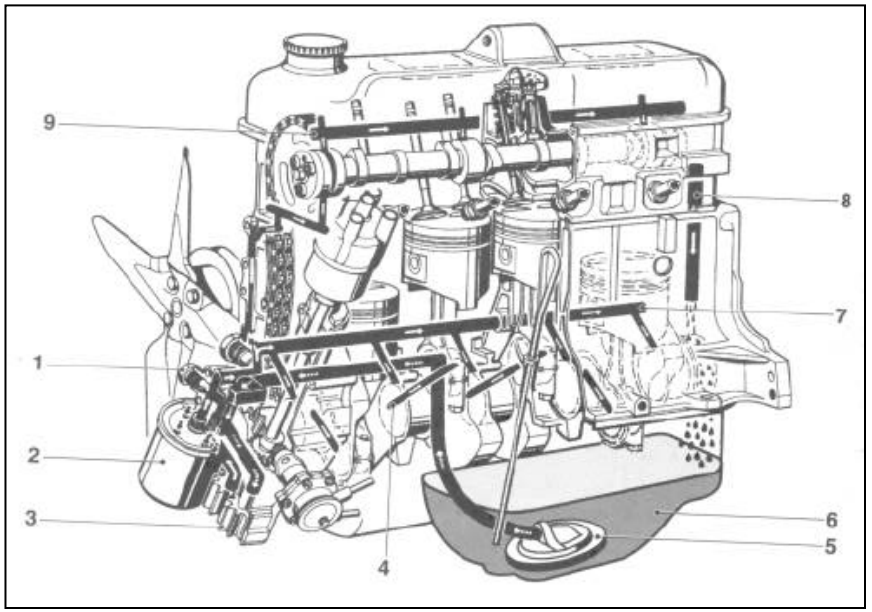
# Engine Mechanical Part 2




SUZUKI TRAINING ACADEMY

Engine Mechanical 2
Course code: EN03

Student training manual
Suzuki Online Training

# Foreword

The lubrication system forces oil to high friction points in the engine to protect moving parts from friction, wear and damage. It is one of the most important engine systems affecting engine service life. In this training manual, we will study the fundamentals of engine lubrication, the functions of the basic lubrication components and basic maintenance procedures.

## Smart manuals

Some sections of this training manual contain videos with detailed information on the topics you are studying. If you are studying this training manual on a PC, look out for the "green play video" symbol on any photo or picture in this manual, click on the green button to watch a video providing you with detailed information on that topic. Note: Internet connection required.



# Suzuki Technician curriculum

This training manual is part of the Non Suzuki Technician to Suzuki Technician curriculum. The curriculum consists of the following modules:

1. GE01 Suzuki Introduction
2. GE02 Electrical / Electronics
3. GE03 Diagnostics
4. EN02 Engine Mechanical part I
5. EN03 Engine Mechanical part II
6. EN04 Engine Mechanical part III
7. EN05 Engine Auxiliary systems
8. DS01 Driveshaft/Axle
9. DS02 Driveshaft/Axle - transfer case
10. BR02 Brake control systems
11. TR02 Manual transmission / transaxle
12. CS02 Control system / body electrical
13. CS03 Communication / bus systems

You are currently studying EN03 Engine mechanical part 2. This module consists of the following courses:

- Engine Fundamentals-Lubrication
- J24B Engine-service procedures

# Lesson 1: Engine lubrication fundamentals

## Learning outcomes

At the end of this lesson, you will be able to:

- Describe the functions of engine oil
- Describe the function of the lubrication system in an internal combustion engine.
- Describe the main causes of oil deterioration.
- Describe the function of the oil pump.
- Describe the function of the oil filer.
- Describe the function of the oil cooler
- Describe basic maintenance procedures for the oil pump.
- Describe the causes of increased oil consumption.

## 1.1 Engine oil

Engine oils are employed primarily to lubricate contiguous components in relative motion within the internal combustion engine. The oil also removes heat generated by friction, carries abraded particles away from the friction surface, washes out contaminants, holds them in suspension, and protects metals against corrosion. The most common engine oils are mineral oils treated with additives. Higher stress resistance requirements combined with extended oil-change intervals have led to widespread application of fully and semi-synthetic oils.

The quality of an engine oil is determined by its origin, the refining processes used on the mineral oil (except in the case of synthetic oils) and the additive composition.

Additives are classified according to their respective functions:

- Viscosity index improvers
- Pour-point improvers
- Oxidation and corrosion inhibitors
- Detergent and dispersant additives
- Extreme-pressure (EP) additives
- Friction modifiers
- Anti-forming agents.

### 1.1.1 SAE viscosity grades

The SAE grades are the internationally accepted standard for defining viscosity. The standard provides no information on the quality of the oil.

A distinction is made between single grade and multi-grade oils. Multi-grade oils are the type in widespread use today. Two series are employed for the designation where the letter “W” (winter) is used to define specific cold-flow properties.

The viscosity grades including the letter “W” are rated according to maximum viscosity , maximum viscosity pumping temperature and the minimum viscosity at 100°C. Viscosity grades without the “W” are rated only according to viscosity at 100°C.


Figure 1: 15W-40 engine oil

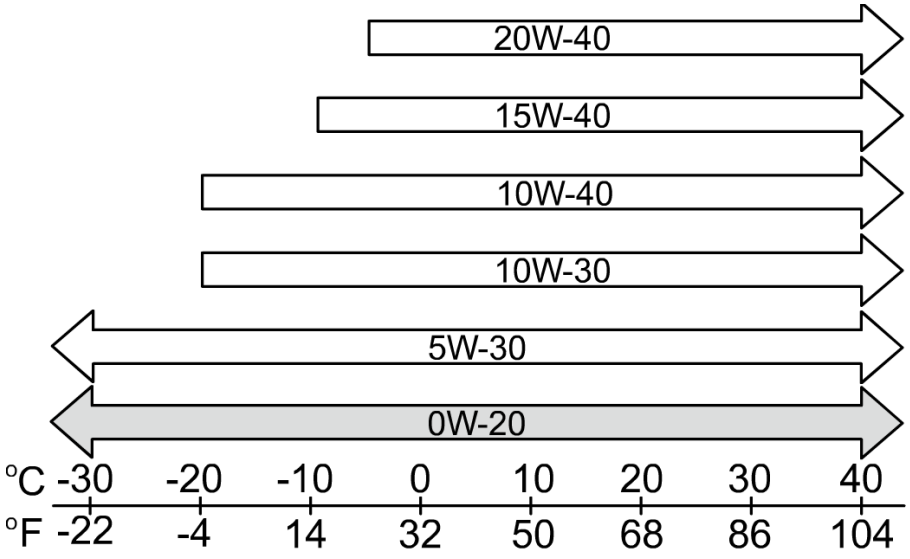
## 1.1.2 Multi-grade oils

Multi-grade oils are characterized by a less pronounced proportional relationship between viscosity and temperature. They reduce friction and wear, can be used all year round, and provide rapid lubrication for all engine components in cold starts.

## 1.1.3 High-lubricity oils

High lubricity oils are lubricating oils with multi-grade properties, low cold viscosity and special anti-friction additives. Extremely low engine friction under all operating conditions reduces fuel consumption.

### 1.1.4. Engine oil viscosity chart




## 1.1.5 Engine oil API grades

An API rating is a set of letters printed on the oil bottle to denote how well the oil will perform under operating conditions. This is a performance standard set by the American Petroleum Institute, an association of oil-related companies that sets industry standards. Below is a list of current API oil ratings:

| for petrol engines | For diesel engines |
|---|---|
| SN | CJ-4 |
| SM | CI-4 |
| SL | CH-4 |
| SJ | |

See complete list of API ratings

The service manual will give the service rating recommended for a specific vehicle. Always use the recommended oil grade.

## 1.2 Engine oil functions

Not only does the engine oil lubricate parts inside the engine,
but it also has many other important functions and properties.

| Function | Description |
|---|---|
| Lubricating action | Friction is generated between sliding parts. The engine oil can reduce the friction between such parts. The engine oil forms an oil film on the sliding parts in the engine, which reduces the friction of the sliding parts and makes them operate smoothly. |
| Cooling action | The engine has cooling devices such as the radiator, but there are some parts such as the pistons and sliding parts that are difficult to cool with the cooling system. The circulating engine oil absorbs the surrounding heat from these parts and cools them by carrying the heat elsewhere and dissipating it. |
| Cleaning action | Metal wear particles and burning residue such as sludge and carbon are generated in an engine. If these accumulate on sliding parts or in oil channels, they may increase wear or clog the oil channels and cause lubrication defects. To prevent such materials from accumulating, the engine oil washes them away. They float in the engine oil and the oil carries them to the oil filter. |
| Sealing action | The oil improves sealing by flowing into gaps, such as between the piston and cylinder and forming a film. |
| Rust prevention action | The oil prevents rust by forming an oil film over the surfaces of parts so they do not make contact with air and moisture. It also neutralized acidic substances that are generated during combustion and that can damage the engine. |

**Key Points**

The 3 main causes of engine oil deterioration are as follows.

- Deterioration due to oxidation of the oil itself: Engine oil deteriorates because of oxidization when heat is generated by burning or friction, or when the oil is mixed with air while it is strongly agitated.
- External contamination: Engine oil deteriorates when it is mixed with worn metal parts, burned substances such as soot, fuel and moisture.
- Additive deterioration: Engine oil is mixed with various additives to increase its performance, such as rust prevention agents, demulsification agents, antiwear agents, extreme pressure agents and friction adjustment agents. These additives can deteriorate due to oxygen or heat, which in turn deteriorates the engine oil.

Even if the vehicle is not used, the properties of engine oil deteriorate over time. The engine oil must be replaced at the specified intervals.

## 2. Engine lubrication overview

An engine is made up of combinations of metal parts that move with rotating and reciprocating actions, and it has many sliding parts. If these parts were not lubricated, they would make direct contact with each other.

This would cause high frictional force, generating wear or heat and resulting in seizure. Not only would this frictional force cause a drop in engine output, but it would also significantly damage the engine. As such, for the engine to operate smoothly, friction between parts must be reduced as much as possible.

Engine lubrication is a total flow filtered pump system where the engine oil is sent to the various engine parts by the oil pump. By forming an engine oil film between the various parts and minimizing the friction and wear caused by sliding parts, it enables the various parts to operate smoothly. It also cools parts, prevents corrosion and helps to seal the combustion chamber.

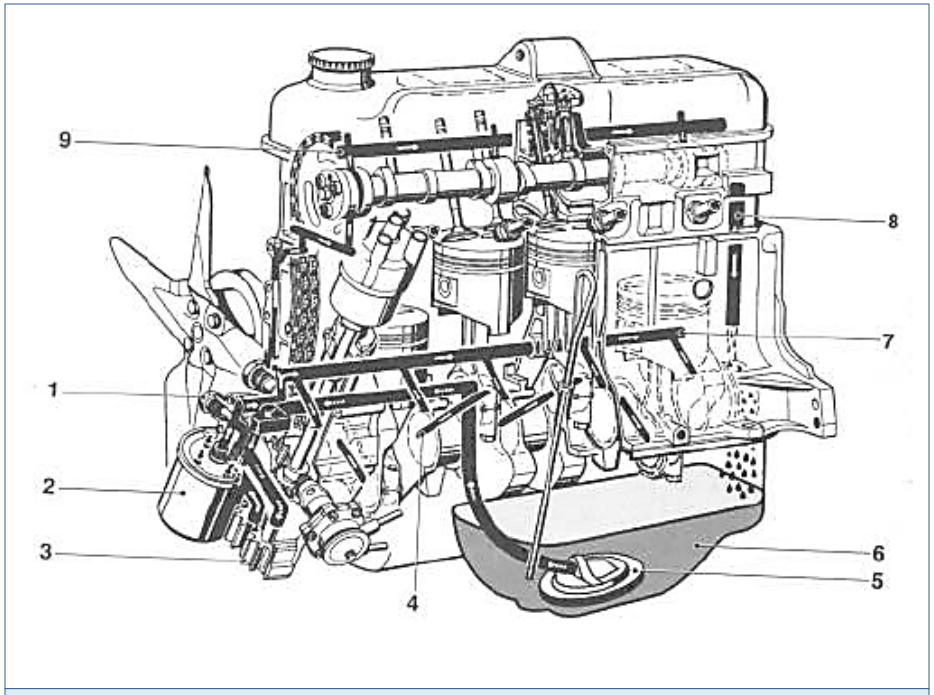



Figure 2: Engine lubrication system

[1] Pressure relief valve
[2] Oil filter
[3] Gear pump
[4] From main bearing to connecting rod bearing
[5] Intake bell housing with strainer
[6] Oil pan
[7] Main oil feed line to crankshaft bearings
[8] Return flow from timing case to crankcase
[9] To camshaft bearings

## 2.1 Engine oil flow

The parts that must be lubricated are different depending on the engine's specifications and therefore oil flow on one engine different to another engine. Always refer to the corresponding service manual for the engine oil flow. As an example, the oil flow for the JB424 engine is shown below

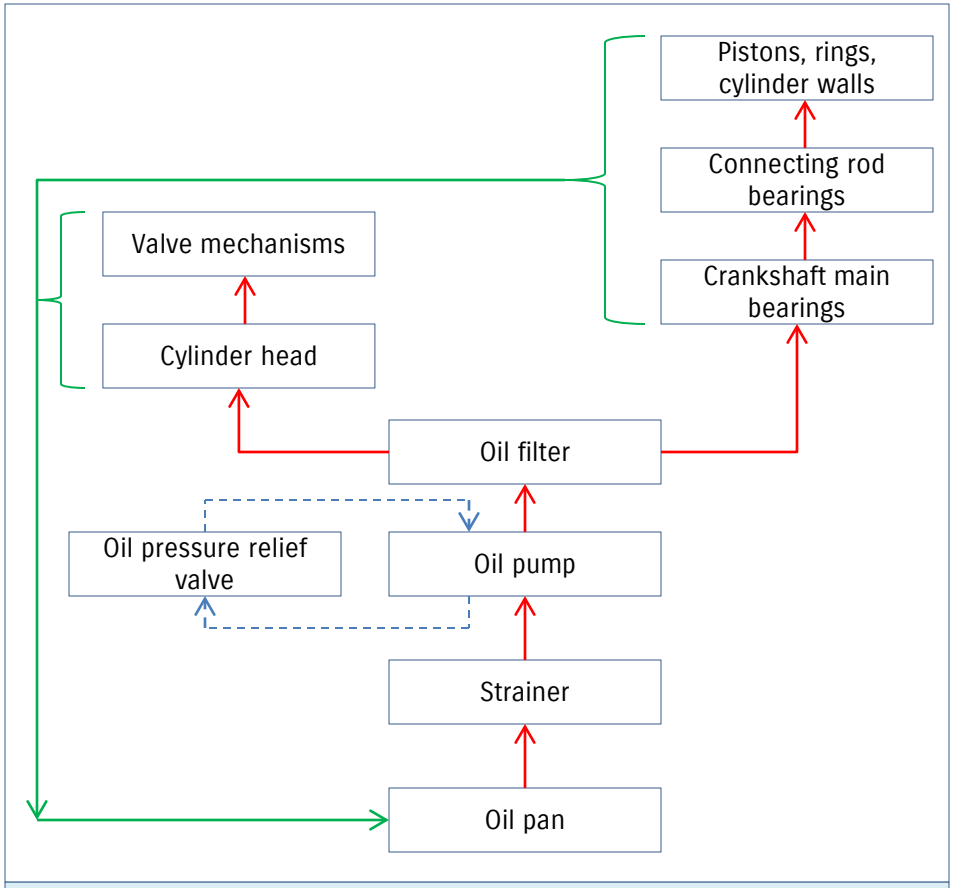



Figure 3: Engine oil flow-J24B

# 3. Lubrication system parts

## 3.1 Oil pump

An internal gear pump, gear pump or trochoid pump can be used as the oil pump. The trochoid pump is used most often.

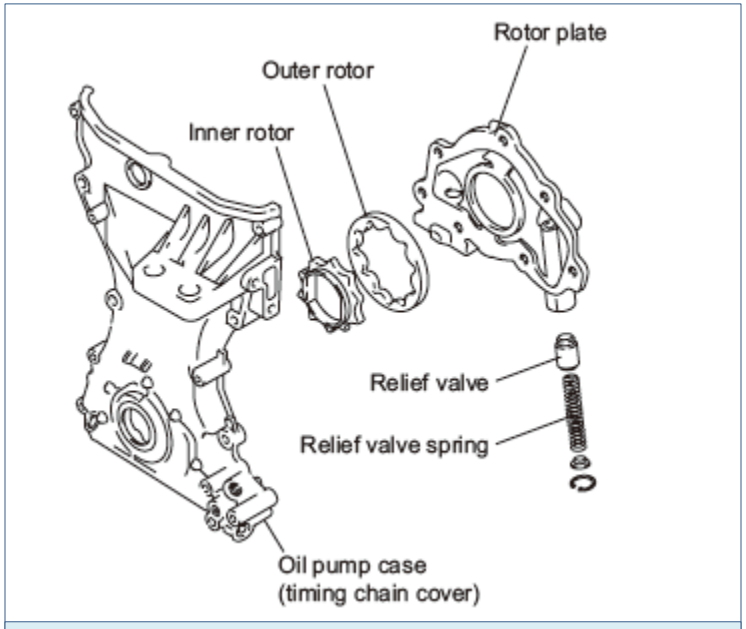
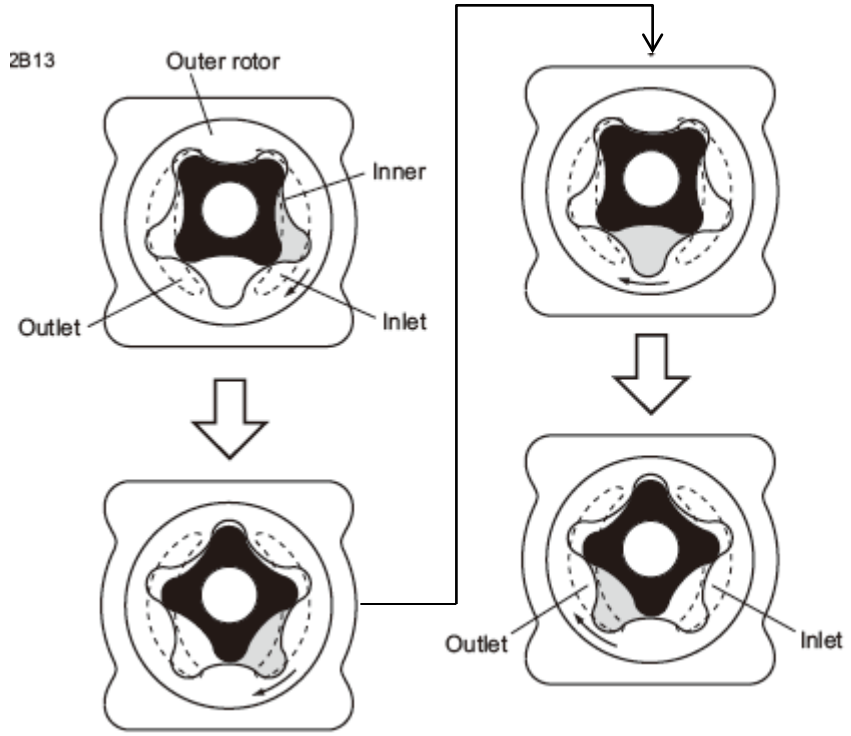



Figure 4: Trochoid oil pump

In a trochoid pump, an inner rotor and outer rotor with a different number of teeth are eccentrically assembled on the oil pump case. When the inner rotor rotates, the outer rotor also rotates. Because the shaft of the inner rotor is slightly eccentric, when it rotates the space between the 2 rotors changes. The change in this space is used to pump the oil.




The pressure that pumps the oil to the engine lubrication areas is called oil pressure. It changes in accordance with the engine rotation speed. When the oil pressure is 20 - 29.4 kPa, the oil pressure warning lamp turns on to alert the driver.

The relief valve on the oil pump prevents excessive oil from being supplied when the oil pressure rises after the engine rotation speed increases. When the oil pressure reaches 294 - 588 kPa, the relief channel opens to control the maximum oil pressure.

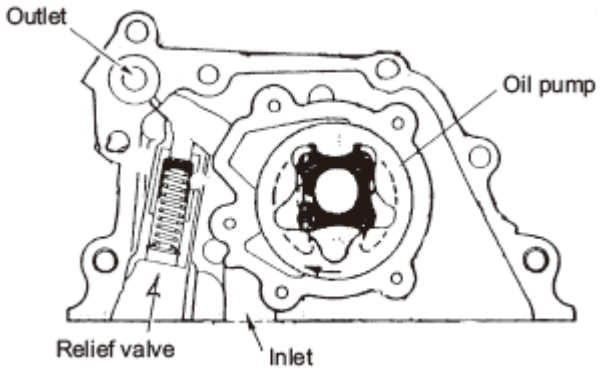



Figure 5: Relief valve

It is important to maintain the correct clearance between the oil pump components. If the clearance becomes too large, it may result in frequent leaks, rattling or a drop in the generated oil pressure.

## 3.2 Oil filter

The oil filter filters the engine oil that passes through the oil strainer to remove foreign objects such as fine metal particles and carbon.

The oil that is pumped from the oil pump pushes open the check valve and enters the outer circumference of the element. After the foreign objects are removed here, the oil flows from the center of the element to the various lubrication areas. The oil filter has a check valve to prevent the reverse flow into the oil pump of the foreign objects in the element when the engine is stopped.

The oil filter also has a relief valve. If the element becomes clogged during use and a pressure difference of about 98 kPa {1 cm2} occurs between the front and rear of the element, the oil is sent to the lubrication areas without passing through the element. This prevents insufficient lubrication.

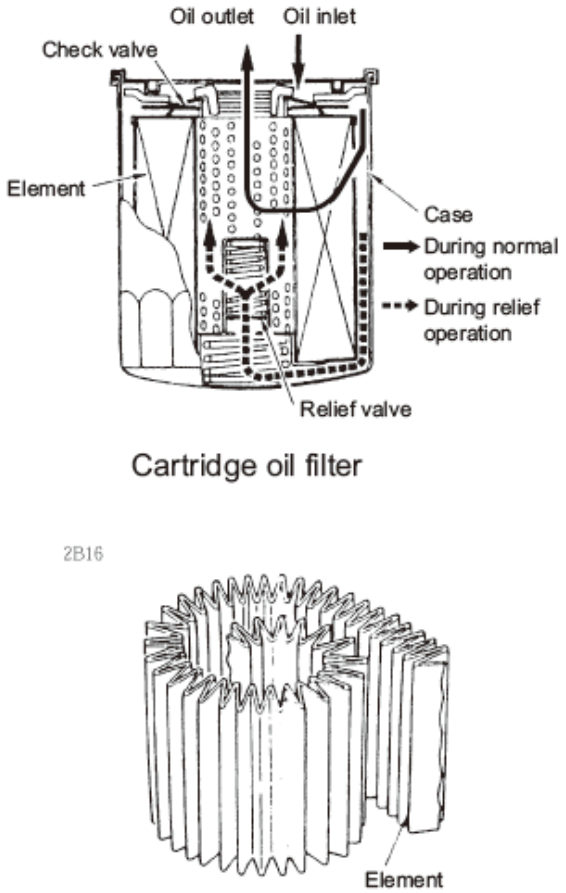



Figure 6: Element

## 3.3 Oil cooler

When the engine oil reaches a high temperature, its lubrication performance drops rapidly. For this reason, engines in which the oil temperature can easily rise, such as turbocharger engines, are equipped with an oil cooler. It uses the wind from driving and the coolant to cool the engine oil and achieve a stable engine oil performance.

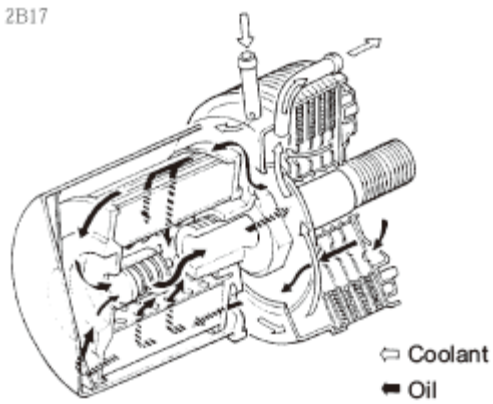



Figure 7: Oil cooler

## 3.4 Oil pan

The oil pan is a tank for storing the engine oil. It has a deep section and a baffle plate (dividing panel). This structure ensures that even if the oil accumulates on one side, such as when the vehicle is on a slope or is turning sharply, there is enough oil at the bottom of the oil pan to be circulated by the oil pump.

# 4. Maintenance

## 4.1. Oil pump check

Check the outer rotor, inner rotor, rotor plate and oil pump case (timing chain cover) for wear or damage and replace if there are any problems.

Also, check the relief valve and relief valve spring for wear or damage and check that the inside of the oil pump case moves smoothly. Replace if there are any problems.

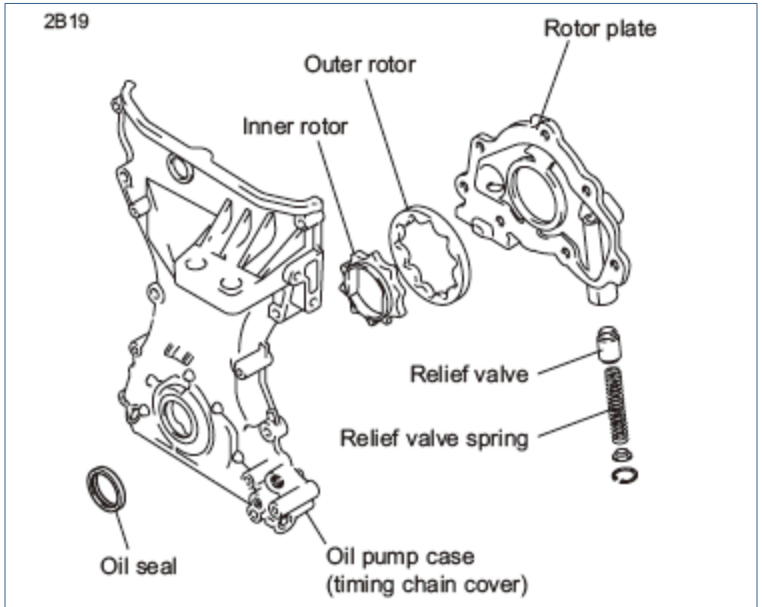



Figure 8: Checking oil pump components

## Radial clearance

When checking the radial clearance, measure the clearance between the oil pump case and the outer rotor with a thickness gauge while positioning the outer rotor on one side. If the measured value deviates from the standard, replace the oil pump rotor set or the oil pump assembly.

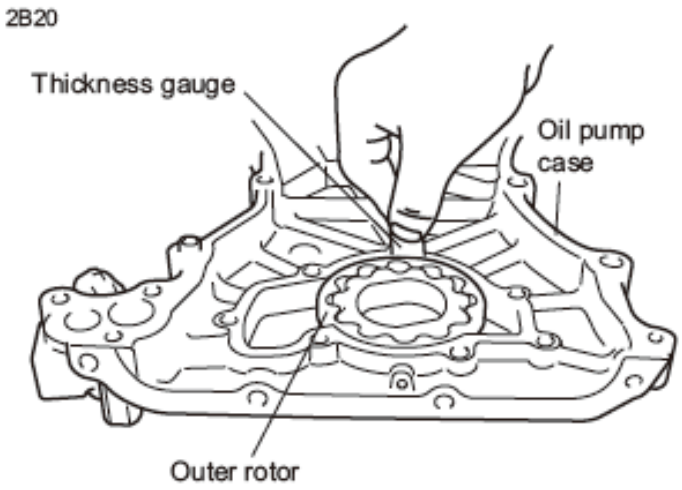



Figure 9: Checking oil pump components

## Side clearance

When checking the side clearance, measure the clearance between the rotor and the oil pump case with a straight edge and a thickness gauge. If the measured value deviates from the standard, replace the rotor set or the oil pump assembly.

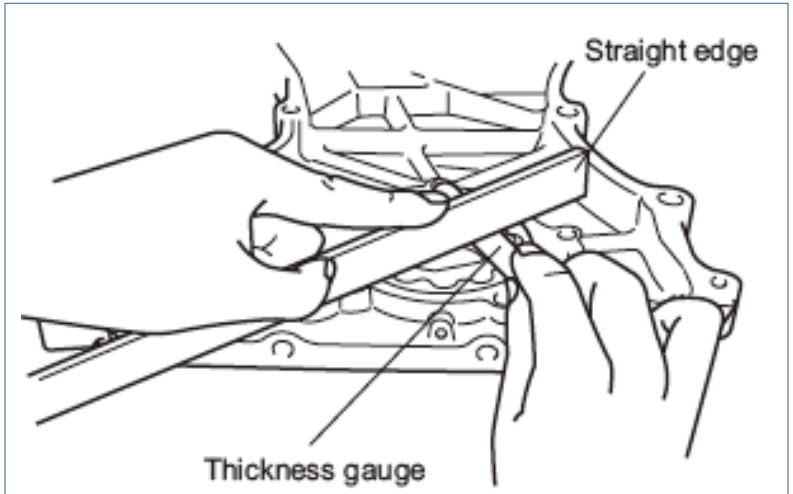



Figure 10: Checking side clearance

### Inner rotor & oil pump clearance

When checking the clearance between the inner rotor and the oil pump case, measure the outside diameter of the inner rotor and the bore of the oil pump case with a micrometer, and calculate the clearance.  If the clearance deviates from the standard, replace the oil pump rotor set or the oil pump assembly.

