2023 KX11 PHEV Engine Manual (DHE15)

The manual provides specifications, diagnostics, and repair service information on KX11 PHEV Engine Manual (DHE15)

Information updated to 2023 08

CONTENTS

Engine Manual(DHE15)

1.1 General

1.1.1 How to use this manual

1.1.1.1 Theme range

• This manual contains regulations for all required overhaul operations. The operation regulations are organized into four basic categories.

a. disassembling

b. removing

c. checking

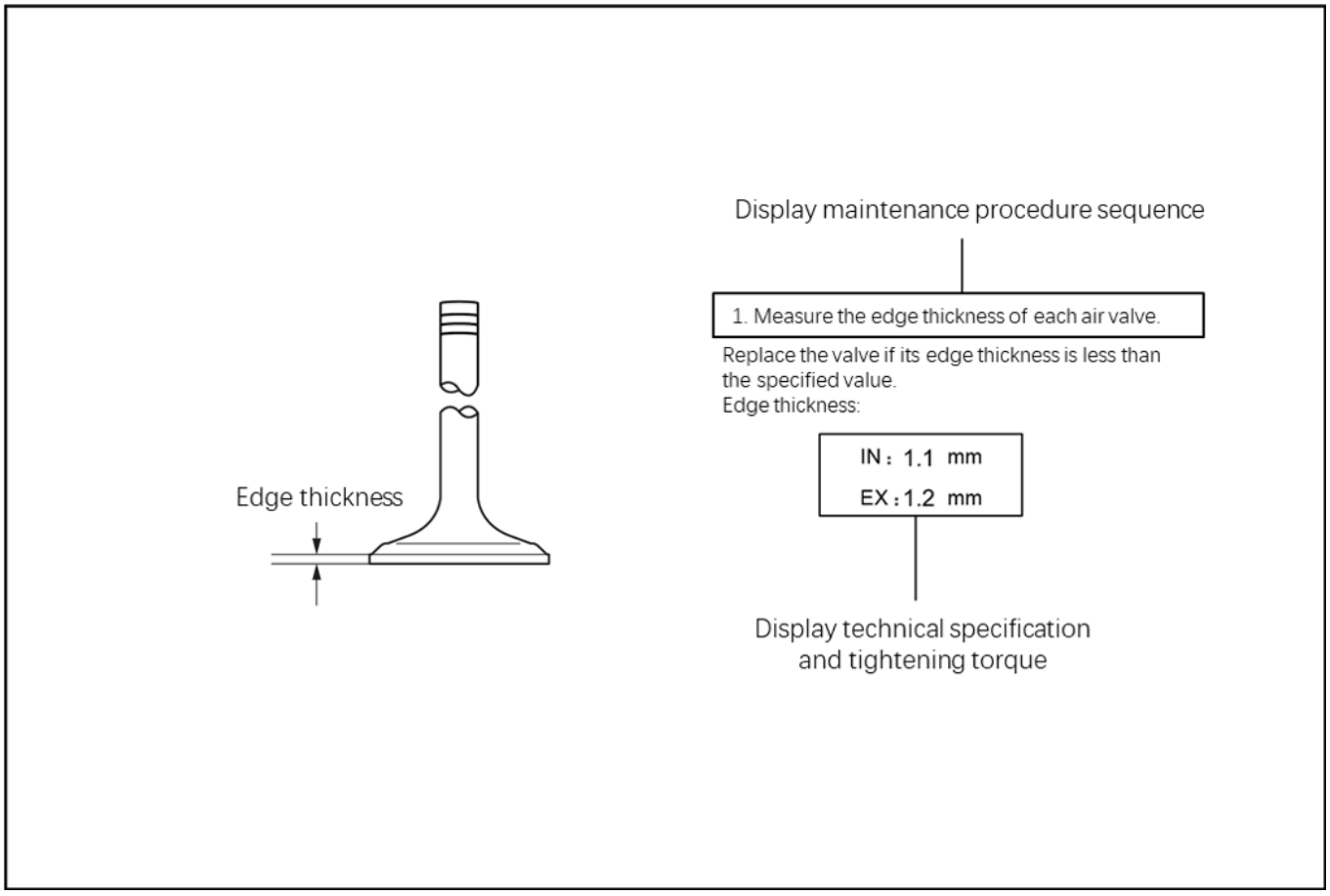
and d. assembling

• Some simple operations, such as cleaning parts and visual inspection, are omitted.

1.1.1.2 Maintenance procedure

Inspection and adjustment

Inspection and adjustment are conducted in steps. The operating parts and contents of important maintenance regulations are described in detail in this manual and accompanied by illustrations.



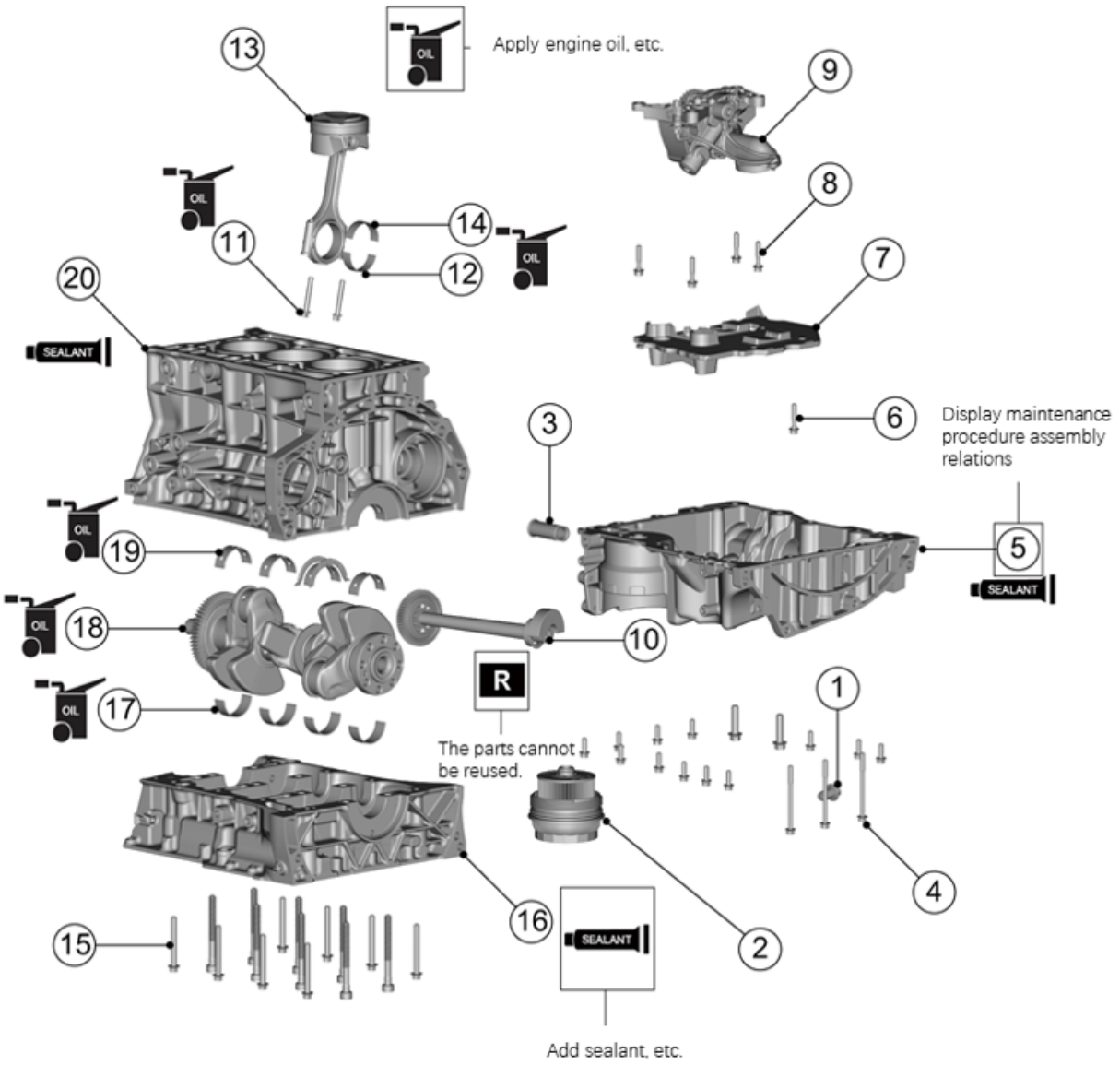
1.1.1.3 Repair procedure

Before descriptions of the most repair regulations, overview diagrams will be provided.

a. The component's name and combination method are illustrated, and the visual inspection method is described for systematically disassembling and installation procedures.

b. The overview diagrams are made marks with non-reuse, lubrication oil and sealant signs.

and c. The main components involved in the maintenance regulations are fitted with illustrations of corresponding numbers.



1. Oil drain plug
2. Oil filter module
3. Oil pump tube
4. Oil pan components bolt
5. Oil pan components
6. Oil baffle plate assembly bolts
7. Oil baffle plate assembly
8. Oil pump component bolt
9. Oil pump components
10. Balance shaft components
11. A connecting rod bolt
12. Connecting rod bearing shell
13. Piston connecting rod components
14. Connecting rod bearing shell
15. Main bearing cap bolts
16. Main bearing cover
17. Main shaft tile
18. Crankshaft
19. Main shaft tile
20. Cylinder block

1.1.1.4 Symbol

There are 3 symbols indicating lubricant, sealant and single-use correspondingly. These symbols indicate the method of use during maintenance, or the usage of the type of material.

Symbol	Meaning	Material type
	Adding engine lubricating oil	Applicable engine lubricating oil
	Adding sealant	Proper sealant
R	Single-use means that old components need to replace with new components after disassembly.	Sealing rings, bolts, etc.

1.1.1.5 Prompt information

In this manual, you will find several warnings, cautions, specifications, and upper and lower limit values.

Warning

The warning indicates that if the prompt is neglected, it may cause damage to the vehicle or parts, or cause serious personal injury or death.

Caution

Caution provides additional information that helps to complete a specific procedure.

Specification

Specification specifies the allowable range of inspection or adjustment operations.

Upper and lower limit values

The upper and lower limit values set forth cannot be exceeded during an inspection or adjustment operation.

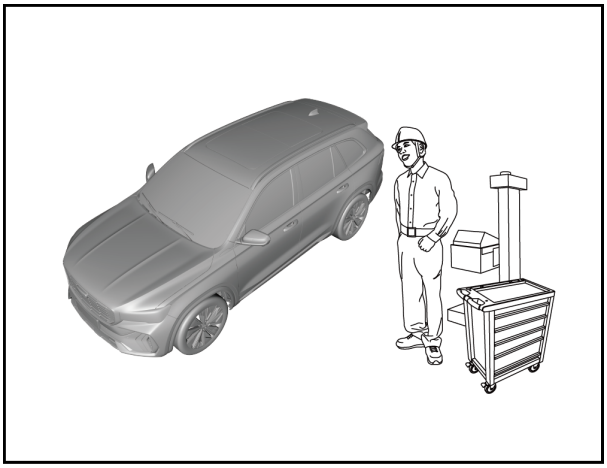
1.1.2 Unit

1.1.2.1 Unit

Length	mm (millimeter)
Pressure	kPa (kilopascal)
Revolution value	rpm (revolutions per minute)
Torque	N·m (Newton meter)
Volume	L (liter)
Weight	g (gram)
	Kg (kilogram)

1.1.3 Basic rules

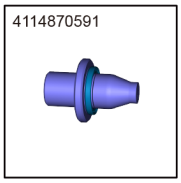
1.1.3.1 Preparation of tools and measuring equipment

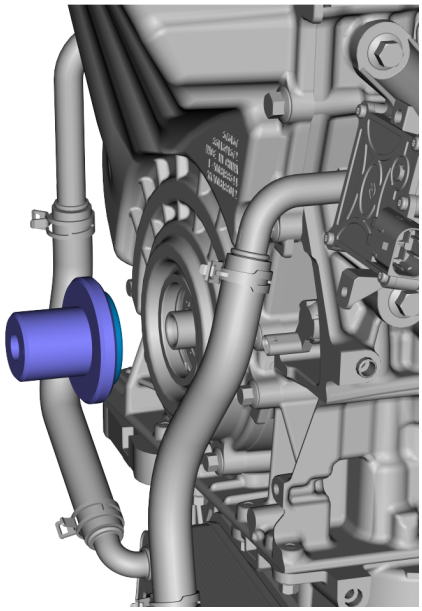


1 It is ensured that all necessary tools and measuring equipment are available before any maintenance work starts.

2 A disposable three-part set is installed (including steering wheel cover, seat covers and foot mats) in the cab please.

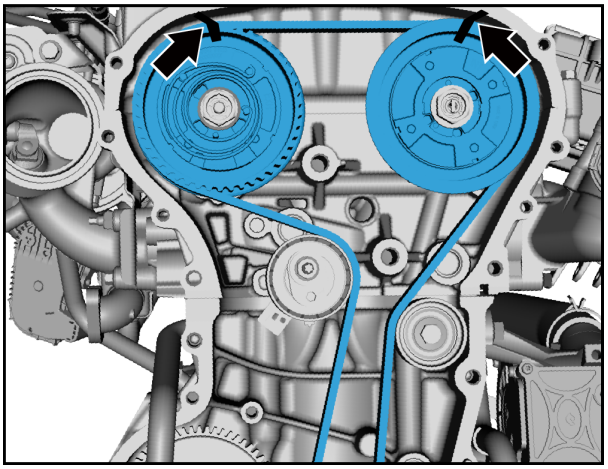
1.1.3.2 Special maintenance tools





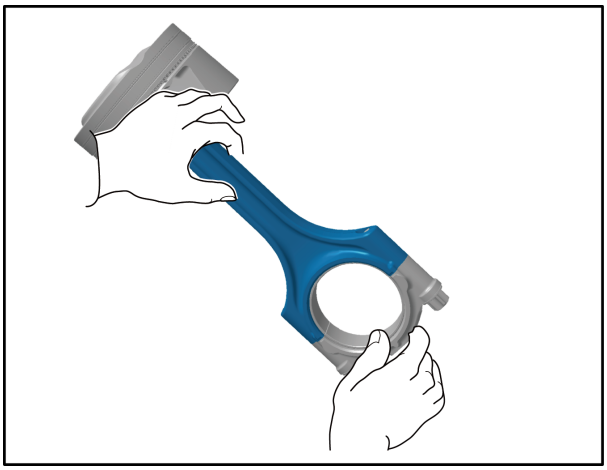
Special repairing tools or other appropriate tools should be used if relevant requirement are needed.

1.1.3.3 Disassembling



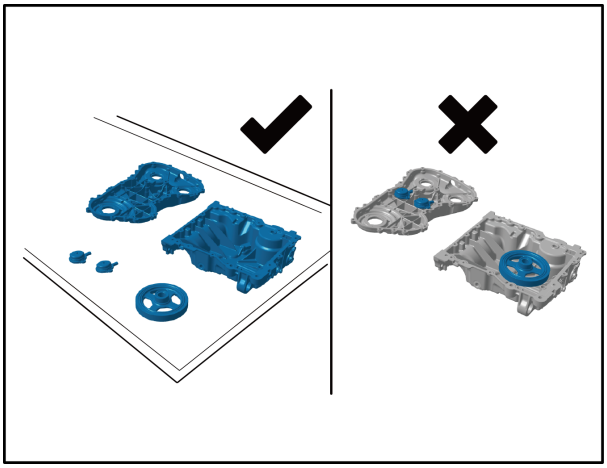
If the disassembly steps are complex and there are many components to be disassembled, all components should be marked for reassembling without affecting the function and appearance of the components. During the disassembly and assembly process, whether the disassembled components are deformed, damaged or other faults shall be carefully checked.

1.1.3.4 Inspection during disassembly and removal



Whether the disassembled components are deformed, damaged or have other faults are carefully checked.

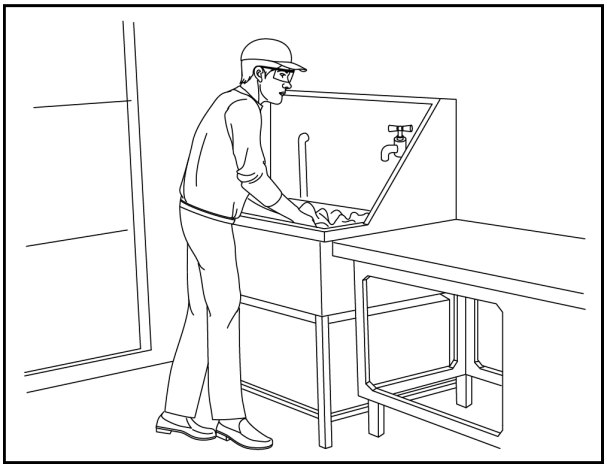
1.1.3.5 Placement of parts and components



1 All removed components should be sorted and placed in a clean, dust-free environment for reassembly.

2 The needed parts and components should be marked and stored separately.

1.1.3.6 Washing of parts and components



Before reassembly, the components should be cleaned carefully before inspection and assembly. The cleaning method comprises:

a. dry cleaning

b. scraping off accumulated dirt with metal plates or wooden strips

c. clearing away dirt with a brush

d. wiping with a duster cloth

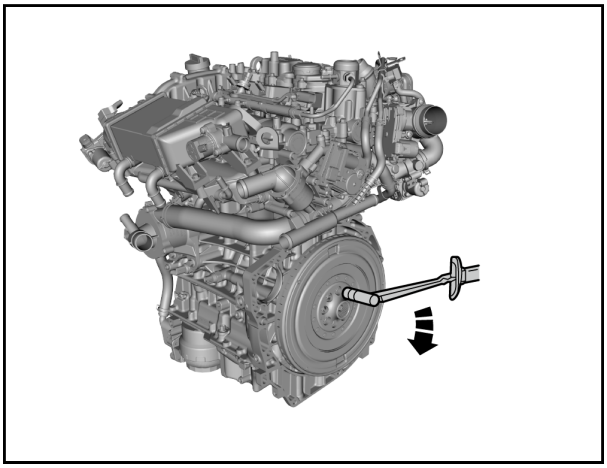
e. clearing away dirt with compressed air

f. cleaning dry dust with a dust catcher

and g. using a solvent suitable for component cleaning.

Warning !

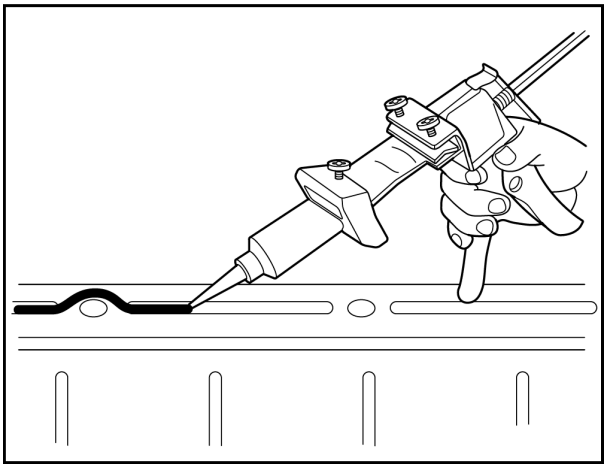
When you use the compressed air, you should wear eye protective devices, otherwise, dust and other particles may spill out and cause damage to the eyes.



1.1.3.7 Reassembly

1 When assembling components, it is sure to strictly follow the standard data, such as tightening torque and component clearance.

2 After disposable components such as oil seal, gasket, O-shaped ring, and the like are disassembled, the disposable components need to replace with new ones.



1.1.3.8 Lubrication and sealing

1 The old sealant attached to a sealant application surface, a mating surface, a fixing bolt and a bolt hole are removed.

2 The sealant application surface and the mating surface are cleaned with unleaded gasoline (used for ignition and heating) by wiping. Water, grease or foreign object should not to be attached on the surfaces.

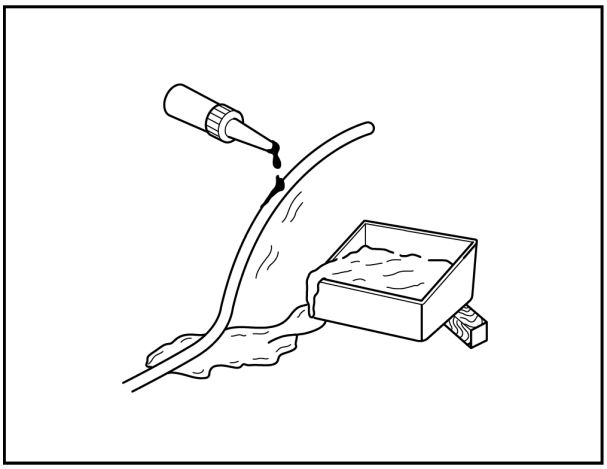
3 The sealant pipe is connected to the glue gun.

4 Please use original sealant or similar product.

- The combination element is installed within 10 minutes after applying the sealant.
- Please clean immediately if there are stains on the sealant.
- Do not re-tighten the fixing bolt or nut after installation.
- The engine oil and engine coolant can be refilled after the device is installed and waits for more than 30 minutes.

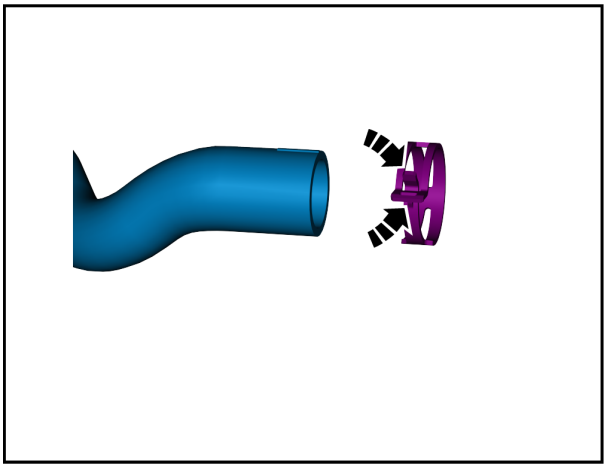
5 During assembly, applicable lubricating oil or grease is applied on special parts (such as oil seals and running parts of components).

1.1.3.9 Rubber parts and pipes



Gasoline, lubrication oil or other liquids are prevented from dripping on the rubber parts.

1.1.3.10 Hose clamping hoop

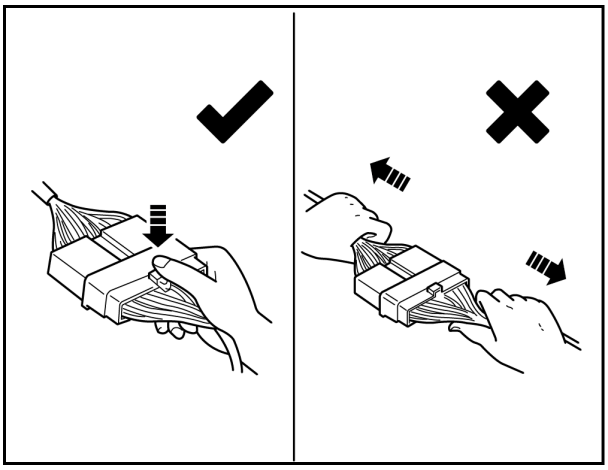


When reinstalling, the hose clamping hoop is placed on the original position on the hose and the clamping hoop is gently squeezed with big pliers to ensure correct assembly.

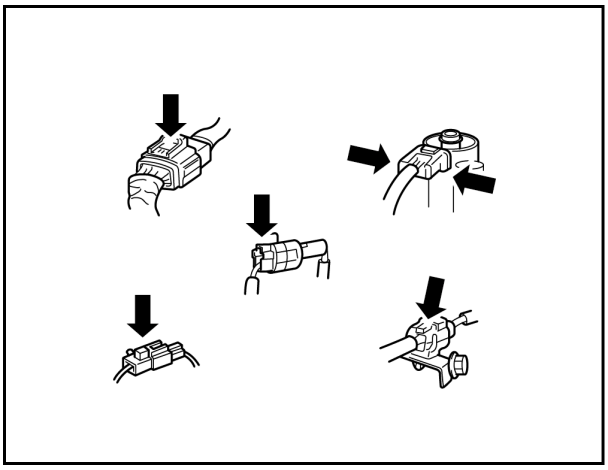
1.1.4 Electrical system

1.1.4.1 Connector

Disconnecting the connector

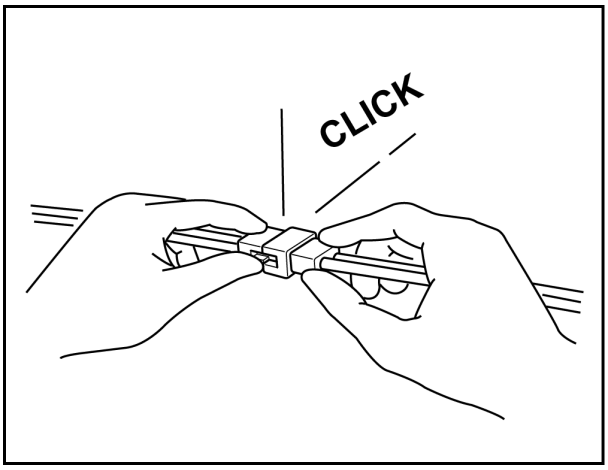


1 When disconnecting the harness connector, the harness connector is held instead of the wire.



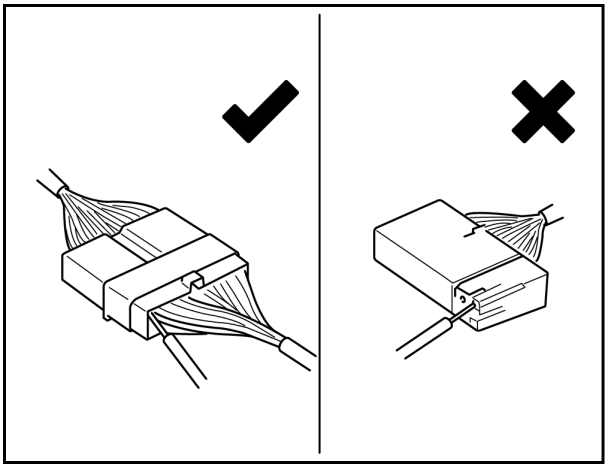
2 As shown in the figure, the harness connector can be disconnected by pressing or pulling out the locking handle.

Installing the connector

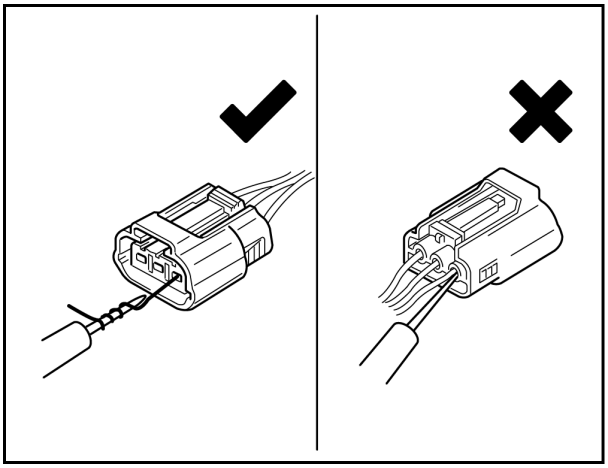


1 When locking the harness connector, a "click" sound indicates that the connector is locked.

Inspecting the connector



1 When an inspection device is used to check continuity or measure voltage, the probe of the detection device is inserted from the harness side.



2 For waterproof connectors, because they cannot be inserted from the harness side, checking is conducted from the harness connector side.

Caution

To prevent damage to the wiring end, a thin wire is wrapped around the probe of the tester before the wiring end is inserted.

1.1.5 Abbreviations

1.1.5.1 Abbreviations

OCV	Oil control valve
IN	Intake side
EX	Exhaust side

1.2 Mechanical

1.2.1 Warnings regarding engine overhaul

1.2.1.1 Warnings regarding engine overhaul

Warning !

It is found by experiments in labs that if a mouse connects the used oil for a long time, the mouse is caused to have skin cancer. Therefore, after completing the work, please use soap and water to wash the parts that have come into contact with or are stained with oily body immediately to protect your skin.

1.2.2 Disassembling of engine

1.2.2.1 Disassembly engine assembly

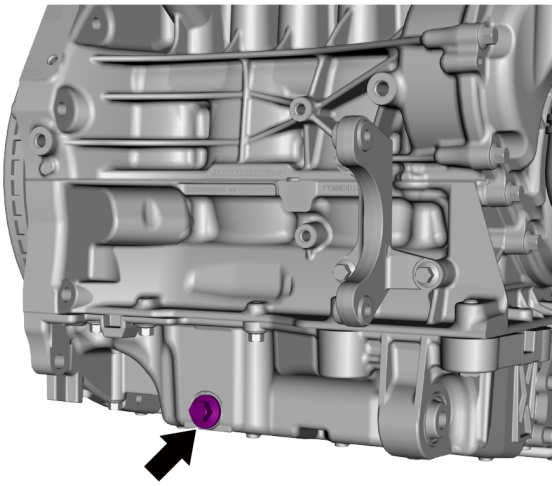
Caution

The engine assembly is disassembled from the engine compartment of the complete vehicle. Refer to "Replacement of engine assembly" in "Mechanical system" in the "Maintenance Manual".

1 The engine is placed on the engine bracket.

Warning !

Be sure to place the engine on the bracket stably, otherwise the engine may tip over during repairing, resulting in personal injuries and engine damage.



2 The oil pan drain plug is disassembled and the oil is drained into a container.

Torque: 35 N·m

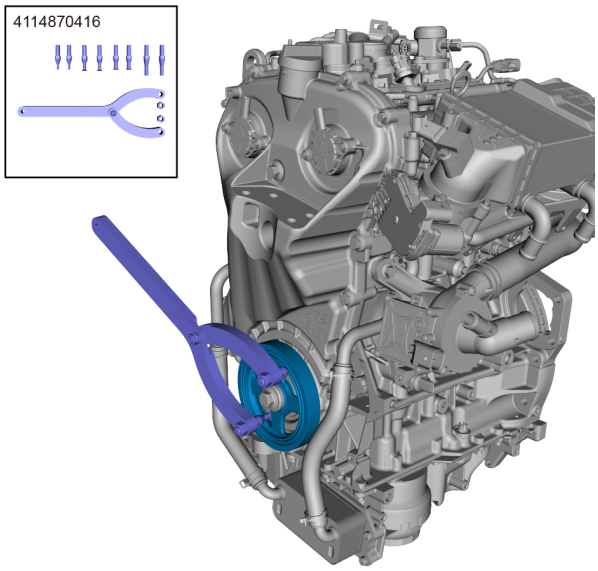
Caution

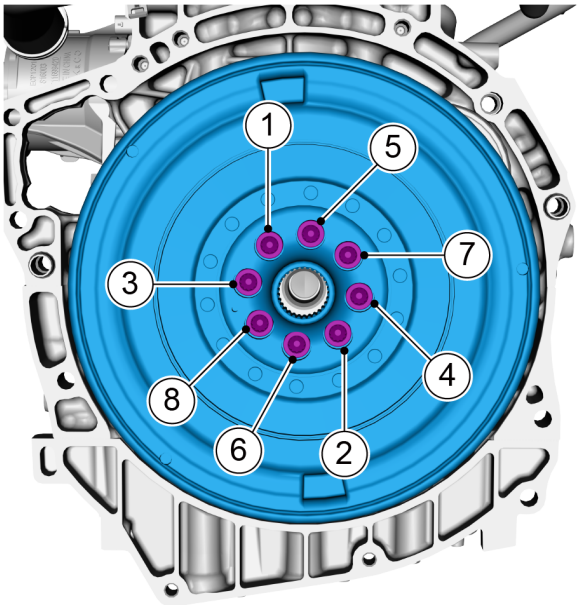
The oil drain plug gasket cannot be reused. It is needed to replace with new ones after disassembly.

1.2.2.2 Disassembling dual mass flywheel assembly

1 The engine assembly is disassembled.

2 The vibration reducing pulley assembly is fixed with special tools and the crankshaft do not allowed to rotate.
Special tool number: 4114870416





3 The fixing bolts connecting the dual mass flywheel assembly are disassembled in a crossing order from 1 to 8 as shown in the figure.

Caution

One bolt on the dual mass flywheel assembly is left to prevent the dual mass flywheel assembly from falling.

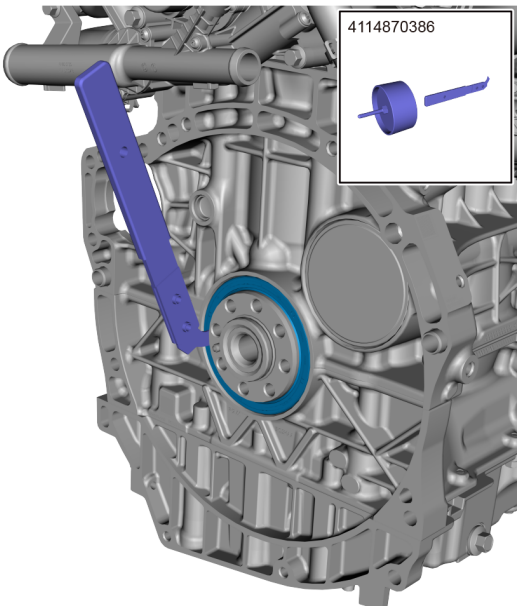
Caution

The flywheel bolts cannot be reused. It is needed to replace with new ones after disassembly.

4 The dual mass flywheel assembly is firmly grasped and the last bolt is disassembled, and then the dual mass flywheel assembly is taken down.

Warning !

Beware of the dual mass flywheel drops when the last bolt is disassembled.



1.2.2.3 Disassembling crankshaft rear oil seal

The special tools are used to disassemble the crankshaft rear oil seal.

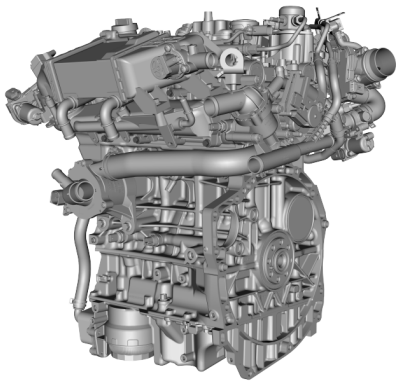
Special tool number: 4114870386

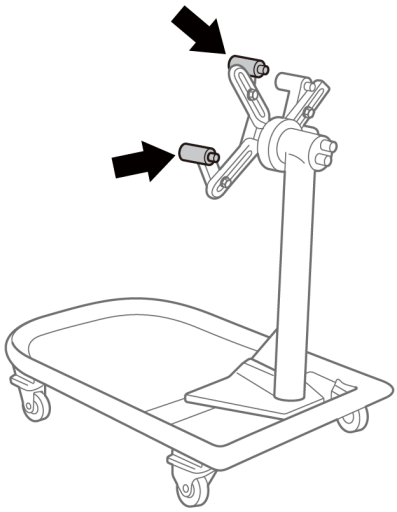
Caution

The crankshaft rear oil seal cannot be reused. It is needed to replace with new ones after disassembly.

1.2.2.4 Installing turnable bracket of engine

1 The general tool is installed to the rear end hole of the cylinder block.



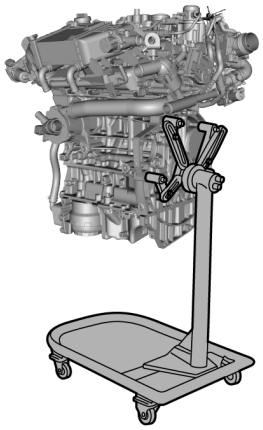


2 The general tools (bolts, nuts and plates) are assembled to the specified positions.

3 The general tool (bolts) are adjusted to make the exposed thread less than 20 mm.

4 The general tools (bolts and nuts) are adjusted to be parallel to the general tools (arms and plates).

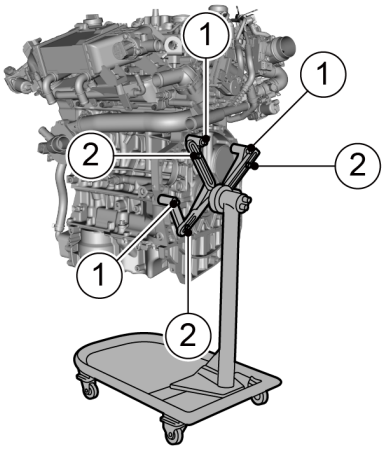
5 The engine is installed on the engine turnover bracket.



6 The general tool bolt 1 and nut 2 are tightened to fix the general tool and the engine.

Warning !

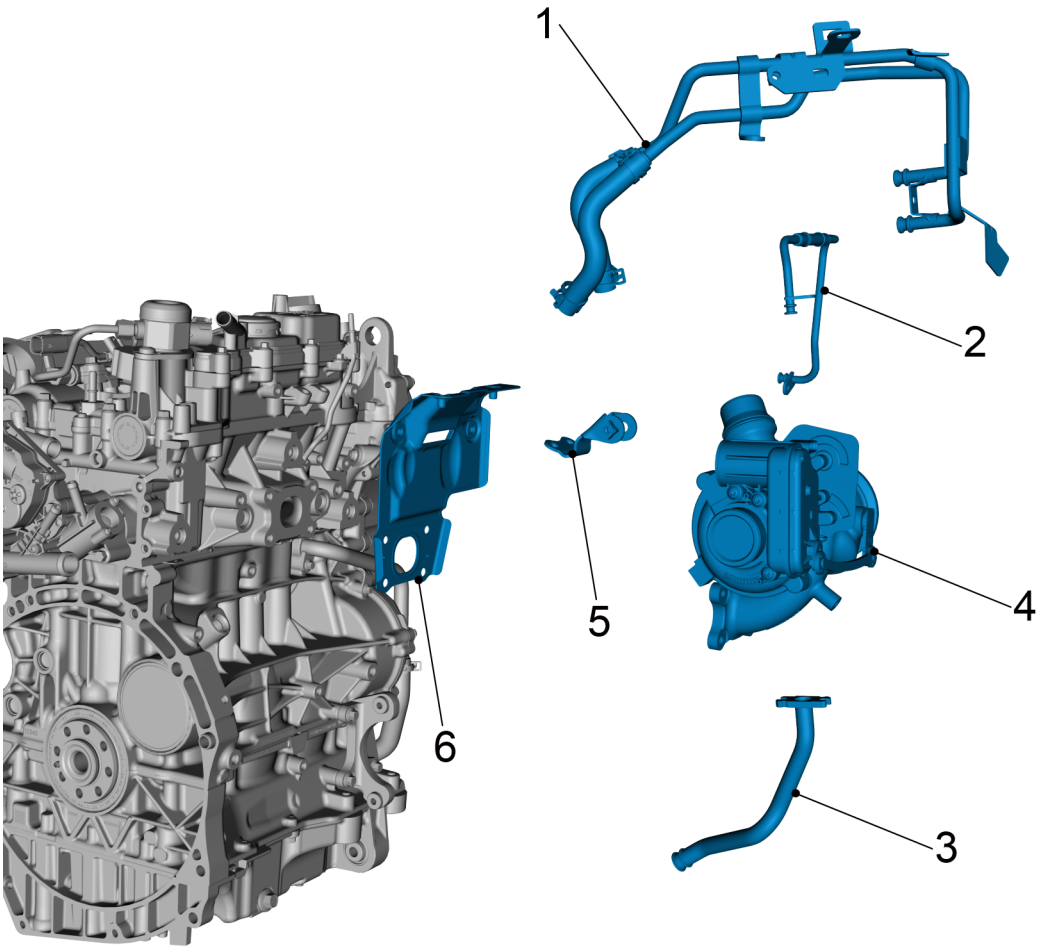
If the engine is fixed in an unbalanced position, the self-locking brake system of the engine bracket may not work effectively. Thus, the engine and the installing bracket handles are caused to suddenly move, resulting serious personal injury. It is sure to place the engine in the balanced position, the rotating handle is tightly grasped when the engine rotates.



1.2.3 Disassembling turbocharger

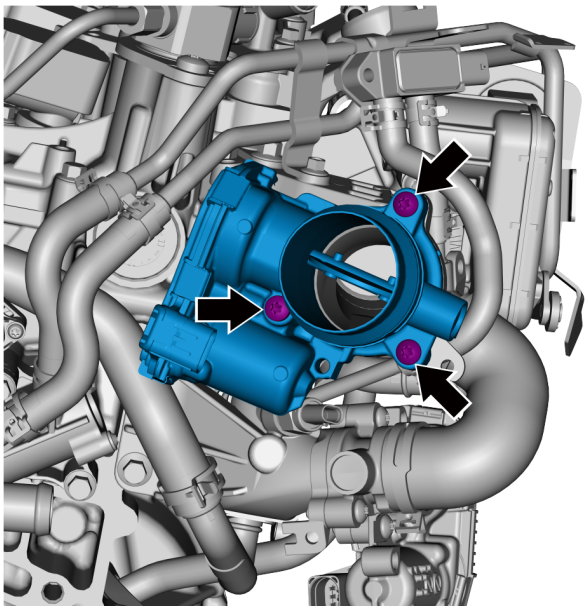
1.2.3.1 Breakdown drawing of disassembling turbocharger

Disassembling is conducted in the order indicated in the table.



1. Supercharger water pipe assembly
2. Fuel inlet pipe of supercharger
3. Fuel returning pipe of supercharger
4. Turbocharger
5. Supercharger bracket
6. Supercharger connecting manifold gasket combination heat shield

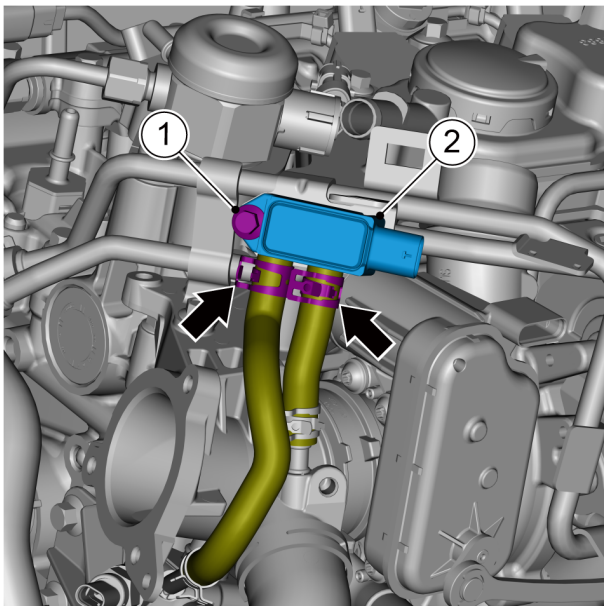
1.2.3.2 Disassembling air/exhaust mix valve



1 Three fixing screws of the air/exhaust mix valve are disassembled.

2 The air/exhaust mix valve is taken down.

1.2.3.3 Disassembling differential pressure sensor

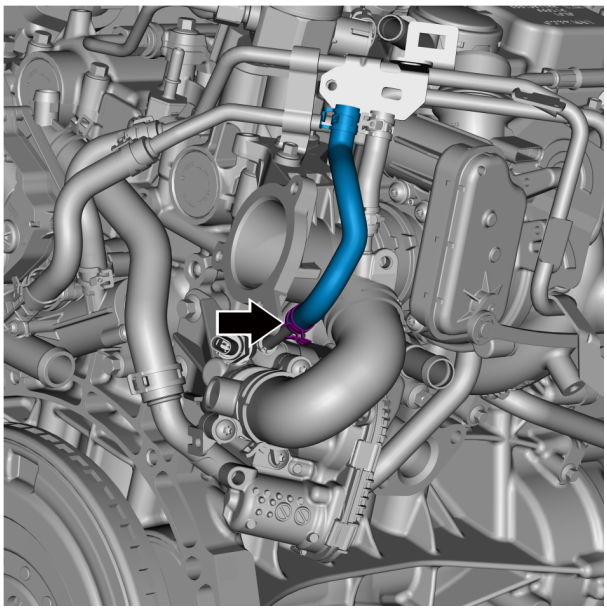


1 The clamping hoops of the differential pressure sensor high/low pressure end rubber pipes are disassembled.

2 One fixing bolt 1 of the differential pressure sensor is disassembled.

3 The differential pressure sensor 2 is disassembled.

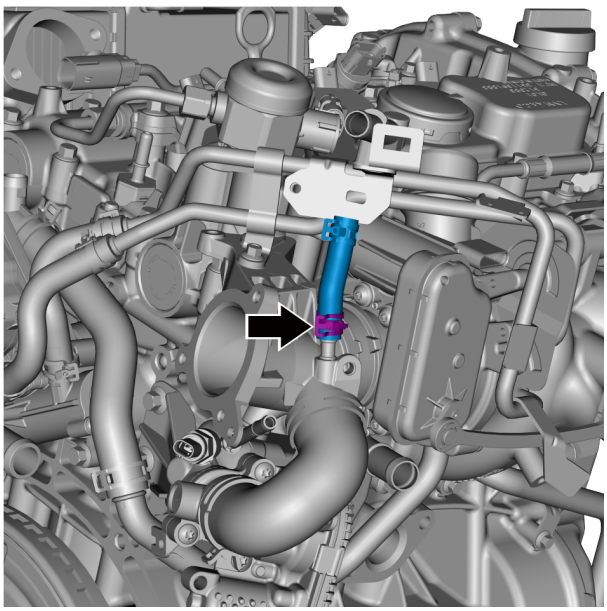
1.2.3.4 Disassembling differential pressure high pressure end rubber pipe



1 The clamping hoops of the differential pressure sensor high pressure end rubber pipe is disassembled.

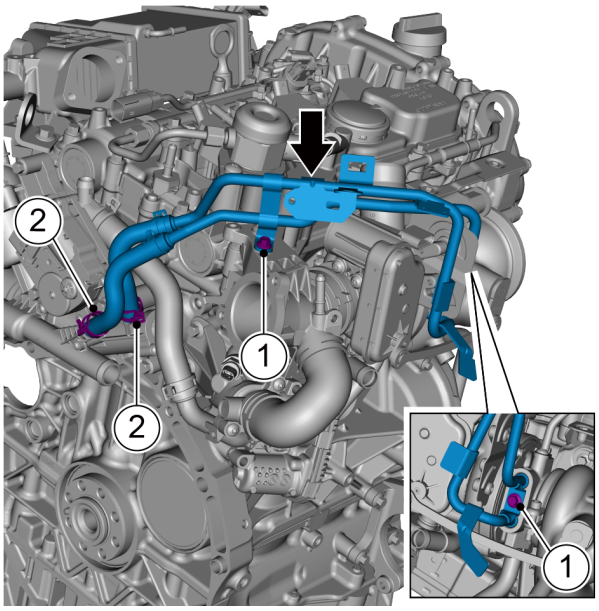
2 The differential pressure sensor high pressure end rubber pipe is taken down.

1.2.3.5 Disassembling differential pressure sensor low pressure end rubber pipe



1 The clamping hoops of the differential pressure sensor low pressure end rubber pipes are disassembled.

2 The differential pressure sensor low pressure end rubber pipe is taken down.



1.2.3.6 Disassembling supercharger water pipe assembly

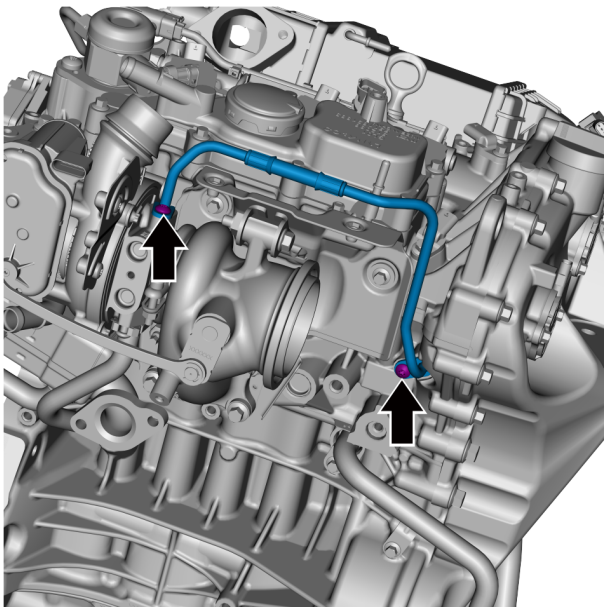
1 The two clamping hoops 2 of the supercharger water pipe assembly is disassembled, and the connection between the supercharger water pipe assembly and the coolant temperature controlling module is disconnected.

2 The two fixing bolts 1 of the supercharger water pipe assembly is disassembled.

Caution

The O-shaped sealing ring cannot be reused. It is needed to replace with new ones after disassembly.

3 The supercharger water pipe assembly is taken down.



1.2.3.7 Disassembling supercharger oil inlet pipe

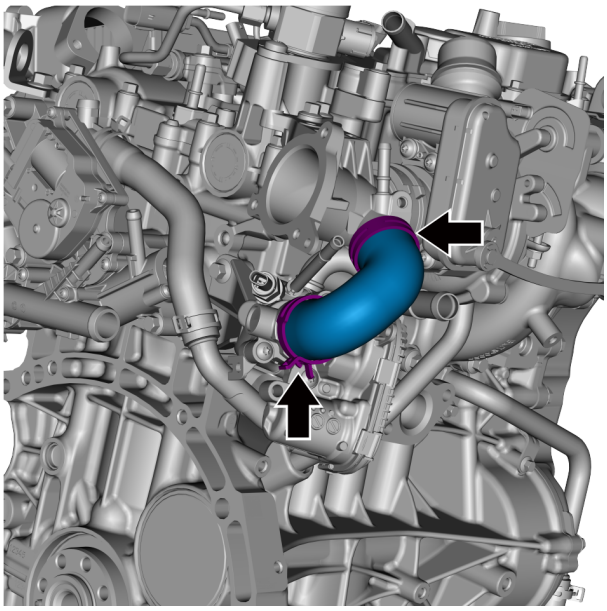
1 The 2 fixing screws of the supercharger fuel inlet pipe is disassembled.

Caution

All spacers and gaskets cannot be reused after disassembly. It is needed to replace with new ones after disassembly.

2 The supercharger fuel inlet pipe is taken down.

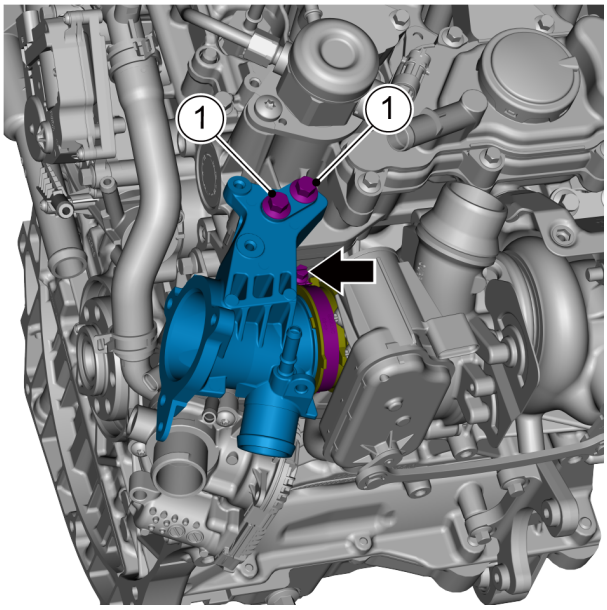
1.2.3.8 Disassembling EGR rubber pipe



1 The clamping hoops of the EGR rubber pipe are disassembled, and the connection between the EGR rubber pipe and the EGR valve and the low pressure intake pipe are disconnected.

2 The EGR rubber pipe is taken down.

1.2.3.9 Disassembling low pressure intake pipe

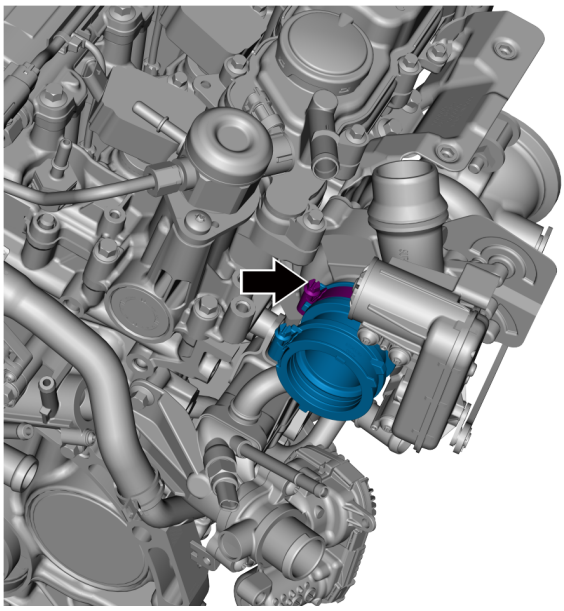


1 The two fixing bolts 1 of the low pressure intake pipe are disassembled.

2 The clamping hoops of the low pressure intake pipe is loosened.

3 The low pressure intake pipe is taken down.

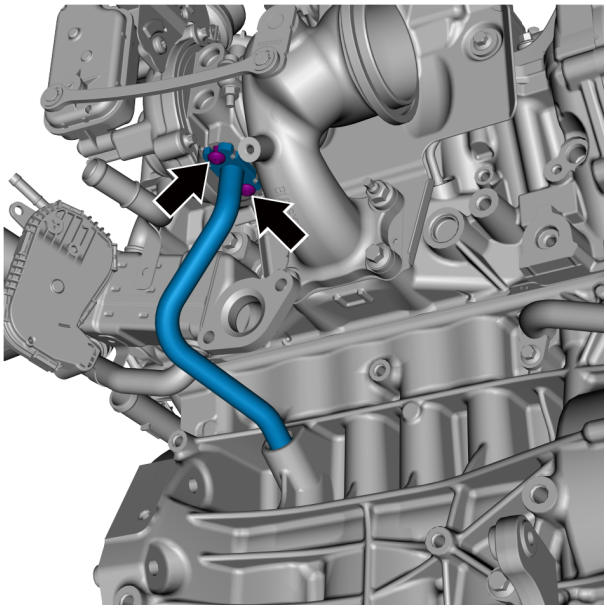
1.2.3.10 Disassembling low pressure seal sleeve



1 The low pressure seal sleeve ring clamp is loosened.

2 The low pressure seal sleeve is taken down.

1.2.3.11 Disassembling supercharger oil return pipe



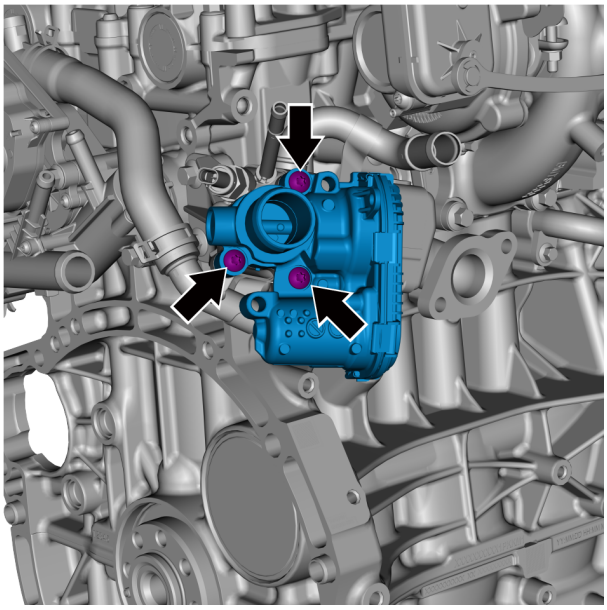
1 The 2 fixing screw of the supercharger fuel return pipe is disassembled.

2 The supercharger fuel return pipe is disassembled.

Caution

All O-shaped sealing rings and the gaskets are not allowed to be reused after removal.

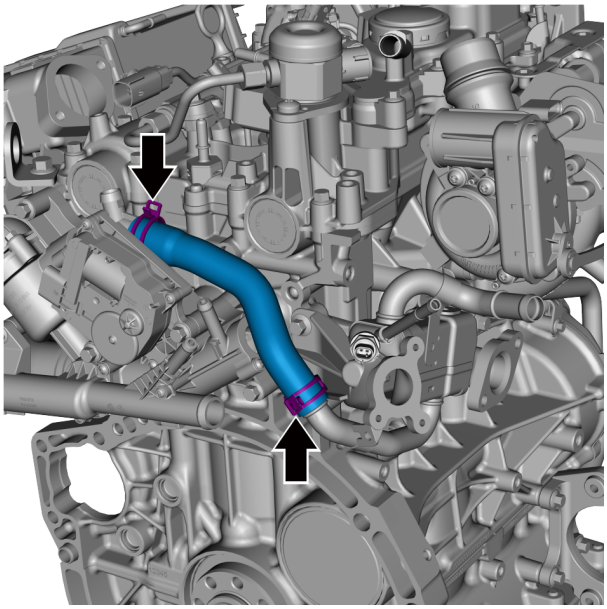
1.2.3.12 Disassembling EGR valve



1 The 3 fixing screws of EGR valve are disassembled.

2 The EGR valve is taken down.

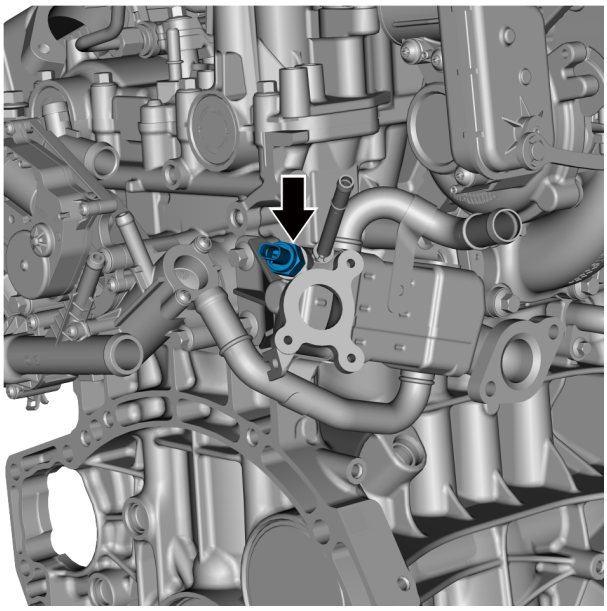
1.2.3.13 Disassembling EGR cooler water inlet rubber pipe



1 The ring clamps of the EGR cooler water inlet rubber pipe are disassembled, and the connection of the EGR cooler water iinlet rubber pipe and the EGR cooler and the coolant liquid temperature controlling module are disconnected.

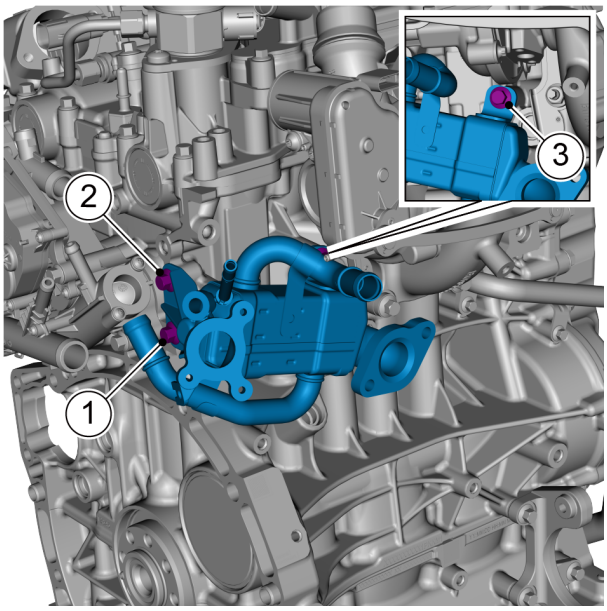
2 The EGR cooler water inlet rubber pipe is disassembled.

1.2.3.14 Disassembling high temperature sensor



The high temperature sensor is disassembled.

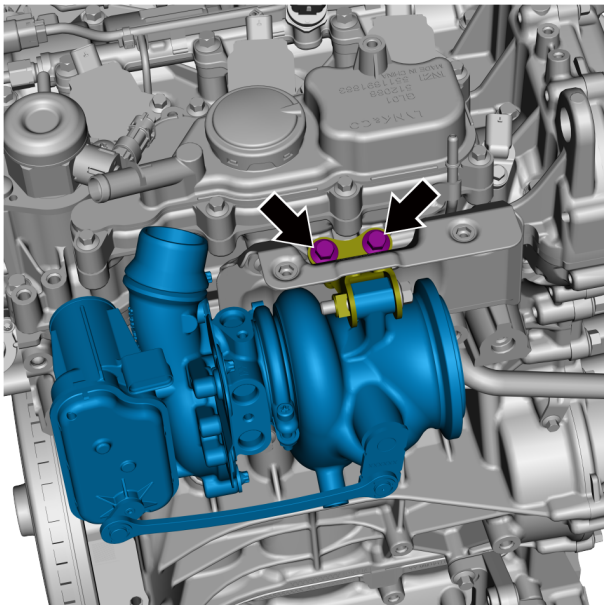
1.2.3.15 Disassembling EGR cooler



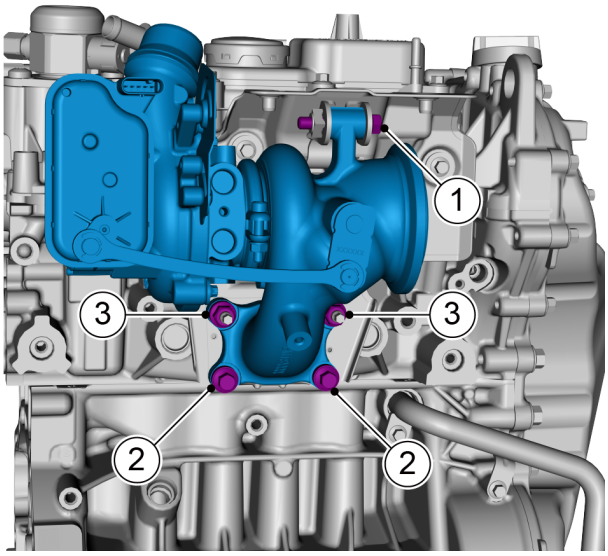
1 3 fixing bolts of the oil cooler are disassembled in the order from 1 to 3 as shown in the figure.

2 The EGR cooler is taken down.

1.2.3.16 Disassembling turbocharger



1 The 2 fixing bolts connecting the turbocharger bracket is loosened until the bolt flange surface is disconnected from the bracket.



2 The fixing bolt 1 of the turbocharger 1 is disassembled.

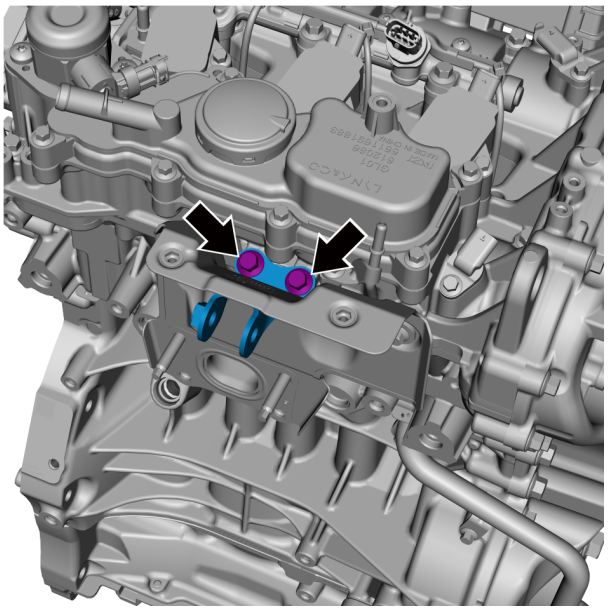
Caution

Before disassembling this bolt, the exposed threaded portion should be sprayed with a thread loosening agent, the WD-40 universal lubricant rust remover is recommended, or lubricant is applied to prevent disassembly. If the bolt breaks, the bracket should be replaced.

3 The fixing bolt 2 of the turbocharger 2 is disassembled.

4 The 2 fixing nuts 3 of the turbocharger is disassembled.

5 The turbocharger is taken down.

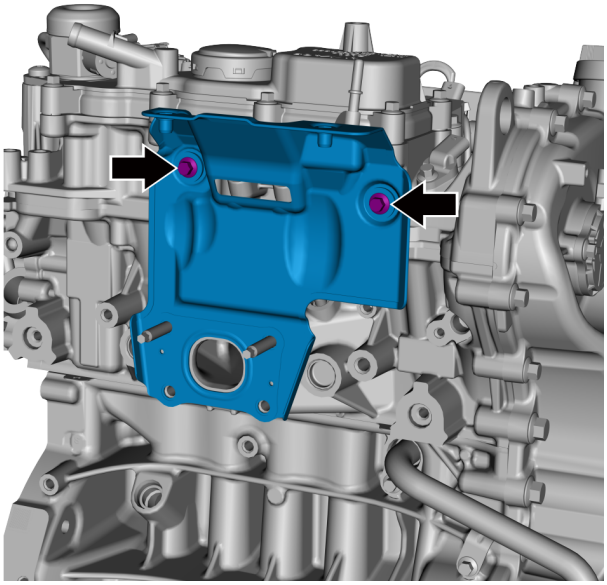


1.2.3.17 Disassembling supercharger bracket

1 The 2 fixing bolts of the supercharger bracket are disassembled.

2 The supercharger bracket is taken down.

1.2.3.18 Disassembling supercharger connection manifold gasket combination heat shield

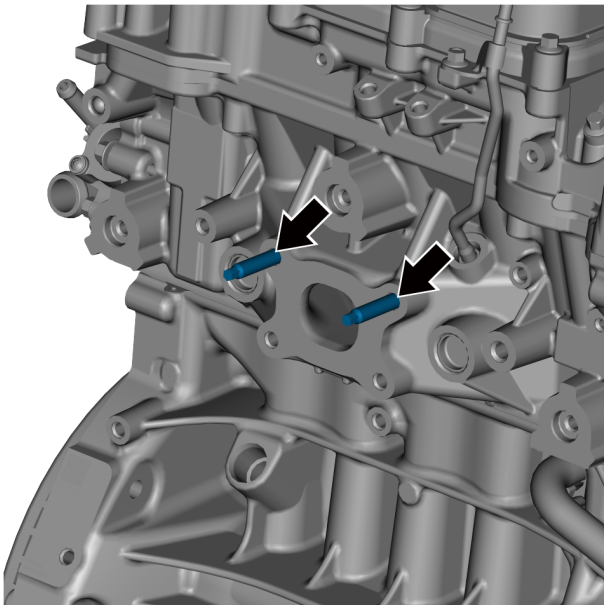


1 The two fixing bolts of the supercharger connection manifold gasket combination heat shield are disassembled.

2 The supercharger connecting manifold gasket combination heat shield is taken down.

Caution

The supercharger connecting manifold gasket combination heat shield is a disposable part, and must be replaced with a new one after each removal.

