

Engine Workshop Manual LF L3

FOREWORD

This manual explains the service points for the above-indicated automotive system. This manual covers all models with the above-indicated automotive system, not any one specific model.

In order to do these procedures safely, quickly, and correctly, you must first read this manual and any other relevant service materials carefully.

All the contents of this manual, including drawings and specifications, are the latest available at the time of printing. As modifications affecting repair or maintenance occur, relevant information supplementary to this volume will be made available at Mazda dealers. This manual should be kept up-to-date.

Mazda Motor Corporation reserves the right to alter the specifications and contents of this manual without obligation or advance notice.

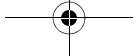
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**Mazda Motor Corporation
HIROSHIMA, JAPAN**

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GENERAL INFORMATION

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GENERAL INFORMATION 00-00

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HOW TO USE THIS MANUAL

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Range of Topics

- This manual contains procedures for performing all required service operations. The procedures are divided into the following five basic operations:
 - Removal/Installation
 - Disassembly/Assembly
 - Replacement
 - Inspection
 - Adjustment
- Simple operations which can be performed easily just by looking at the vehicle (i.e., removal/installation of parts, jacking, vehicle lifting, cleaning of parts, and visual inspection) have been omitted.

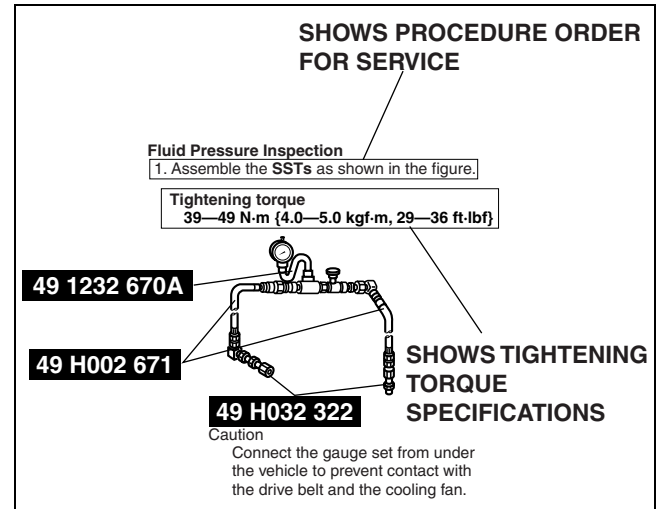
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GENERAL INFORMATION

Service Procedure

Inspection, adjustment

- Inspection and adjustment procedures are divided into steps. Important points regarding the location and contents of the procedures are explained in detail and shown in the illustrations.



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GENERAL INFORMATION

Repair procedure

1. Most repair operations begin with an overview illustration. It identifies the components, shows how the parts fit together, and describes visual part inspection. However, only removal/installation procedures that need to be performed methodically have written instructions.
2. Expendable parts, tightening torques, and symbols for oil, grease, and sealant are shown in the overview illustration. In addition, symbols indicating parts requiring the use of special service tools or equivalent are also shown.
3. Procedure steps are numbered and the part that is the main point of that procedure is shown in the illustration with the corresponding number. Occasionally, there are important points or additional information concerning a procedure. Refer to this information when servicing the related part.

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Procedure

"Removal/Installation" Portion

"Inspection After Installation" Portion

INSTALL THE PARTS BY PERFORMING STEPS 1-3 IN REVERSE ORDER

SHOWS THERE ARE REFERRAL NOTES FOR SERVICE

SHOWS SERVICE ITEM (S)

INDICATES ANY RELEVANT REFERENCES WHICH NEED TO BE FOLLOWED DURING INSTALLATION

SHOWS SPECIAL SERVICE TOOL (SST) FOR SERVICE OPERATION

SHOWS APPLICATION POINTS OF GREASE, ETC.

SHOWS NON-REUSEABLE PARTS

SHOWS DETAILS

SHOWS TIGHTENING TORQUE UNITS

SHOWS TIGHTENING TORQUE SPECIFICATIONS

SHOWS PROCEDURE ORDER FOR SERVICE

SHOWS TIGHTENING TORQUE SPECIFICATIONS

SHOWS THERE ARE REFERRAL NOTES FOR SERVICE

LOWER TRAILING LINK, UPPER TRAILING LINK REMOVAL/INSTALLATION

1. Jack up the rear of the vehicle and support it with safety stands.
2. Remove the undercover. (See 01-10-4 Undercover Removal)
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.
5. Inspect the rear wheel alignment and adjust it if necessary.

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>1</td><td>Split pin</td></tr> <tr><td>2</td><td>Nut</td></tr> <tr><td>3</td><td>Lower trailing link ball joint (See 02-14-5 Lower Trailing Link Ball Joint Removal Note)</td></tr> <tr><td>4</td><td>Bolt</td></tr> <tr><td>5</td><td>Lower trailing link</td></tr> <tr><td>6</td><td>Dust boot (lower trailing link)</td></tr> </table>	1	Split pin	2	Nut	3	Lower trailing link ball joint (See 02-14-5 Lower Trailing Link Ball Joint Removal Note)	4	Bolt	5	Lower trailing link	6	Dust boot (lower trailing link)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>7</td><td>Split pin</td></tr> <tr><td>8</td><td>Nut</td></tr> <tr><td>9</td><td>Upper trailing link ball joint (See 02-14-5 Upper Trailing Link Ball Joint Removal Note)</td></tr> <tr><td>10</td><td>Nut</td></tr> <tr><td>11</td><td>Upper trailing link</td></tr> <tr><td>12</td><td>Dust boot (upper trailing link)</td></tr> </table>	7	Split pin	8	Nut	9	Upper trailing link ball joint (See 02-14-5 Upper Trailing Link Ball Joint Removal Note)	10	Nut	11	Upper trailing link	12	Dust boot (upper trailing link)
1	Split pin																								
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10	Nut																								
11	Upper trailing link																								
12	Dust boot (upper trailing link)																								

Lower Trailing Link Ball Joint, Upper Trailing Link Ball Joint Removal Note

- Remove the ball joint using the SSTs.

SHOWS SPECIAL SERVICE TOOL (SST) NO.

49 T028 304 UPPER TRAILING LINK
49 T028 305 LOWER TRAILING LINK

49 T028 303

KNUCKLE

N-m (kgf-m, ft-lbf)









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GENERAL INFORMATION

Symbols

- There are eight symbols indicating oil, grease, fluids, sealant, and the use of **SST** or equivalent. These symbols show application points or use of these materials during service.

Symbol	Meaning	Kind
	Apply oil	New appropriate engine oil or gear oil
	Apply brake fluid	New appropriate brake fluid
	Apply automatic transaxle/transmission fluid	New appropriate automatic transaxle/transmission fluid
	Apply grease	Appropriate grease
	Apply sealant	Appropriate sealant
	Apply petroleum jelly	Appropriate petroleum jelly
	Replace part	O-ring, gasket, etc.
	Use SST or equivalent	Appropriate tools

Advisory Messages

- You will find several **Warnings**, **Cautions**, **Notes**, **Specifications** and **Upper and Lower Limits** in this manual.

Warning

- A Warning indicates a situation in which serious injury or death could result if the warning is ignored.

Caution

- A Caution indicates a situation in which damage to the vehicle or parts could result if the caution is ignored.

Note

- A Note provides added information that will help you to complete a particular procedure.

Specification

- The values indicate the allowable range when performing inspections or adjustments.

Upper and lower limits

- The values indicate the upper and lower limits that must not be exceeded when performing inspections or adjustments.

GENERAL INFORMATION

UNITS

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Electric current	A (ampere)
Electric power	W (watt)
Electric resistance	ohm
Electric voltage	V (volt)
Length	mm (millimeter)
	in (inch)
Negative pressure	kPa (kilo pascal)
	mmHg (millimeters of mercury)
	inHg (inches of mercury)
Positive pressure	kPa (kilo pascal)
	kgf/cm ² (kilogram force per square centimeter)
	psi (pounds per square inch)
Number of revolutions	rpm (revolutions per minute)
Torque	N·m (Newton meter)
	kgf·m (kilogram force meter)
	kgf·cm (kilogram force centimeter)
	ft·lbf (foot pound force)
	in·lbf (inch pound force)
Volume	L (liter)
	US qt (U.S. quart)
	Imp qt (Imperial quart)
	ml (milliliter)
	cc (cubic centimeter)
	cu in (cubic inch)
	fl oz (fluid ounce)
Weight	g (gram)
	oz (ounce)

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Conversion to SI Units (Système International d'Unités)

- All numerical values in this manual are based on SI units. Numbers shown in conventional units are converted from these values.

Rounding Off

- Converted values are rounded off to the same number of places as the SI unit value. For example, if the SI unit value is 17.2 and the value after conversion is 37.84, the converted value will be rounded off to 37.8.

Upper and Lower Limits

- When the data indicates upper and lower limits, the converted values are rounded down if the SI unit value is an upper limit and rounded up if the SI unit value is a lower limit. Therefore, converted values for the same SI unit value may differ after conversion. For example, consider 2.7 kgf/cm² in the following specifications:

210—260 kPa {2.1—2.7 kgf/cm², 30—38 psi}
270—310 kPa {2.7—3.2 kgf/cm², 39—45 psi}

- The actual converted values for 2.7 kgf/cm² are 264 kPa and 38.4 psi. In the first specification, 2.7 is used as an upper limit, so the converted values are rounded down to 260 and 38. In the second specification, 2.7 is used as a lower limit, so the converted values are rounded up to 270 and 39.

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GENERAL INFORMATION

FUNDAMENTAL PROCEDURES

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Preparation of Tools and Measuring Equipment

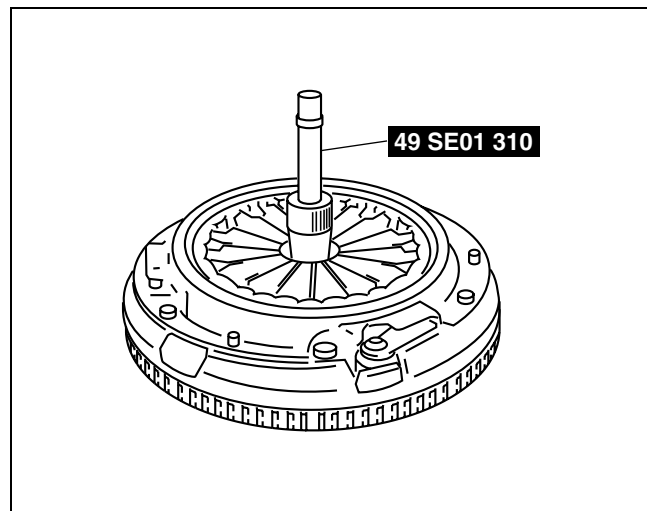
- Be sure that all necessary tools and measuring equipment are available before starting any work.