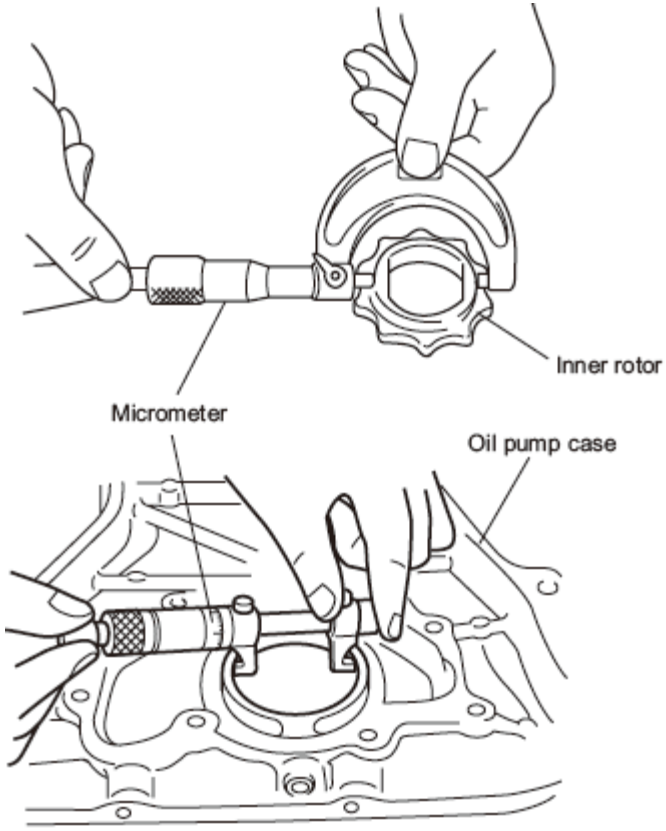



Figure 11: Inner rotor & oil pump clearance check

### Relief valve spring check

When checking the relief valve spring, perform a free length measurement, and a load measurement using a spring tester. If a measured value is equal to or less than the limit, replace the relief valve spring.

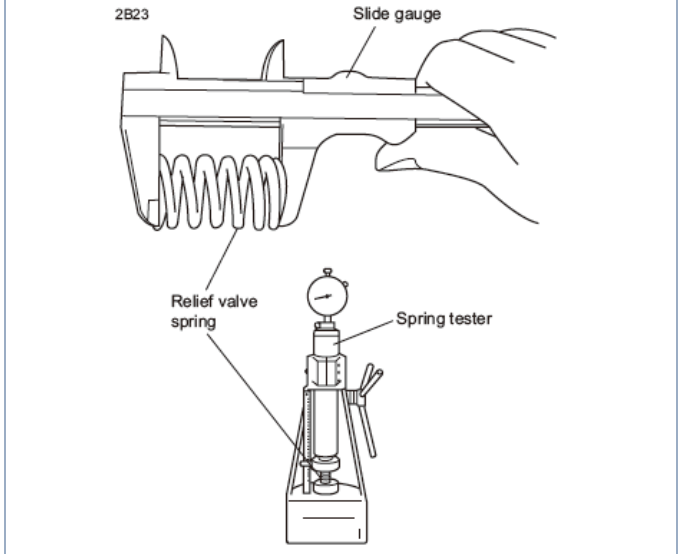



Figure  12: Spring check

## 2.2 Oil pump strainer check

Check the oil pump strainer for cracks, deformation and clogging, and replace if there are any problems.

## 5. Important points for disassembly and assembly

Before disassembly, use a quick-drying ink pen to mark the parts with reference marks so that you assemble them in the same direction. Align these reference marks when assembling the parts.

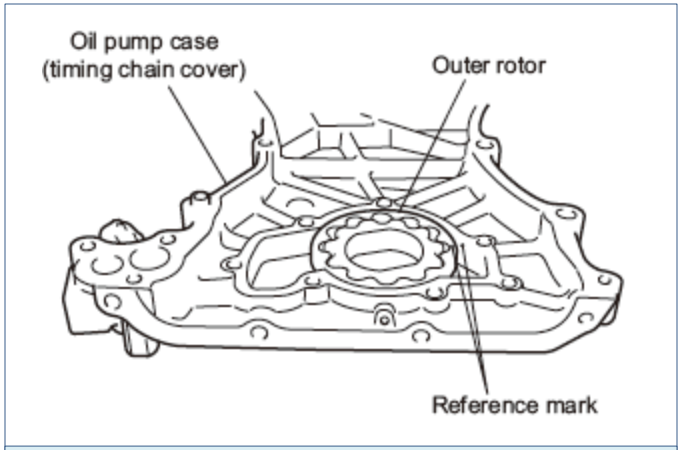



Figure 13: Reference marks

## 6. Oil consumption

Even if there are no leaks, the engine oil level goes down. Oil is consumed as it enters the combustion chambers, burns and evaporates.

The oil consumption greatly increases if the vehicle is driven at high speed with high loads and high engine rotation speeds, or with frequent and repeated acceleration and deceleration.

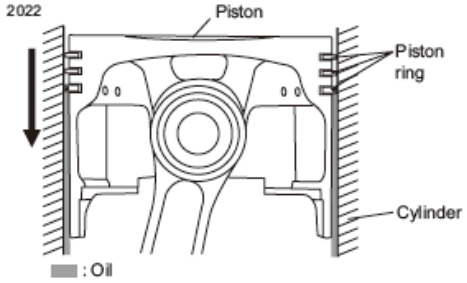
If deteriorated oil or oil that contains a large amount of sludge is used for a long time, it will accelerate the wearing of engine parts and increase the oil consumption. For this reason, it is important to periodically check and replace the engine oil.

Engine oil is mainly consumed in the clearance between the cylinder and the piston, in the clearance between the valve guide and valve stem, and by the blow-by gas reducing device.

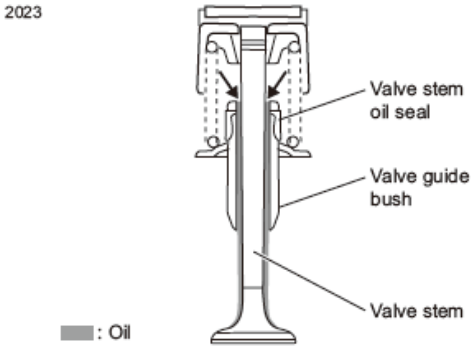
## Key Points

**Oilloss via the piston rings and via the valve guides**

If the clearance between the cylinder and the piston rings (compression rings) increases, the amount of oil that remains in the cylinder also increases. In this way, oil leaks into the combustion chamber from the clearance between the cylinder and the piston and a large amount of oil is consumed, which is referred to as oilloss via the piston rings.




Oil that leaks from the valve stem seal slides down the valve stem, enters the combustion chamber and is consumed, which is referred to as oilloss via the valve guides.




## Summary

- Engine oil, also called motor oil, is needed to keep moving parts in an engine from making direct contact.
- Oil viscosity is the thickness or fluidity (flow ability) of the engine oil.
- Engine oil has many functions including lubrication, cooling, rust prevention and sealing.
- Multi-grade oils provide rapid lubrication for all engine components in cold starts
- The oil filter removes foreign objects such as fine metal particles and carbon from the engine oil.
- A pressure relief valve limits maximum oil pressure. It is a spring-loaded bypass valve in the oil pump, engine block or oil filter housing.
- An oil pump forces oil out of the pan, through the engine filter, galleries and to the engine bearings and other components requiring lubrication.
- An oil cooler is used in engines where the oil temperature can easily rise, such as engines equipped with a turbo charger. It uses air or the coolant to maintain the oil temperature in a stable for peak performance.
- Even when there are no leaks in the engine, the engine oil level goes down. Oil is consumed when entering the combustion chambers via the piston rings or the valve stem oil seals.

# Lesson 2: J20B Engine Service Procedures

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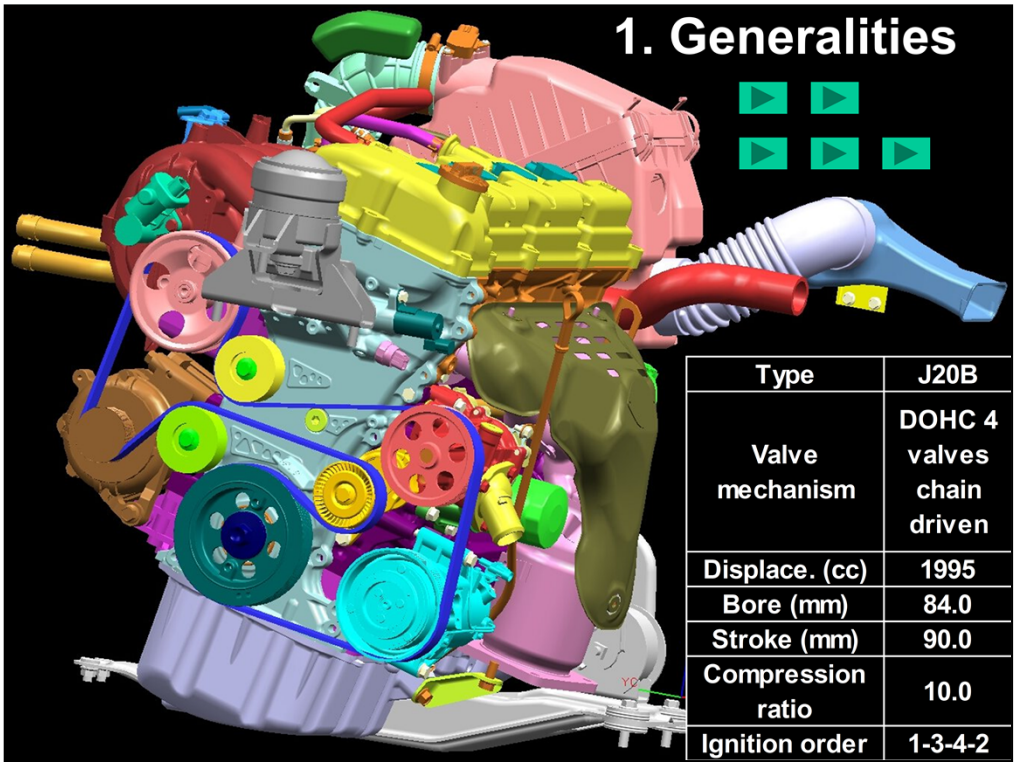



| Type | J20B |
|---|---|
| Valve mechanism | DOHC 4 valves chain driven |
| Displace. (cc) | 1995 |
| Bore (mm) | 84.0 |
| Stroke (mm) | 90.0 |
| Compression ratio | 10.0 |
| Ignition order | 1-3-4-2 |

>Cylinder head made of aluminum alloy, which is light-weight and excellent in heat radiation

>A center plug pentroof combustion chamber

>Cross-flow type of intake and exhaust layout

>A direct driving type valve train, which increases rigidity and reduces mechanical loss

>Valve clearance adjustable by tappet

>Cylinder head bolt tightened in a plastic range in order to stabilize bolt axis strength and to improve reliability

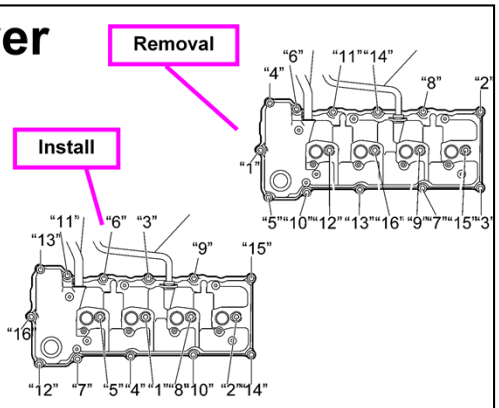
>Optimized engine coolant gallery of cylinder head ,which improves performance of resistance for knocking

[Reference : J24B engine]

Bore is 92.0 mm. Displacement is 2392cc.

1-1

## 2. Cylinder Head Cover




Tightening torque :
3.0Nm→5.0Nm→7.5Nm

Cylinder head cover is mounted on the cylinder head via rubber gasket.
There is no washer between cylinder head cover and size-8 bolt head.

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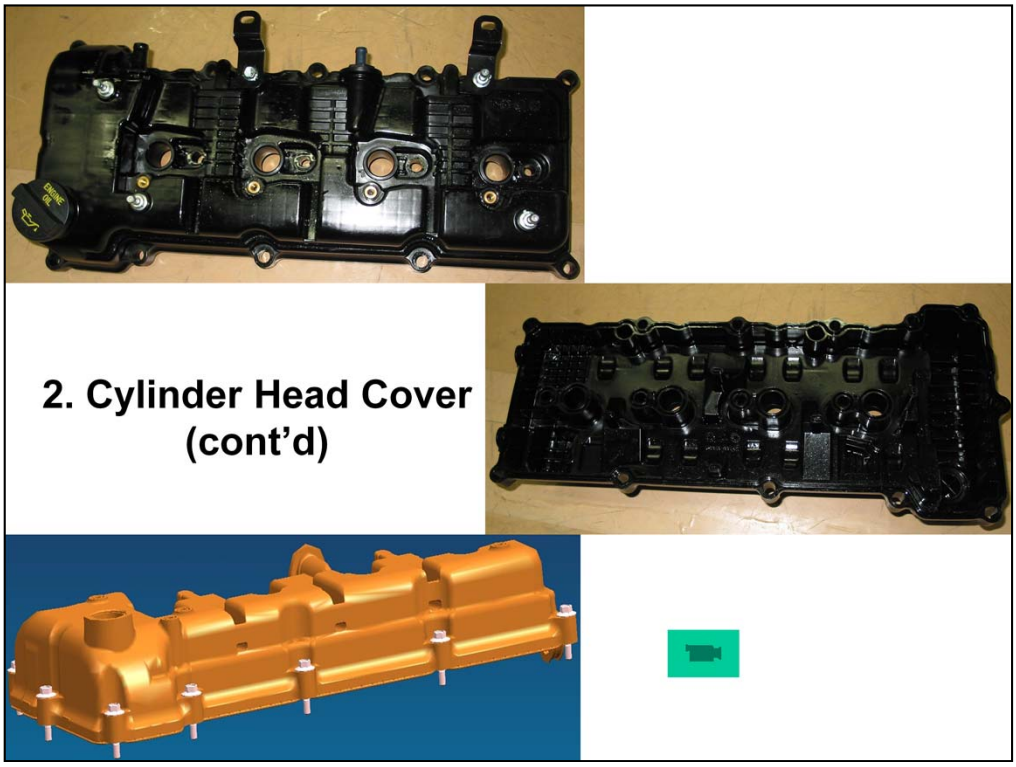


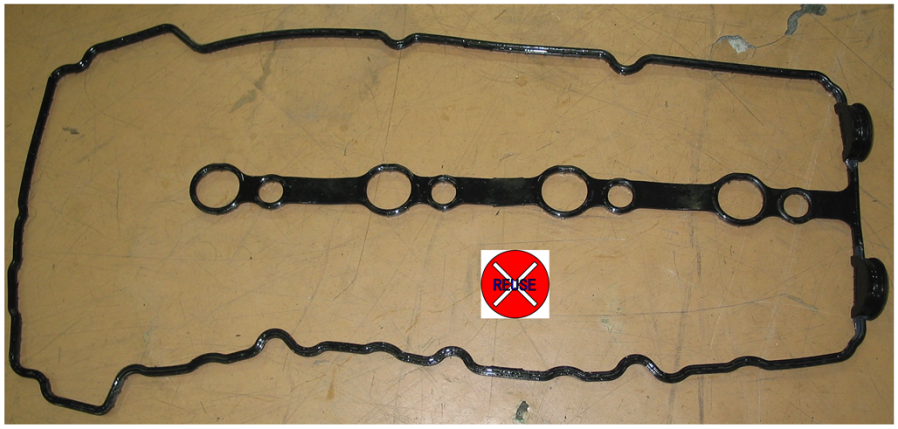

There is rubber gasket between the cover and head to shut off noise and vibration. Once cylinder head cover is separated from cylinder head, the cylinder head cover gasket and spark plug hole O-ring must be replaced with new one.

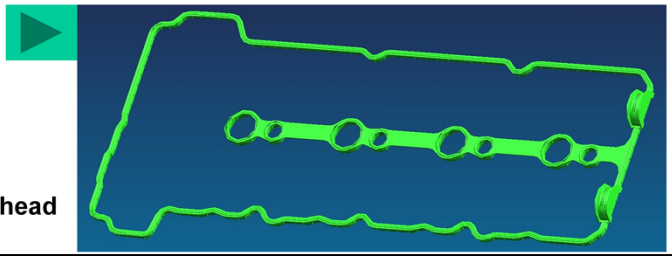
Breather plate is also made of resin.

[Animation] Cylinder head cover rotation

1-1

## 3. Cylinder Head Cover Gasket



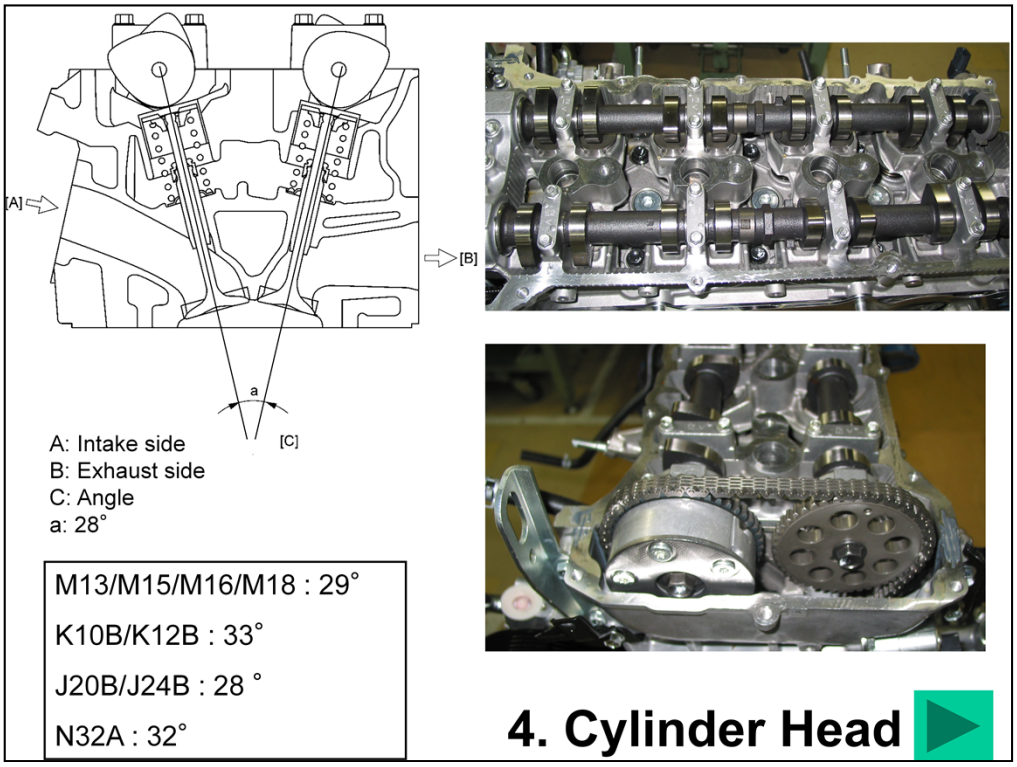
**Caution:**

**Do not reuse cylinder head cover gasket**

Use a new one every time the cylinder head cover is removed.
Cylinder head gasket and spark plug hole gasket are unified as one part.

[Animation] Cylinder head cover gasket rotation

1-1




Valve angle is 28 degrees.

The valves are lifted by cam through tappet.

[Animation] Cylinder Head Rotation

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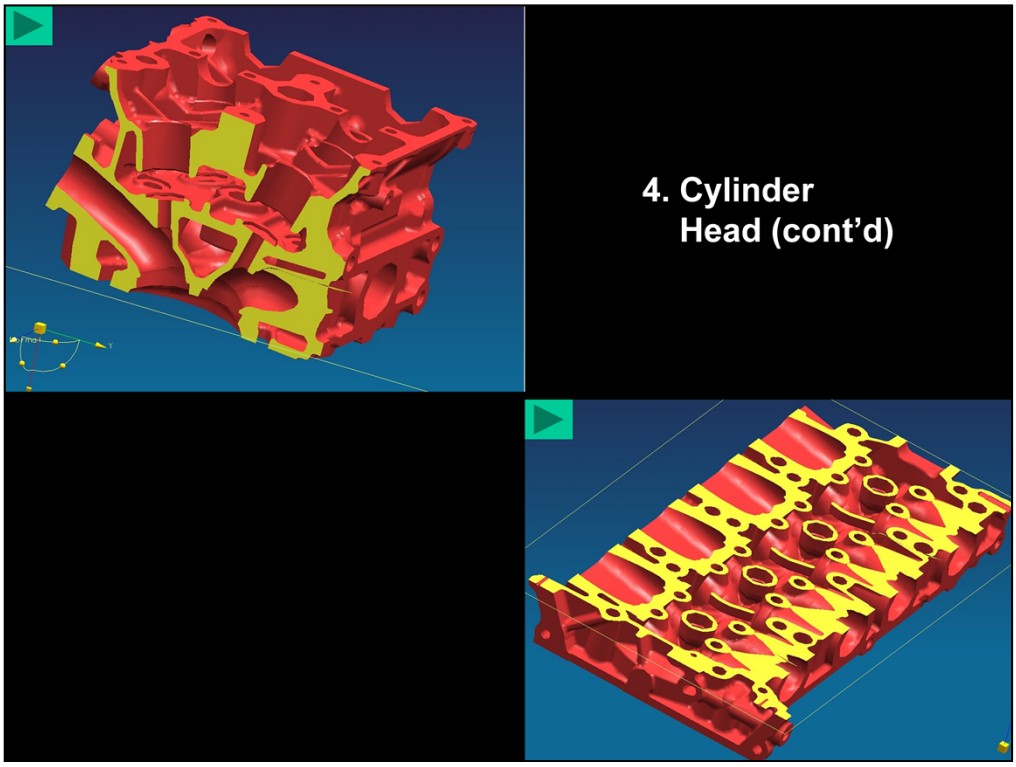


[Animations]
Upper left : Cutting the cylinder head from the flywheel side
Lower right : Cutting the cylinder head from the top

As animations show, there is not an EGR passage in the cylinder head.

1-1

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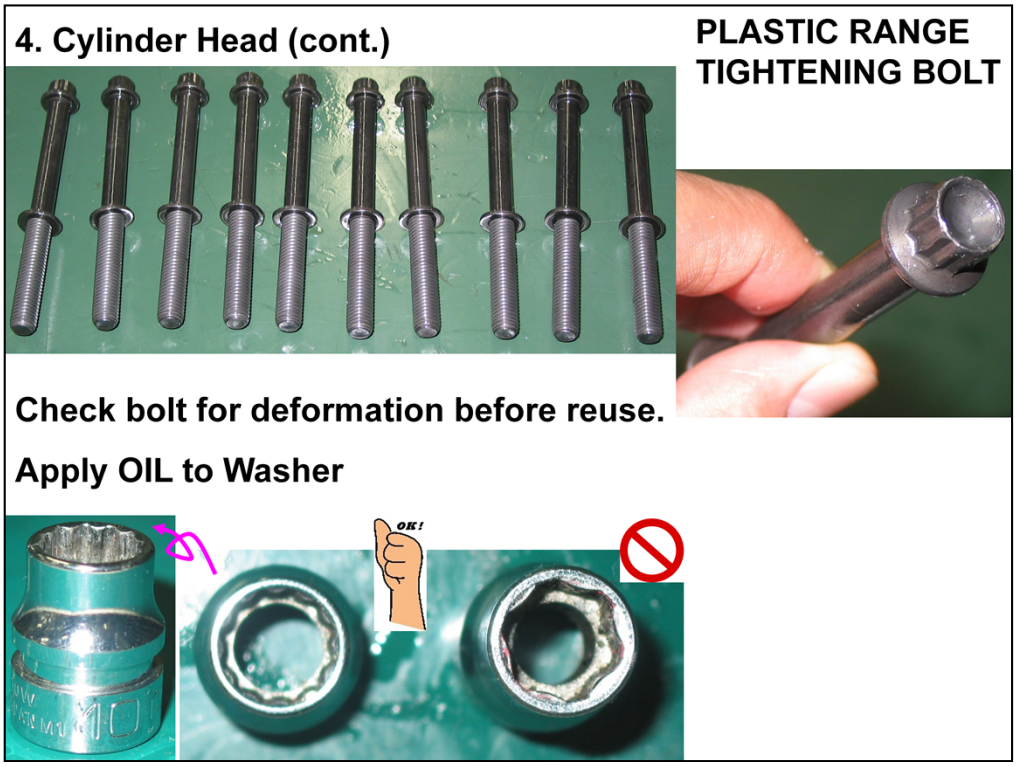



The plastic range tightening bolt is used as a cylinder head bolt.

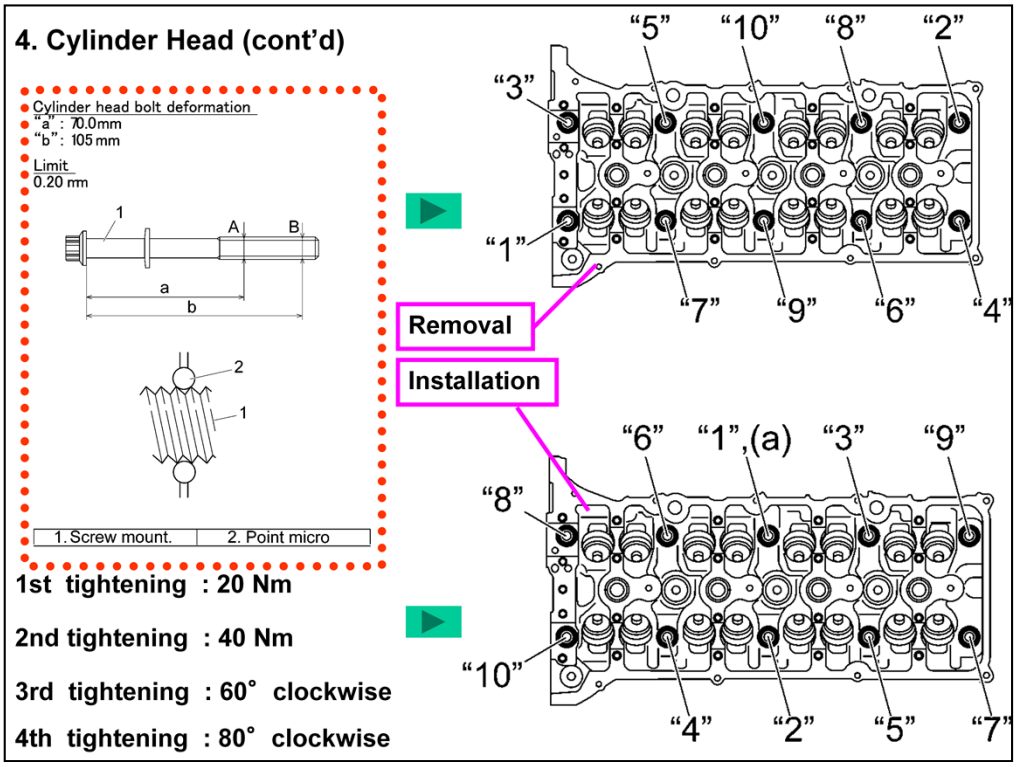
As this type of bolt is a plastic deformation bolt, it should be inspected before reuse.

The method of inspection is described later.

A 6-point socket cannot be used for cylinder head bolt tightening/loosening.

A 12-point socket must be used.

1-1




Before reusing plastic tightening range bolts, check them for deformation. Measure diameter at points “a” and “b”. The difference between obtained values “A” and “B” should be less than 0.2mm.

If “A”-”B” exceeds this service limit, the bolt should be replaced with a new one.

When tightening 10 pcs. of the cylinder head bolts, you have to go through four (4) steps.

1st step, all bolts shall be tightened in the torque of 20Nm (2.0kg-m) diagonally.

2st step, all bolts shall be further tightened in the torque of 40Nm (4.0kg-m) diagonally.

3rd step, all bolts shall be turned clockwise 60 degrees clockwise.

4th step (last step), all bolts shall turned more 80 degrees.

Note:

There is no “elastic” range bolt to fit the cylinder head to the cylinder block. This point is different from M engines.

[Reference : M engines]

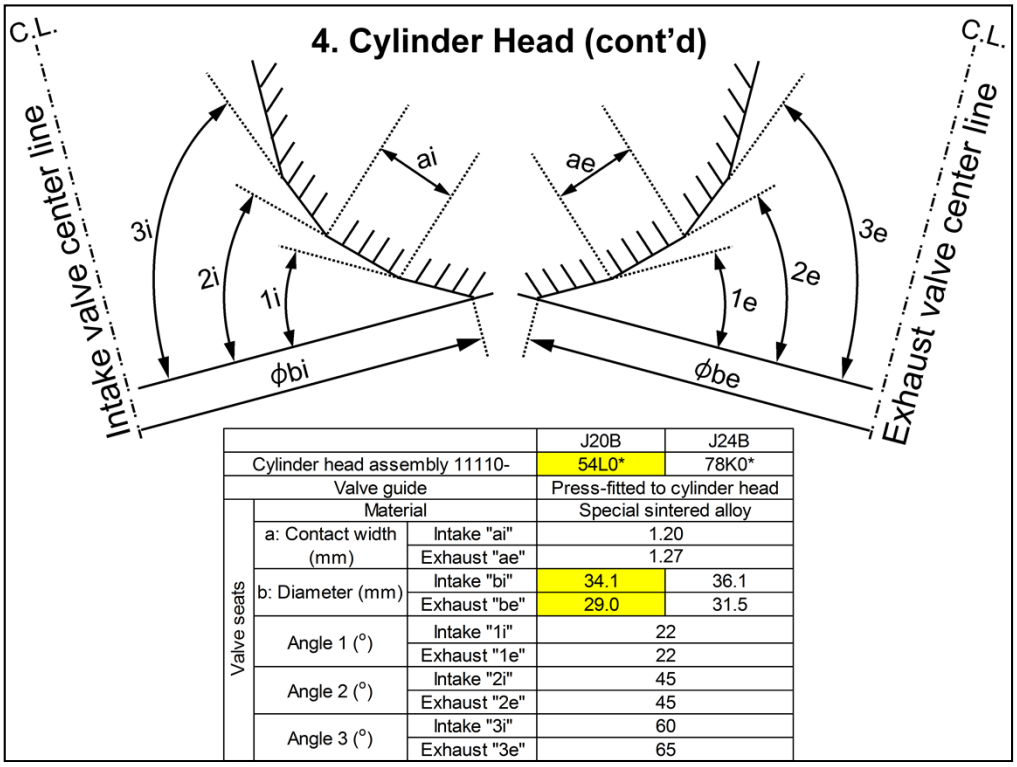
Service limit of the bolt is 0.1 mm between 83.5 mm and 115 mm points.