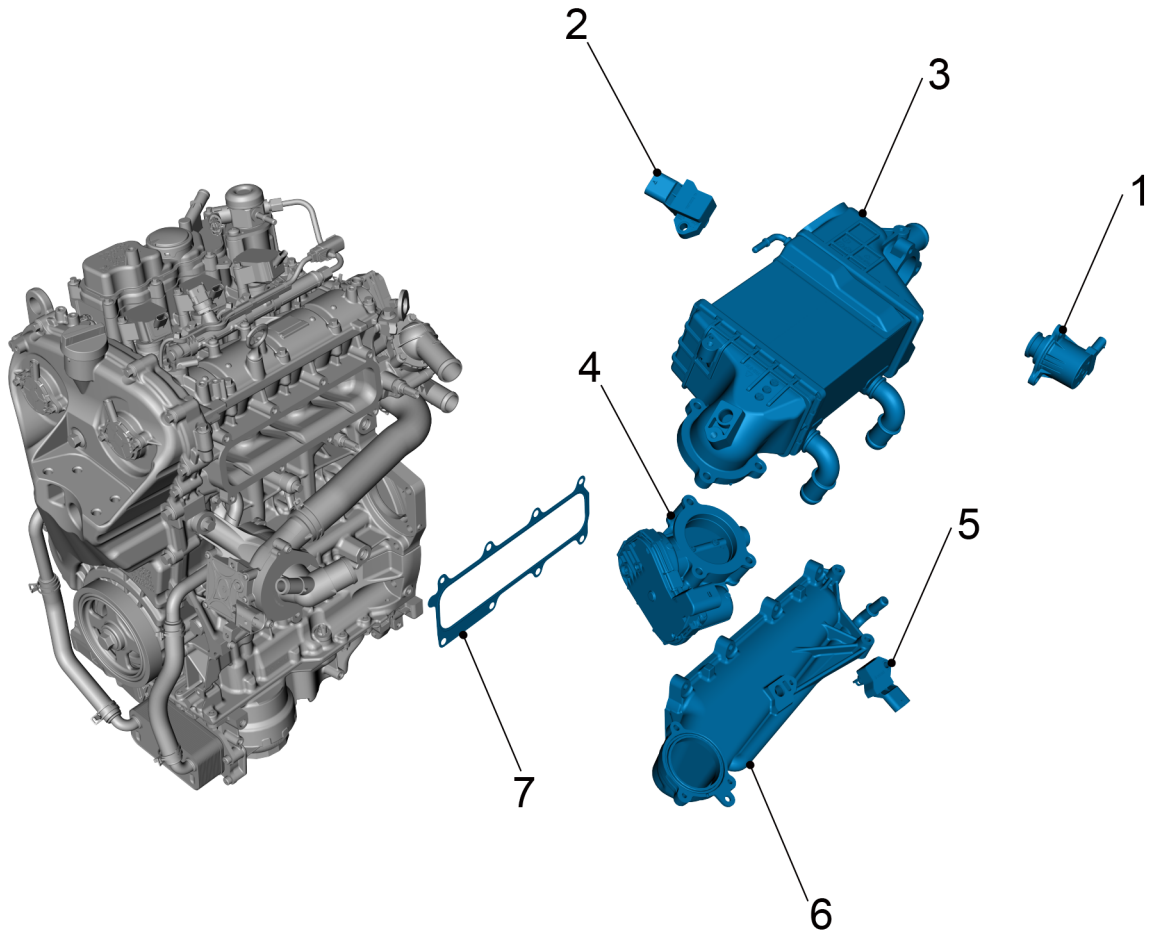


3 The double end stud is disassembled.

1.2.4 Disassembling intake manifold

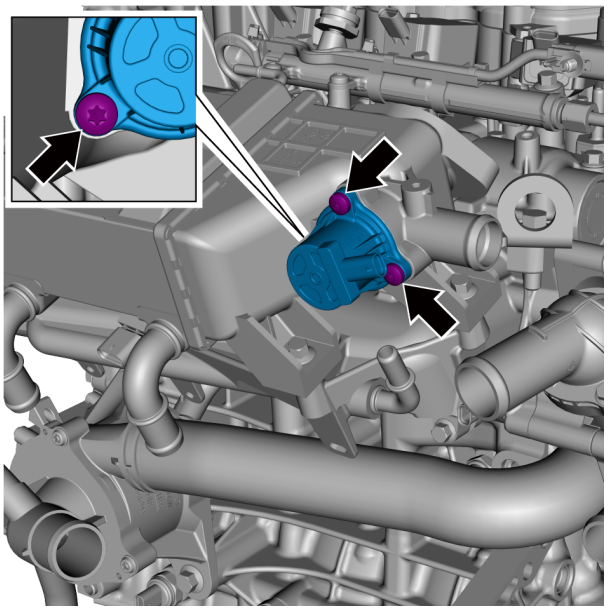
1.2.4.1 Breakdown drawing of disassembling intake manifold

Disassembling is conducted in the order indicated in the table.



1. Pressure relief valve
2. Air pressure temperature sensor
3. Water cooling intercooler
4. Electronic throttle valve body
5. Intake pressure temperature sensor
6 Intake manifold
7. Intake manifold gasket

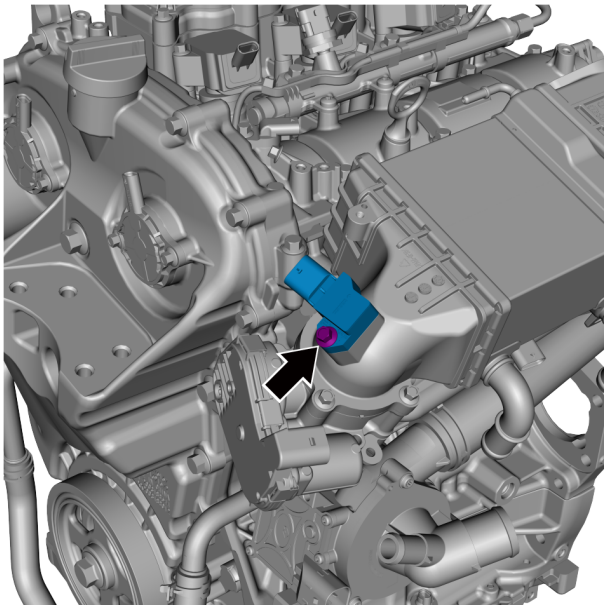
1.2.4.2 Disassembling electronic pressure relief valve



1 Three fixing screws of the electronic pressure relief valve are disassembled.

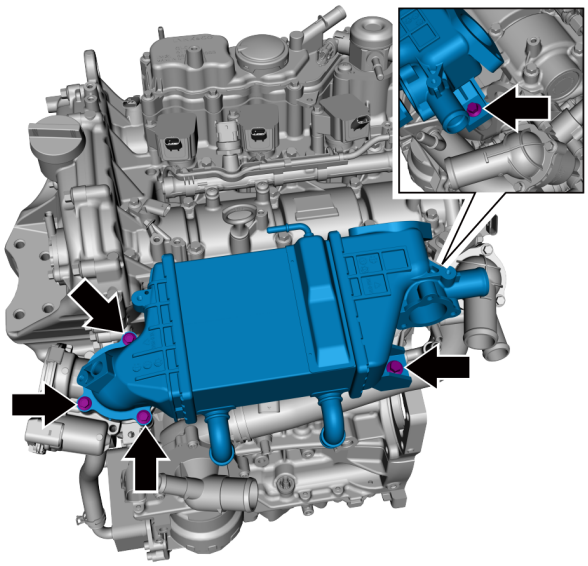
2 The electronic pressure relief valve is taken down.

1.2.4.3 Disassembling air pressure temperature sensor



1 One fixing bolt of the air pressure sensor is disassembled.

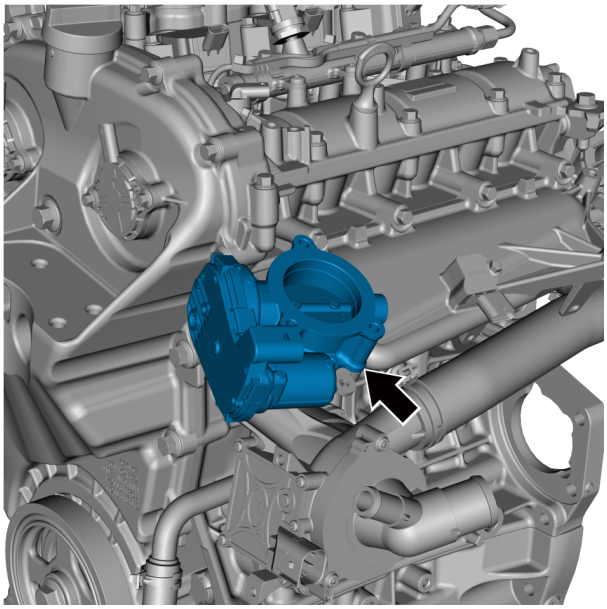
2 The air pressure temperature sensor is taken down.



1.2.4.4 Disassembling water cooling intercooler

1 The 5 fixing bolts in the water cooling intercooler are disassembled.

2 The water cooling intercooler is taken down.



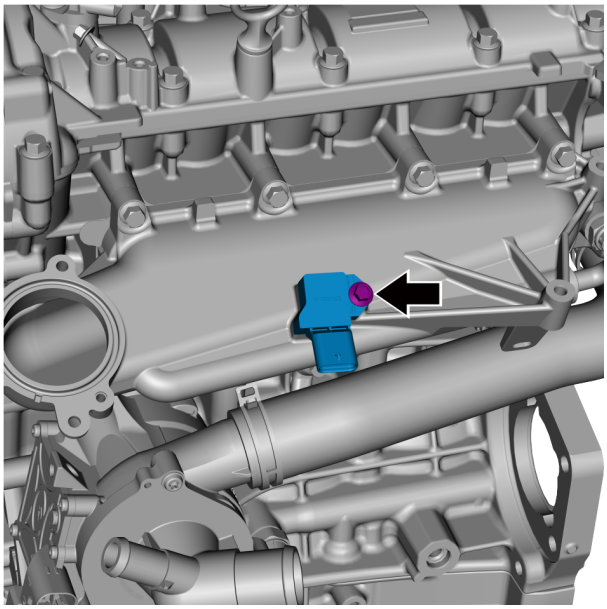
1.2.4.5 Disassembling electronic throttle valve body

The electronic throttle valve body is disassembled.

Caution

The sealing gaskets of the throttle valve is a disposable part, and must be replaced with a new one after each removal.

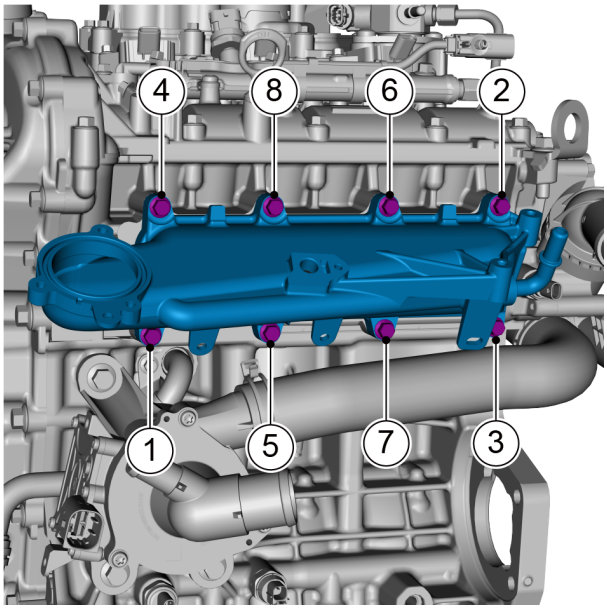
1.2.4.6 Disassembling intake pressure temperature sensor



1 One fixing bolt of the intake air pressure temperature sensor is disassembled.

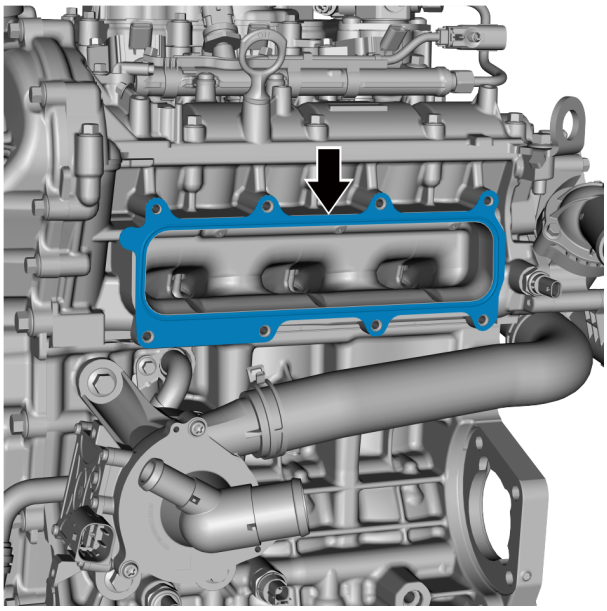
2 The intake pressure temperature sensor is taken down.

1.2.4.7 Disassembling intake manifold



1 Eight fixing bolts of the intake manifold are disassembled in the order from 1 to 8 as shown in the figure.

2 The intake manifold is taken down.



1.2.4.8 Disassembling intake manifold gasket

The intake manifold gasket is taken down.

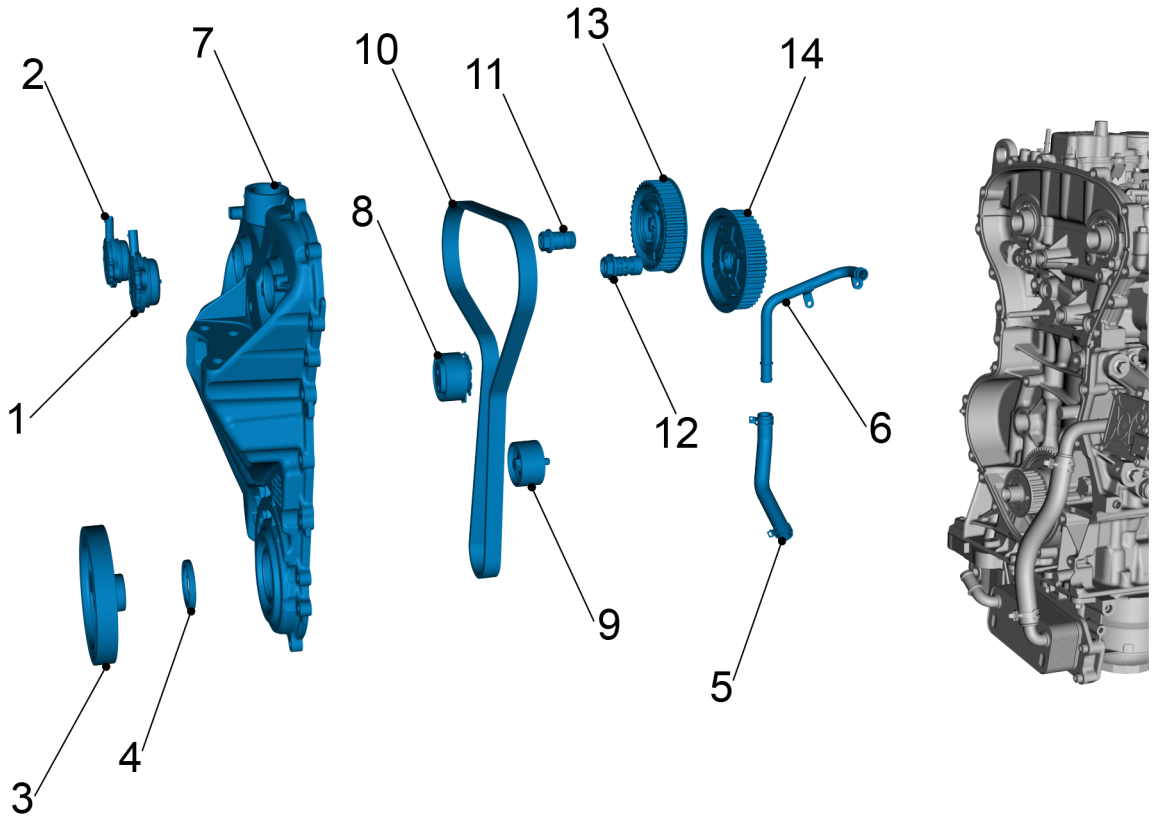
Caution

The intake manifold gasket cannot be reused. It is needed to replace with new ones after disassembly.

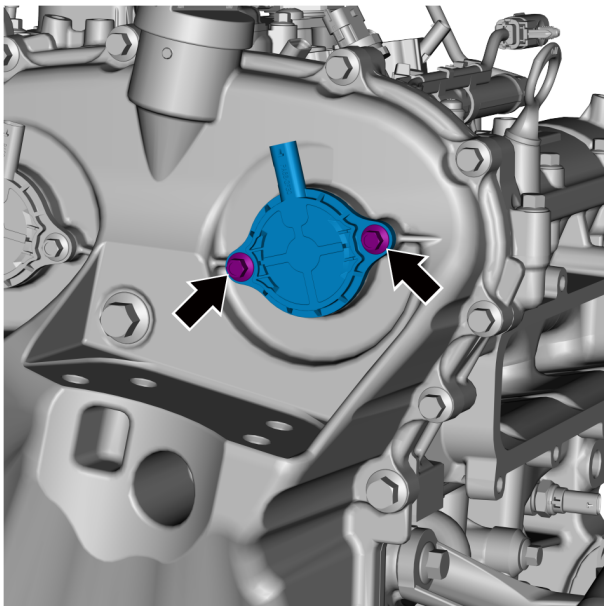
1.2.5 Disassembling timing system

1.2.5.1 Breakdown drawing of disassembling timing system

Disassembling is conducted in the order indicated in the table.



1.	Intake/exhaust center electromagnet	8.	Timing belt tensioning pulley
2.	Exhaust center electromagnet	9.	Timing idler
3.	Vibration dampening pulley assembly	10.	Timing belt
4.	Crankshaft front oil seal	11.	Exhaust-side central oil control valve
5.	Oil cooler inlet pipe assembly	12.	Intake-side central oil control valve
6.	Oil cooler water inlet pipe	13.	Exhaust VVT assembly
7.	Timing belt guard	14.	Intake VVT assembly



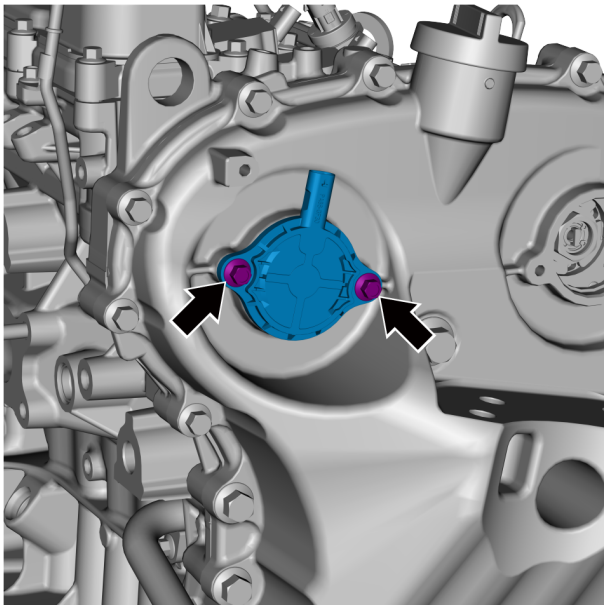
1.2.5.2 Disassembling intake center electromagnet

1 Two fixing bolts of the intake center electromagnet is installed and tightened.

2 The intake center electromagnet is disassembled.

Caution

The intake center electromagnet is checked after disassembling. If there's no damage, it can be used again.



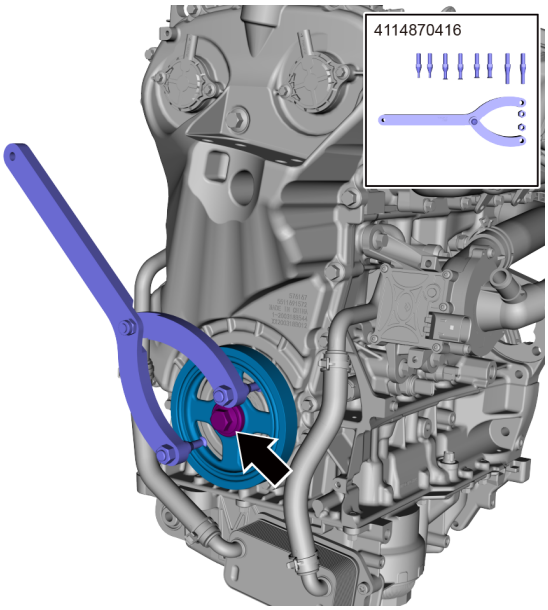
1.2.5.3 Disassembling exhaust center electromagnet.

1 The two fixing bolts of the intake center electromagnet are disassembled.

2 The intake center electromagnet is disassembled.

Caution

The intake center electromagnet is checked after disassembling. If there's no damage, it can be used again.



1.2.5.4 Disassembling vibration dampening pulley assembly

1 The special tool is used for disassembling one fixing bolt of the vibration dampening pulley assembly.

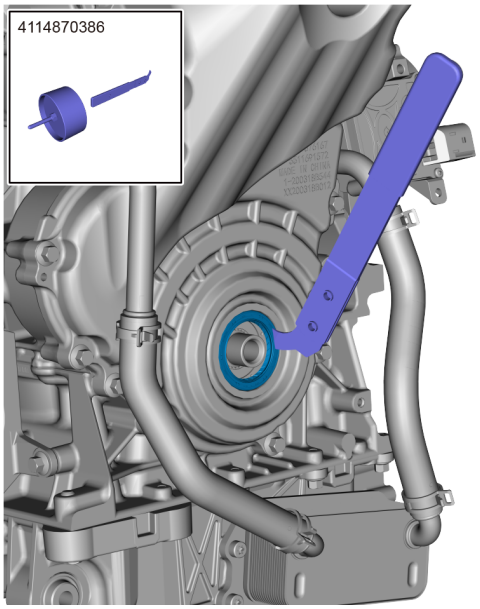
Special tool number: 4114870416

Caution

The vibration dampening pulley assembly cannot be reused. It is needed to replace with new ones after disassembly.

The vibration dampening pulley bolt should be disassembled by using a 13/16-inch socket, otherwise there is a possibility of damaging the bolt.

2 The vibration dampening pulley assembly is taken down.



1.2.5.5 Disassembling crankshaft front oil seal

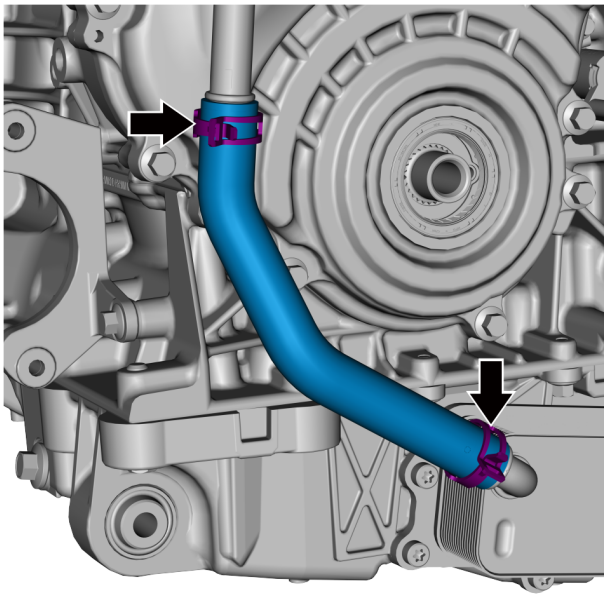
The special tool is used for removing the crankshaft front oil seal.

Special tool number: 4114870386

Caution

The crankshaft front oil seal cannot be reused. It is needed to replace with new ones after disassembly.

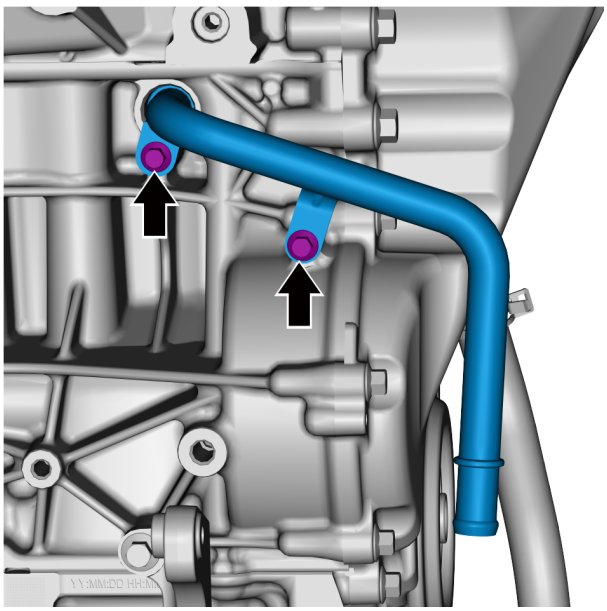
1.2.5.6 Disassembling oil cooler inlet pipe assembly



1 The clamping hoops of the oil cooler inlet pipe is disassembled.

2 The oil cooler water inlet pipe is disassembled.

1.2.5.7 Disassembling oil cooler water inlet pipe



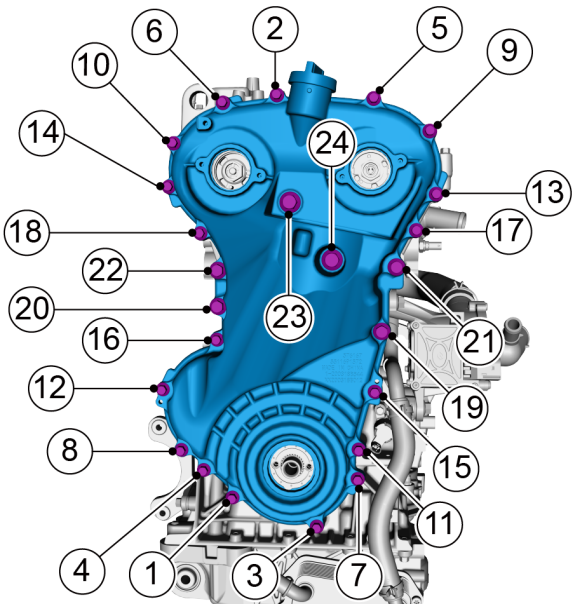
1 Two fixing bolts of the oil cooler water inlet pipe are disassembled.

2 The oil cooler water inlet pipe is taken off.

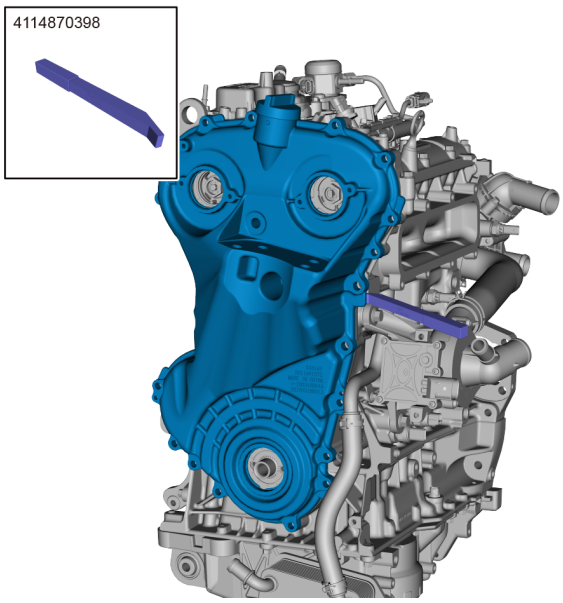
Caution

The O-shaped sealing ring cannot be reused. It is needed to replace with new ones after disassembly.

1.2.5.8 Disassembling timing belt shield

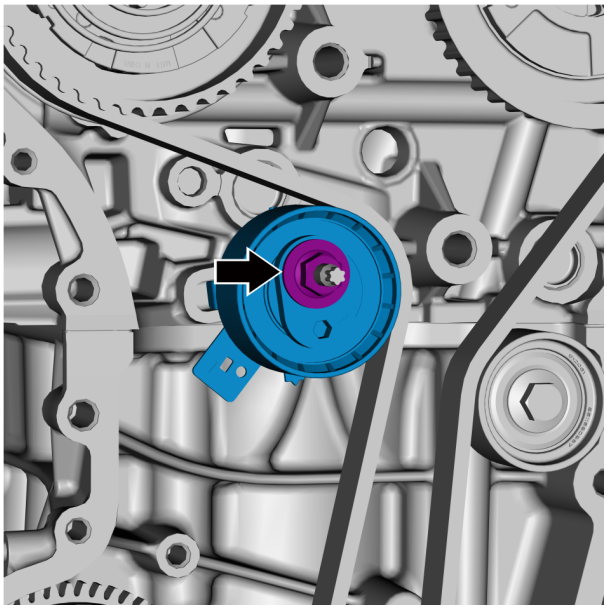


1 The 24 fixing bolts of the timing shield are disassembled in the order from 1 to 24 as shown in the figure.

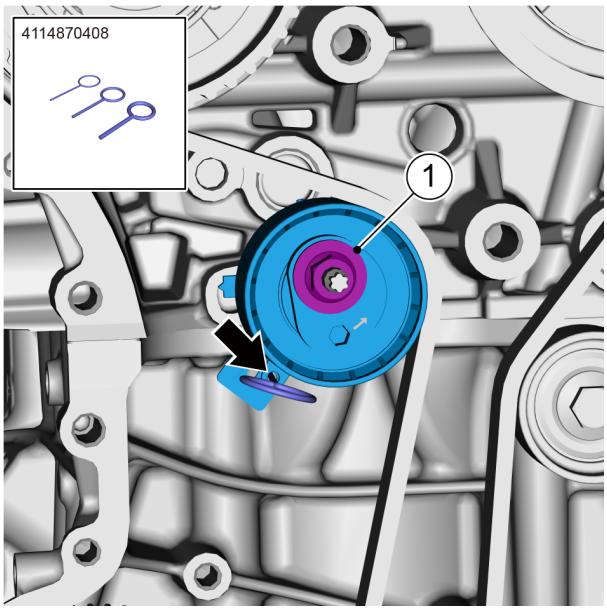


2 The special tool is used for removing the timing shield.
Special tool number: 4114870398

1.2.5.9 Disassembling timing belt tensioner pulley



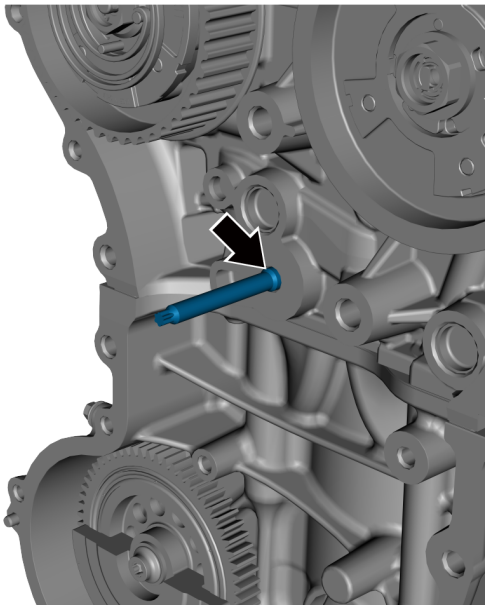
1 1 fixing nut of the timing belt tensioning pulley is loosened.



2 The timing belt tensioner pulley is rotated counterclockwise in the direction of the arrow and the locating pin is arranged at the arrow position in an inserted mode.
Special tool number: 4114870408

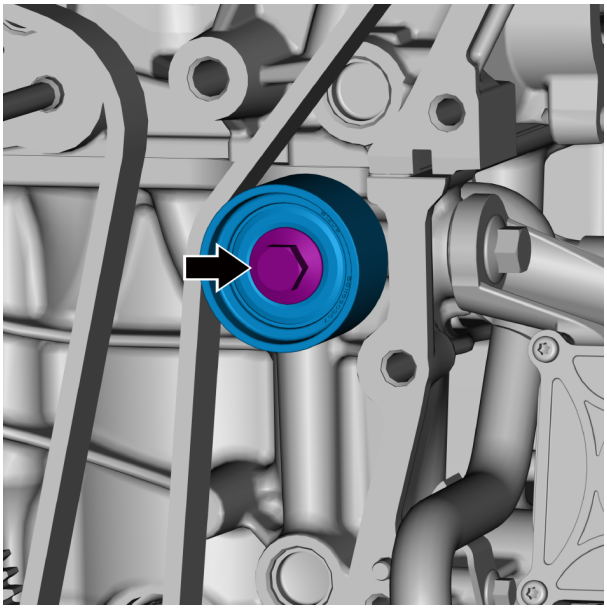
3 1 fixing nut of the timing belt tensioning pulley 1 is loosened.

4 The timing belt tensioner pulley is disassembled.



5 The double end stud is disassembled.

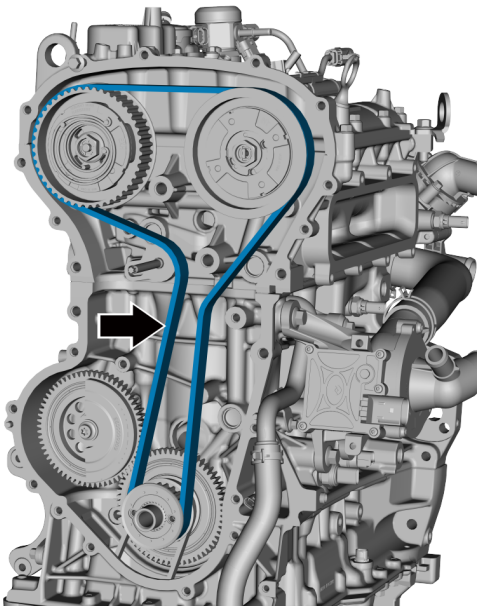
1.2.5.10 Disassembling timing idler



1 One fixing bolt of the timing idler is disassembled.

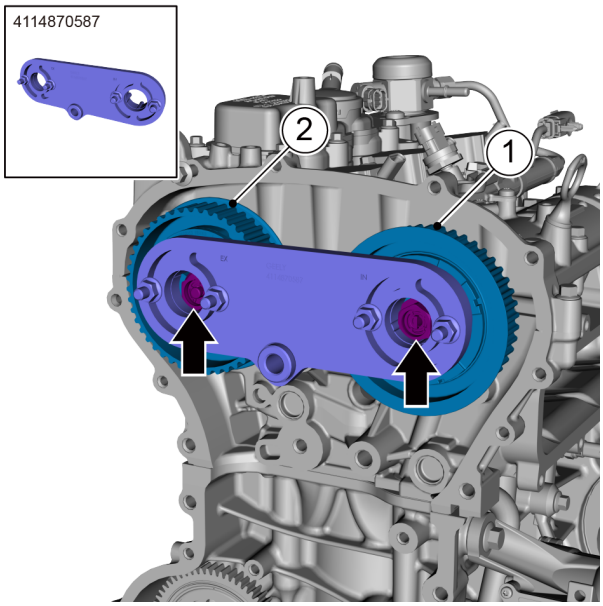
2 The timing idler is disassembled.

1.2.5.11 Disassembling timing belt



The timing belt is disassembled.

1.2.5.12 Disassembling VVT assembly



1 The special tool is used to disassemble the intake side central oil control valve and the exhaust side central oil control valve.
Special tool: 4114870587

2 The exhaust VVT assembly 1 and exhaust VVT assembly 2 are taken down.

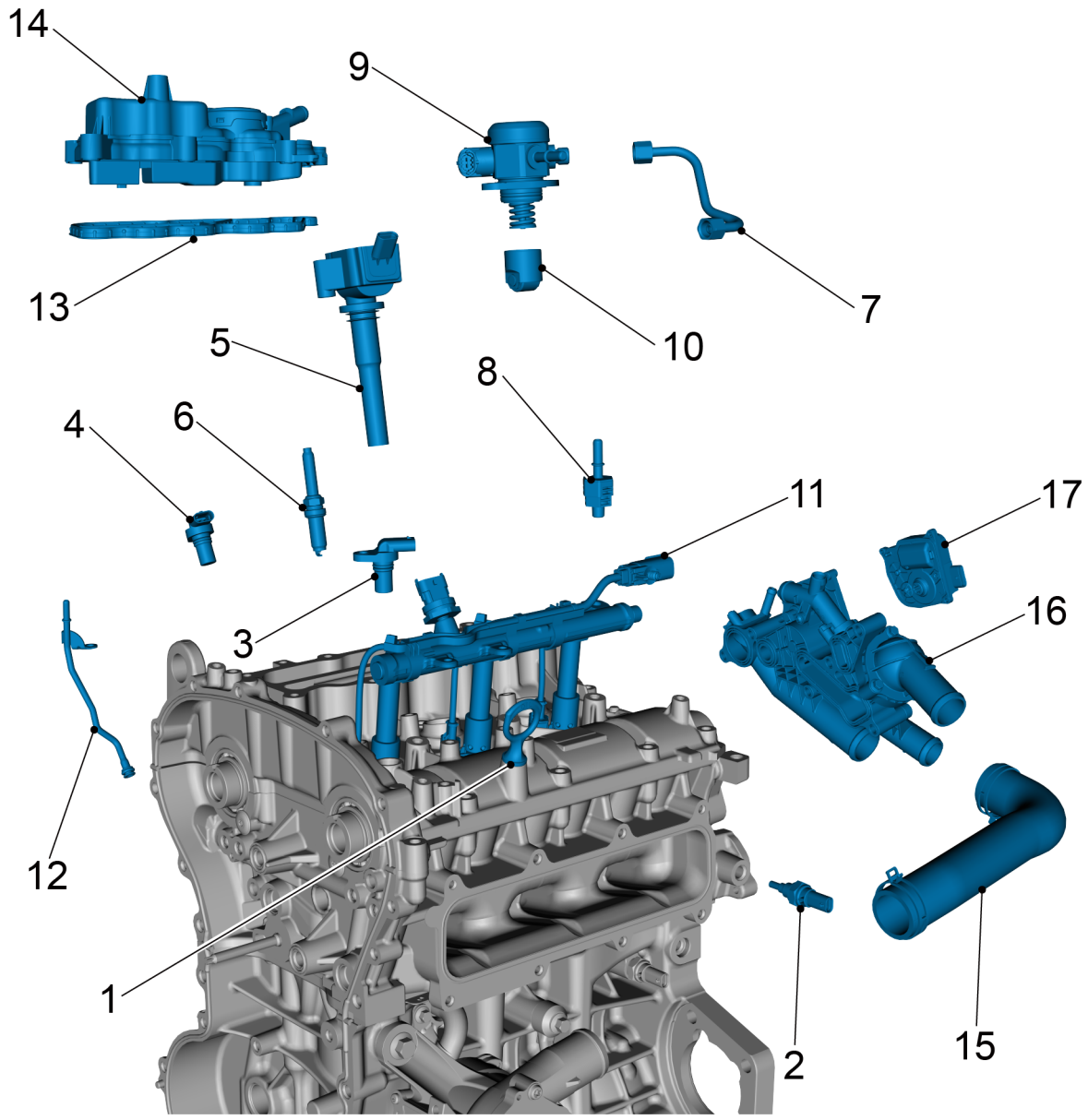
Caution

If there's no deformation or damage after disassembly, it can be used again, only being permitted for using two times.

1.2.6 Disassembling cylinder head (I)

1.2.6.1 Breakdown drawing of disassembling cylinder head (I)

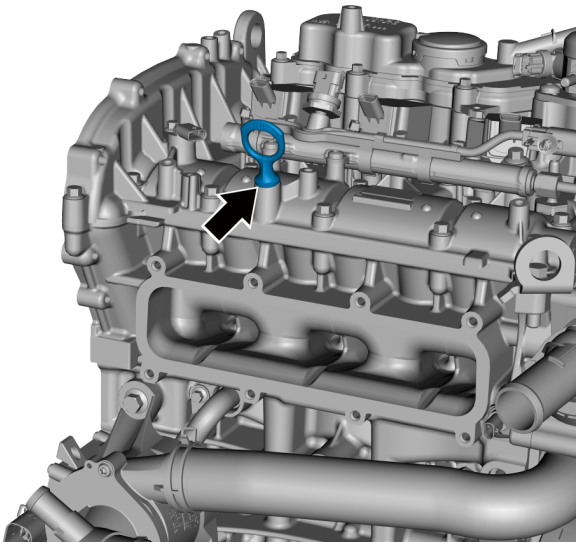
Disassembling is conducted in the order indicated in the table.



1. Dipstick pipe assembly
2. Coolant temperature sensor (cylinder head)
3. Intake camshaft position sensor
4. Exhaust camshaft position sensor
5. Ignition coil
6. Spark plug
7. High-pressure oil pipe assembly
8. Ventilation valve assembly
9. High-pressure oil pump
10. Oil pump tappet
11. Fuel rail oil injector assembly
12. Engine air outlet pipe
13. Oil-gas separator and sealing gasket
14. Oil-gas separator assembly
15. Rubber connecting pipe
16. Coolant temperature controlling module
17. Coolant climate control module actuator

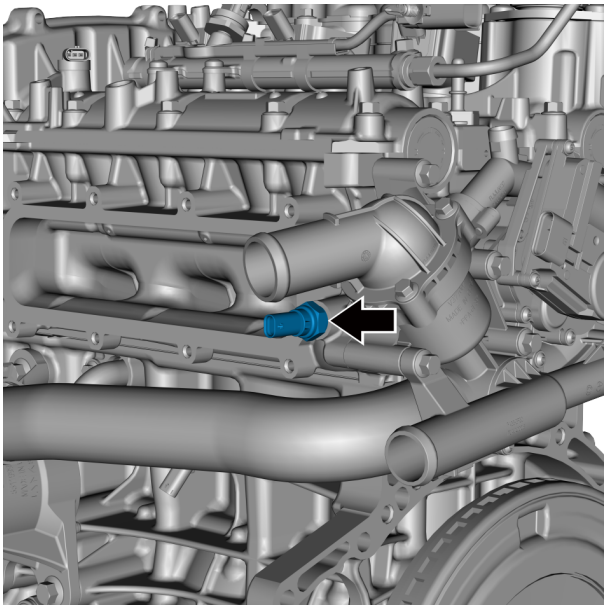
1.2.6.2 Disassembling dipstick assembly

The dipstick pipe assembly is pulled out.

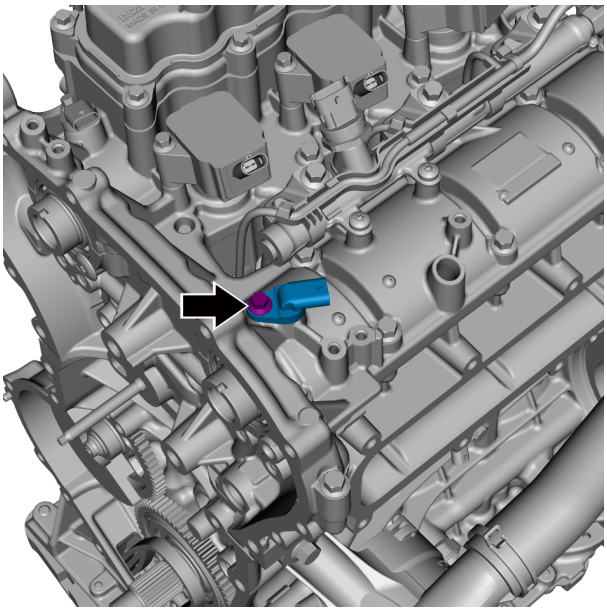


1.2.6.3 Disassembling coolant temperature sensor (cylinder head)

The coolant temperature sensor (cylinder head) is disassembled.



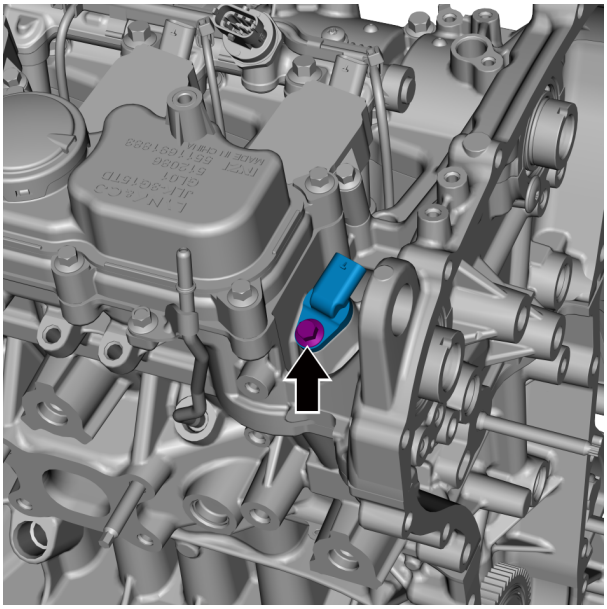
1.2.6.4 Disassembling intake camshaft position sensor



1 One fixing bolt of the intake camshaft position sensor is disassembled.

2 The intake camshaft position sensor is disassembled.

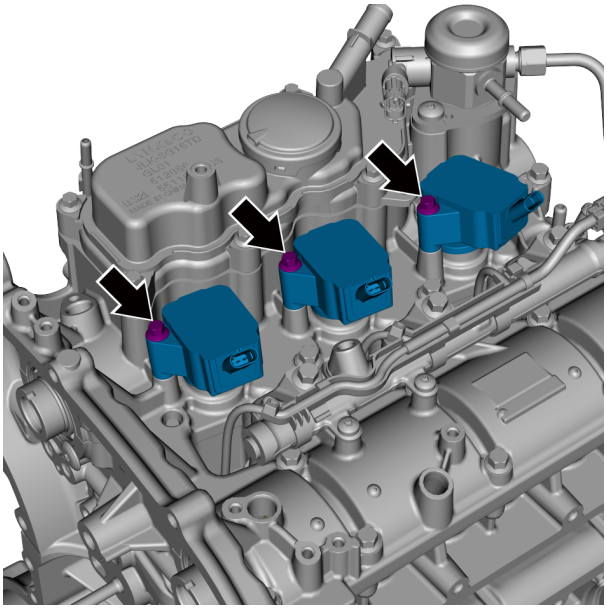
1.2.6.5 Disassembling exhaust camshaft position sensor



1 One fixing bolt of the intake camshaft position sensor is disassembled.

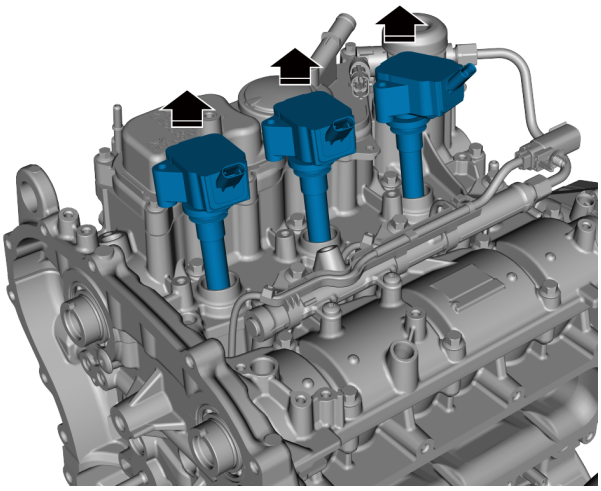
2 The exhaust camshaft position sensor is disassembled.

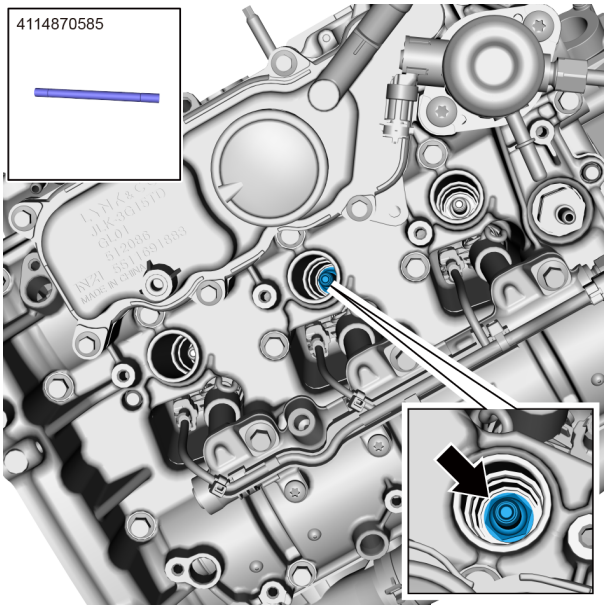
1.2.6.6 Disassembling ignition coil



1 Three fixing bolts of the ignition coils is disassembled.

2 The ignition coils are disassembled.





1.2.6.7 Disassembling spark plug

The special tool is used for inserting into the spark plug hole and arranging the sleeve to be fully sleeve into the hexagonal flange surface of the spark plug for disassembling the spark plug.

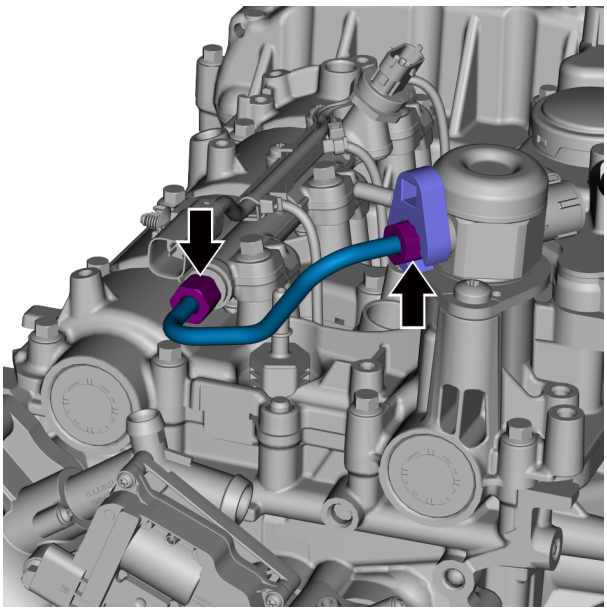
Special tool number: 4114870585

Caution

The high-pressure air is used for blowing around the periphery of the spark plug. The special spark plug tool must be used during the disassembly process, and whether the clamping device in the spark plug tool is intact and the clamping force is normal are is checked.

Caution

If there's no deformation or damage of the sparking plug after disassembling, the sparking plug can be used for 2 times.



1.2.6.8 Disassembling high-pressure oil pipe assembly

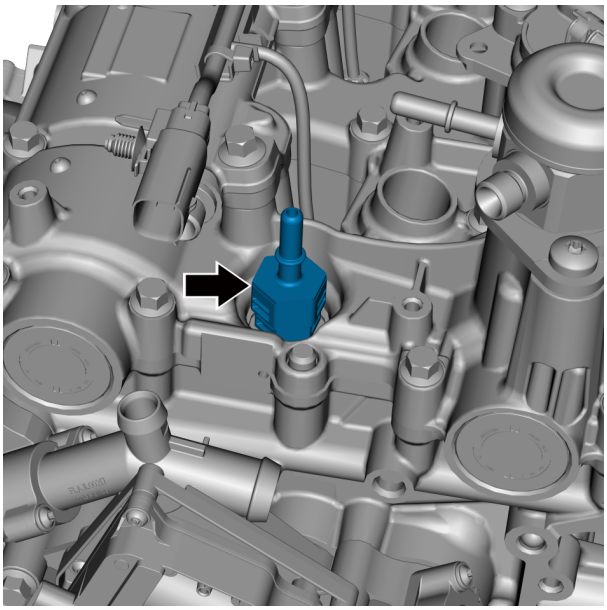
1 The special tool is used for removing the 2 fixing nuts at the two ends of the high pressure oil pipe assembly.

2 The high-pressure oil pipe assembly is taken down.

Caution

The high-pressure oil pipe assembly cannot be reused. It is needed to replace with new parts after disassembly.

1.2.6.9 Disassembling ventilation valve assembly

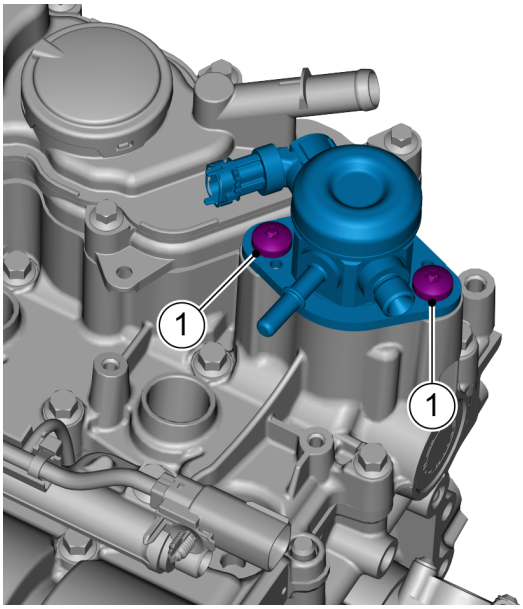


The ventilation valve assembly is disassembled.

Caution

The ventilation valve assembly cannot be reused. It is needed to replace with new ones after disassembly.

1.2.6.10 Disassembling high-pressure oil pump



1 The 2 fixing bolts 1 of the high-pressure oil pump are disassembled, loosened for multiple times and alternately, rotated 1-2 turns at most each time and replaced with another one bolt until the bolts are fully rotated out.

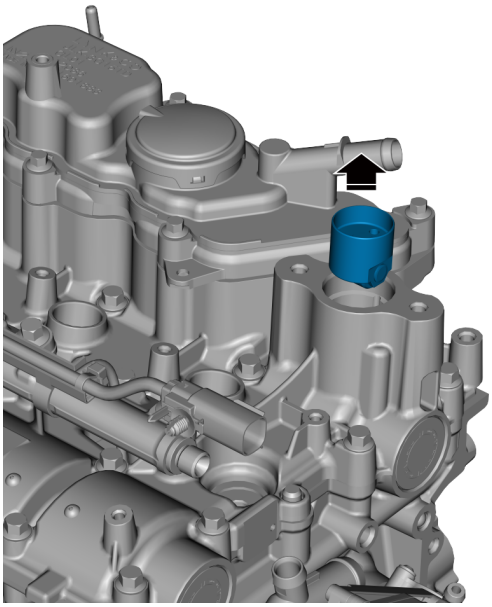
2 The high-pressure oil pump is taken down.

Caution

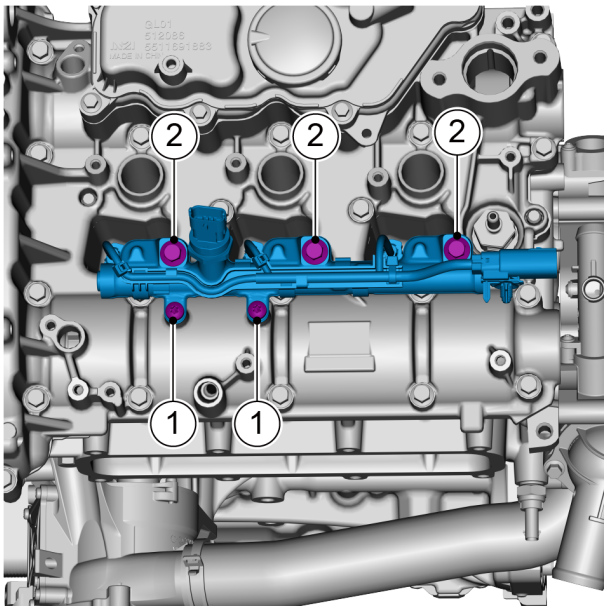
After removing the high pressure oil pump, the O-shaped sealing ring is checked.

1.2.6.11 Disassembling oil pump tappet

The oil pump tappet is disassembled.

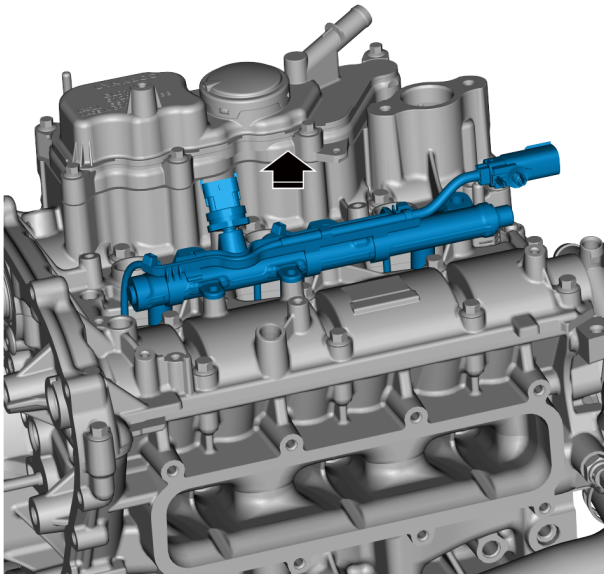


1.2.6.12 Disassembling fuel rail injector assembly



1 The 2 fixing bolts 1 of the fuel rail injector assembly are disassembled.

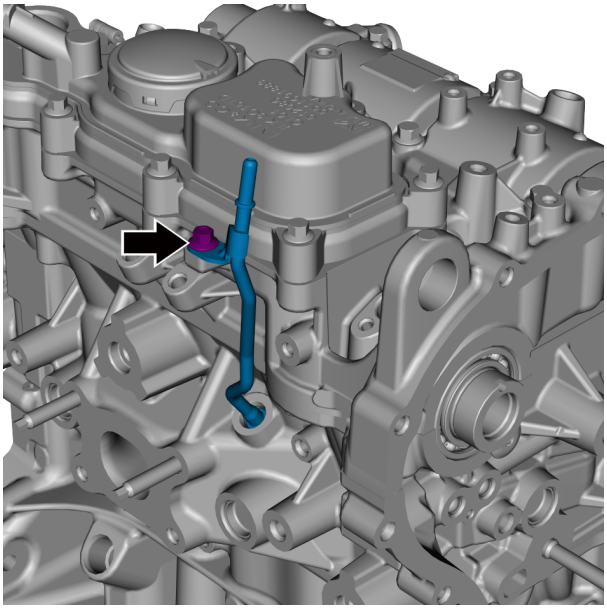
2 The 3 fixing bolts 2 of the fuel rail injector assembly are disassembled.



3 The fuel rail injector assembly are disassembled as a whole along the common axis of the fuel injector.

Caution

1. When the fuel rail oil injector assembly is moved, it is not allowed to hold the oil injector or fuel pressure sensor by hand.
2. If the seal ring and the clamping ring are damaged, it must be replaced.
3. Lubrication oil is not allowed to be applied on the Teflon sealing ring of the oil injector.
4. Do not touch part pins.
5. During the power-on operation, it is not allowed to plug in connectors with live parts.
6. Parts are prevented from falling or being impacted, and falling parts must be scrapped.



1.2.6.13 Disassembling engine degassing pipe

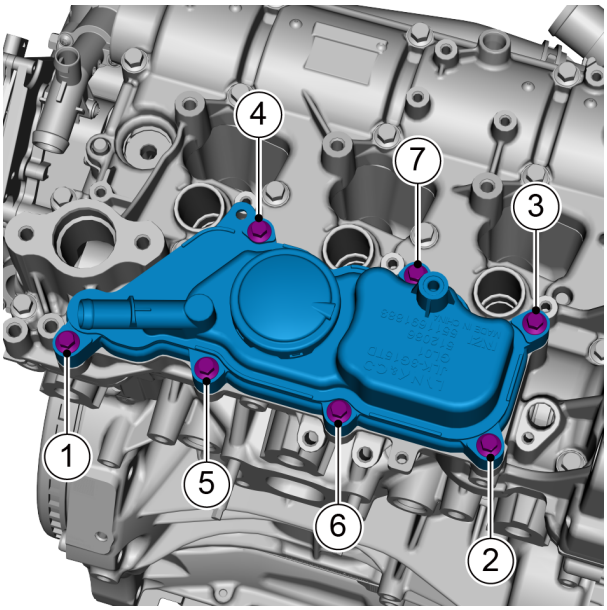
1 1 fixing bolt of the engine degassing pipe is disassembled.

2 The engine degassing pipe is disassembled.

Caution

The O-shaped sealing ring is replaced after disassembling.

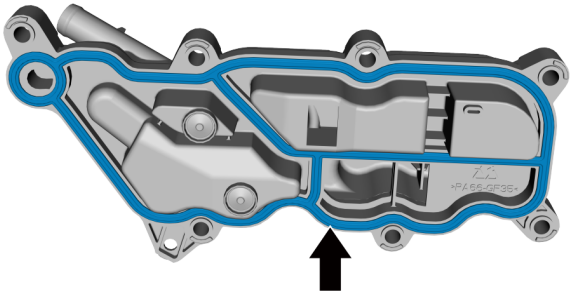
1.2.6.14 Disassembling oil/air separator assembly



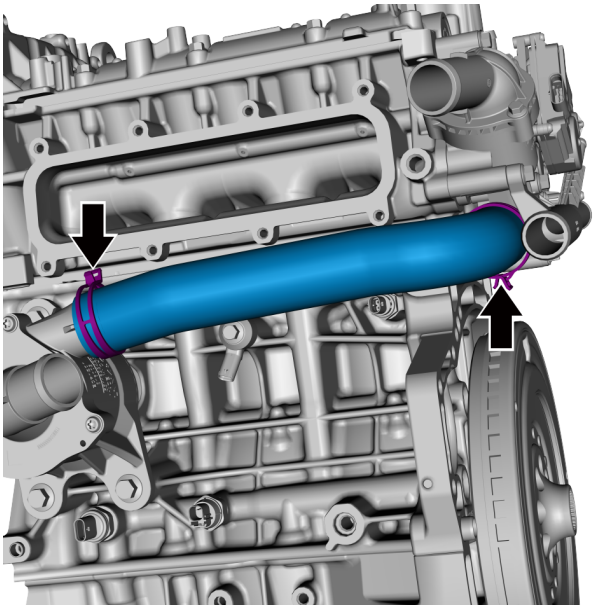
1 7 fixing bolts of the oil cooler are disassembled in the order from 1 to 7 as shown in the figure.

2 The oil-gas separator assembly is taken down.

3 The oil/air separator assembly is disassembled.



1.2.6.15 Disassembling rubber connecting pipe

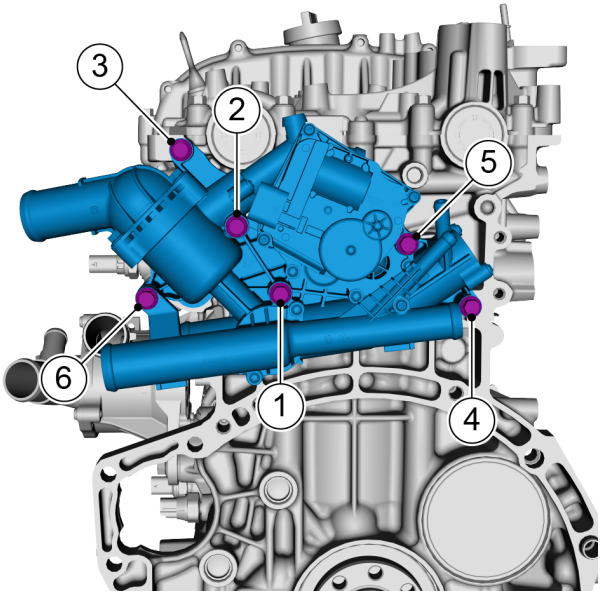


1 The clamping hoops at the two ends of the rubber connecting pipe are disassembled.

2 The connection between the rubber connecting pipe and the electronic coolant pump and the coolant temperature controlling module are disconnected.

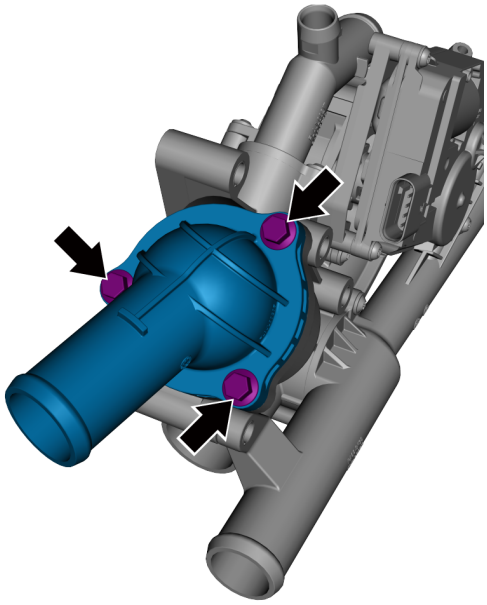
3 The rubber connecting pipe is disassembled.