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Special Service Tools

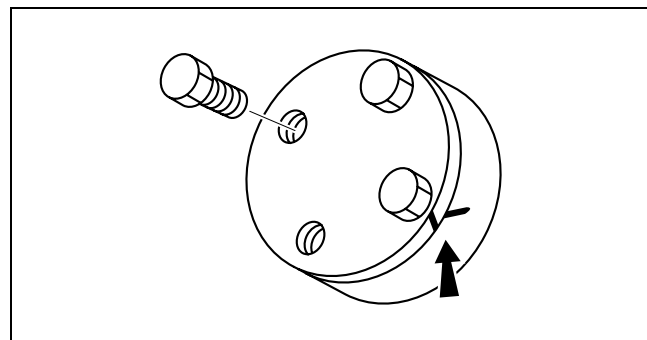
- Use special service tools or equivalent when they are required.



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Disassembly

- If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be marked in a place that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.

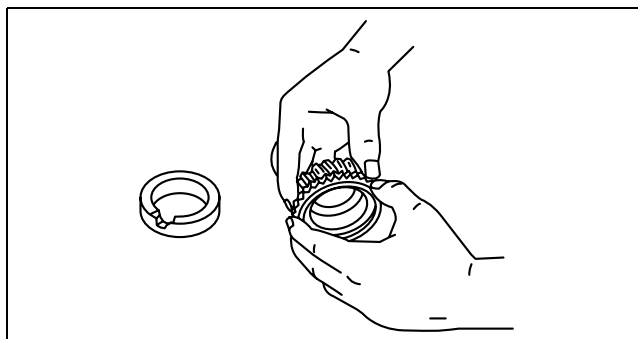


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GENERAL INFORMATION

Inspection During Removal, Disassembly

- When removed, each part should be carefully inspected for malfunction, deformation, damage and other problems.

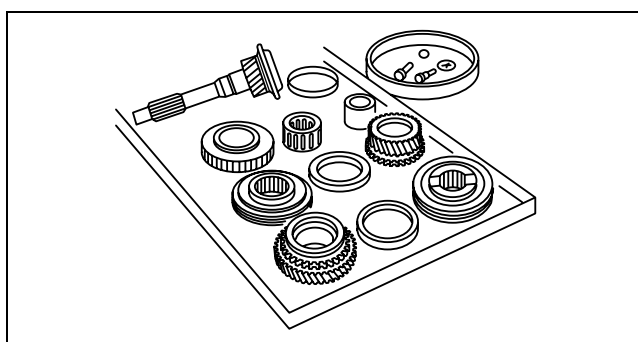


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Arrangement of Parts

- All disassembled parts should be carefully arranged for reassembly.
- Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.



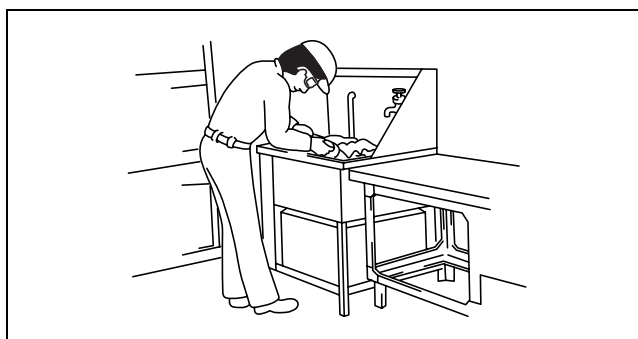
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Cleaning of Parts

- All parts to be reused should be carefully and thoroughly cleaned in the appropriate method.

Warning

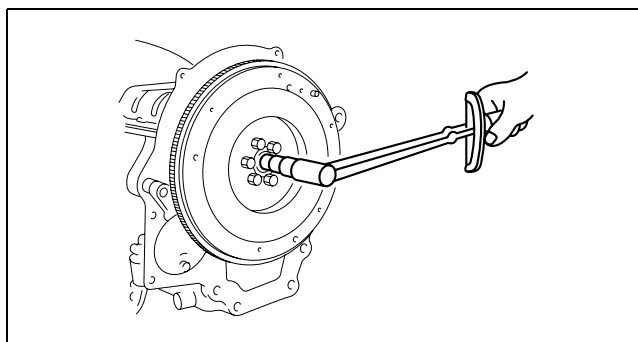
- **Using compressed air can cause dirt and other particles to fly out causing injury to the eyes. Wear protective eye wear whenever using compressed air.**



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Reassembly

- Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
- If removed, the following parts should be replaced with new ones:
 - Oil seals
 - Gaskets
 - O-rings
 - Lockwashers
 - Cotter pins
 - Nylon nuts

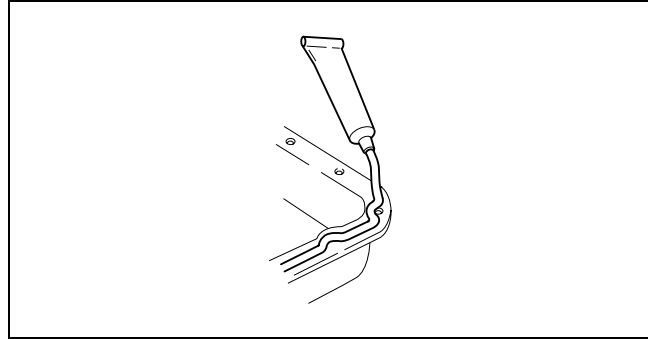


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GENERAL INFORMATION

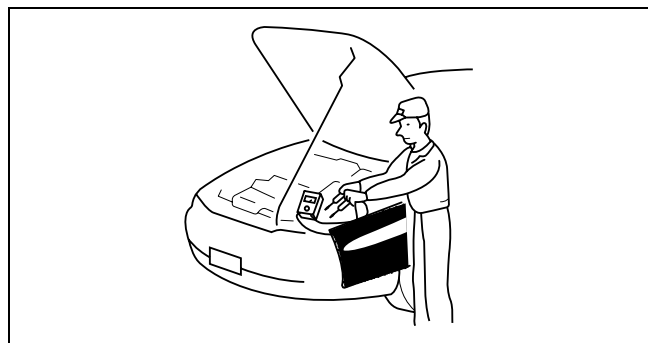
- Depending on location:
 - Sealant and gaskets, or both, should be applied to specified locations. When sealant is applied, parts should be installed before sealant hardens to prevent leakage.
 - Oil should be applied to the moving components of parts.
 - Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.



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Adjustment

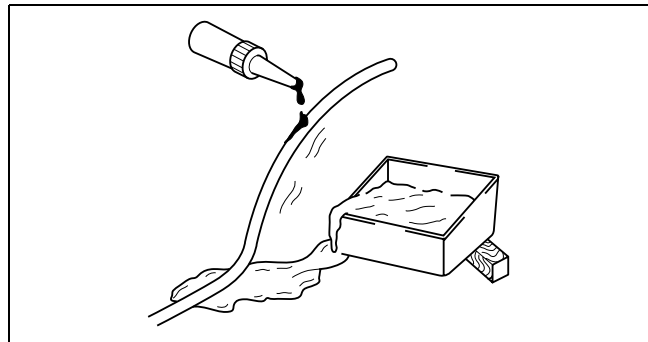
- Use suitable gauges and testers when making adjustments.



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Rubber Parts and Tubing

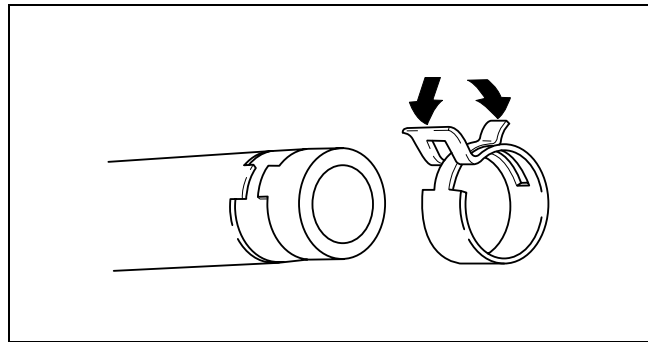
- Prevent gasoline or oil from getting on rubber parts or tubing.



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Hose Clamps

- When reinstalling, position the hose clamp in the original location on the hose and squeeze the clamp lightly with large pliers to ensure a good fit.



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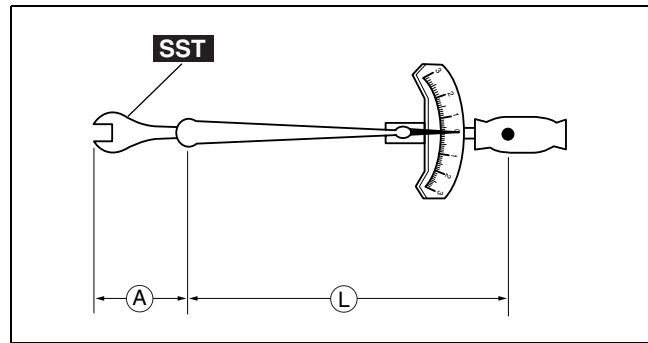
GENERAL INFORMATION

Torque Formulas

- When using a torque wrench-SST or equivalent combination, the written torque must be recalculated due to the extra length that the SST or equivalent adds to the torque wrench. Recalculate the torque by using the following formulas. Choose the formula that applies to you.

Torque Unit	Formula
N·m	$N \cdot m \times [L / (L + A)]$
kgf·m	$kgf \cdot m \times [L / (L + A)]$
kgf·cm	$kgf \cdot cm \times [L / (L + A)]$
ft·lbf	$ft \cdot lbf \times [L / (L + A)]$
in·lbf	$in \cdot lbf \times [L / (L + A)]$

- A : The length of the SST past the torque wrench drive.
 L : The length of the torque wrench.

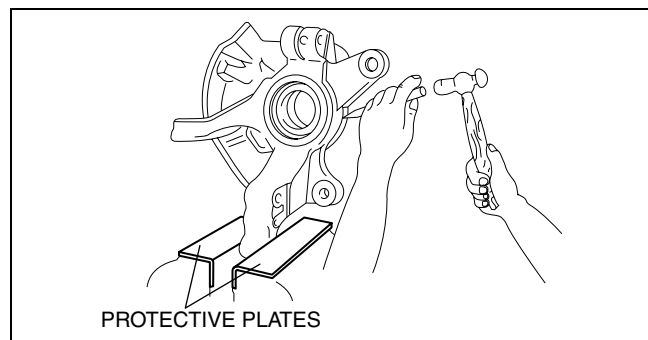


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Vise

- When using a vise, put protective plates in the jaws of the vise to prevent damage to parts.