[Animation]

Upper : Cylinder Head Cam Housing Section

Lower : Cylinder Head Cam Housing Section Vertical

1-1




| | | | J20B | J24B |
|---|---|---|---|---|
| Cylinder head assembly 11110- | | | 54L0* | 78K0* |
| Valve guide | | | Press-fitted to cylinder head | |
| Valve seats | Material | | Special sintered alloy | |
| | a: Contact width (mm) | Intake "ai" | 1.20 | |
| | | Exhaust "ae" | 1.27 | |
| | b: Diameter (mm) | Intake "bi" | 34.1 | 36.1 |
| | | Exhaust "be" | 29.0 | 31.5 |
| | Angle 1 (°) | Intake "1i" | 22 | |
| | | Exhaust "1e" | 22 | |
| | Angle 2 (°) | Intake "2i" | 45 | |
| | | Exhaust "2e" | 45 | |
| | Angle 3 (°) | Intake "3i" | 60 | |
| | | Exhaust "3e" | 65 | |

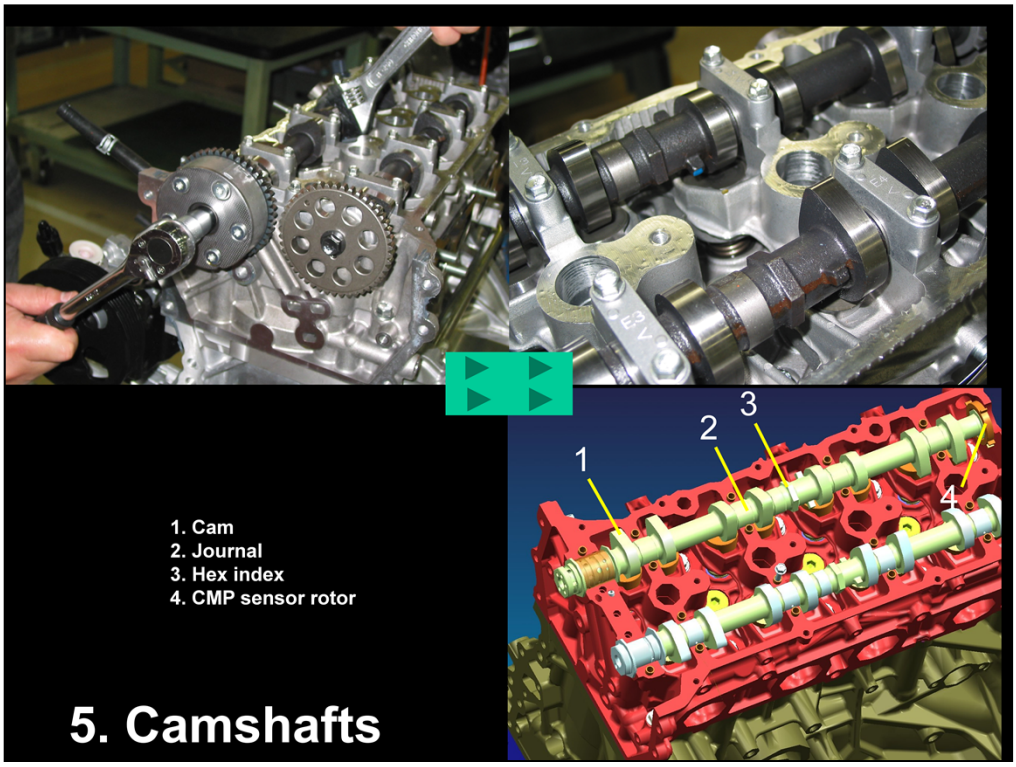
This page shows valve seat specification in the cylinder head.

The figure shows the cylinder profile at valve passages.

Cylinder head is not compatible between J20B and J24B, because the lower diameter of valve passage is different, due to valve head difference.

The part number for J20B cylinder head is, therefore, different from that for J24B.

1-1




Camshaft is of a hollow structure. The hollow part is oil passage for a better lubrication.

Intake camshaft has camshaft position sensor rotor on its flywheel side end.

A sprocket is press-fitted onto the chain-side end of Intake camshaft

Camshaft position sensor (CMP sensor) rotor is different between M engines and J24B engine.

[Animation]

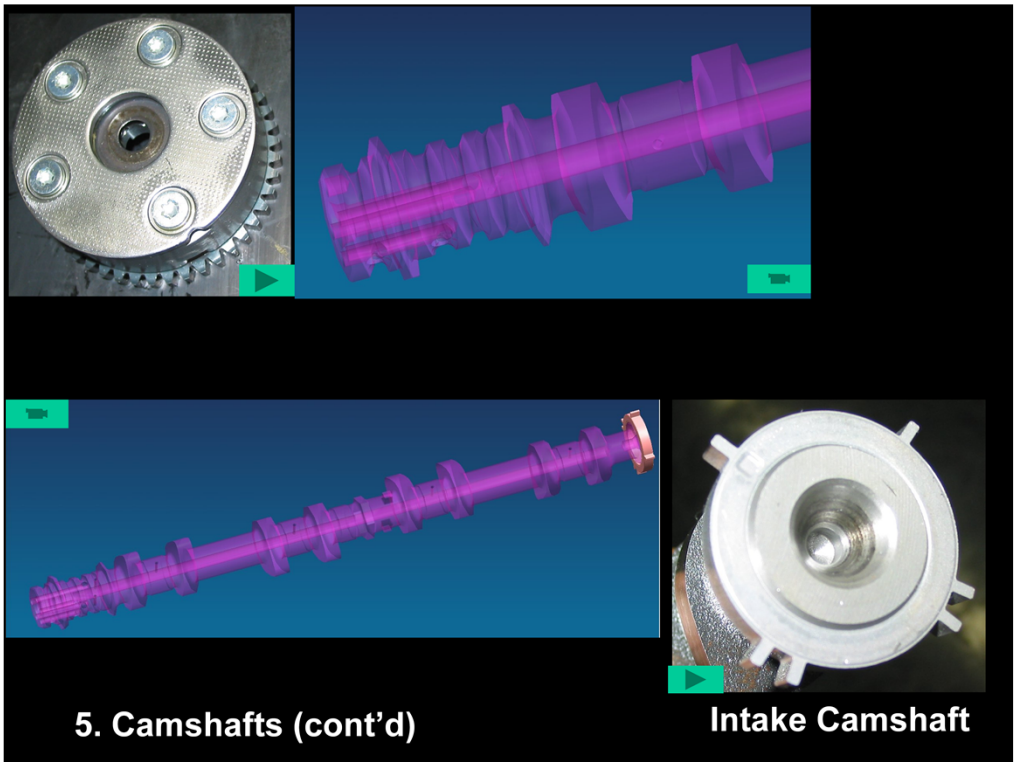
Upper left : Intake CMP actuator bolt rotation

Upper right : Intake CMP actuator removal

Lower left : Camshaft bearing see through

Lower right : Overview of intake and exhaust camshafts and inside of camshaft bearing

1-1




The picture on the left shows intake camshaft actuator.

The picture on the right shows CMP sensor rotor press-fitted onto the intake camshaft.

[Animations]

Upper left : CMP actuator rotation

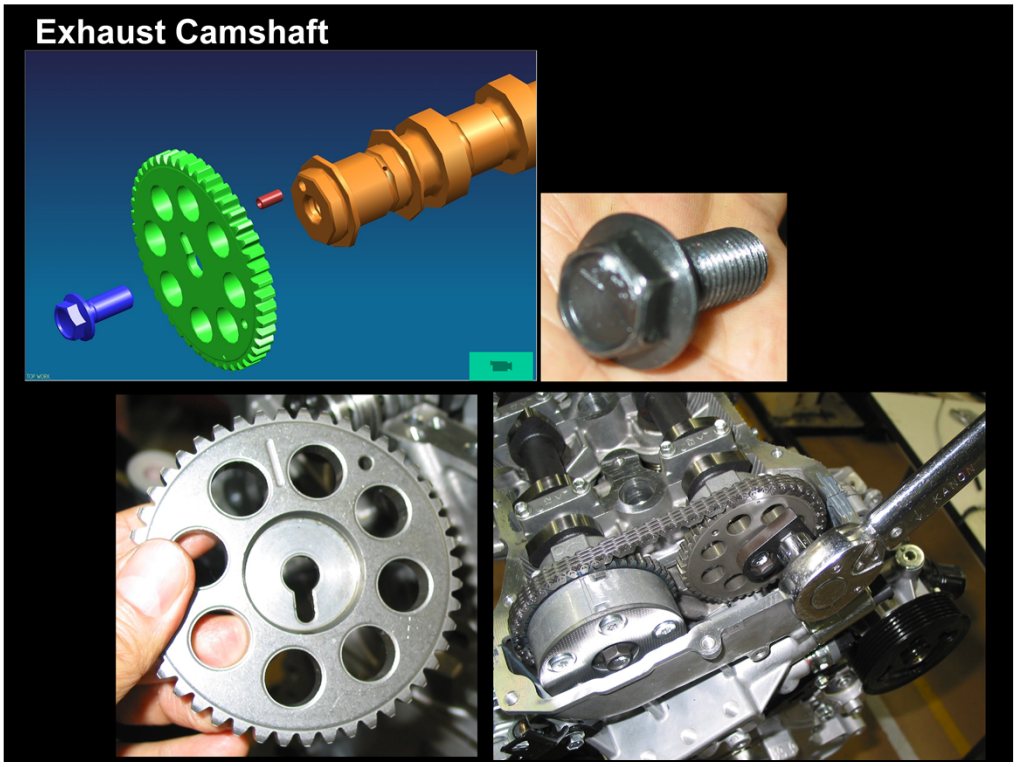
Upper right : Rotating see-through intake camshaft

Lower left : See-through intake camshaft

Lower right : Camshaft lower bearing cylinder head matching

1-1

1-1




This page shows pictures of exhaust camshaft sprocket fitted with a bolt.

When loosening/tightening the exhaust camshaft sprocket bolt, the exhaust camshaft must be held stationary with a spanner or the like.

Special care should be taken not to damage the bolt head, as the head corner is “rounded”.

[Animation]

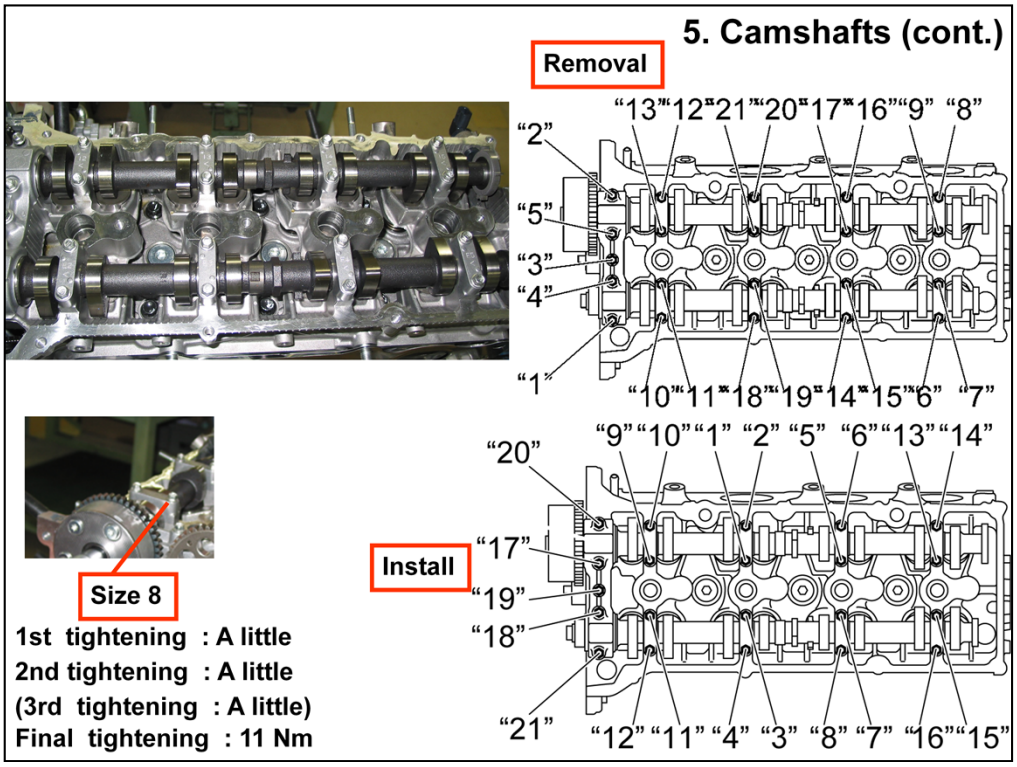
Sprocket removal and installation

1-1


1-1

This page shows special tool (09911-05120) for exhaust camshaft bolt.
It should be used when you tighten exhaust camshaft bolt.
[Animation]
Overview of exhaust camshaft sprocket

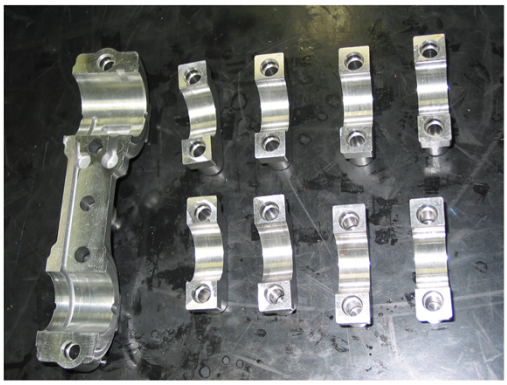
1-1

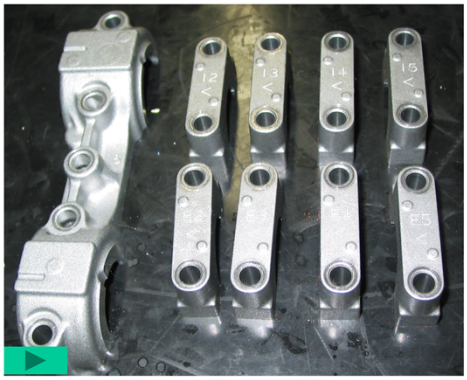


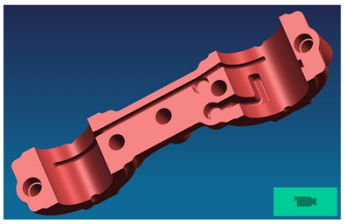

There is a specified loosening and tightening order of camshaft housing bolts.
Use a size-8 tool for bolt loosening/tightening.

1-1

## 5. Camshafts (cont.)







Camshaft housing has position and direction marks on the top surface for a proper installation.

The first housing has oil groove for camshaft lubrication.

[Animation]

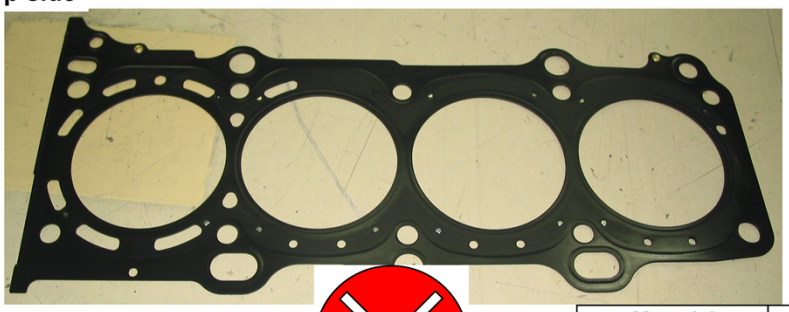
Upper : Cam housing cylinder head matching

Lower : Overview of the first housing

1-1

## 6. Cylinder Head Gasket

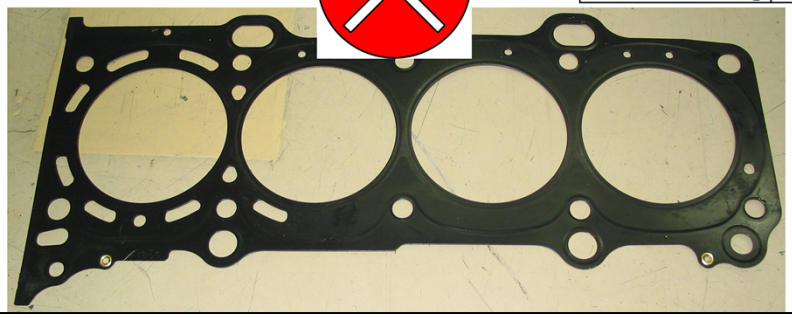
Top side



REUSE

| | |
|---|---|
| **Material** | Stainless |
| **Surface finishing** | NBR coating |

Bottom side

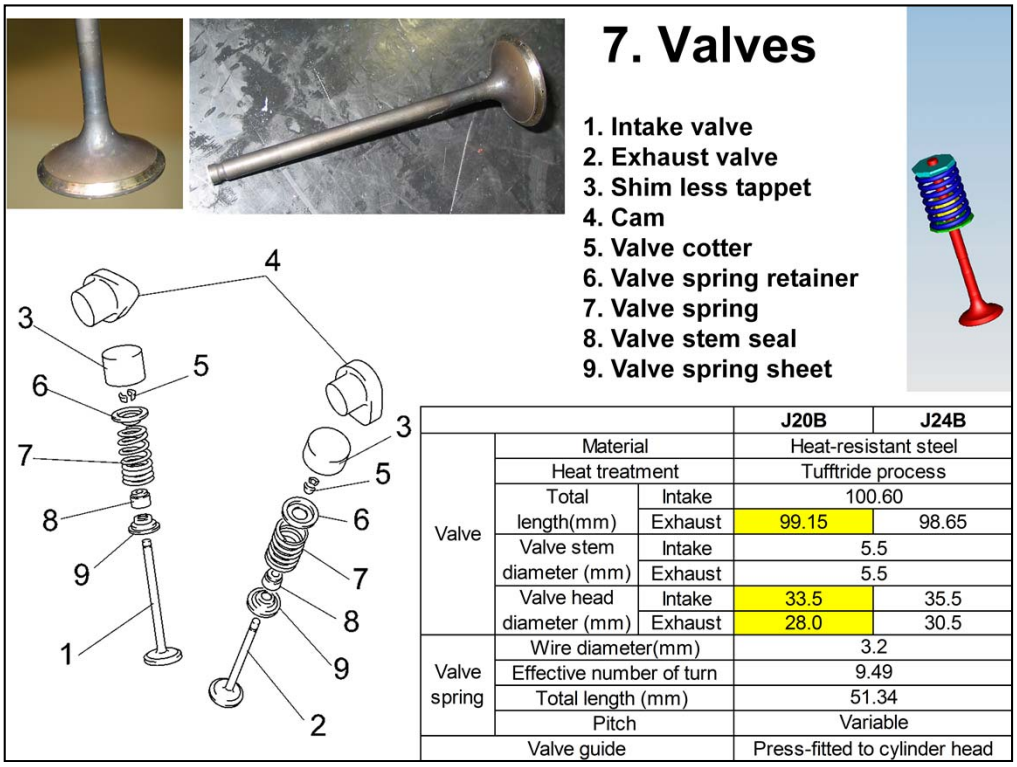


A two-layer metal gasket is used to improve durability and reliability.

Stamped numbers should face upward.

The gasket cannot be reused after removal.

1-1




| | | | J20B | J24B |
|---|---|---|---|---|
| Valve | Material | | Heat-resistant steel | |
| | Heat treatment | | Tufftride process | |
| | Total length(mm) | Intake | 100.60 | |
| | | Exhaust | 99.15 | 98.65 |
| | Valve stem diameter (mm) | Intake | 5.5 | |
| | | Exhaust | 5.5 | |
| | Valve head diameter (mm) | Intake | 33.5 | 35.5 |
| | | Exhaust | 28.0 | 30.5 |
| Valve spring | Wire diameter(mm) | | 3.2 | |
| | Effective number of turn | | 9.49 | |
| | Total length (mm) | | 51.34 | |
| | Pitch | | Variable | |
| Valve guide | | | Press-fitted to cylinder head | |

This page shows specifications of valve and valve spring.

J20B valves are different from J24B. This is why cylinder head is also different between J20B and J24B.

[Part Number]

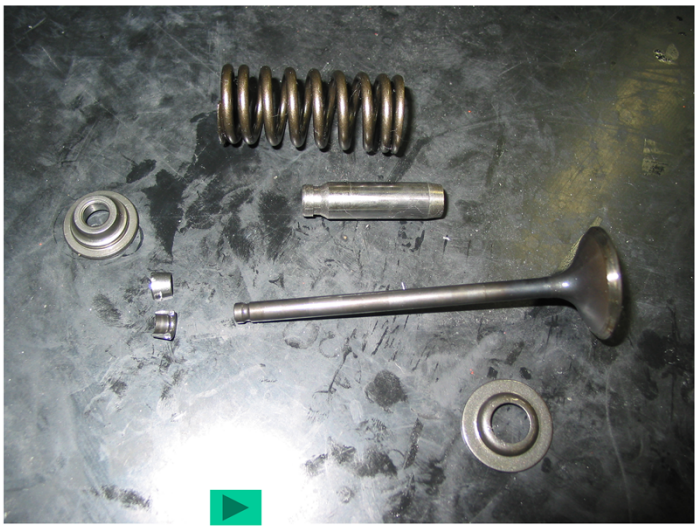
Intake valve : 12911-54L00 (J20B), 12911-78K00 (J24B)

Exhaust valve : 12951-54L00 (J20B), 12951-78K00 (J24B)

Valve spring : 12921-78K00 (J20B/J24B)

1-1

**7. Valves (cont.)**

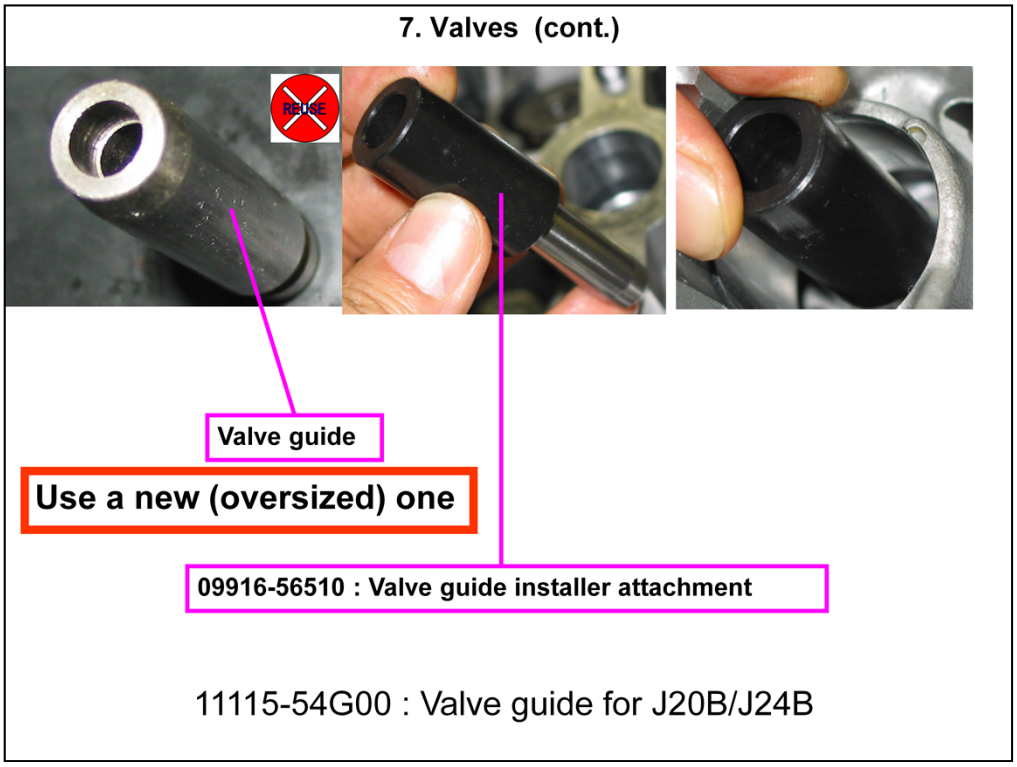


These are pictures of valve and surrounding parts and valve-related parts.

[Animation] Valve train section

1-1

1-1



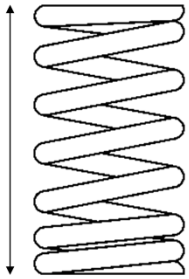

Use 09916-56510 to attach valve guide to cylinder head.

Once original valve guide (5.0 mm in outer diameter) is removed from cylinder head, discard it.

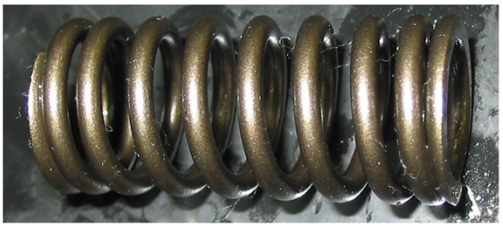
Use a new oversized guide (5.5 mm in outer diameter) after reaming the valve guide hole in the cylinder head. See next page.

1-1

**7. Valves (cont.)**



Symmetrical



Valve has no up/down direction for installation.

1-1

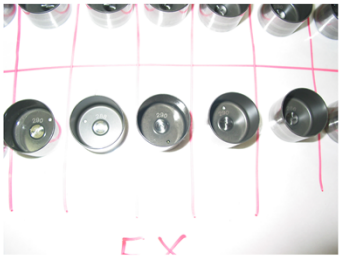
**Selecting Tappet**

| Valve Clearance | Intake | Exhaust |
|---|---|---|
| ECT 15-25°C | 0.14-0.23 | 0.30-0.40 |

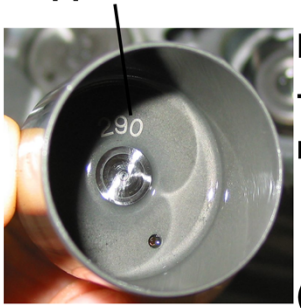
**FORMULA**

**Intake:**
**A=B+C-0.20mm**
**Exhaust:**
**A=B+C-0.35mm**

**A: New tappet No. to be installed**
**B: Removed tappet No.**
**C: Measured valve clearance (mm)**



**Tappet No.**




**For example of intake side:**

**Tappet with No.290 was installed, and measured clearance is 0.27mm.**

**A=2.90+0.27-0.20**
**=2.97 → Select tappet No.296**
**(Available thickness : 272, 274, --- 328)**

This page shows how to select a proper tappet to satisfy the specified valve clearance.

The service manual states based on the figure printed on the tappet inner surface by laser beam.

However, in the market, if it is hard to identify the figure, measure tappet head thickness by a micrometer in the scale of 25 one thousand.

The printed figure is 100 times as big as the actual (measured) thickness in millimeter.

That is, in case of 2.9 mm, the tappet has a numeral of 290.

If the thickness of A is odd number ,select the tappet (A – 0.01)

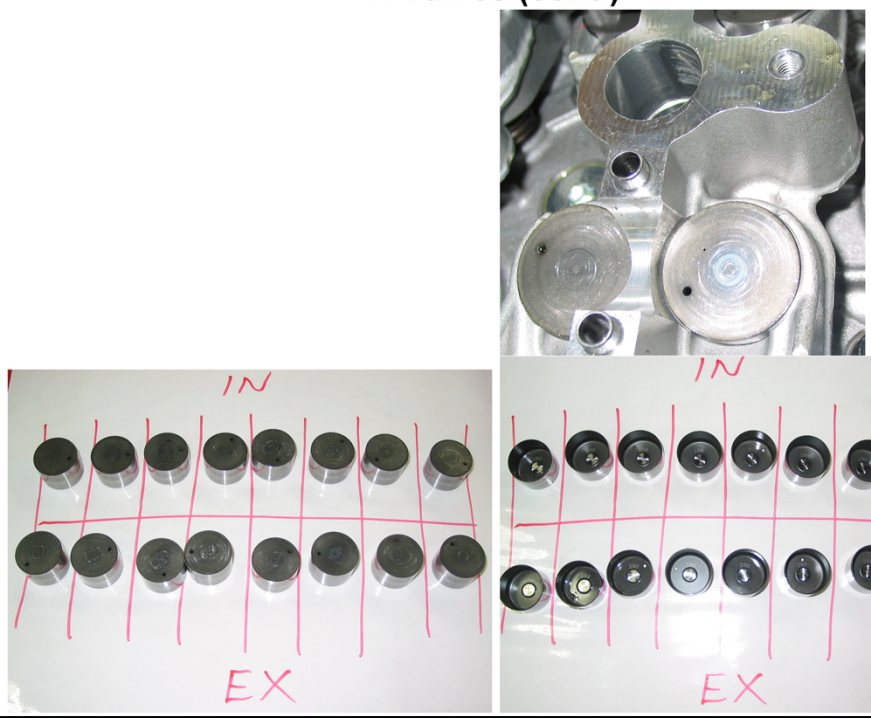
For example, if a desired thickness is 2.97mm, select tappet with a thickness of 2.96mm.

If the thickness of A is even number ,select the tappet (A)

For example, if a desired thickness is 2.74mm, select tappet with a thickness of 2.974mm.

1-1

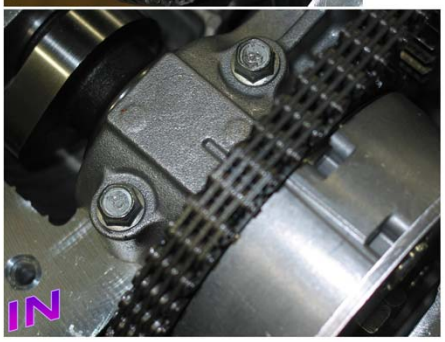
**7. Valves (cont.)**

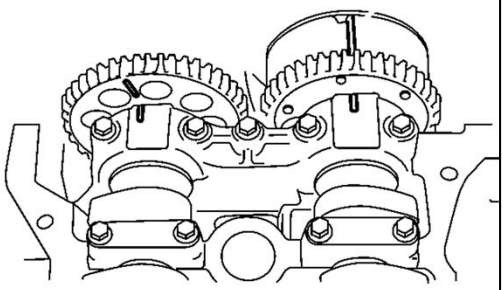



If the tappets should be removed from the cylinder head, put them on a tappet position mat as shown above.

As each tappet may have different size and no reference mark is put on the shim to determine the position, a tappet position mat as shown above may avoid mixture.

1-1

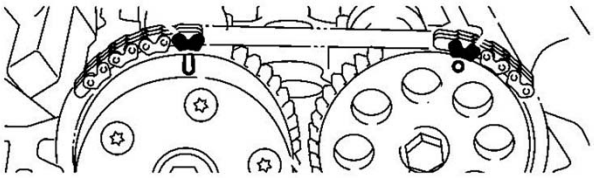
1st. Align lines

**Tappet replacement on vehicle**

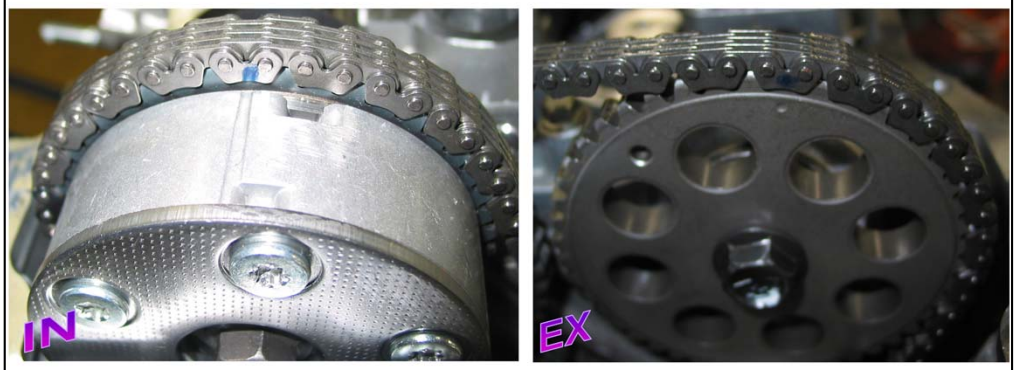
Align line marks on the camshaft housing with line marks on exhaust camshaft sprocket and intake VVT actuator.