1.2.6.16 Disassembling coolant temperature control module

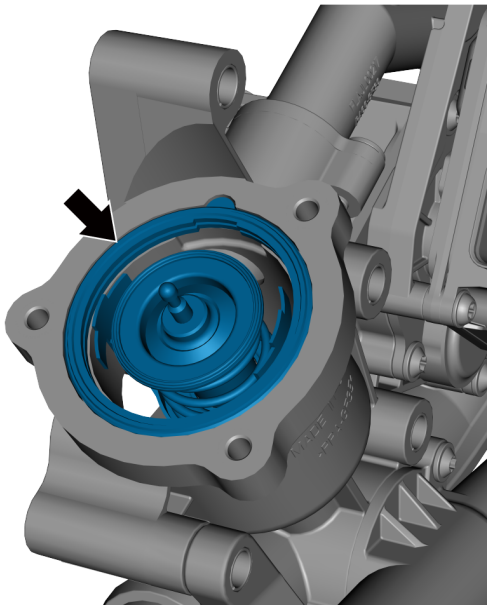


1 6 fixing bolts of the coolant temperature control module are disassembled in the order from 1 to 6 as shown in the figure.

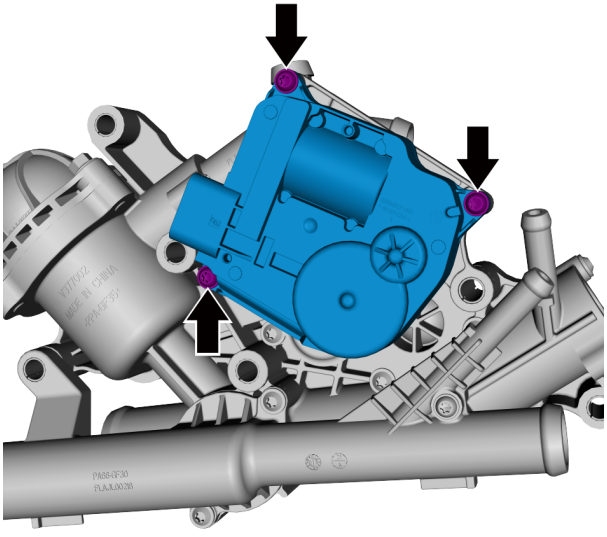
2 The coolant temperature controlling module is disassembled.



3 The 3 fixing bolts of the thermostat cover plate is disassembled.



4 The thermostat cover plate is taken down.



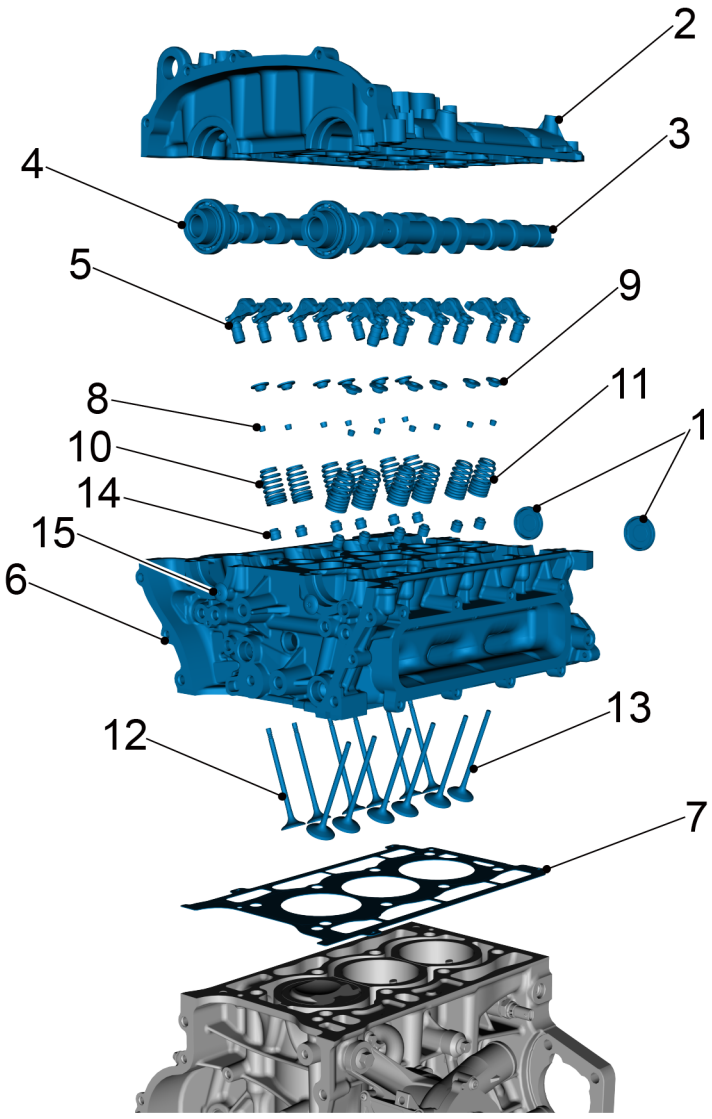
5 The three fixing screws of the coolant temperature control module actuator is disassembled.

6 The coolant temperature control module actuator is taken down.

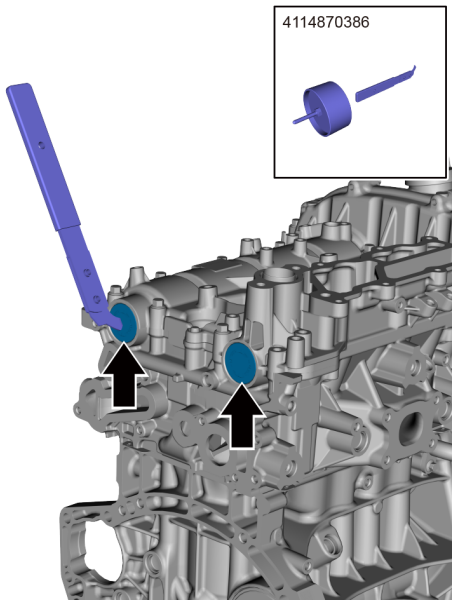
1.2.7 Disassembling cylinder head (II)

1.2.7.1 Breakdown drawing of removing cylinder head (II)

Disassembling is conducted in the order indicated in the table.



1. Camshaft blank plug
2. Bearing cap of the camshaft
3. Intake camshaft unit
4. Exhaust camshaft unit
5. roller rocker arm and hydraulic tappet
6. Cylinder head
7. Cylinder gasket
8. Valve collet
9. Valve spring retainer
10. Exhaust valve spring
11. Intake valve spring
12. Exhaust valve
13. Intake valve
14. Valve oil seal
15. Fastening bolt



1.2.7.2 Disassembling camshaft blanking cap

The special tool is used for removing the camshaft blanking cap.

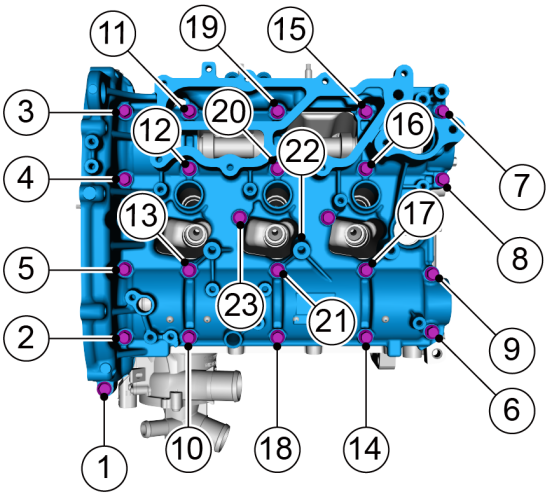
Special tool number: 4114870386

Caution

The camshaft blanking cap cannot be reused. It is needed to replace with new ones after disassembly.

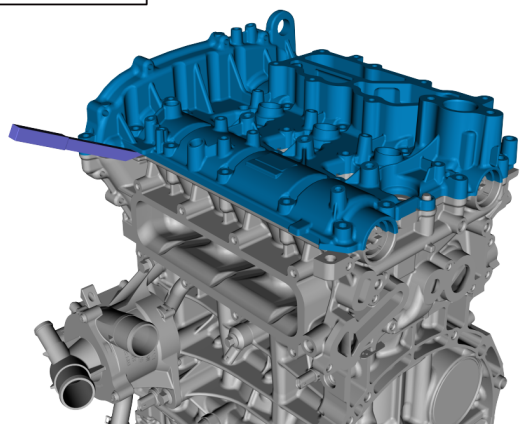
1.2.7.3 Disassembling camshaft bearing cover

1 23 fixing bolts of the camshaft bearing cap are disassembled in the order from 1-23 as shown in figure.



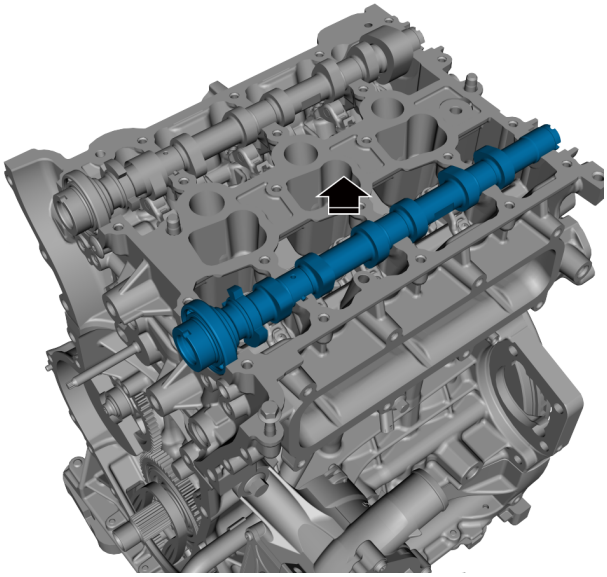
2 The special tool is used to disassemble the camshaft bearing cap.

Special tool number: 4114870398



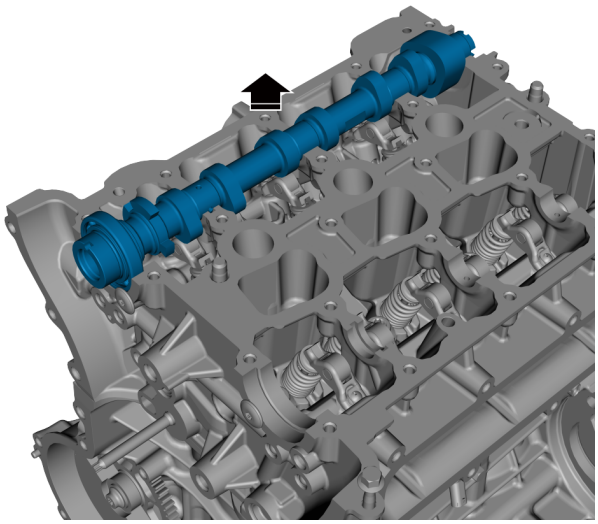
1.2.7.4 Disassembling intake camshaft assembly

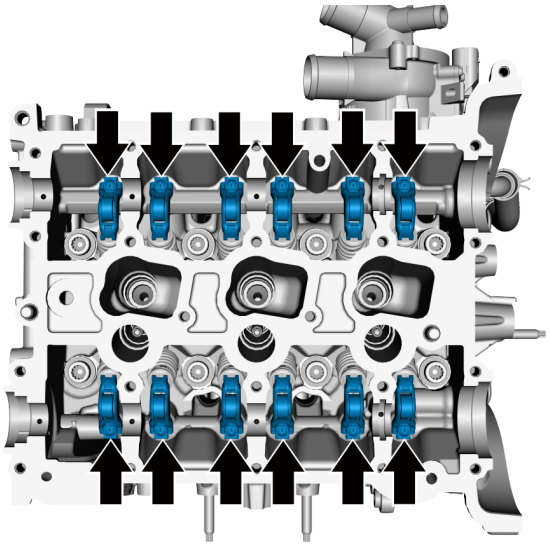
The intake/exhaust camshaft assembly is taken off.



1.2.7.5 disassembling exhaust camshaft assembly

The intake/exhaust camshaft assembly is taken off.

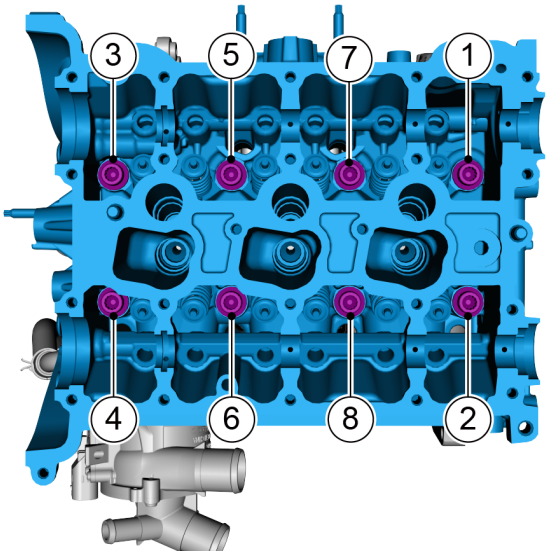




1.2.7.6 Disassembling roller rocker arm and hydraulic tappet

The roller rocker arm and the hydraulic tappet are taken off

1.2.7.7 Disassembling cylinder head



1 Disassembling 8 fixing bolts of the cylinder head in the order from 1 to 8 as shown in the figure.

Caution

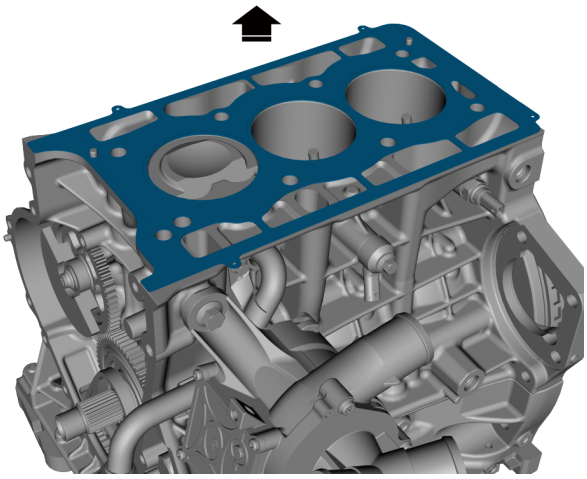
It is forbidden to assembly the cylinder head when the engine is in the hot state, if disassembling is conducted, the cylinder head will be caused to deform and damage the cylinder head.

Caution

The cylinder head bolts cannot be reused. It is needed to replace with new ones after disassembly.

2 The cylinder head bolts are taken out.

3 The cylinder head is taken off.

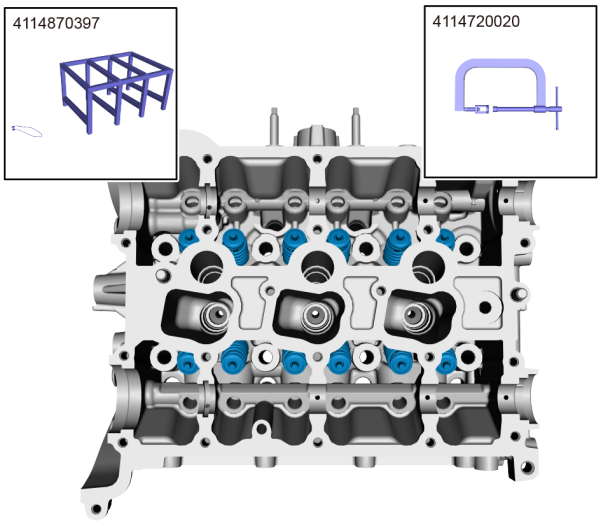


4 The cylinder gasket is taken off.

Caution

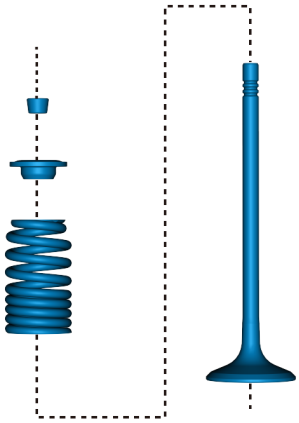
The cylinder head gasket cannot be reused. It is needed to replace with new ones after disassembly.

1.2.7.8 Disassembling valve



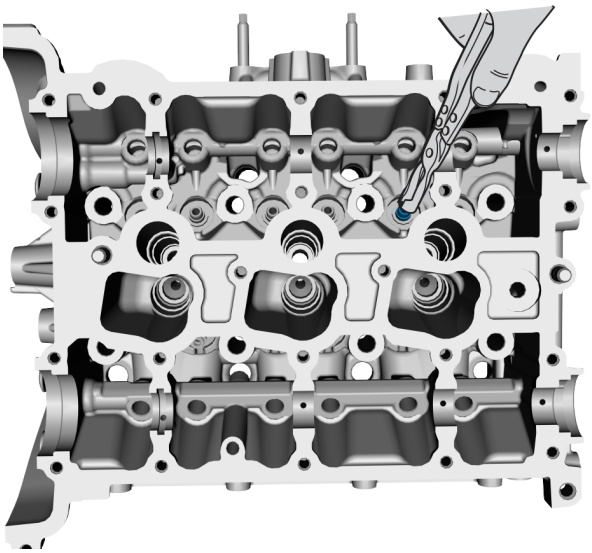
1 A special tool is used to compress the valve spring retainer to cause the valve locking plate to fall off naturally.
Special tool number: 4114870397
Special tool number: 4114720020

2 A magnetic bar is used to take the valve locking plate out.



3 The valve spring retainer, the valve spring, the valve are disassembled in turn.

1.2.7.9 Disassembling valve oil seal

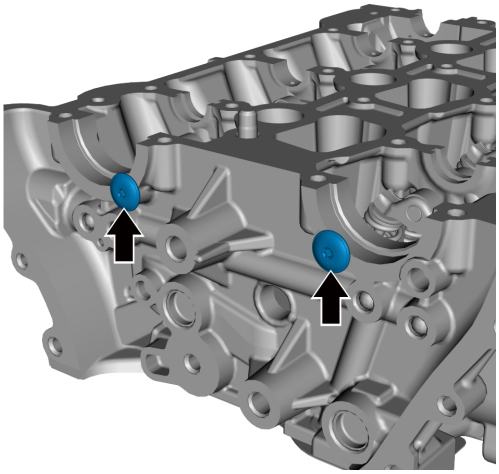


The valve oil seal is disassembled.

Caution

The intake/exhaust valve oil seal cannot be reused. It is needed to replace with new ones after disassembly.

1.2.7.10 Disassembling fastening bolt



Two fastening screws of the cylinder head are disassembled.

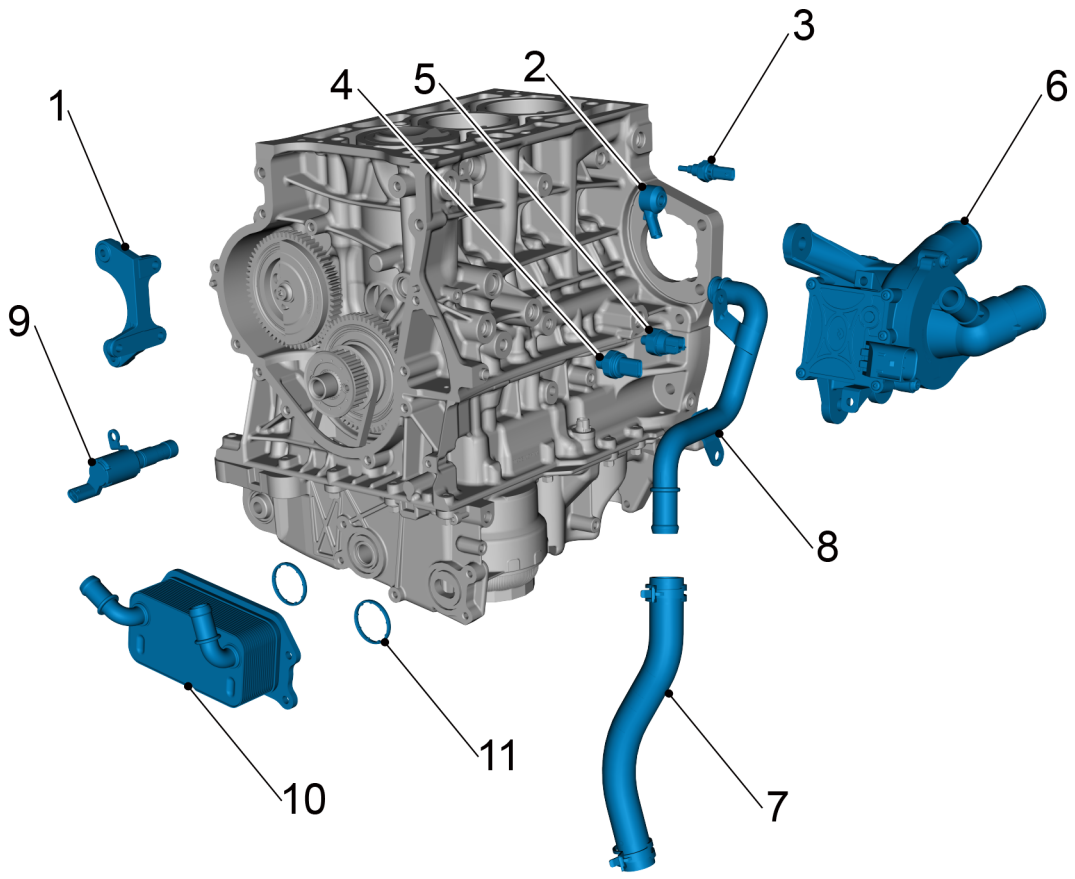
Caution

This fastening bolts are left-handed bolts.

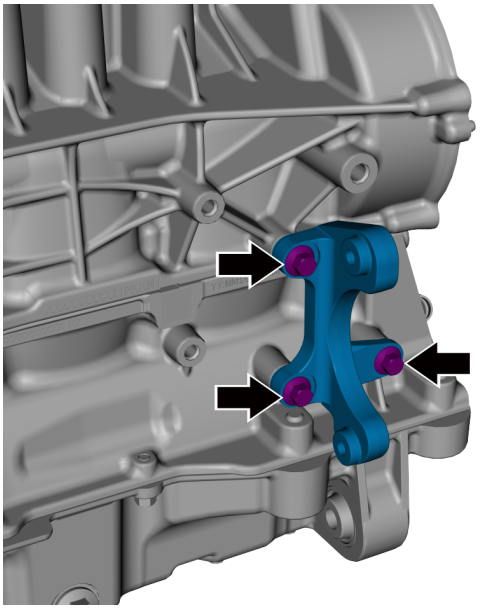
1.2.8 Disassembling cylinder block (I)

1.2.8.1 Breakdown drawing of disassembling cylinder body (I)

Disassembling is conducted in the order indicated in the table.



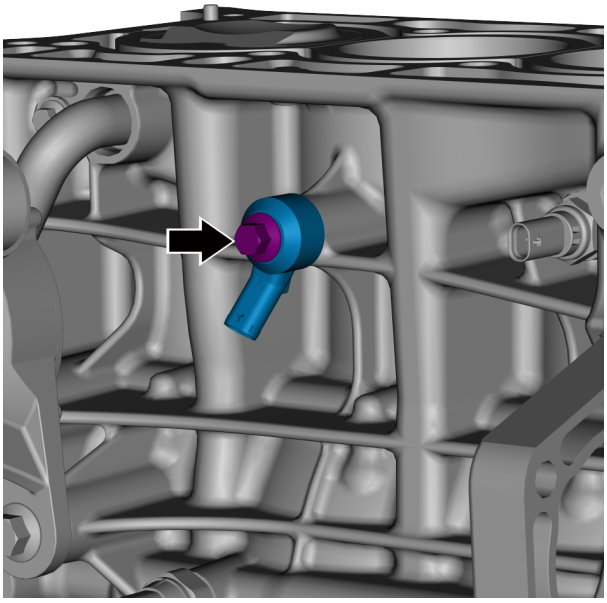
1. Driving shaft bracket
2. Knock sensor
3. Water temperature sensor (cylinder block)
4. Oil pressure sensor
5. Oil pressure alarm
6. Electronic water pump
7. Oil cooler water outlet pipe assembly
8. Oil cooler water outlet pipe
9. Piston cooling nozzle control valve
10. Oil cooler
11. Engine cooler seal ring



1.2.8.2 Disassembling drive shaft bracket

1 The 3 fixing bolts of the drive shaft bracket are disassembled.

2 The driving shaft bracket is taken off.



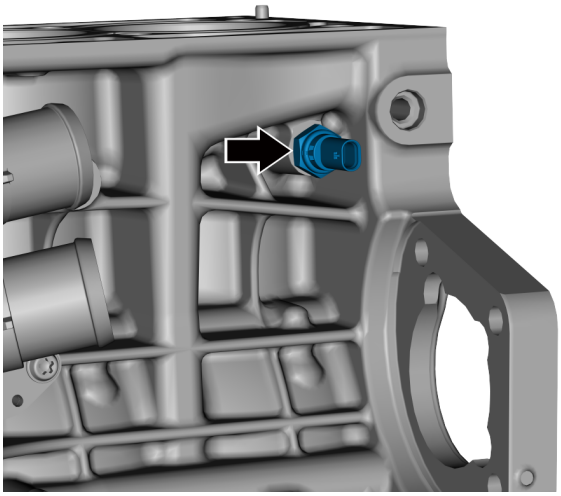
1.2.8.3 Disassembling knock sensor

1 One fixing bolt of the knock sensor is disassembled.

2 The knock sensor is taken off.

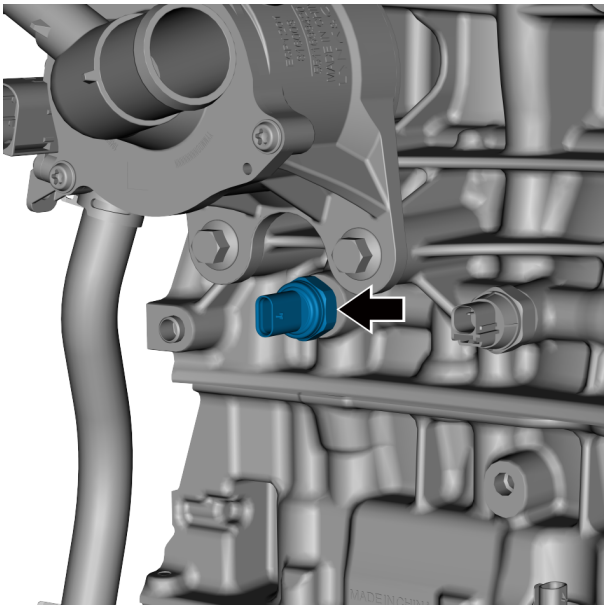
1.2.8.4 Disassembling coolant temperature sensor (Cylinder block)

The coolant temperature sensor (cylinder block) is disassembled.

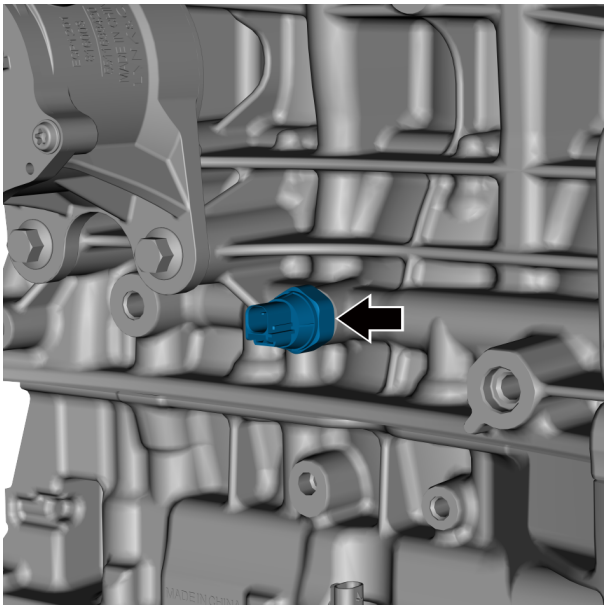


1.2.8.5 Disassembling oil pressure sensor

The oil pressure sensor is disassembled.

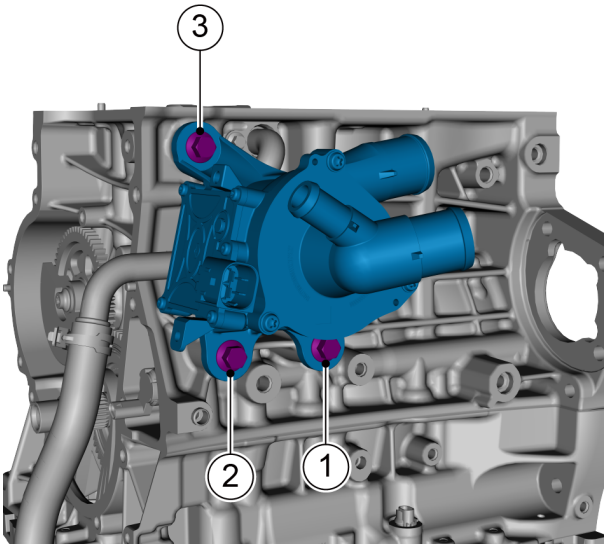


1.2.8.6 Disassembling oil pressure alarm



The oil pressure alarm is disassembled.

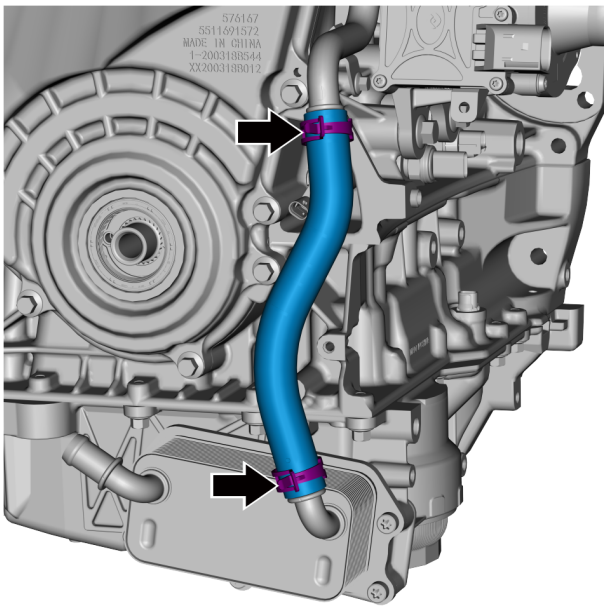
1.2.8.7 Disassembling electronic water pump



1 The 3 fixing bolts of the electronic water pump is disassembled in the order from 1 to 3 as shown in the figure.

2 The electronic water pump is taken off.

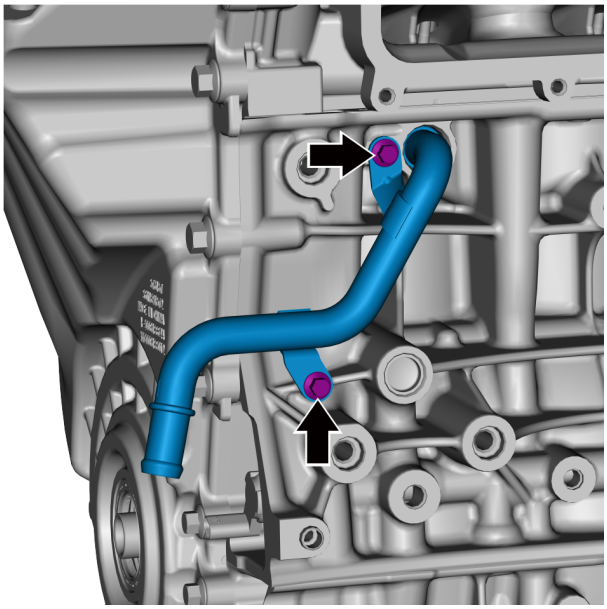
1.2.8.8 Disassembling oil cooler outlet pipe assembly



1 The ring clamp of the oil cooler outlet pipe assembly is disassembled.

2 The oil cooler water outlet pipe assembly is disassembled.

1.2.8.9 Disassembling oil cooler outlet pipe

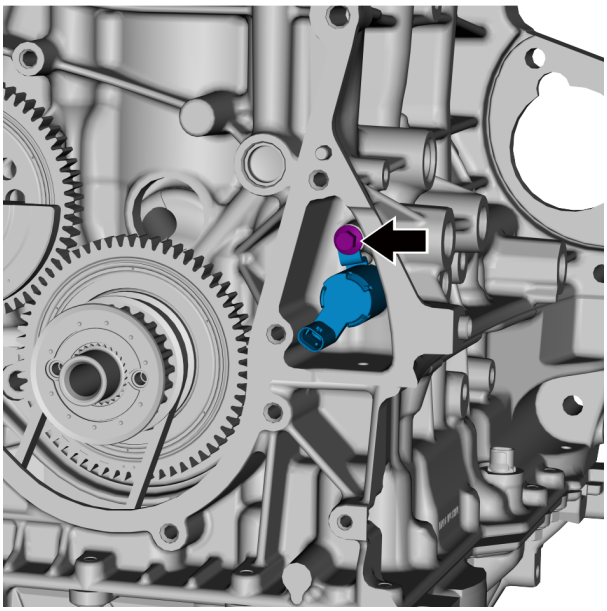


1 2 fixing bolts of the oil cooler water outlet pipe is taken off.

2 The oil cooler water outlet pipe is disassembled.

Caution

The O-shaped sealing ring of the outlet pipe cannot be reused. It is needed to replace with new ones after disassembly.

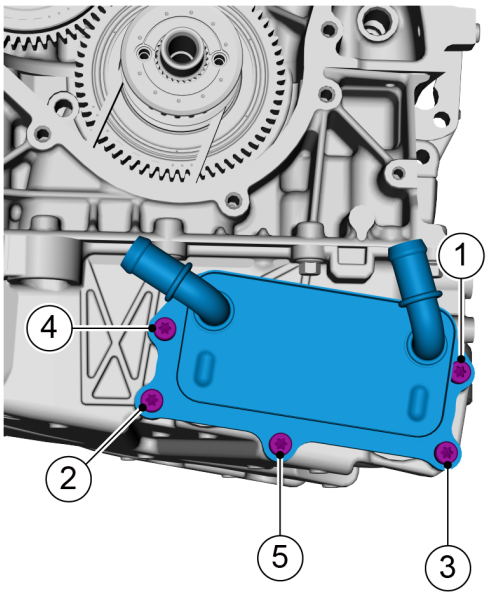


1.2.8.10 Disassembling piston cooling nozzle control valve

1 The fixing bolt of the piston cooling nozzle control valve is disassembled.

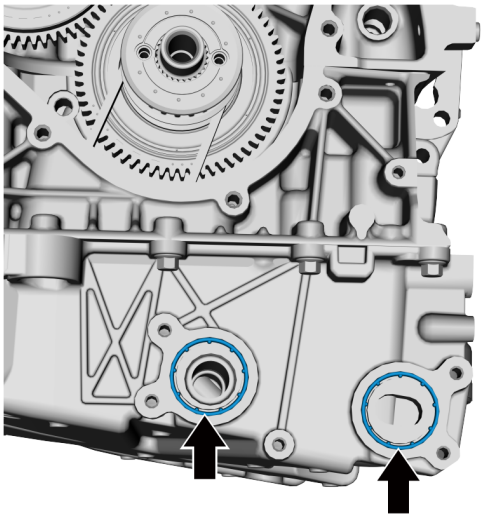
2 The piston cooling nozzle control valve is taken out.

1.2.8.11 Disassembling oil cooler



1 5 fixing bolts of the oil cooler are disassembled in the order from 1 to 5 as shown in the figure.

2 The oil cooler is taken off.



3 The oil cooler seal ring is taken off.

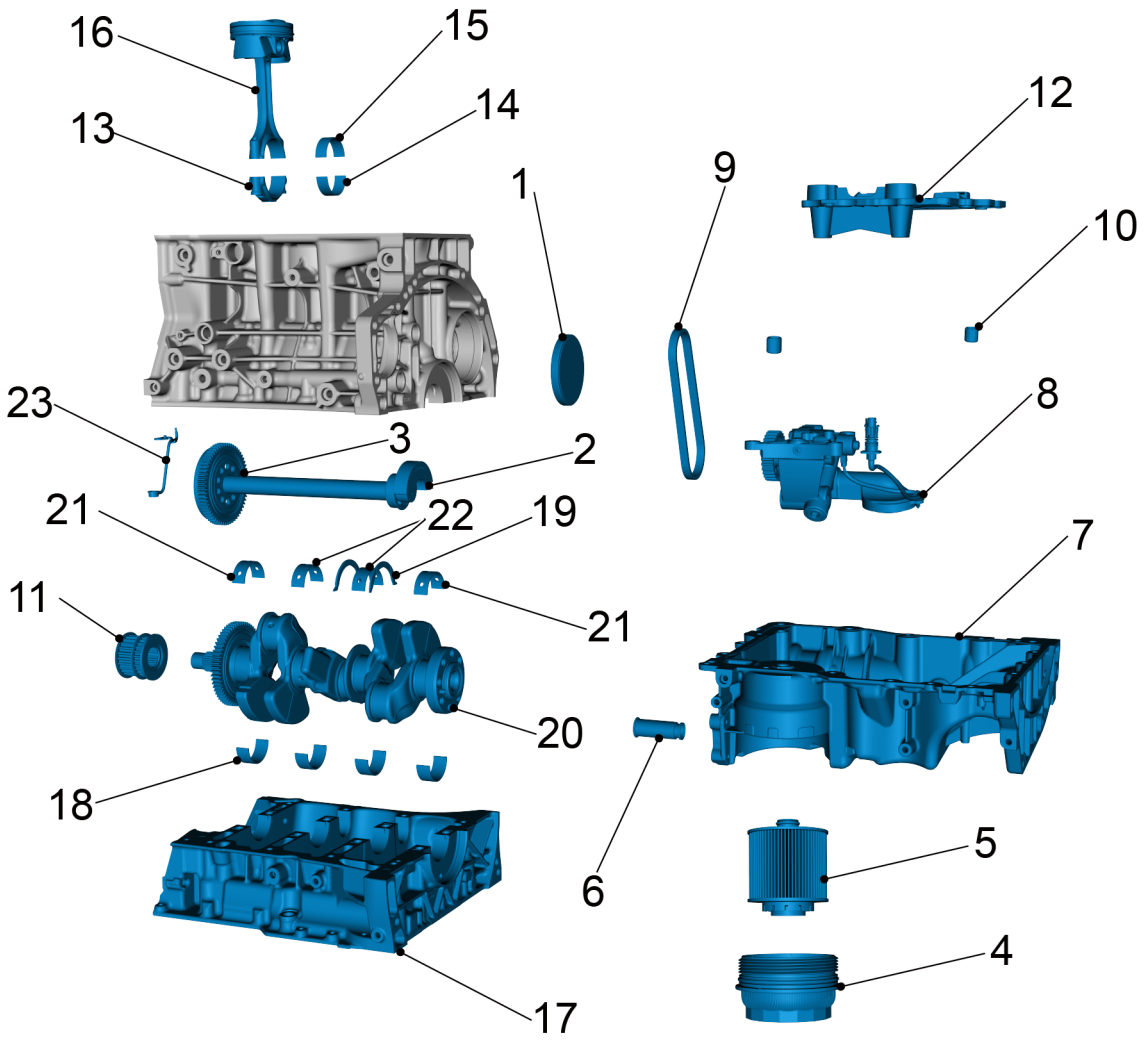
Caution

The oil cooler seal ring cannot be reused. It is needed to replace with new parts after disassembly.

1.2.9 Disassembling cylinder block (II)

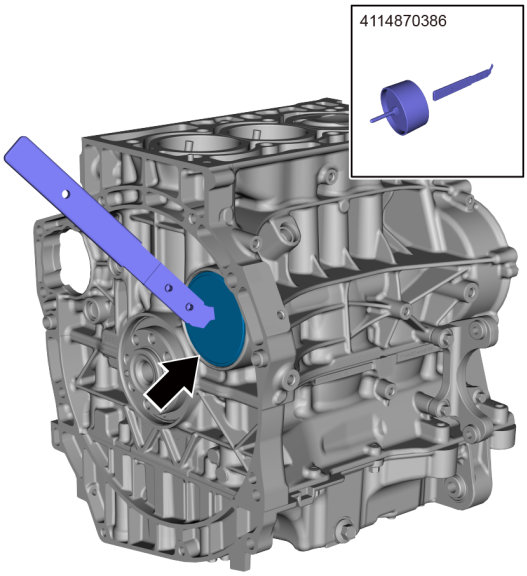
1.2.9.1 Breakdown drawing of disassembling cylinder block (II)

Disassembling is conducted in the order indicated in the table.



1.	Blanking cover of silent shaft	13.	Connecting rod cover
2.	Rear end balance weight	14.	Connecting rod bearing shell lower
3.	Silent shaft assembly	15.	Connecting rod bearing shell upper
4.	Engine oil filter element shell	16.	Piston connecting rod assembly
5.	Engine oil filter element	17.	Crankcase
6.	Oil pump guiding pipe	18.	Main bearing shell lower
7.	Oil pan assembly	19.	Thrust plate
8.	Oil pump assembly	20.	Crankshaft
9.	Oil pump driving belt	21.	Main bearing upper (with black coating)

10. Positioning pin of oil pump assembly
11. Timing belt pulley assembly
12. Oil baffle assembly
22. Main bearing shell upper
23. Piston cooling nozzle assembly



1.2.9.2 Assembling silent shaft blanking cap

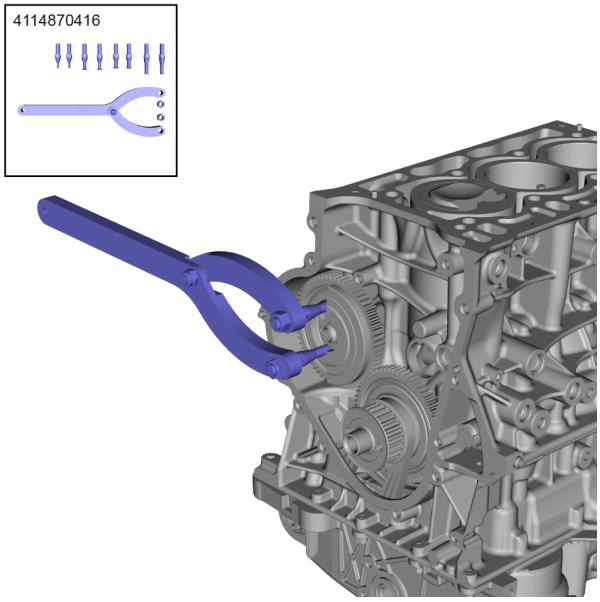
The special tool is used to disassemble the silent shaft blanking cap.

Special tool number: 4114870386

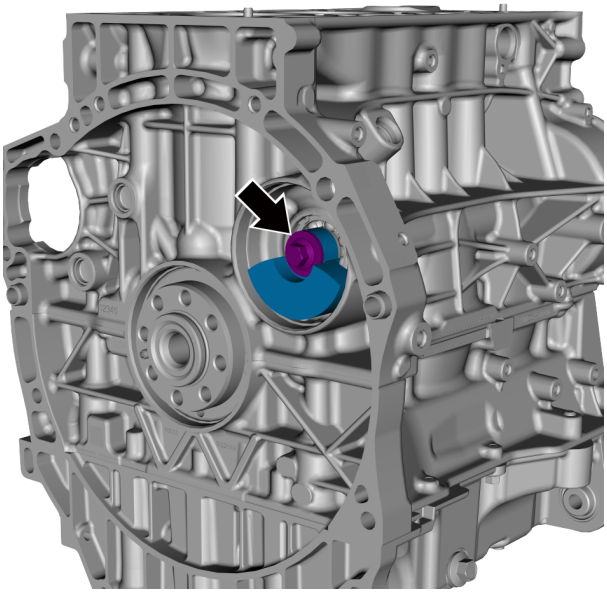
Caution

The silent shaft blanking cap cannot be reused. It is needed to replace with new ones after disassembly.

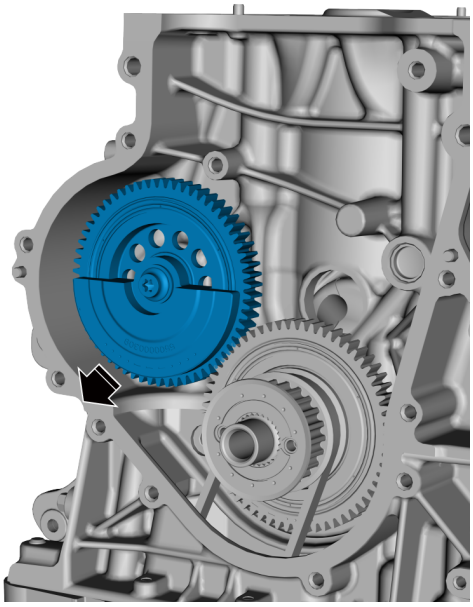
1.2.9.3 Disassembling rear end balance weight



1 The special tool is used to fix the front end shaft gear.
Special tool number: 4114870416



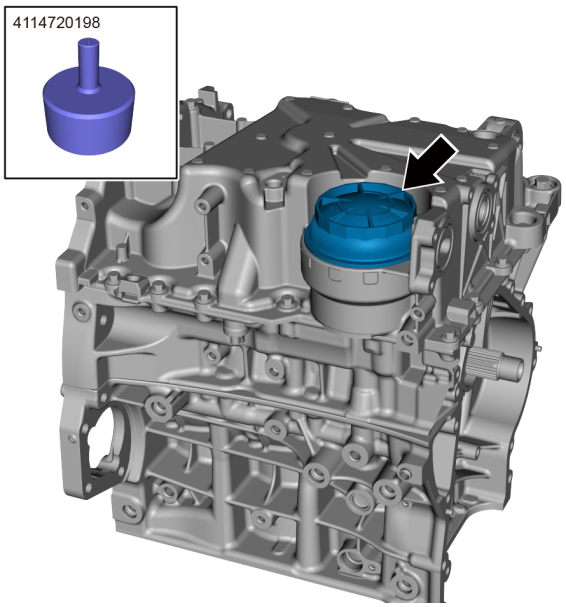
2 One fixing bolt of the rear end counterweight is taken off, and the rear end balance weight is taken off.



1.2.9.4 disassembling silent shaft assembly

The silent shaft assembly is taken down.

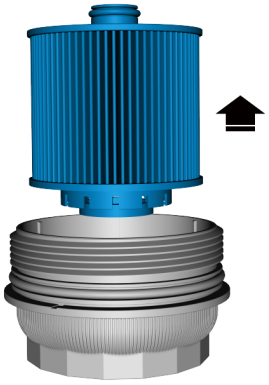
1.2.9.5 Disassembling oil filter module



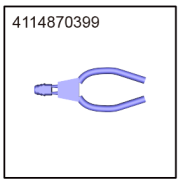
1 The special tool is used for disassembling the oil filter module.

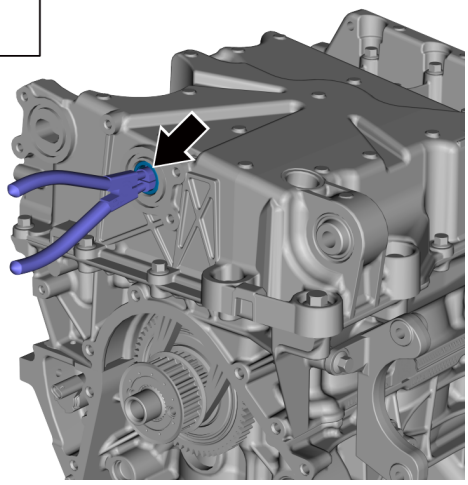
Special tool number: 4114720198

2 The engine oil filter element is disassembled.



1.2.9.6 Disassembling oil pump guiding pipe

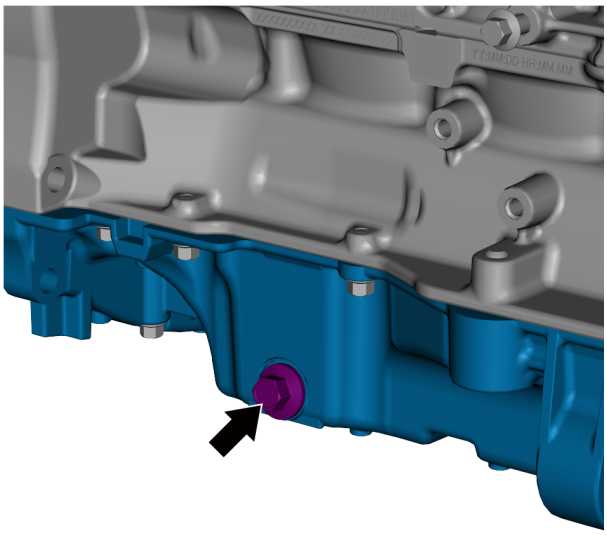




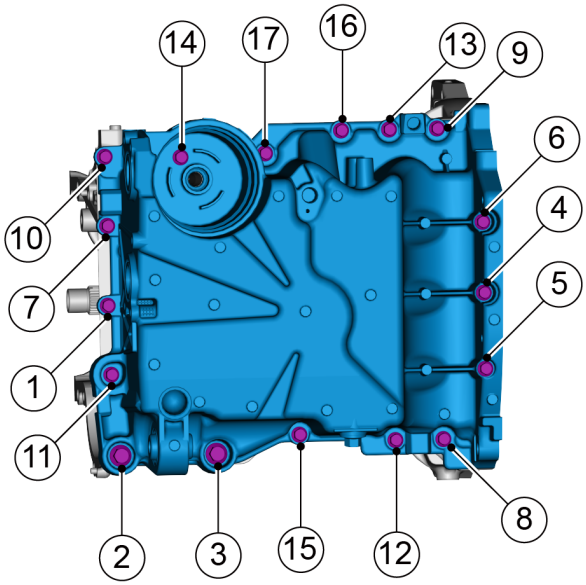
A dedicated tool is used for disassembling the oil pump guiding pipe.

Special tool number: 4114870399

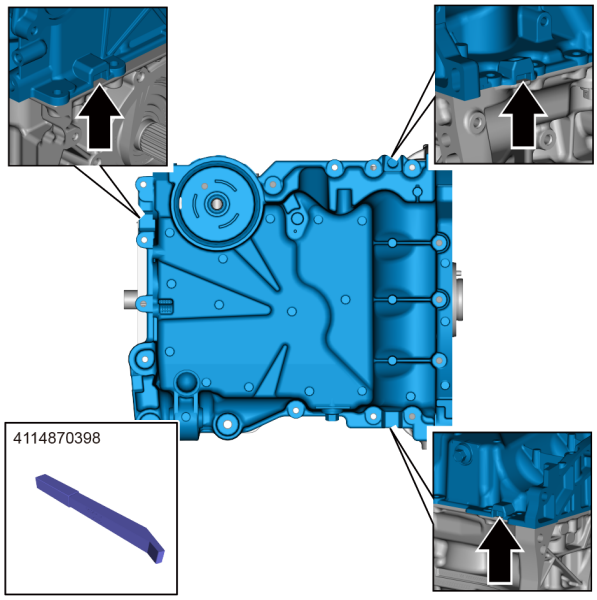
1.2.9.7 Disassembling oil pan assembly



1 The engine oil drain plug is disassembled.



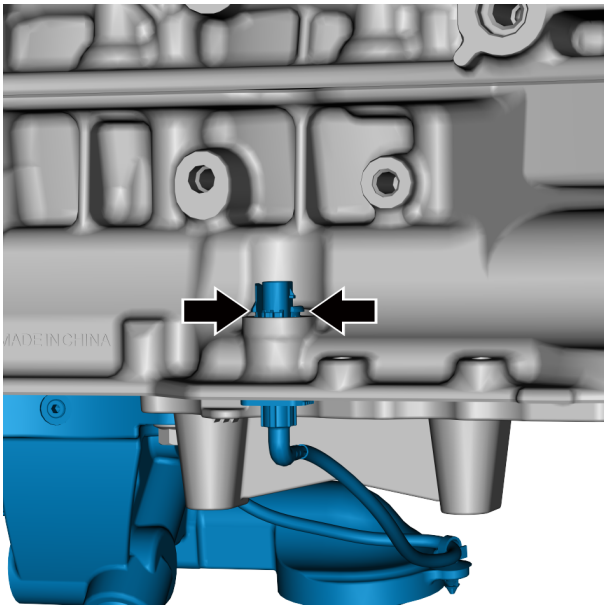
2 The 17 fixing bolts of the oil pan assembly are disassembled in the order from 1 to 17 as shown in the figure.



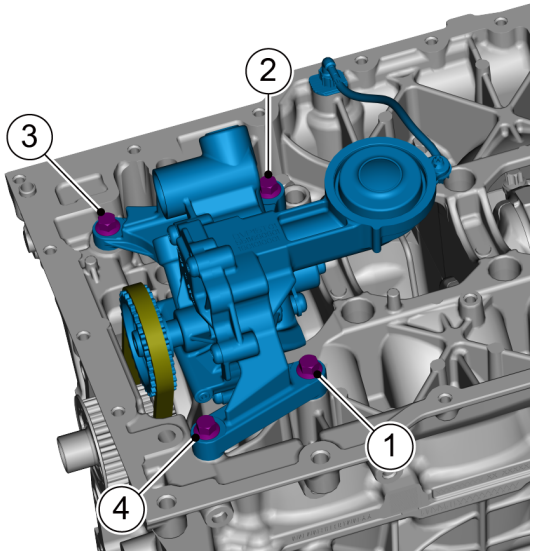
3 The special tool is used for separating the oil pan assembly.
Special tool number: 4114870398

4 The oil pan assembly is taken down.

1.2.9.8 Disassembling oil pump assembly



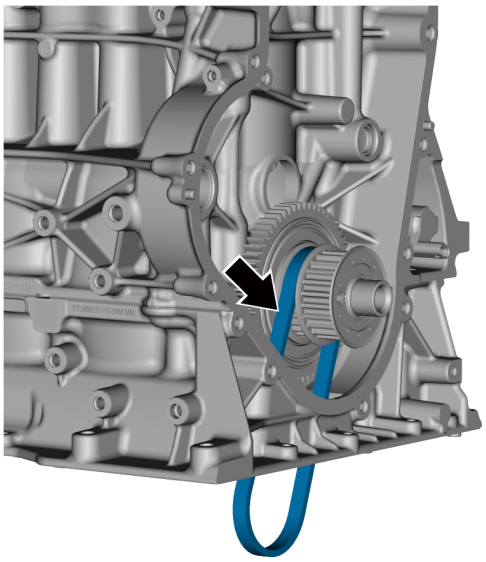
1 The oil pump assembly harness plug is pressed at the arrow position, and the oil pump assembly harness plug is disassembled.



2 The 4 fixing bolts of the oil pump assembly is disassembled in the order as shown in the figure.

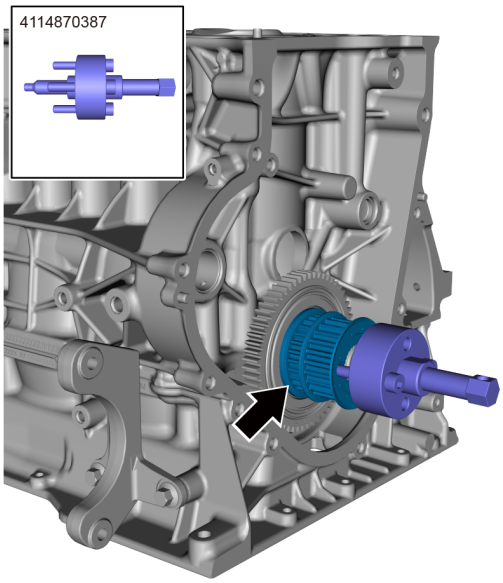
3 The oil pump assembly is taken down.

1.2.9.9 disassembling oil pump driving belt



The oil pump driving belt is disassembled.

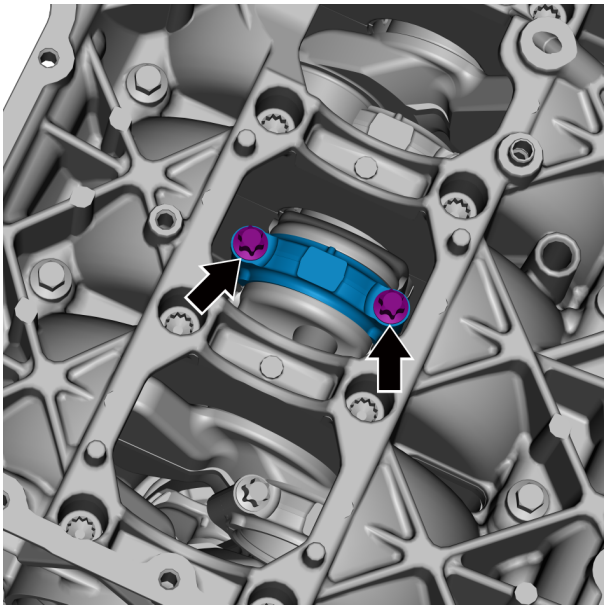
1.2.9.10 Disassembling timing pulley assembly



The special tool is used for disassembling the timing belt pulley assbmely.

Special tool number: 4114870387

1.2.9.11 Disassembling connecting rod cover



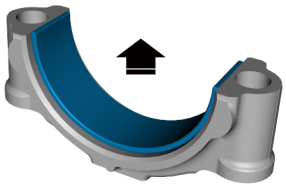
1 The crankshaft is rotated so that the corresponding cylinder piston is at the bottom dead center position, and the 2 fixing bolts of the connecting rod cover is disassembled.

Caution

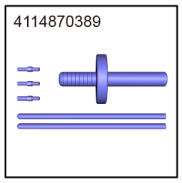
The connecting rod bolt cannot be reused. It is needed to replace with new ones after disassembly.

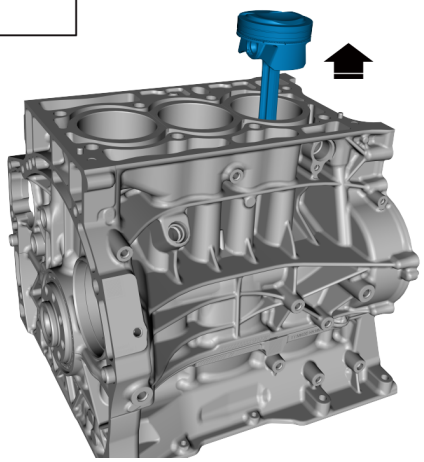
2 The connecting cover is taken down. A note is recorded on the connecting rod cap number and the location of the corresponding cylinder block.

3 The connecting rod bearing shell lower is taken down from the connecting rod cap.



1.2.9.12 Disassembling piston connecting rod assembly





1 The rotating handle is rotated on the bench to make the bottom surface of the cylinder block perpendicular to the ground.

2 The crankshaft is rotated so that the piston to be disassembled is at the top dead center position.

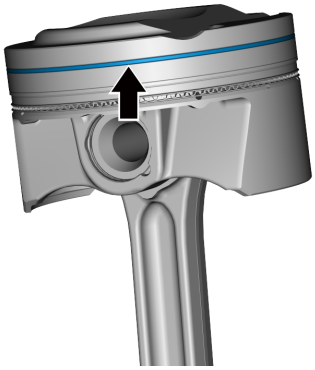
3 The rubber handle rod is used to push out the connecting rod and the piston assembly.
Special tool number: 4114870389

4 A note is recorded on the connecting rod body number and the location of the corresponding cylinder block.

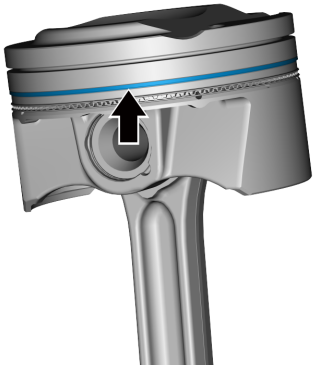
5 The connecting rod bearing shell is taken off from the piston connecting rod.

1.2.9.13 Disassembling piston ring

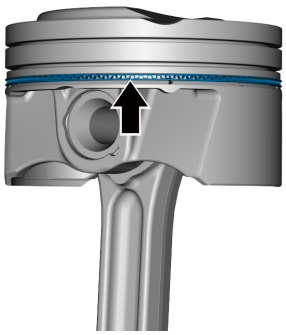
1 The first compression ring is disassembled.



2 The second compression ring is disassembled.



3 The oil ring is disassembled.

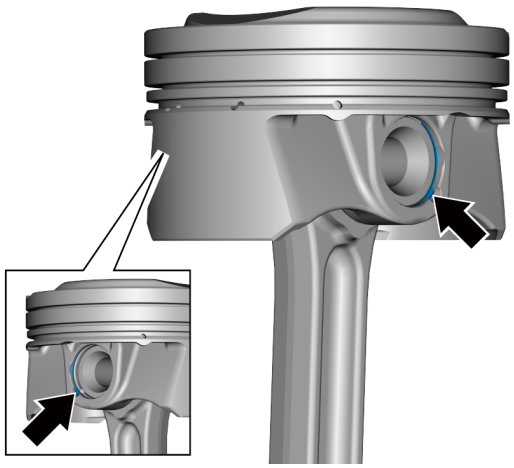


1.2.9.14 disassembling piston pin

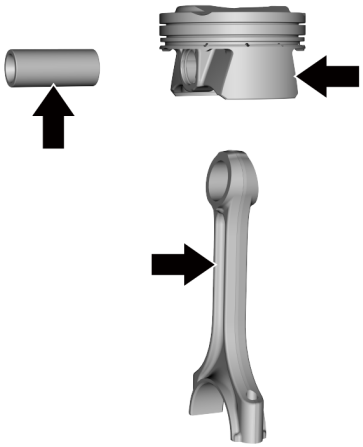
1 A tool is used to disassemble the piston pin clamping springs on the two sides.

Caution

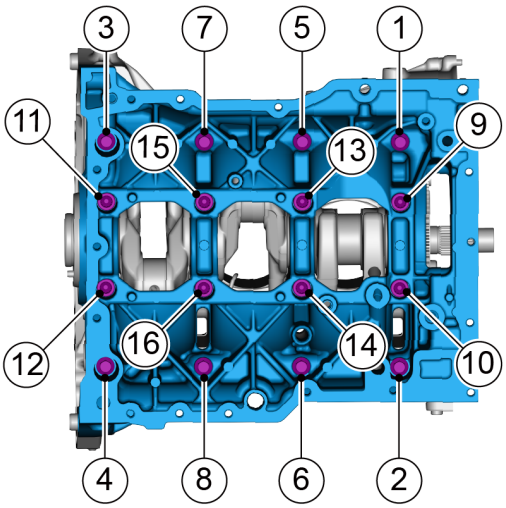
The piston pin clamping springs cannot be reused. It is needed to replace with new ones after disassembly.



2 The connecting rod, the piston pin, and the piston are disassembled.



1.2.9.15 Disassembling crankcase



1 The crankcase fixing bolts are pre-loosened in sequence 1-16 as shown in the figure, then are disassembled in sequence 1-16, the disassembled crankcase is placed on a clean countertop with the bottom of the crankcase facing downwards. The bonding surface of the crankcase and the main bearing cap of the cylinder block is cleaned.

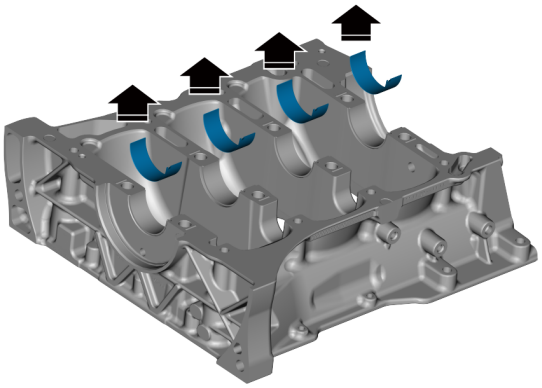
Caution

The crankcase and the cylinder block are positioned by means of a number of irregular steps, which are very easily destroyed, and nothing must be placed on the surface of the crankcase, under any circumstances.

Caution

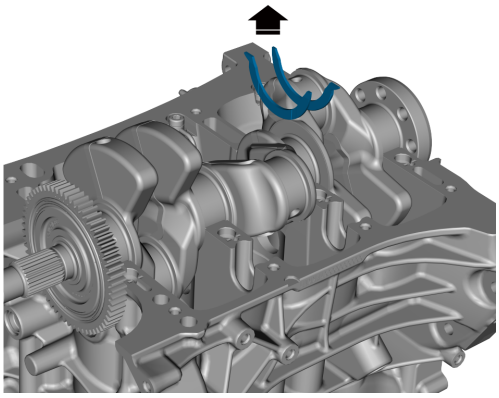
The main bearing cover bolt must be replaced after assembling, and the new changed main bearing cover bolt can be used utmost 3 times.