PROTECTIVE PLATES

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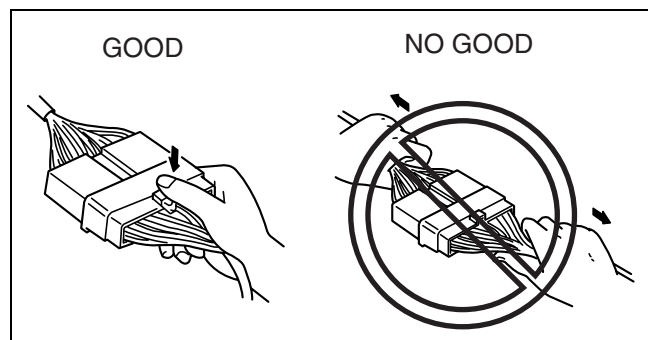
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ELECTRICAL SYSTEM

Connectors

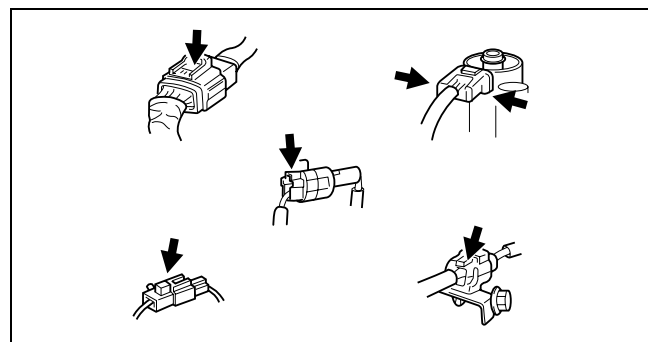
Disconnecting connectors

- When disconnecting connector, grasp the connectors, not the wires.



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- Connectors can be disconnected by pressing or pulling the lock lever as shown.



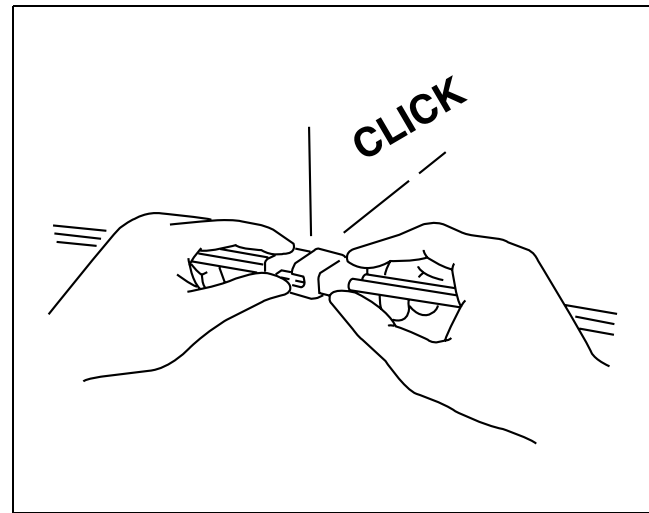
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GENERAL INFORMATION

Locking connector

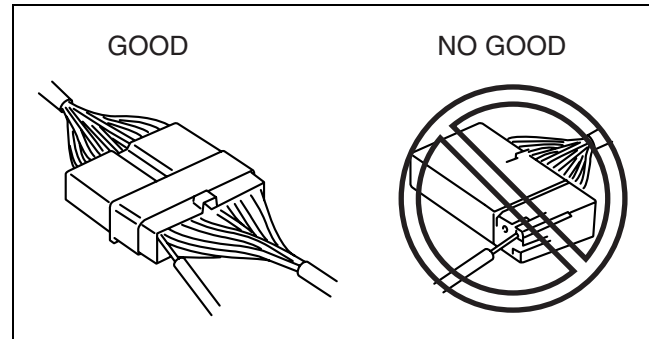
- When locking connectors, listen for a click indicating they are securely locked.



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Inspection

- When a tester is used to inspect for continuity or measuring voltage, insert the tester probe from the wiring harness side.

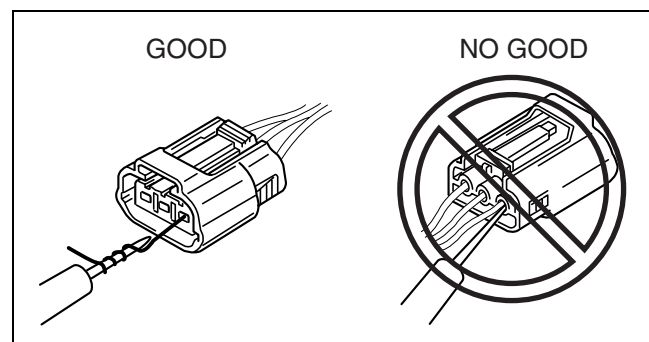


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- Inspect the terminals of waterproof connectors from the connector side since they cannot be accessed from the wiring harness side.

Caution

- To prevent damage to the terminal, wrap a thin wire around the tester probe before inserting into terminal.



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GENERAL INFORMATION

NEW STANDARDS

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- Following is a comparison of the previous standard and the new standard.

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
AP	Accelerator Pedal	—	Accelerator Pedal	
ACL	Air Cleaner	—	Air Cleaner	
A/C	Air Conditioning	—	Air Conditioning	
A/F sensor	Air Fuel Ratio Sensor	—	—	
BARO	Barometric Pressure	—	Atmospheric Pressure	
B+	Battery Positive Voltage	Vb	Battery Voltage	
—	Brake Switch	—	Stoplight Switch	
—	Calibration Resistor	—	Corrected Resistance	#6
CMP sensor	Camshaft Position Sensor	—	Crank Angle Sensor	
CAC	Charge Air Cooler	—	Intercooler	
CLS	Closed Loop System	—	Feedback System	
CTP	Closed Throttle Position	—	Fully Closed	
CPP	Clutch Pedal Position	—	Idle Switch	
CIS	Continuous Fuel Injection System	—	Clutch Position	
CS sensor	Control Sleeve Sensor	CSP sensor	Control Sleeve Position Sensor	#6
CKP sensor	Crankshaft Position Sensor	—	Crank Angle Sensor 2	
DLC	Data Link Connector	—	Diagnosis Connector	
DTM	Diagnostic Test Mode	—	Test Mode	#1
DTC	Diagnostic Trouble Code(s)	—	Service Code(s)	
DI	Distributor Ignition	—	Spark Ignition	
DLI	Distributorless Ignition	—	Direct Ignition	
EI	Electronic Ignition	—	Electronic Spark Ignition	#2
ECT	Engine Coolant Temperature	—	Water Thermo	
EM	Engine Modification	—	Engine Modification	
—	Engine Speed Input Signal	—	Engine RPM Signal	
EVAP	Evaporative Emission	—	Evaporative Emission	
EGR	Exhaust Gas Recirculation	—	Exhaust Gas Recirculation	
FC	Fan Control	—	Fan Control	
FF	Flexible Fuel	—	Flexible Fuel	
4GR	Fourth Gear	—	Overdrive	
—	Fuel Pump Relay	—	Circuit Opening Relay	#3
FSO solenoid	Fuel Shut Off Solenoid	FCV	Fuel Cut Valve	#6
GEN	Generator	—	Alternator	
GND	Ground	—	Ground/Earth	
HO2S	Heated Oxygen Sensor	—	Oxygen Sensor	With heater
IAC	Idle Air control	—	Idle Speed Control	
—	IDM Relay	—	Spill Valve Relay	#6
—	Incorrect Gear Ratio	—	—	
—	Injection Pump	FIP	Fuel Injection Pump	#6
—	Input/Turbine Speed Sensor	—	Pulse Generator	
IAT	Intake Air Temperature	—	Intake Air Thermo	
KS	Knock Sensor	—	Knock Sensor	
MIL	Malfunction Indicator Lamp	—	Malfunction Indicator Light	
MAP	Manifold Absolute Pressure	—	Intake Air Pressure	
MAF sensor	Mass Air Flow Sensor	—	Airflow Sensor	
MFL	Multiport Fuel Injection	—	Multiport Fuel Injection	
OBD	On-Board Diagnostic	—	Diagnosis/Self-Diagnosis	
OL	Open Loop	—	Open Loop	
—	Output Speed Sensor	—	Vehicle Speed Sensor 1	

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GENERAL INFORMATION

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
OC	Oxidation Catalytic Converter	—	Catalytic Converter	
O2S	Oxygen Sensor	—	Oxygen Sensor	
PNP	Park/Neutral Position	—	Park/Neutral Range	
—	PCM Control Relay	—	Main Relay	#6
PSP	Power Steering Pressure	—	Power Steering Pressure	
PCM	Powertrain Control Module	ECU	Engine Control Unit	#4
—	Pressure Control Solenoid	—	Line Pressure Solenoid Valve	
PAIR	Pulsed Secondary Air Injection	—	Secondary Air Injection System	Pulsed injection
—	Pump Speed Sensor	—	NE Sensor	#6
AIR	Secondary Air Injection	—	Secondary Air Injection System	Injection with air pump
SAPV	Secondary Air Pulse Valve	—	Reed Valve	
SFI	Sequential Multipoint Fuel Injection	—	Sequential Fuel Injection	
—	Shift Solenoid A	—	12 Shift Solenoid Valve	
—		—	Shift A Solenoid Valve	
—	Shift Solenoid B	—	23 Shift Solenoid Valve	
—		—	Shift B Solenoid Valve	
—	Shift Solenoid C	—	34 Shift Solenoid Valve	
3GR	Third Gear	—	3rd Gear	
TWC	Three Way Catalytic Converter	—	Catalytic Converter	
TB	Throttle Body	—	Throttle Body	
TP sensor	Throttle Position Sensor	—	Throttle Sensor	
TCV	Timer Control Valve	TCV	Timing Control Valve	#6
TCC	Torque Converter Clutch	—	Lockup Position	
TCM	Transmission (Transaxle) Control Module	—	EC-AT Control Unit	
—	Transmission (Transaxle) Fluid Temperature Sensor	—	ATF Thermosensor	
TR	Transmission (Transaxle) Range	—	Inhibitor Position	
TC	Turbocharger	—	Turbocharger	
VSS	Vehicle Speed Sensor	—	Vehicle Speed Sensor	
VR	Voltage Regulator	—	IC Regulator	
VAF sensor	Volume Air Flow Sensor	—	Air flow Sensor	
WUTWC	Warm Up Three Way Catalytic Converter	—	Catalytic Converter	#5
WOT	Wide Open Throttle	—	Fully Open	

#1 : Diagnostic trouble codes depend on the diagnostic test mode

#2 : Controlled by the PCM

#3 : In some models, there is a fuel pump relay that controls pump speed. That relay is now called the fuel pump relay (speed).

