bush, do not install wrong.***

⑩ Install piston connecting rod assembly

a. Rotate the crankshaft so that the connecting rod journal on the 1st and 4th cylinder crankshaft is in the lowest position, and install the 1st and 4th cylinder piston connecting rod assembly.

b. Apply adequate engine oil to the cylinder wall, connecting rod upper bush, piston outer surface, and special tool used for mounting piston.

c. Using the piston guide tool, put the piston connecting rod assembly into the guide tool from the cylinder fire surface and press the piston into the cylinder block with the rubber rod.



■ ***Always pay attention to the opening direction of the piston ring during installation to prevent the wrong opening direction.***

■ ***Make sure the mark on the top of the piston is pointing engine front edn after installation.***

■ ***Be careful not to let the connecting rod head damage the cylinder wall and crankshaft journal.***

■ ***Be careful not to damage the fitting surface of the connecting rod big end cover and the connecting rod.***

d. Rotate the crankshaft a circle, so that the connecting rod journal on the 2nd and 3rd cylinder is in the lowest position, and install the 2nd and 3rd cylinder piston connecting rod assembly.

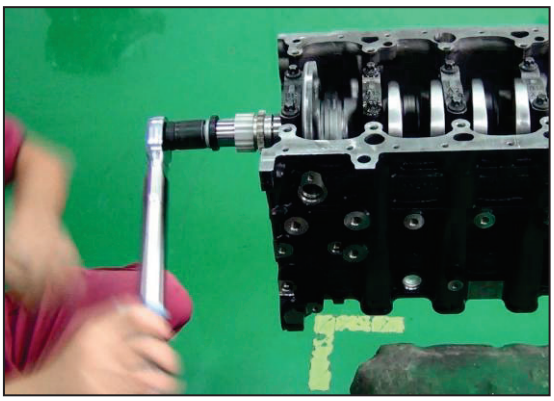
e. Install the connecting rod big head cover.

✓ When installing, first use high pressure gas to blow and wash the connecting rod and the cracking surface of the big end cover.

■ Connecting rod bolt tightening method: first tighten the bolt to ***20±2N·m***, and then tighten to 88-92°.

■ ***Connecting rod bolts could only be used once and shall not be reused.***

■ ***After installing the connecting rod piston assembly, rotate the crankshaft to check whether the crankshaft can rotate flexibly.***



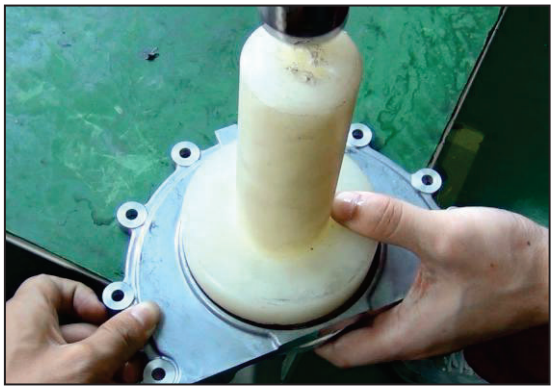
■ ***Check the side clearance of the connecting rod big end, refer to "Measurement of connecting rod big end".***

⑪ Install the crankshaft rear oil seal.

a. Pre-install the crankshaft rear oil seal on the rear oil seal bracket.

✓ Spread engine oil on the crankshaft rear oil sealing.

✓ Use special tools to press the crankshaft rear oil seal into the oil seal bracket.

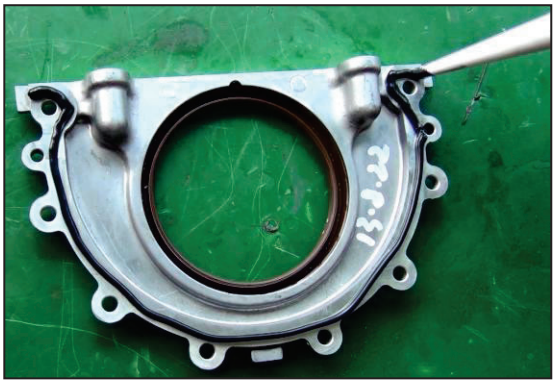


■ ***Must use the correct special tool. After installation, crankshaft rear oil seal shall not have any damage, tilt and installation not in place phenomenon.***

b. Install the crankshaft rear oil seal bracket.