2 The main bearing shell lower on the crankcase is taken down.

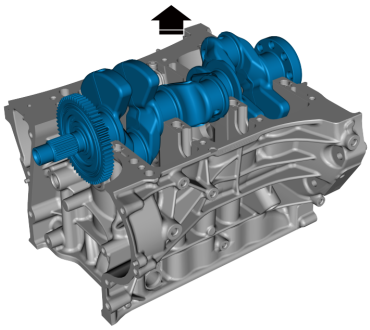


1.2.9.16 Disassembling crankshaft

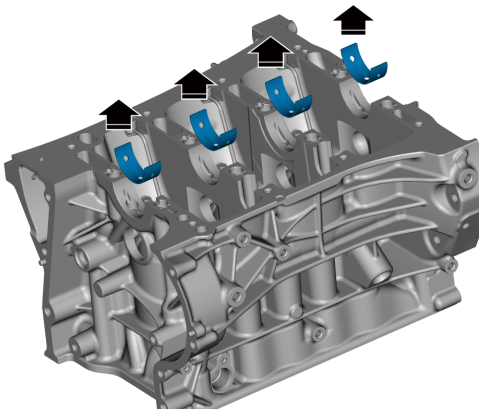
1 The thrust plates are taken from the two sides of the third main bearing seat.

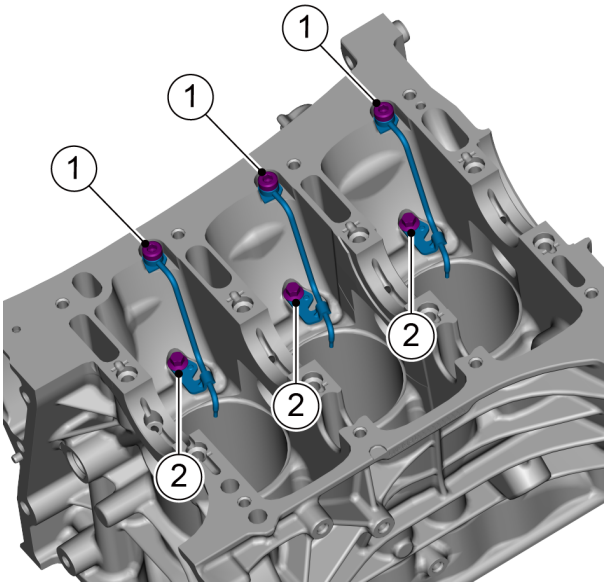


2 The crankshaft is taken off.



3 The main bearing shell on the cylinder block is taken off.





1.2.9.17 Disassembling piston cooling nozzle assembly

1 The hollow bolt 1 and the hexagon flange bolt 2 are disassembled.

2 The piston cooling nozzle assembly is taken out.

1.2.10 Checking cylinder head

1.2.10.1 Checking cracks, scratches and leaks

1 The installing surface of the cylinder head and the cylinder gasket are cleaned.

2 The installing surface of the cylinder head and the cylinder head cover are cleaned.

3 Color contrast and penetration inspection are conducted on the cylinder head surface to confirm that there is no crack.

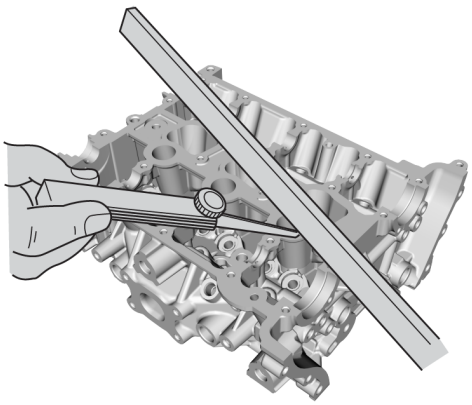
Caution

The cylinder head is replaced if necessary.

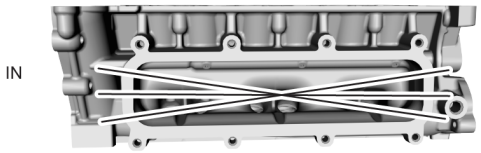
4 Whether there is a scratch on the installing surface between the cylinder head and the cylinder head cover is checked and confirmed.

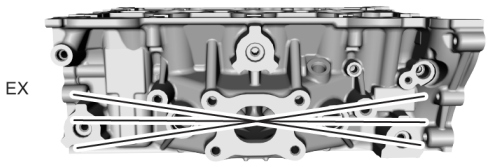
5 Whether there is a leakage or a gas leakage on the installing surface of the cylinder head and the cylinder gasket is checked and confirmed.

1.2.10.2 Checking flatness of cylinder head



1 Whether the sealing surface is free of deformation and warping is checked and confirmed. The flatness of the sealing surface of the cylinder head assembly must be within the standard value. If the value exceeds the standard value, please replace the cylinder head.
Local flatness of bonding surface with the cylinder block: 0.015mm/20×20mm
Overall flatness of bonding surface with the cylinder block: 0.03mm





2 The flatness of the installing surface of the cylinder head and the intake and exhaust manifolds is checked.
The flatness of intake and exhaust side: 0.02mm/ 20×20mm

Caution

If it exceeds the maximum specification range, the surface is ground or the cylinder head is replaced.

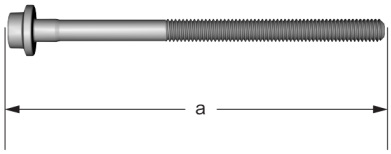
1.2.10.3 Checking cylinder head bolt

The length of the cylinder head bolt is measured.

Standard value: 162 mm±0.5 mm

Caution

A new bolt must be used for each maintenance.



1.2.11 Checking valve

1.2.11.1 Checking valve edge thickness

The thickness of each valve edge is measured.

Edge thickness:

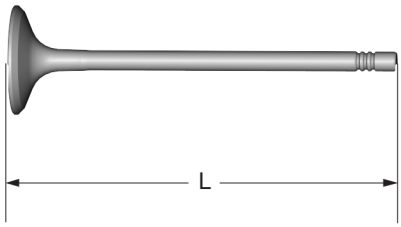
IN: 1.1 mm ± 0.25 mm

EX: 1.2 mm ± 0.25 mm

Caution

If the value exceeds the specified value, the valve is replaced please.

1.2.11.2 Checking valve length



The length of each valve is measured. Replace the valve if necessary.

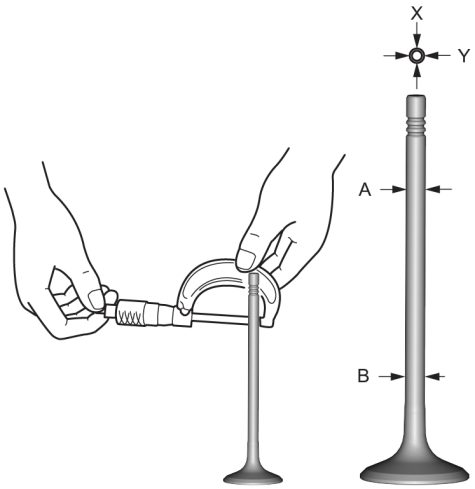
Standard valve length L:

IN: 105.48 mm ± 0.25 mm

EX: 104.42 mm ± 0.25 mm

Caution

If the value exceeds the specified value, the valve is replaced please.



1.2.11.3 Checking valve diameter

The diameter of each valve rod is measured in the X and Y directions at point A (20 mm from the small end) and point B (78 mm from the small end).

Standard diameter:

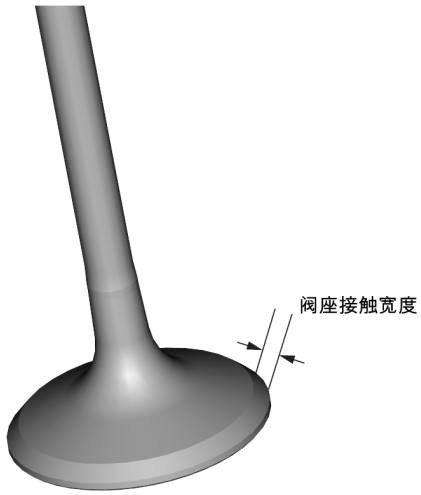
IN: 5.455 mm ~ 5.47 mm

Caution

If the value exceeds the specified value, the valve is replaced please.

1.2.12 Checking/repairing valve seat

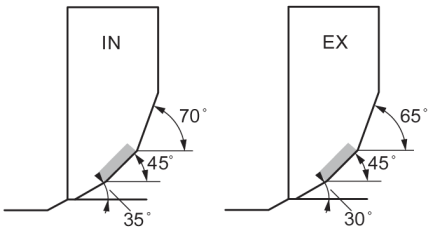
1.2.12.1 Checking/repairing valve seat



1 Whether there is excessive wear or burning point on the valve seat ring is checked and confirmed. If so, the cylinder head assembly should be replaced.

2 The contact width of the valve seat is measured.
Valve seat width:
IN: 1.75 mm
EX: 1.75 mm

3 If it is out of the specification range, a 45° valve seat cutter is used to rearrange the valve seat and/or the valve surface please.



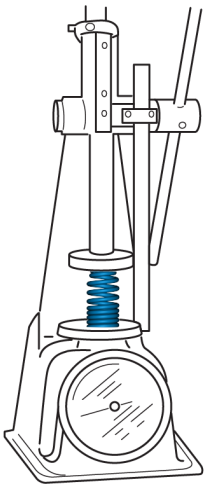
4 That the valve seat position is checked to be in the center of the valve surface is confirmed.

5 If the valve seat position is too external, a 70°(IN) or 65°(EX) and 45°cutter are used to correct the valve seat please.

6 If the valve seat position is too internal, a 35°(IN) or 30°(EX) and 45°cutter are used to correct the valve seat please.

1.2.13 Checking valve spring

1.2.13.1 Checking pressing force of valve spring



The valve spring is pressed to a standard height and the pressing force of the valve spring is tested.

Standard heights:

Intake side: 37.72 mm/ 29.82 mm; exhaust side: 36.08 mm/ 27.08 mm

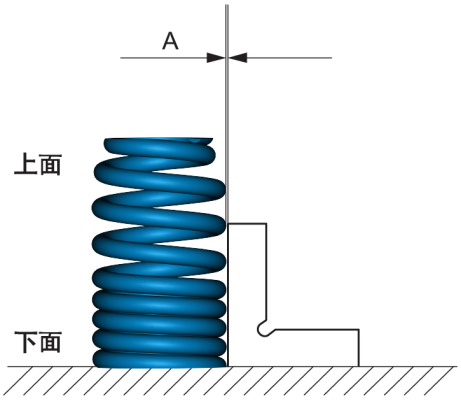
The pressing force:

Intake side: 220±11 N/490±24 N; Exhaust side: 250±13 N/ 470±23 N

Caution

If it exceeds the specification range, the valve spring is replaced.

1.2.13.2 Checking the verticality of the valve spring



1 Valve springs are conical in shape with a small outer diameter at the top, the verticality of the valve springs is checked as shown in the figure on the left.

2 The valve springs are rotated in a circle and measure the "A" at the position with the maximum clearance counting from the third circle in the upper part.

The verticality of the intake or exhaust valve spring:

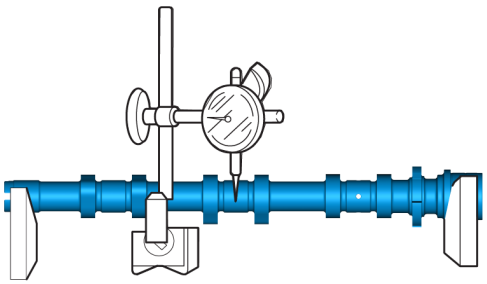
Maximum value: 1.5 mm

Caution

If it exceeds the specification range, the valve spring is replaced.

1.2.14 Checking camshaft

1.2.14.1 Checking camshaft assembly



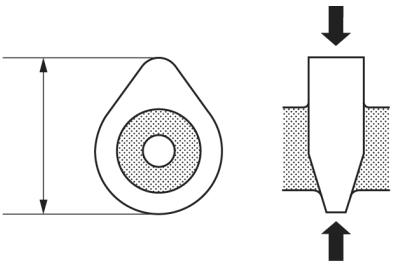
1 The 1st and 5th journals are placed on the V-shaped frame.

2 The radial run-out of the camshaft assembly is measured.

Maximum run-out value: 0.03 mm

Caution

If the specifications are exceeded, the camshaft assembly is replaced.



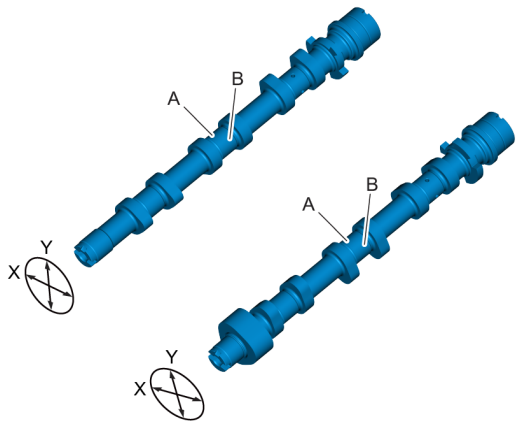
3 Measure the height of the cam lobe angle at the two point positions shown in the figure.

IN: 36.68 mm ± 0.05 mm

EX: 37.33 mm ± 0.05 mm

Caution

If the specifications are exceeded, the camshaft assembly is replaced.



4 The journal diameter is measured along the X and Y directions at two points (point A and point B). If the value exceeds the specified value, the camshaft assembly is replaced please.
Standard diameter: 23.95 mm ~ 23.97 mm

5 The plastic line clearance is arranged on the top part of the journal in the axial direction.

6 The camshaft bearing cap is installed.

7 The camshaft bearing cap is disassembled.

8 Oil film clearance is measured.
Standard clearance:
The third main journal of the exhaust camshaft assembly: 0.03 mm ~ 0.071 mm
The third main journal of the intake camshaft assembly: 0.03 mm ~ 0.071 mm

Caution

If the value exceeds the specification range, the cylinder head is replaced.

9 The radial internal clearance between the intake camshaft and the exhaust camshaft is measured.
The standard radial internal clearance: 0.05 mm ~ 0.065 mm

Caution

If the value exceeds the specification range, the cylinder head or the camshaft is replaced.

1.2.15 Checking hydraulic tappet

1.2.15.1 Checking hydraulic tappet

The hydraulic tappet is put in the engine oil, and repeatedly pressed to let the oil enter the hydraulic tappet until it is not moved.

Caution

If the hydraulic tappet is still pressed freely after the repeated pressing, the hydraulic tappet needs to be replaced.

1.2.16 Checking cylinder block

1.2.16.1 Checking cracks, scratches and leaks

1 The joint surface with the cylinder gasket is cleaned.

2 The joint surface with the crankcase is cleaned.

3 The color comparison penetration inspection is conducted on the surface of the cylinder block assembly.

4 Whether there is a scratch on the joint surface between cylinder block and the cylinder gasket is checked and confirmed.

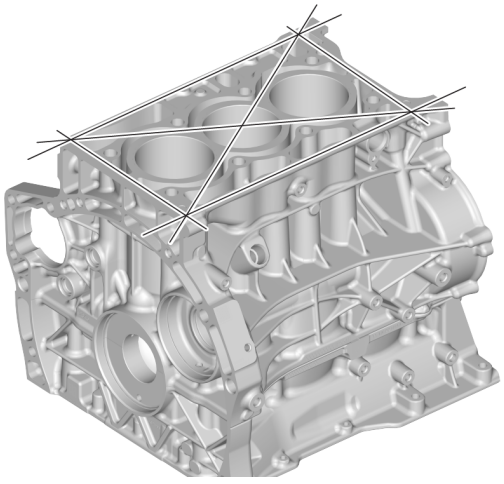
5 Whether there is leakage or gas leakage on the joint surface between the cylinder block assembly and the cylinder gasket is checked and confirmed.

6 Whether the cylinder block assembly has cracks is checked.

Caution

The cylinder block assembly is replaced if necessary.

1.2.16.2 Checking flatness of cylinder block assembly



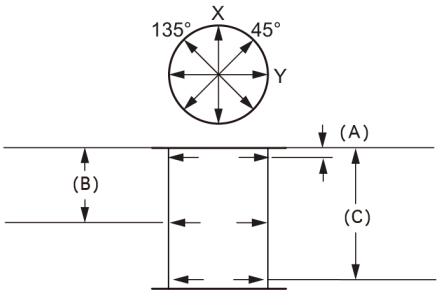
The flatness of the surface at the top end of the cylinder block assembly is measured in the six directions as shown in the figure. Whether the sealing surface is deformed or wrapped is checked and confirmed, and the flatness of the sealing surface of the cylinder block assembly must be within the standard range. If the value exceeds the standard value, the cylinder block is replaced please.

The local flatness of the bonding surface with the cylinder head gasket: 0.015 mm/20×20 mm

The overall flatness of the bonding surface with the cylinder head gasket: 0.05 mm

Caution

If the value exceeds the maximum value, the cylinder block assembly is replaced.



1.2.16.3 Checking cylinder diameter

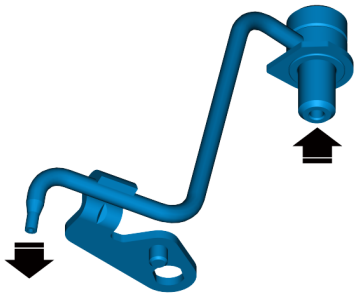
The cylinder diameter is measured at the positions A (5 mm), B (32 mm) and C (85 mm) along the X and Y directions, 45° and 135 ° respectively below the top surface.

Standard diameter limit:

Φ82.015 mm± 0.007 mm

Caution

If the value is not within the specification range, the cylinder block assembly is replaced.



1.2.17 Checking piston cooling fuel injector components

1.2.17.1 Checking continuity of piston cooling nozzle assembly

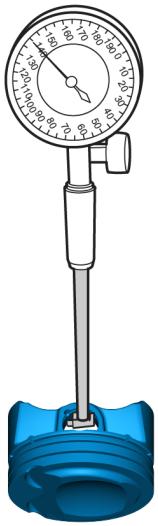
The compressed air is added to the piston nozzle assembly and it is confirmed that the air passes through the piston nozzle assembly.

Caution

If the air does not flow, the piston cooling nozzle assembly is replaced.

1.2.18 Checking piston and connecting rod components

1.2.18.1 Checking piston



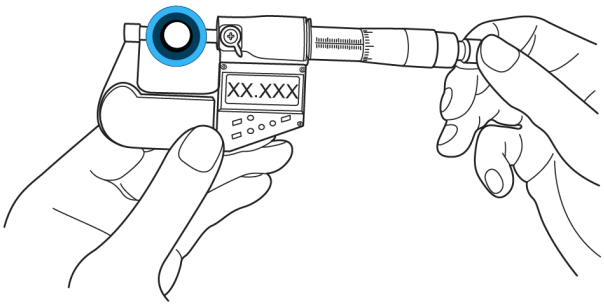
1 The piston is checked for scratches, cracks and wear.

2 An internal dial gauge is used to measure the diameter of the piston pin hole.

Standard value: 20.004 mm ~ 20.008 mm

Caution

If it exceeds the standard range, the piston is replaced please.



3 Whether the piston pin has scratches, cracks and wear is checked. The piston pin is replaced if any.

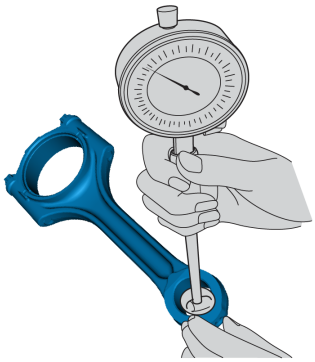
4 An internal dial gauge is used to measure the diameter of the piston pin hole.

Standard value of the piston pin:

19.997 mm ~ 20 mm

Caution

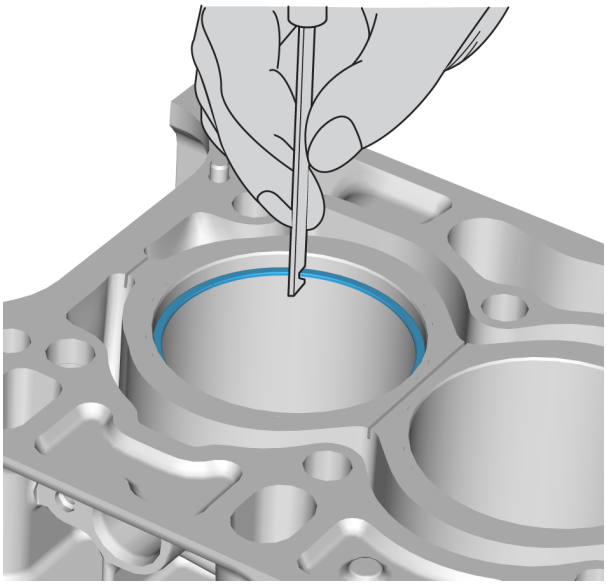
If it exceeds the standard range, the piston is replaced please.



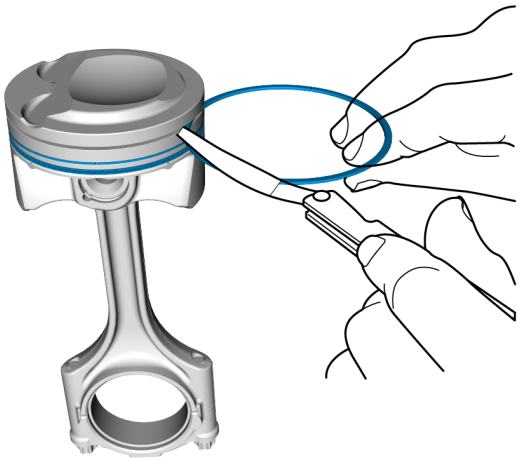
5 Whether there is a crack at the piston pin hole of the connecting rod is checked. The connecting rod is replaced if any.

6 The internal dial gauge is used to measure the diameter of the piston pin hole.
Standard value:
20.008 mm ~ 20.014 mm

1.2.18.2 Checking piston ring assembly



1 A new set of piston ring assembly is selected and a clearance gauge is used to measure the opening clearance of the piston ring.
Closing clearance of the first piston ring:
0.15 mm ~ 0.25 mm
Closing clearance of the second piston ring:
0.4 mm ~ 0.6 mm



2 The clearance between the piston ring and the ring slot is measured along the entire circumference.
Side clearance between the first piston ring and the piston:
0.03 mm ~ 0.07 mm
Back clearance between the first piston ring and the piston:
0.954 mm ~ 1.261 mm
Side clearance between the second piston ring and the piston:
0.025 mm ~ 0.07 mm
Backlash between the second piston ring and the piston:
0.954 mm ~ 1.261 mm

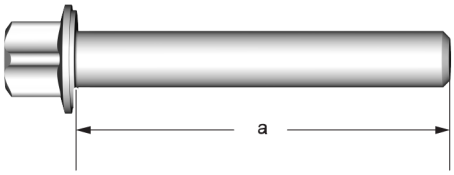
Caution

If it exceeds the specification range, the piston, the piston pin, the piston ring and the connecting rod assembly are replaced as a whole please.

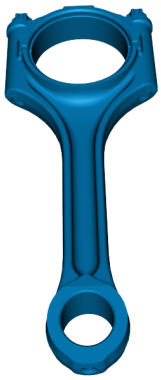
1.2.18.3 Checking connecting rod bolt

The connecting rod bolt is measured.

Standard: 48 mm±0.5 mm



1.2.18.4 Checking connecting rod assembly



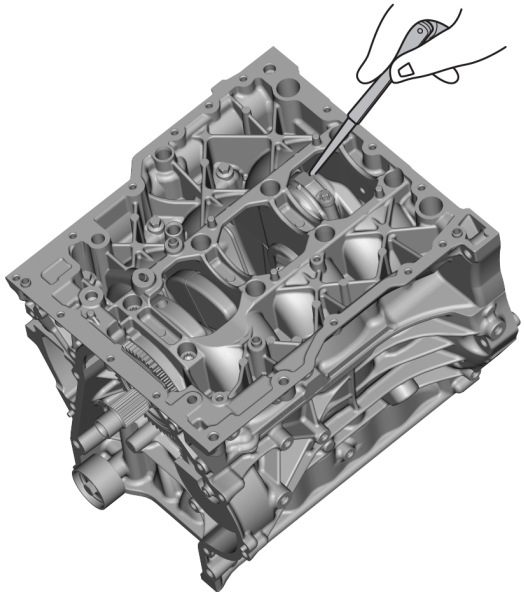
1 If the connecting rod assembly is bent or twisted is checked. If the connecting rod assembly is bent or twisted, the connecting rod assembly is replaced.
Bending degree: 0.02 mm
Twisting degree: 0.04 mm

2 The connecting rod bearing is checked.

3 The lower end of the connecting rod assembly is checked for wear.

4 The upper end of the connecting rod assembly is checked for wear.

5 The journal of the crankshaft connecting rod bearing is checked for wear.



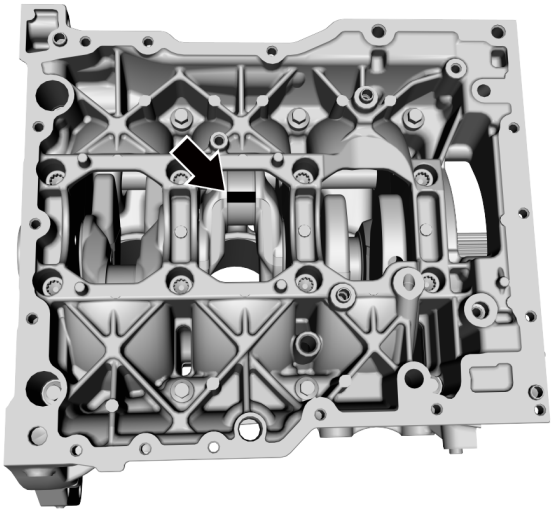
6 The connecting rod bearing cap is installed.

7 Before the connecting rod bearing cap is disassembled, the thin clearance at the larger end of the connecting rod is measured.

Standard value:0.18 mm ~ 0.48 mm

Caution

If the clearance exceeds the maximum range, the connecting rod is replaced.



8 The fit clearance of the connecting rod bearing is checked.

9 A plastic clearance gauge is placed on the connecting rod journal.

10 The connecting rod cover (the forward marking of the connecting rod cover should face the front end of the engine) is installed and the connecting rod bolts are tightened according to the specified torque.

11 The connecting rod cover is disassembled.

12 The widest point of the clearance is measured with the plastic clearance gauge.

Standard value: 0.040 mm ~ 0.058 mm

Caution

If the clearance exceeds the maximum range, the connecting rod bearing is replaced.

1.2.19 Checking crankshaft

1.2.19.1 Checking main journal of crankshaft

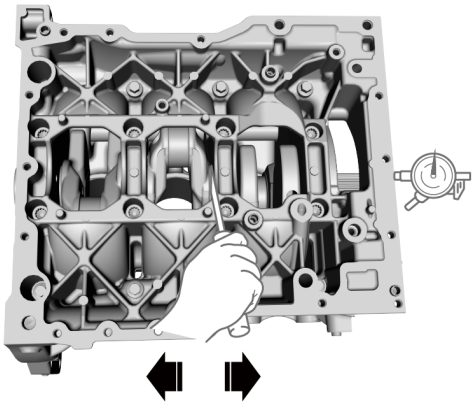
Use a dial indicator to measure the circular run-out of the main journal of the crankshaft.

Maximum radial run-out of the crankshaft： 0.015 mm

Caution

If the circular run-out is not qualified, replace the crankshaft assembly.

1.2.19.2 Checking thrust clearance of crankshaft



1 The crankshaft is installed.

2 The main bearing cap and the main bearing cap bolts with lower bearing bushes are installed.

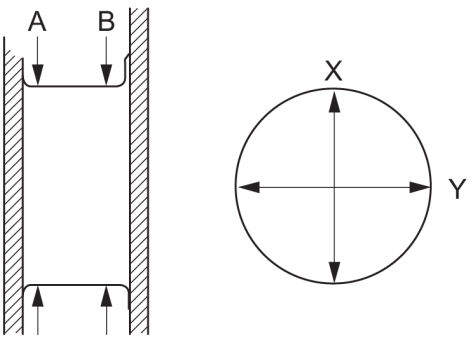
3 A dial indicator is used to measure the thrust clearance when prying the crankshaft assembly forward and backward with a screwdriver.

Standard thrust clearance: 0.1 mm ~ 0.29 mm

Caution

If the thrust clearance does not meet the requirements, the thrust washer is replaced in a complete set.

1.2.19.3 Checking diameter of crankshaft journal



The diameter of the crankshaft journal of the two points (A and B) are measured along the X and Y directions as shown in the figure. If it exceeds the specification range, the crankshaft assembly is replaced or the journal is ground and the smaller bearing is installed please.

Diameter of the Crankshaft journal: 50 mm

Diameter of the crankshaft connecting rod neck: 48 mm

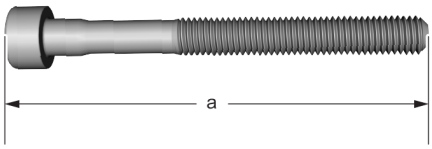
1.2.19.4 Checking main bearing cap bolt

The bolt length of the main bearing cap (only applicable for tightening bolts in the plastic area) is measured.

Standard: 99.5 mm±0.5 mm

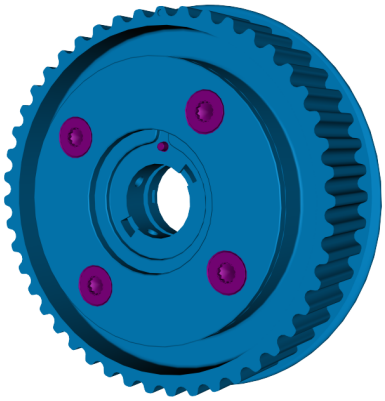
Caution

A new bolt must be used for each maintenance.



1.2.20 Checking variable valve timing actuator

1.2.20.1 Checking variable valve timing actuator

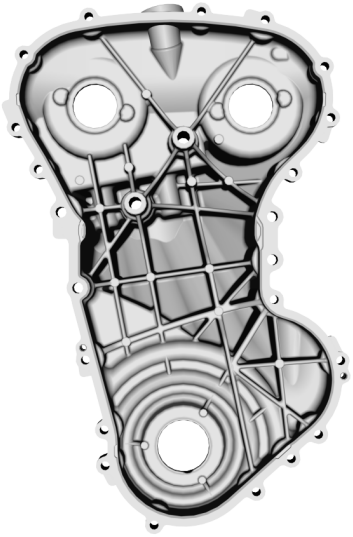


Caution

VVT components cannot be disassembled, because it is a precise part.

1 Confirm whether the 4 fixing bolts are loosened. If loosened, replace the VVT components.

2 Confirm whether the positioning pin is broken or worn. If it is broken or worn, replace the VVT components.



1.2.21 Checking timing belt shield

1.2.21.1 Checking flatness of timing belt protecting cover sealing surface

Whether the timing belt protecting cover sealing surface is free of deformation and warping is checked and confirmed. The flatness of the timing belt protecting cover sealing surface must be within the standard value. If the value exceeds the standard value, the timing belt protecting cover is replaced please.

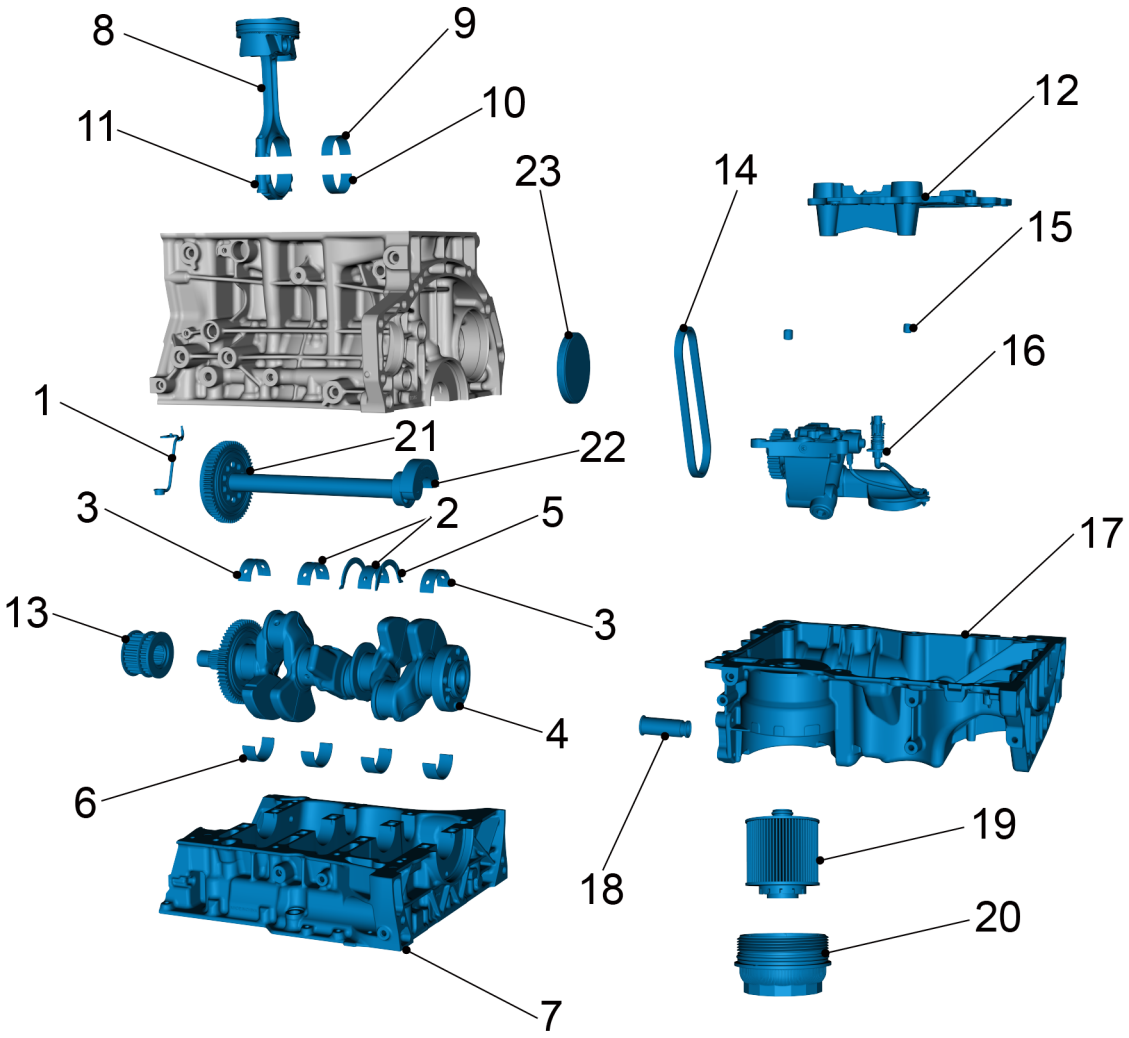
Overall flatness of bonding surface with the cylinder block: 0.2mm

Local flatness of bonding surface with the cylinder block: 0.05mm/100×100mm

1.2.22 Assembling cylinder block (II)

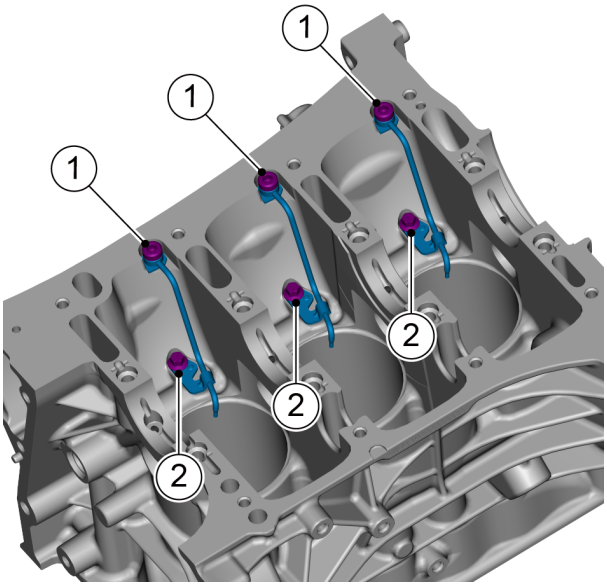
1.2.22.1 Breakdown drawing of assembling cylinder block (II)

Assembling is conducted in the order indicated in the table.



1. Piston cooling nozzle assembly
2. Main bearing shell upper
3. Main bearing upper (with black coating)
4. Crankshaft
5. Thrust plate
6. Main bearing shell lower
7. Crankcase
8. Piston connecting rod assembly
9. Connecting rod bearing shell upper
13. Timing belt pulley assembly
14. Oil pump driving belt
15. Positioning pin of oil pump assembly
16. Oil pump assembly
17. Oil pan assembly
18. Oil pump guiding pipe
19. Engine oil filter element
20. Engine oil filter element shell
21. Silent shaft assembly

10. Connecting rod bearing shell lower
11. Connecting rod cover
12. Oil baffle assembly
22. Rear end balance weight
23. Blanking cover of silent shaft



1.2.22.2 Assembling piston cooling nozzle assembly

1 The positioning pin of the piston cooling nozzle assembly is installed to the corresponding positions of the cylinder block in an inserting mode.

2 The bolt 2 is used to pre-tighten the piston cooling nozzle assembly to the cylinder block till in a snug fit mode.

3 The hollow bolt 1 is pre-tightened till in a snug fit mode.

4 The hollow bolt 1 and the hexagon flange bolt 2 are fastened.

Torque:

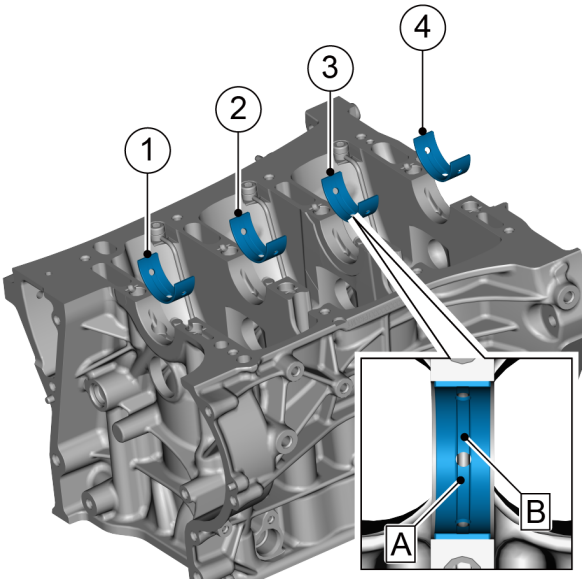
Bolt 1: 10 N·m

Bolt 2: 12 N·m

Caution

The sensitive parts are stored with care.

1.2.22.3 Assembling crankshaft



1 The diameter grouping information of the cylinder block main bearing holes and the crankshaft main journal are read, the main bearing shells upper (#1/#4) and the main bearing shells upper (#2/#3) are installed in the main bearing holes of the cylinder block according to the chapter of the bearing shell mating table. Making sure that the bearing shells 1#-4# are installed correctly from front to back, and are centered after being installed (as shown in the enlarged figure).

A: Main bearing shell seat centerline

B: Main bearing shell center

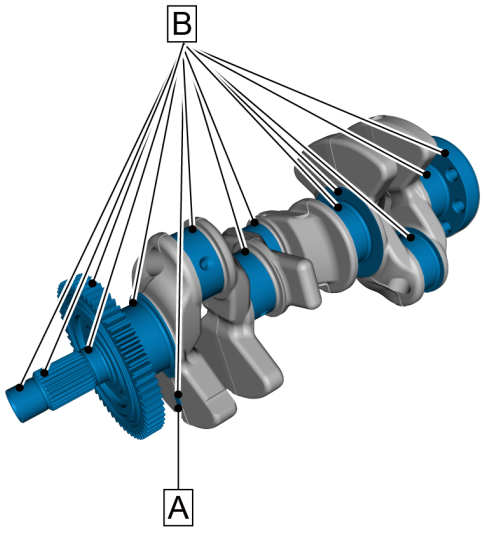
Requirements for centering: ±0.2

Caution

1. That the surfaces of the bearing shells are clean and free of foreign matters are confirmed before the bearing shells are assembled.
2. The main bearings with black coatings are assembled to the 1st and the 4th main bearing seats.
3. That the surfaces of the bearing shells are clean and free of foreign matters are confirmed after the installation is completed.
4. No oil is allowed on the backs of the bearing shells.
5. Bearing shells from different suppliers must not be mixed.

Caution

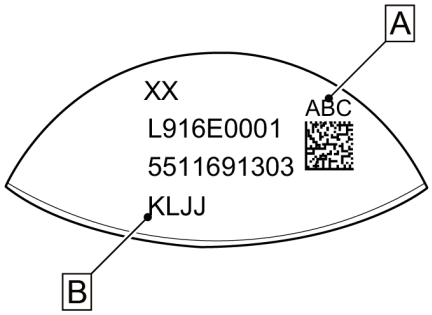
After the installation is completed, engine oil is used for evenly coating the inner surfaces of the bearing shells.



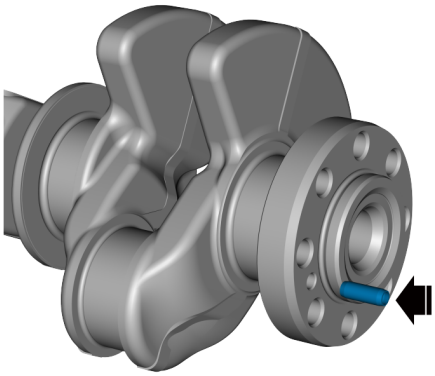
2 Confirming state of crankshaft assembly

Caution

1. The plain code of the crankshaft is engraved in the area B. That its contents are clearly visible is confirmed, otherwise, the crankshaft is replaced.
2. The vulnerable surface B is easily damaged and needs to be prevented from being knocked during the assembly process.



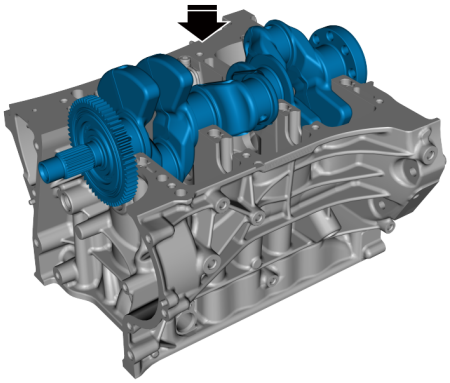
3 For the grouping figures of the crankshaft main journal and the connecting rod journal, see the chapter of the grouping number table for details.
A: grouping number of connecting rod journal
B: grouping number of main journal



4 The elastic cylinder pin is installed on the rear end of the crankshaft.

Caution

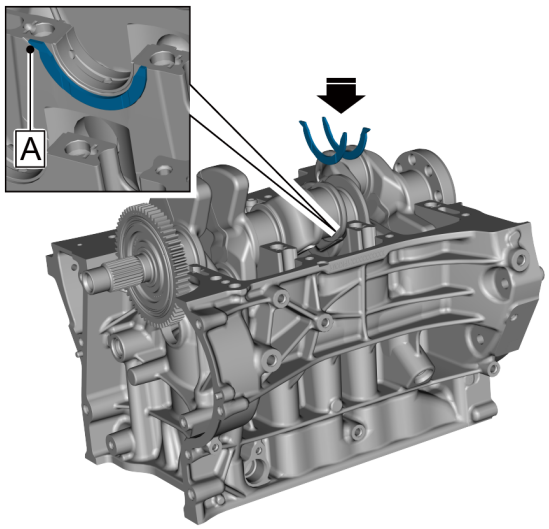
That the protrusion of the elastic cylinder pin is (6±1) mm is confirmed after assembly.



5 The crankshaft assembly is installed in the main bearing holes of the cylinder block.

Caution

After the installation is completed, at least two drops of engine oil are applied on the main journals of the crankshaft correspondingly for lubrication.



6 A proper amount of the engine oil is applied by smearing before installation, the thrust plate is installed on thrust grooves on the two sides of the 3rd main bearing seat.

7 That the mistake preventing lip of the thrust plate is in the mistake preventing groove of the cylinder block is confirmed.

Caution

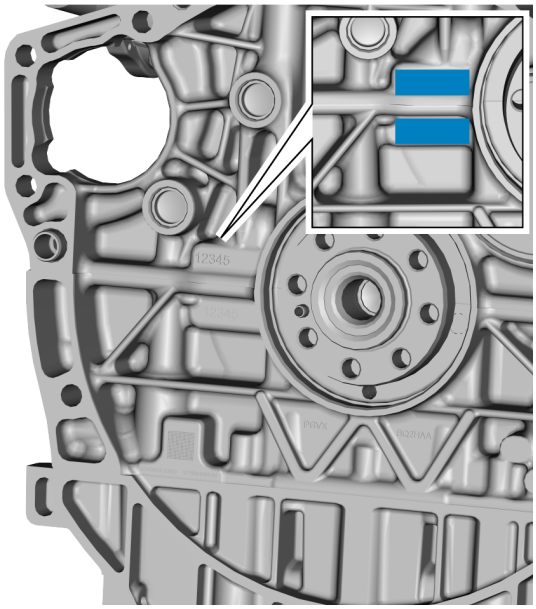
When installing, note that the side with the oil groove faces toward the direction of the crank arm.

A: Cylinder block mistake preventing groove

1.2.22.4 Assembling crankcase

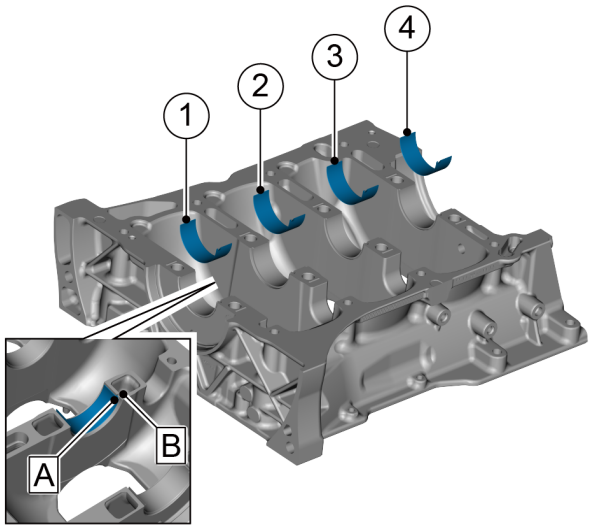
Warning !

The crankcase can not be replaced separately, must be changed with the cylinder block at the same time.



1 The cylinder block and the rear end of the crankshaft are checked, and whether the combination box code of the cylinder block and the crankcase is consistent is checked.

Type I



2 The diameter grouping information of the cylinder block main bearing holes and the crankshaft main journal are read, the main bearing shells lower (1/2/3/4) are installed on the crankcase according to the bearing shell mating table. Making sure that the bearing shells 1#-4# are installed correctly from front to back.

A: bearing shell positioning lip

B: bearing shell positioning groove

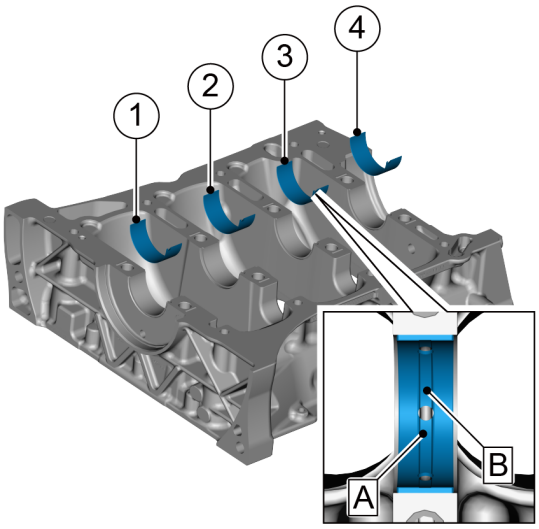
Caution

1. That the surfaces of the bearing shells are clean and free of foreign matters are confirmed before the bearing shells are assembled.
2. That the surfaces of the bearing shells are clean and free of foreign matters are confirmed after the installation is completed.
3. No oil is allowed on the backs of the bearing shells.
4. That the bearing shell positioning lip is installed into the positioning groove is ensured.

Caution

After the installation is completed, engine oil is used for evenly coating the inner surfaces of the bearing shells.

Type II



3 The diameter grouping information of the cylinder block main bearing holes and the crankshaft main journal are read, the main bearing shells lower (1/2/3/4) are installed on the crankcase according to the bearing shell mating table. Making sure that the bearing shells 1#-4# are installed correctly from front to back, and are centered after being installed (as shown in the enlarged figure).

A: Main bearing shell seat centerline

B: Main bearing shell center

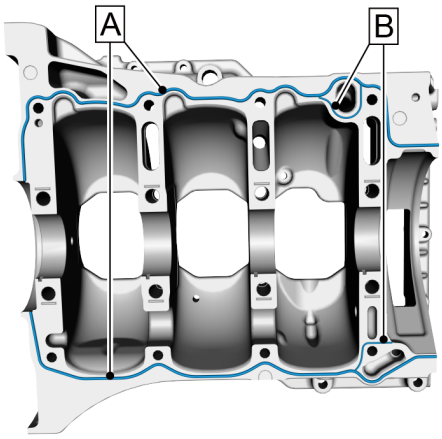
Requirements for centering: ±0.2

Caution

1. That the surfaces of the bearing shells are clean and free of foreign matters are confirmed before the bearing shells are assembled.
2. That the surfaces of the bearing shells are clean and free of foreign matters are confirmed after the installation is completed.
3. No oil is allowed on the backs of the bearing shells.
4. That the bearing shell positioning lip is installed into the positioning groove is ensured.

Caution

After the installation is completed, engine oil is used for evenly coating the inner surfaces of the bearing shells.



4 The cylinder block and the sealing surface of the crankcase are inspected to ensure that they are clean and free from oil and grease. The modified alcohol or similar medium is used for wiping.

5 After the cleaning agent is completely evaporated, Loctite 1455 is sprayed on a clean dust-free cloth to wipe the bonding surface. It is required that the amount of residual Loctite 1455 surface adhesion agent on the bonding surface is controlled, the upper surface of the wiped bonding surface is wet, but there is no beads of water by shrinking. After the Loctite 1455 surface adhesion agent on the bonding surface dries, the Loctite 1455 surface adhesion agent is not allowed to wipe for the second time.

6 The crankcase and the gluing surface of the cylinder block are ensured to be clean before applying the flat sealing silica gel.

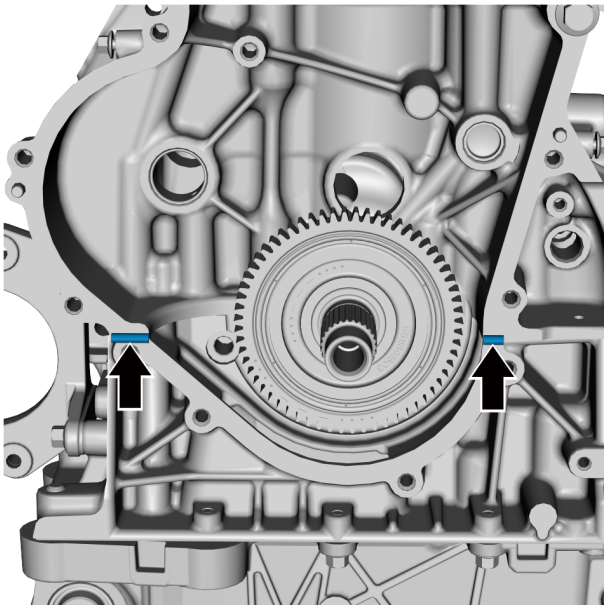
7 The sealant line is applied to the crankcase or the corresponding position, on the bonding surface, of the bonding surface. The sealant line is controlled according to the width of 2 mm~5 mm within its starting position to 10 mm. The crankcase is installed together to the cylinder block to ensure that the cylinder block and the timing belt guard sealing face at the front end of the crankcase is aligned.

Caution

Bolt assembly should be completed within 10 minutes after silica gel application. If it exceeds 10 minutes, the sealant should be removed and the operation is started again.

A: φ2.5 mm±0.5 mm

B: φ1.5 mm±0.5 mm

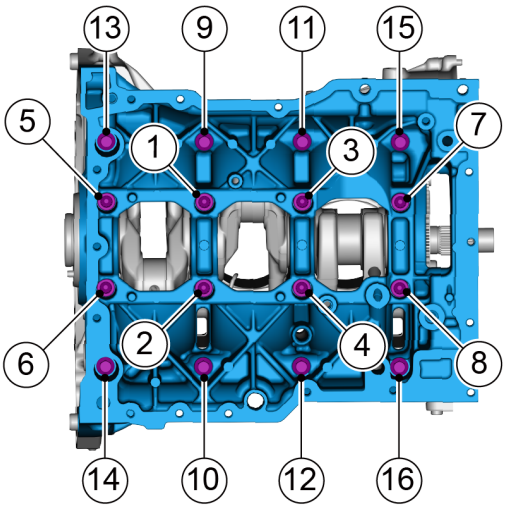


8 The main bearing cover bolt is lubricated with engine oil (at the minimum length position of 30 mm at the end part of the main bearing cover bolt), and the fixing bolt is installed. After the bolt is installed, the overflowed silica gel is wiped from the sealing surface of the timing belt guard to avoid affecting the sealing of the timing belt guard.

Caution

It should be ensured that the main bearing cover bolt assembly should be completed within 10 minutes after the sealing surface of the crankcase is glued, and the overflowed silica gel at the front end should be removed within 30 minutes.

If the silica gel in the installing hole of the crankshaft rear oil seal overflowed more than 10 minutes, the silica gel needs to be cleared up to avoid damaging the oil seal.



9 Assembling torque on the main bearing cap bolt and tightening order:

Step 1: pre-tightening M10, 5 N·m according to the order of 1 – 8

Step 2: tightening M10, 20 N·m according to the order of 1 – 8

Step 3: pre-tightening M8, 5 N·m according to the order of 9– 16

Step 4: tightening M10, 40 N·m according to the order of 1 – 8

Step 5: tightening M8, 25 N·m according to the order of 9 – 16

Step 6: turning the corner M10, 90° according to the order of 1 – 8

1–8: (M8)

9–16: (M10)

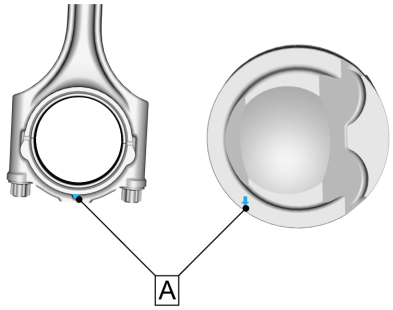
The axial clearance of the crankshaft is detected after the bolt is tightened, the clearance must be between 0.1 mm ~ 0.29 mm, otherwise the cause is checked.

The crankshaft rotating torque is less than or equal to 10 N.m.

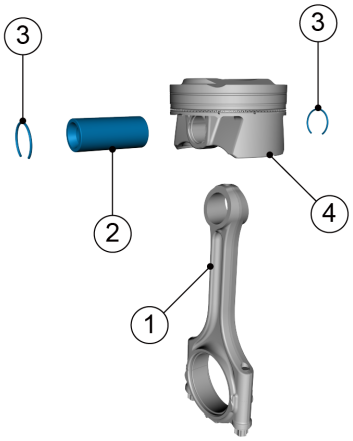
Caution

The main bearing cover bolt must be replaced after assembling, and the new changed main bearing cover bolt can be used utmost 3 times.

1.2.22.5 Assembling piston connecting rod



1 The connecting rod direction marking is ensured to be same as the piston direction marking (the arrow direction), and the connecting rod body and the connecting rod cover are confirmed to be well bonded without gaps.

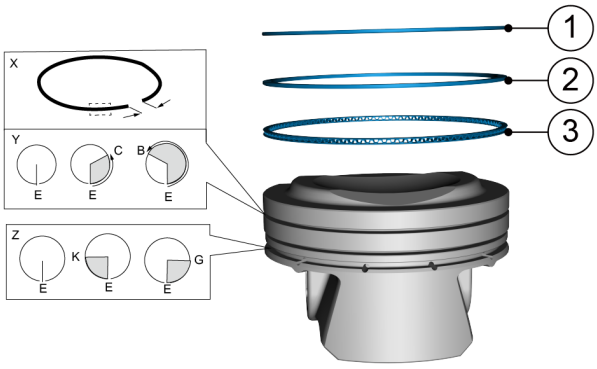


2 An appropriate amount of engine oil is applied before the piston pin is installed. The piston pins 2 are assembled into the pin hole of the piston 4 and the small head hole of the connecting rod 1, and the piston pin clamping spring 3 is assembled into the clamping spring groove on the piston 4.

Caution

The opening of the piston pin clamping spring 3 should be ensured to face downwards.

1.2.22.6 Assembling piston rings



1 The maximum permissible openings of the assembled piston rings are ensured not to exceed the requirement, see view X for the opening.

2 The first and second piston rings are installed in sequence, a tool is used for installing the piston rings, the piston rings are staggered by about 120° among them, see view Y.

3 The opening position of the oil ring liner spring (D) is positioned above the piston pin hole, while avoiding the oil returning hole.

4 The oil ring scraping plates are installed, the openings of the scraping plates and the opening of the oil ring liner spring stagger approximately 90° and the scraping plates stagger 180° between the two the scraping plates, see view Z.

Caution

The maximum assembly opening clearance of the piston rings during the installation process are ensured not to exceed the requirements of the table below.

Position	Part name	Note
1	The first piston ring	Maximum permissible assembly opening clearance: 23 mm
2	The second piston ring	Maximum permissible assembly opening clearance: 24 mm

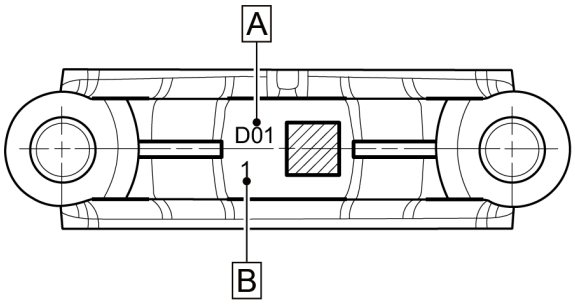
The upper surface of the piston ring is marked with the TOP mark, and the oil ring is not required to be oriented.

The upper and lower end surfaces of the first piston ring is silver, the outer round face is black and the blue color is marked on it, and the second piston ring is black and the white color is marked on it.

Caution

Piston rings from different suppliers is prohibited to be mixed.

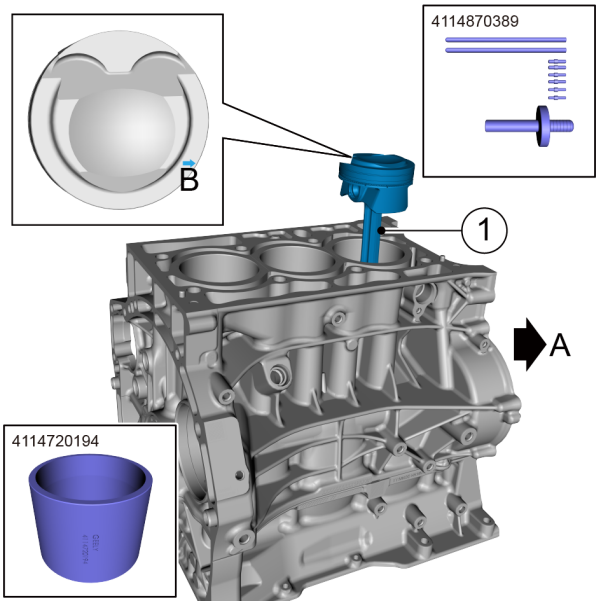
1.2.22.7 Assembling piston connecting rod assembly



1 The connecting rod weight is divided into 5 groups, labeled 1, 2, 3, 4, and 5 correspondingly. The same engine connecting rod weight is the same group, see the grouping number table for an example of the grouping number.

A: grouping number of big end hole journal

B: grouping number of connecting rod weight



2 The piston connecting rod corresponding to the cylinder hole number is selected. The combined connecting rod piston group 1 is assembled into the cylinder hole with the special tool, and the other one is installed after one piston connecting rod assembly is completely installed.

Special tool number: 4114870389

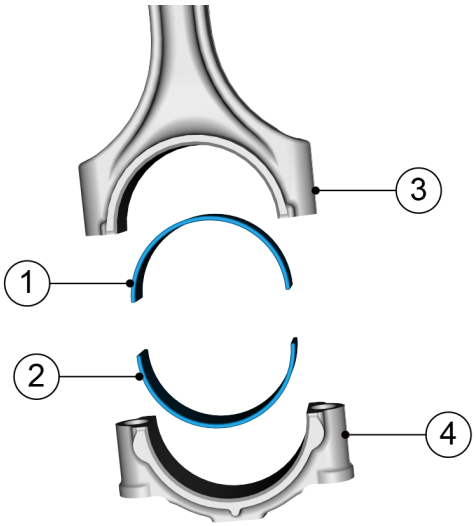
Special tool number: 4114720194

Caution

The engine oil is applied to the cylinder hole wall before installation, and the piston head part forward marking faces toward the front end of the engine. The connecting rod is prevented from touching the cooling nozzle during assembly.

A: engine front end

B: piston head part forward marking



1.2.22.8 Assembling connecting rod bearing shell

1 The diameter grouping information of the connecting rod big head hole and the crankshaft connecting rod journal are read, and the correct color of the connecting rod bearing shell is selected according to the grouping table, the connecting rod bearing shell upper 1 is installed to the connecting rod body 3, the bearing shell is ensured to be centered, and the connecting rod bearing shell lower 2 is installed to the connecting rod cover 4.

Caution

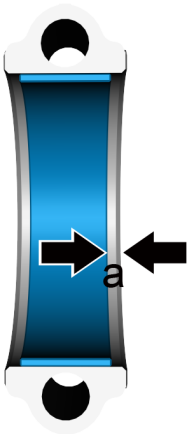
No engine oil is allowed on the back of the bearing shell.

The connecting rod bearing shell has a black coating and the lower part of the connecting rod bearing shell is uncoated.

Caution

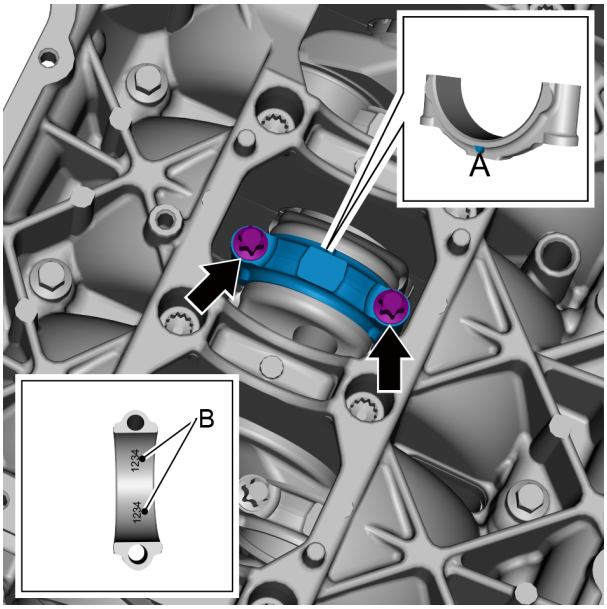
The engine oil is evenly applied to the inner surface of the connecting rod bearing shell upper and the inner surface of the connecting rod bearing shell lower for lubrication after installation is completed.

Bearing shells from different suppliers must not be mixed.



2 The distance a between one side of the connecting rod bearing shell and the end face of the big end face of the connecting rod bearing shell meet the requirement after the connecting rod bearing shell is assembled.

a: 2.8±0.3



1.2.22.9 Assembling connecting rod cover

1 The marked connecting rod cover is installed to the piston rod of the corresponding cylinder.

Caution

When the connecting rod cover is assembled, make sure that the pairing numbers of the connecting rod body and the connecting rod cover are on the same side.

B: Pairing number

2 The forward marking on the top of the connecting rod cover is toward the front end of the engine, and there is no gap between the connecting rod body and the connecting rod cover after assembly.

A: Forward marking

3 The connecting rod cap fixing bolt is installed.

Two bolt torques of the same connecting rod:

Step 1: 12± 1.2 N·m

Step 2: 12±1.2 N·m

Step 3: rotating angle 100° ± 5°

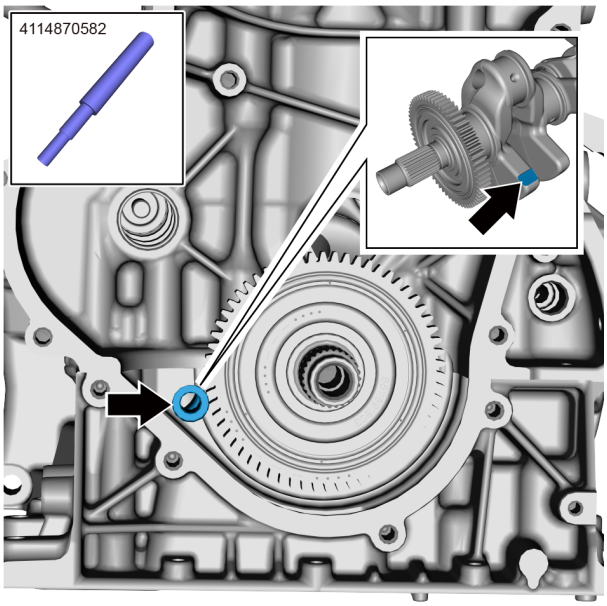
The final monitor torque value is 35 N·m ~ 65 N·m and the other connecting rod bolts are assembled in the same way.