#4 : Device that controls engine and powertrain

#5 : Directly connected to exhaust manifold

#6 : Part name of diesel engine

GENERAL INFORMATION

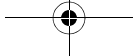
ABBREVIATIONS

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ATDC	After Top Dead Center
ATX	Automatic Transaxle
EGR	Exhaust Gas Recirculation
EX	Exhaust
IN	Intake
MTX	Manual Transaxle
OCV	Oil Control Valve
TDC	Top Dead Center
SST	Special Service Tool

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Engine Workshop Manual LF L3 (1972-1U-08K)

ENGINE	01 SECTION
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01-10

MECHANICAL 01-10	SERVICE TOOLS 01-60
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01-10 MECHANICAL

<p>ENGINE OVERHAUL</p> <p>SERVICE WARNING 01-10-2</p> <p>ENGINE</p> <p>MOUNTING/DISMOUNTING 01-10-2</p> <p style="padding-left: 20px;">Dismounting 01-10-3</p> <p>TIMING CHAIN DISASSEMBLY 01-10-4</p> <p style="padding-left: 20px;">Crankshaft Pulley Lock Bolt</p> <p style="padding-left: 40px;">Disassembly Note 01-10-5</p> <p style="padding-left: 20px;">Front Oil Seal Disassembly Note 01-10-5</p> <p style="padding-left: 20px;">Chain Tensioner</p> <p style="padding-left: 40px;">Disassembly Note 01-10-5</p> <p style="padding-left: 20px;">Oil Pump Sprocket</p> <p style="padding-left: 40px;">Disassembly Note 01-10-5</p> <p>CYLINDER HEAD</p> <p>DISASSEMBLY (I) 01-10-6</p> <p style="padding-left: 20px;">Camshaft Sprocket Lock Bolt,</p> <p style="padding-left: 40px;">Variable Valve Timing Actuator</p> <p style="padding-left: 40px;">Lock Bolt Disassembly Note 01-10-7</p> <p style="padding-left: 20px;">Camshaft Cap Disassembly Note 01-10-7</p> <p style="padding-left: 20px;">Tappet Disassembly Note 01-10-7</p> <p style="padding-left: 20px;">Cylinder Head Bolt</p> <p style="padding-left: 40px;">Disassembly Note 01-10-8</p> <p>CYLINDER HEAD</p> <p>DISASSEMBLY (II) 01-10-8</p> <p style="padding-left: 20px;">Valve Keeper Disassembly Note 01-10-8</p> <p style="padding-left: 20px;">Valve Seal Disassembly Note 01-10-9</p> <p>CYLINDER BLOCK</p> <p>DISASSEMBLY (I) 01-10-10</p> <p style="padding-left: 20px;">Drive Plate (ATX), Flywheel (MTX)</p> <p style="padding-left: 40px;">Disassembly Note 01-10-11</p> <p>CYLINDER BLOCK</p> <p>DISASSEMBLY (II) 01-10-11</p> <p style="padding-left: 20px;">Pilot Bearing</p> <p style="padding-left: 40px;">Disassembly Note 01-10-13</p> <p style="padding-left: 20px;">Connecting Rod Cap</p> <p style="padding-left: 40px;">Disassembly Note 01-10-13</p> <p style="padding-left: 20px;">Main Bearing Cap</p> <p style="padding-left: 40px;">Disassembly Note 01-10-13</p> <p>CYLINDER HEAD INSPECTION 01-10-13</p> <p>VALVE SEAT</p> <p>INSPECTION/REPAIR 01-10-14</p> <p>VALVE, VALVE GUIDE</p> <p>INSPECTION 01-10-15</p> <p>VALVE GUIDE REPLACEMENT 01-10-17</p> <p style="padding-left: 20px;">Valve Guide Removal 01-10-17</p> <p style="padding-left: 20px;">Valve Guide Installation 01-10-17</p> <p>VALVE SPRING INSPECTION 01-10-18</p> <p>TAPPET INSPECTION 01-10-19</p>	<p>VARIABLE VALVE TIMING</p> <p>ACTUATOR INSPECTION 01-10-20</p> <p>OIL CONTROL VALVE (OCV)</p> <p>INSPECTION 01-10-20</p> <p style="padding-left: 20px;">Coil Resistance Inspection 01-10-20</p> <p style="padding-left: 20px;">Spool Valve Operation Inspection 01-10-20</p> <p>CAMSHAFT INSPECTION 01-10-21</p> <p>CYLINDER BLOCK INSPECTION 01-10-22</p> <p>OIL JET VALVE INSPECTION 01-10-23</p> <p>PISTON INSPECTION 01-10-23</p> <p>PISTON AND CONNECTING ROD</p> <p>INSPECTION 01-10-24</p> <p>CONNECTING ROD INSPECTION 01-10-25</p> <p>CRANKSHAFT INSPECTION 01-10-26</p> <p>PILOT BEARING INSPECTION 01-10-27</p> <p>BOLT INSPECTION 01-10-27</p> <p>VALVE CLEARANCE</p> <p>INSPECTION 01-10-28</p> <p>VALVE CLEARANCE</p> <p>ADJUSTMENT 01-10-28</p> <p>CYLINDER BLOCK ASSEMBLY (I) 01-10-35</p> <p style="padding-left: 20px;">Main Bearing Cap Assembly Note 01-10-36</p> <p style="padding-left: 20px;">Piston Pin Assembly Note 01-10-36</p> <p style="padding-left: 20px;">Piston Ring Assembly Note 01-10-36</p> <p style="padding-left: 20px;">Piston Assembly Note 01-10-36</p> <p style="padding-left: 20px;">Connecting Rod Bearing</p> <p style="padding-left: 40px;">Assembly Note 01-10-37</p> <p style="padding-left: 20px;">Connecting Rod Cap</p> <p style="padding-left: 40px;">Assembly Note 01-10-37</p> <p style="padding-left: 20px;">Balancer Unit Assembly Note 01-10-38</p> <p style="padding-left: 20px;">Pilot Bearing Assembly Note 01-10-41</p> <p>CYLINDER BLOCK ASSEMBLY (II) 01-10-42</p> <p style="padding-left: 20px;">Rear Oil Seal Assembly Note 01-10-43</p> <p style="padding-left: 20px;">Drive Plate (ATX), Flywheel (MTX)</p> <p style="padding-left: 40px;">Assembly Note 01-10-44</p> <p style="padding-left: 20px;">Gasket Assembly Note 01-10-44</p> <p style="padding-left: 20px;">Oil Cooler Type B Assembly Note 01-10-44-1</p> <p style="padding-left: 20px;">Oil pan Assembly Note 01-10-44-2</p> <p>CYLINDER HEAD ASSEMBLY (I) 01-10-45</p> <p style="padding-left: 20px;">Valve Seal Assembly Note 01-10-45</p> <p style="padding-left: 20px;">Valve Keeper Assembly Note 01-10-46</p> <p>CYLINDER HEAD ASSEMBLY (II) 01-10-47</p> <p style="padding-left: 20px;">Cylinder Head Gasket</p> <p style="padding-left: 40px;">Assembly Note 01-10-48</p> <p style="padding-left: 20px;">Cylinder Head Bolt</p> <p style="padding-left: 40px;">Assembly Note 01-10-48</p> <p style="padding-left: 20px;">Camshaft Assembly Note 01-10-49</p>
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Revised 9/2011 (Ref. No. R337/11)

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<p>Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note 01-10-49 TIMING CHAIN ASSEMBLY.....01-10-50 Oil Pump Sprocket Assembly Note 01-10-51 Timing Chain Assembly Note 01-10-51</p>	<p>Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note 01-10-52 Front Oil Seal Assembly Note 01-10-52 Engine Front Cover Assembly Note 01-10-53 Crankshaft Pulley Lock Bolt Assembly Note 01-10-54 Cylinder Head Cover Assembly Note 01-10-55</p>
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ENGINE OVERHAUL SERVICE WARNING

id011000503900

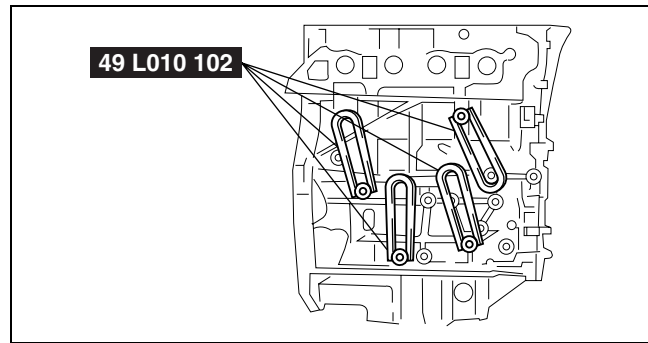
Warning

- Continuous exposure with USED engine oil has caused skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after this work.

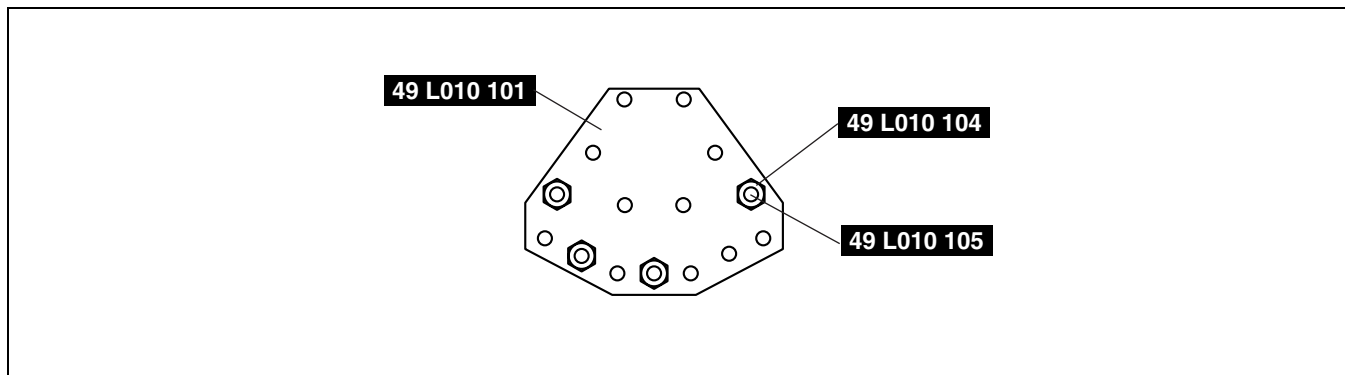
ENGINE MOUNTING/DISMOUNTING

id011000507000

1. Install the **SSTs** (arms) to the cylinder block holes as shown, and hand-tighten the bolts (**part No.: 9YA20-1003**) or **M10 × 1.5T length 90 mm {3.55 in}**.
2. Assemble the **SSTs** (bolts, nuts and plate) to the specified positions.