1-1

**7. Valves (cont.)**



2nd. Put mark on the chain closest to the dot mark by hand-paint




**Tappet replacement on vehicle**

Put mark on the chain link closest to the dot mark of the sprocket by oil paint. The hand-painted marks are necessary when the chain is refitted.

1-1


J20B/J24B Engines have a hole for special tool on chain cover.

Remove this plug with hexagonal wrench when you replace tappet on vehicle.

Do not reuse gasket on the plug.

The new special tool holds the timing chain tensioner directly.

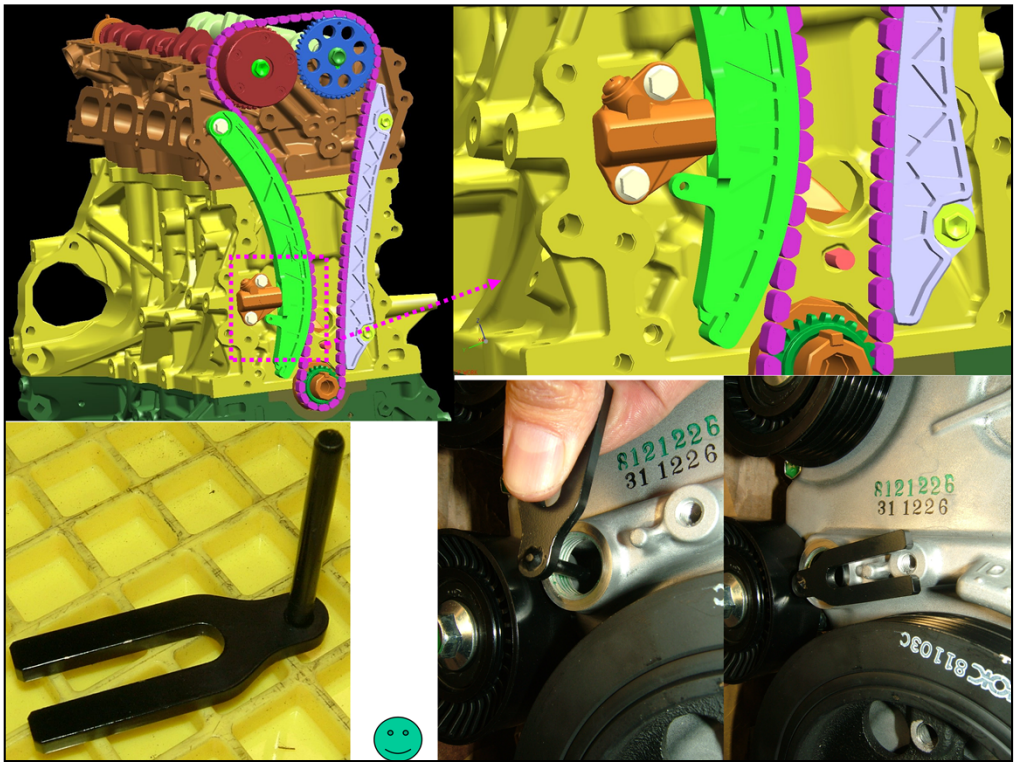
“NTN” shows the supplier of the chain tensioner adjuster (plunger) located behind the chain tensioner.

**IMPORTANT:**

**The service plug is located in front of the chain tensioner. This position is also applicable to JB424 Grand Vitara.**

1-1

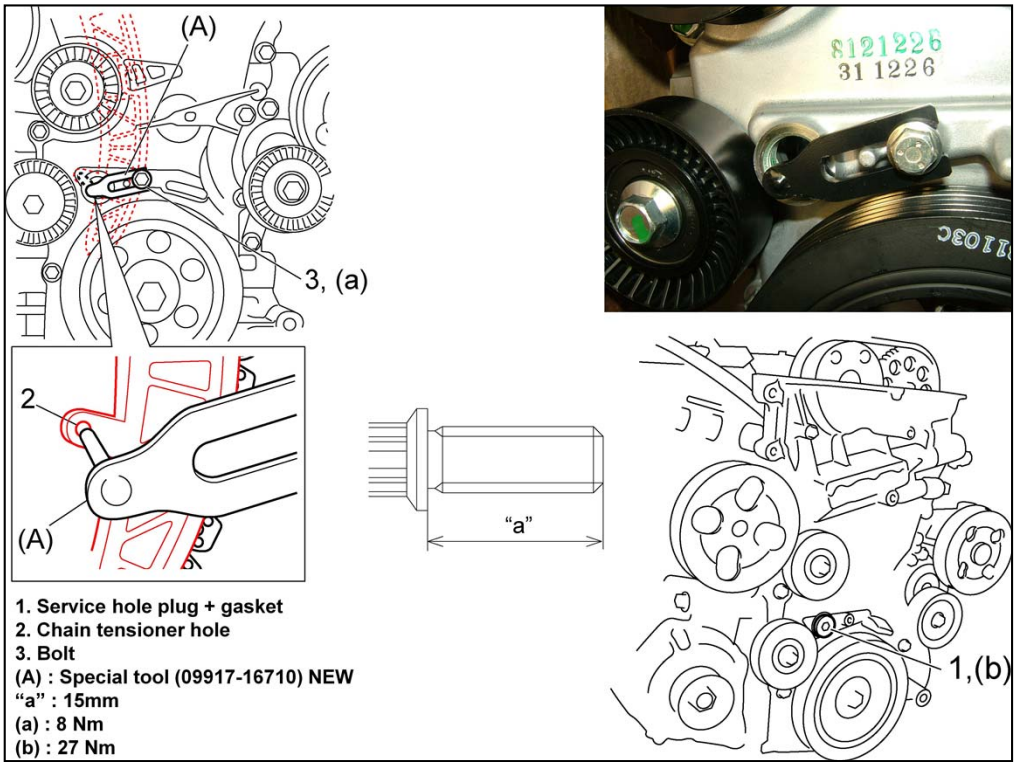
1-1




The timing chain tensioner (light green part in the figure above) has a hole located in front of the tensioner adjuster (light brown part).

Insert the new special tool 09917-16710 into the hole mentioned above. In this way, the tensioner adjuster plunger is maintained compressed during the tappet replacement on vehicle.

1-1



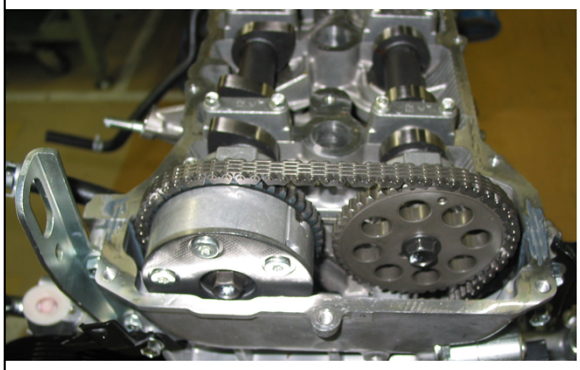

1. Service hole plug + gasket
2. Chain tensioner hole
3. Bolt
(A) : Special tool (09917-16710) NEW
"a" : 15mm
(a) : 8 Nm
(b) : 27 Nm

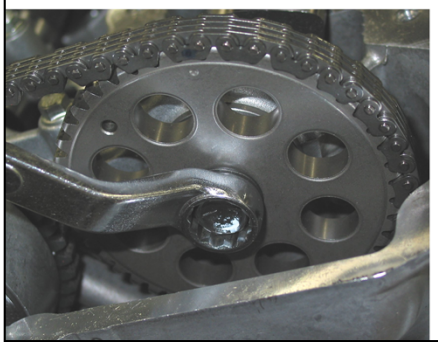
To fix the new special tool in place, use an M6 1.0-mm thread pitch bolt. The dimension "a" should be 15mm.

Tighten the bolt to 8Nm.

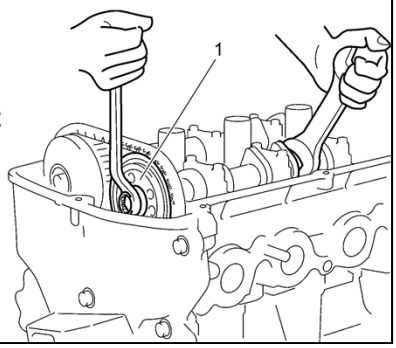
1-1

**7. Valves (cont.)**





**Tappet replacement on vehicle**

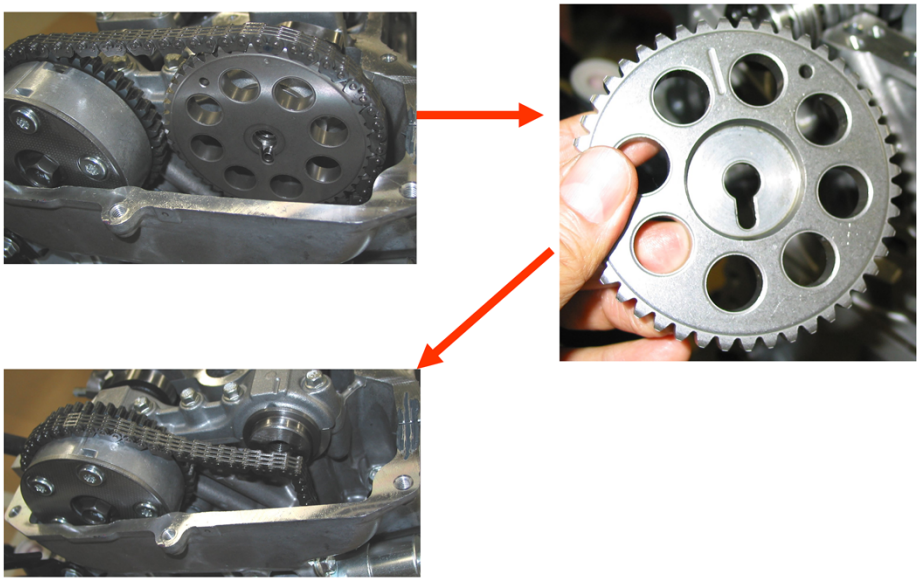



**1. Exhaust cam timing sprocket**

Loosen the exhaust camshaft sprocket bolt, with the camshaft held stationary with a spanner or the like. Use the hexagonal part of the camshaft.

1-1

**7. Valves (cont.)**



Tappet replacement on vehicle

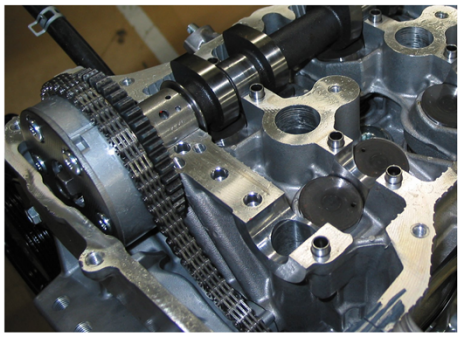
After removing the sprocket bolt, detach the sprocket from the camshaft and chain.

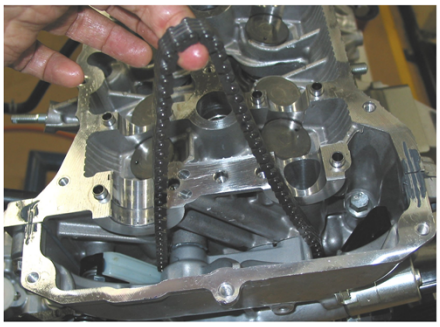
Note:

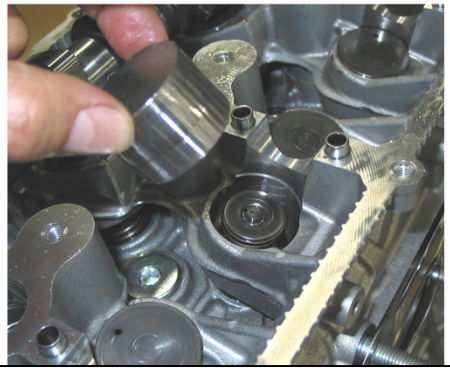
The sprocket should be detached in this step for a better removal of camshaft in the next step.

1-1

**7. Valves (cont.)**







Remove camshaft housing bolts in the specified order.

Remove the intake and exhaust camshafts.

Note:

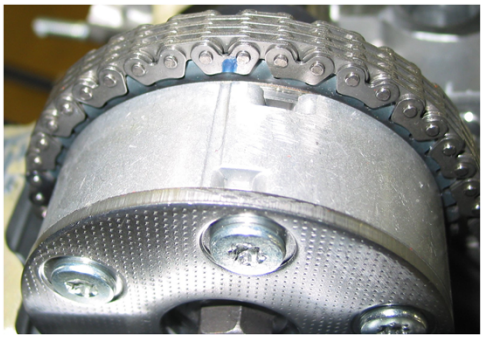
If the exhaust camshaft sprocket had not been removed in the previous step, the camshafts could not been detached from the chain in this step.

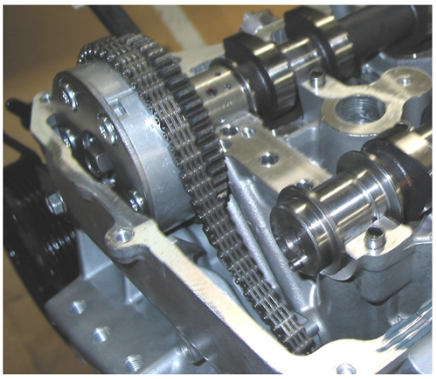
You can drop the chain down, because the relationship between the crankshaft sprocket and the chain does not shift.

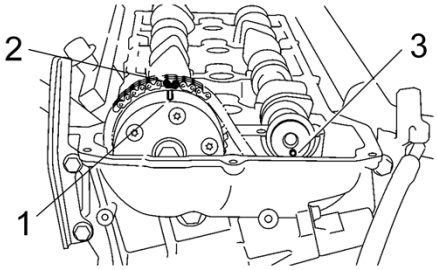
After leaving the chain, replace the desired tappet.

1-1

**7. Valves (cont.)**








**Tappet replacement on vehicle**

1. Intake cam timing sprocket triangle mark
2. Painted chain link
3. Exhaust camshaft notch pin

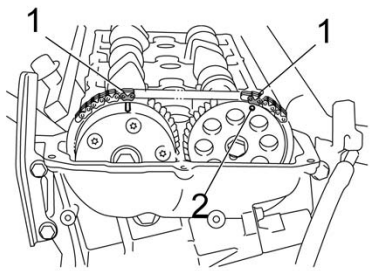
After replacing the tappet(s), place the camshafts in correct direction as shown above.

The chain link with the hand-painted mark must be faced to the line mark on the intake VVT actuator.

Notch pin of the exhaust camshaft should be positioned at the bottom.

1-1

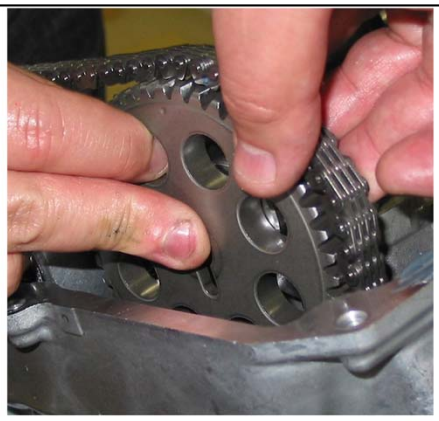
**7. Valves (cont.)**



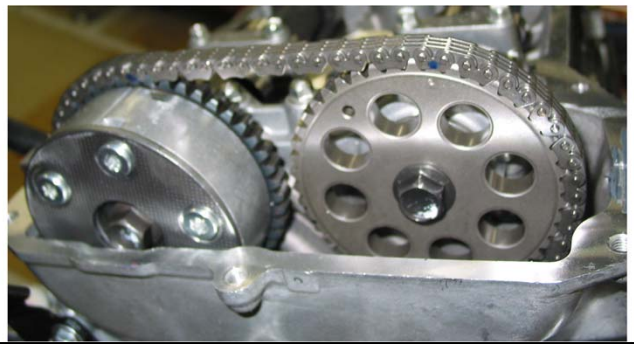

**1. Painted chain link**

**2. Exhaust timing sprocket dot mark**

**(A) : 09914-06310**



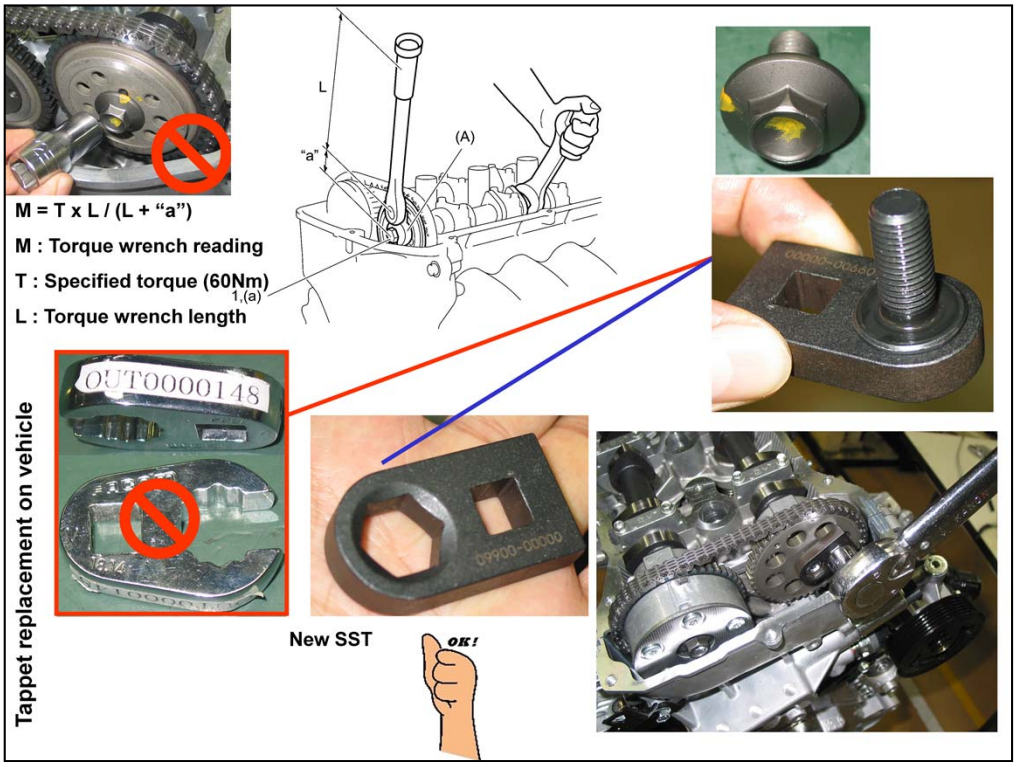
**Tappet replacement on vehicle**



The chain link with the hand-painted mark must be faced to the dot mark on the sprocket.

Insert the sprocket to exhaust camshaft ,aligning the camshaft notch pin with the slot of the sprocket ,by rotating the camshaft slightly.

1-1




In order to tighten the bolt to the sprocket, special tool is required, as the clearance between the bolt head and the timing chain cover is not enough to commercially available socket.

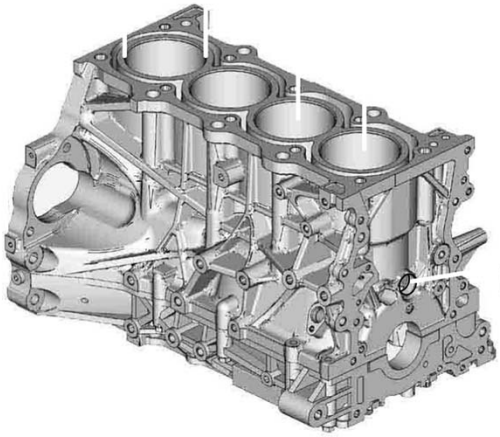
PCM's special tool OUT0000148 can be fitted to the bolt, but it is hard to obtain 60-Nm torque, because the bolt head is relatively rounded. OUT0000148 is, therefore, not recommended for this purpose.

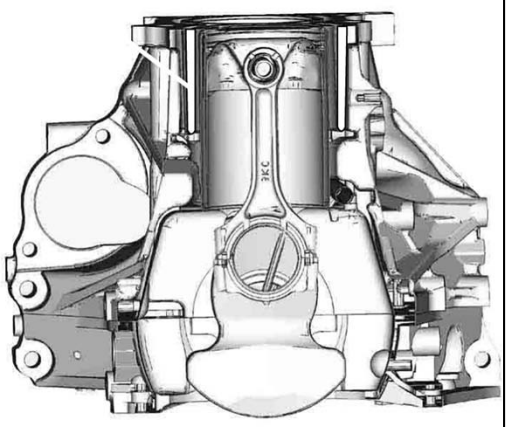
Suzuki introduced another special tool made in Japan.

Tightening torque should be calculated by formula shown above.

1-1

## 8. Cylinder Block



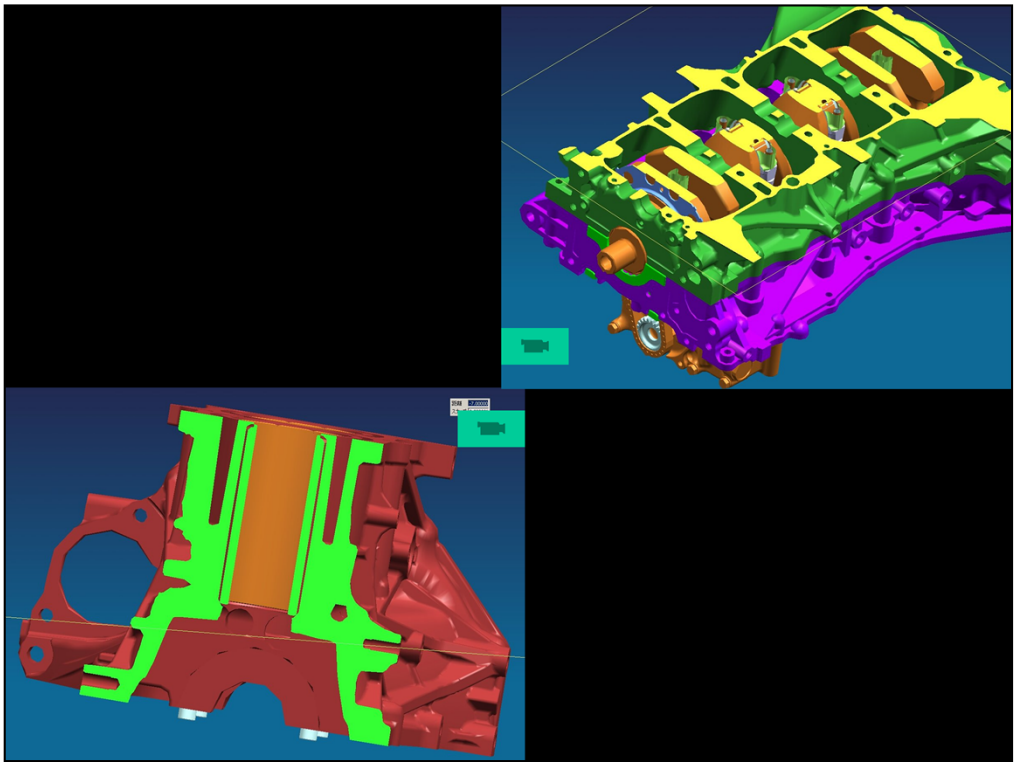


| Type | J20B | J24B |
|---|---|---|
| Displacement(cc) | 1995 | 2393 |
| Bore (mm) | 84.0 | 92.0 |
| Stroke (mm) | 90.0 | 90.0 |
| p: Pitch (mm) | 102.0 | 102.0 |

Cylinder block is made of aluminum alloy, with cast iron liner inserted to the cylinder.

Dimension is shown on the table above.

1-1

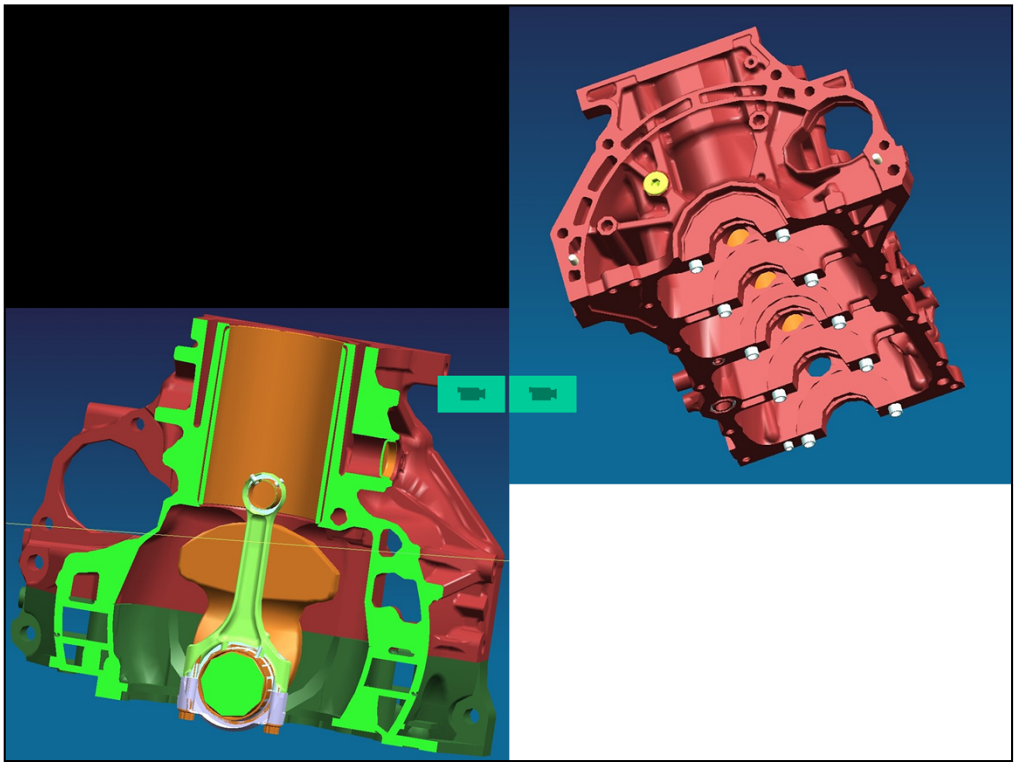


1-1

Watch the animations, paying attention to the following points:
- Air passage to reduce piston pumping loss
- Main oil gallery through the cylinder block
- Oil passages from main oil gallery to the crankshaft
- Coolant jacket around the cylinder

[Animation]
Left : Cutting the cylinder block from the chain side
Right : Cutting the cylinder block from the top side

1-1



1-1

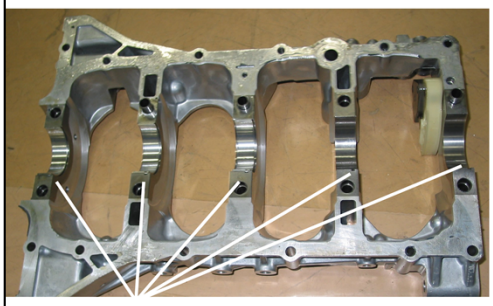
[Animations]

Right : Rotating cylinder block

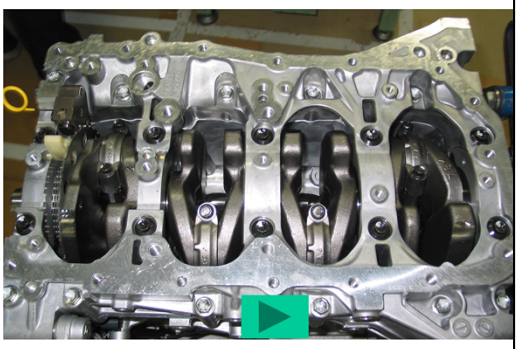
Left : Section of cylinder block with connecting rod and crankshaft

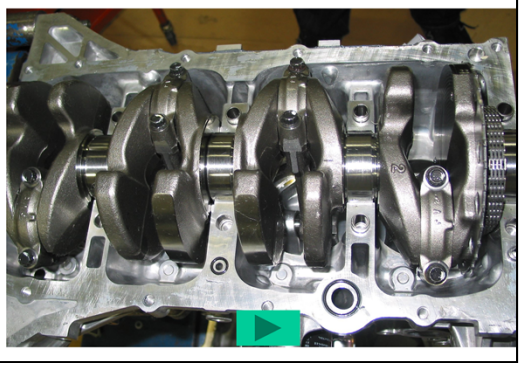
1-1

## 9. Lower crankcase



Bearing cap fitted on lower crankcase





Plastic range tightening bolts, which fit lower crank case, increases rigidity around crankshaft and reduce noise and vibration.

Use a size 10 socket to loosen/tighten crankshaft bearing cap bolts. Socket must be a 12-point type.

High rigidity ductile cast iron bearing caps are fitted on the lower crankcase.