Caution

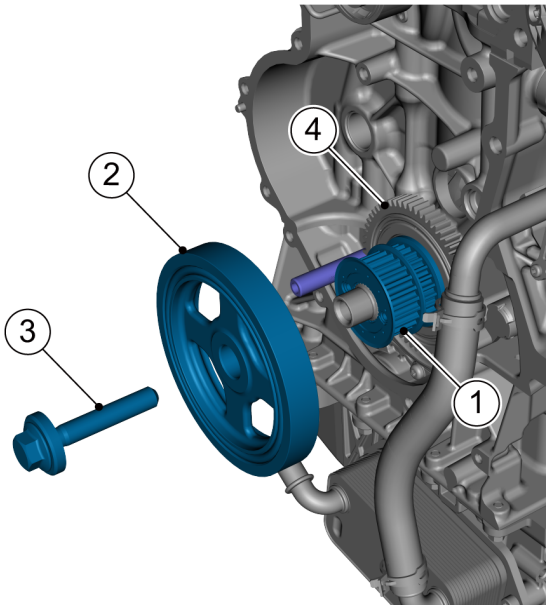
No oil on the surface of the connecting rod bolt.

4 After the connecting rod bolt is installed, the rotation torque range of the crankshaft is: 1 N·m ~ 8.5 N·m

1.2.22.10 Assembling timing pulley assembly



1 The crankshaft zero position special tool is arranged in the zero position basic hole in an inserted mode for positioning, making sure that the tooling head makes contact with the small plane of the first balance block of the crankshaft. If the crankshaft rotates counterclockwise, the crankshaft does not rotate, the crankshaft is in the zero position.
Special tool number: 4114870582



2 The crankshaft timing belt pulley assembly 1 is arranged on the crankshaft in a sleeving mode.

3 The vibration dampening pulley 2 is arranged on the timing belt pulley assembly 1 in a pressing mode.

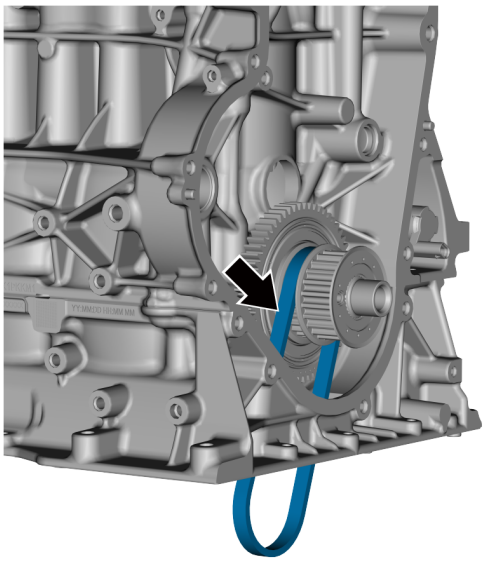
4 The vibration dampening pulley bolt assembly 3 is slowly screwed clockwise into the threaded hole in the front end of the crankshaft assembly until the crankshaft timing pulley assembly 1 fits against the front face position 4 of the crankshaft gear.

5 The vibration dampening pulley bolt assembly 3 is loosened and the vibration dampening pulley bolt assembly 3 and the vibration dampening pulley 2 are removed.

6 The crankshaft plate is ensured to be in the zero position, if the crankshaft rotates counterclockwise, the crankshaft does not rotate, the crankshaft is in the zero position.
The pressing force is less than or equal to 35KN

Caution

The vibration dampening pulley bolt should be disassembled by using a 13/16-inch socket, otherwise there is a possibility of damaging the bolt.



1.2.22.11 Assembling oil pump driving belt

One end of the oil pump driving belt is arranged to the crankshaft pulley assembly in a hooking mode, and the other end to the inclined oil pump pulley.

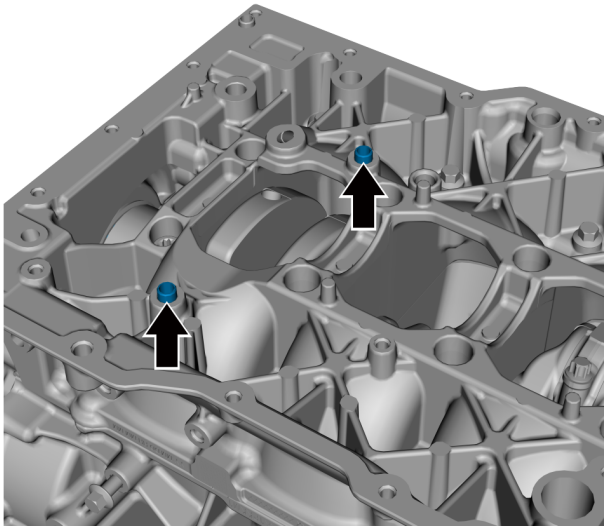
Caution

It is strictly forbidden to bend the oil pump driving belt, in case of special circumstances, it is necessary to meet the minimum bending radius being greater than 20 mm.

That the oil pump driving belt is placed in the center position of the oil pump pulley is ensured.

1.2.22.12 Assembling oil pump assembly

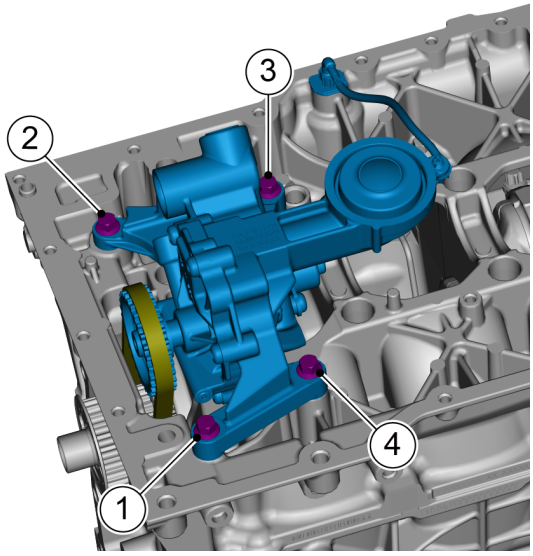
1 The positioning pin of the oil pump assembly is installed.

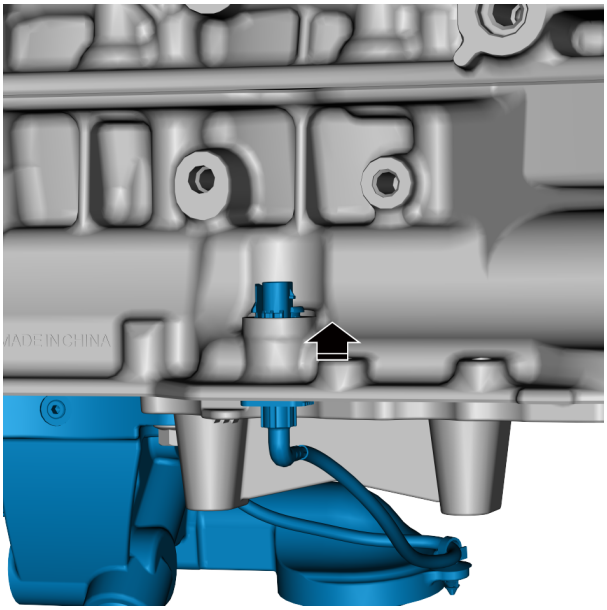


2 The oil pump assembly is installed on the crankcase.

3 The four fixing bolts of the oil pump are pre-tightened in orders as shown in the figure, and tightened in order.

Torque: 17 N·m





4 Before assembling the oil pump harness connector, P80 or other insertion aid with the lubrication function are used to lubricate the oil pump harness connector seals and crankcase holes. The oil pump harness connector is pressed into the crankcase hole.

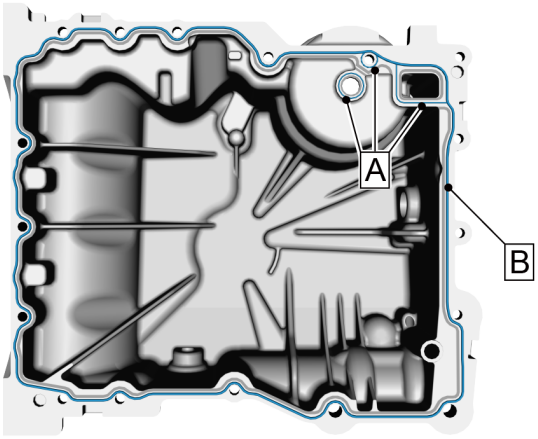
Caution

An audible click means the assembling of the oil pump harness connector is in place.

Caution

Making sure the end face of the oil pump driving belt is within the end face of the oil pump pulley.

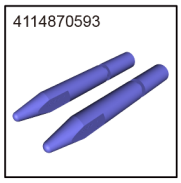
1.2.22.13 Assembling oil pan assembly

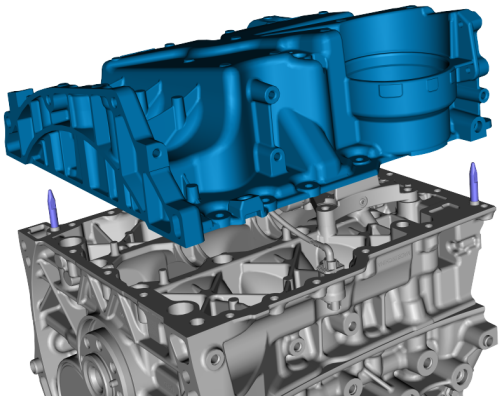


1 The crankcase and the sealing surface of the oil pan are checked and the surface is wiped with alcohol to ensure that the surface is free of oil and grease. The silica gel is uniformly applied on the oil pan according to the gluing track shown in the figure, controlling the width of the glue line B at 2 mm±0.5 mm, and the width of the glue line A at 1 mm±0.5 mm. The distance from the outline of the glue line to the glue storing chamfered corner is controlled at 1 mm±0.5 mm.

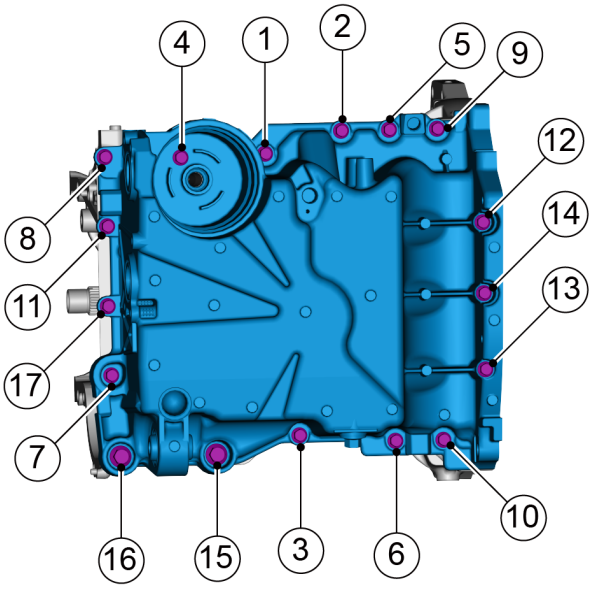
Caution

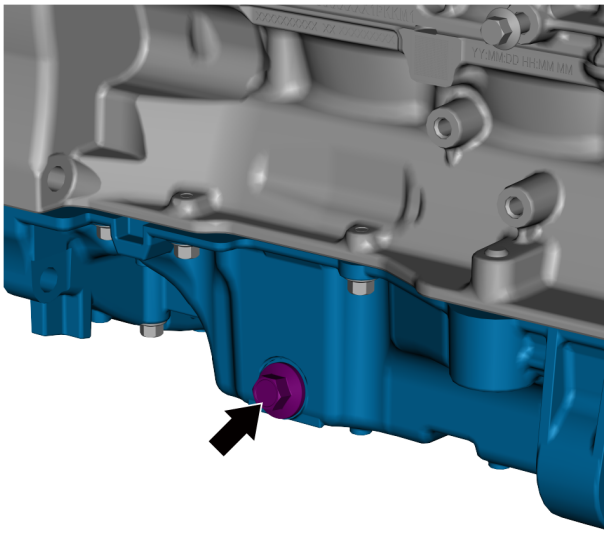
The crankcase should be assembled within 10 minutes after gluing. If it exceeds the installation time, you need to clear the glue line and apply the silica gel again for assemble.





2 The guiding pin of the oil pan assembly is installed and the oil pan assembly is installed.
Special tool number: 4114870593



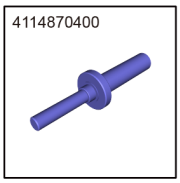


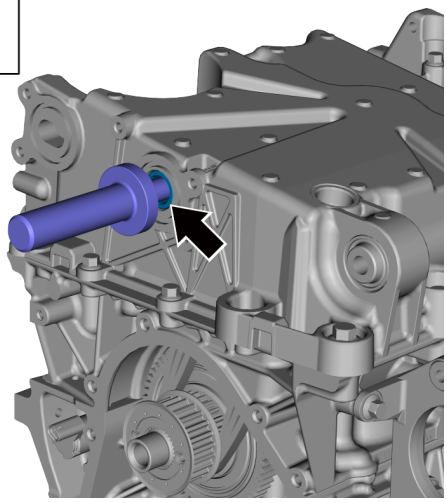
3 When the oil pan is assembled, the oil pan should be parallel to the assembly bonding surface of the bottom surface of the crankcase to prevent damaging the glue line, and assembled to the crankcase.

4 The oil pan bolts (1 ~ 16) are pre-tightened in orders as shown in the figure, and tightened in orders (1 ~ 16).
Torque:
Step 1: 1-16, pre-tighten
Step 2: 1 ~ 11, 17 N·m
Step 3: 12 ~ 14, 17 N·m
Step 4: 15 ~ 16, 48 N·m

5 The 17th bolt is installed and tightened within 5 minutes after the above actions are completed.
Torque: 17 N·m

6 The drain plug of the engine is installed.
Torque: 35 N·m





1.2.22.14 Assembling oil pump guiding pipe

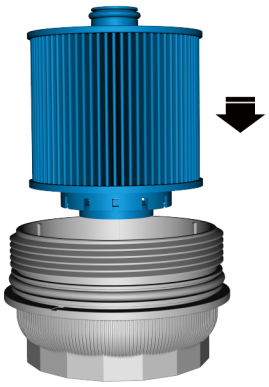
1 The integrity of the seal is checked visually before assembly.

2 The sealing ring is lubricated with P80 or other insertion aid with the lubricating function. The oil pump guiding pipe installed with the sealing ring is arranged into the oil inlet of the oil cooler on the oil pan by using the special tool.
Special tool number: 4114870400

Caution

The sealing ring of the guiding pipe of the oil cooler is disposable and requires replacement after removal.

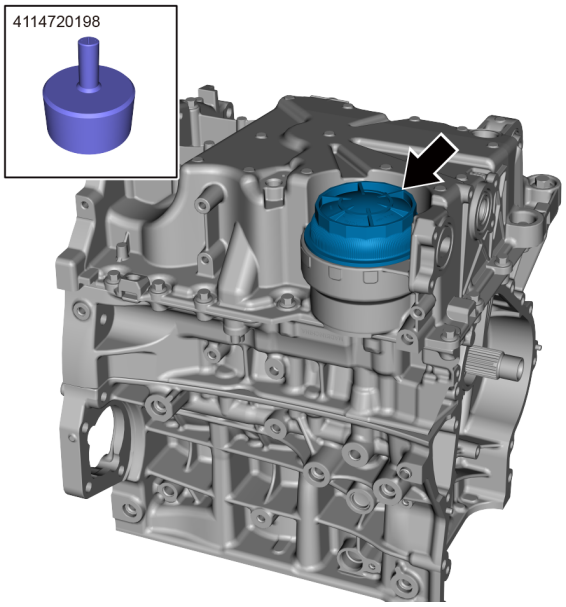
1.2.22.15 Assembling oil filter module



1 The engine oil filter element is installed.

Caution

Whether the check valve is installed in place is checked.



2 The silicone oil or the white oil are used to lubricate the two sealing rings or oil pan installing hole of the oil filter module.

3 The oil filter module is installed on the oil pan by using the special tool.

Special tool number: 4114720198

Torque:

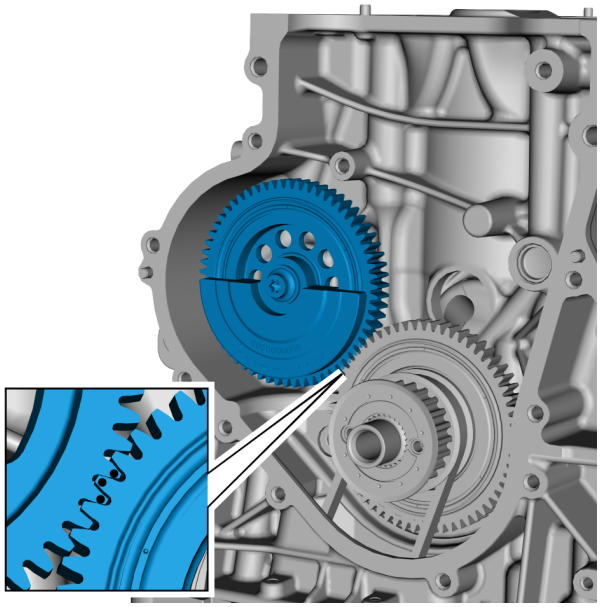
Step 1: 25 ~ 30 N·m

Step 2: Reverse rotation 30°

Step 3: 25 ~ 30 N·m

Caution

After being tightened, the oil filter module must be tightened again in place after reverse rotation as required.

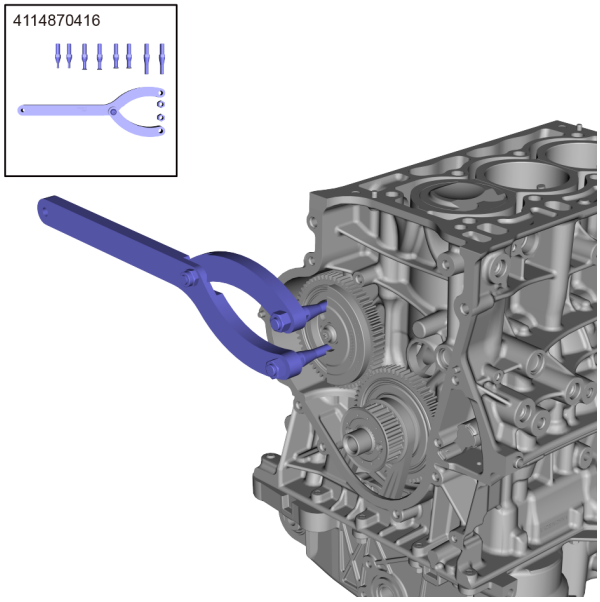


1.2.22.16 Assembling silent shaft assembly

1 The journal and the bearing of the silent shaft are lubricated by using engine oil.

2 The silent shaft assembly is installed into the silent shaft holes of the cylinder block, ensuring that the marks on the crankshaft gear and silent shaft gear are aligned.

1.2.22.17 Assembling rear end counterweight

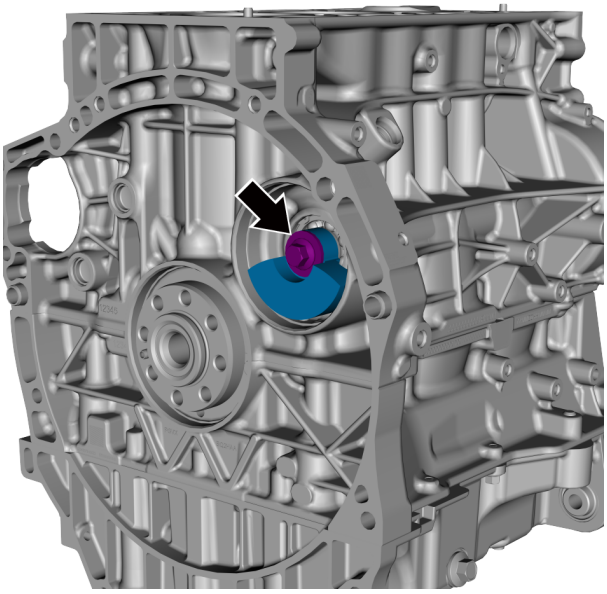


1 The rear end counterweight is assembled to the end part of the silent shaft and the front end counterweight is fixed by using the special tool.

Special tool number: 4114870416

Caution

It must be ensured that the silent shaft and the positioning slot of the silent shaft are installed in place.

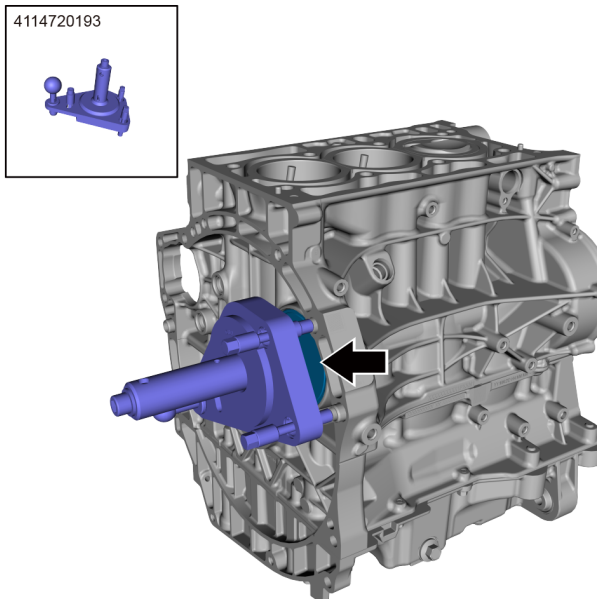


2 The fixing bolt and the flat washer of the rear end counterweight are installed.

Torque:

Step 1: 20 N·m

Step 2: 90°±5°



1.2.22.18 Assembling counterweight blanking cover

1 The assembly surface must be dry and free from oil and grease.

2 The special tool is used to install the counterweight blanking cover into the cylinder block blanking cover hole in a press-fit mode, ensuring that the blanking cover is installed to the correct depth and parallelism.

Special tool number: 4114720193

Press-fitting depth: 5.9 mm± 0.6 mm

Parallelism: 0.5 mm

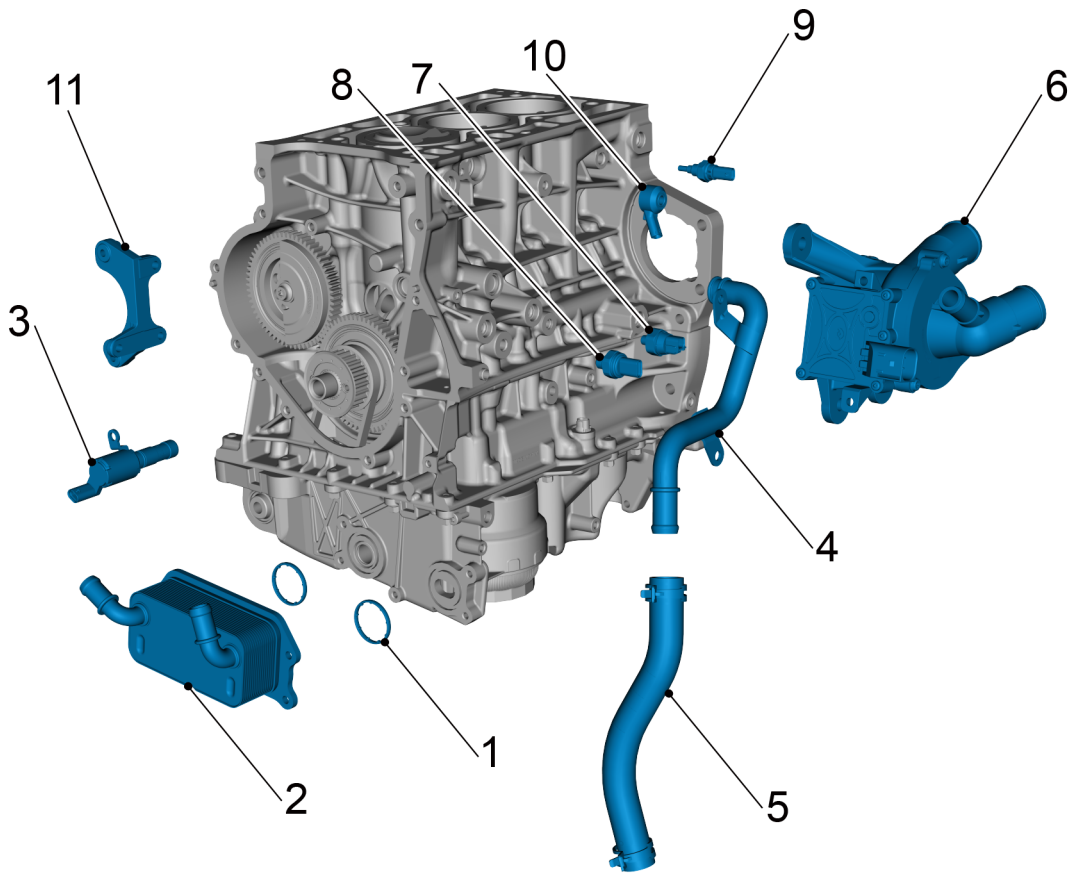
Caution

The counterweight blanking cover is a disposable part, and must be replaced after disassembling.

1.2.23 Assembling cylinder block (I)

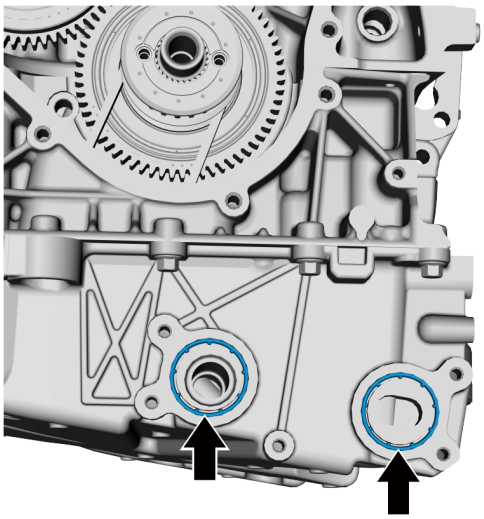
1.2.23.1 Breakdown drawing of assembling cylinder block (I)

Assembling is conducted in the order indicated in the table.



1. Engine cooler seal ring
2. Oil cooler
3. Piston cooling nozzle control valve
4. Oil cooler water outlet pipe
5. Oil cooler water outlet pipe assembly
6. Electronic water pump
7. Oil pressure alarm
8. Oil pressure sensor
9. Water temperature sensor (cylinder block)
10. Knock sensor
11. Driving shaft bracket

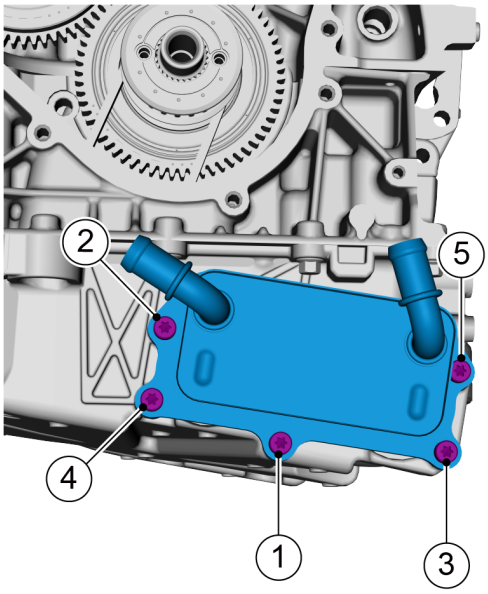
1.2.23.2 Assembling oil cooler



1 The oil cooler seal ring is installed on the crankcase.

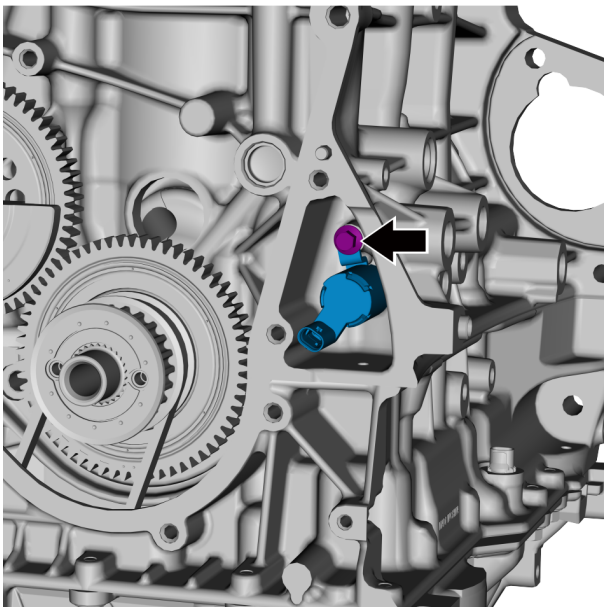
Caution

The oil cooler seal ring is disposable and requires replacement after removal.



2 The oil cooler is installed on the oil pan, 2 bolts are used for pre-tightening 2 and 5 by 2~3 threads, then 3 bolts are used for pre-tightening by 2~3 threads in the order of 1, 3 and 4, and then the bolts are tightened in the order of 1-5.
Torque: 17 N·m

1.2.23.3 Assembling piston cooling nozzle control valve



Caution

Before assembly, whether the seal ring is damaged or missing is checked. If it is damaged or missing, it needs to be replaced.

1 P80 or other grease with the similar function is evenly applied in the chamfer of the piston cooling nozzle control valve installing hole, it must be ensured that the O-ring will not be damaged during installation.

Caution

The lubricating medium shall be applied in an appropriate amount to avoid oil stains or leakage.

2 The piston cooling nozzle control valve is installed in the corresponding hole of the cylinder block, the fixing bolts are installed and tightened.

Torque: 10 N·m

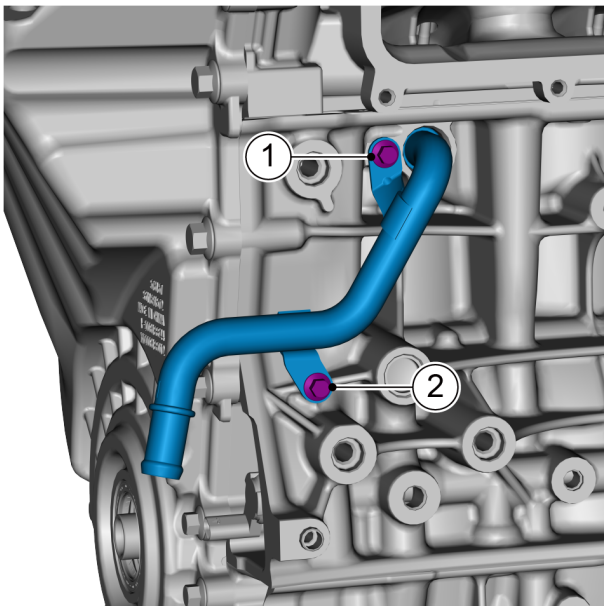
Caution

It is prohibited to touch the pins of the piston cooling nozzle control valve.

It is prohibited to plug or unplug the connectors of the piston cooling nozzle control valve.

Parts that fall or are impacted must be scrapped.

1.2.23.4 Assembling oil cooler water outlet pipe assembly



Caution

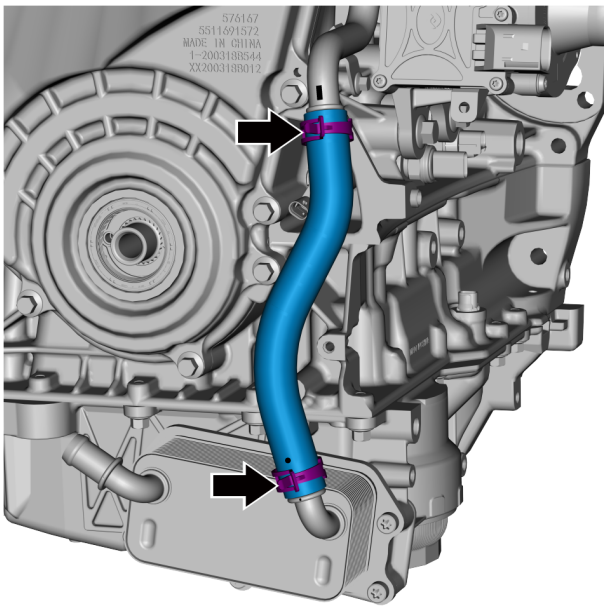
Before assembling, whether the O-ring is damaged or not is checked, if so, it should be replaced before assembling.

1 An appropriate amount of P80 or other insertion aid with the lubricating function is applied to the O-ring before installation, then the oil cooler outlet pipe is installed and the bolts are pre-tightened, then the bolts are tightened in the order of 1 and 2.

Torque: 10 N·m

Caution

Oil substances such as the engine oil are prohibited from being used as the insertion aid.

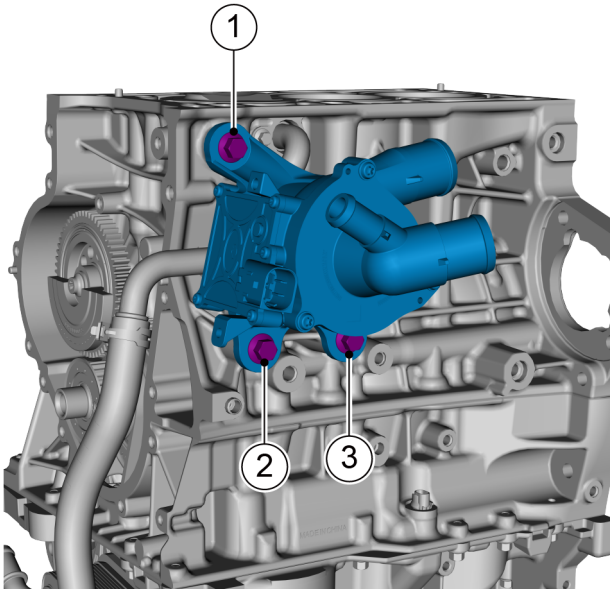


1.2.23.5 Assembling oil cooler water outlet pipe assembly

The inner wall of the rubber pipe is coated with appropriate amount of P80 or other insertion aids with the lubricating function, the oil cooler outlet pipe assembly is installed on the oil cooler outlet pipe and the oil cooler, the "□" marking end of the oil cooler water outlet pipe assembly is connected to the oil cooler, and aligned with the small groove mark. The mark on the other end is aligned with the black mark on the oil cooler outlet pipe, and then the rubber pipe ring clamp is clamped.

Caution

Oil substances such as the engine oil are prohibited from being used as the insertion aid.



1.2.23.6 Assemble electronic coolant pump

1 The cylinder block is fixed on the electronic coolant pump.

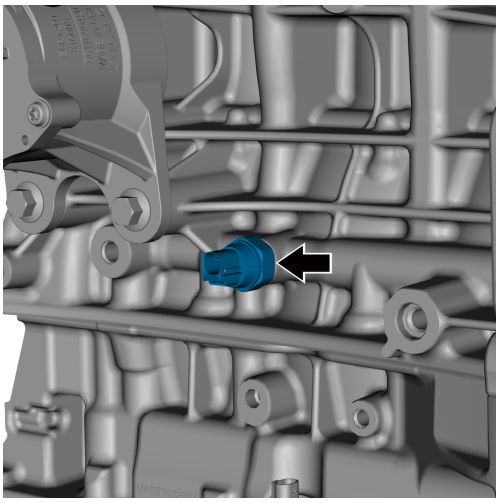
2 The 3 fixing bolts of the electronic coolant pump is installed, the bolts are pre-tightened firstly, and then the bolts are tightened in the order according to 1 to 3 as shown in the figure.

Torque: 50 N·m

Caution

It is not allow to plug or unplug the connectors of the electronic coolant pump with power.

During the storage and assembly of the electronic coolant pump, there must be anti-static protection measures. It is forbidden to touch the pins of the connector.



1.2.23.7 Assembling oil pressure alarm

1 The residual glue of installing holes are cleared, and whether there is visible deformation or damage on the installing hole threads is checked.

2 The oil pressure alarm is installed on the cylinder block and tighten it.

Torque: 15.75 N·m

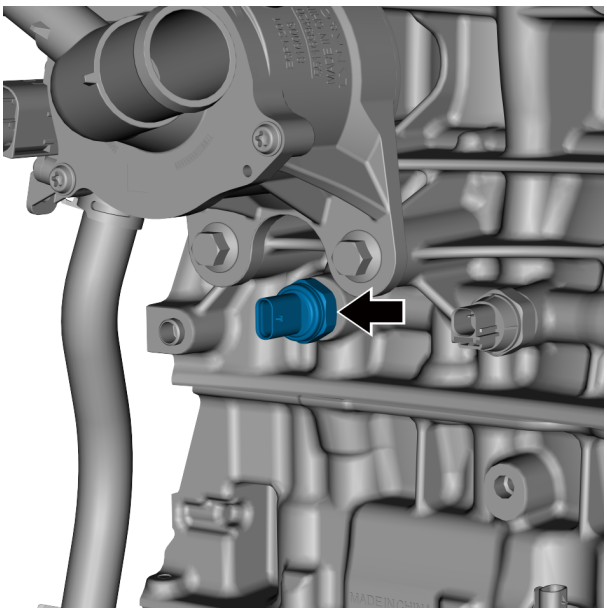
Caution

The pins of the connector is prohibited to touch.

It is prohibited to plug or unplug the connector of the oil pressure alarm.

Parts that fall or are impacted must be scrapped.

If the oil pressure alarm is reused, it is necessary to clear the residual glue at the thread of the oil pressure alarm and its installing holes. It is required to check that the alarm and its installing hole thread have no obvious deformation and damage, and after an appropriate amount of thread sealant is evenly applied to the thread of oil pressure alarm, then tightening is conducted according to regulations.



1.2.23.8 Assembling oil pressure sensor

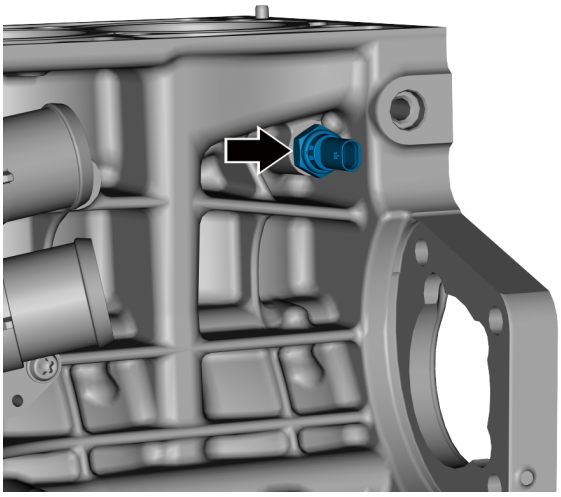
The oil pressure sensor is installed on the cylinder block and tighten it.

Torque: 22 N·m

Caution

1. Plugging or unplugging the connector of the oil pressure sensor with power on are not allowed.

2. During the storage and assembly of the oil pressure sensor, there must be anti-static protection measures. It is forbidden to touch the pins of the connector.



1.2.23.9 Assembling coolant temperature sensor (cylinder block)

1 Whether there is visible deformation or damage on the installing hole threads is checked.

2 The coolant temperature sensor is installed on the cylinder block and tighten it.

Torque: 15 N·m

Caution

It is prohibited to touch the pins of the coolant temperature sensor .

It is prohibited to plug or unplug the connector of the water temperature sensor alarm (cylinder block).

Parts that fall or are impacted must be scrapped.

If the coolant temperature sensor (cylinder block) is reused, the residual glue in the installing hole of the coolant temperature sensor should be cleared up, and the gaskets of the coolant temperature sensor should be free of obvious damage and through indentation, and the coolant temperature sensor and its installing hole should be checked and free of obvious deformation or damage, and after an appreciate amount of thread sealant is evenly applied on the threads of the oil pressure alarm, then tightening is conducted according to the specified torque.

Caution

The gasket of the coolant temperature sensor is prohibited from being reused.

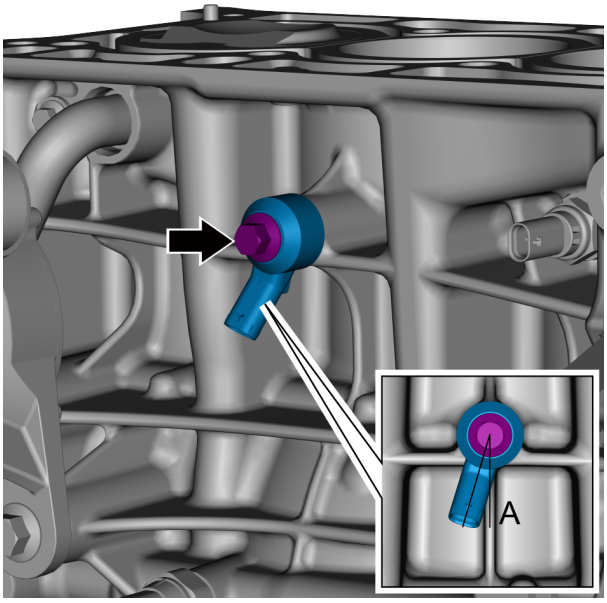
1.2.23.10 Assembling knock sensor

Warning !

When in the channel status, it is not allowed to plug and unplug the connector of the knock sensor with electricity, and it is forbidden to touch the pins of the knock sensor.

Parts that fall or are impacted must be scrapped.

During the storage, transportation and assembling process, there must be anti-static protection measures. It is forbidden to touch the pins of the sensor.



1 The fixing bolt of the knock sensor is installed and fastened.

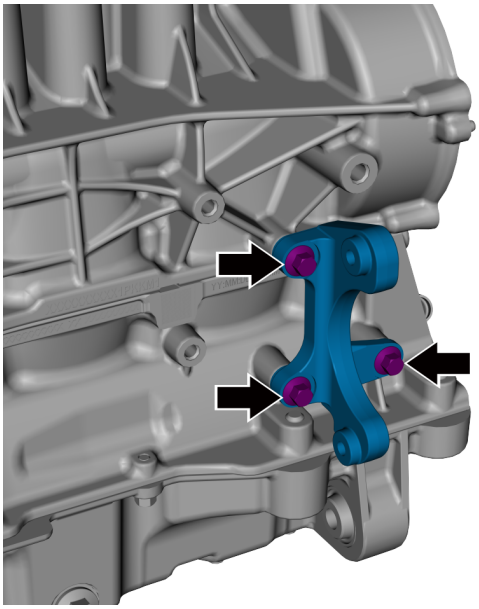
2 The position of the knock sensor is adjusted, the angle of the knock sensor's connector requires a vertical downward clockwise rotation of 17°±5°.

A: 17°±5°

3 The fixing bolt of the knock sensor is fastened.

Torque: 23 N·m

1.2.23.11 Assembling driving shaft bracket



1 The driving shaft brackets are fixed to the cylinder block and the crankcase.

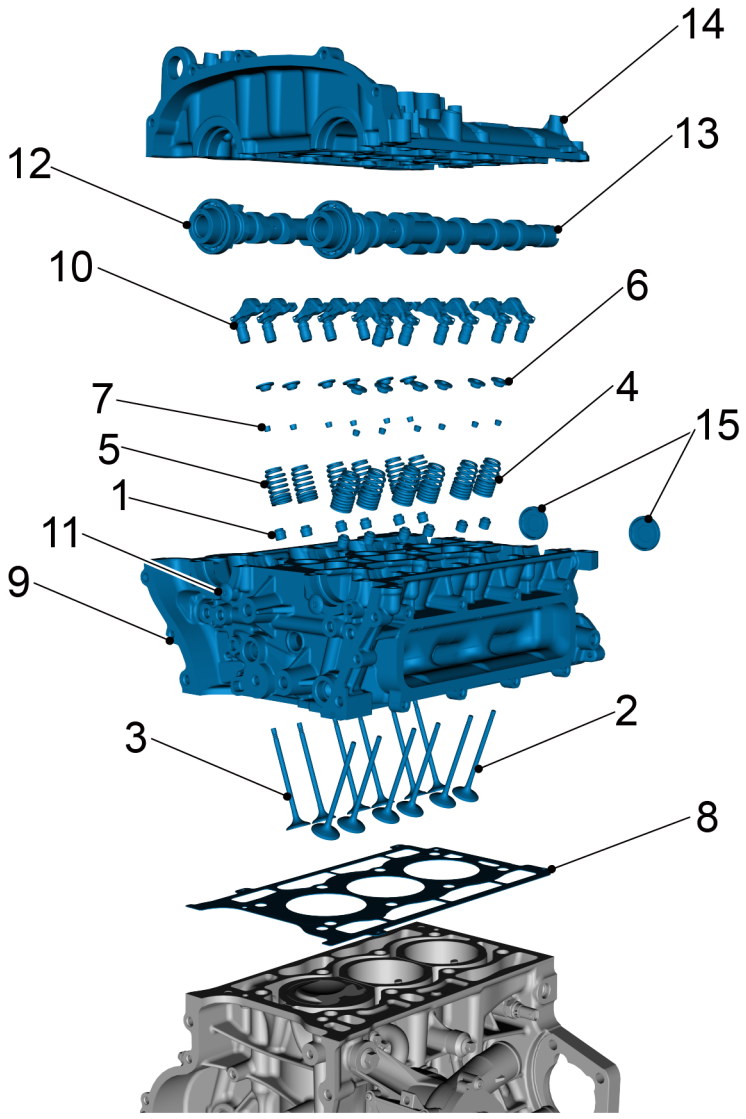
2 The fixing bolts of the driving shaft bracket are installed and fastened.

Torque: 24 N·m

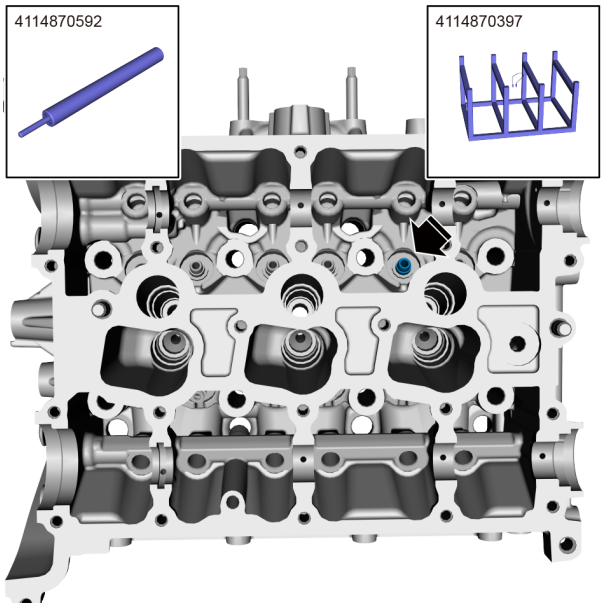
1.2.24 Assembling cylinder head (II)

1.2.24.1 Breakdown drawing of assembling cylinder head (II)

Assembling is conducted in the order indicated in the table.



1. Valve oil seal
2. Intake valve
3. Exhaust valve
4. Intake valve spring
5. Exhaust valve spring
6. Valve spring retainer
7. Valve collet
8. Cylinder gasket
9. Cylinder head
10. roller rocker arm and hydraulic tappet
11. Fastening bolt
12. Exhaust camshaft unit
13. Intake camshaft unit
14. Bearing cap of the camshaft
15. Camshaft blank plug



1.2.24.2 Assembling valve oil seal

1 The cylinder head is put on the valve collet installation auxiliary tool.

2 The oil is applied to the top outer circle of the valve guiding pipe, the oil type and supplier are the same as the engine's filled oil type.

3 The special tool is used to install intake valve oil seal (red) and exhaust valve oil seal (black) on the valve guiding pipe.

Special tool number: 4114870592

Special tool number: 4114870397

Caution

1. The sensitive parts should be carefully assembled to avoid damage.
2. The intake oil seals are disposable parts and must be replaced after disassembly.

1.2.24.3 Assembling valve

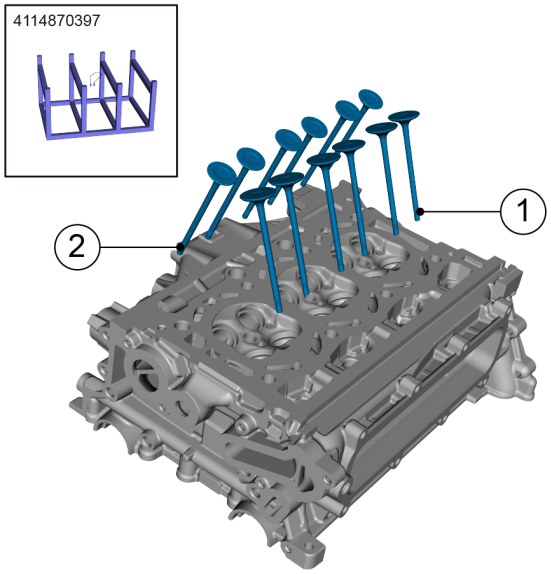
1 The engine oil is applied to the valve rod end with a oil applying height of 3 mm~4 mm.

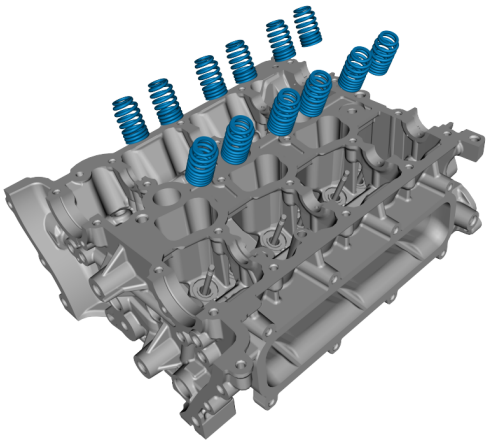
2 The valve is installed in the cylinder block. If the valve is naturally lowered and not installed in place, the valve is pushed gently to be installed to the cylinder head valve seat ring in a fitting mode.

Special tool number: 4114870397

Caution

The intake valve plate part is large, and the exhaust valve is small.

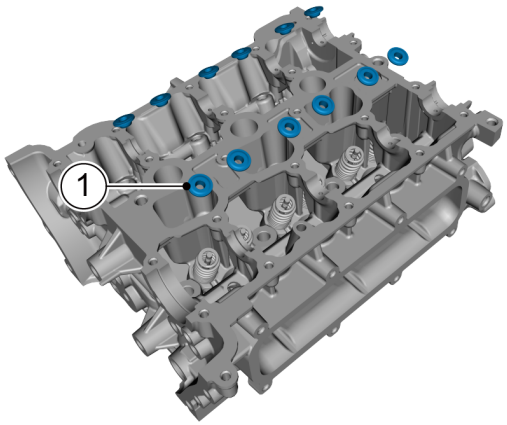




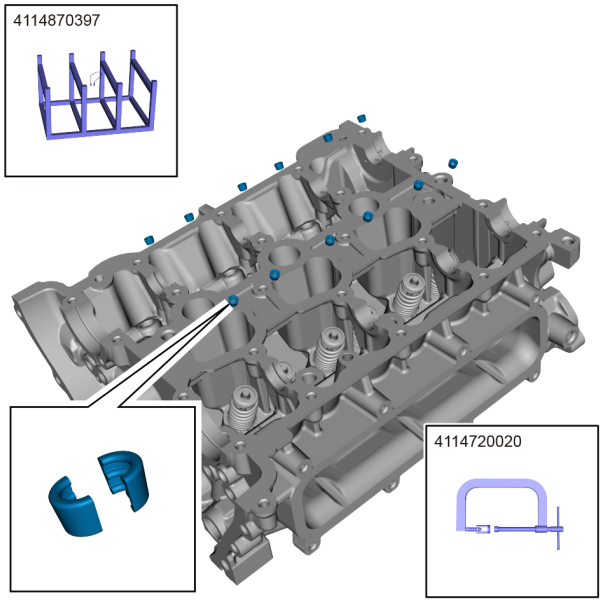
3 The intake valve springs (pink) and the exhaust valve spring (orange) are installed onto the valve.

Caution

The valve spring is honeycomb shaped and should be installed with the small end of the spring facing up. It is avoid to install the valve spring outside the cylinder head spring hole.



4 The valve spring retainer 1 is installed on the top part of the valve spring.



5 The special tool is used to compress the valve spring retainer and the valve lock clamp is installed into the lock clamp hole of the valve spring retainer in clamping mode.

Special tool number: 4114870397

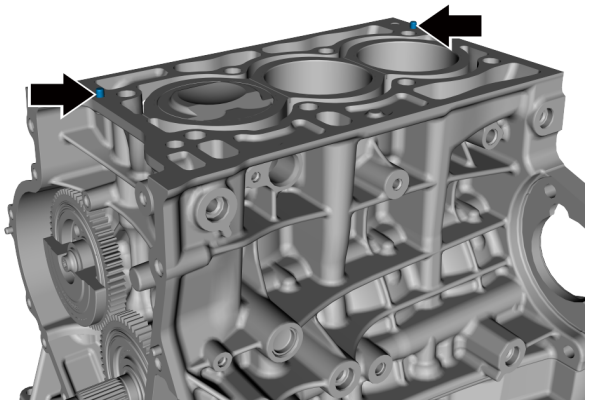
Special tool number: 4114720020

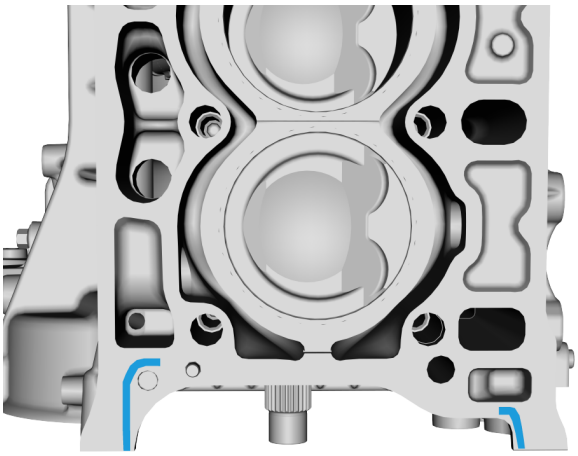
Caution

With the large end of the valve locking clip facing up, the valve spring installing position is checked after assembly is complete to avoid a situation where the valve spring is installed out of position.

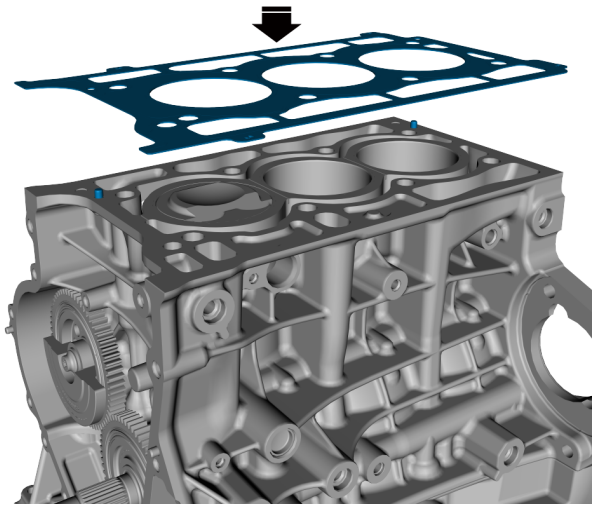
1.2.24.4 Assembling cylinder head

1 The special tool is used to assemble the locating pin into the locating pin hole on the top surface of the cylinder block.
Protruding amount: 5.5±0.5mm





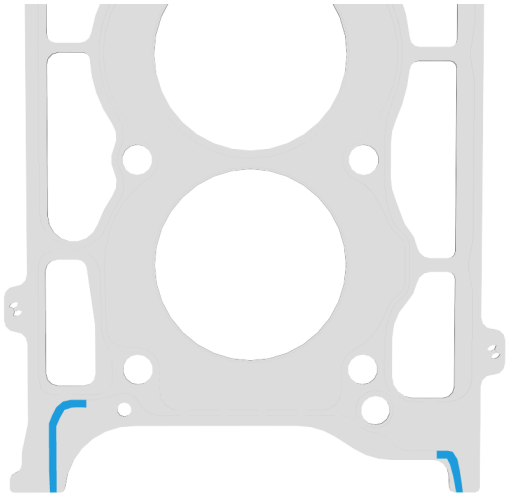
2 The plane sealing silica gel is applied at the front end position of the cylinder block, the rubber product: rubber diameter 3 mm~5 mm.



3 The cylinder gasket is installed on the cylinder block equipped with the locating pin and the hole position is kept correctly.

Caution

The face, marked with "part number", of the cylinder gasket faces up.



4 The plane sealing silica gel is applied at the front end position of the cylinder block, and the rubber diameter is 3 mm~5 mm.

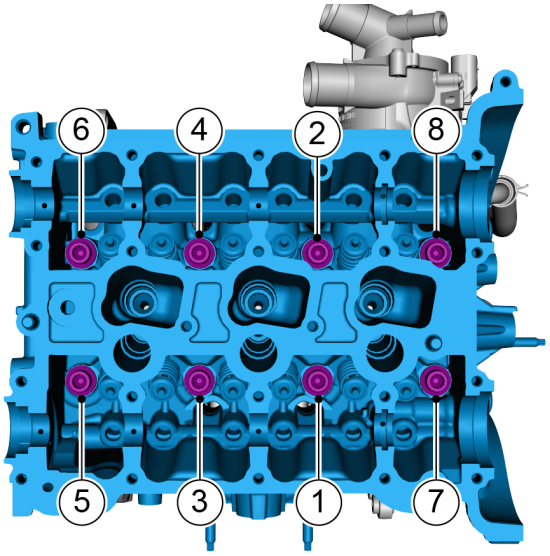
5 The layers of the front end of the cylinder gasket gently push aside, the spacing among the layers is about 2 mm ~ 5mm, using a flat piece with one side coated with the silica gel to smear the front end of the cylinder gasket vertically, silica gel filling is conducted among the layers of the cylinder gasket.

Caution

The operation process does not damage the structure and the coating of the front end of the cylinder gasket itself, the ribs cannot be bent, and the coating cannot be scratched.

Caution

The cylinder gasket is a disposable part, and must be replaced after disassembly.



6 The cylinder head assembly is installed to the cylinder block, when the cylinder head assembly is fixed to the positioning pin, the positioning pin is ensured not to scratch the bottom plane of the cylinder head assembly.

Caution

The bottom plane of the cylinder head assembly is ensured to be free of oil and grease, and the surface is cleaned with a mechanical cleaner.

7 Eight cylinder head bolts are installed and tightened as shown in the figure.

Torque

Step 1: pre-tightened, 10 N·m

Step 2: pre-tightened, 40 N·m

Step 3: checking torque, 40 N·m

Step 4: rotating angle, 120°±5°

Step 5: rotating angle, 120°±5°

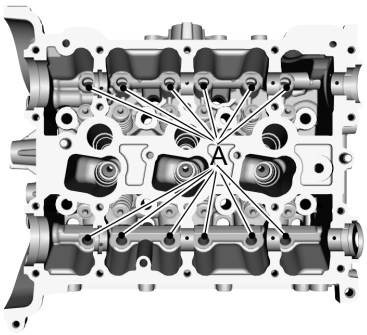
Final torque: 70~160 N·m

Caution

It should be ensured that the cylinder head cover bolt assembly should be assembled within 10 minutes after the cylinder gasket is glued, and the overflowed silica gel at the front end should be removed within 30 minutes.

1.2.24.5 Assembling roller rocker arm and hydraulic tappet

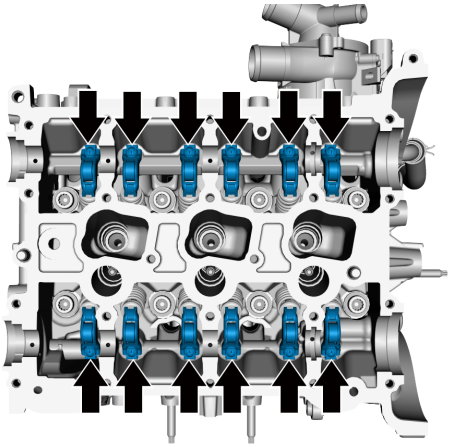
1 An appropriate amount of the engine oil or 10W60 oil is applied to the cylinder head tappet installing holes.



2 The roller rocker arm and the hydraulic tappet are assembled into the end part of the valve rod and the hydraulic tappet.

Caution

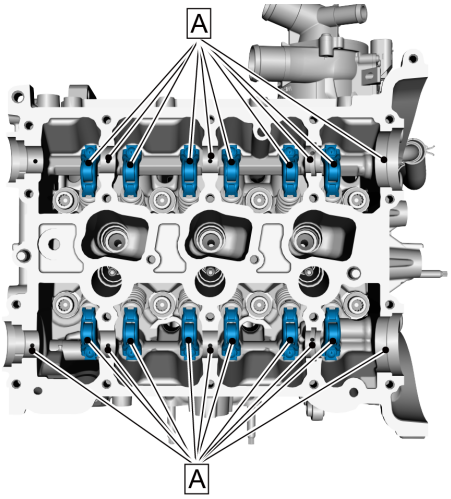
After the assembly is completed, the installation position of the roller rocker arm and the hydraulic tappet should be checked to avoid the situation that the assembly is not in place.

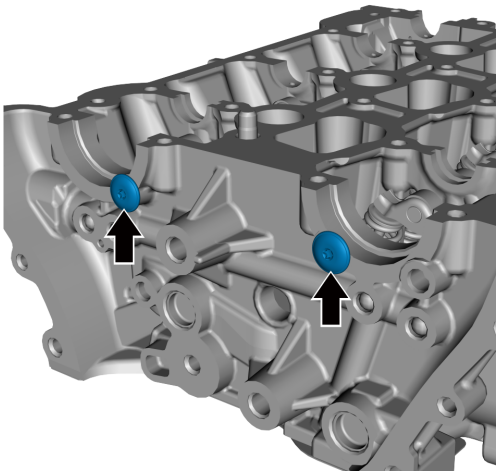


3 An appropriate amount of the engine oil or 10W60 oil is applied to the roller rocker arm and the position (A) of the camshaft bearing hole of the cylinder head.

Caution

Oil must not be applied to the cylinder head bearing holes where the camshaft ball bearings are installed in the first gear.





1.2.24.6 Assembling fastening bolts

The 2 fastening bolts are installed to the corresponding positions on the cylinder head.

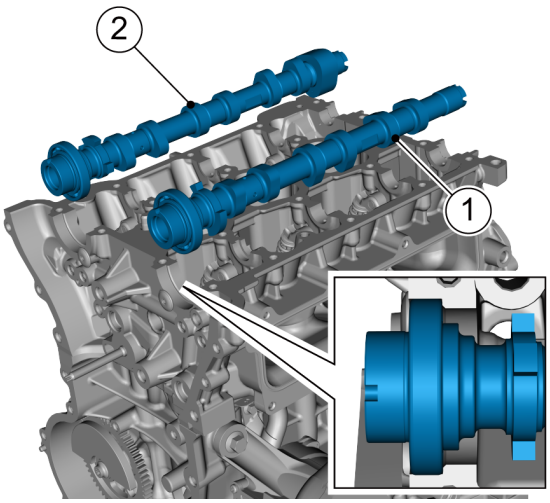
Torque: 9 N·m

Caution

This fastening bolts are left-handed bolts.

1.2.24.7 Assembling camshaft assembly

1 The intake camshaft assembly 1 and the exhaust camshaft assembly 2 are installed to the camshaft holes of the cylinder head.

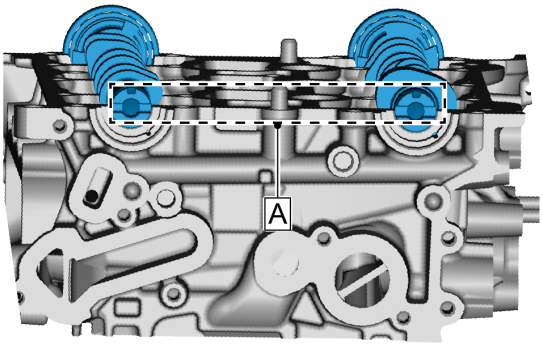


Caution

The camshaft bearings are required to be installed into the installing grooves on the cylinder head when assembling, and the rear ends of the bearings are ensured to be arranged at the positioning end surface of the cylinder head in a fitting mode.

The intake and exhaust camshaft assemblies are not allowed to be assembled wrongly.

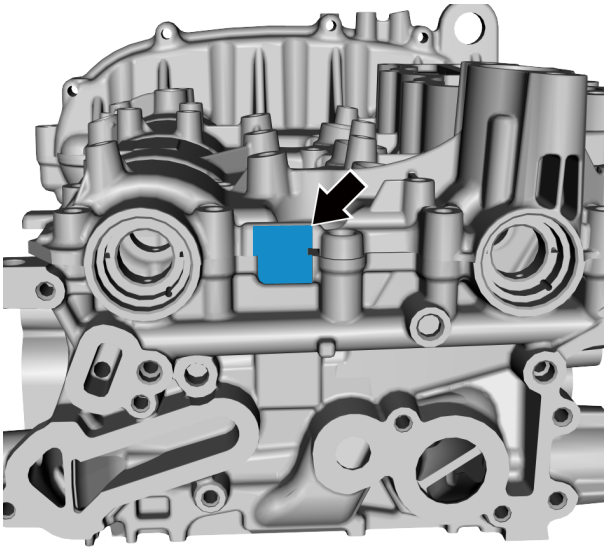
2 The rear end grooves of two camshafts are arranged horizontally with the notches facing upward, as shown in figure A.