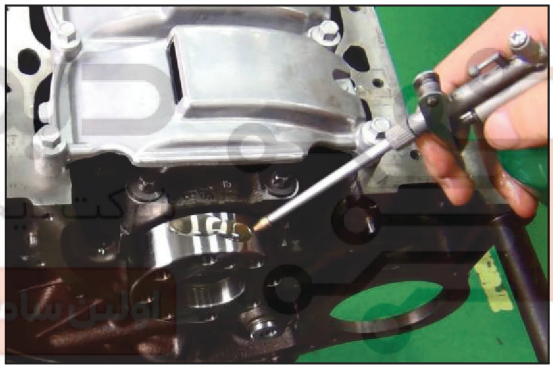
✓ Apply sealant to the crankshaft rear oil seal bracket. The sealant path is as

follows:

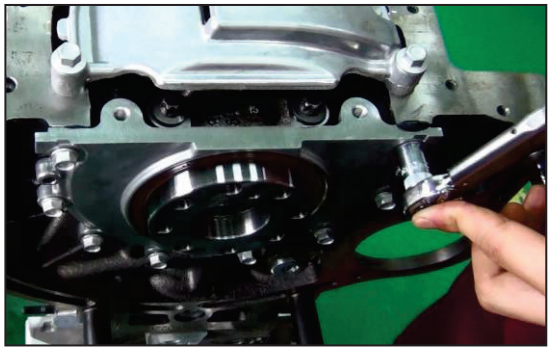


■ ***Ensure that the coating surface is clean and coated with Corning 3-0115 sealant or equivalent product with size of (1.5 ~ 2.5) mm. The adhesive tape should be uniform and continuous.***

✓ Spread engine oil on the crankshaft (rear oil sealing installation position).



✓ Install the crankshaft rear oil seal bracket.



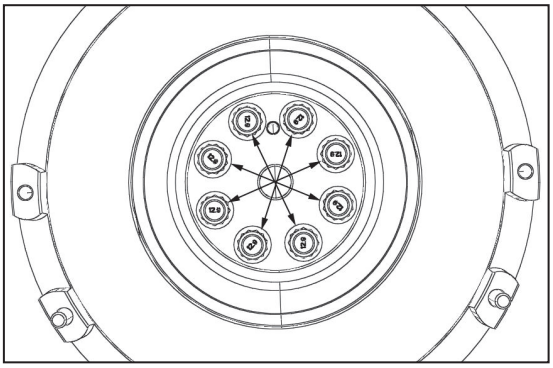
■ ***Tighten bolts in the order from the middle to the crossing of both sides. Tightening torque: 9 ~ 11N.m.***

■ ***Pay attention not to damage the lip of the rear oil seal during installation.***

⑫ Install the cylinder head and other part. Refer to “Removal and installation of cylinder head”

⑬ Install the flywheel

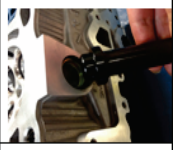
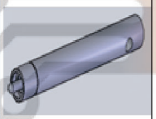
■ ***Follow the principle of pre-tightening first and then symmetrical cross - tightening.***

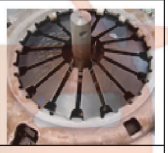


■ ***Tightening method: （19～21）N.m+（70°～74°）.***

■ ***Flywheel bolt doesn't need to spread engine oil or sealant.***

3.3.6 Special Tools

No.	江淮国内编号	Parts No.	Parts name	工具简图	使用图片
1	JAC-T6F011	27P0026	Piston Installer		
2	JAC-T6F012	27P0027	Cap Installer No 22		
3	JAC-T6F013	27P0028	Cap Installer No 25		
4	JAC-T6F014	27P0029	Cap Installer No 16		
5	JAC-T6F015	27P0030	OCV Dismantler		
6	JAC-T6F016	27P0031	Guide Valve Oil Seal		

7	JAC-T6F017	27P0032	Rear Crankshaft Oil seal Installer		
8	JAC-T6F018	27P0033	Front Crankshaft Oil seal Installer		
9	JAC-T6F019	27P0034	Engine Oil Filter Tool		
10	JAC-T6F025	27P0039	Guide of Disc and Clutch		
11	JAC-T6F027	NST-B132	Spring Valve Tools