**[Note]**

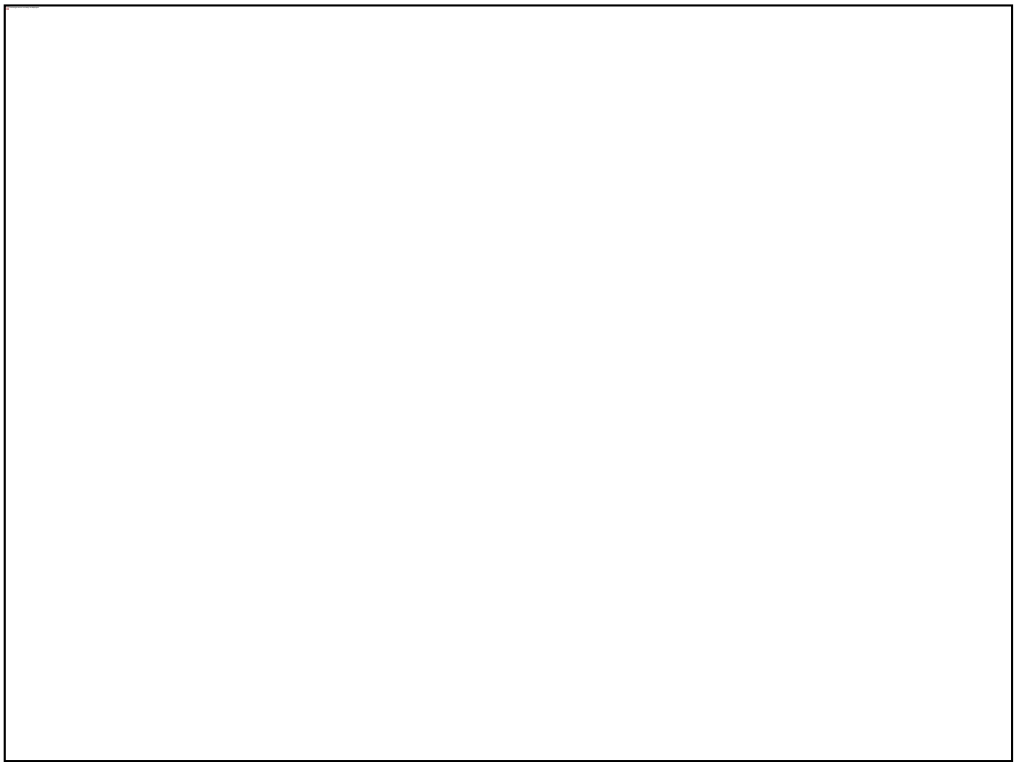
**In the same manner as J20A engine, lower crankcase should not be replaced as individual part. Replace it together with cylinder block.**

[Animation]

Upper : Lower crankcase rotation

Lower : Lower crankcase see through

1-1



1-1

Before reusing plastic tightening range bolts, check them for deformation. Measure diameter at points “a” and “b”. The difference between obtained values “A” and “B” should be less than 0.2mm.

If “A”-”B” exceeds this service limit, the bolt should be replaced with a new one.

1-1

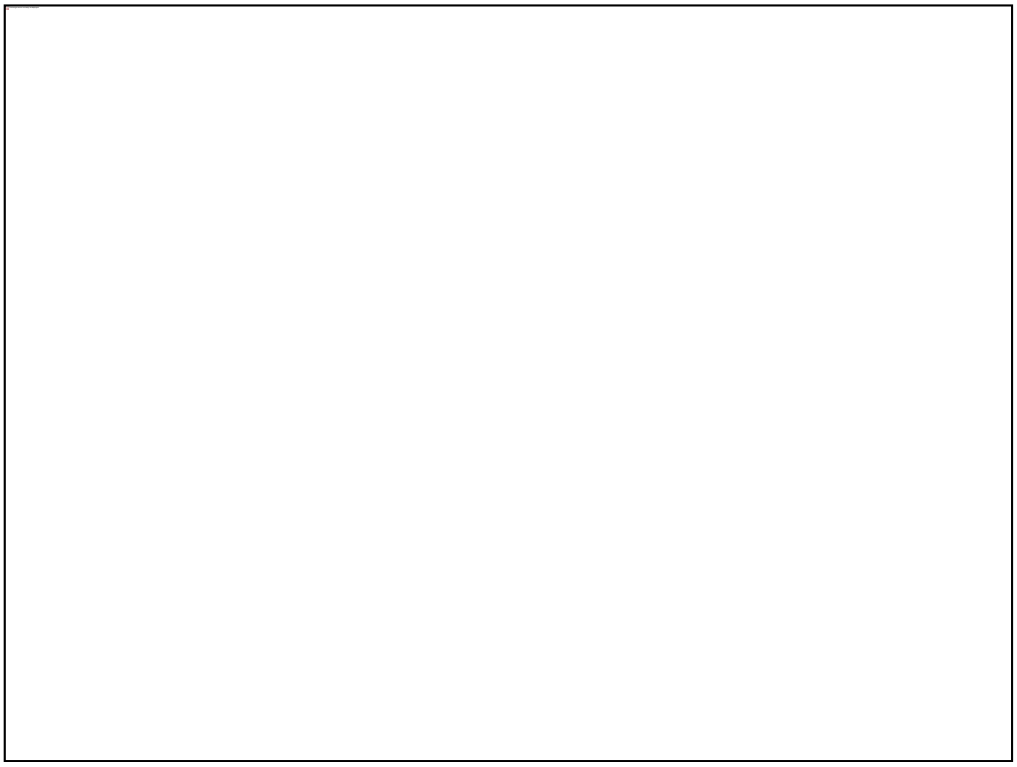
1-1

| 10. Crankshaft | | |
|---|---|---|
| | | J20B / 24B |
| Crankshaft | Part number | 12221-78K00 |
| | Material | Forged carbon steel |
| | Journal diameter | 52 |
| | Pin diameter | 50 |
| | Crank diameter | 45 |
| | Total length | 494 |
| Main bearing | Base material | Aluminum alloy |
| | Backing material | Steel |
| | Central thickness (mm) | 2.0 |
| Thrust bearing | Base material | Aluminum alloy |
| | Backing material | Steel |
| | Central thickness (mm) | 2.5 |

This page shows the specification of the crankshaft.

Crankshaft is made of high rigidity forged carbon steel.

1-1

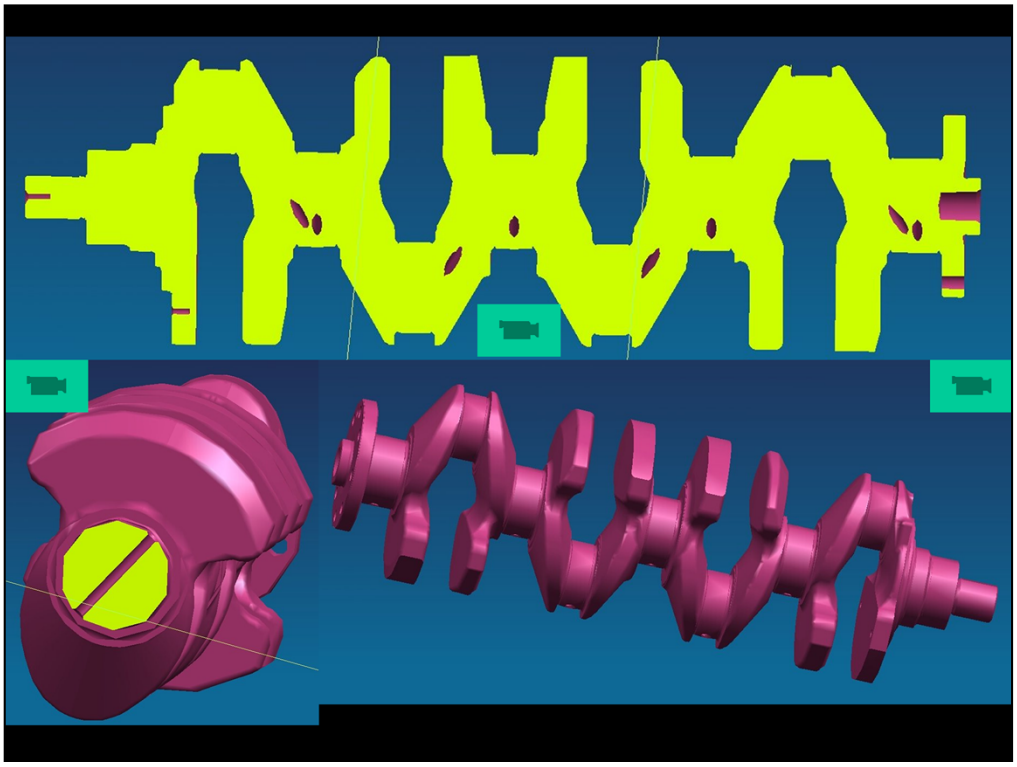


1-1

Balance weight is a totally parallel type.

CKP sensor plate is fitted to crankshaft counterweight No.1 by pin and screws.

1-1



1-1

These are animations to show lubrication gallery inside the crankshaft.

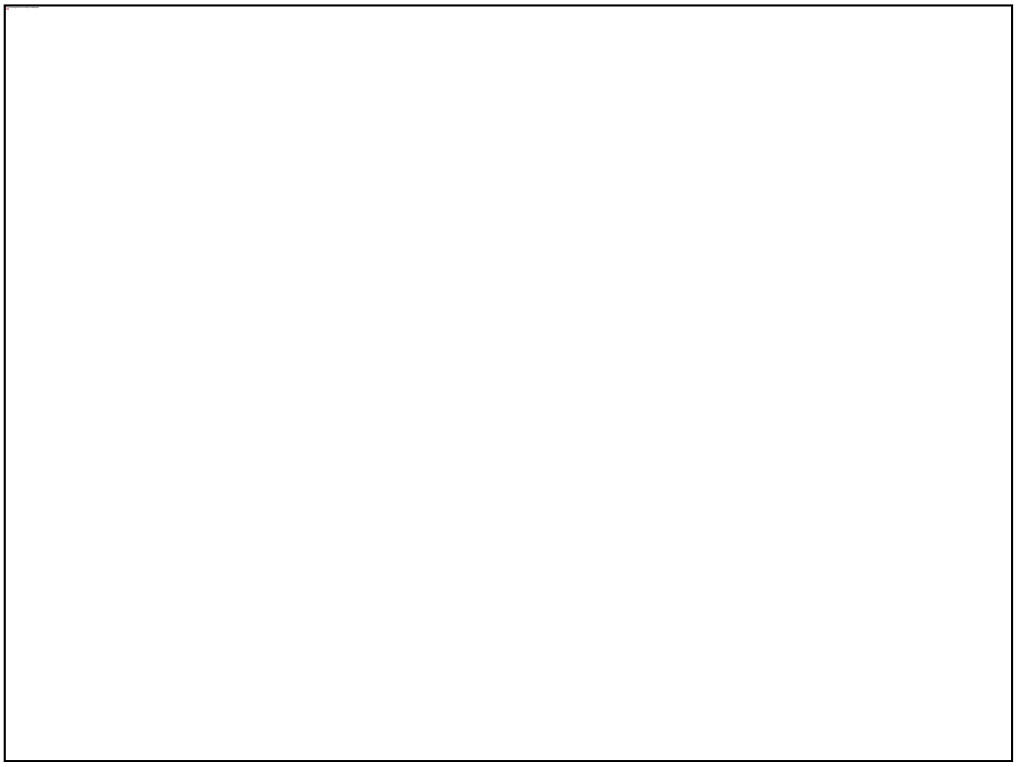
[Animations]

Left : Cutting the crankshaft from the chain side

Center : Cutting the crankshaft from exhaust side

Right : Crankshaft rotation

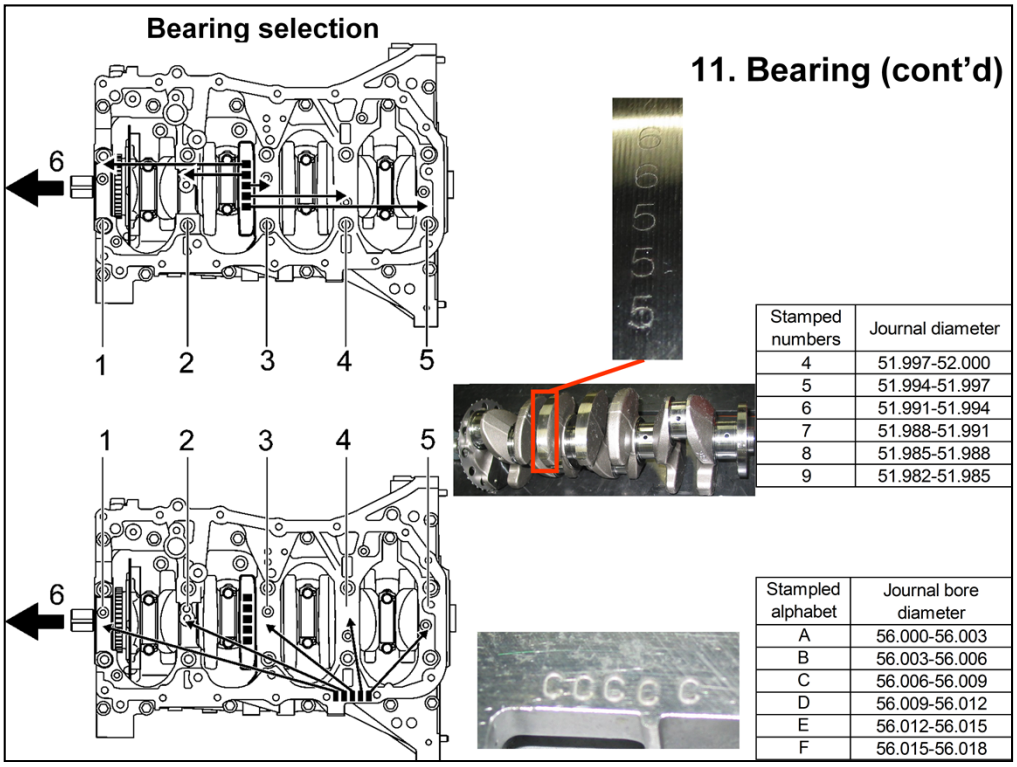
1-1



1-1

A micro groove type is used for both upper and lower journal bearings to maintain oil film so that seizing might be prevented. Thanks to micro groove type, the clearance has been scaled down, which results in reduction of noise and vibration.

1-1




| Stamped numbers | Journal diameter |
|---|---|
| 4 | 51.997-52.000 |
| 5 | 51.994-51.997 |
| 6 | 51.991-51.994 |
| 7 | 51.988-51.991 |
| 8 | 51.985-51.988 |
| 9 | 51.982-51.985 |

| Stampled alphabet | Journal bore diameter |
|---|---|
| A | 56.000-56.003 |
| B | 56.003-56.006 |
| C | 56.006-56.009 |
| D | 56.009-56.012 |
| E | 56.012-56.015 |
| F | 56.015-56.018 |

The numbers stamped on the crank web indicate tolerance of journal diameter at each crank journal as shown above.

Bottom surface of cylinder block indicates tolerance of journal bore diameter at each crank journal as shown above.

Next page shows how to choose a proper bearing for each number-alphabet combination.

1-1

## 11. Bearing (cont'd)

**[J20B/J24B]**

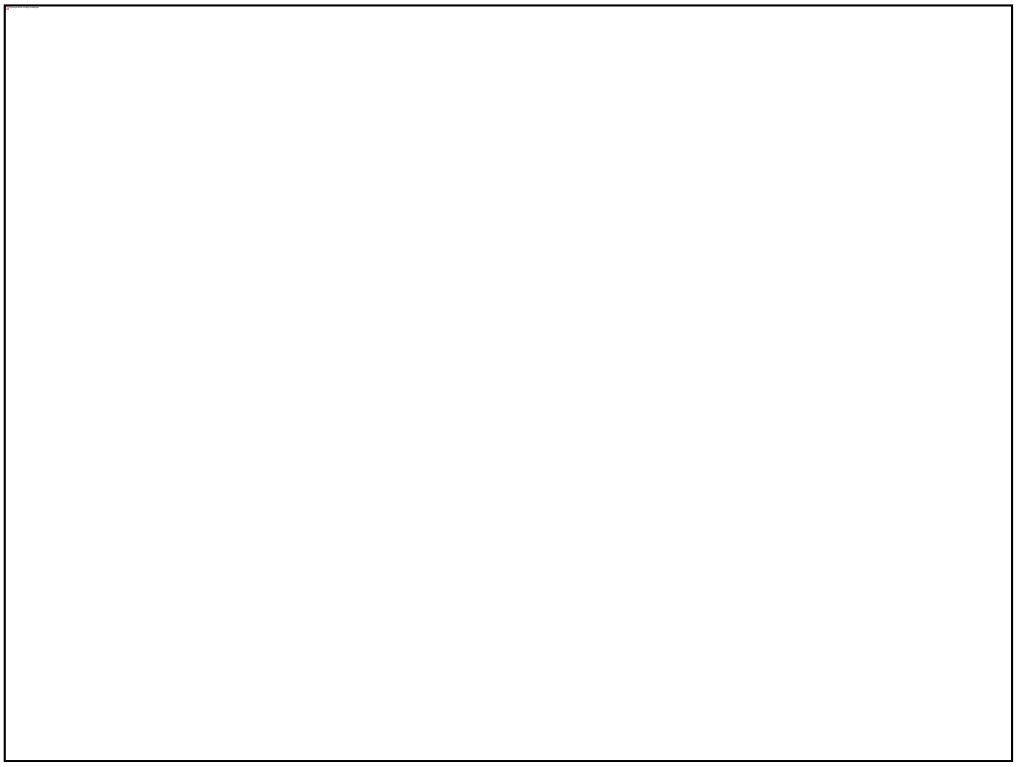
**Oil clearance : 0.019-0.031 mm (Except A-4)**
**0.022-0.034 mm (A-4)**

| Cylinder journal bore diameter | Mark | Diameter +Tolerance | Crankshaft journal outer diameter 4<br>52 0 -0.003 | 5<br>52 -0.003 -0.006 | 6<br>52 -0.006 -0.009 | 7<br>52 -0.009 -0.012 | 8<br>52 -0.012 -0.015 | 9<br>52 -0.015 -0.018 |
|---|---|---|---|---|---|---|---|---|
| | A | 56 +0.0030 0 | GRN 12341-78K00-0A0 | GRN 12341-78K00-0A0 | GRN 12341-78K00-0A0 | BLK 12341-78K00-0B0 | BLK 12341-78K00-0B0 | NON 12341-78K00-0C0 |
| | | | GRN 12345-78K10-0A0 | GRN 12345-78K10-0A0 | BLK 12345-78K10-0B0 | BLK 12345-78K10-0B0 | NON 12345-78K10-0C0 | NON 12345-78K10-0C0 |
| | B | 56 +0.006 0.0003 | GRN 12341-78K00-0A0 | GRN 12341-78K00-0A0 | BLK 12341-78K00-0B0 | BLK 12341-78K00-0B0 | NON 12341-78K00-0C0 | NON 12341-78K00-0C0 |
| | | | GRN 12345-78K10-0A0 | BLK 12341-78K00-0B0 | BLK 12345-78K10-0B0 | NON 12345-78K10-0C0 | NON 12345-78K10-0C0 | YEL 12345-78K10-0D0 |
| | C | 56 +0.009 +0.006 | GRN 12341-78K00-0A0 | BLK 12341-78K00-0B0 | BLK 12341-78K00-0B0 | NON 12341-78K00-0C0 | NON 12341-78K00-0C0 | YEL 12341-78K00-0D0 |
| | | | BLK 12345-78K10-0B0 | BLK 12345-78K10-0B0 | NON 12345-78K10-0C0 | NON 12345-78K10-0C0 | YEL 12345-78K10-0D0 | YEL 12345-78K10-0D0 |
| | D | 56 +0.012 +0.009 | BLK 12341-78K00-0B0 | BLK 12341-78K00-0B0 | NON 12341-78K00-0C0 | NON 12341-78K00-0C0 | YEL 12341-78K00-0D0 | YEL 12341-78K00-0D0 |
| | | | BLK 12345-78K10-0B0 | NON 12345-78K10-0C0 | NON 12345-78K10-0C0 | YEL 12345-78K10-0D0 | YEL 12345-78K10-0D0 | BLU 12345-78K10-0E0 |
| | E | 56 +0.015 +0.012 | BLK 12341-78K00-0B0 | NON 12341-78K00-0C0 | NON 12341-78K00-0C0 | YEL 12341-78K00-0D0 | YEL 12341-78K00-0D0 | BLU 12341-78K00-0E0 |
| | | | NON 12345-78K10-0C0 | NON 12345-78K10-0C0 | YEL 12345-78K10-0D0 | YEL 12345-78K10-0D0 | BLU 12345-78K10-0E0 | BLU 12345-78K10-0E0 |
| | F | 56 +0.018 +0.015 | NON 12341-78K00-0C0 | NON 12341-78K00-0C0 | YEL 12341-78K00-0D0 | YEL 12341-78K00-0D0 | BLU 12341-78K00-0E0 | BLU 12341-78K00-0E0 |
| | | | NON 12345-78K10-0C0 | YEL 12345-78K10-0D0 | YEL 12345-78K10-0D0 | BLU 12345-78K10-0E0 | BLU 12345-78K10-0E0 | BLU 12345-78K10-0E0 |

| Upper bearing | | | Lower bearing | | |
|---|---|---|---|---|---|
| Color | Thickness + Tolerance | Part Number | Color | Thickness + Tolerance | Part Number |
| Green | 2.000 +0.002 -0.001 | 12341-78K00-0A0 | Green | 2.000 +0.002 -0.001 | 12345-78K10-0A0 |
| Black | 2.000 +0.005 +0.002 | 12341-78K00-0B0 | Black | 2.000 +0.005 +0.002 | 12345-78K10-0B0 |
| None | 2.000 +0.008 -0.005 | 12341-78K00-0C0 | None | 2.000 +0.008 -0.005 | 12345-78K10-0C0 |
| Yellow | 2.000 -0.011 -0.008 | 12341-78K00-0D0 | Yellow | 2.000 -0.011 -0.008 | 12345-78K10-0D0 |
| Blue | 2.000 -0.014 -0.011 | 12341-78K00-0E0 | Blue | 2.000 -0.014 -0.011 | 12345-78K10-0E0 |


**1. Color**

This page shows how to select a proper pair of main bearings.



1-1

Using a dial gauge, measure play in axial (thrust) direction of crankshaft.

If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Thrust bearing is fitted between cylinders No.2 and No.3.

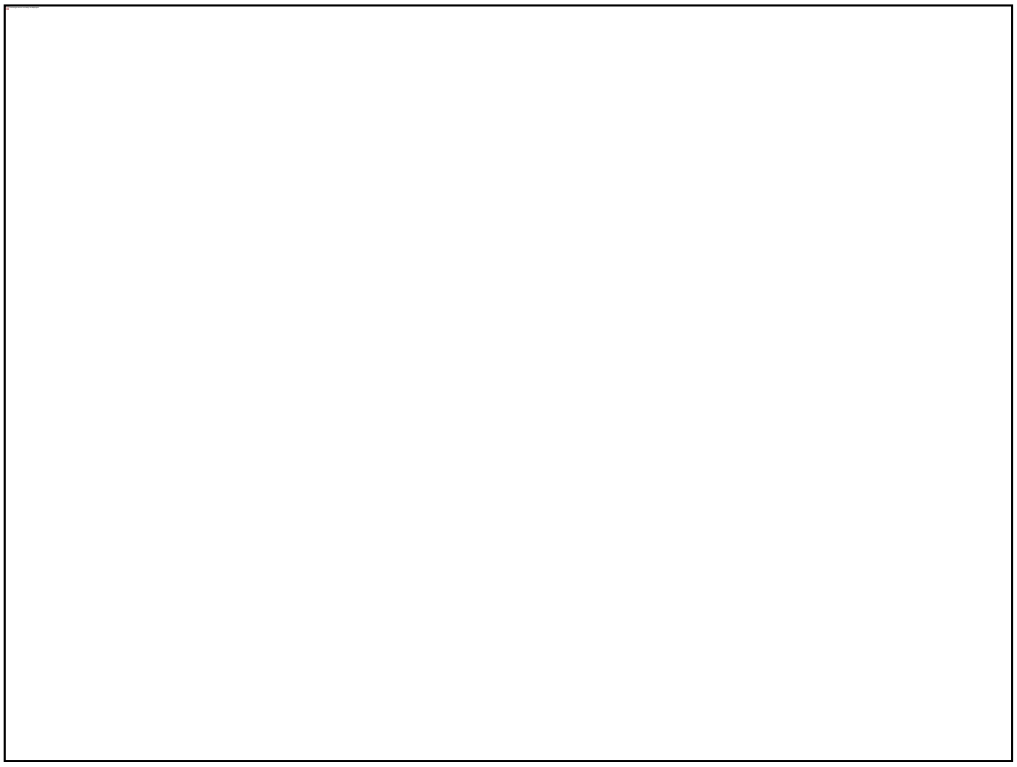
**Crankshaft thrust play**

**Standard: 0.10 – 0.35 mm (0.0039 – 0.0137 in.)**

**Limit: 0.35 mm (0.0137 in.)**

**NOTE:**

**After checking the thrust play, make sure that thread deformation of each main bearing cap bolt.**

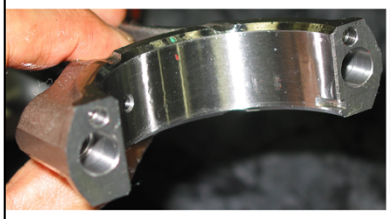


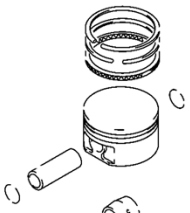
1-1

Special tool 09911-97710 , 09911-97811 provides a proper fitting of crankshaft rear oil seal.

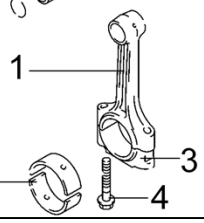
1-1

| (mm) | | J20B / J24B | |
|---|---|---|---|
| Connecting rod | Part number | 12161-78K00 | |
| | Material | Carbon steel | |
| | Lower diameter | 53 | |
| | Upper diameter | 21 | |
| Connecting rod bearing | Center to center distance | 143.2 | |
| | Base material | Aluminum alloy | |
| | Finishing material | Steel | |
| | Central thickness | Standard | 1.5 |
| | | Undersize | 1.605-1.615 |





1. Connecting rod
2. Connecting rod bearing
3. Connecting rod cap
4. Connecting rod bolt




## 13. Connecting Rod

Connecting rods are made of carbon steel and have I-shaped cross section.

Connecting rod cap is fitted to connecting rod by tightening bolts with a plastic range torque to stabilize bolt axial strength.

The large end has oil jet to lubricate small end, piston and cylinder inner surface.

Connecting rod bearing is finished with micro groove.

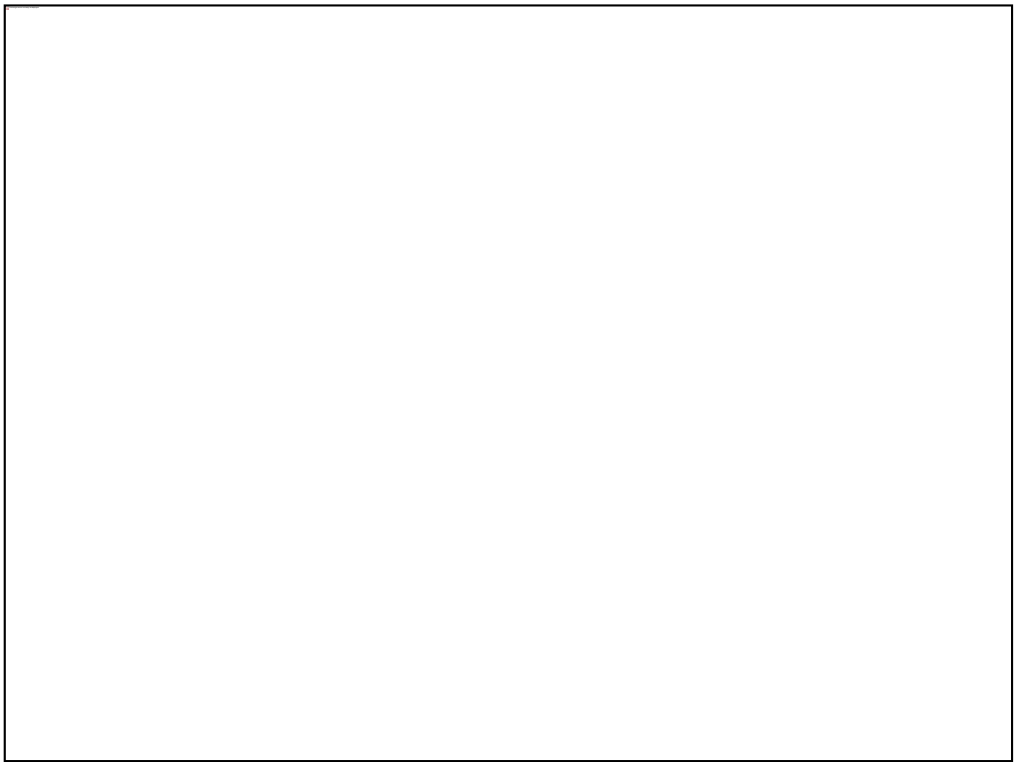
Check bolts for deformation.

Connecting rod nuts have been eliminated to reduce weight and fuel consumption. Connecting rod bolts are used instead. Bolt replacement has become much cheaper than M engines in which whole connecting rod must be replaced if stud bolt thread is deformed.

The small end has force fitted copper alloy bushing in order to improve sliding characteristic.

[Animation] Connecting rod assy rotation

1-1



1-1

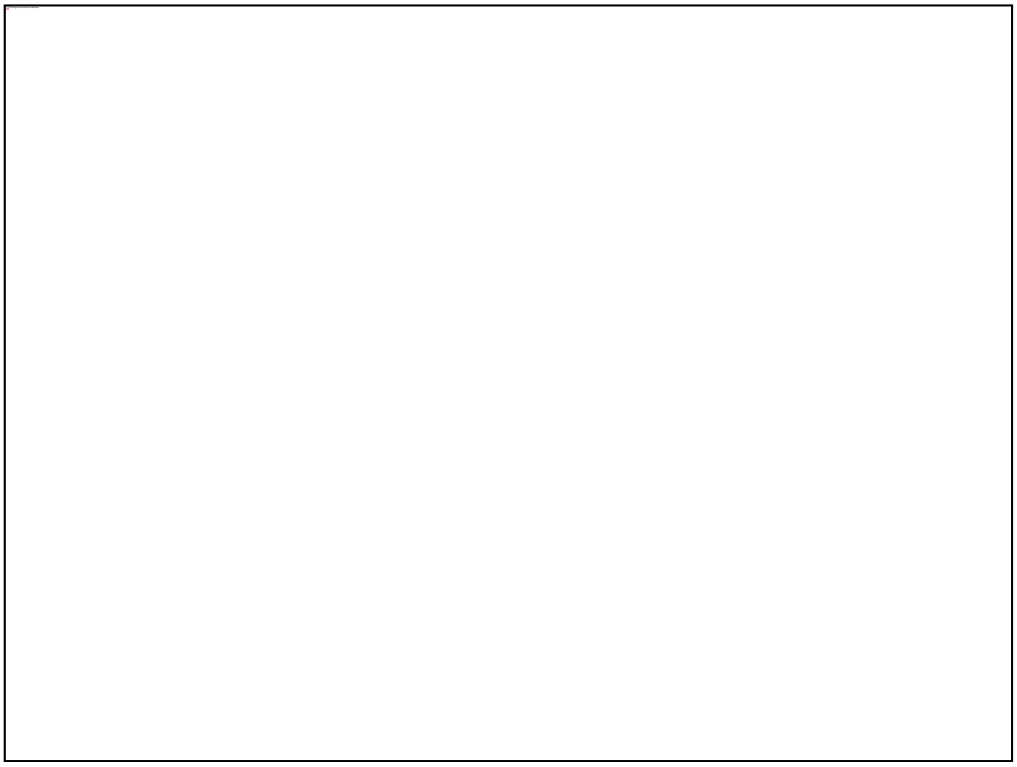
Before reusing connecting rod, check it for deformation. Measure diameter at two points shown above. The difference between obtained values “A” and “B” should be less than 0.05 mm.