Caution

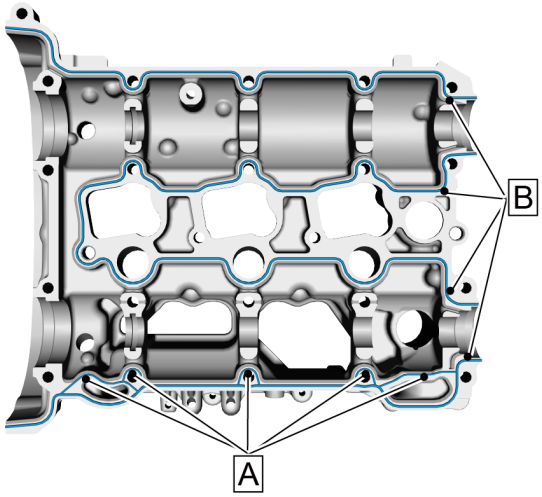
After assembling the camshafts, 1 to 2 drops of the engine oil are required to be dropped on all camshaft journals (except ball bearings) and cams in a coatinig mode.

1.2.24.8 Assembling camshaft bearing cover



Warning !

The number of the camshaft bearing cap and the number of the cylinder head must be kept in consistent.



1 The residual plane sealing silica gel is cleared. The cylinder head and the camshaft bearing cap bonding surface is ensured to be clean, free of oil and grease, and the surface is cleaned with a mechanical cleaner.

2 Gluing (or gluing is conducted on the corresponding position of the cylinder head bonding surface) is conducted on the sealing ring of the camshaft bearing cap according to the track as shown in the figure. The starting position of the silica gel line and the intersection position of the silica gel line are controlled according to the width of 1.5 mm-5 mm.

A: φ1.5 mm±0.5 mm

B: φ2.5 mm±0.5 mm

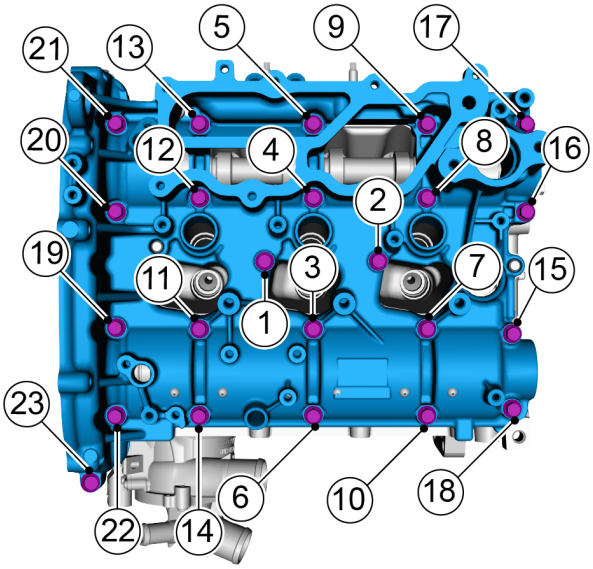
Caution

It is required that the fitting is completed within 10 minutes. If the time is exceeded, the silica gel must be cleared up and reapplied.

3 At least one drop of the engine oil is dropped on each camshaft bearing, then the camshaft bearing cover is assembled to the cylinder head.

Caution

No engine oil on the sealing surface.



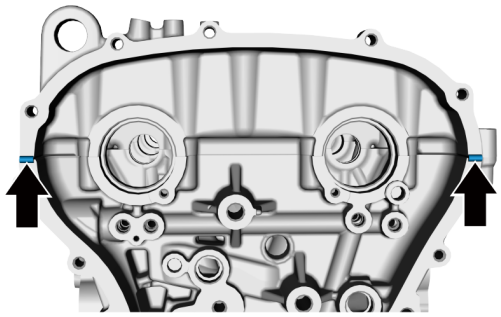
4 The camshaft oil pan bolts are installed, are pre-tightened in orders as shown in the figure, and tightened in orders from 1-23 as shown in the figure.

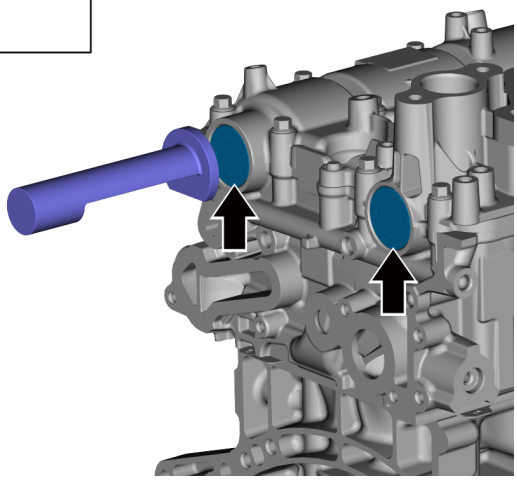
Torque: 17 N·m

5 The spilled silica gel is wiped off from the spark plug holes and injector holes of the camshaft bearing cover so that it does not subsequently fall into the combustion chamber.

Caution

It should be ensured that the camshaft bearing cover bolt should be assembled within 10 minutes after the camshaft bearing cover is tightened, and the overflowed silica gel at the front end should be removed within 30 minutes.





1.2.24.9 Assembling camshaft blanking cap

The special tool is used to install the camshaft blanking cap to the rear end of the cylinder cap assembly in place.

Special tool number: 4114870395

Press-fitting depth: 0.7 mm± 0.4 mm

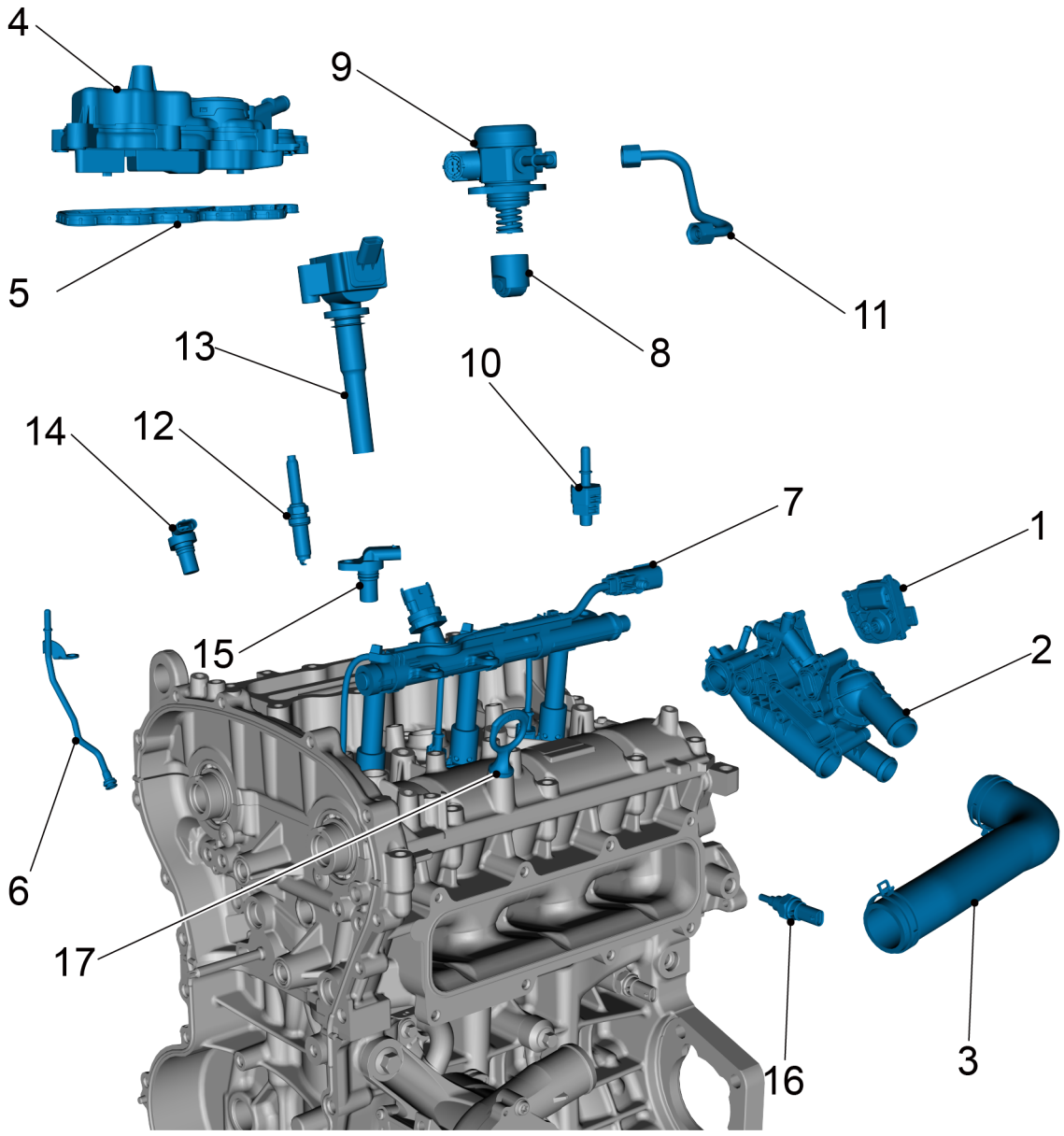
Caution

The camshaft blanking cap is a disposable part, and must be replaced after removal.

1.2.25 Assembling cylinder head (I)

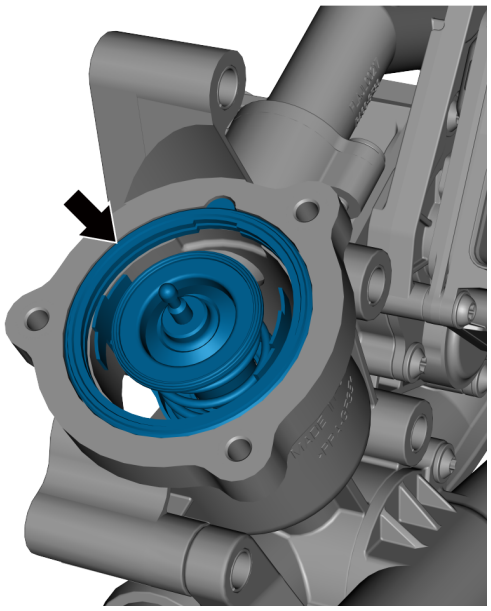
1.2.25.1 Breakdown drawing of assembling cylinder head (I)

Assembling is conducted in the order indicated in the table.

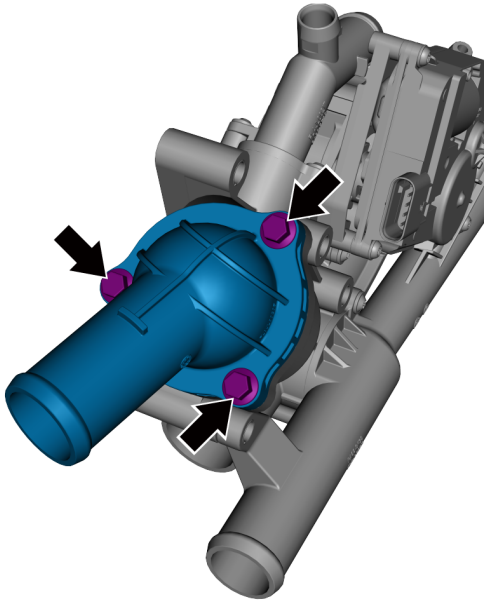


1. Coolant climate control module actuator
2. Coolant temperature controlling module
3. Rubber connecting pipe
4. Oil-gas separator assembly
5. Oil-gas separator and sealing gasket
6. Engine air outlet pipe
7. Fuel rail oil injector assembly
8. Oil pump tappet
9. High-pressure oil pump
10. Ventilation valve assembly
11. High-pressure oil pipe assembly
12. Spark plug
13. Ignition coil
14. Exhaust camshaft position sensor
15. Intake camshaft position sensor
16. Coolant temperature sensor (cylinder head)
17. Dipstick pipe assembly

1.2.25.2 Assembling coolant temperature control module

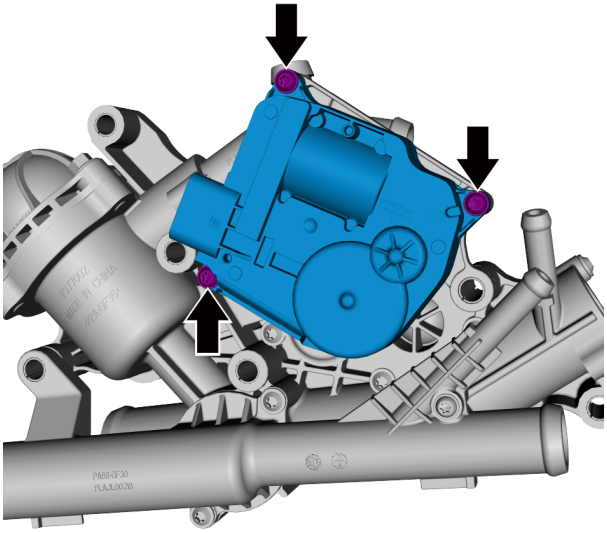


1 Thermostat is installed.

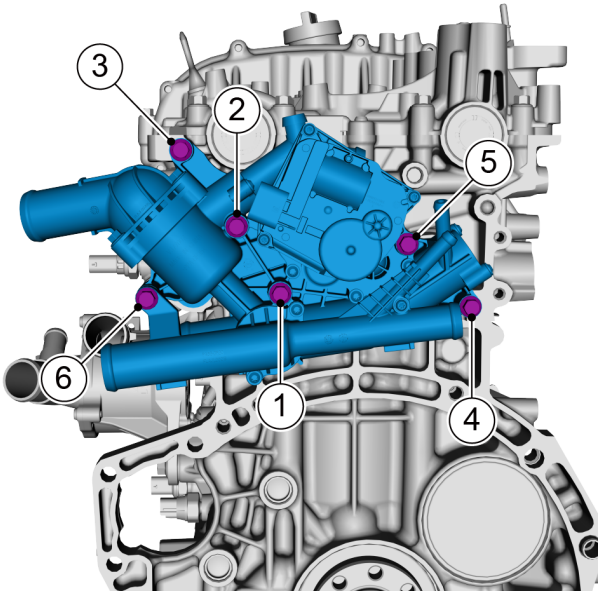


2 The thermostat cover plate is installed and the bolt is tightened.

Torque: 10 N·m



3 The coolant temperature control module actuator is installed and the screws are tightened.
Torque: 1.5 N·m

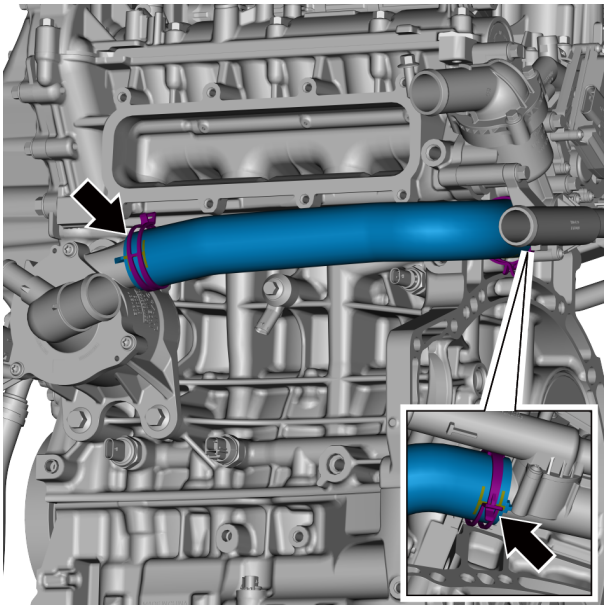


4 Whether the seal ring is damaged or missing is checked. If it is damaged or missing, it needs to be replaced.

5 The coolant temperature control module is installed to the rear end face of the cylinder head, the fixing bolts are installed and pre-tightened, and then the bolts are tightened in the order of 1, 2, 3, 4, 5, and 6.
Torque: 16 N·m

Caution

During the storage, transportation and assembling process, there must be anti-static protection measures. It is forbidden to touch the pins of the coolant temperature controlling module.



1.2.25.3 Assembling rubber connecting pipe

1 The rubber connecting pipe is assembled to the coolant temperature controlling module and the connector of the electronic coolant pump.

Caution

An appreciated amount of cleaner and the water mixed liquor inserting aids (1:10) are applied on the inner wall of the rubber pipe in a smearing mode. Oil substances such as the engine oil are prohibited from being used as the insertion aid.

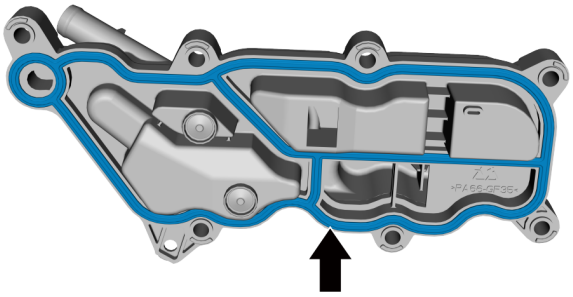
2 The marking of the rubber connecting pipe is aligned with the boss on the electronic coolant pump, the hoop at the end of the water pump connector is tightened firstly, and then the hoop at the end of the coolant temperature control module is tightened.

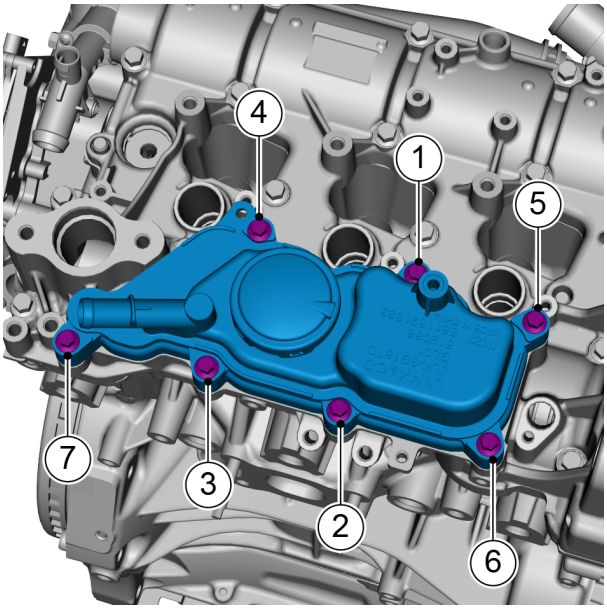
1.2.25.4 Assembling oil-air separator assembly

1 The oil-gas separator is installed.

Caution

Whether the oil-air separator assembly seal is complete and clean is checked, and the position is ensured to be correct.



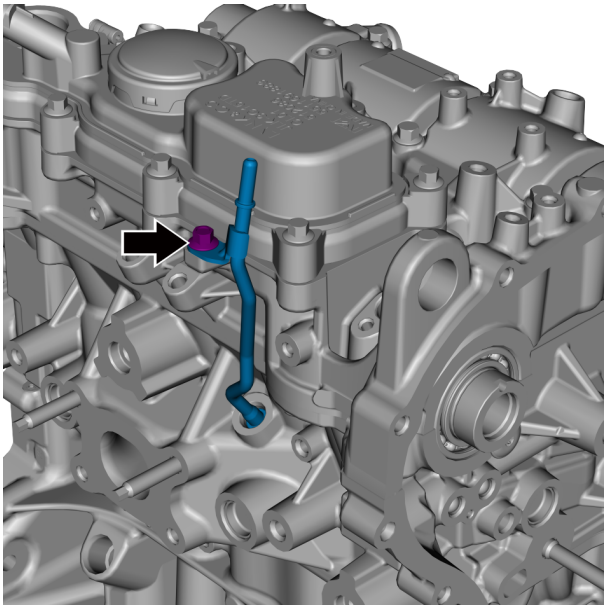


2 The 7 fixing bolts of the oil-gas separator is installed and tightened, and then the bolts are tighten in the order from 1 to 7 as shown in the figure.

Torque

Step 1: pre-tightened force is less than 5 N·m.

Step 2: 9 N·m



1.2.25.5 Assembling engine degassing pipe

1 Whether the O-shaped ring is damaged is checked. If so, it needs to be replaced.

Caution

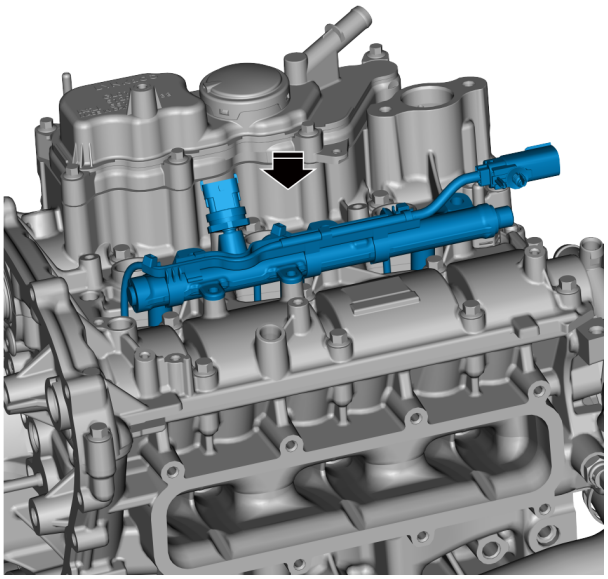
An appreciated amount of P80 and the insertion aids with the lucubrating function is applied on the O-shaped ring. Oil substances such as the engine oil are prohibited from being used as the insertion aid.

2 The degassing pipe with the O-shaped ring is inserted into the installing hole of the cylinder head.

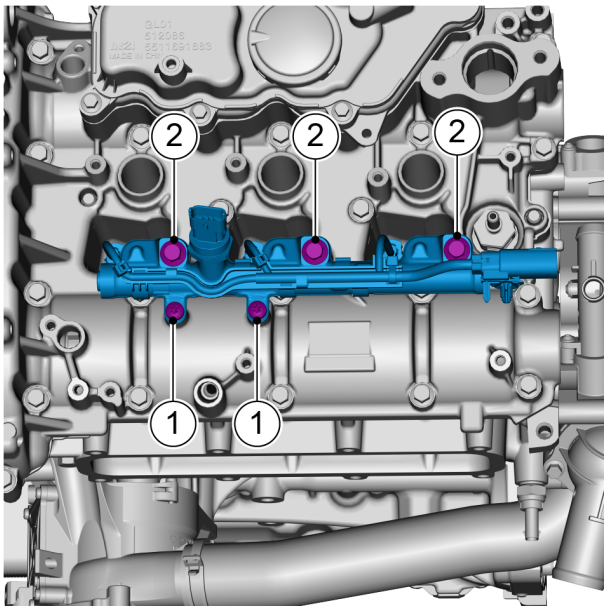
3 The fixing bolt of the degassing pipe are installed and tightened.

Torque: 10 N·m

1.2.25.6 Assembling fuel rail oil injector assembly



1 The fuel rail oil injector assembly is aligned with the oil injector installing holes, the downward force is applied at an even speed along the common axis of the oil injector to release the installing force and allow the self-alignment of the oil injector, and the installing force is applied again to ensure a balanced distribution of the installing force to avoid tensioning of the fuel system.



2 The oil injector fixing bolt 2 is installed and the bolt is pre-tightened until it fits the fuel rail. To ensure parallel installing, the bolt 2 is tightened several times alternately, the bolt is allowed to be screwed in a maximum of 2 to 3 turns at a time, cylinders are tightened in the order of 1, 3, and 2 until the oil rail injector fits the camshaft bearing cover, and then the bolt 2 is tightened to the final torque.

Torque

Step 1: pre-tighten the bolt 2 to fit the fuel rail

Step 2: tighten alternately in the order of cylinders 1, 3 and 2, allowing a maximum of 2~3 turns to be screwed at a time.

Step 3: 23 N·m

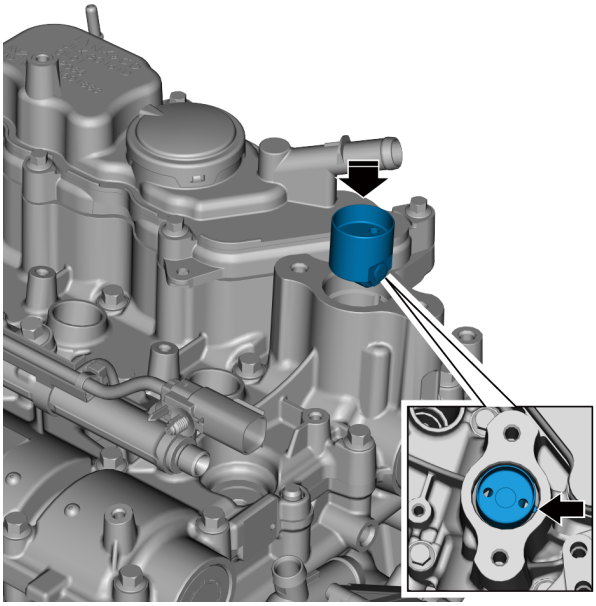
3 The fixing screws 1 of the oil injector is installed tightened.

Torque: 10 N·m

Caution

1. When the fuel rail oil injector assembly is moved, it is not allowed to hold the oil injector or fuel pressure sensor by hand.
2. If the seal ring and the clamping ring are damaged, it must be replaced.
3. Lubrication oil is not allowed to be applied on the Teflon sealing ring of the oil injector.
4. Do not touch part pins.
5. During the power-on operation, it is not allowed to plug in connectors with live parts.
6. Parts are prevented from falling or being impacted, and falling parts must be scrapped.

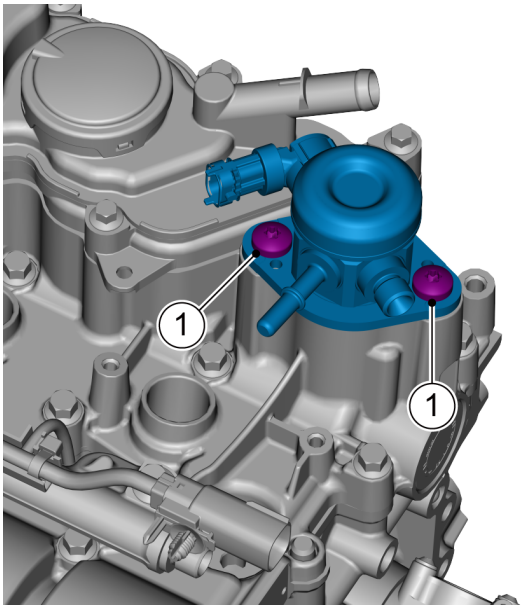
1.2.25.7 Assembling oil pump tappet



The oil pump tappet is installed into the cylinder head in the orientation shown in the figure, with the anti-rotation pin on the tappet aligned with the installing hole pin slot.

Caution

The installing holes or the outer wall of the oil pump tappet is lubricated with appropriate engine oil before the oil pump tappet is installed.



1.2.25.8 Assembling high-pressure oil pump

1 Whether the O-shaped ring is damaged is checked. If so, it needs to be replaced.

2 An appropriate amount of insertion aids with similar to P80 is applied to the position of the high-pressure oil pump installing hole for lubrication.

3 The exhaust camshaft is adjusted until the base circle of the oil pump cam is directly opposite the oil pump installing hole, and the high pressure oil pump is installed into the oil pump installing hole.

4 The fixing screw 1 of the high-pressure oil pump is installed, pre-tightened until fitting the flange surface of the high-pressure oil pump, and during the process, the flange surface of the high-pressure oil pump needs to be ensured to be parallel to the upper surface of the oil pump installing base.

5 The screws are tightened alternately several times, the screws are allowed to be screwed in up to 1~2 turns at a time until the high-pressure oil pump flange fits the upper surface of the oil pump installing base, and tighten to the final torque.

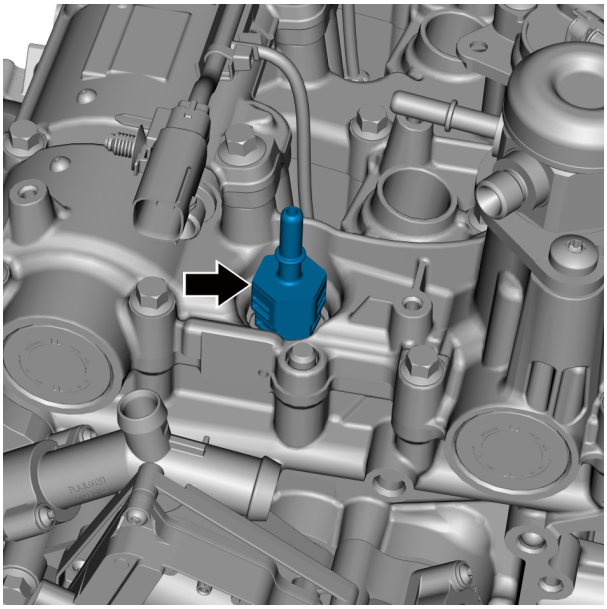
Torque: 23 N·m

6 Finally, the torque of the 2 screws is tightened to avoid false torque.

Caution

When powered on, it is not allowed to plug in and unplug the fuel injector connectors with electricity, and it is forbidden to touch the fuel injector pins.

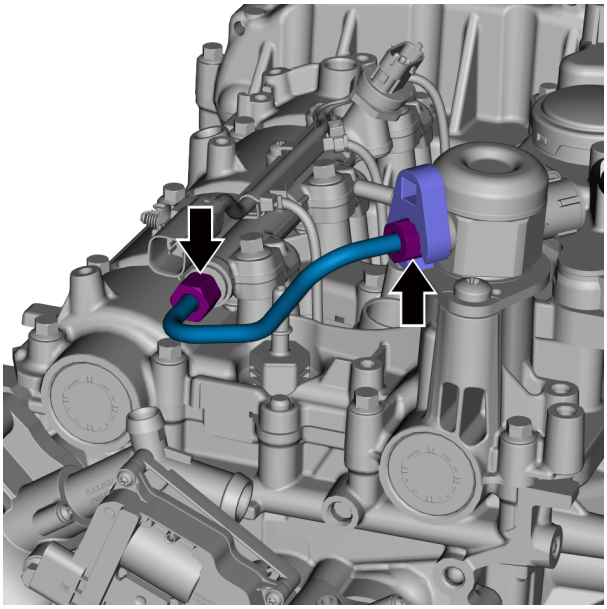
Parts that fall or are impacted must be scrapped.



1.2.25.9 Assembling vent valve assembly

The vent valve assembly is installed and tightened.

Torque: 12 N·m



1.2.25.10 Assembling high-pressure oil pipe assembly

1 Whether the sealing surface of the ball joint of the high-pressure oil pipe assembly is scratched and have other defects is checked. It needs to be replaced if any.

2 The strut head of the high-pressure oil pipe assembly is aligned with the fuel rail oil injector port and the high pressure fuel pump port at the same time to ensure that the strut head of the high-pressure oil pipe is just pressed into the matching parts.

3 The special tool is used to pre-tighten the nuts at both ends of the high-pressure oil pipe assembly, and then tightened the two ends.

4 The special tool is used to pre-tighten the nuts at both ends of the high-pressure oil pipe assembly, and then tighten the two ends.

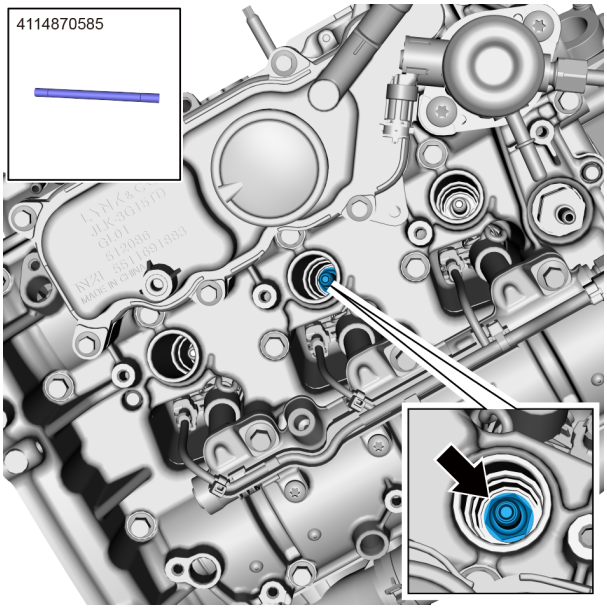
Torque

Step 1: pre-tightened, 15±3 N·m

Step 2: 25 N·m

Caution

The high-pressure oil pipe is disposable. It must be replaced with a new one after each removal.



1.2.25.11 Assembling spark plug

1 Before assembly, the spark plug electrode interval test is conducted. The value of interval is required to be: (0.6 ~ 0.7) mm.

2 Before using the special tool for spark plug, whether the clamping device in the spark plug tool is intact and the clamping force is normal are checked. The spark plug is completely plugged into the tooling, then the spark plug is installed in the cylinder head hole and tightened. The spark plug special tool is not allowed to be tilted under force during tightening.

Special tool number: 4114870585

Torque: 22.5 N·m

Caution

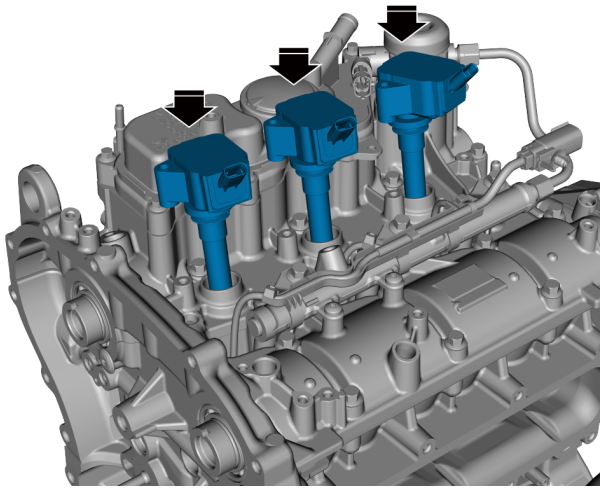
Mixed installation of spark plugs of different suppliers in the same engine is forbidden.

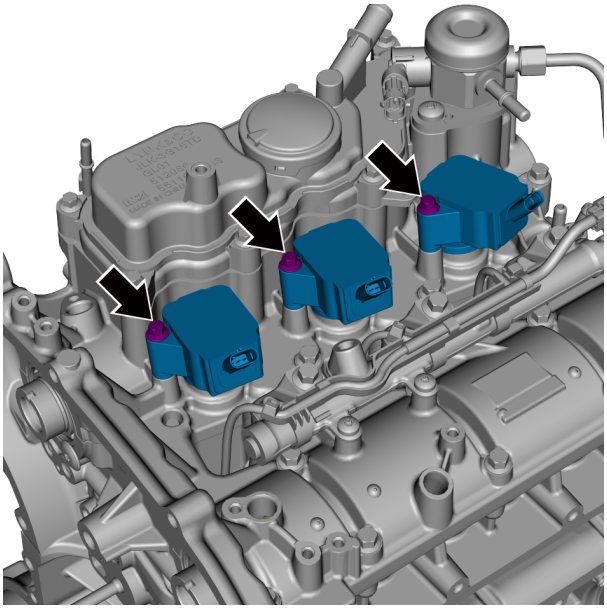
The sparking plug is a quick-wear part that must be scrapped and cannot be reused after falling off or bumping.

The axis of the spark plug installing hole has an angle of 9° with the cylinder hole. When tightening, the spark plug is avoided to be subject to lateral force.

1.2.25.12 Assembling ignition coil

1 The ignition coils are installed into the ignition coil installing holes in an inserted mode, and the bolt holes are aligned.





2 3 fixing bolt of the ignition coil are installed and tightened.

Torque: 10 N·m

Caution

Mixed installation of spark plugs of different suppliers in the same engine is forbidden.

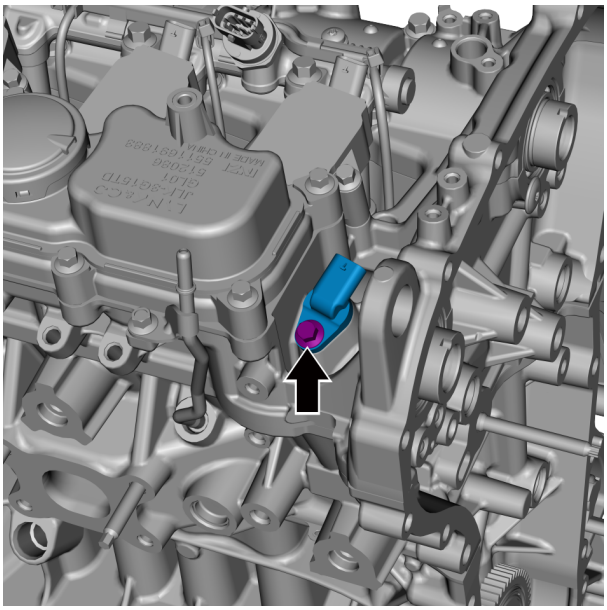
The ignition coil needs electrostatic protection, and electrostatic protection measures must be taken during storage, transportation and assembly. In the power-on state, it is not allowed to plug and unplug the ignition coil connectors, and it is forbidden to touch the ignition coil pins.

Parts that fall or are impacted must be scrapped.

1.2.25.13 Assembling exhaust camshaft position sensor

Warning !

The camshaft phase sensor needs electrostatic protection, and the electrostatic protection measures must be taken during storage, transportation and assembly; when the power is on, it is not allowed to plug and unplug the connectors of the camshaft phase sensor, and it is forbidden to contact the pins of the camshaft phase sensor.



1 An appropriate amount of engine oil, silicone oil, P80 or other insertion aids with the lubricating function are dipped, and evenly at the chamfered angle position of the installing hole are applied with them.

2 The fixing bolt of the exhaust camshaft position sensor is installed and tightened.

Torque: 10 N·m

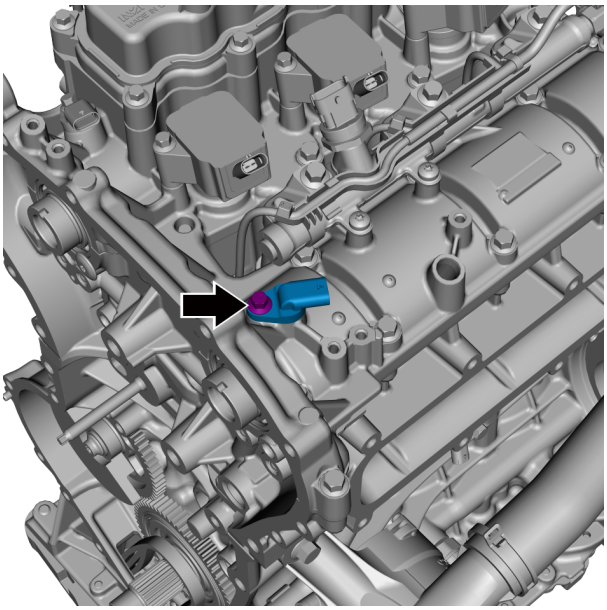
Caution

Sensitive and vulnerable parts need to be operated carefully.

1.2.25.14 Assembling air intake camshaft position sensor

Warning !

The camshaft phase sensor needs electrostatic protection, and the electrostatic protection measures must be taken during storage, transportation and assembly; when the power is on, it is not allowed to plug and unplug the connectors of the camshaft phase sensor, and it is forbidden to contact the pins of the camshaft phase sensor.



1 An appropriate amount of engine oil, silicone oil, P80 or other insertion aids with the lubricating function are dipped, and evenly at the chamfered angle position of the installing hole are applied with them.

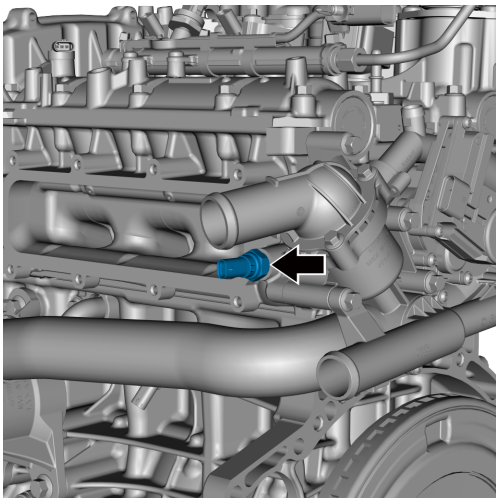
2 The fixing bolt of intake camshaft position sensor is installed and tightened.

Torque: 10 N·m

Caution

Sensitive and vulnerable parts need to be operated carefully.

1.2.25.15 Assembling coolant temperature sensor (cylinder head)



1 Whether there is visible deformation or damage on the installing hole threads is checked.

2 The coolant temperature sensor is installed on the cylinder block and tighten.

Torque: 15 N·m

Caution

It is prohibited to touch the pins of the coolant temperature sensor.

It is prohibited to plug or unplug the connector of the water temperature sensor alarm (cylinder head).

Parts that fall or are impacted must be scrapped.

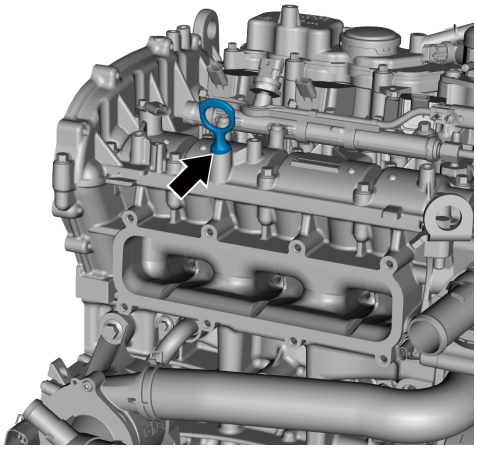
If the coolant temperature sensor (cylinder head) is reused, the residual glue in the installing hole of the coolant temperature sensor should be cleared up, whether the gaskets of the coolant temperature sensor is free of obvious damage and through indentation, and the coolant temperature sensor and its installing hole threads are free of obvious deformation or damage are checked, and after an appreciate amount of thread sealant is evenly applied on the threads of the oil pressure alarm, tightening is conducted according to the specified torque.

Caution

The gaskets of the coolant temperature sensor are prohibited from being reused.

1.2.25.16 Assembling dipstick assembly

The oil dipstick is inserted into the camshaft bearing cover installing hole.



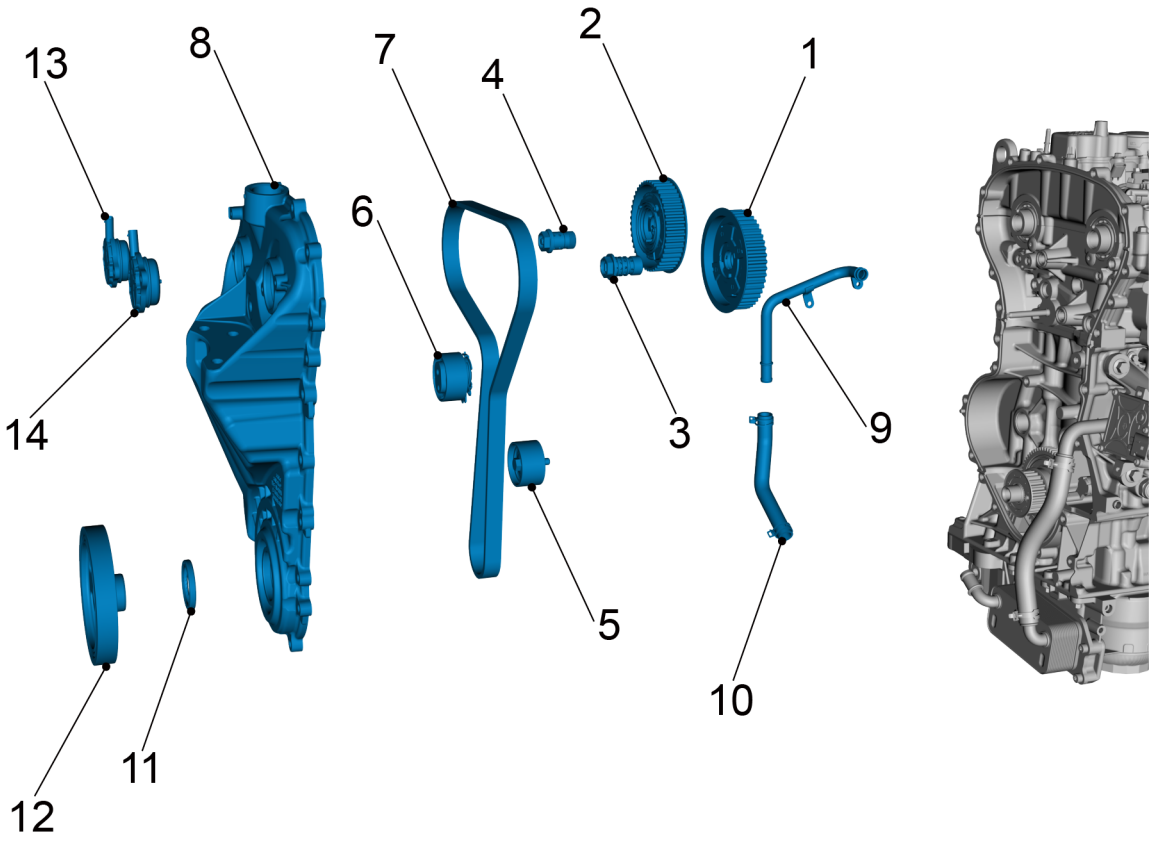
Caution

The seal ring or oil pump installing hole of the dipstick are lubricated with silicone oil.

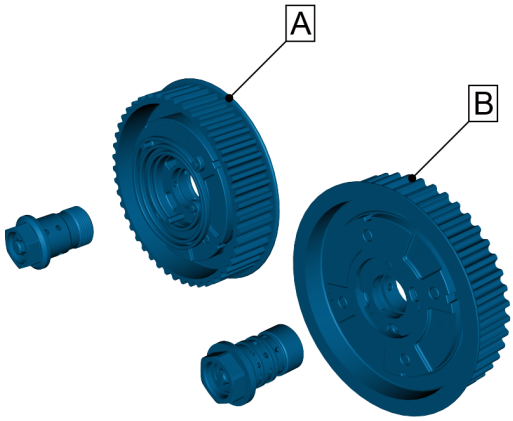
1.2.26 Assembling timing system

1.2.26.1 Breakdown drawing of assembling timing system

Assembling is conducted in the order indicated in the table.



1. Intake VVT assembly
2. Exhaust VVT assembly
3. Intake-side central oil control valve
4. Exhaust-side central oil control valve
5. Timing idler
6. Timing belt tensioning pulley
7. Timing belt
8. Timing belt guard
9. Oil cooler water inlet pipe
10. Oil cooler inlet pipe assembly
11. Crankshaft front oil seal
12. Vibration dampening pulley assembly
13. Exhaust center electromagnet
14. Intake/exhaust center electromagnet



1.2.26.2 Assembling VVT assembly

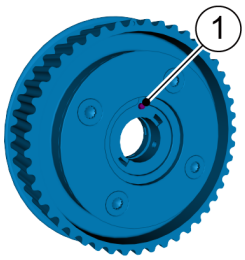
Warning !

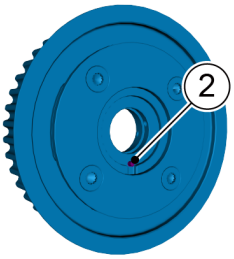
It is prohibited to mix the central oil control valve, the intake/exhaust VVT assembly, and the electromagnet from different suppliers on the same engine; and parts from the same supplier must be used.

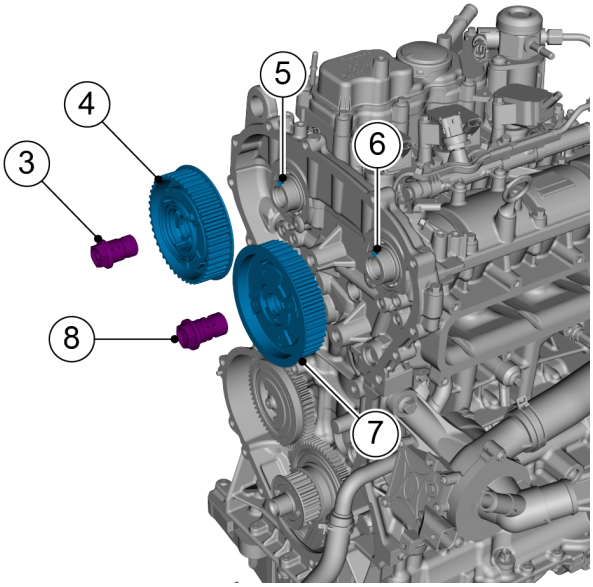
1 The intake side and exhaust side of the VVTs and the center oil control valve are different, do not install them backwards. The exhaust VVT belt stopper is on the inside and the intake VVT belt stopper is on the outside. The exhaust side oil control valve is a circular structure and the intake side oil control valve is a long structure.

A: exhaust VVT

B: intake VVT







2 The intake VVT assembly (7) and exhaust VVT assembly (4) are assembled to the camshaft by using the center oil control valve (3) and the center oil control valve (8) respectively (the VVT assembly can be rotated at a small angle relative to the camshaft).

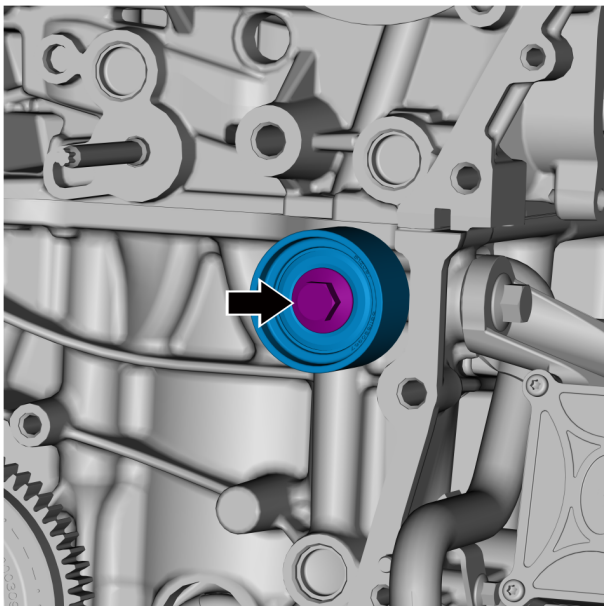
Caution

1. If there's no deformation or damage after disassembly, it can be used again, only being permitted for two times of disassembly.
2. The locating pins (1) and (2) on the intake and exhaust VVT assembly are arranged into the camshaft pin holes (5) and (6) in an inserted mode respectively.

3 The intake and exhaust VVT assemblies (4) and (7) are rotated clockwise until the VVT's pins make contact with the right side of the camshaft's grooves (5) and (6).

Caution

The center oil control valves (3) and (4) are pre-installed to the flange surface to be fitted against the intake VVT assembly (7) and the exhaust VVT assembly (4) respectively, and the force does not need to be tightened to the specified torque.

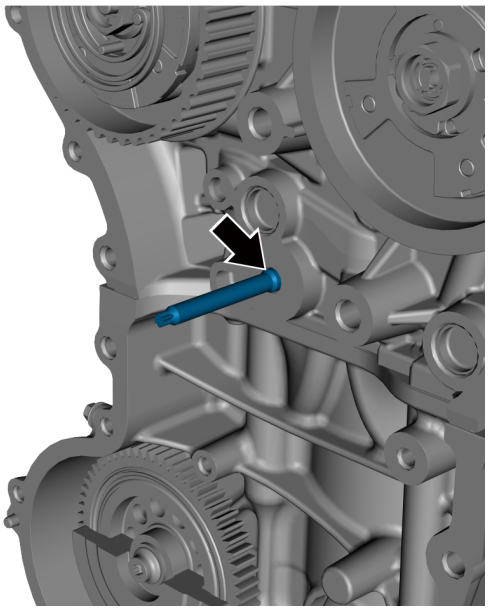


1.2.26.3 Assembling timing Idler

The timing idler is installed and the bolt is tightened.

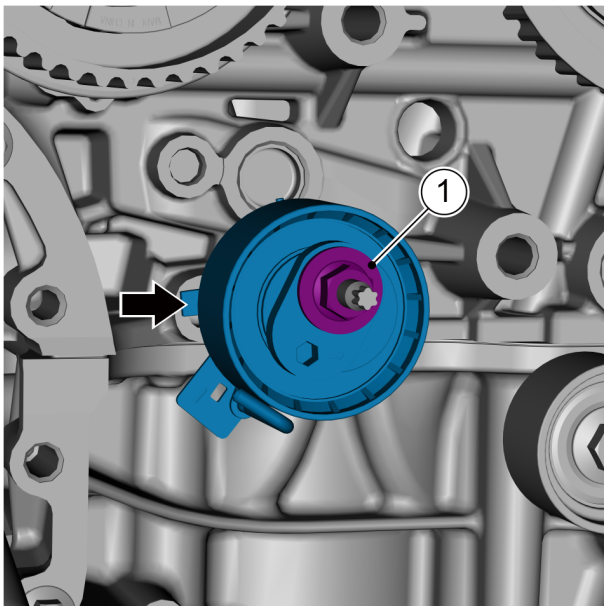
Torque: 25 N·m

1.2.26.4 Assembling timing belt tensioner pulley

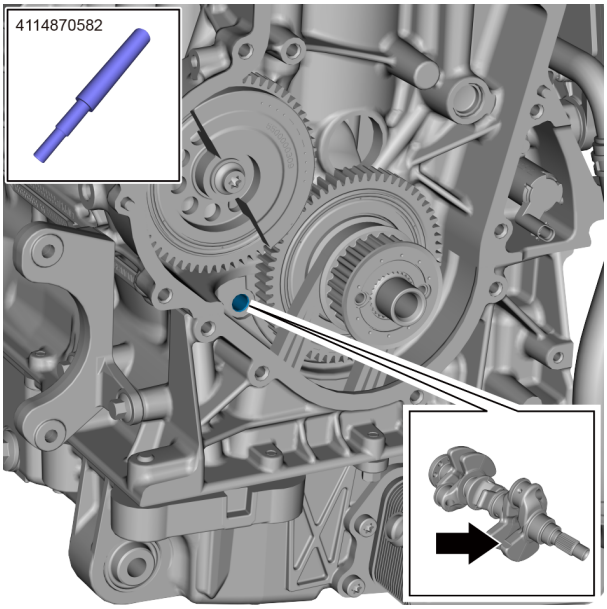


1 The stud is installed on the cylinder head.

Torque: 10 N·m



2 The timing belt tensioner pulley is installed and the rear end protruding point of the timing belt tensioner pulley are placed at the arrow position, and the timing belt tensioner pulley fixing nut 1 is manually pre-tightened.

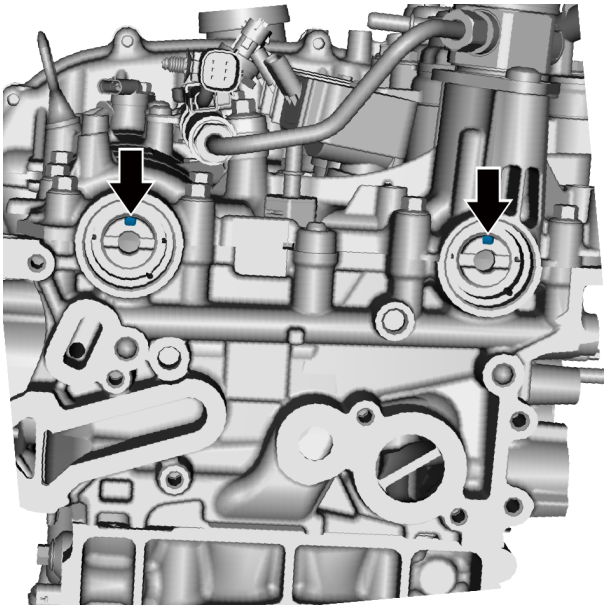


1.2.26.5 Crankshaft zero position alignment

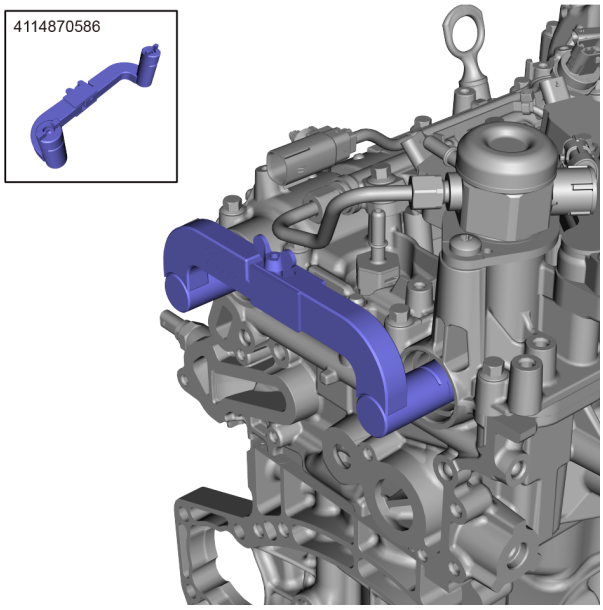
If the crankshaft is in the zero position is determined with the crankshaft zero position special tool (by rotating the crankshaft counterclockwise, if it does not rotate, the crankshaft is in the zero position).

Special tool number: 4114870582

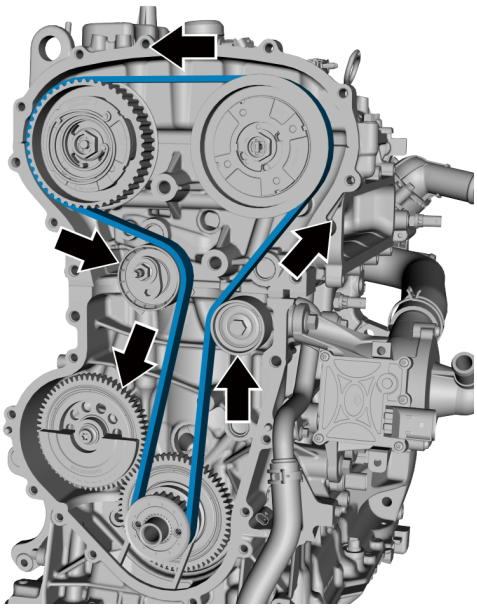
1.2.26.6 Camshaft position alignment



1 The intake/exhaust camshaft is adjusted to the position shown in the figure: notch faces up, and the two end grooves are horizontal.



2 The camshaft rear end alignment special tool is inserted to ensure that the camshaft is in the zero position.
Special tool number: 4114870586



1.2.26.7 Assembling timing belt

1 One person is required to assist before assembling the belt, the crankshaft rotation tool is used to rotate the crankshaft in the counterclockwise direction, the crankshaft is fixed to ensure it is in the zero position. When assembling the belt, the belt and the crankshaft pulley position are assisted in a fitting mode to prevent misalignment of the belt.

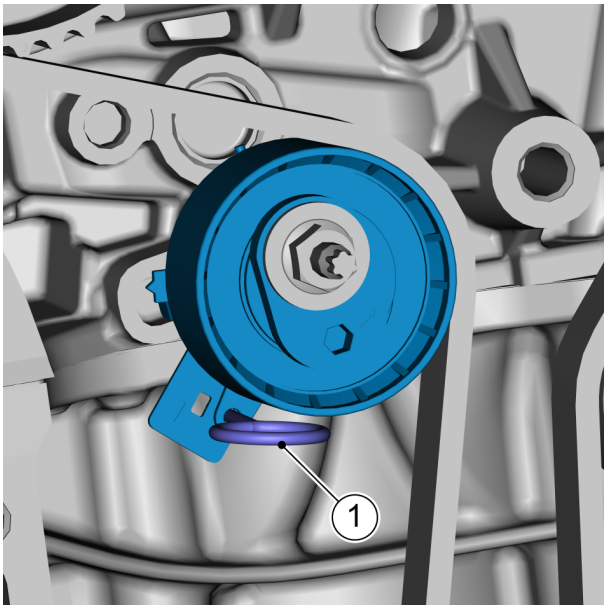
2 The timing belt is installed from the crankshaft timing belt pulley counterclockwise position. After assembling the belt assembly, whether the belt position is between the VVT belt pulley is confirmed, and the intake-side central oil control valve and the exhaust-side central oil control valve are loosened by tightening.

Caution

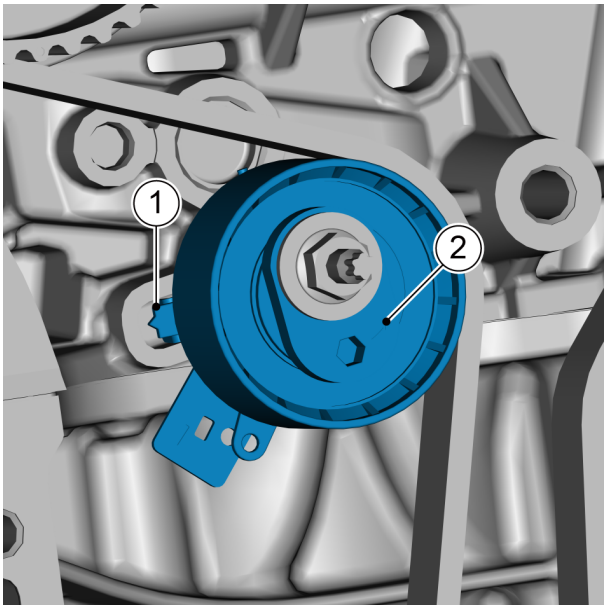
It is strictly forbidden to bend the timing belt, in case of special circumstances, it is necessary to meet the minimum bending radius being greater than 50 mm.

The assembly of the high pressure oil pump must be completed before assembling the timing belt.

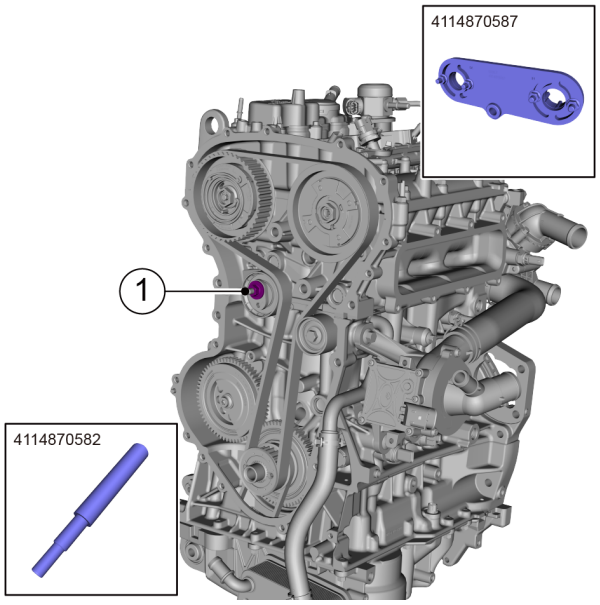
1.2.26.8 Alignment timing



1 The bolt (1) of the timing belt tensioner is pulled up.
Special tool number: 4114870408

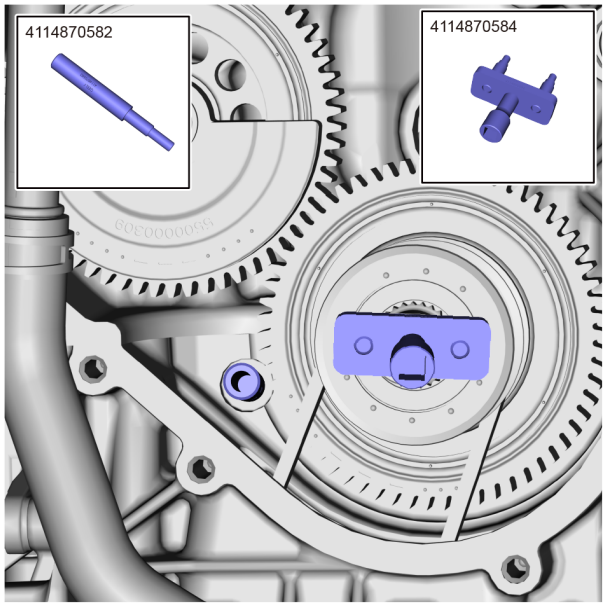


2 The tensioner adjusting arm (1) rotates counterclockwise and the tensioner assembly is in the position shown (the tensioner pointer (2) points into the cylinder head limit groove).