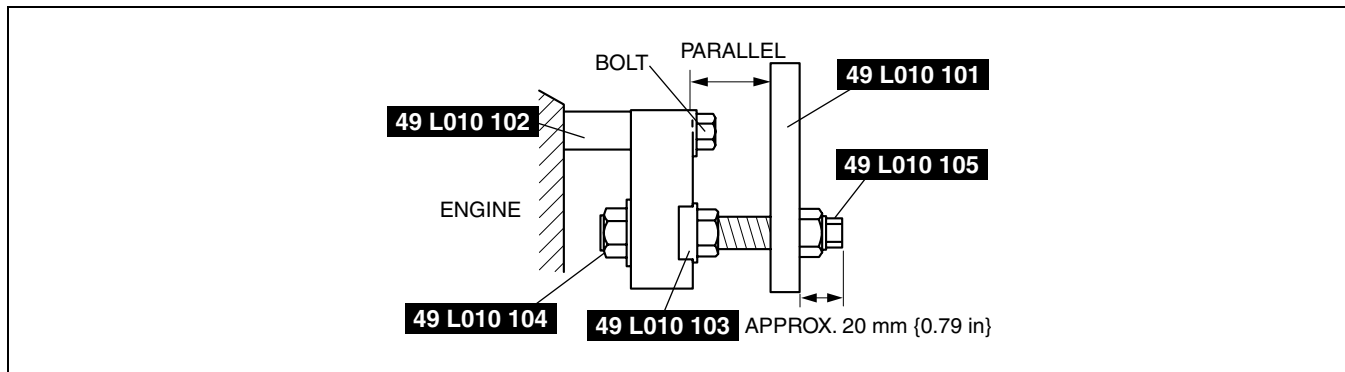


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3. Adjust the **SSTs** (bolts) so that less than **20 mm {0.79 in}** of thread is exposed.
4. Make the **SSTs** (arms and plate) parallel by adjusting the **SSTs** (bolts and nuts).
5. Tighten the **SSTs** (bolts and nuts) to affix the **SSTs** firmly.



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01-10-2

MECHANICAL

Warning

- **Self-locking brake system of the engine stand may not be effective when the engine is held in an unbalanced position. This could lead to sudden, rapid movement of the engine and mounting stand handle and cause serious injury. Never keep the engine in an unbalanced position, and always hold the rotating handle firmly when turning the engine.**

6. Mount the engine on the **SST** (engine stand).
7. Drain the engine oil into a container.
8. Install the oil pan drain plug.
 - With washer
 1. Install the oil pan drain plug with a new washer.

Tightening torque

30—41 N·m {3.1—4.1 kgf·m, 23—30 ft·lbf}

- Without washer
 1. Inspect the seal rubber of the oil pan drain plug and make sure there are no cracks or damage.
 - If necessary, replace the oil pan drain plug.
 2. Clean the flange surface (seal rubber) on the oil pan drain plug, then install the oil pan drain plug.

Tightening torque

22—30 N·m {2.2—3.1 kgf·m, 16—22 ft·lbf}

Dismounting

- Dismount in the reverse order of mounting.

01-10

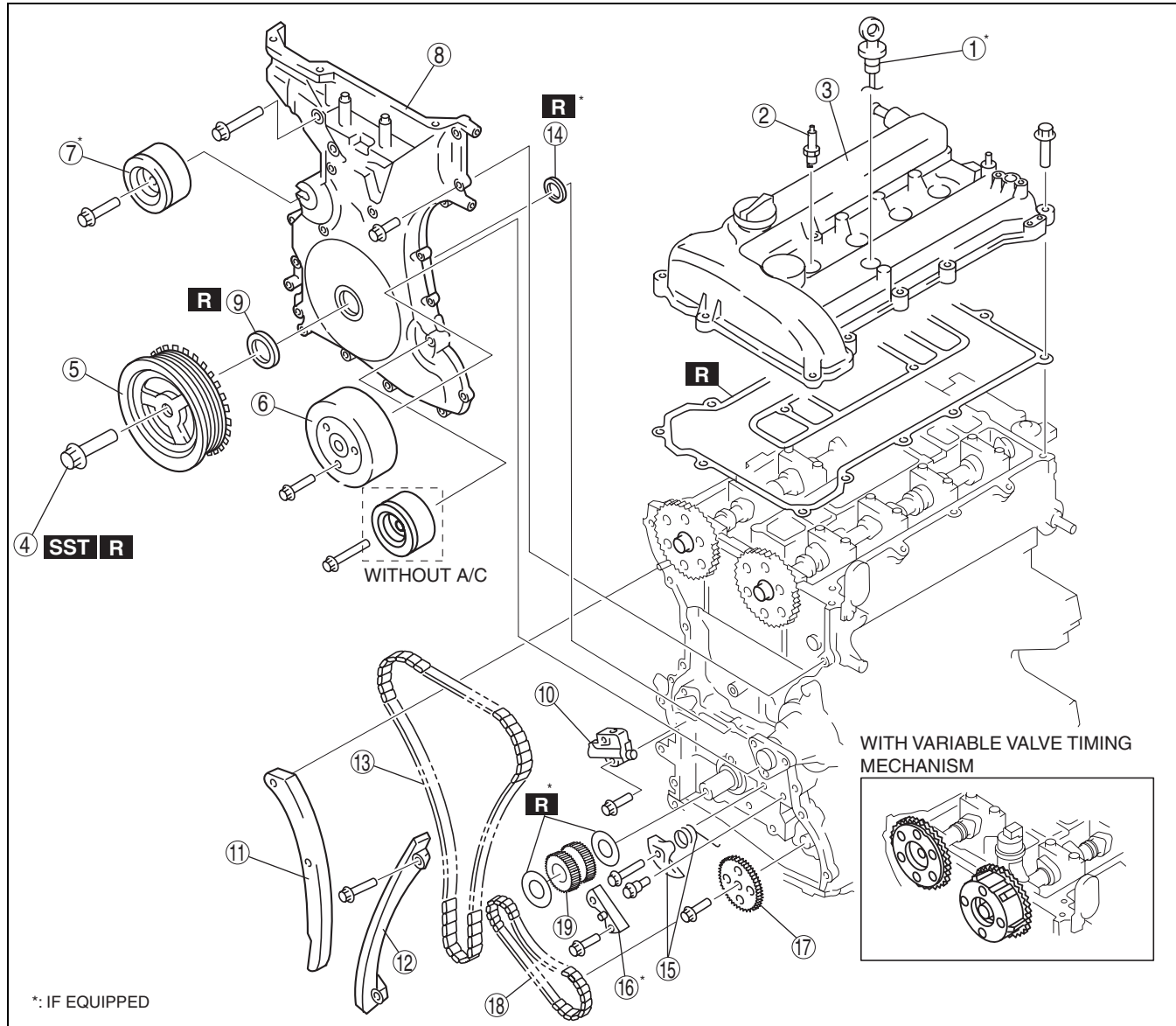
01-10-3

MECHANICAL

TIMING CHAIN DISASSEMBLY

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1. Disassemble in the order indicated in the table.



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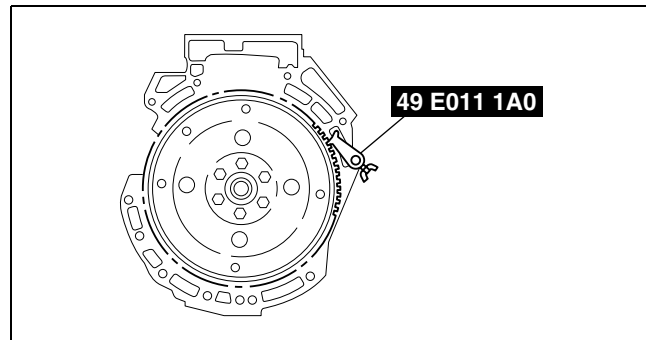
1	Oil level gauge (if equipped)
2	Spark plug
3	Cylinder head cover
4	Crankshaft pulley lock bolt (See 01-10-5 Crankshaft Pulley Lock Bolt Disassembly Note.)
5	Crankshaft pulley
6	Water pump pulley
7	Drive belt idler pulley (if equipped)
8	Engine front cover
9	Front oil seal (See 01-10-5 Front Oil Seal Disassembly Note.)

10	Chain tensioner (See 01-10-5 Chain Tensioner Disassembly Note.)
11	Tensioner arm
12	Chain guide
13	Timing chain
14	Seal (if equipped)
15	Oil pump chain tensioner
16	Oil pump chain guide (if equipped)
17	Oil pump sprocket (See 01-10-5 Oil Pump Sprocket Disassembly Note.)
18	Oil pump chain
19	Crankshaft sprocket

Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

Crankshaft Pulley Lock Bolt Disassembly Note

1. Install the **SST** to the ring gear to lock the crankshaft against rotation.

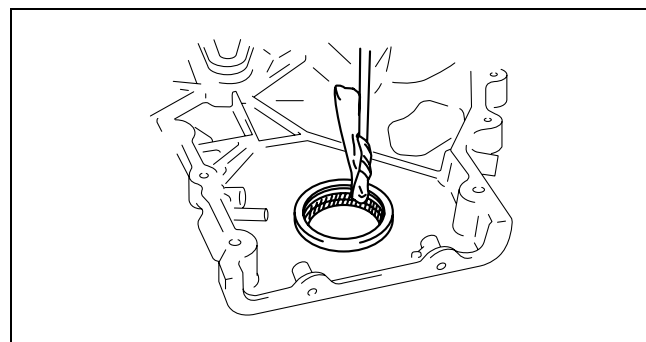


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01-10

Front Oil Seal Disassembly Note

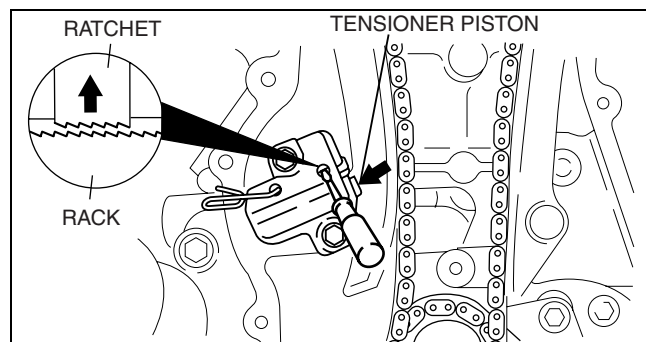
1. Remove the oil seal using a screwdriver.