Use a size-8 type 12-point socket to loosen/tighten the connecting rod bolts.

[Animation]

Left : Connecting rod & piston rotation

Right : Connecting rod bolt



1-1

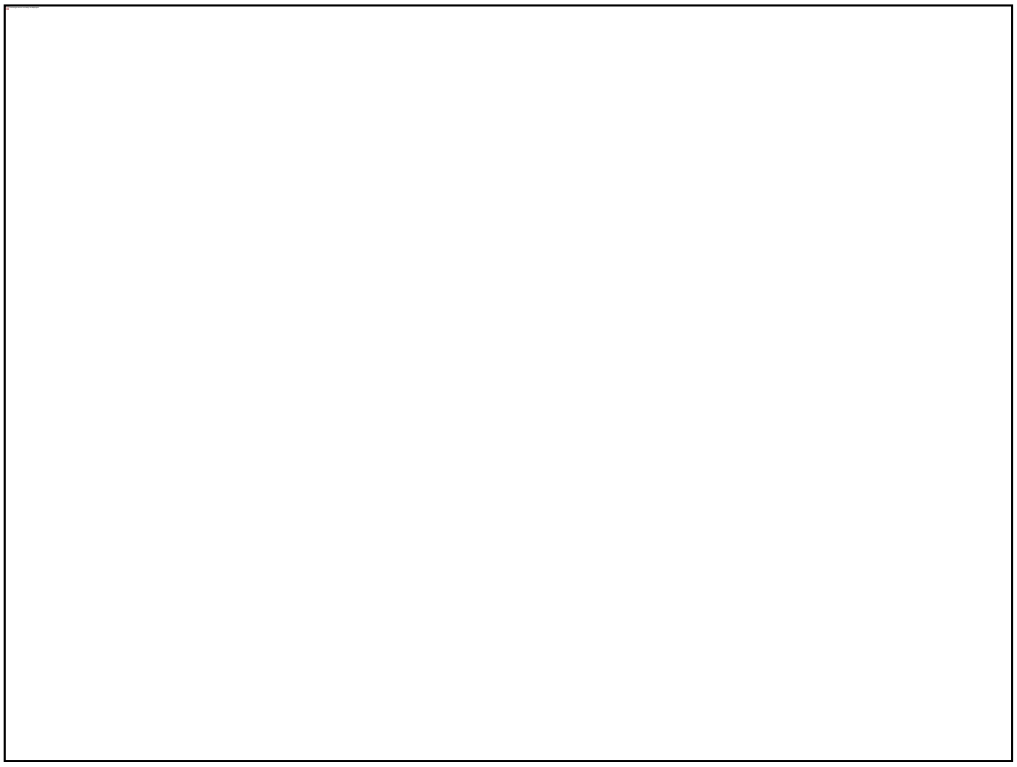
Connecting rod larger end has an oil hole to supply crank pin with engine oil.

Do not apply engine oil to connecting rod larger end mating surface with bearing.

Do not apply engine oil to inner surface of connecting rod cap.

[Animation] : Connecting rod disassembly

1-1



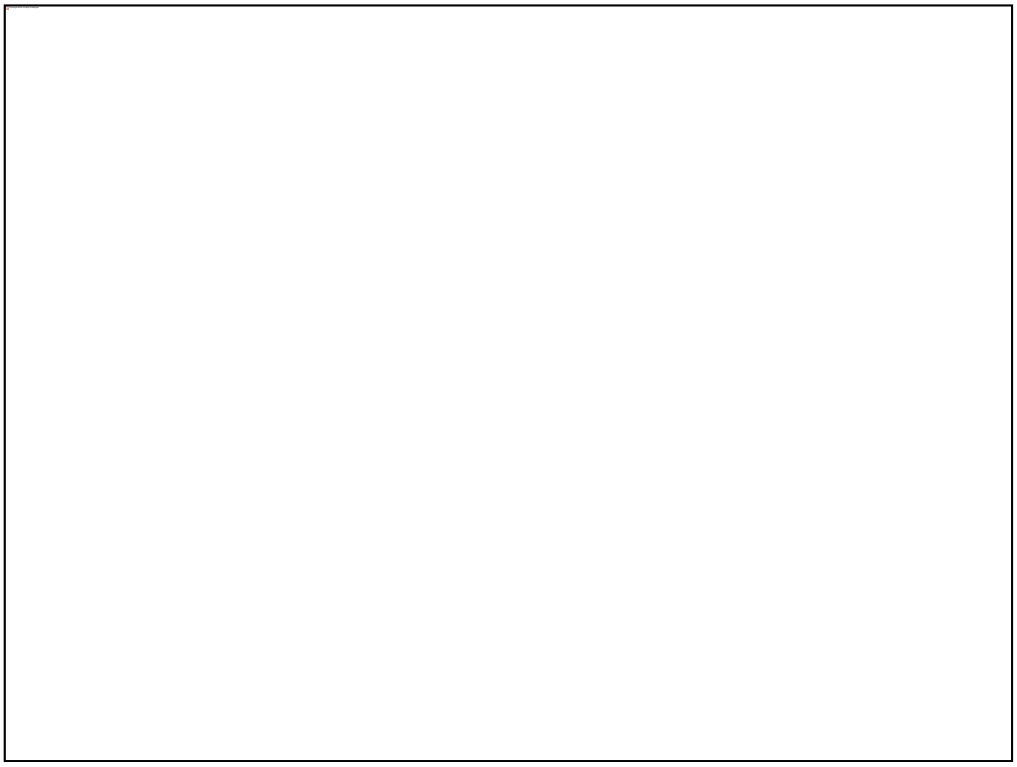
1-1

Stamped number on connecting rod with cap indicates connecting rod big end inside diameter as shown above.

Stamped alphabet on crank web No.5 indicates diameter at corresponding crankshaft pin.

By referring to number and alphabet, a proper bearing can be selection. See next page for more detail.

1-1



1-1

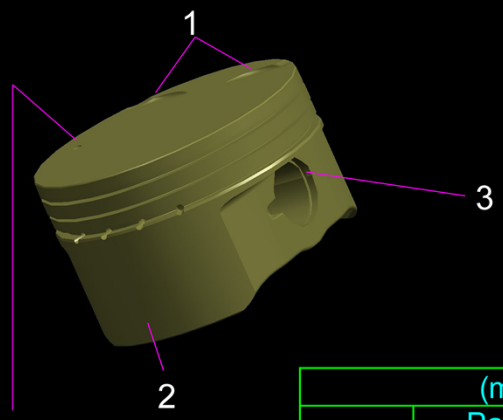
This page shows how to select a proper thickness of connecting rod bearing.

If undersize bearing is used, confirm that connecting rod bearing clearance is within standard value shown above.

[Animation] Connecting rod bearing see through

1-1

## 14. Piston / Ring / Pin (cont.)



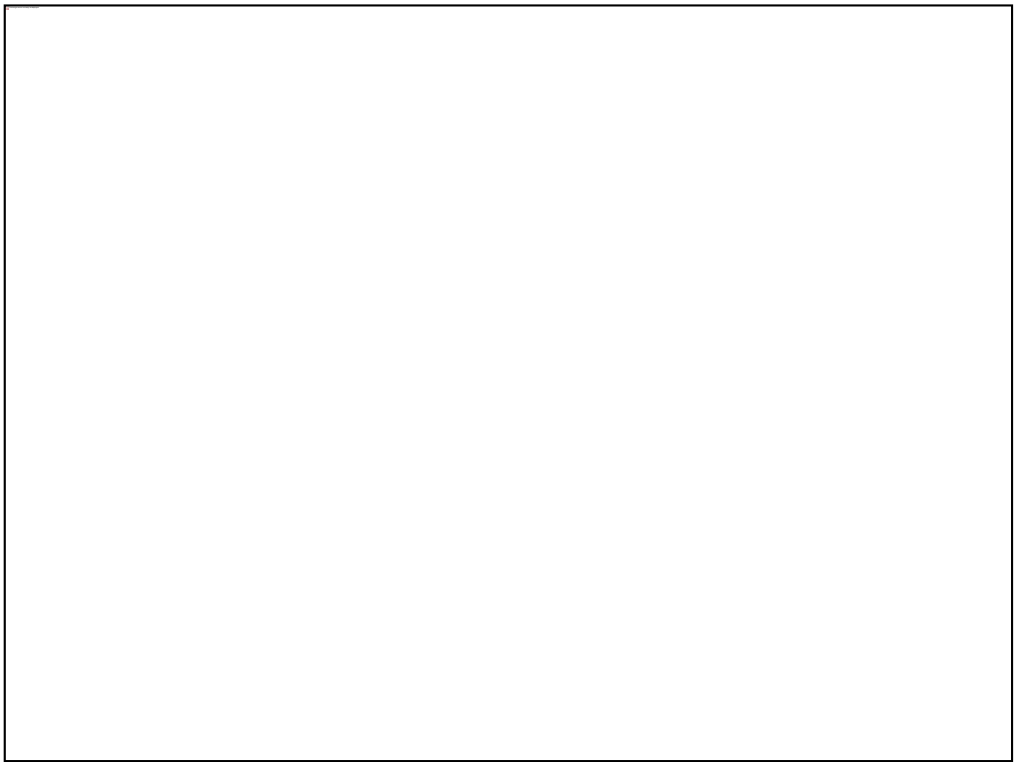

1. Valve recess
2. Dry film coating
3. Side relief groove

**Single dot mark**
**: Timing chain side**

| (mm) | | J20B | J24B |
|---|---|---|---|
| Piston | Part No. 12111- | 54L00 | 78K00 |
| | Material | Aluminum alloy | |
| | Top volume (cc) | 0.14 | -4.4 |
| | Outer diameter (mm) | 84 | 92 |
| | Height (mm) | 51.6 | 51.2 |
| | Pin to top distance | 30.6 | 30.7 |
| Pin | Outer diameter | 21 | |
| | Length | 59 | |

Piston is made of aluminum alloy.
Outer surface of piston skirt is finished with dry film coating to reduce friction.
Dry film is of an organoresin compound.

There is a protruded surface on the top of the piston.
There are valve recesses for intake valves.
Single dot mark indicates timing chain side.
[Animation]
Piston overview



1-1

Dry film coating reduces friction.

Top surface of the piston has a simple shape and there are valve recesses on the intake side.

[Animations]

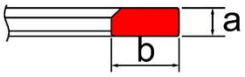
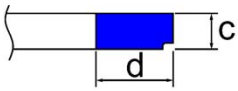
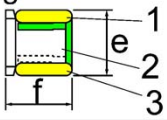
Left : Rotating piston assy

Right : Rotating piston

1-1

**14. Piston / Ring / Pin (cont.)**

1. Upper rail
2. Spacer
3. Lower rail

| | | J20B | J24B |
|---|---|---|---|
| 1st ring   | Thickness (a) | 1.0 mm | 1.2 mm |
| | Width (b) | 2.6 mm | 3.1 mm |
| | Shape | Barrel face | |
| | Surface finishing | PVD on outer surface | |
| 2nd ring   | Thickness (c) | 1.0 mm | 1.0 mm |
| | Width (d) | 2.7 mm | 3.1 mm |
| | Shape | Taper under cut | |
| | Surface finishing | Zinc phosphate | |
| Oil ring   | Thickness (e) | 2.0 mm | 2.0 mm |
| | Width (f) | 2.3 mm | 2.5 mm |
| | Shape | Multi-piece | |
| | Surface finishing | Phosphate (rail) + PVD (outer) | |

The 1st ring is of barrel type for smoother initial movement of piston.

The second ring is of taper under cut type to improve combustion efficiency.

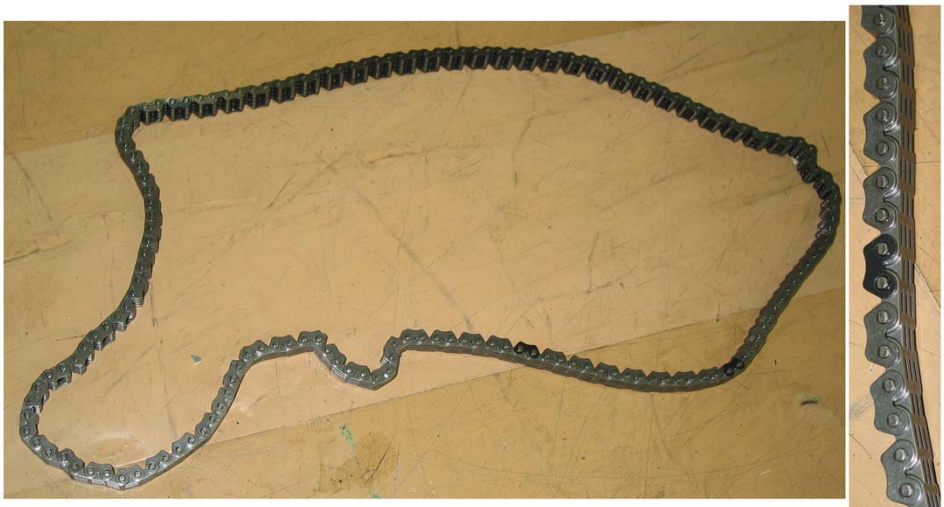
Outer surface of 1st ring and oil ring is finished with physical vapor deposition process to increase durability.

Piston rings are made by Teikoku Piston Ring Co., Ltd.

1-1

## 15. Timing Chain

| Timing chain | | | |
|---|---|---|---|
| Structure | 164 links | | |
| **Sprocket** | | | |
| | Crank | Intake cam | Exhaust cam |
| Number of teeth | 23 | 46 | 46 |
| Pitch (mm) | 6.35 | 6.35 | 6.35 |



**J20B / J24B : 12761-78K00**

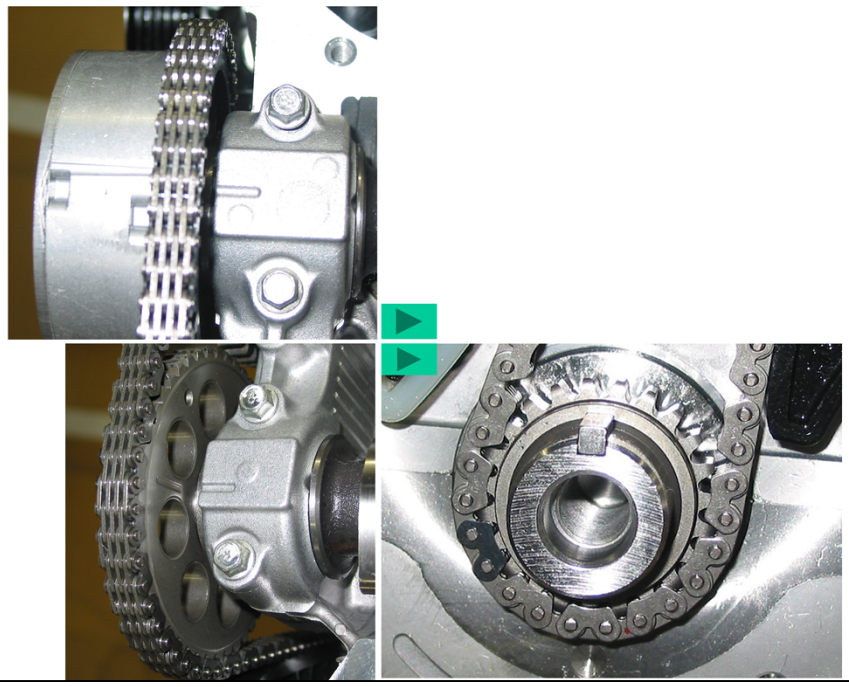
The timing chain is a silent type.

As inner plate has a mountain shape, it can be well engaged with sprocket. It therefore produces less noise compared with a roller type chain.

1-1

[Chain removal]

## 15. Timing Chain (cont'd)



If you are removing chain ,at first align line marks on the camshaft housing with line marks on exhaust sprocket and intake VVT

And face key on the crankshaft sprocket upward.

[Animation]

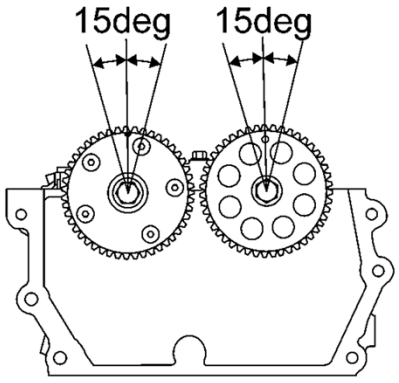
Upper : Crank sprocket removal

Lower : Crank sprocket rotation

1-1

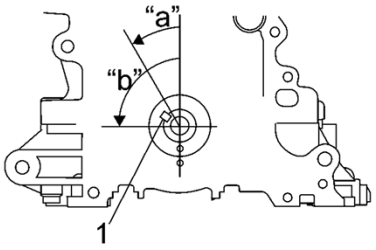
**[Caution after chain removal]**

**15. Timing Chain (cont'd)**




**1. Crankshaft allowed to turn 90°**
**2. Camshafts allowed to turn 15°**

**[If camshaft rotation is necessary]**




| |
|---|
| "a" : 30 |
| "b" : 90 |
| 1. Key |

**First rotate crankshaft counter clockwise 30-90°.**

**Then camshaft can be rotated.**

[Caution after timing chain removal]

After timing chain is removed, never turn crankshaft and camshafts independently more than 90 degree and 15 degree.

If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

[If camshaft rotation is necessary after chain removal]

If it is necessary to rotate the camshaft with the timing chain removed, rotate the camshaft after turning crankshaft clockwise 30 - 90° as shown in figure.

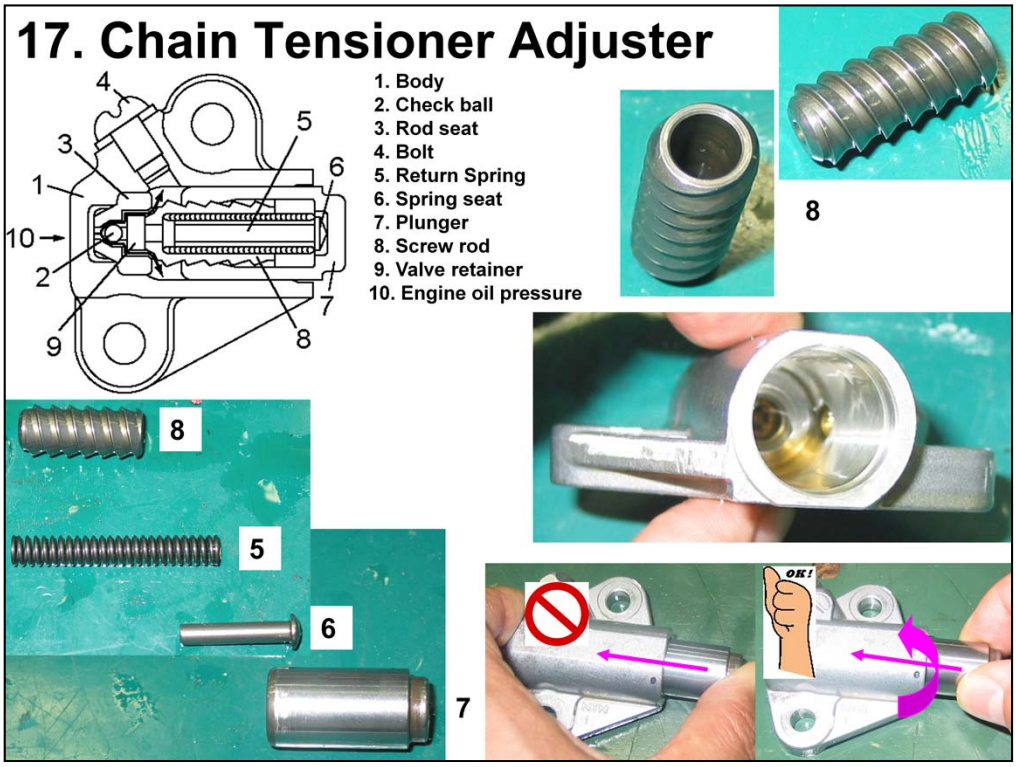
1-1

## 16. Chain Guide / Tensioner

Chain tensioner consists of plastic base and resin shoe. Resin shoe is clamped to the plastic base.

Chain guide consists of resin shoe.

1-1




Screw Rod Type chain tensioner adjuster.

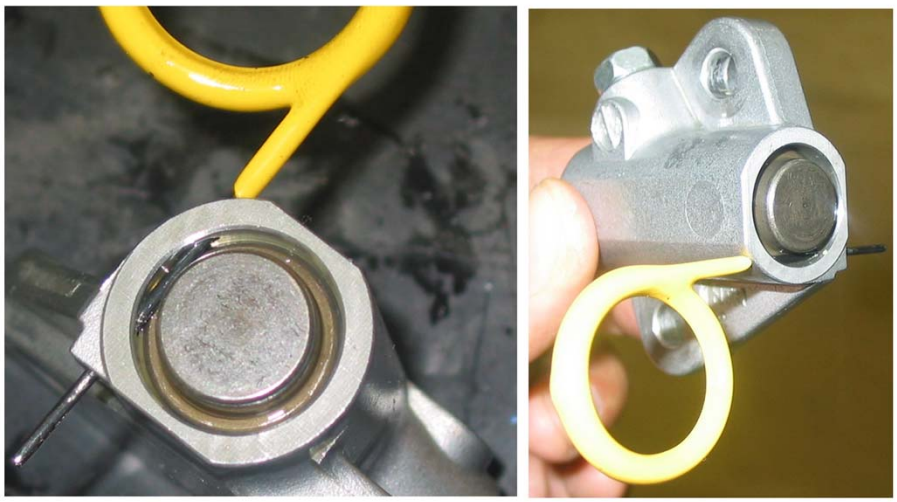
Plunger is pushed out by return spring and engine oil pressure to obtain a chain tension.

Once the plunger is pushed out, it is hard to return freely due to screw rod resistance (due to a large thread pitch) and check ball that maintains oil pressure in tensioner adjuster.

If it is necessary to push the plunger into the body, turn the plunger clockwise (looking at the body from the left side in the picture above).

1-1

**17. Chain Tensioner Adjuster (cont'd)**

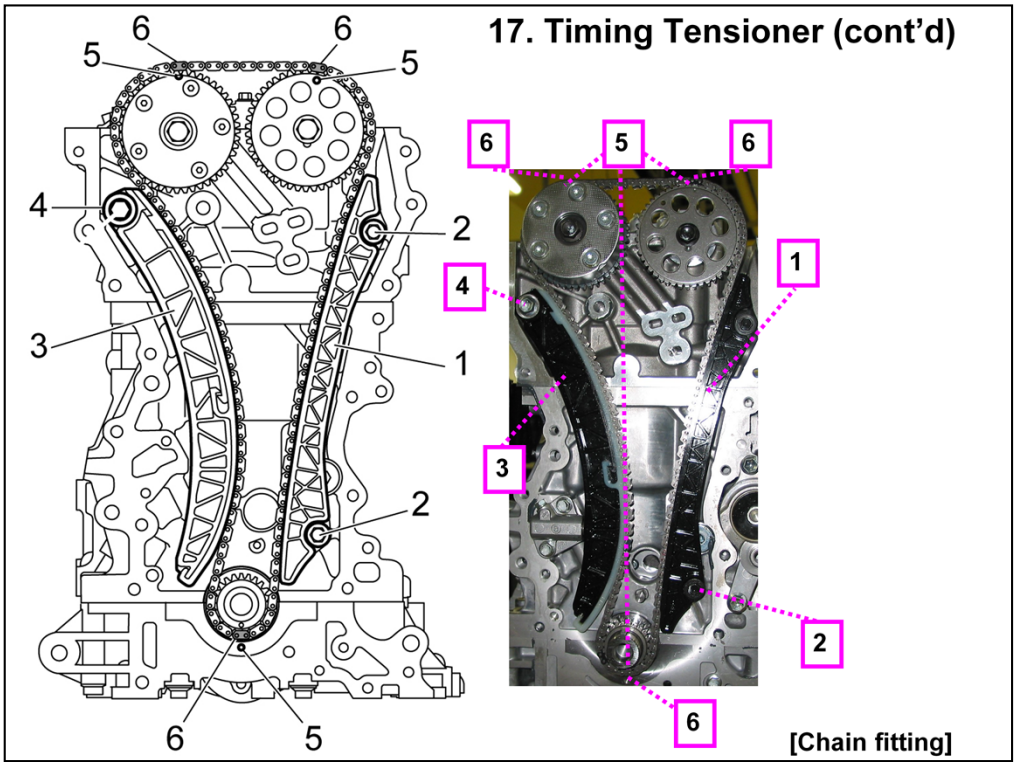


Before installing the chain tensioner adjuster onto the cylinder block, fit timing chain, chain guide and chain tensioner.

Push the plunger into the chain tensioner adjuster body completely and lock the plunger with a clip.

Then install the chain tensioner adjuster to the cylinder block. After tightening the two bolts, extract the clip.

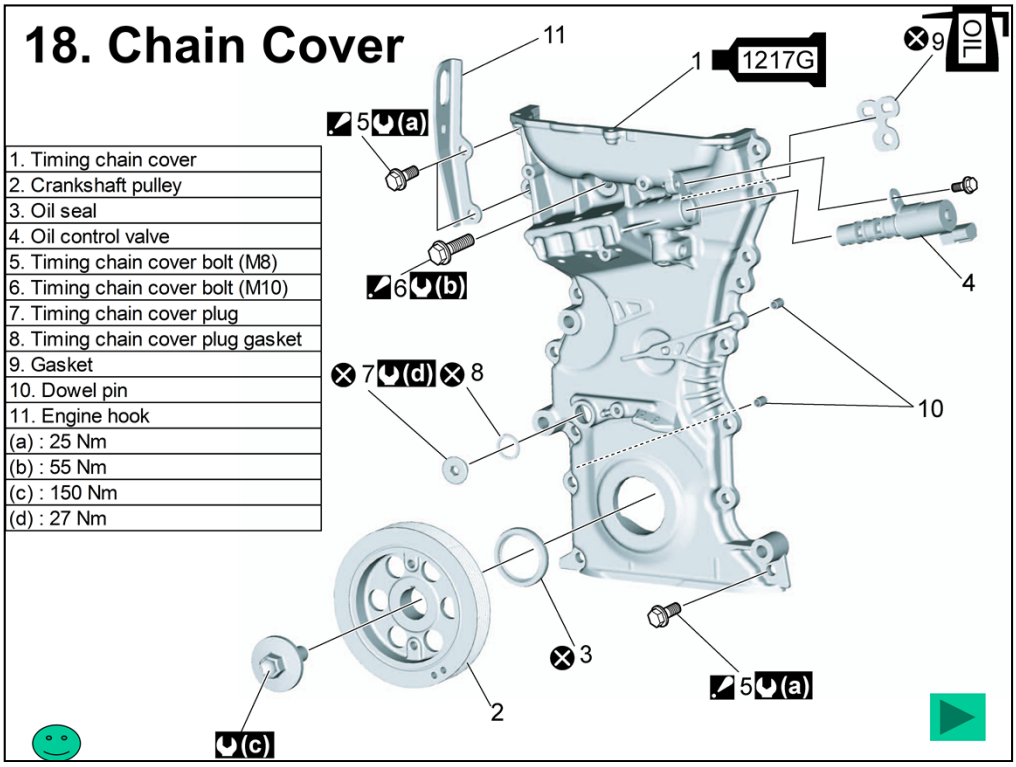
1-1




1. Set timing chain guide
2. Tighten timing chain guide bolts
3. Set timing chain tensioner
4. Tighten timing chain tensioner bolt
5. 6. Align marked chain and dot mark on the crankshaft shaft sprocket/exhaust camshaft sprocket/intake VVT actuator

Before removing the timing chain, align 3 marks with 3 dot marks respectively to avoid interference between valve and piston.

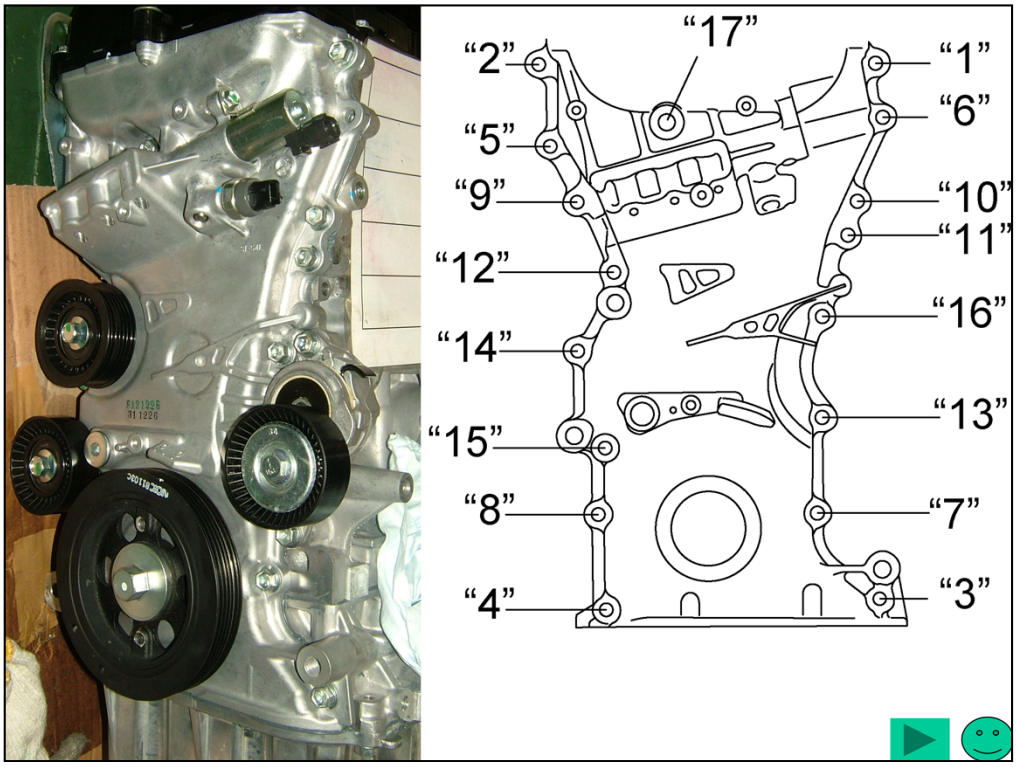
1-1




Timing chain cover is made of aluminum alloy.