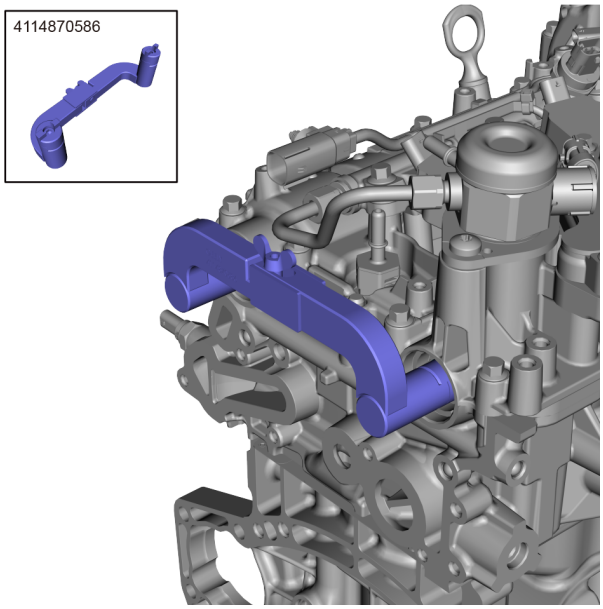


3 The fixing nut (1) is pre-tightened to ensure that the tensioner does not rotate.
Pre-tightening torque: 10 N·m

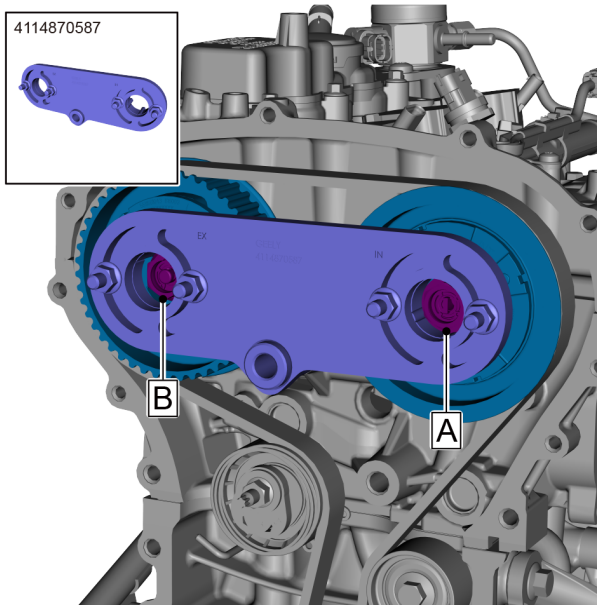
4 The special tool for fixing the VVT is arranged onto the intake and exhaust VVT assembly in an inserted mode.
Special tool number: 4114870587



5 The crankshaft is ensured to be in the zero position, if the crankshaft rotates counterclockwise, the crankshaft does not rotate, the crankshaft is in the zero position.
Special tool number: 4114870582
Special tool number: 4114870584

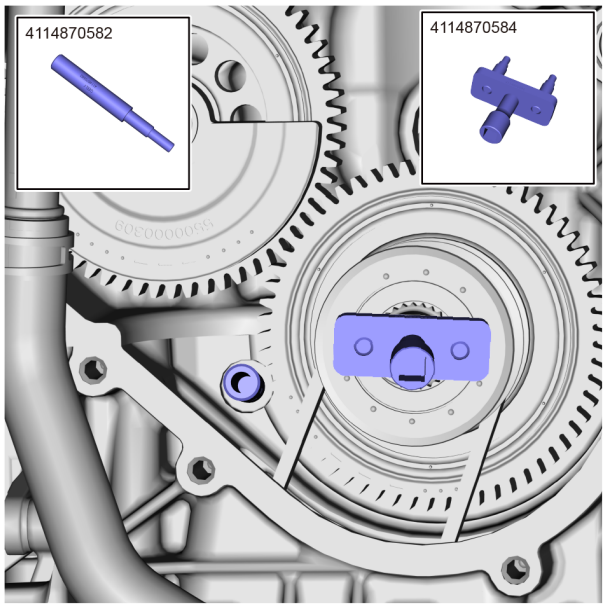


6 The camshaft is ensured in the zero position, the special tool is visually checked at the rear end of the camshaft to be in the correct position.
Special tool number: 4114870586

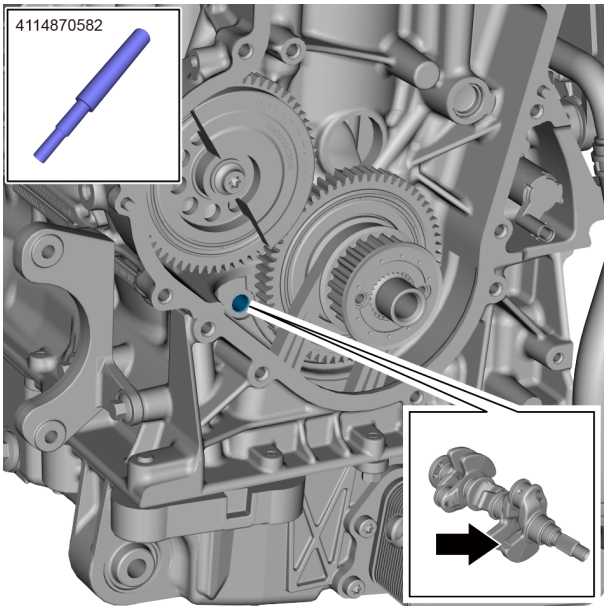


7 The special tool for fixing the VVT is locked and the intake side central oil control valve and the exhaust side oil control valve B are tightened.
Special tool number: 4114870587
Torque:
Step 1: 50 N·m
Step 2: 30°±2°

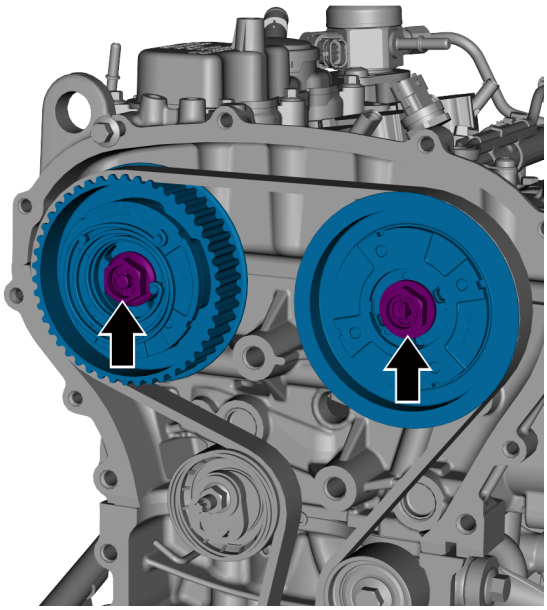
8 The VVT special tool, the crankshaft zero position special tool and the camshaft rear end positioning special tool are removed.



9 The crankshaft zero position special tool is arranged in an inserted mode after the crankshaft rotates 2 turns clockwise.
Special tool number: 4114870582
Special tool number: 4114870584

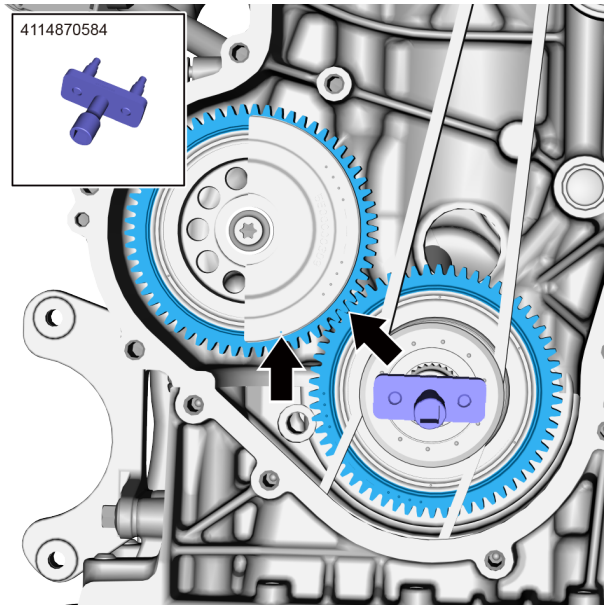


10 The crankshaft rotates counterclockwise to ensure that the head part of its special tool is in contact with the small plane of the crankshaft's first balancing block and that the crankshaft is in the zero position, and finally the camshaft rear end locating special tool is installed to check that the camshaft is in the zero position or not.
Special tool number: 4114870582

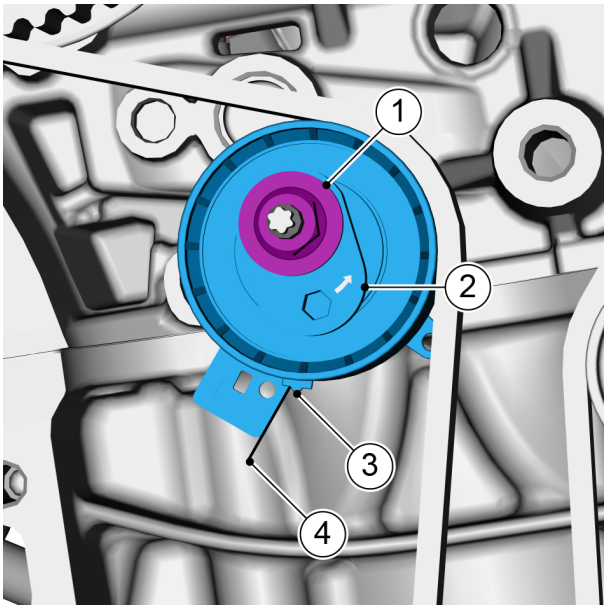


11 If the camshaft is not in the zero position, the center oil control valve and the center oil control valve are loosened, and the alignment timing is conducted again by following the steps 1.2.26.7 to 1.2.26.8.

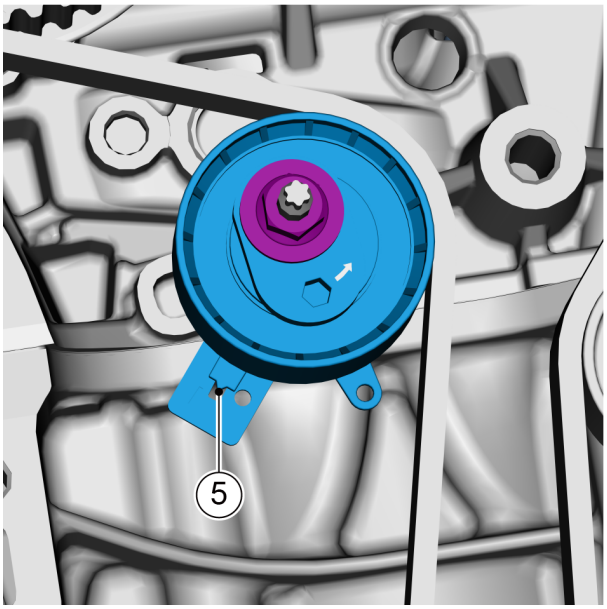
1.2.26.9 Adjusting timing belt tensioner pulley



1 The crankshaft is rotated by 690° clockwise until the 6th tooth of the balance shaft gear after the distance marking point is fully engaged with the crankshaft gear.
Special tool number: 4114870584



2 The fixing nut (1) is loosened, and the tensioner adjusting arm (2) is adjusted clockwise until the tensioner pointer (3) reaches below the position of the lower edge (4) of the tensioner base plate.



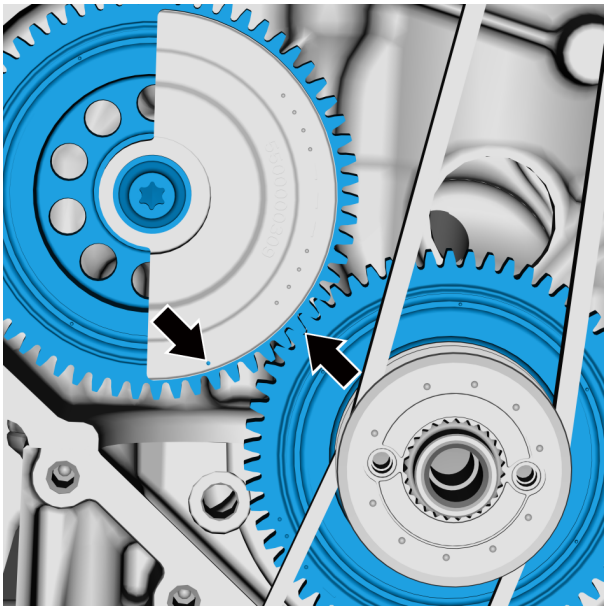
3 Then the direction is changed to adjust the tensioner adjusting arm (2) counterclockwise until the tensioner pointer (3) is in the middle of the notch (5).

4 The tensioner adjusting arm (2) is locked, the fixing nut (1) is tightened and the tensioner pointer (3) is ensured to remain in the notch (5).

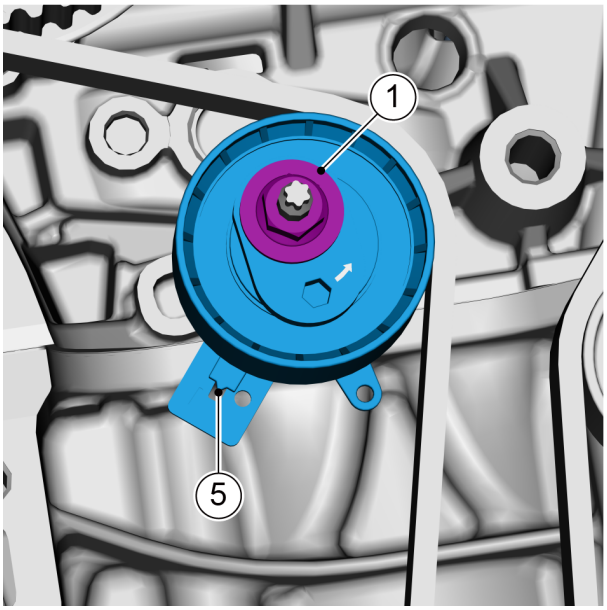
Torque

Step 1: 10 N·m

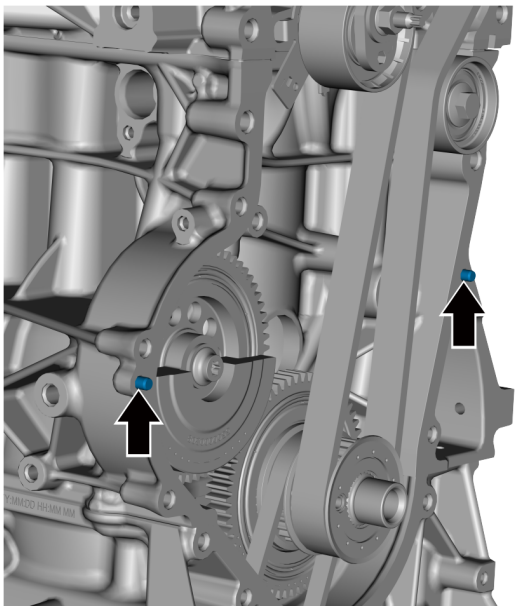
Step 2: 25 N·m



5 The crankshaft is rotated by 2 clockwise until the 6th tooth of the balance shaft gear after the distance marking point is fully engaged with the crankshaft gear. The pointer position of the timing belt tensioner should be in the notch as shown in the figure.



6 If the pointer position of the timing belt tensioner is not in the notch (5), the fixing nut (1) is loosened and the timing belt tensioner is readjusted according to the above steps.



1.2.26.10 Assembling timing belt guard locating pin

The locating pin is assembled to the locating pin hole on the top end surface of the cylinder block.

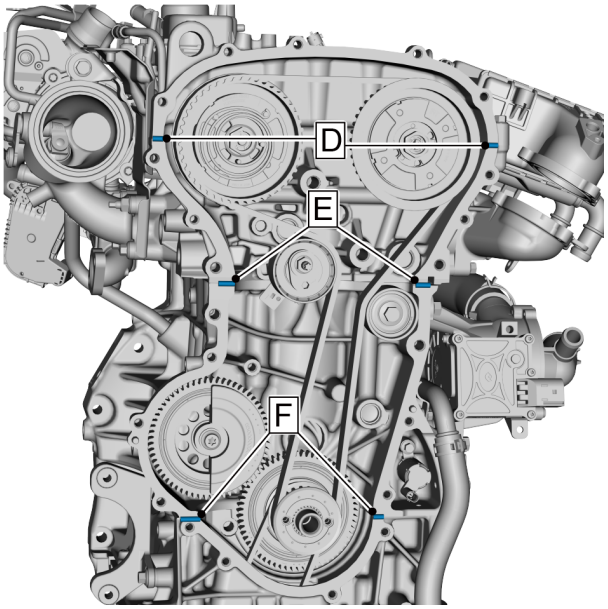
Caution

The protrusion of the locating pin is confirmed to be (5.5±0.5) mm after assembly.

1.2.26.11 Assembling timing belt guard

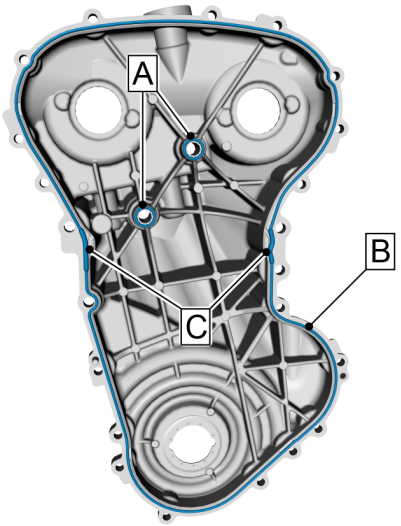
Caution

The dust-free cloth is used and dipped with the cleaning agent to clean the installing surfaces of the timing belt guard, the crankcase, the cylinder block, the cylinder head and the camshaft bearing cap. After the cleaning agent is completely evaporated, Loctite 1455 is sprayed on a clean dust-free cloth to wipe the bonding surfaces of the timing belt guard, the crankcase, the cylinder block, the cylinder head and the camshaft bearing cap. It is required that the amount of residual Loctite 1455 surface adhesion agent on the bonding surfaces is controlled, the upper surfaces of the wiped bonding surfaces are wet, but there is no beads of water by shrinking. After the Loctite 1455 surface adhesion agent on the bonding surfaces dry, the Loctite 1455 surface adhesion agent is not allowed to wipe for the second time.

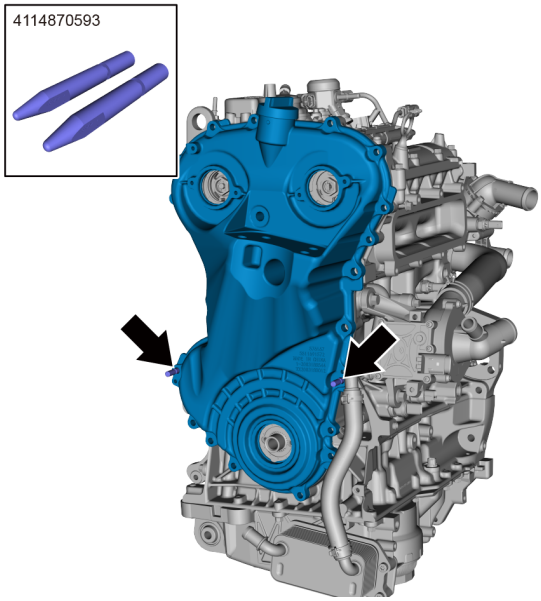


1 Before assembling the timing belt guard, the excision treatment of the spilled glue is conducted on the crankcase, the cylinder block, the cylinder head and the camshaft bearing cover front surface, the specific location as shown in figure D, E, and F.

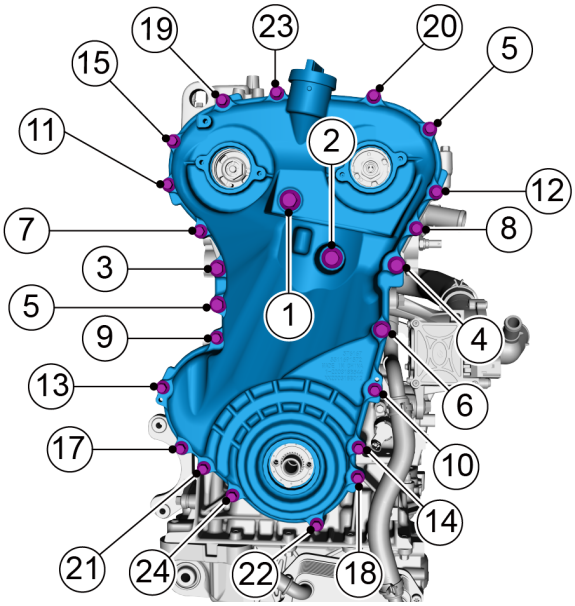
2 A plane sealant is applied on the position between the camshaft bearing cover and the cylinder head and the three bonding surfaces formed between the cylinder head and the cylinder block, the cylinder head and the cylinder block and the part between the crankcase and the sealing end surface of the timing belt guard, the sealant diameter is 4 mm ~ 6 mm, the sealant applying position and the trajectory are shown as in figure D, E, and F.



3 The installing surface of the timing belt guard is coated with the plane sealant, the sealant diameter is 2.5 mm ~ 4mm, of which the cylinder block - cylinder head T-type area of the sealant diameter is 4.5 mm ~ 6mm (in the C position in the figure), the sealant coating position and the track are showed in figures A, B, and C, the starting position of the sealant line within the range of 10mm is controlled in accordance with the width of 2.5 mm~ 6 mm.



4 The timing belt guard guiding pin is installed, and the timing belt guard is installed.
Special tool number: 4114870593



5 The timing belt guard fixing bolts are installed, the bolts are pre-tightened firstly in the order of 1-24 shown in the figure, then the bolts are tightened.

Caution

After the cylinder body coating with the sealant, final tightening should be completed within 10 minutes. If it exceeds 10 minutes, the sealant should be removed and the operation is started again.

Torque:

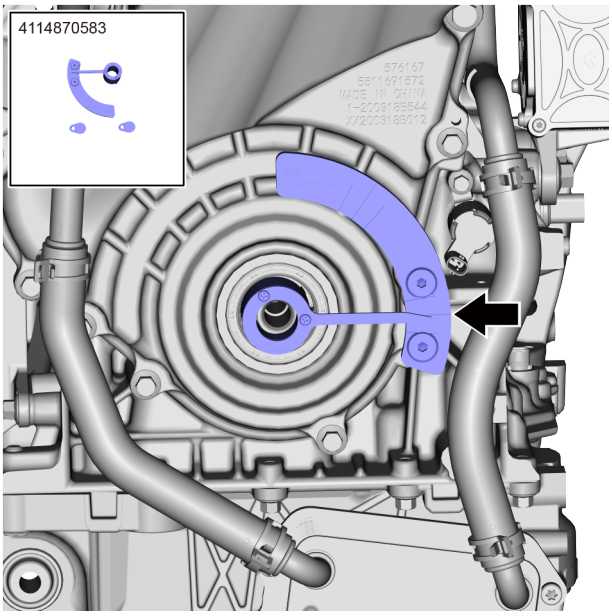
Torque (1~2): 110 N·m.

Torque (3~6): 50 N·m.

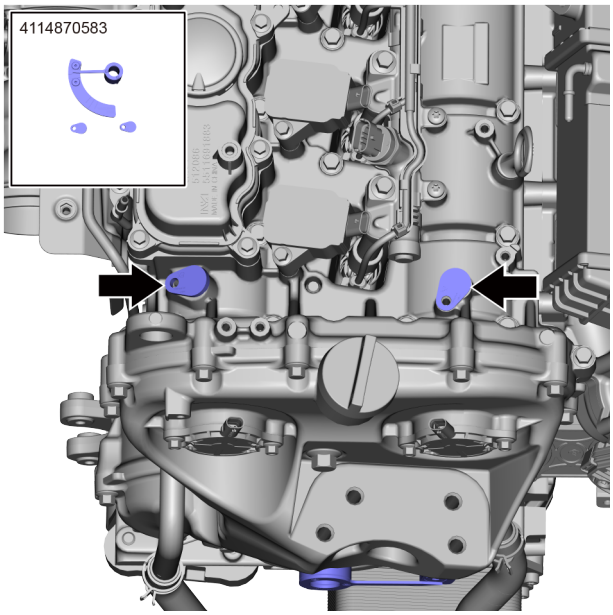
Torque (7~24): 24 N·m.

1.2.26.12 Timing checking

Inspection program 1



1 The timing zero checking tool is installed, and the pointer is adjusted to the scale position.
Special tool number: 4114870583

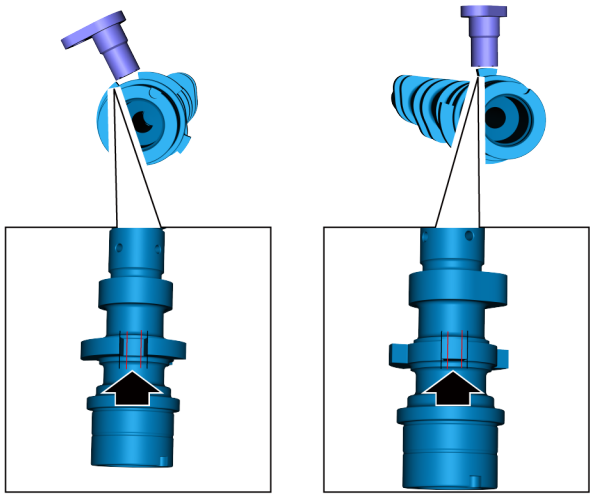


2 The timing zero checking tool at the position of the camshaft position sensor is installed.
Special tool number: 4114870583

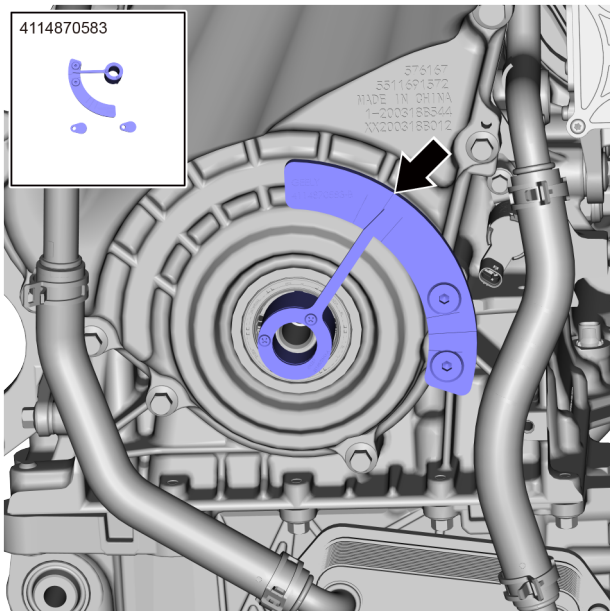
3 The position of zero +26.25° on the signal panel of the intake/exhaust camshaft position sensor is checked.
Special tool number: 4114870583

Caution

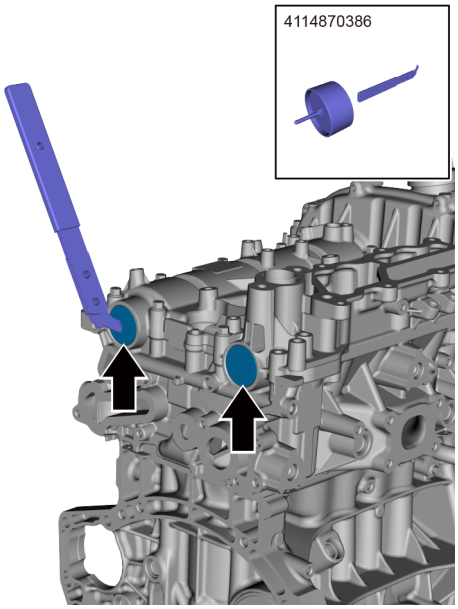
The red scale line on the timing zero checking tool is ensured to be less than the range of black lines formed by the two ends of the concave-convex part of the camshaft.



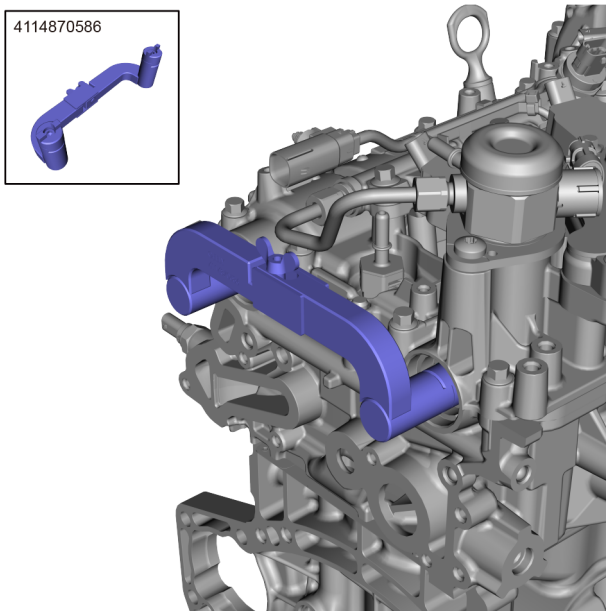
Inspection program 2



1 The timing zero checking tool is installed, and the pointer is adjusted to the scale position.
Special tool number: 4114870583



2 The special tool is used for disassembling the camshaft blanking cap.
Special tool: 4114870386



3 The camshaft positioning tooling is installed and the camshaft is in the zero position is checked.

Special tool number: 4114870586

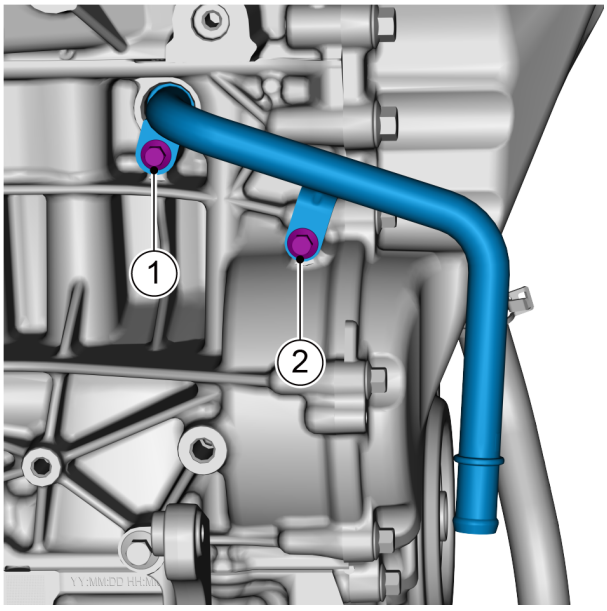
Caution

The camshaft notch faces up and both end grooves are horizontal when the camshaft is positioned at zero.

1.2.26.13 Assembling oil cooler water inlet pipe

Caution

Whether the seal ring is damaged or missing is checked before assembling. If it is damaged or missing, it needs to be replaced.

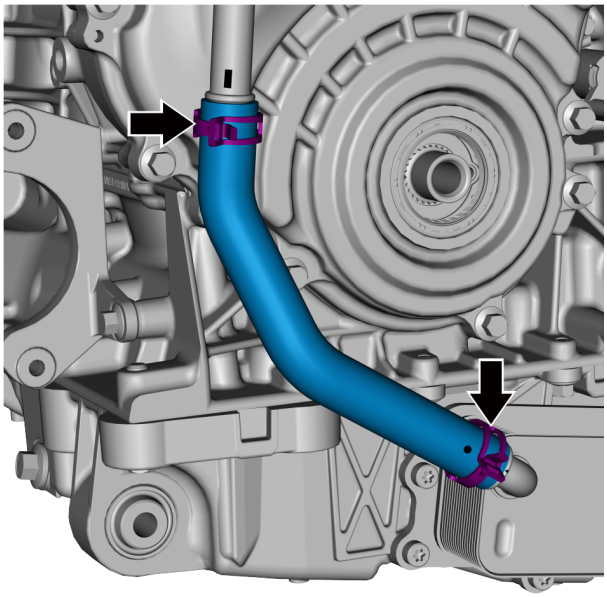


An appropriate amount of P80 or other insertion aid with the lubricating function is applied to the O-ring before installation, then the oil cooler inlet pipe is installed to the cylinder block installing hole in an inserting mode and the bolts are pre-tightened, and then the bolts are tightened in the order of 1 and 2.

Torque: 10 N·m

Caution

Oil substances such as the engine oil are prohibited from being used as the insertion aid.



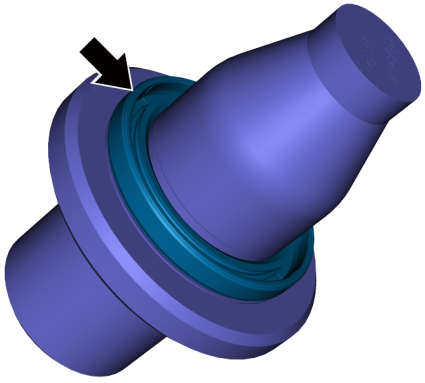
1.2.26.14 Assembling oil cooler inlet pipe assembly

The inner wall of the rubber pipe is coated with appropriate amount of P80 or other insertion aids with the lubricating function, the oil cooler outlet pipe assembly is installed on the oil cooler outlet pipe and the oil cooler, the "□" marking end of the oil cooler water outlet pipe assembly is connected to the oil cooler, and aligned with the small groove mark. The mark on the other end is aligned with the black mark on the oil cooler outlet pipe, and then the rubber pipe ring clamp is clamped.

Caution

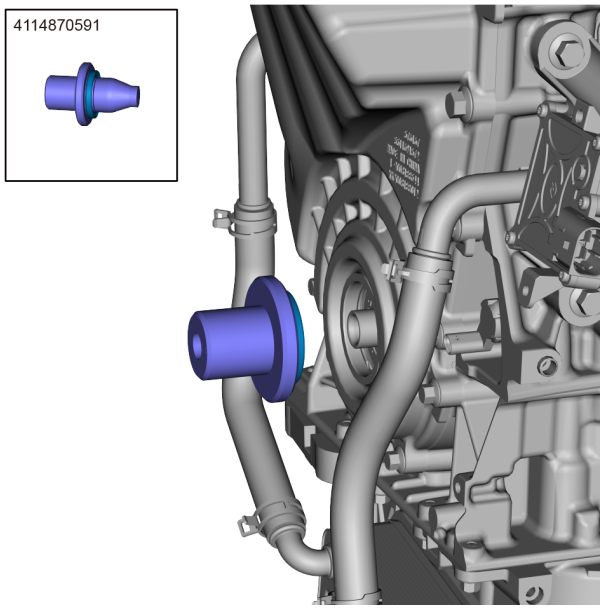
Oil substances such as the engine oil are prohibited from being used as the insertion aid.

1.2.26.15 Assembling crankshaft front oil seal



1 Before assembly, a small amount of engine oil is applied to the guiding head part of the special tool to ensure that the guiding head is free from scratches, knocks, impurities, etc. After the oil seal is pressed and installed, the tooling is carefully taken out in the reverse direction of the press-in direction, and pay attention to the fact that the tooling should not be skewed when it is taken out so as not to lead to the lip flipping of the oil seal.

2 The crankshaft front oil seal is installed to the tooling, when the oil seal is installed on a special tool, the assembly is completed within 15 minutes to avoid damage to the oil seal.



3 The special tool is used to install the crankshaft front oil seal to the timing belt guard in a fitting mode.
Special tool number: 4114870591
Depth of oil seal pressing: 0.6 mm-1 mm
Parallelism: 0.25 mm

Caution

The sensitive parts should be careful not to damage the oil cover during installation:

1. The worktable, the oil seal pressing head and the base are wiped with white cotton cloth every two hours and visually checked the cleaning effect.
2. The oil seal indenter is checked to ensure that there is no foreign object before use.
3. The oil seal installation groove should not be touched during installation.
4. Before taking the oil seal, gloves are used for scrubbing the wool cylinder by the two hands.
5. Hands should not touch the oil seal installing groove during the installation process.
6. The oil seal falling on the ground is scrapped directly.

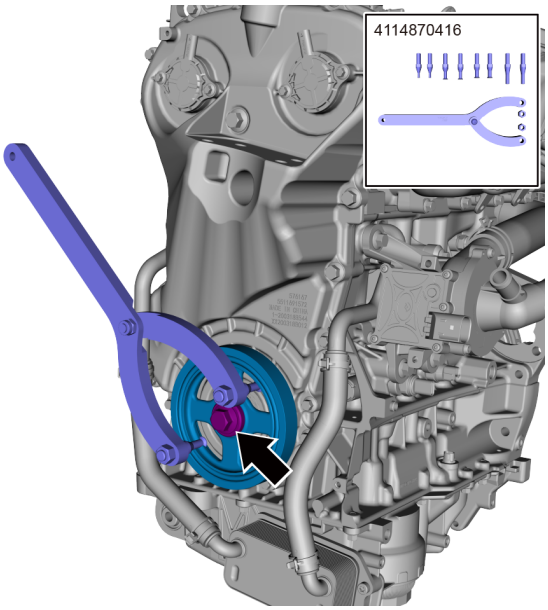
7. Do not touch the inner ring and lips of the oil seal.

Caution

The crankshaft front oil seal is a disposable part, and must be replaced with a new one after each disassembly.

1.2.26.16 Assembling damping pulley assembly

1 Before assembling, make sure that the installing surface of the vibration-dampening pulley bolt is free of foreign matters and rust-resistant oil, and if so, the foreign matters and the rust-resistant oil is wiped off with a dust-free cloth.



2 The vibration-dampening pulley assembly is installed to the front end of the crankshaft.

Caution

The sealing surface of the oil seal is avoided to be scratched by the journal of the vibration-dampening pulley.

Before assembly, make sure that the oil seal installing journal and the chamfer are clean and free of foreign matters, if so, wipe them off; make sure that the oil seal installing journal and the chamfer are free of any appearance defects such as knocks, scratches, indentations, rust, overpainting and so on; if there are any defects, please replace with a new vibration-damping pulley.

The oil seal installing journal is avoided to be touched during moving, taking and assembling.

If the disassembled vibration-damping pulley assembly needs to be assembled twice, the vibration-dampening pulley needs to be cleaned or wiped and then smeared the engine oil with a brand-new clean non-woven cloth, after the surface of the vibration-dampening pulley shaft diameter is wiped evenly, then assembling is conducted. After wiping the wiped surface of the shaft diameter, the less the amount of oil applied, the better.

3 The fixing bolt is installed, a special tool is used to fix the vibration-dampening pulley assembly.

4 The fixing bolt of the vibration-dampening assembly is tightened.

Special tool number: 4114870416

Torque:

Step 1: 110 N·m

Step 2: 135°±5°

Caution

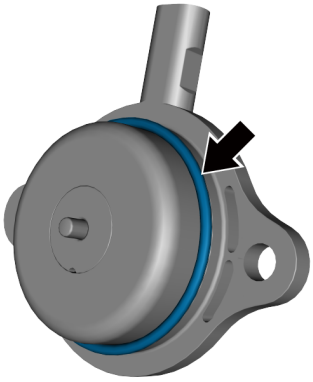
Incorrect use can result in deformation damage to the head part of the bolt.

1.2.26.17 Assembling intake/exhaust center electromagnet

Warning !

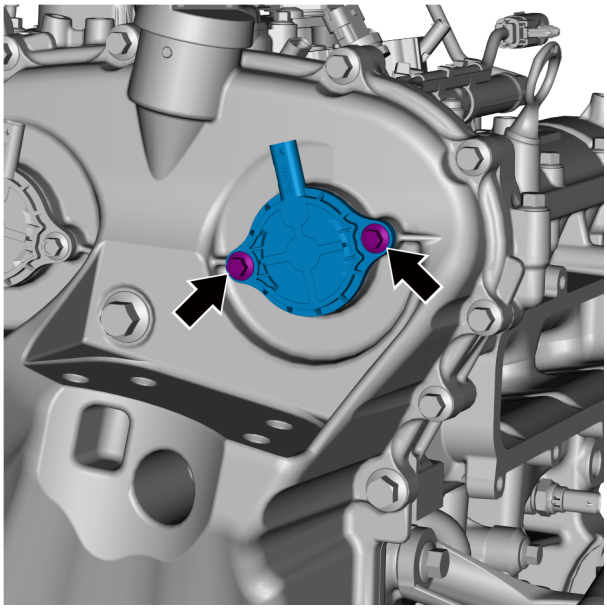
It is prohibited to mix the central oil control valve, the intake/exhaust VVT assembly, and the electromagnet from different suppliers on the same engine; and parts from the same supplier must be used.

1 Before assembly, whether the seal ring is damaged or missing is checked. If it is damaged or missing, it needs to be replaced.

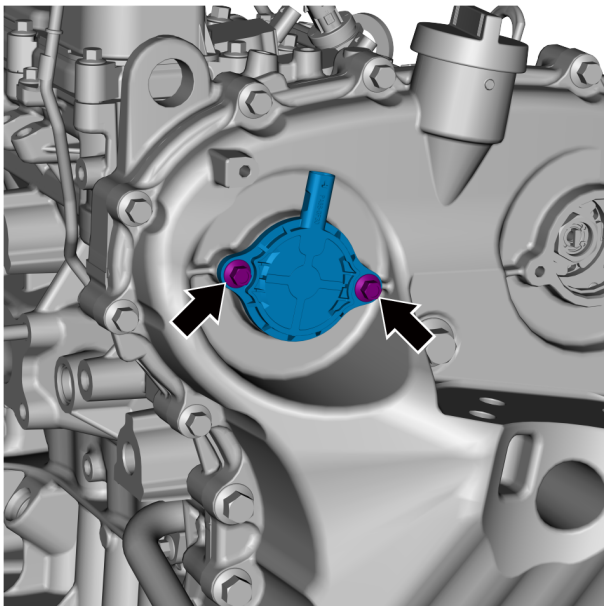


Caution

When assembly is difficult, an appropriate amount of engine oil, silica gel, or insertion aids similar to P80 is dipped with an oil coating rod to be applied evenly at the position of the sealing ring of the center electromagnet.



2 The fixing bolt of the intake center electromagnet is installed and tightened.
Torque: 10 N·m

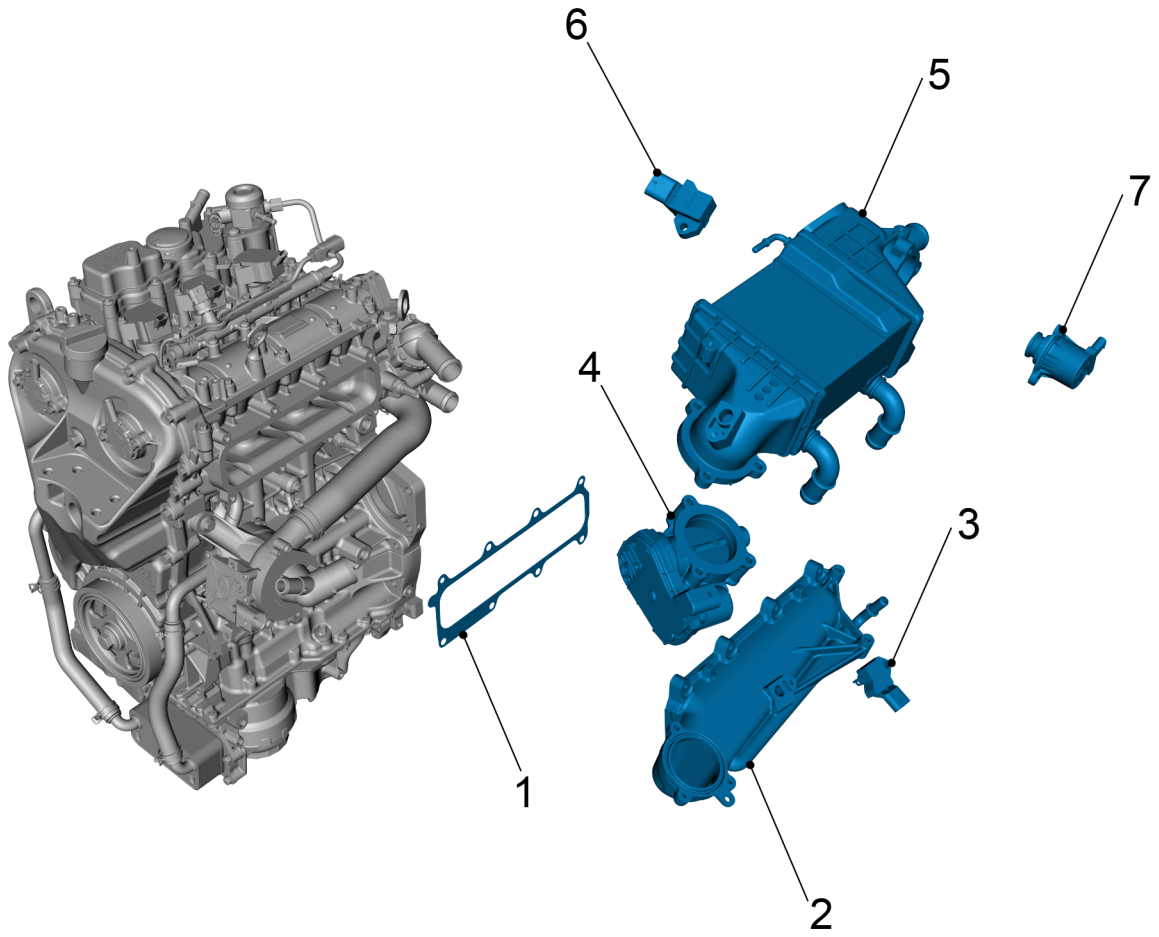


3 The fixing bolt of the exhaust center electromagnet is installed and tightened.
Torque: 10 N·m

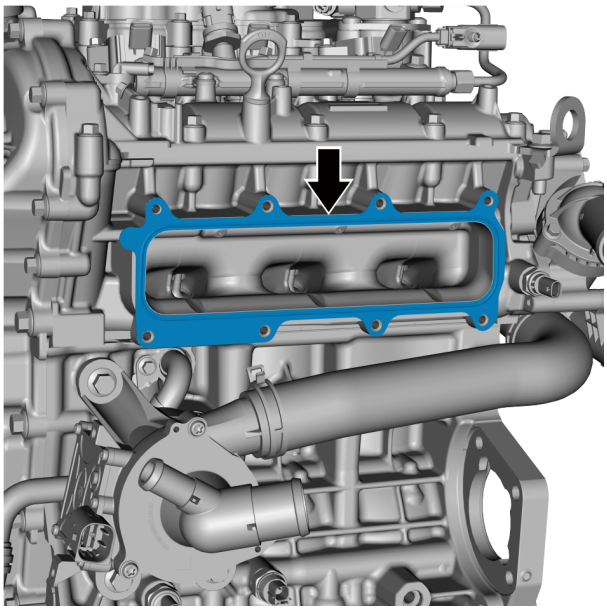
1.2.27 Assembling intake manifold

1.2.27.1 Breakdown drawing of assembling intake manifold

Assembling is conducted in the order indicated in the table.



1.	Intake manifold gasket	5.	Water cooling intercooler
2.	Intake manifold	6	Air pressure temperature sensor
3.	Intake pressure temperature sensor	7.	Pressure relief valve
4.	Electronic throttle valve body		



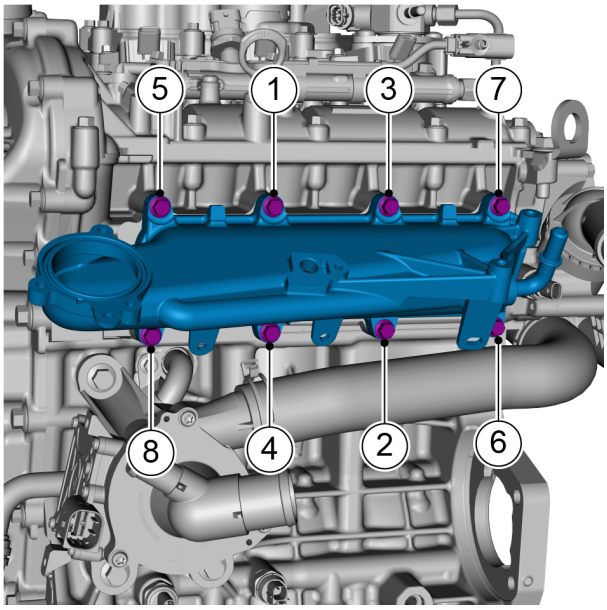
1.2.27.2 Assembling intake manifold gasket

1 Whether he surface of the intake manifold gasket has scratches, oil and foreign matter adherence is inspected to ensure sealing.

2 The intake manifold gasket is fixed to the cylinder head.

Caution

The cylinder gasket is a disposable part, and must be replaced with a new one after each removal.



1.2.27.3 Assembling intake manifold

1 The eight fixing bolts of the intake manifold are installed and the intake manifold gasket and the intake manifold are installed on the cylinder head.

2 The fixing bolts are pre-tightened, then tightened in the order of 1-8 shown in the figure, and finally retightened once in the order of 1-8 shown in the figure.

Torque: 17 N·m

Caution

1. The cylinder gasket is a disposable part, and must be replaced with a new one after each removal.
2. Whether he surface of the intake manifold gasket has scratches, oil and foreign matter adherence is inspected to ensure sealing.

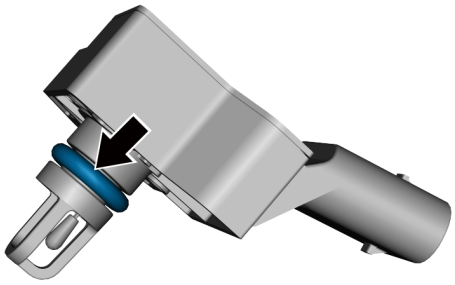
1.2.27.4 Assembling intake air pressure and air temperature sensor

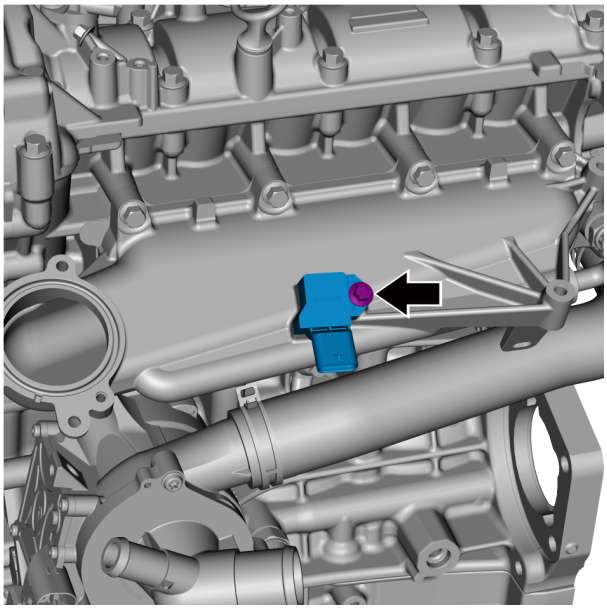
Warning !

The intake air pressure sensor needs the electrostatic protection, and electrostatic protection measures must be taken during storage, transportation and assembly. In the power-on state, the connector of the intake air pressure sensor is not allowed to be plugged in or plugged out with electricity, and it is forbidden to contact with the intake air pressure sensor pins.

1 Whether the seal ring is damaged or missing is checked.

If it is damaged or missing, it needs to be replaced.





2 An appropriate amount of engine oil is dipped with an oil coating rod, and evenly applied at the installing hole chamfered position of the sensor.

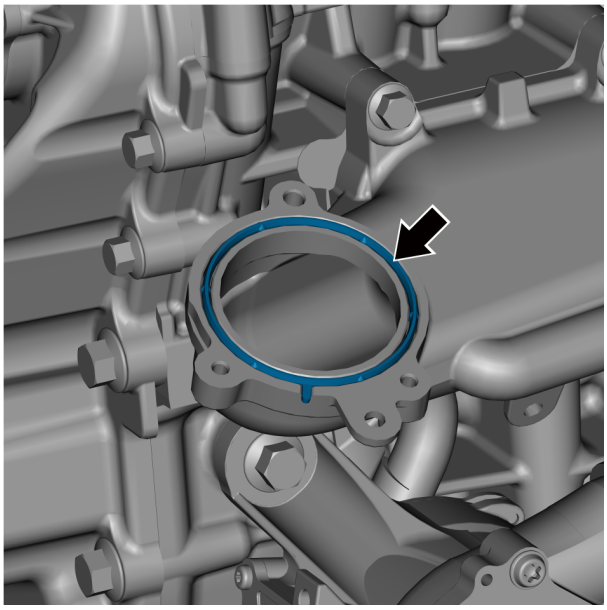
Caution

The lubricating medium shall be applied in an appropriate amount to avoid oil stains or leakage.

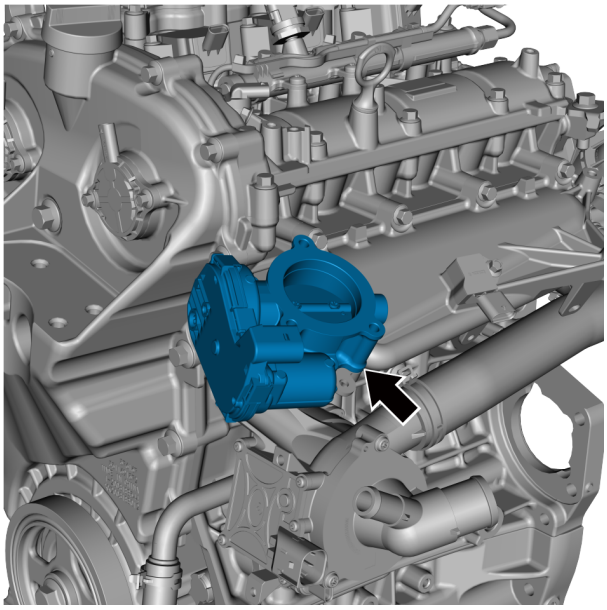
3 The fixing bolt of the intake pressure sensor is installed and tightened.

Torque: 10 N·m

1.2.27.5 Assembling electronic throttle valve



1 Whether the installing surfaces on the two sides of the electronic throttle valve have other defects such as scratches is checked. It needs to be replaced if any.



2 The sealing gaskets on the two sides of the throttle valve are installed in place or not are checked and that there are no scratches, oil or dirt on the gaskets are checked.

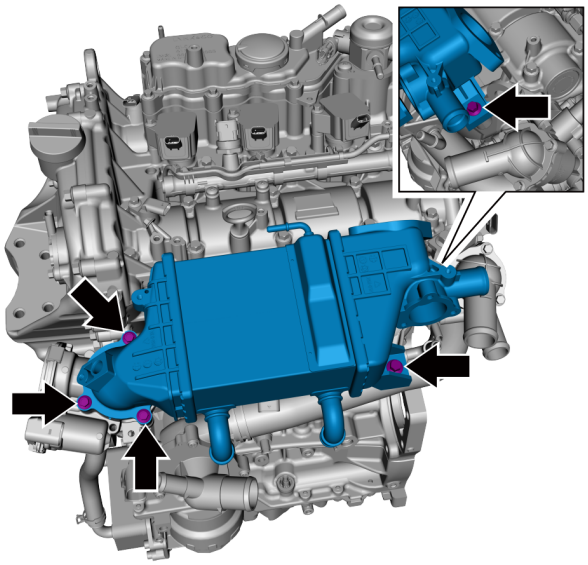
Caution

The sealing gaskets of the throttle valve is a disposable part, and must be replaced with a new one after each removal.

3 The electronic throttle valve is fixed to the intake manifold.

Caution

During the storage, transportation and assembling process, there must be anti-static protection measures. It is forbidden to touch the pins of the electronic throttle valve.



1.2.27.6 Assembling water cooling intercooler

1 The 5 fixing bolts in the water cooling intercooler are installed.

2 The 3 fixing bolts at the body side of the throttle valve are tightened firstly, 2 fixing bolts in the left water cooling intercooler are tightened, after all bolts are tightened, and then retightening is conducted once in order.

Torque: 23 N·m

Caution

During the storage, transportation and assembling process, there must be anti-static protection measures. It is forbidden to touch the pins of the water cooling intercooler.

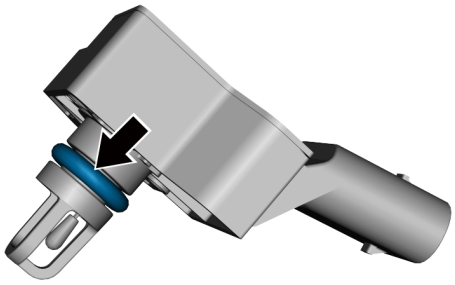
1.2.27.7 Assembling air pressure temperature sensor

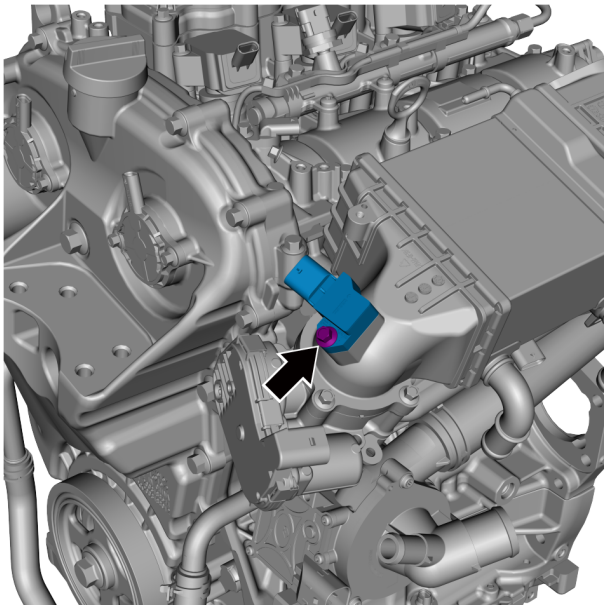
Warning !

The intake air pressure sensor needs the electrostatic protection, and electrostatic protection measures must be taken during the storage, transportation and assembly process. In the power-on state, the sensor connector of the air pressure sensor is not allowed to be plugged in or plugged out with electricity, and it is forbidden to contact with the air pressure sensor pins.

1 Whether the seal ring is damaged or missing is checked.

If it is damaged or missing, it needs to be replaced.





2 An appropriate amount of engine oil is dipped with an oil coating rod, and evenly applied at the installing hole chamfered position of the sensor.

Caution

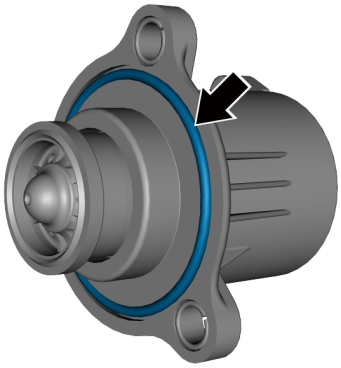
The lubricating medium shall be applied in an appropriate amount to avoid oil stains or leakage.

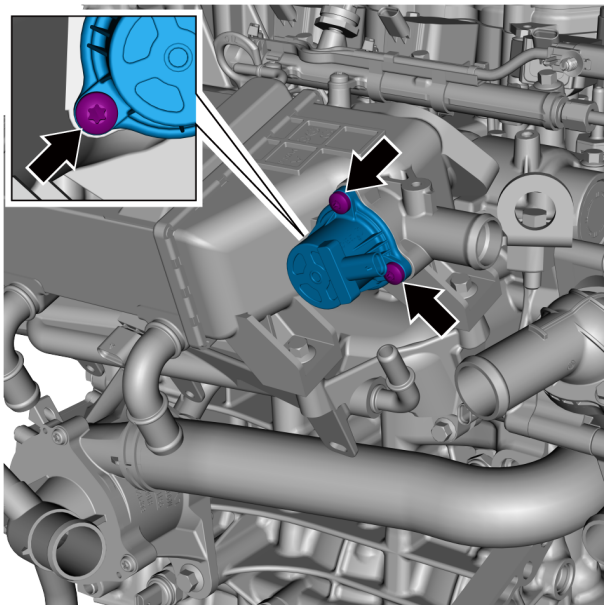
3 The fixing bolt of the air pressure temperature sensor are installed and tightened.

Torque: 10 N·m

1.2.27.8 Assembling electronic pressure relief valve

1 Whether the electronic pressure relief valve rubber seal is peeled or has foreign material adherence is checked to ensure sealing.





2 The electronic pressure relief valve is installed on the water cooling intercooler flange.

3 The 3 fixing bolts of the electronic pressure relief valve is installed, the screws are pre-tightened firstly, and then the screws are tightened.

Torque: 10 N·m

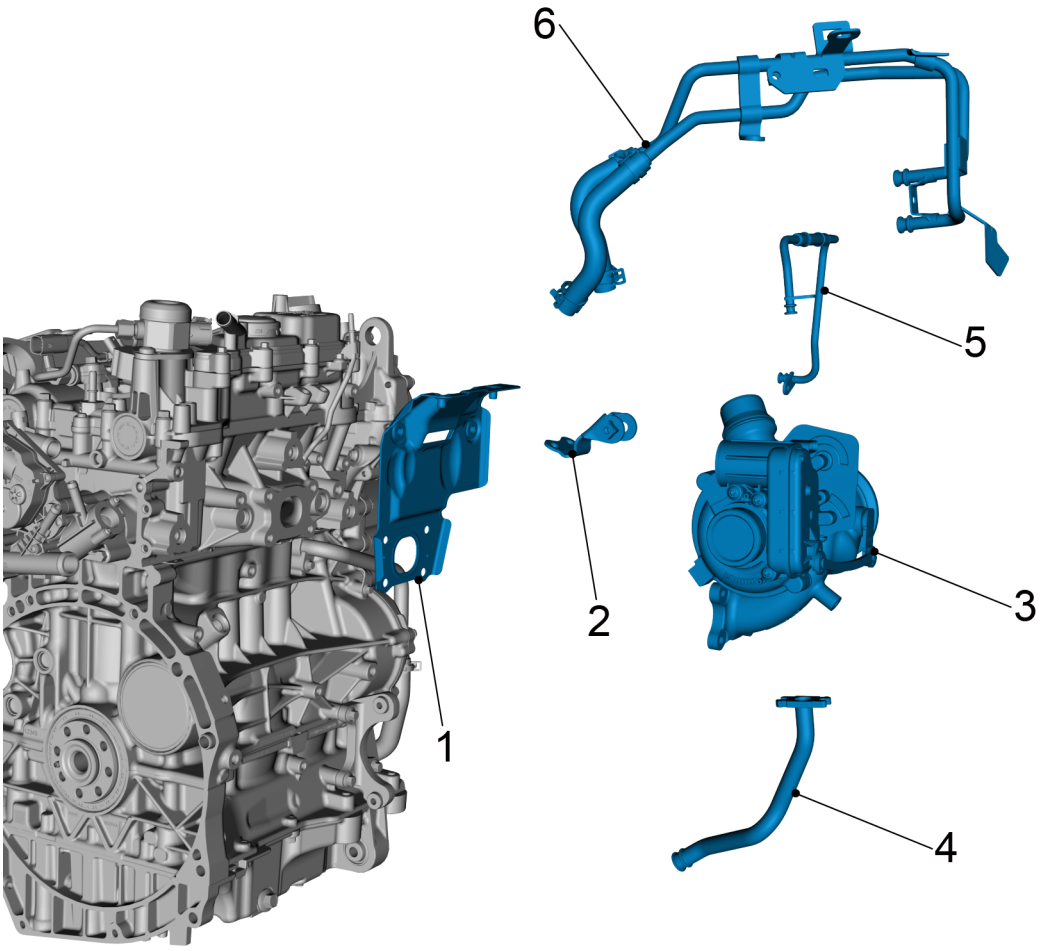
Caution

The 3 fixing bolts of the electronic pressure relief valve has spatial position for error proofing, and then the screws are tightened after the position of the electronic pressure relief valve are arranged in place.

1.2.28 Assembling turbocharger

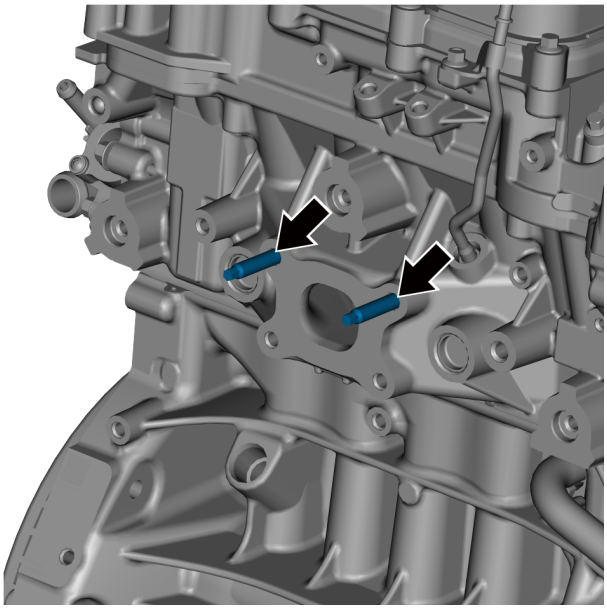
1.2.28.1 Breakdown drawing of assembling turbocharger

Assembling is conducted in the order indicated in the table.



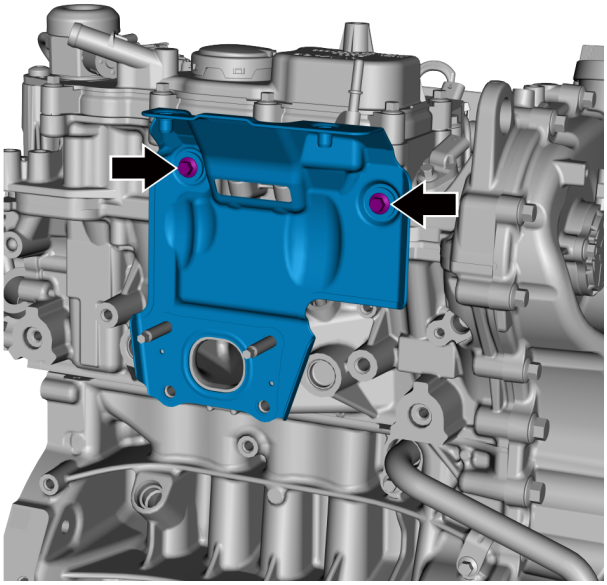
1.	Supercharger connecting manifold gasket combination heat shield	4.	Fuel returning pipe of supercharger
2.	Supercharger bracket	5.	Fuel inlet pipe of supercharger
3.	Turbocharger	6.	Supercharger water pipe assembly

1.2.28.2 Assembling supercharger connecting manifold gasket combination heat shield



1 The heat-resisting stud is installed on the cylinder head and is tightened.

Torque: 10 N·m



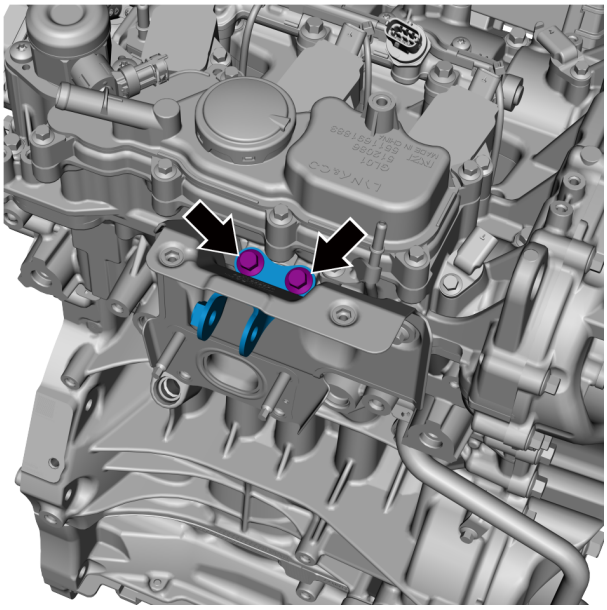
2 The supercharger connecting manifold gasket combination heat shield is installed on the heat-resistant stud.