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Chain Tensioner Disassembly Note

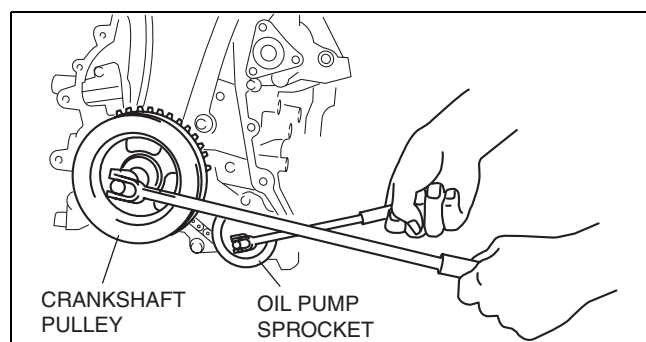
1. Unlock the chain tensioner ratchet using a suitable screw driver or equivalent tool.
2. Slowly press the tensioner piston.
3. Hold the chain tensioner piston with a **1.5 mm {0.06 in}** wire or paper clip.



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Oil Pump Sprocket Disassembly Note

1. Temporarily install the crankshaft pulley and crankshaft pulley lock bolt to the crankshaft, and lock the oil pump against rotation as shown in figure.
2. Remove the oil pump sprocket, and then remove the crankshaft pulley and crankshaft pulley lock bolt.



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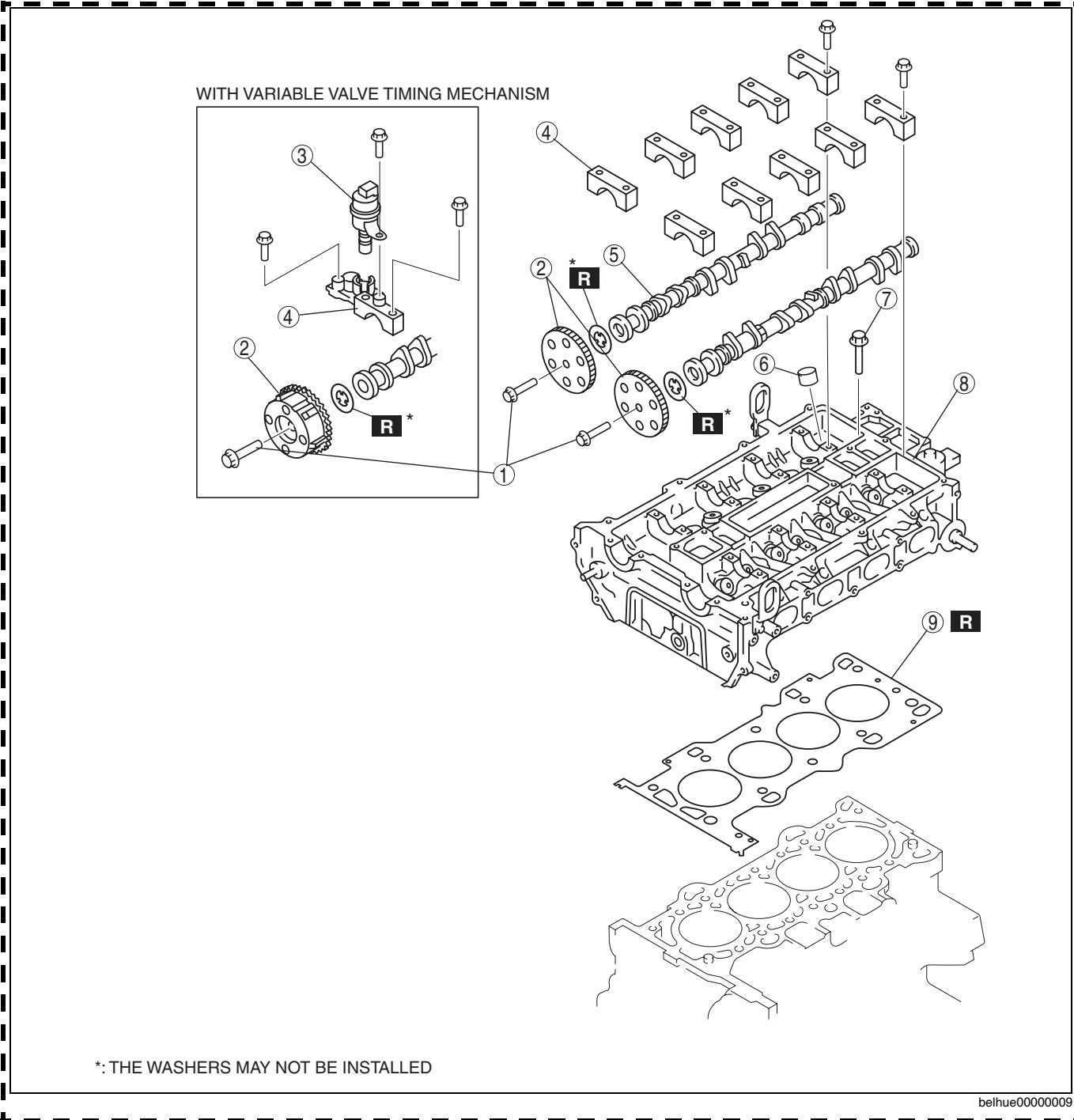
01-10-5

Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

CYLINDER HEAD DISASSEMBLY (I)

id011000500400

1. Disassemble in the order indicated in the table.



1	Camshaft sprocket lock bolt, variable valve timing actuator lock bolt (With variable valve timing mechanism) (See 01-10-7 Camshaft Sprocket Lock Bolt, Variable Valve Timing Actuator Lock Bolt Disassembly Note.)
2	Camshaft sprocket, variable valve timing actuator (With variable valve timing mechanism)
3	OCV (With variable valve timing mechanism)
4	Camshaft cap (See 01-10-7 Camshaft Cap Disassembly Note.)

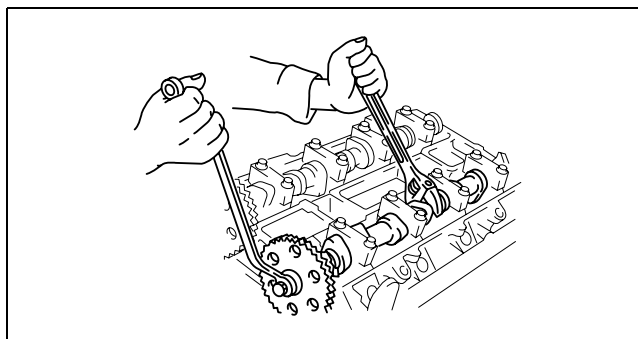
5	Camshaft
6	Tappet (See 01-10-7 Tappet Disassembly Note.)
7	Cylinder head bolt (See 01-10-8 Cylinder Head Bolt Disassembly Note.)
8	Cylinder head
9	Cylinder head gasket

MECHANICAL

Camshaft Sprocket Lock Bolt, Variable Valve Timing Actuator Lock Bolt Disassembly Note

1. Hold the camshaft by using a wrench on the cast hexagon as shown, and loosen the camshaft sprocket installation bolt or variable valve timing actuator installation bolt (With variable valve timing mechanism).

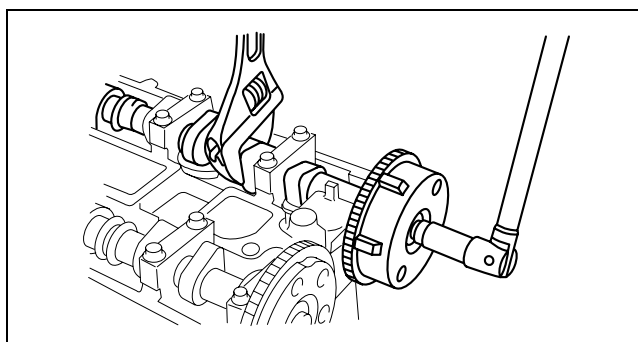
Without variable valve timing mechanism



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01-10

With variable valve timing mechanism



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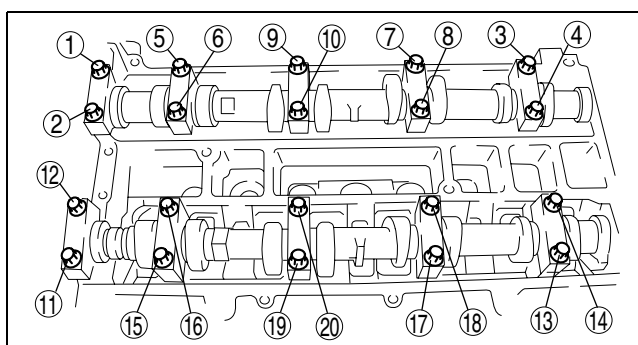
Camshaft Cap Disassembly Note

1. Before removing the camshaft caps, inspect the following:
 - Camshaft end play and camshaft journal oil clearance (See 01-10-21 CAMSHAFT INSPECTION.)

Note

- The camshaft caps are numbered to make sure they are assembled in their original positions. When removed, keep the caps with the cylinder head they were removed from. Do not mix the caps.

2. Loosen the camshaft caps bolts in 2—3 steps in the order shown in the figure.



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Tappet Disassembly Note

Note

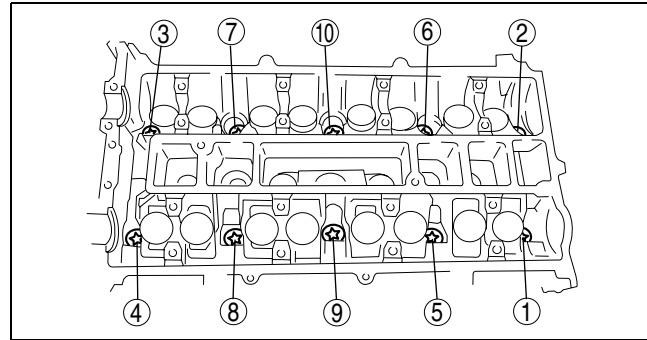
- The tappets are numbered to make sure they are assembled in their original positions. When removed, keep the tappets with the cylinder head they were removed from. Do not mix the tappets.

01-10-7

MECHANICAL

Cylinder Head Bolt Disassembly Note

- Loosen the cylinder head bolts in 2—3 steps in the order shown in the figure.