Dowel pins assure a proper fitting of timing chain cover to cylinder head and block.

[Animation] Chain cover section

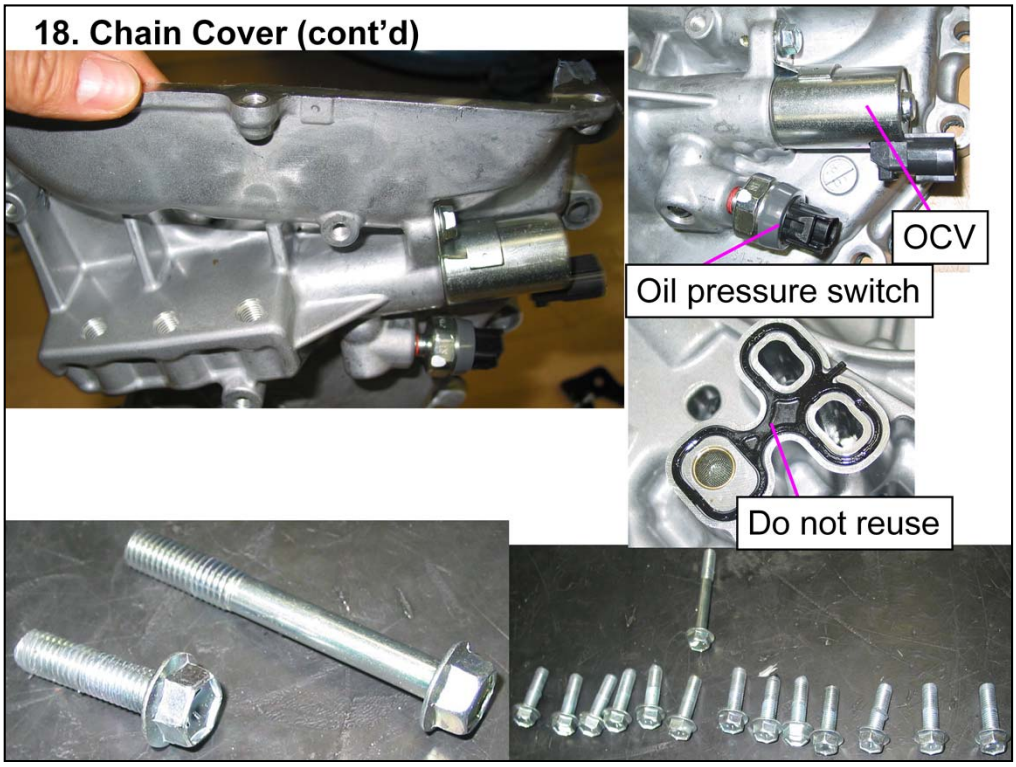



1-1

Loosen chain cover bolts following the sequence shown above.
The bolt number “17” is longer than the others.

[Animation] Chain cover & head section vertical

1-1



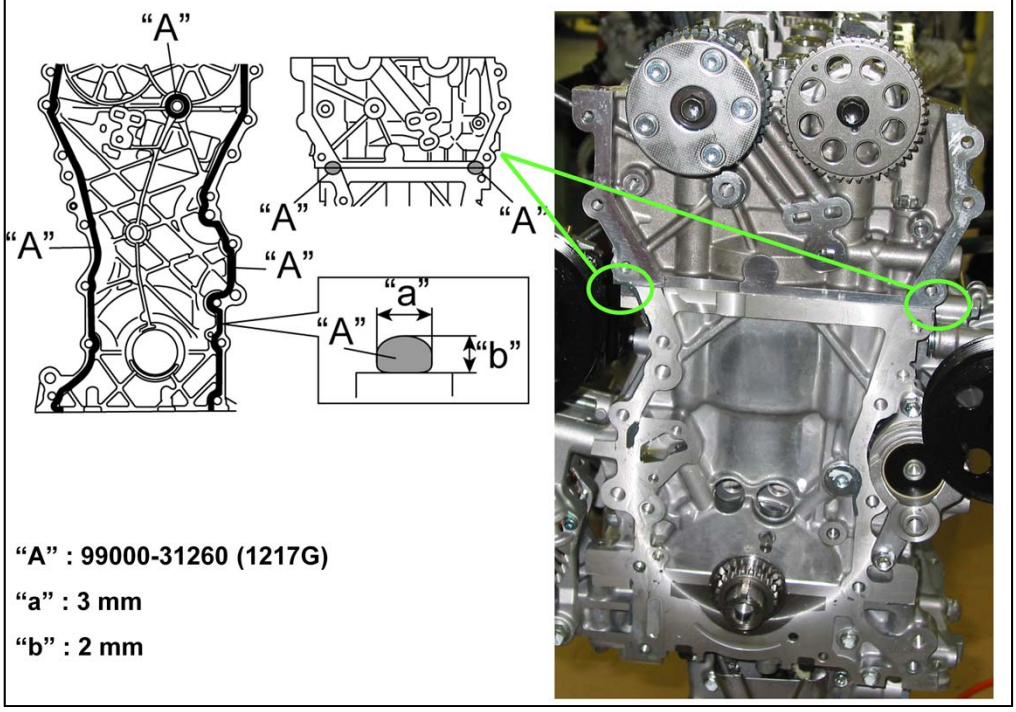

Timing chain cover is fitted to the cylinder block and cylinder head with 17 bolts.

Oil control valve is fitted on the chain cover.

Oil pressure switch is located under the oil control valve.

1-1

**18. Chain Cover (cont'd)**

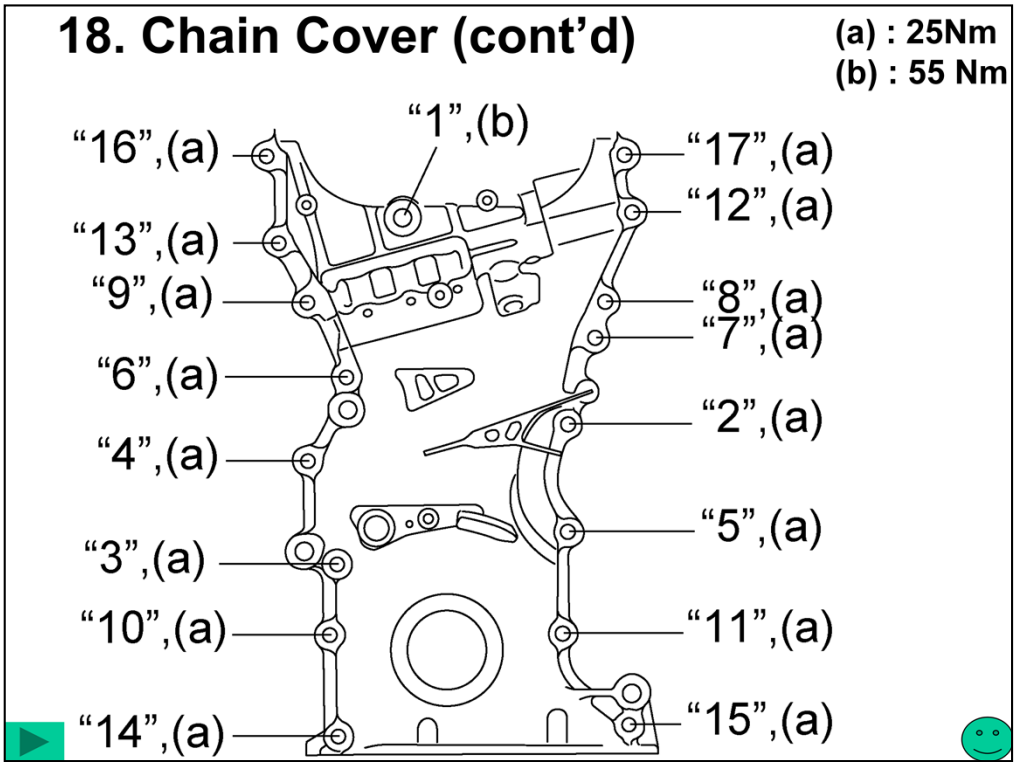



**"A" : 99000-31260 (1217G)**

**"a" : 3 mm**

**"b" : 2 mm**

Apply sealant "A" to mating surface of cylinder block and cylinder head and chain cover.




1-1

Tighten chain cover bolts following the sequence shown above.
Note that the bolt "1" has different tightening torque.

[Animation] Chain cover & head horizontal

1-1

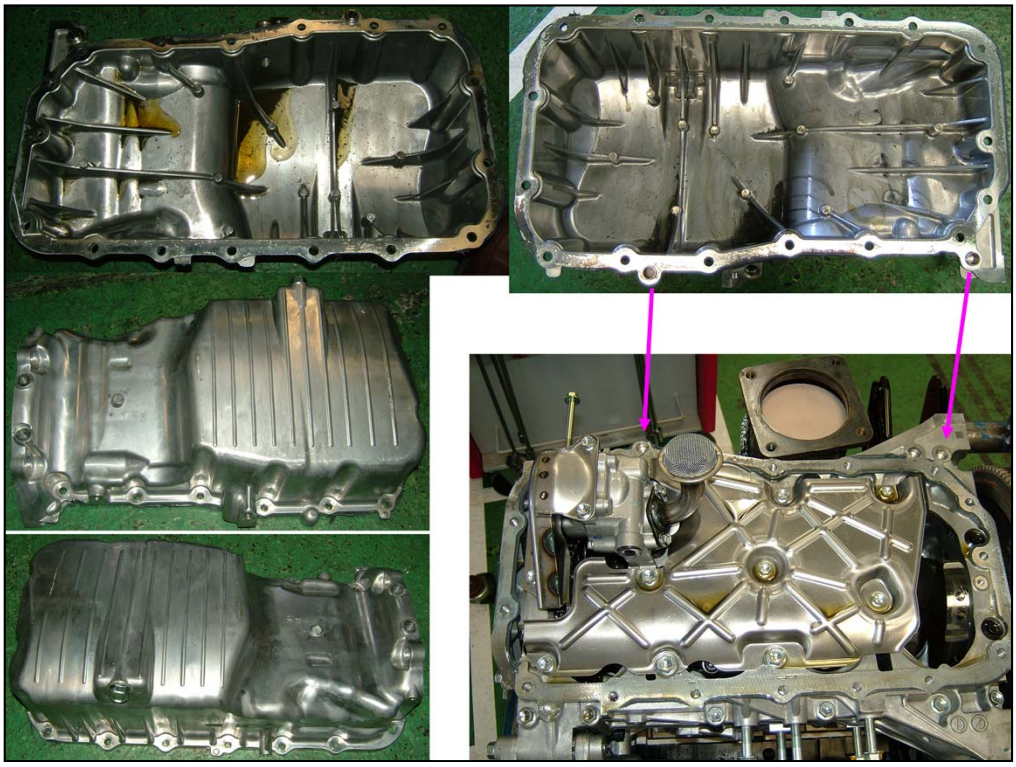
1-1

## 19. Oil Pan


Oil pan is made of aluminum alloy.

Oil pan is completely different between SX4 and Grand Vitara as shown above.

1-1



There are two collars between lower crankcase and oil pan for a better positioning.

1-1

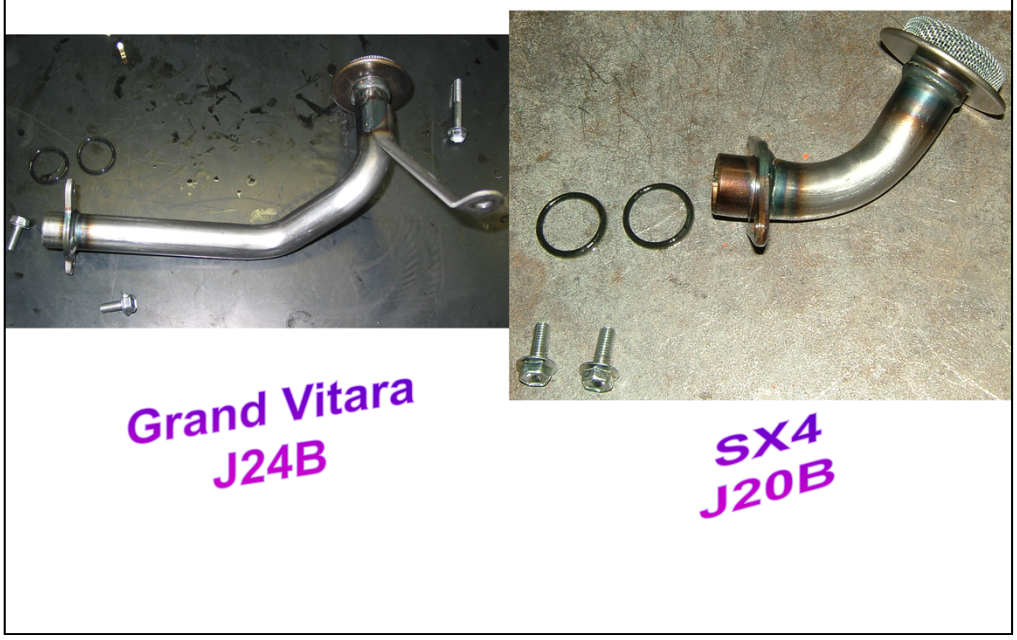
Oil pan is fitted on the lower crankcase via the following bolts:

- Size 10 : 14 pieces
- Size 12 short : One piece
- Size 12 long : One piece
- Size 12 the longest : One piece

Two long bolts are used on the flywheel end.

1-1

## 20. Oil Strainer




Oil strainer for SX4 J20B engine is much simpler than that for Grand Vitara J24B engine.

Two O-rings are fitted on the oil strainer flange.

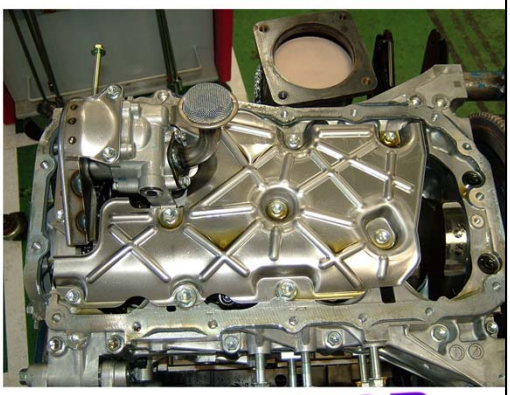
1-1

Oil strainer is fitted on the oil pump inlet port via two bolts. Two O-rings must be fitted as shown above.

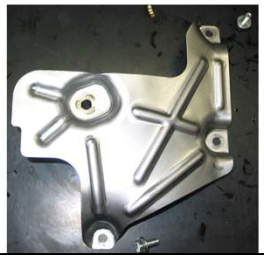
1-1

**21. Baffle Plate**

Grand Vitara J24B



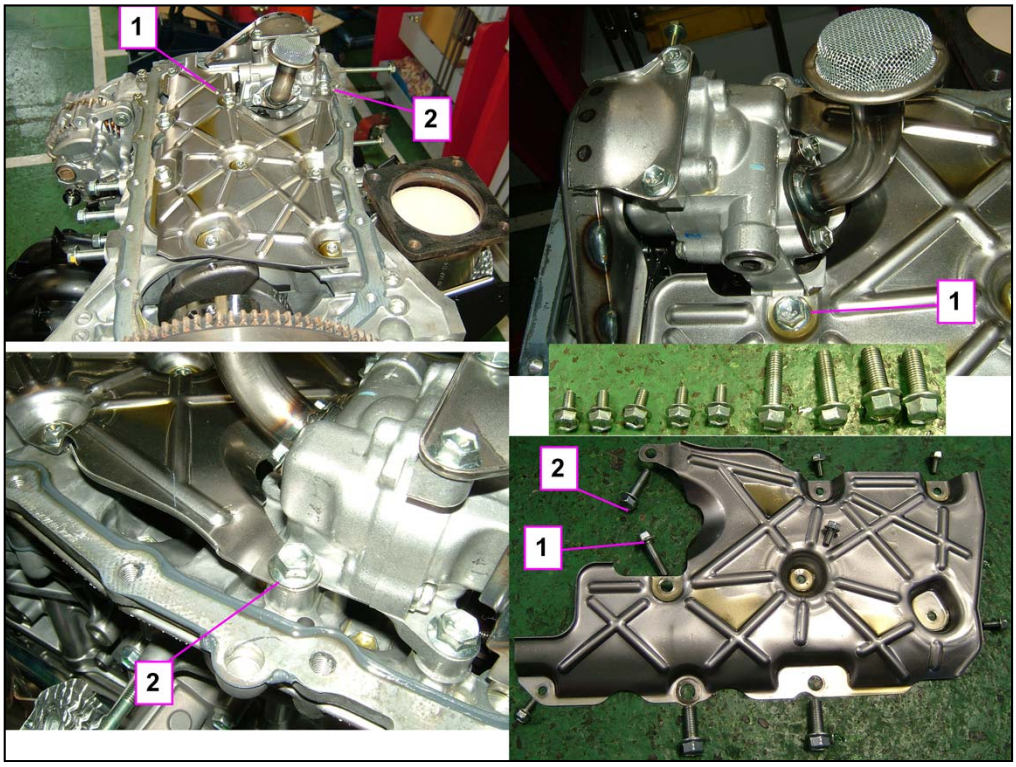
SX4 J20B



Balancer shafts are not mounted on SX4 J20B engine.

The baffle plate for SX4 is, therefore, occupies a bigger area than Grand Vitara as shown above.

1-1




Baffle plate is made of stamped steel.

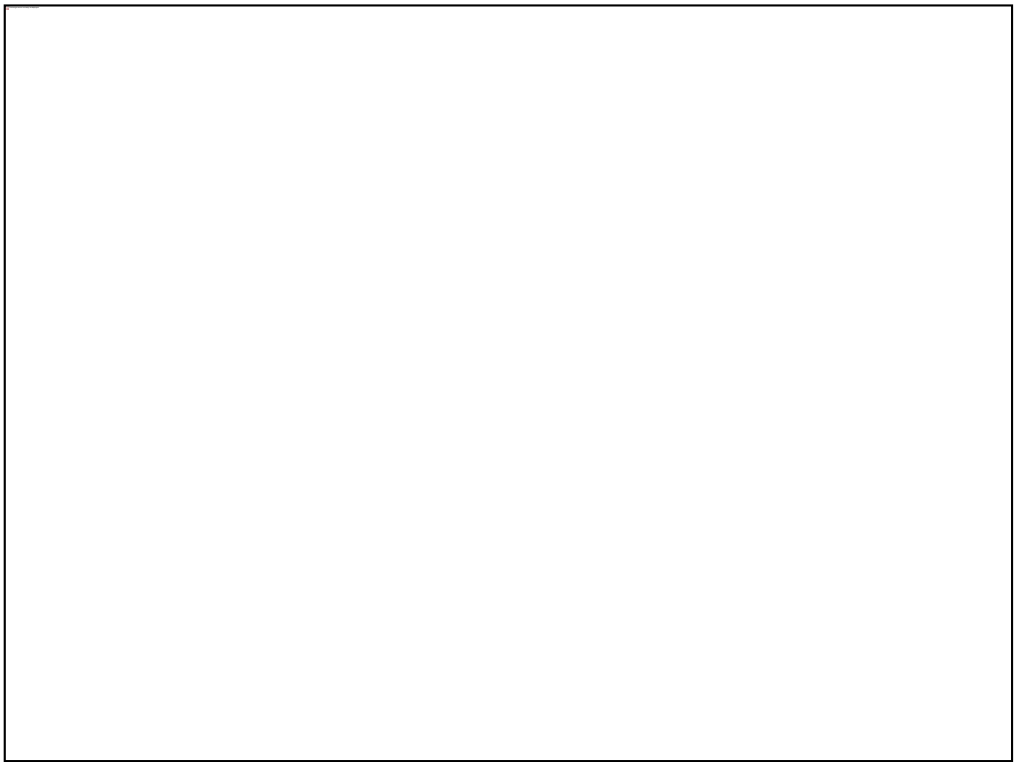
It avoids engine oil shaking due to vehicle movement.

It is fitted to the lower crank case via the following bolts:

- Size 10 : 5 pieces
- Size 12 : 2 pieces
- Size 14 : 2 pieces

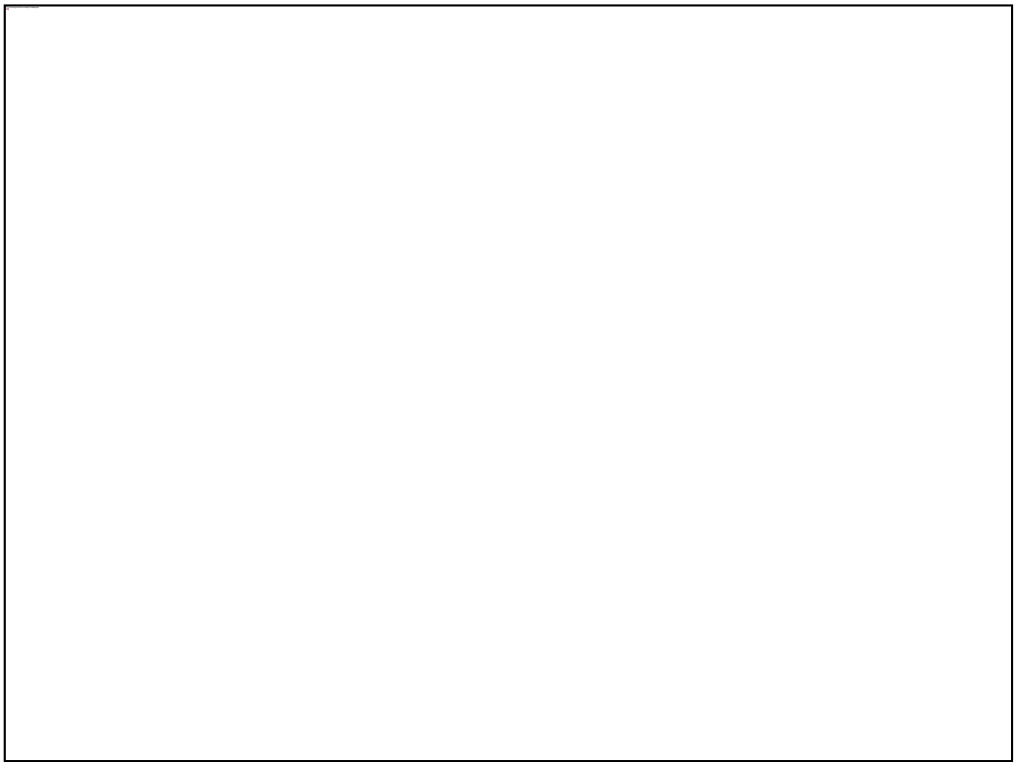
Size 12 bolts fix baffle plate to lower crankcase together with oil pump housing. These bolts are indicated by “1” and “2” in the pictures shown above.

1-1



1-1

Size 14 bolts are used at the places shown above.

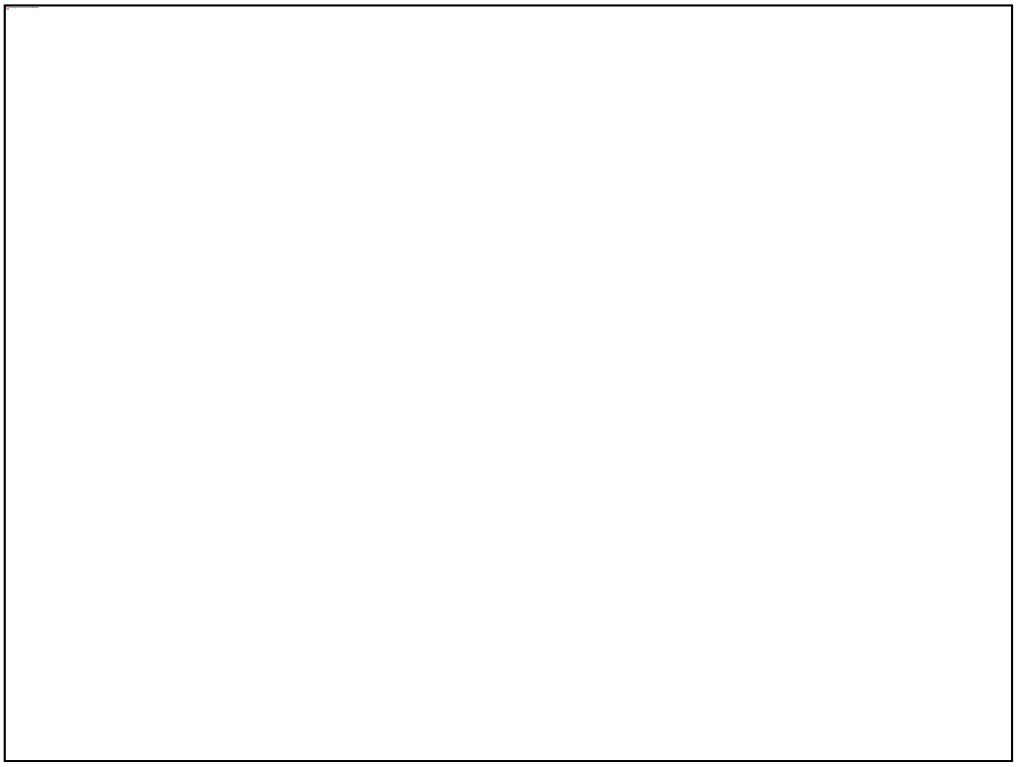


1-1

Oil pump is of a conventional trochoid type driven by crankshaft via sprockets and chain.

As there is no balancer shaft in SX4, the oil pump itself is similar to the J20A oil pump.

1-1

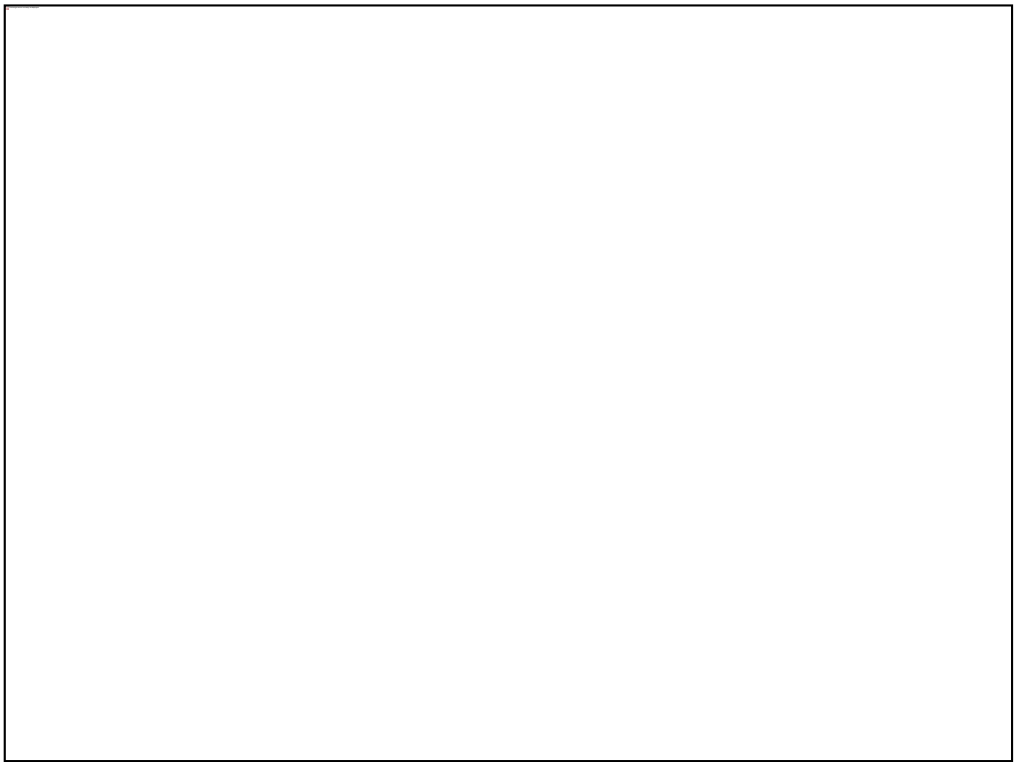


1-1

Oil pump drive chain and driven sprocket are covered with sprocket cover.

The sprocket cover consists of 4 pieces of stamped steel sheet welded to each other.

The sprocket cover is fitted on the oil pump via two bolts and also fitted on the lower crankcase via one bolt.

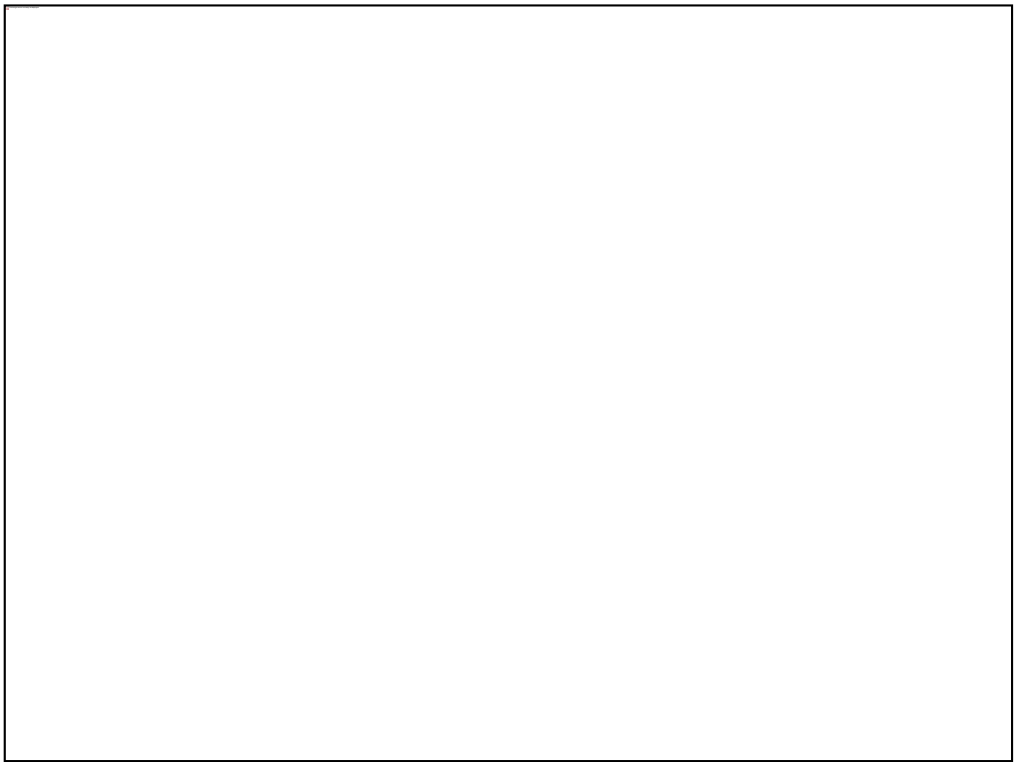


1-1

A roller type chain drives the oil pump.