3 The 2 fixing bolts of the heat shield is installed and tightened.

Torque: 10 N·m

Caution

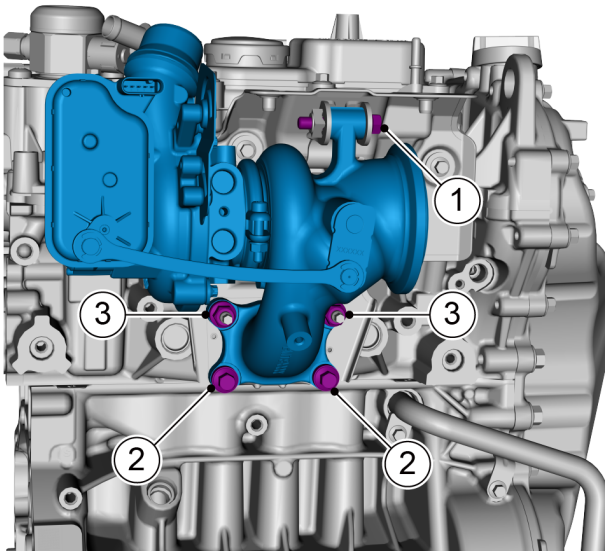
The supercharger connecting manifold gasket combination heat shield is a disposable part, and must be replaced with a new one after each removal.



1.2.28.3 Assembling supercharger bracket

1 The supercharger bracket is arranged in the heat shield reserved window in an inserted mode.

2 The 2 fixing bolts of the supercharger bracket is installed and the bolts are pre-tightened.



1.2.28.4 Assembly of turbocharger

1 The turbocharger is assembled to the cylinder head so that the supercharger bracket holes line up with the supercharger bracket bolt installing holes.

2 The heat-resistant bolts 1 are installed and the bolts are pre-tightened.

3 The heat-resistant bolt 2 is installed, the washer and the nut assembly 3 are pre-tightened firstly in sequence or crosswise and then tightened, and finally retightened once in sequence or crosswise.

Torque: 23 N·m

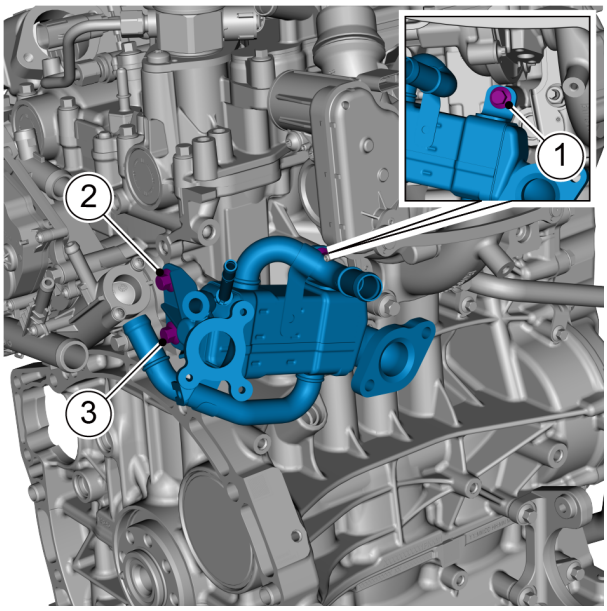
4 The turbocharger heat-resistant bolt 1 is tightened.

Torque: 24 N·m

Caution

The turbocharger bolt and the nut are disposable parts, and must be replaced with a new one after each removal.

1.2.28.5 Assembling EGR cooler

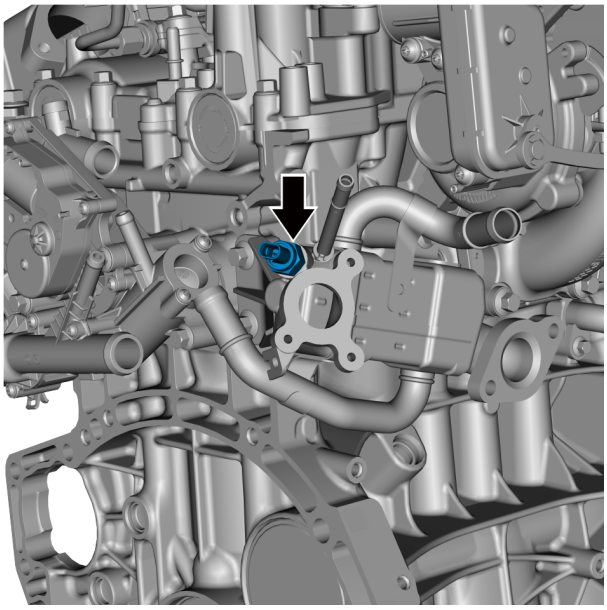


1 The EGR cooler is fixed to the cylinder head.

2 The fixing bolt of the EGR cooler is installed, the fixing bolt is pre-tightened, then the bolts are pre-tightened in the order from 1 to 3 as shown in the figure, and the original assembly stress is eliminated for maximum.

Torque: 24 N·m

1.2.28.6 Assembling high temperature sensor



The high temperature sensor is installed and tightened.

Torque: 25 N·m

Caution

It is prohibited to touch the pins of the high temperature sensor.

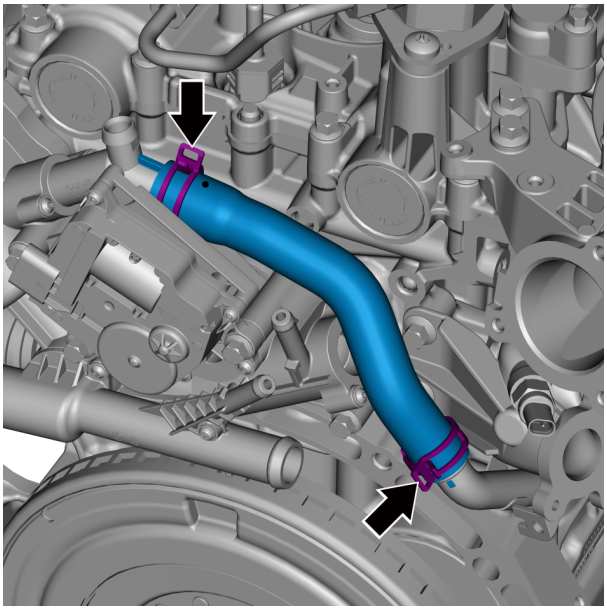
It is prohibited to plug or unplug the connector of the high temperature sensor alarm.

Parts that fall or are impacted must be scrapped.

Caution

The gasket of the high temperature sensor is prohibited from being reused.

1.2.28.7 Assembling EGR cooler water inlet pipe



1 The small end of the EGR cooler water inlet rubber pipe is assembled to the EGR cooler joint , and the marking is aligned with the marking on the EGR cooler joint.

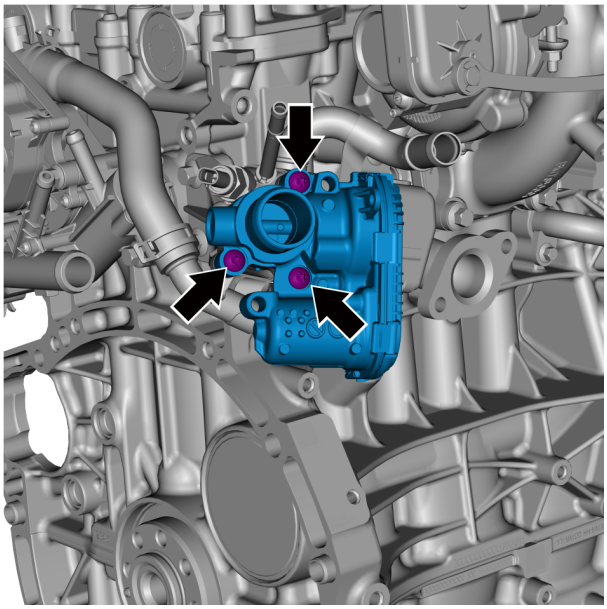
2 The large end of the rubber pipe is assembled to the coolant temperature control module joint.

3 The hoop at the end of the EGR cooler is clamped firstly, and then the hoop at the end of the coolant temperature control module is clamped.

Caution

An appropriate amount of P80 or other lubricating aid with the lubricating function is applied to the inner wall of the rubber pipe. Do not use motor oil substance such as engine oil as an insertion aid.

1.2.28.8 Assembling EGR valve



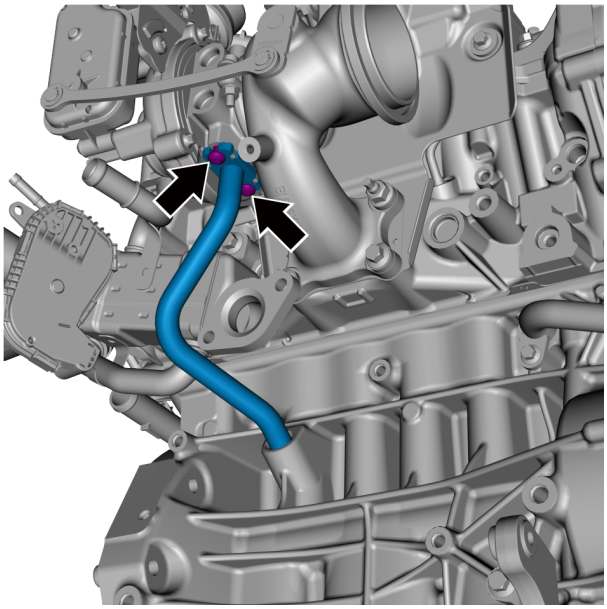
1 Whether the EGR valve rubber sealing ring is peeled or has foreign material adherence is checked to ensure sealing.

2 The 3 fixing bolts of the EGR valve is installed, the EGR valve is pre-installed on the EGR cooler, and then the fixing screws are tightened.

Torque: 10 N·m

Caution

During the storage, transportation and assembling process, there must be anti-static protection measures. It is forbidden to touch the pins of the EGR valve.



1.2.28.9 Assembling supercharger oil return pipe

1 The seal ring or the cylinder block hole is lubricated with silicone oil or lubricant with the similar function.

Caution

All O-shaped sealing rings and gaskets cannot be reused.

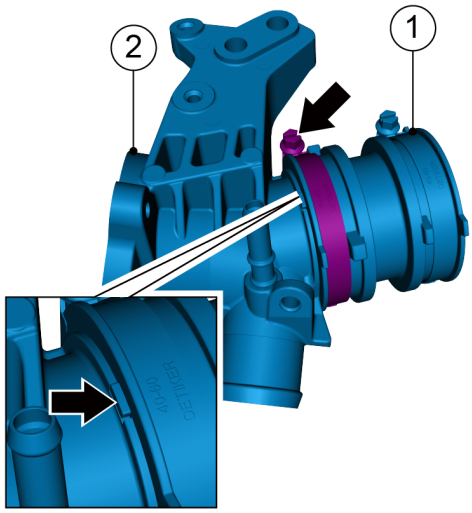
2 The oil return pipe gasket and the sealing ring are installed on the oil return pipe.

3 The oil return pipe is arranged into the cylinder block hole in an inserted mode and rotated in place.

4 The 2 fixing bolts of the oil return pipe is installed, pre-tightened firstly, and then the tightened.

Torque: 10 N·m

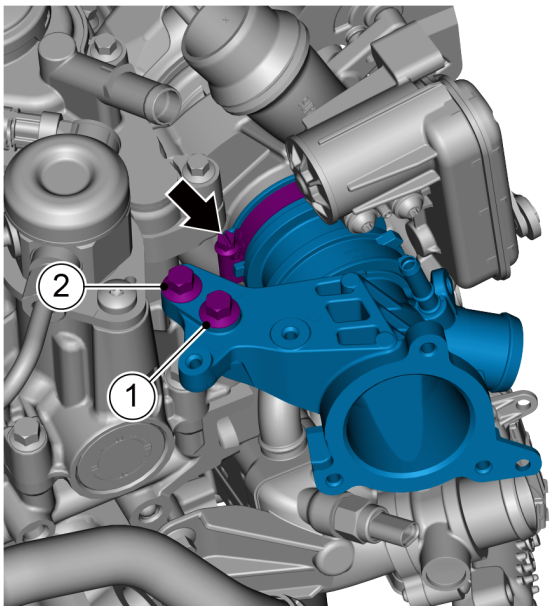
1.2.28.10 Assembling low pressure intake pipe/low pressure seal sleeve



1 The low pressure sealing sleeve 1 is preassembled to the low pressure intake pipe 2, aligns the limit markings as shown in the figure, and the low pressure intake pipe clamp bolt is tightened.

Caution

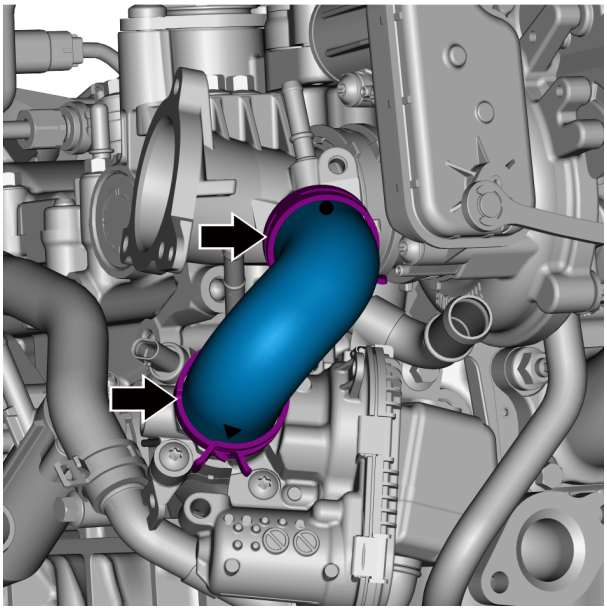
The angle limiting should be conducted on the preassembling of the low pressure sealing sleeve to ensure space for tightening the clamp bolt at the end of the turbocharger and operation convenience.



2 The connection assembly of the low-pressure intake pipe and the low-pressure sealing sleeve is assembled to the intake port of the turbocharger, the position is adjusted so that the installing surfaces of the low-pressure sealing sleeve and the turbocharger fit, the position of the low-pressure intake pipe is adjusted to fit the installing surfaces of the camshaft bearing cover, and the clamp is tightened on the supercharger side.

3 After adjusting the position of the low-pressure intake pipe to fit the camshaft bearing cover installing surface, the hexagonal flange face bolt 1 is installed firstly and tightened, and then the hexagonal flange face bolt 2 is installed and tightened.

Torque: 24 N·m



1.2.28.11 Assembling EGR rubber pipe

1 An appreciate amount of P80 or other insertion aid with the lubricating function is applied on the EGR rubber pipe port firstly before installing.

Caution

Oil substances such as the engine oil are prohibited from being used as the insertion aid.

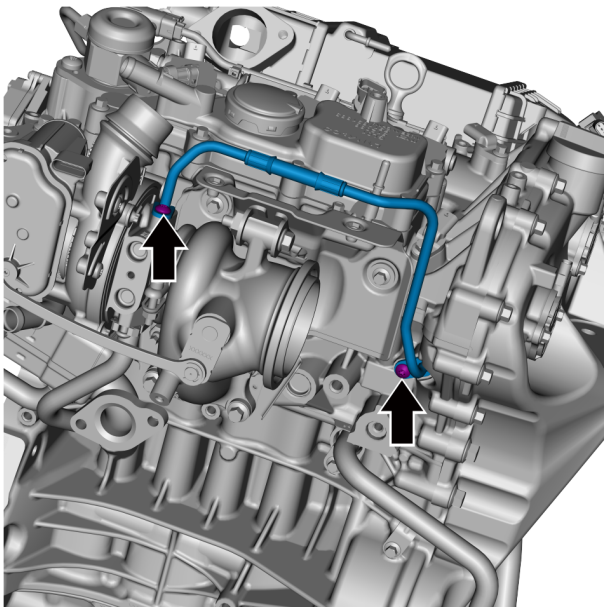
2 The triangular marking end of the EGR rubber pipe is assembled to the pipe joint of EGR.

3 The round marking end of the EGR rubber pipe is assembled to the joint of the low pressure intake pipe.

4 The ring hoop of the EGR valve end is clamped firstly, and then the ring hoop of the low pressure intake pipe end is tightened.

Caution

The "I" shaped marks on both ends of the rubber pipe, the lower end "I" shaped mark are centered with the EGR valve seal leak-proof installing mark, and the upper end "I" shaped mark is centered with the alignment mark on the lower end of the differential pressure sensor rubber pipe. This ensures that the rubber pipe is assembled in place and avoids interference between the lugs and surrounding parts.



1.2.28.12 Assembling supercharger oil inlet pipe

1 That the seals must not have cut edges is checked.

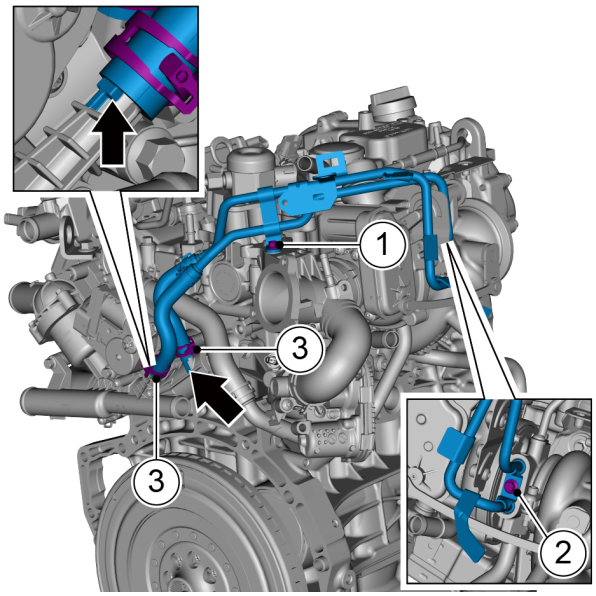
Caution

All O-sealing rings and gaskets cannot be reused. It is needed to replace with new ones after disassembly.

2 The supercharger oil inlet pipe installed with the O-ring is arranged into the cylinder head end, then one end is inserted into the supercharger end.

Caution

P80 or other insertion aid with the lubricating function is applied on the two sealing rings before installing.



3 The 2 fixing screws of the supercharger oil inlet pipe are installed, the screws are pre-tightened in the order of the cylinder head end and the supercharger end, and then the screws are tightened in the above order.

Torque

Step 1: 1.5 N·m

Step 2: 10 N·m

1.2.28.13 Assembling supercharger water pipe assembly

1 The O-shaped sealing ring is assembled to the supercharger water intake pipe.

Caution

An appreciated amount of P80 and the insertion aid with the lucubrating function is applied on the O-shaped sealing ring. Oil substances such as the engine oil are prohibited from being used as the insertion aid.

2 The supercharger intake pipe assembly is arranged into the supercharger in an insert mode, one bolt 2 is pre-tightened to the supercharger, and one bolt 1 is pre-tightened to the low pressure intake pipe.

3 The fixing bolt 2 at the supercharger is tightened firstly, and then the fixing bolt 1 at the low pressure intake pipe is tightened.

Torque: 10 N·m

4 One end of the supercharger water pipe assembly rubber pipe is connected to the coolant temperature control module connector and aligned with the marking on the coolant temperature module connector, and the ring clamps 3 on two rubber pipes are clamped.

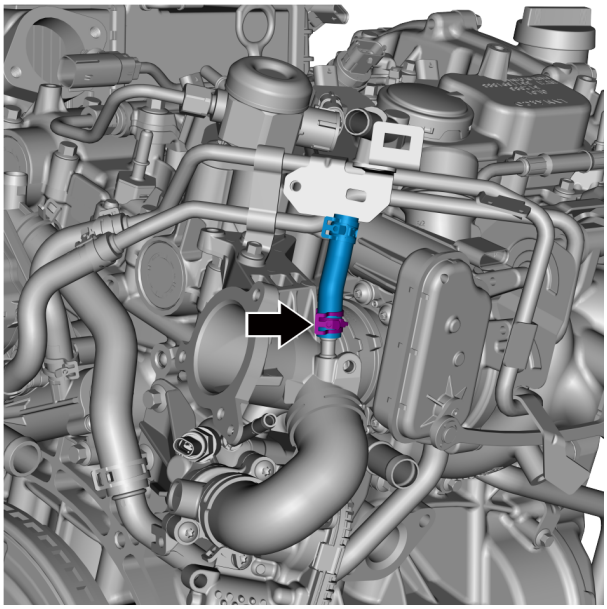
Caution

Before assembling the rubber pipes, an appropriate amount of P80 or other lubricating aid is applied to the inner wall of the rubber pipe. It is not permitted to use oil substances such as the engine oil as an insertion aid.

1.2.28.14 Assembling differential pressure sensor high/low pressure end rubber pipe

Caution

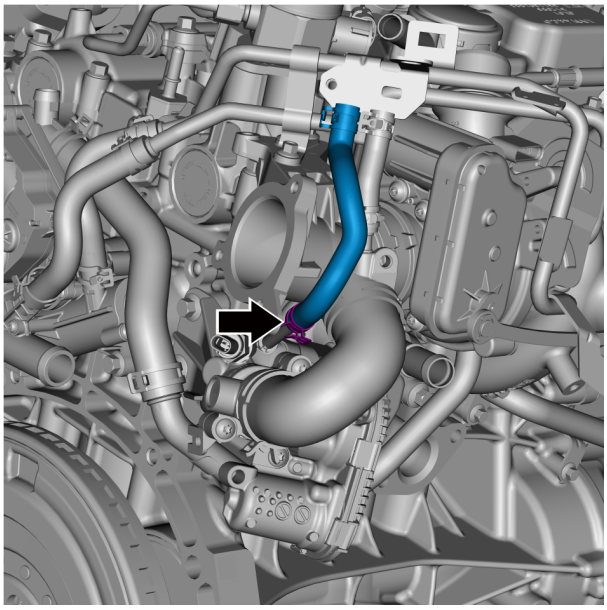
Before installation, an appreciate amount of P80 or other lubricating auxiliary agent is applied to the rubber pipe port firstly, and it is prohibit to use oil substances such as the engine oil as an insertion aid.



1 The I-shaped marking end of the low pressure end rubber pipe of the differential pressure sensor is arranged into the pipe joint of the low pressure air inlet aluminum pipe, and the clamping hoop is clamped.

Caution

The I-shaped direction of the clamping hoop is centered with the marking point to avoid interference between the lugs and surrounding parts.



2 The I-shaped marking end of the high pressure end rubber pipe of the differential pressure sensor is arranged into the pipe joint of the EGR cooler, and the clamping hoop is clamped.

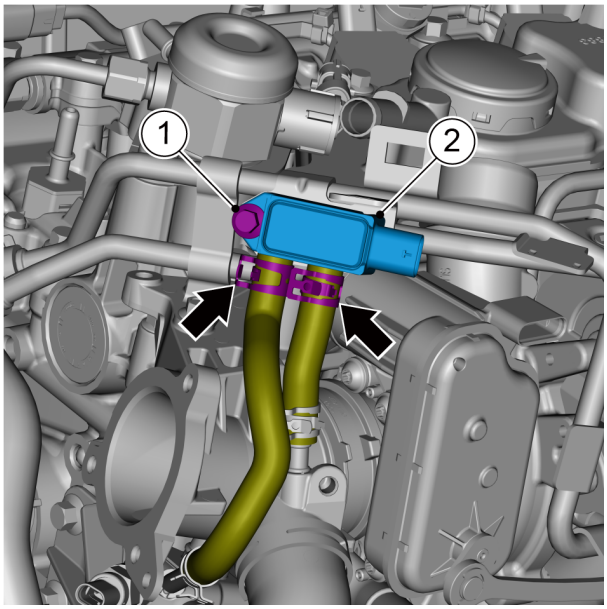
Caution

The I-shaped direction of the clamping hoop is centered with the marking point to avoid interference between the lugs and surrounding parts.

1.2.28.15 Assembling differential pressure sensor

Warning !

The differential pressure sensor needs the electrostatic protection, and electrostatic protection measures must be taken during the storage, transportation and assembling process. In the power-on state, the connector of the intake air pressure sensor is not allowed to be plugged in or plugged out with electricity, and it is forbidden to contact with the differential pressure sensor pins.



1 The high-pressure connector of the differential pressure sensor 2 is arranged into the connector of the rubber pipe at the high-pressure end of the differential pressure sensor to the end in an inserted mode, and is aligned with the markings.

Caution

Before installation, an appreciate amount of P80 or other lubricating auxiliary agent is applied to the pipe port of the differential pressure sensor firstly, and it is prohibit to use oil substances such as the engine oil as an insertion aid.

2 The low-pressure connector of the differential pressure sensor 2 is arranged into the connector of the rubber pipe at the low pressure end of the differential pressure sensor to the end in an inserted mode, and is aligned with the markings.

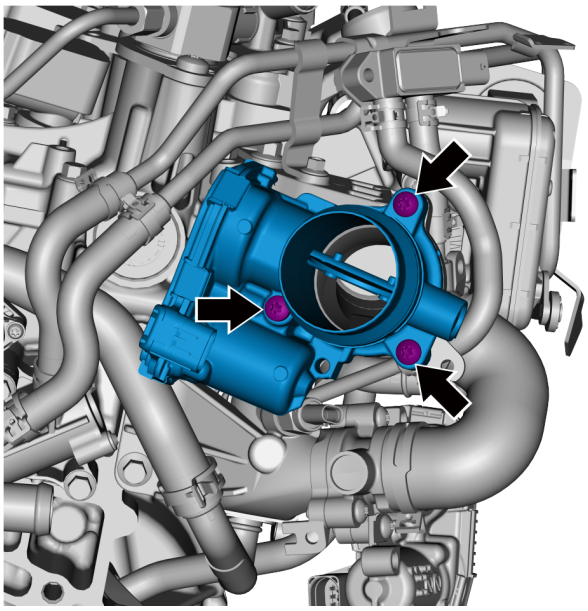
Caution

Before installation, an appreciate amount of P80 or other insertion aid with the lubricating function is applied to the pipe port of the differential pressure sensor firstly, and it is prohibit to use oil substances such as the engine oil as an insertion aid.

3 The clamping hoops of the differential pressure sensor high/low pressure end rubber pipes are clamped.

4 The fixing bolt 1 of the differential pressure sensor is installed and tightened.

Torque: 10 N·m



1.2.28.16 Assembling air/exhaust mix valve

1 Whether the air/exhaust mix valve rubber seal is peeled or has foreign material adherence is checked to ensure sealing.

2 The air/exhaust mix valve is placed in the low pressure intake pipe installing position.

3 The 3 fixing bolts of the air/exhaust mix valve is installed, the screws are pre-tightened firstly, and then the screws are tightened.

Torque: 10 N·m

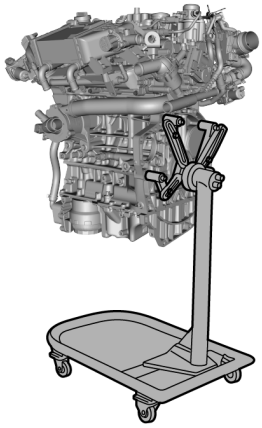
Caution

During the storage, transportation and assembling process, there must be anti-static protection measures. It is forbidden to touch the pins of the air/exhaust mix valve.

1.2.29 Assembling engine

1.2.29.1 Disassembling turnable bracket of engine

The engine is disassembled from the turnable bracket and placed on the engine bracket.

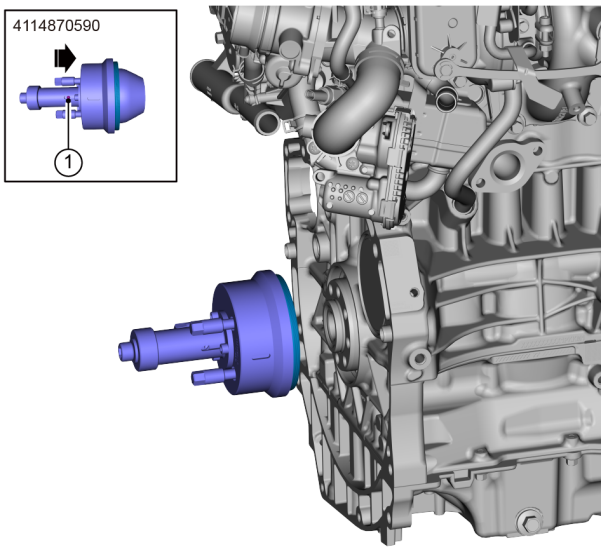


1.2.29.2 Assembling crankshaft rear oil seal

Caution

The oil seal surface is very sensitive and the correct orientation of the crankshaft rear oil seal is extremely important.

1. The worktable, the oil seal pressing head and the base are wiped with white cotton cloth every two hours and visually checked the cleaning effect.
2. The oil seal indenter is checked to ensure that there is no foreign objects before use.
3. Before taking the oil seal, gloves are used for scrubbing the wool cylinder by hands.
4. The oil seal installation groove should not be touched during installation.
5. The oil seal falling on the ground is scrapped directly.
6. Do not touch the inner ring and lips of the oil seal.



1 The oil seal outer ring seal installing surface is ensured to be clean, the position of the upper and lower cylinder block bonding surface is allowed to have glue extrusion, if the gluing is conducted for more than 10 minutes, the sealing surface of the oil seal seat hole needs to be cleared so as not to damage the oil seal.

2 The crankshaft rear oil seal is installed on the tooling, and the special tool is used for installing the crankshaft rear oil seal to the cylinder block assembly in a pressing mode.

Special tool number: 4114870590

Depth of oil seal pressing: 0.7 mm-1.8 mm

Parallelism: 0.5 mm

Caution

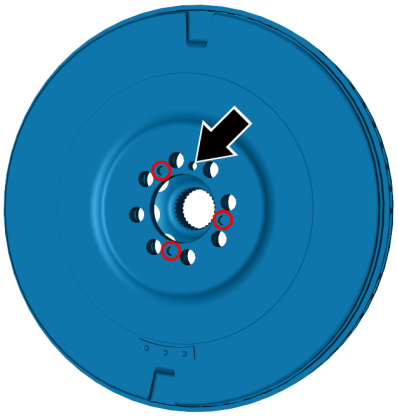
Before placing the oil seal on the tooling, the position of mark 1 is rotated to the forefront position in the direction indicated according to the arrow.

Caution

The crankshaft rear oil seal is a disposable part, and must be replaced with a new one after each disassembly.

Caution

1. Before assembly, a small amount of engine oil is applied to the guiding head part of the special tool to ensure that the guiding head is free from scratches, knocks, impurities, etc. After the oil seal is pressed and installed, the tooling is carefully taken out in the reverse direction of the press-in direction, and pay attention to the fact that the tooling should not be skewed when it is taken out so as not to lead to the lip flipping of the oil seal.
2. When the oil seal is installed on the special tool, the assembly is completed within 15 min to avoid damage to the oil seal.



1.2.29.3 Assembling dual mass flywheel assembly

1 That the flexible cylindrical pin is properly installed in the pin hole on the flywheel is confirmed.

Caution

It is strictly prohibited to lift or wrench the flywheel secondary mass during any movement of the dual mass flywheel such as bag turning, handling, testing, assembly, etc.

Warning !

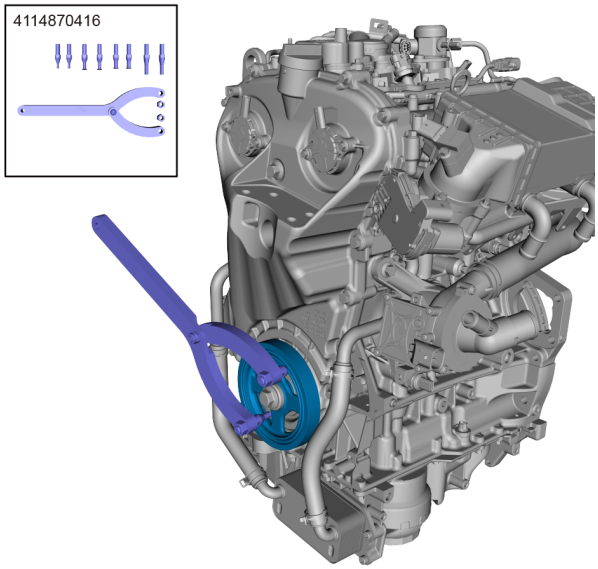
It is prohibited to install the locating pin into the flywheel process hole (red circle).

2 Before assembling the flywheel bolts, make sure that the adhesive coating on the surface of the bolts is complete.

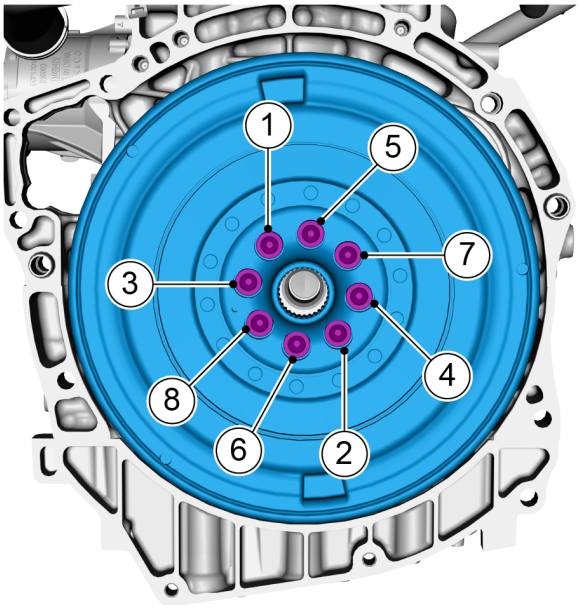
Caution

Flywheel bolt is a disposable part, and must be replaced with a new one after each disassembly.

3 The dual mass flywheel assembly is assembled to the crankshaft, the dual mass flywheel pin holes are aligned with the crankshaft's cylindrical pins.



4 The vibration dampening pulley assembly is locked with the special tool and the crankshaft is not allowed to rotate.
Special tool number: 4114870416



5 The bolts of the flywheel is tightened diagonally in the order from 1 to 8 as shown in the figure.
Torque:
Step 1: 45± 3 N·m
Step 2: 65°±3°

Caution

After the bolts are tightened, all bolts need to be rechecked to ensure that they are not tightened for leakage.

1.2.29.4 Installing engine assembly

1 The engine oil is filled.

2 The engine assembly is installed into the engine compartment of the complete vehicle. Refer to "Replacement of engine assembly" in "Mechanical system" in the "Maintenance Manual".

1.3 Engine technological data

1.3.1 Mechanical system specification

1.3.1.1 Mechanical system specification

Item	Specification
Model	DHE15 - ESZ, DHE15 - ESZ - A00
Type	Straight-three engine
Combustion chamber type	Ridge type
Air intake mode	Supercharged mid-cooling
Cylinder diameter (mm)	82
Travel (mm)	93.2
Compression ratio	13.0:1
Displacement (L)	1.480
Fuel specification	Unleaded gasoline, Ron92 or higher level
Low speed torque(N•m/r/min)	225/2500– 4000
Original valve timing	Intake open 1mm lift 379°CA, closed 1mm lift 533°CA
	Exhaust open 1mm lift 140°CA, closed 1mm lift 336°CA
Idle speed (r/min)	1200 ± 50
Ignition sequence	1 - 3 - 2
Oil pressure (kPa)	High pressure: 400 ± 30KPa, low pressure: 180 ± 20KPa
Piston air leakage (L/min)	≤50
Contour dimension (Length x width x Height) (mm)	601×628×677 (Exhaust side backward tilting angle 11°)
Engine net weight (± 2%) (kg)	(118 ± 2%) kg
Emission level	National standard VIb
Cylinder head	
Cylinder block joint surface flatness (mm)	Part: 0.015/20 Overall: 0.03
Intake side flatness (mm)	0.02/20
Exhaust side flatness (mm)	0.02/20
Volume of combustion chamber	
1, 2, 3 volume standard of cylinder body and cylinder head combustion chamber (ml)	41 ± 0.5
Piston	
Piston diameter standard value (mm)	81.97
Standard oil film interval (mm)	0.045
Maximum oil film interval (mm)	0.057
Intake valve	
Length (mm)	105.48
Crown diameter (mm)	5.5 (- 0.03 / - 0.045)
Plate part diameter (mm)	30 ± 0.15

Item	Specification
Valve angle (°)	45 (+0.35/+0.1)
Conducting pipe interval (mm)	0.03-0.06
Valve clearance (mm)	0
Valve seat angle (°)	45 (0/ - 0.5)
Exhaust valve	
Length (mm)	104.42mm
Crown diameter (mm)	Rod part 20 position 5.442 ± 0.007
	Rod part 78 position 5.434 ± 0.007
Plate part diameter (mm)	26 ± 0.15
Valve angle (°)	45 (+0.35/+0.1)
Conducting pipe interval (mm)	0.059-0.088
Valve clearance (mm)	0
Valve seat angle (°)	45 (0/ - 0.5)
Intake/exhaust camshaft	
Camshaft radical run-out (mm)	0.03
Maximum stoke of air intake camshaft	4.68
Maximum stroke of air exhaust camshaft	5.33
No. 1 camshaft journal (mm)	55mm (ball bearing outer ring diameter)
Others camshaft journal (mm)	24
Intake VVT adjusting range (°CA)	60 ± 1
Exhaust VVT adjusting range (°CA)	30 ± 1
Crankshaft	
Maximum radial run-out of the crankshaft	0.015
Diameter of crankshaft main journal	Φ50
Maximum crankshaft journal taper and roundness	Roundness: 0.004, Straightness: 0.004
Diameter of crankshaft connecting rod neck	Φ48
Crankshaft journal taper and roundness	0.004
Crankshaft main journal oil film clearance	0.025 - 0.041
Crankshaft connecting rod neck oil film clearance	0.040 - 0.058
Crankshaft axial displacement	0.1 - 0.29
Timing belt	
Length (mm)	8x159
Width (mm)	20
Depth (mm)	3.02
Engine oil specification and capacity	
Oil specification	0W - 20 VCC RBS0 - 2AE
Dry filling (L)	5.8
Wet filling (L)	5

Item	Specification
Exhaust value	
Total hydrocarbons (THC)	≤33.3mg/km
Non-methane hydrocarbons (NMHC)	≤23.3mg/km
Carbon monoxide (CO)	≤277.7mg/km
Nitrogen oxide (NOx)	≤19.4mg/km
Particulate matter (PM)	Pm≤3mg/km PN≤6.0E+11 #/km
Coolant type	
Type	Geely-approved ethylene glycol-type coolant
Spark plug	
Model	SP
Spark plug gap (mm)	0.6-0.7
Supplier	Niterra Trading (Shanghai) Co., Ltd.
Valve timing	
Intake valve opening (1mm lift)	379°CA
Intake valve closed (1mm lift)	533°CA
Exhaust valve opening (1mm lift)	140°CA
Exhaust valve closed (1mm lift)	336°CA

Air tightness requirement			
Item	Leakage testing pressure	Qualified leakage	Leakage testing volume
Combustion chamber	(0.2±0.02) bar	≤50ml/min	(41±0.5) ml/cylinder
Short oil channel	(0.25±0.03) bar	≤30ml/min	22.8L
Short waterway	(1±0.1) bar	≤4.5ml/min	2.2L
Whole engine waterway	(1.8±0.1) bar	≤15ml/min	2.9L
Whole engine oil passages	(0.25±0.03) bar	≤75ml/min	24.8L

1.3.2 Tightening torque specification

1.3.2.1 Tightening torque specification

Standard tightening torque table

Fastener's name	Model	Installing torque (N·m)
Hexagon flange bolts Hexagon flange nut Hexalobular socket pan head screw Inner hexagon socket cap head screw	M6	10 ± 1.5
	M7	17 ± 3
	M8	23 ± 2
	M10	48 ± 7

High-strength bolt tightening torque table

Fastener's name	Model	Installing torque (N·m)
The crankcase and the cylinder block are used for fixing the main bearing cap bolt.	M10×99.5	50-90
Connecting rod big end cap and connecting rod fixing connecting rod bolt	M8×48	35-65
Rear end counterweight and silent shaft fixing bolt	M10×75	Step 1: 20 ± 2
		Step 2: rotating angle 90° ± 5°
		Final: 50-112
Cylinder head fixing bolt	M11×162	Step 1: 40
		Step 2: 120°
		Step 3: 120 °
		Final: 70-160
Cylinder head fixing double-end stud	M8	10 ± 2
Double-end stud, timing belt tensioner hexagonal flange face fixing nut	M8×10.2	Step 1: 10 ± 2
		Step 2: 25 ± 3
Flywheel fixing bolt	M11×26	Step 1: 45 ± 3
		Step 2: rotating angle 65° ± 3°
		Final: 100-190
Vibration dampening pulley fixing bolt	M14×84×1.5	Step 1: 110 ± 5
		Step 2: rotating angle 135° ± 5°
		Final: 180-340
Timing belt guard, cylinder head, cylinder block hexagonal flange surface fixing bolt	M12×70	110 ± 15
Timing belt guard, cylinder head, cylinder block electronic water pump, and cylinder block hexagonal flange surface fixing bolt	M10×35	50 ± 5
Exhaust central oil control valve	M22×1	Step 1: 50 ± 3

Fastener's name	Model	Installing torque (N·m)
		Step 2: rotating angle 30° ± 2°
Intake central oil control valve	M22×1	Step 1: 50 ± 3
		Step 2: rotating angle 30° ± 2°
Front end counterweight fixing bolt	M9×35	Step 1: 25 ± 2
		Step 2: rotating angle 60° ± 3°
		Final: 45-95

Non-standard tightening torque table

Fastener's name	Model	Installing torque (N·m)
Piston cooling nozzle assembly and cylinder block fixing bolt	M8 hollow bolt	12 ± 1
Oil pan drain plug	M18×1.5	35 ± 2
Oil filter module	/	25+5/0
Spark plug	M12S×1.25	22.5 ± 2.5
Cylinder head fixing bolt	M6×16	9 ± 1
Clutch driving device and flywheel fixing bolt	M8×14	26 ± 6
High-pressure oil pipe assembly	M14×1.5	First time: 15 ± 3
		Second time: 25 ± 3
Ventilation valve assembly	1/8″ -27-NPTF	12 ± 2
Cylinder head heat-resistant double end stud	M8×50	10 ± 1
Low-pressure sealing sleeve, supercharger/low-pressure inlet pipe worm clamp	/	3.5 ± 0.5
High temperature sensor (EGR cooler end)	M12×1.5	25 ± 2
Oil adding hole cap assembly	M36×3	4.5 ± 0.5
Crankcase and cylinder block fixing bolt	M8×70	25 ± 3
Oil pressure sensor	M12×1.5	22 ± 2
Oil pressure alarm	Rc1/8	15.75 ± 0.75
Water temperature sensor	M12×1.5	15 ± 1
Timing idler	M8	25 ± 2
Knock sensor fixing bolt	M8×35	23 ± 2
Bracket and cylinder block fixing bolt	M8×30	24 ± 4
Supercharger bracket and cylinder cap fixing bolt	M8×20	24 ± 4
Supercharger bracket and cylinder cap fixing heat-resistant bolt	M8×20	24 ± 4

Fastener's name	Model	Installing torque (N·m)
Coolant temperature control module, thermostat housing assembly and cylinder head fixing bolt	M7×45	16 ± 2.5
Coolant temperature control module, thermostat housing assembly and cylinder head fixing bolt	M7×65	16 ± 2.5
Oil-gas separator assembly - camshaft bearing cap	M6×30	9 ± 0.5

1.3.3 Bearing shell matching table

1.3.3.1 Bearing shell matching table

Main bearing shell matching shell table

Main bearing shell matching shell table				Diameter grouping of the cylinder block main bearing hole														
				≤5-4.0-00	≤5-4.0-01	≤5-4.0-02	≤5-4.0-03	≤5-4.0-04	≤5-4.0-05	≤5-4.0-06	≤5-4.0-07	≤5-4.0-08	≤5-4.0-09	≤5-4.0-10	≤5-4.0-11	≤5-4.0-12	≤5-4.0-13	≤5-4.0-14
				D	E	F	G	H	J	K	L	M	N	O	P	R	S	T
Diameter grouping of crankshaft main journal	D	49.-985	Upper bearing shell	B	B	G	G	G	G	G	G	G	G	G	G	G	G	G
			Lower bearing shell	B	B	B	B	B	B	G	G	G	G	G	G	G	G	G
	E	49.-986	Upper bearing shell	B	B	B	G	G	G	G	G	G	G	G	G	G	G	G
			Lower bearing shell	B	B	B	B	B	B	B	G	G	G	G	G	G	G	G
	F	49.-987	Upper bearing shell	B	B	B	B	G	G	G	G	G	G	G	G	G	G	G

			Lower bearing shell	B	B	B	B	B	B	B	B	G	G	G	G	G	G	G
	G	49.-988	Upper bearing shell	B	B	B	B	B	G	G	G	G	G	G	G	G	G	G
			Lower bearing shell	Y	B	B	B	B	B	B	B	B	G	G	G	G	G	G
	H	49.-989	Upper bearing shell	B	B	B	B	B	B	G	G	G	G	G	G	G	G	G
			Lower bearing shell	Y	Y	B	B	B	B	B	B	B	B	G	G	G	G	G
	J	49.-990	Upper bearing shell	B	B	B	B	B	B	B	G	G	G	G	G	G	G	G

			Lower bearing shell	Y	Y	Y	B	B	B	B	B	B	B	B	G	G	G	G
	K	49.-991	Upper bearing shell	B	B	B	B	B	B	B	B	G	G	G	G	G	G	G
			Lower bearing shell	Y	Y	Y	Y	B	B	B	B	B	B	B	B	G	G	G
	L	49.-992	Upper bearing shell	Y	B	B	B	B	B	B	B	B	G	G	G	G	G	G
			Lower bearing shell	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B	G	G
	M	49.-993	Upper bearing shell	Y	Y	B	B	B	B	B	B	B	B	G	G	G	G	G

			Lower bearing shell	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B	G
	N	49.-994	Upper bearing shell	Y	Y	Y	B	B	B	B	B	B	B	B	G	G	G	G
			Lower bearing shell	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B
	O	49.-995	Upper bearing shell	Y	Y	Y	Y	B	B	B	B	B	B	B	B	G	G	G
			Lower bearing shell	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B
	P	49.-996	Upper bearing shell	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B	G	G

			Lower bearing shell	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B
	R	49.-997	Upper bearing shell	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B	G
			Lower bearing shell	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B
	S	49.-998	Upper bearing shell	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B
			Lower bearing shell	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B
	T	49.-990	Upper bearing shell	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B

			Lower bearing shell	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B
	V	50.-000	Upper bearing shell	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B
			Lower bearing shell	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B
	X	50.-001	Upper bearing shell	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B
			Lower bearing shell	R	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B
	Y	50.-002	Upper bearing shell	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B

			Lower bearing shell	R	R	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y
	Z	50.-003	Upper bearing shell	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B
			Lower bearing shell	R	R	R	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y

Color gear grouping of upper and lower main bearing shells and main bearing upper:

Color (R)	Outer wall thickness (WALL THICKNESS)	
GREEN	2	+0.003
		-0.001
BLUE	2	-0.001
		-0.005
YELLOW	2	-0.005
		-0.009
Red (RED)	2	-0.009
		-0.013

Grouping bearing shell matching table of connecting rod

Connecting rod bearing shell matching table	Diameter of connecting rod hole diameter												
	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D12	D13
	5L0-01	5L0-02	5L0-03	5L0-04	5L0-05	5L0-06	5L0-07	5L0-08	5L0-09	5L0-10	5L0-11	5L0-12	5L0-13

Diameter of crankshaft connecting rod														
	A	47.9-82	B	B	B	B	B	B	B	B	B	G	G	G	G
			B	B	B	B	B	B	B	B	B	G	G	G	G
	B	47.9-83	B	B	B	B	B	B	B	B	B	B	G	G	G
			B	B	B	B	B	B	B	B	B	B	G	G	G
	C	47.9-84	B	B	B	B	B	B	B	B	B	B	B	G	G
			B	B	B	B	B	B	B	B	B	B	B	G	G
	D	47.9-85	Y	B	B	B	B	B	B	B	B	B	B	B	G
			Y	B	B	B	B	B	B	B	B	B	B	B	G
	E	47.9-86	Y	Y	B	B	B	B	B	B	B	B	B	B	B
			Y	Y	B	B	B	B	B	B	B	B	B	B	B
	F	47.9-87	Y	Y	Y	B	B	B	B	B	B	B	B	B	B
			Y	Y	Y	B	B	B	B	B	B	B	B	B	B
	G	47.9-88	Y	Y	Y	Y	B	B	B	B	B	B	B	B	B
			Y	Y	Y	Y	B	B	B	B	B	B	B	B	B
	H	47.9-89	Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B
			Y	Y	Y	Y	Y	B	B	B	B	B	B	B	B
	J	47.9-90	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B
			Y	Y	Y	Y	Y	Y	B	B	B	B	B	B	B
	K	47.9-91	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B
			Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B
	L	47.9-92	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B
			Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B
	M	47.9-93	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B
			R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B
	N	47.9-94	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B
			R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B
	O	47.9-95	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B
			R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B	B
	P	47.9-96	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B
			R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	B
	R	47.9-97	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y
			R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y
	S	47.9-98	R	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y
			R	R	R	R	R	R	Y	Y	Y	Y	Y	Y	Y
	T	47.9-99	R	R	R	R	R	R	R	Y	Y	Y	Y	Y	Y
			R	R	R	R	R	R	R	Y	Y	Y	Y	Y	Y
	V	48.0-00	R	R	R	R	R	R	R	R	Y	Y	Y	Y	Y
			R	R	R	R	R	R	R	R	Y	Y	Y	Y	Y

Color gear grouping of upper and lower connecting rod bearing shell

Color (R)	Outer wall thickness (WALL THICKNESS)	
GREEN	1.5	-0.001
		-0.005

Color (R)	Outer wall thickness (WALL THICKNESS)	
BLUE	1.5	-0.005
		-0.009
YELLOW	1.5	-0.009
		-0.013
Red (RED)	1.5	-0.013
		-0.017

1.3.4 Lubricating oil smearing and adding parts

1.3.4.1 Lubricating oil smearing and adding parts

Parts to be lubricated and lubricating medium

Lubricating parts	Lubricating medium
Main bearing shell upper and lower inner surfaces, main bearing upper, thrust plates, and connecting rod bearing shell upper and lower inner surfaces	Engine oil
Crankshaft main journal, silent shaft journal and silent shaft bearing, intake and exhaust camshaft journal and cams	Engine oil
Main bearing cap bolt	Engine oil
Piston pin	Engine oil
Cylinder block cylinder hole inner wall	Engine oil
Cylinder head camshaft bearing hole tappet hole	Engine oil
Intake/Exhaust valve rod end	Engine oil
Roller rocker arm rolling wheel	Engine oil or 10W60
Oil pump tappet	Engine oil
Intake/Exhaust valve oil seal tooling	Engine oil
Engine oil dipstick	Silica gel
Oil filter sealing ring	Silica gel or white oil
O-shaped ring of supercharger fuel returning pipe	Silica gel
Cam phase sensor installing hole	P80 or other insertion aid with the lubricating function similar to P80/silica gel/engine oil
Sealing ring of oil pipe	P80 or other insertion aid with the lubricating function similar to P80
High pressure oil pump installing holes or the positions of O-shaped rings	P80 or other insertion aid with the lubricating function similar to P80
Crankshaft front oil seal	P80 or other insertion aid with the lubricating function similar to P80
Oil pump harness joint sealing ring	P80 or other insertion aid with the lubricating function similar to P80
Oil cooler water outlet pipe O-shaped rings	P80 or other insertion aid with the lubricating function similar to P80
Oil cooler water inlet pipe O-shaped rings	P80 or other insertion aid with the lubricating function similar to P80
Oil cooler water outlet pipe assembly	P80 or other insertion aid with the lubricating function similar to P80
Oil cooler inlet pipe assembly	P80 or other insertion aid with the lubricating function similar to P80
Rubber connecting pipe	P80 or other insertion aid with the lubricating function similar to P80

Lubricating parts	Lubricating medium
Engine air outlet pipe	P80 or other insertion aid with the lubricating function similar to P80
Two O-shaped rings of supercharger fuel inlet pipe	P80 or other insertion aid with the lubricating function similar to P80
Differential pressure sensor high/low pressure end rubber pipe	P80 or other insertion aid with the lubricating function similar to P80
Differential pressure sensor	P80 or other insertion aid with the lubricating function similar to P80
Supercharger water pipe assembly	P80 or other insertion aid with the lubricating function similar to P80
EGR cooler water inlet rubber pipe	P80 or other insertion aid with the lubricating function similar to P80
EGR rubber pipe	P80 or other insertion aid with the lubricating function similar to P80
Intake pressure temperature sensor	Engine oil

1.3.5 Applying sealant part

1.3.5.1 Applying sealant part

Sealant part and sealant grade

Sealant application parts	Sealant grade
Crankcase/cylinder block	Plane silica gel Loctite 5970
Oil pan	Plane silica gel Loctite 5970
Cylinder gasket	Plane silica gel Loctite 5970
Bearing cap bearing cap	Plane silica gel Loctite 5970
Timing belt guard	Plane silica gel Loctite 5970
Bowl type expansion plug	Cylindrical retaining compound Loctite 648

1.3.6 Clearance fit and interference fit

1.3.6.1 Clearance fit and interference fit

Clearance fit and interference fit

Parts to be checked	Required value of clearance (mm)
Silent shaft front journal clearance	0.020-0.057
Silent shaft rear end and ball bearing inner ring clearance	0.001-0.022
First ring and piston side clearance	0.03-0.07
Second ring and piston side clearance	0.25-0.07
First ring and piston back clearance	0.954-1.261
Second ring and piston back clearance	0.954-1.261
First ring closing clearance	0.15-0.25
Second ring closing clearance	0.4-0.6
Piston cylinder matching clearance	0.033-0.057
Piston pin and piston hole clearance	0.004-0.011
Connecting rod big end and crankshaft handle clearance	0.18-0.48
Piston pin and connecting rod small end lining clearance	0.008-0.017
Crankshaft axial displacement	0.1-0.29
Main bearing shell matching shell clearance	0.015 ~ 0.031(without expansion) 0.025 ~ 0.041(considering expansion)
Connecting rod bearing shell matching shell clearance	0.027 ~ 0.045(without expansion) 0.040 ~ 0.058(considering expansion)

1.3.7 List of disposable parts and components

1.3.7.1 List of disposable parts and components

List of disposable parts and components

Part Name	Quantity	Number of times allowed	Note
Heat-resistant bolt	2	1	Replace after removal
Supercharger connecting manifold gasket combination heat shield	1	1	Replace after removal
Heat-resistant double end stud	2	1	Replace after removal
Elastic cylinder pin	1	1	Replace after removal
Piston pin circlip	6	1	Replace after removal
Supercharger fuel drain port gasket	1	1	Replace after removal
Plug cover	1	1	Replace after removal
Camshaft blank plug	2	1	Replace after removal
Main bearing cap bolt	8	1	Newly replaced bolts can be used up to 3 times.
Crankshaft front oil seal	1	1	Replace after removal
Crankshaft rear oil seal	1	1	Replace after removal
O-shaped gaskets	2	1	Replace after removal
O-shaped gaskets	2	1	Replace after removal
O-shaped gaskets	1	1	Replace after removal
Cylinder gasket	1	1	Replace after removal
Cylinder head bolt	8	1	Replace after removal
Intake valve oil seal	6	1	Replace after removal
Exhaust valve oil seal	6	1	Replace after removal
Camshaft blank plug	2	≤1	Replace after removal
Ventilation valve assembly	1	1	Replace after removal
High-pressure oil pump	1	Depends on the situation	O-ring can be reassembled if it is not broken.
High-pressure oil pipe assembly	1	1	Replace after removal
Flywheel bolt	8	1	Replace after removal
Damping pulley bolt assembly	1	1	Replace after removal
Intake central oil control valve	1	≤3	If there’s no deformation or damage, it can be used for two times.

Part Name	Quantity	Number of times allowed	Note
Intake central oil control valve	1	≤3	If there's no deformation or damage, it can be used for two times.
Connecting rod bolt	6	1	Replace after removal
Piston pin circlip	6	1	Replace after removal
Intake manifold gasket	1	1	Replace after removal
Throttle body gasket	2	1	If there's no deformation or damage, it can be used again.
Drain plug washer	1	1	Replace after removal
spark plug	3	≤3	If there's no deformation or damage, it can be used again

1.3.8 Group number

1.3.8.1 Group number

Main journal grouping of crankshaft

Identification signal	Diameter of main journal
D	49.985
E	> 49.985-49.986
F	> 49.986-49.987
G	> 49.987-49.988
H	> 49.988-49.989
J	> 49.989-49.990
K	> 49.990-49.991
L	> 49.991-49.992
M	> 49.992-49.993
N	> 49.993-49.994
O	> 49.994-49.995
P	> 49.995-49.996
R	> 49.996-49.997
S	> 49.997-49.998
T	> 49.998-49.999
V	> 49.999-50.000
X	> 50.000-50.001
Y	> 50.001-50.002
Z	> 50.002-50.003

Grouping number of connecting rod journal

Identification signal	Diameter of connecting rod journal
A	47.982
B	> 47.982-47.983
C	> 47.983-47.984
D	> 47.984-47.985
E	> 47.985-47.986
F	> 47.986-47.987
G	> 47.987-47.988
H	> 47.988-47.989
J	> 47.989-47.990
K	> 47.990-47.991
L	> 47.991-47.992
M	> 47.992-47.993
N	> 47.993-47.994
O	> 47.994-47.995
P	> 47.995-47.996
R	> 47.996-47.997

Identification signal	Diameter of connecting rod journal
S	> 47.997-47.998
T	> 47.998-47.999
V	> 47.999-48.000

Grouping number of connecting rod weight

Conrod weight		Group marking
Total weight	470g	/
Small end	140.6±7g	/
Big end	> 318.4g~≤ 322.8g	1
	> 322.8g~≤ 327.2g	2
	> 327.2g~≤ 331.6g	3
	> 331.6g~≤ 336g	4
	> 336g~≤ 340.4g	5

Grouping number of connecting rod big end hole

Big hole diameter group	
Marking	Dimensions
D01	≥ 51-≤ 51.001
D02	> 51.001~≤ 51.002
D03	> 51.002~≤ 51.003
D04	> 51.003~≤ 51.004
D05	> 51.004~≤ 51.005
D06	> 51.005~≤ 51.006
D07	> 51.006~≤ 51.007
D08	> 51.007~≤ 51.008
D09	> 51.008~≤ 51.009
D10	> 51.009~≤ 51.010
D11	> 51.010~≤ 51.011
D12	> 51.011~≤ 51.012
D13	> 51.012~≤ 51.013

1.3.9 Group number

1.3.9.1 Static protection parts list

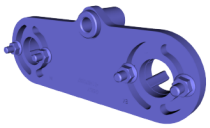
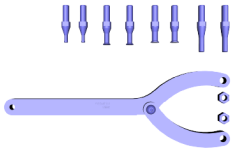
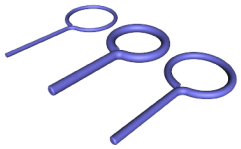
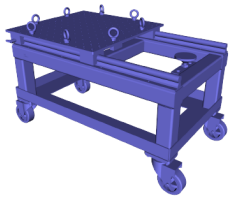
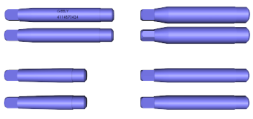
Static protection parts list

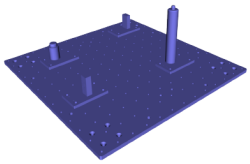
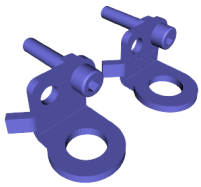
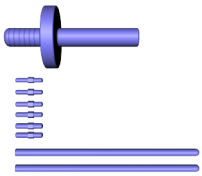
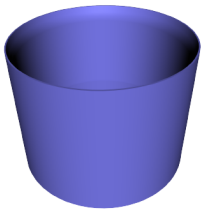
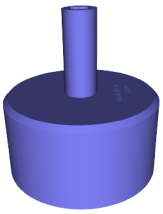
Serial number	Part Name	Static protection measures
1	Oil pressure sensor	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
2	Camshaft phase sensor	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
3	Electronic throttle valve body	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
4	Intake pressure temperature sensor	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
5	Electronic water pump	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
6	Coolant temperature controlling module	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
7	Fuel rail oil injector assembly	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
8	Differential pressure sensor	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
9	Ignition coil	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
10	EGR valve	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
11	Air/exhaust mix valve	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets
12	Knock sensor	Anti-static shelves, anti-static floor mats, static discharge, static gloves or bracelets

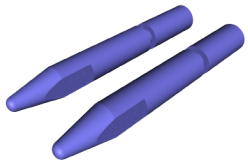
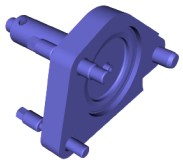
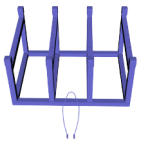
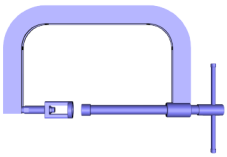
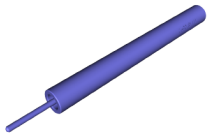
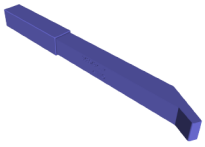
1.4 Special tools of engine

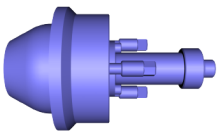
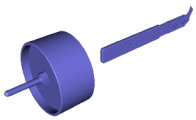
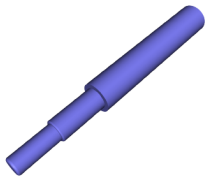
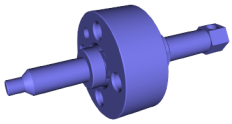
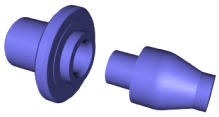
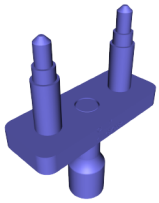
1.4.1 Special tools of engine

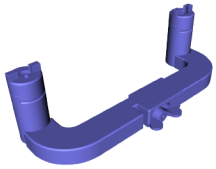
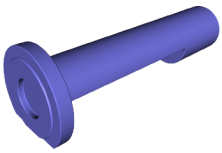
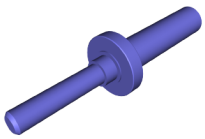
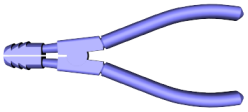
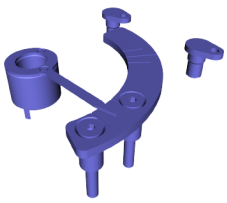
1.4.1.1 Special tools of engine

Serial number	Figure	Tool number	Name
1		4114870587	VVT fixing tool
2		4114870416	Belt pulley fixing tool
3		4114870408	Positioning pin outfit
4		4114870610	Power assembly positioning placing rack
5		4114870424	Engine-transmission assembling guide pin

Serial number	Figure	Tool number	Name
6		4114870619	Engine positioning pillar
7		4114870401	Engine front lifting hook
8		4114870389	Auxiliary tooling for piston into the cylinder
9		4114720194	Piston cone sleeve into the cylinder
10		4114870585	Disassembly and assembly tool of spark plug (14MM)
11		4114720198	Oil filter module uninstalling and installing tool

Serial number	Figure	Tool number	Name
12		4114870593	Housing installing guide pin
13		4114720193	Silent shaft blanking cap installing tool
14		4114870397	Valve collet installing tool
15		4114720020	Valve collet installing tool
16		4114870592	Valve oil seal installing tool
17		4114870398	Prying bar

Serial number	Figure	Tool number	Name
18		4114870590	Crankshaft rear oil seal installing tool
19		4114870386	Crankshaft rear oil seal uninstalling tool
20		4114870582	Special tool for crankshaft zero-point position
21		4114870387	Crankshaft pulley uninstalling tool
22		4114870591	Crankshaft front oil seal installing tool
23		4114870584	Rotation tool of crankshaft

Serial number	Figure	Tool number	Name
24		4114870586	Camshaft fixing tool
25		4114870395	Camshaft blanking cap installing tool
26		4114870400	Oil pipe installing tool
27		4114870399	Oil pipe uninstalling tool
28		4114870583	Timing zero check tool
29		/	High-pressure oil pipe dissassembly and assembly tool