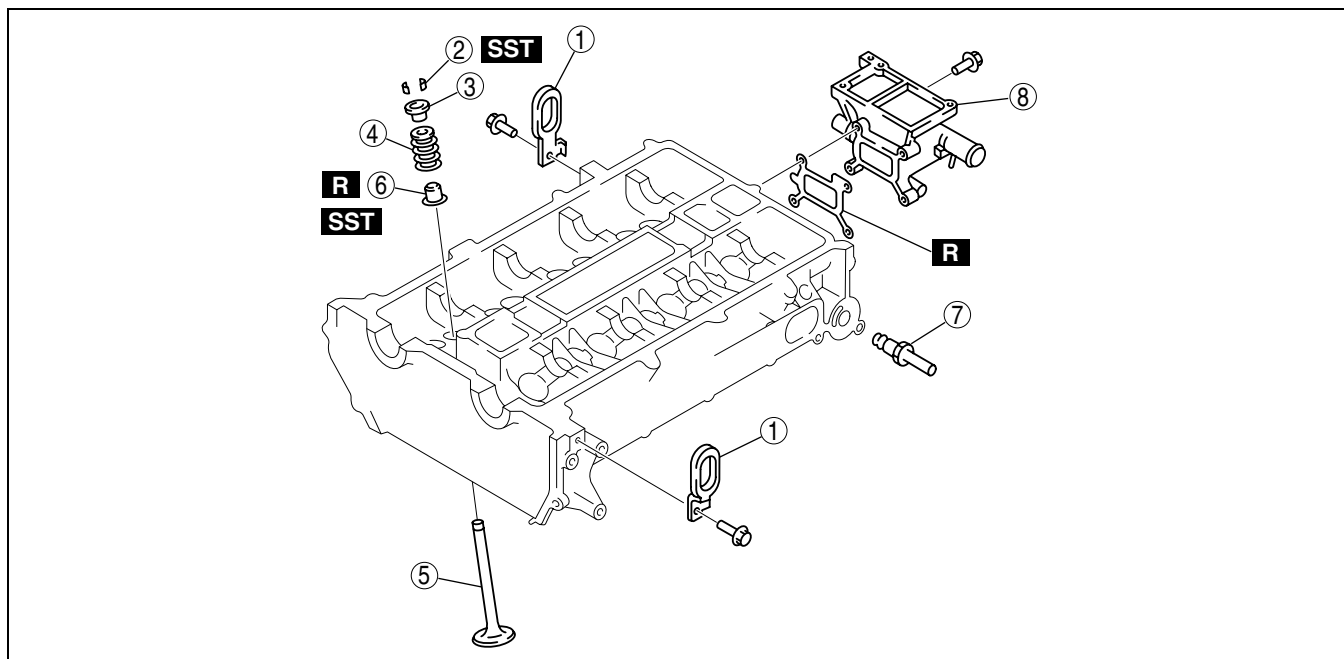


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CYLINDER HEAD DISASSEMBLY (II)

id011000500500

- Disassemble in the order indicated in the table.



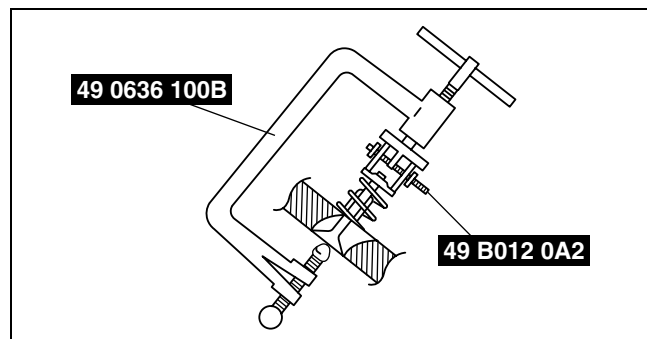
belhue00000014

1	Engine hanger
2	Valve keeper (See 01-10-8 Valve Keeper Disassembly Note.)
3	Upper valve spring seat
4	Valve spring

5	Valve
6	Valve seal (See 01-10-9 Valve Seal Disassembly Note.)
7	EGR pipe
8	Water outlet

Valve Keeper Disassembly Note

- Remove the valve keeper using the SSTs.



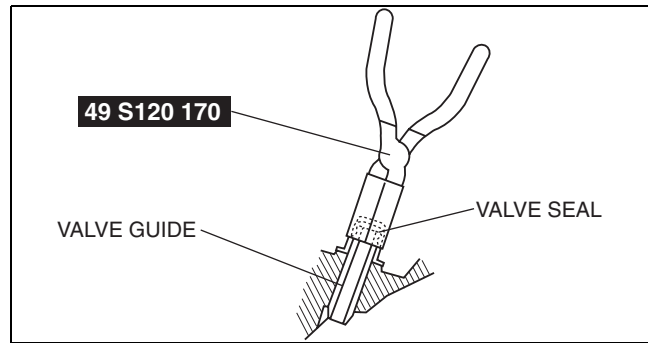
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01-10-8

Engine Workshop Manual LF L3 (1972-1U-08K)
MECHANICAL

Valve Seal Disassembly Note

1. Remove the valve seal using the SST.



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01-10

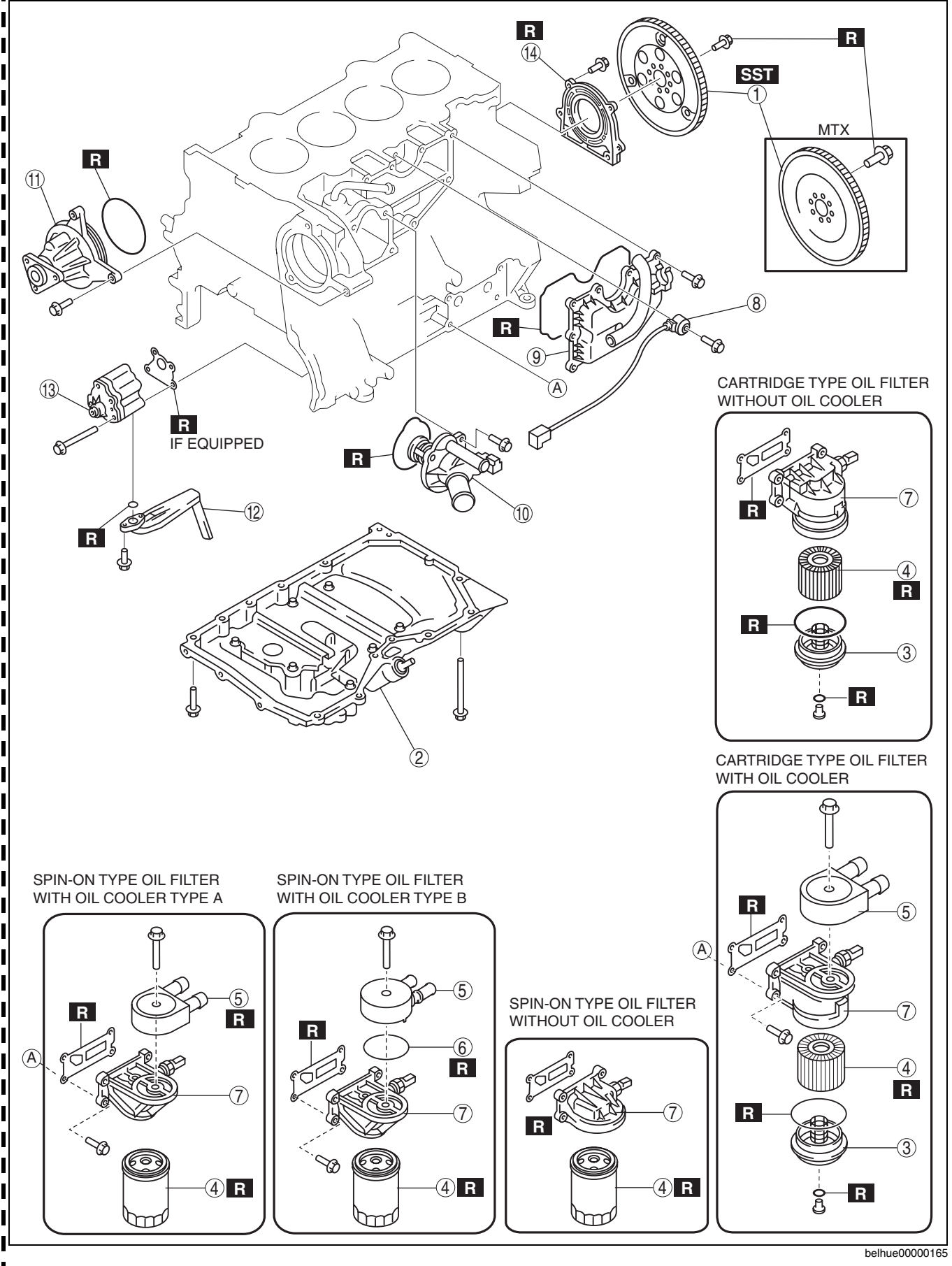
01-10-9

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MECHANICAL

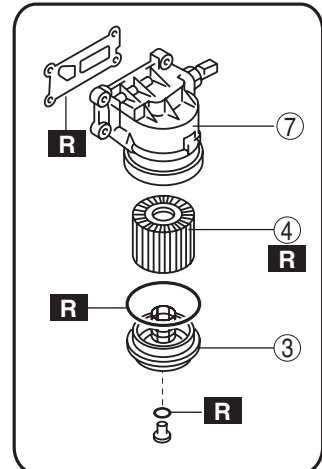
CYLINDER BLOCK DISASSEMBLY (I)

id011000500600

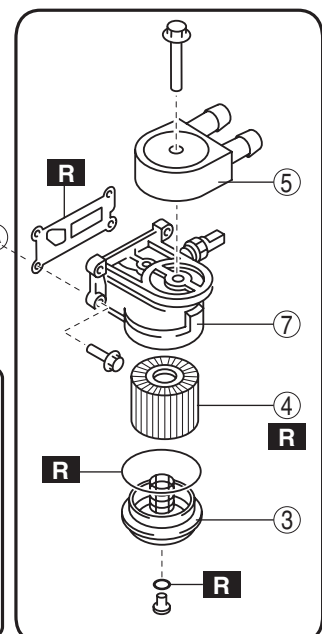
1. Disassemble in the order indicated in the table.