There is a chain guide. No tensioner is used.

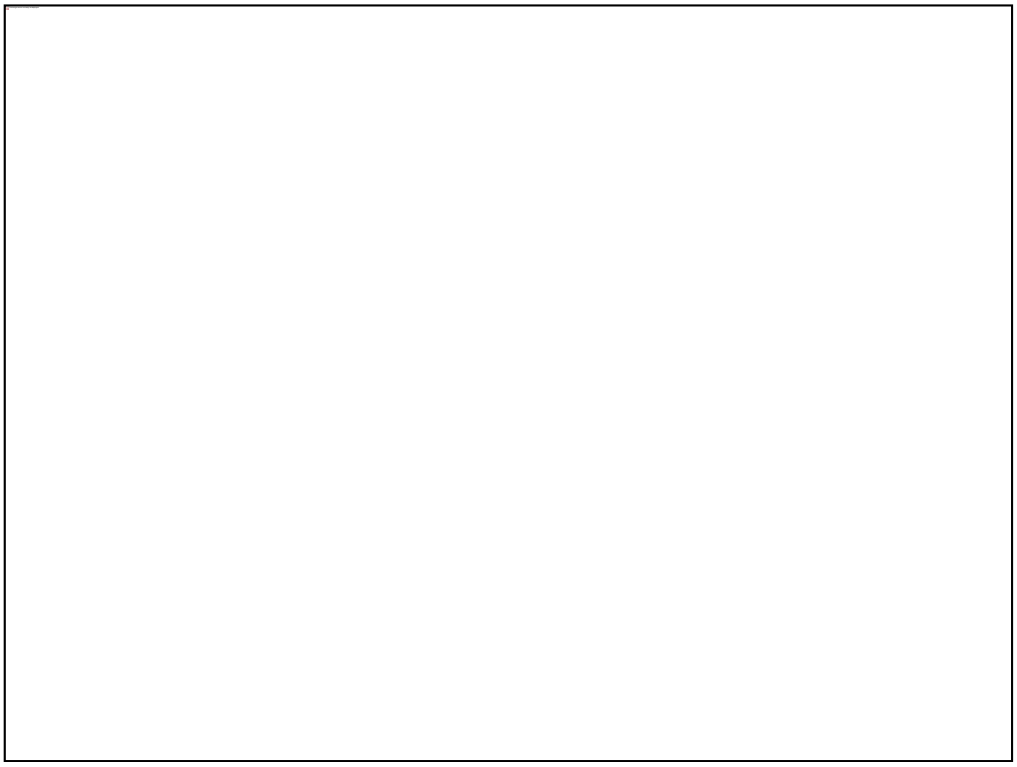
1-1



1-1

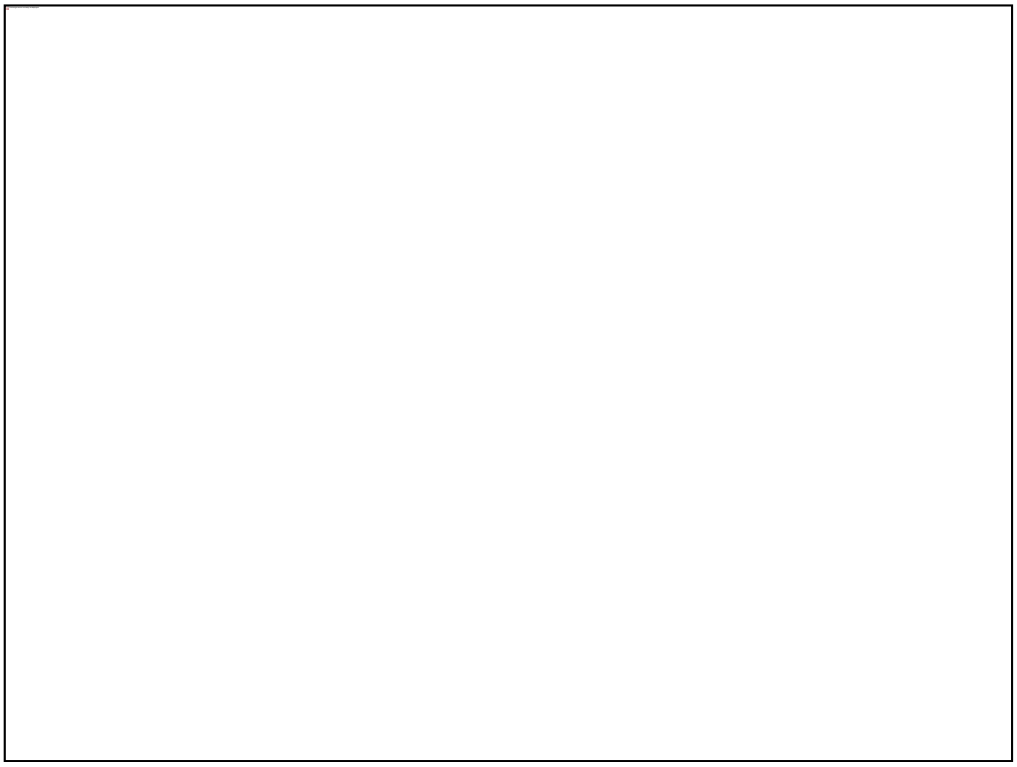
Oil pump chain guide is fitted on the lower crankcase via two bolts.
The lower pictures were taken with timing chain cover removed.

1-1



1-1

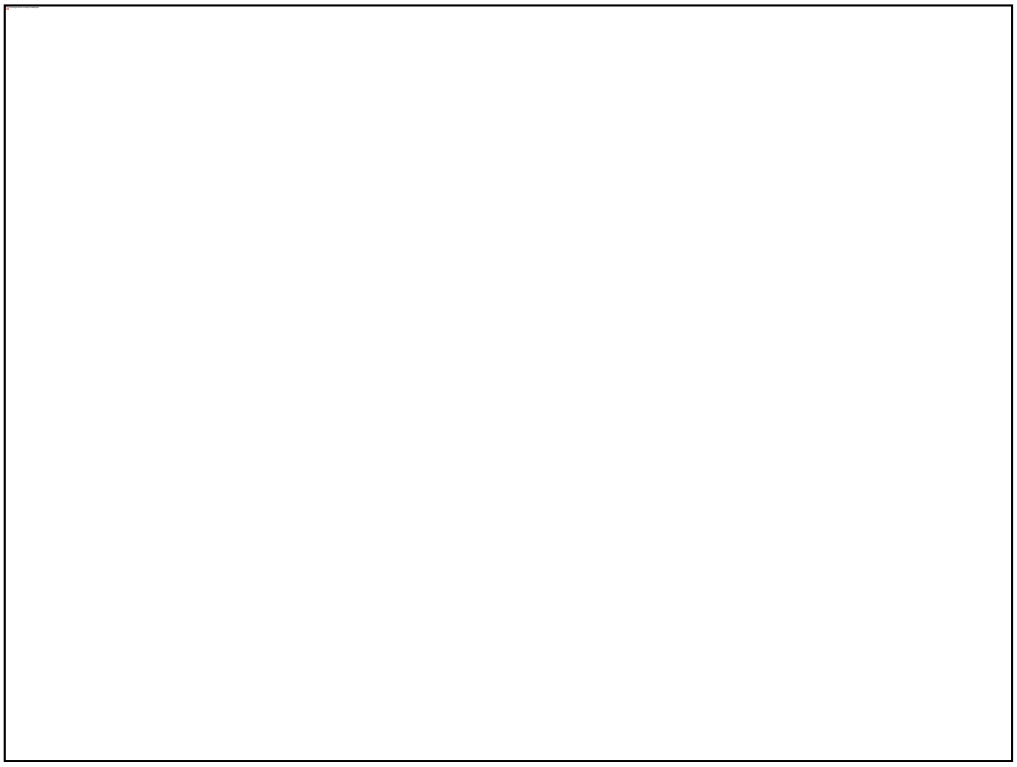
Oil pump chain guide consists of a steel plate, two weld nuts and a resin pad.



1-1

The oil chain guide has a small bent part as indicated by pink dotted circle above. This part works as a hook for the chain during oil pump installation. It improves mass production efficiency.

1-1

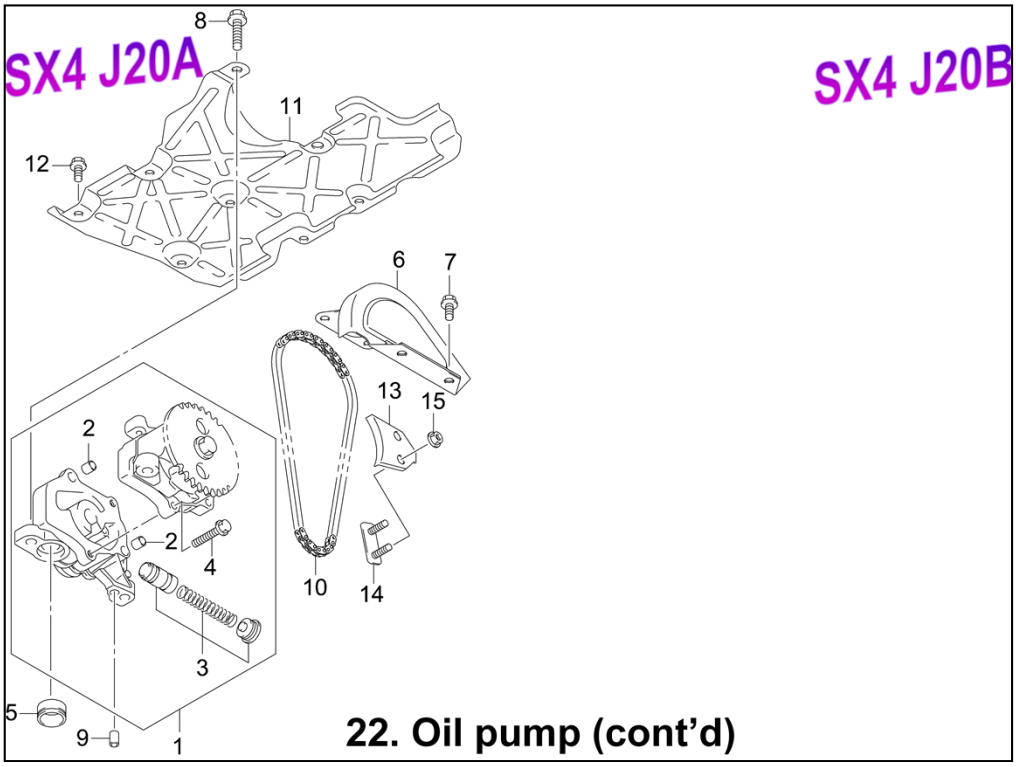


The oil sucked from the oil pan passes through the oil strainer and enters oil pump inlet shown in the upper pictures.

The oil is then compressed and discharged from the outlet port shown in the lower left picture.

The lower right picture shows oil inlet to the oil filter.

1-1




**22. Oil pump (cont'd)**

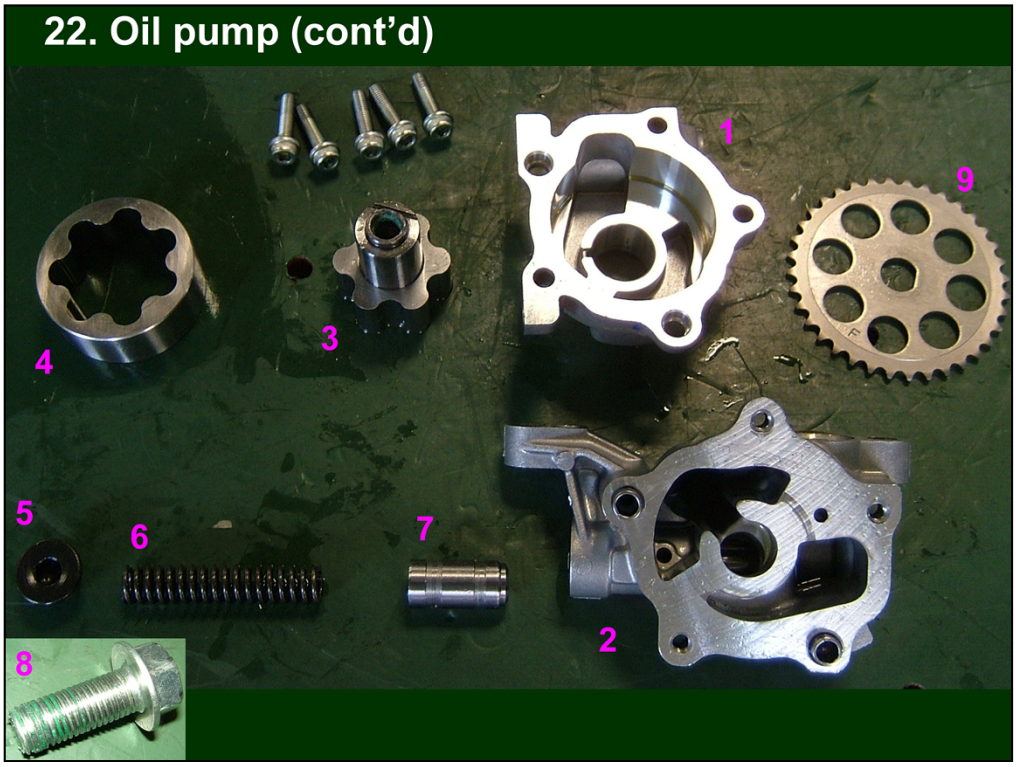
## SX4 J20A

| |
|---|
| 1. Oil pump assembly |
| 2. Pin |
| 3. Oil pump relief valve set |
| 4. Bolt |
| 5. Oil pump case pin |
| 6. Oil pump sprocket cover |
| 7. Bolt |
| 8. Bolt |
| 9. Pin |
| 10. Oil pump drive chain |
| 11. Oil pump baffle plate |
| 12. Bolt |
| 13. Oil pump chain guide |
| 14. Plate |
| 15. Nut |

## SX4 J20B

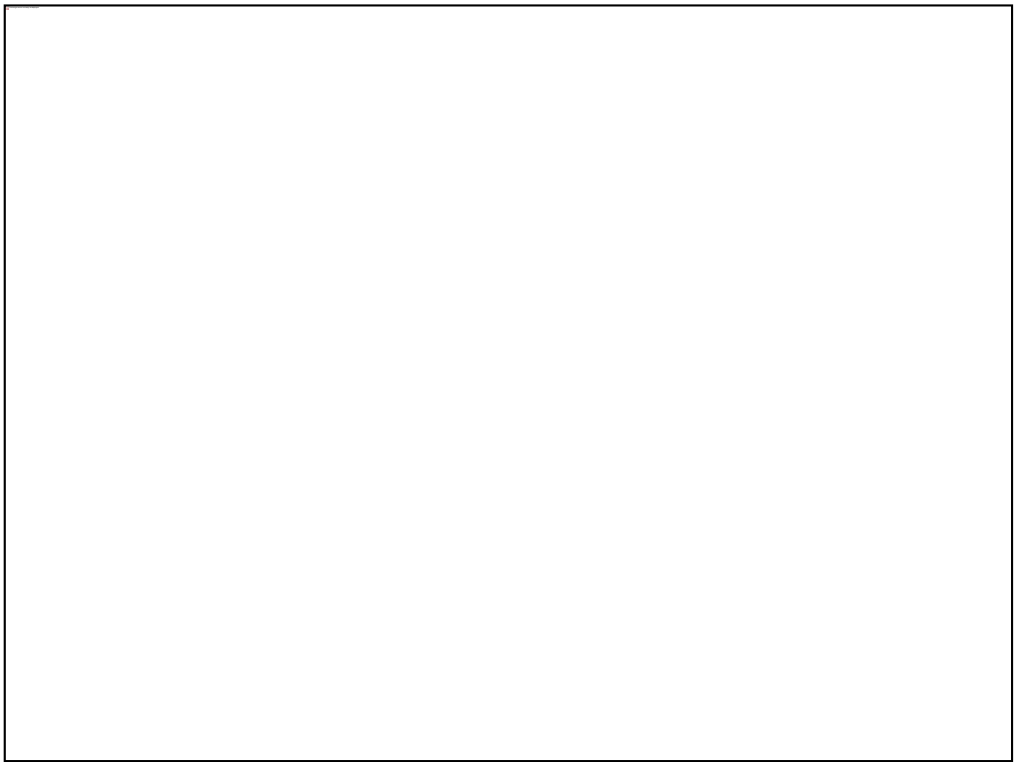
| |
|---|
| 1. Cylinder block |
| 2. Oil pump relief valve set |
| : Replace as a set |
| 3. Baffle plate |
| 4. Pin No.1 |
| 5. Pin No.2 |
| 6. Oil pump relief valve retainer |
| 7. Oil pump chain guide |
| 8. Oil pump case No.1 |
| 9. Oil pump case No.2 |
| 10. Pin No.3 |
| 11. Oil pump sprocket cover |
| (a) : 25 Nm |
| (b) : 12 Nm |
| (c) : 28 Nm |
| (d) : 11 Nm |
| (e) : 55 Nm |

1-1




This page shows the J20B engine oil pump parts.

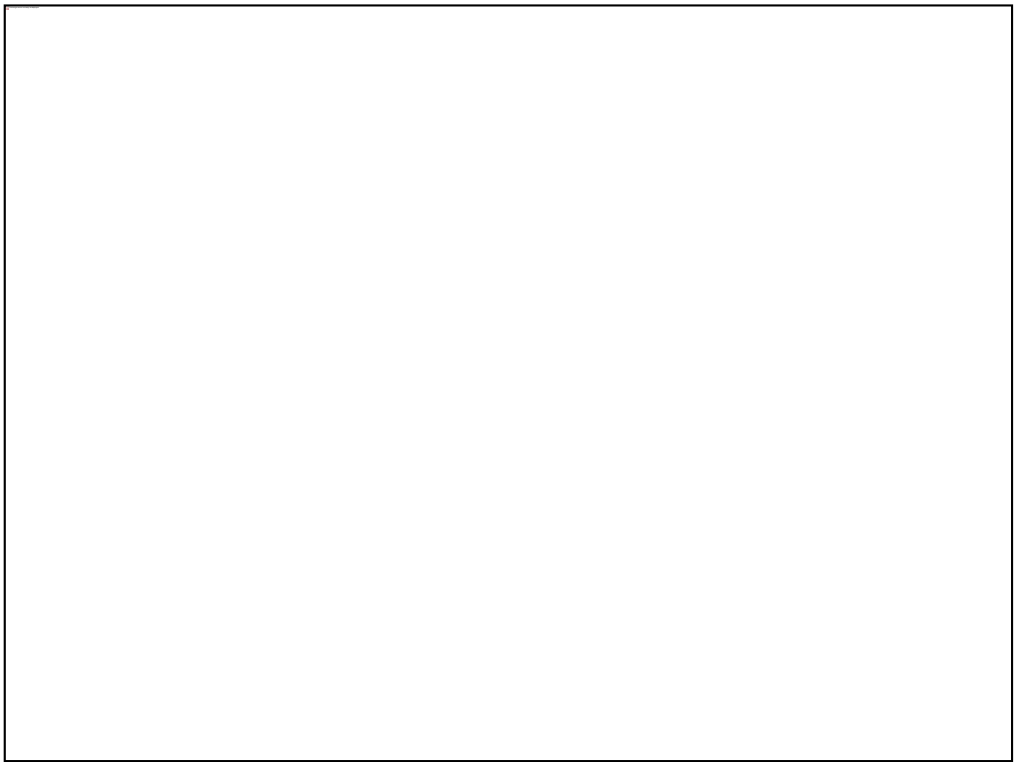
1. Oil pump case No.1
2. Oil pump case No.2
3. Oil pump inner rotor
4. Oil pump outer rotor
5. Relief valve nut
6. Relief valve return spring
7. Relief valve spool
8. Sprocket bolt
9. Sprocket



1-1

1. Oil pump case No.1
2. Oil pump case No.2

Both parts have “54L” indication on the outer surface. These parts have been exclusively designed for SX4 J20B engine.



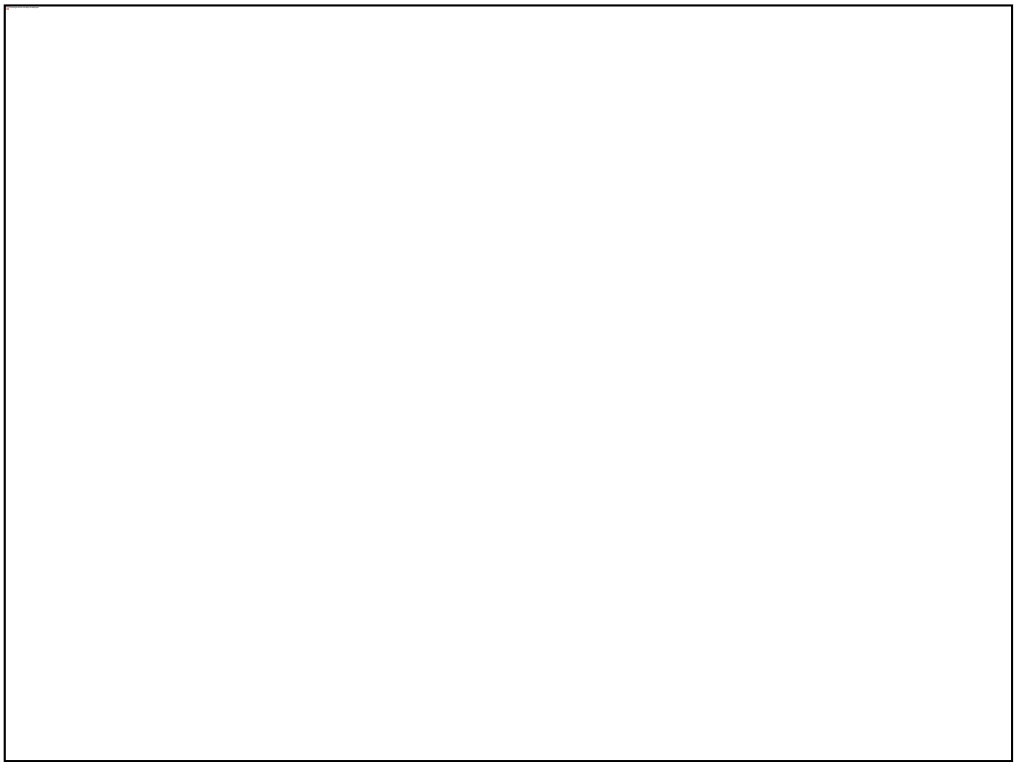
1-1

3. Oil pump inner rotor

Oil pump shaft is press-fitted to the inner rotor.

4. Oil pump outer rotor

This is a symmetrical part.



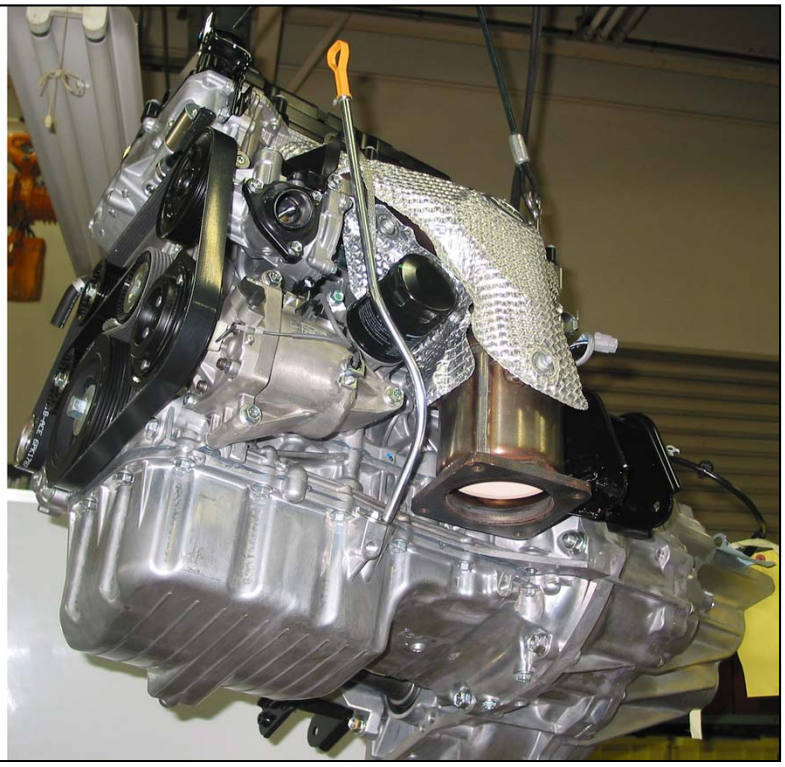
1-1

5. Relief valve nut
6. Relief valve return spring
7. Relief valve spool
8. Sprocket bolt

Do not remove the sprocket bolt from the inner rotor assembly. This bolt is not individually

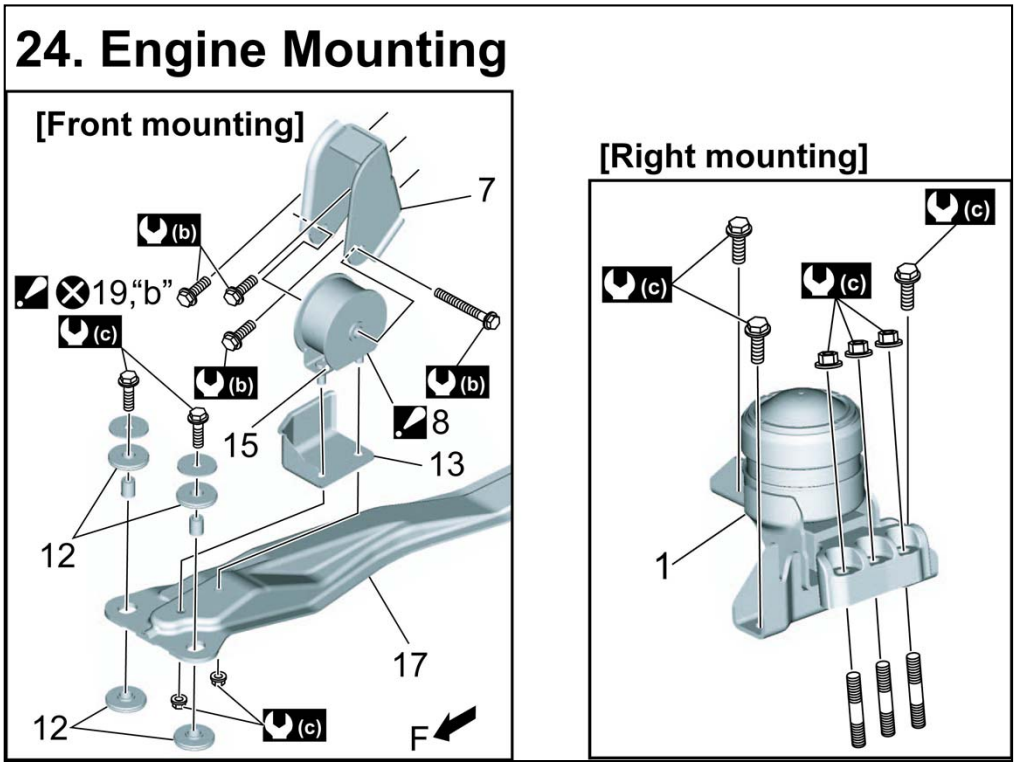
1-1

**23. Oil Filter**



Oil filter is mounted on the exhaust side, above the A/C compressor.

1-1




1. Engine right mounting
7. Engine front mounting bracket
8. Engine front mounting : Be sure to direct yellow mark forward
12. Mounting member cushion
13. Engine front mounting cover
15. Yellow mark
17. Mounting member
19. Mounting member bolt : Tighten in sequence : "a" → "b"

In this page only the bolts "b" are shown at the front end of mounting member. The nuts "a" are located at the rear end of mounting member and shown on another page which describes "rear mounting".

(b) : 55 Nm

(c) : 65 Nm

F : Vehicle Forward

1-1

1-1

N

| | |
|---|---|
| NOx | Nitrogen Oxides |

O

| | |
|---|---|
| OBD | On-Board Diagnostic system |
| OCM | Occupant Classification Module |
| OCV | Oil Control Valve |
| O/D | Overdrive |
| OHC | Over Head Camshaft |
| O2S | Oxygen Sensor |

P

| | |
|---|---|
| PCM | Powertrain Control Module |
| PCV | Positive Crankcase Ventilation |
| PM | Particulate Mater |
| PNP | Park / Neutral Position |
| P/S | Power Steering |
| PSP | Power Steering Pressure |

R

| | |
|---|---|
| R | Right |
| RAM | Random Access Memory |
| RHD | Right Hand Drive Vehicle |
| ROM | Read Only Memory |
| RPM | Engine Speed |

S

| | |
|---|---|
| SAE | Society of Automotive Engineers |
| SDM | Sensing and Diagnostic Module (Air Bag Controller, Air bag Control Module) |
| SDT | Smart Diagnostic Tester |
| SFI | Sequential Multiport Fuel Injection |
| SI | System International |
| SOHC | Single Over Head Camshaft |
| SRS | Supplemental Restraint System |

T

| | |
|---|---|
| TCC | Torque Converter Clutch |
| TCM | Transmission Control Module |
| TCSS | Traction Control Support System |
| TDC | Top Dead Center |
| TP | Throttle Position |
| TPMS | Tire Pressure Monitoring System |
| TWC | Three-Way Catalytic converter |

U

| | |
|---|---|
| UART | Universal Asynchronous Receiver / Transmitter |
| USB | Universal Serial Bus |

V

| | |
|---|---|
| VFD | Vacuum Fluorescent Display |
| VIN | Vehicle Identification Number |
| VSS | Vehicle Speed Sensor |
| VVT | Variable Valve Timing |

W

| | |
|---|---|
| WU-OC | Warm Up Oxidation Catalytic converter |
| WU-TWC | Warm Up Three-Way Catalytic converter |

Other

| | |
|---|---|
| 2WD | 2-Wheel Drive |
| 4WD | 4-Wheel Drive |

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