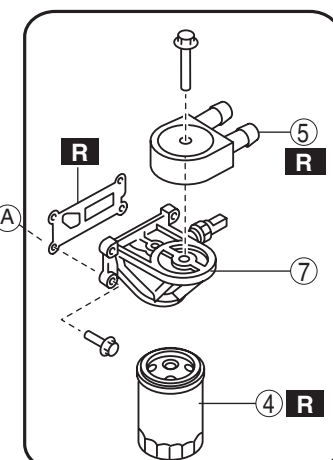
CARTRIDGE TYPE OIL FILTER WITHOUT OIL COOLER



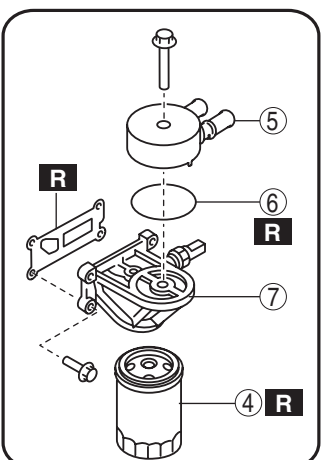
CARTRIDGE TYPE OIL FILTER WITH OIL COOLER



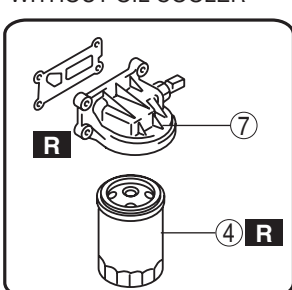
SPIN-ON TYPE OIL FILTER WITH OIL COOLER TYPE A



SPIN-ON TYPE OIL FILTER WITH OIL COOLER TYPE B



SPIN-ON TYPE OIL FILTER WITHOUT OIL COOLER



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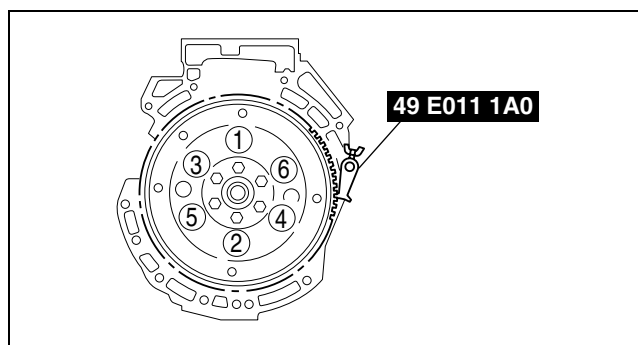
1	Flywheel (MTX), Drive plate (ATX) (See 01-10-11 Drive Plate (ATX), Flywheel (MTX) Disassembly Note.)
2	Oil pan
3	Oil filter cover (cartridge type)
4	Oil filter
5	Oil cooler
6	Gasket

7	Oil filter adapter
8	Knock sensor
9	Oil separator
10	Thermostat
11	Water pump
12	Oil strainer
13	Oil pump
14	Rear oil seal

01-10

Drive Plate (ATX), Flywheel (MTX) Disassembly Note

1. Hold the crankshaft using the **SST**.
2. Remove the bolts in several passes.



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CYLINDER BLOCK DISASSEMBLY (II)

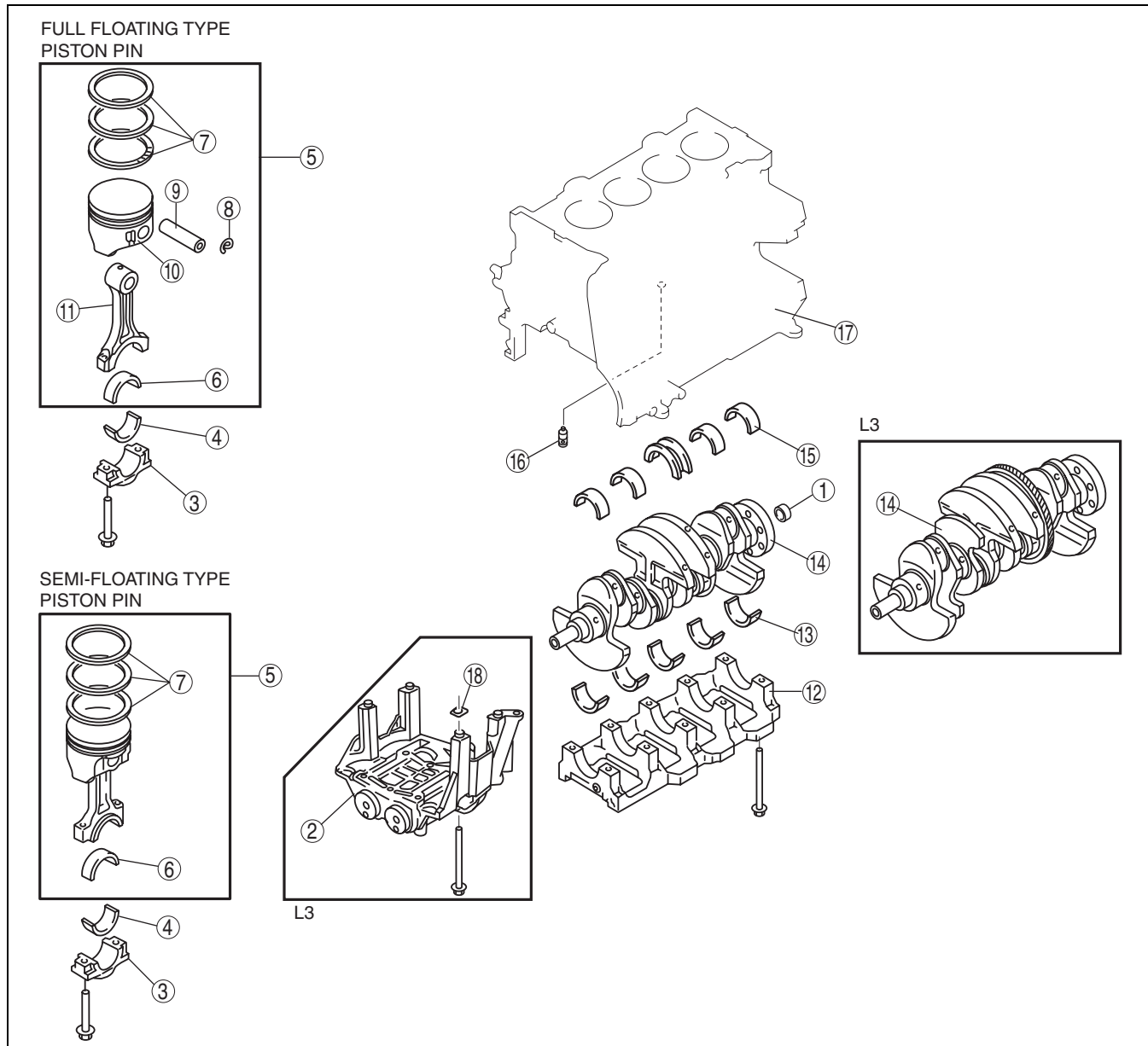
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Caution

- Placing the crankshaft on a disassembly bench will cause the drive gear to contact the disassembly bench because the crankshaft drive gear is larger than the counterweight. This could result in the drive gear being scratched or damaged which could become a source of noise. Therefore, set wood blocks or similar object on the both sides of the crankshaft or place a thick clean rag under the drive gear so that the drive gear does not contact the disassembly bench directly.
- The piston, piston pin and connecting rod (semi-floating type piston pin) cannot be disassembled.
- If the piston, piston pin, and connecting rod of the full floating type piston pin are disassembled, the piston, piston pin, and snap ring must be replaced as a single unit. Therefore, inspect the following items before disassembly so as to avoid unnecessary disassembly.
 - Piston diameter (See 01-10-23 PISTON INSPECTION.)
 - Piston-to-cylinder clearance (See 01-10-23 PISTON INSPECTION.)
 - Piston and connecting rod oscillation torque (See 01-10-24 PISTON AND CONNECTING ROD INSPECTION.)
 - Connecting rod large end side clearance (See 01-10-24 PISTON AND CONNECTING ROD INSPECTION.)

Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

1. Disassemble in the order indicated in the table.



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1	Pilot bearing (If equipped) (See 01-10-13 Pilot Bearing Disassembly Note.)
2	Balancer unit (L3)
3	Connecting rod cap (See 01-10-13 Connecting Rod Cap Disassembly Note.)
4	Lower connecting rod bearing
5	Connecting rod, piston component
6	Upper connecting rod bearing
7	Piston ring
8	Snap ring (Full floating type piston pin)
9	Piston pin (Full floating type piston pin)

10	Piston (Full floating type piston pin)
11	Connecting rod (Full floating type piston pin)
12	Main bearing cap (See 01-10-13 Main Bearing Cap Disassembly Note.)
13	Lower main bearing
14	Crankshaft
15	Upper main bearing, thrust bearing
16	Oil jet valve
17	Cylinder block
18	Adjustment shim (L3)

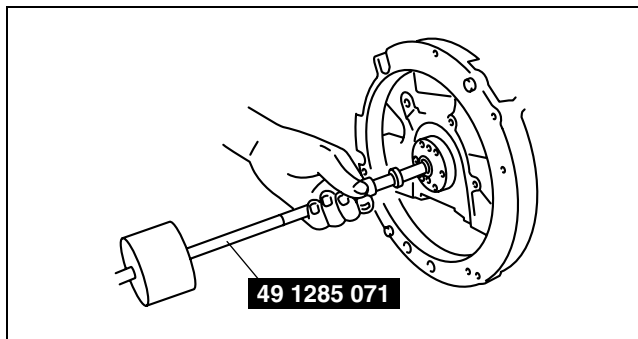
Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

Pilot Bearing Disassembly Note

Note

- Only remove the pilot bearing if there is a malfunction in the pilot bearing or when replacing the crankshaft.

1. Use the **SST** to remove the pilot bearing.



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01-10

Connecting Rod Cap Disassembly Note

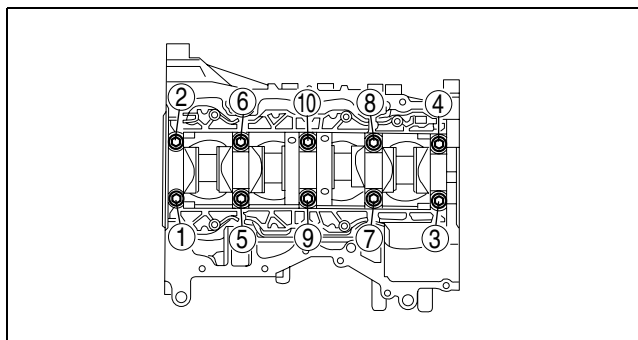
1. Before removing connecting rod inspect the connecting rod side clearance. (See 01-10-25 CONNECTING ROD INSPECTION.)
2. Remove the connecting rod bolt from the connecting rod cap by tapping the bolt with a plastic hammer.

Note

- The tappets are numbered to make sure they are assembled in their original positions. When removed, keep the tappets with the cylinder head they were removed from. Do not mix the tappets.

Main Bearing Cap Disassembly Note

1. Before removing main bearing cap inspect the crankshaft end play. (See 01-10-26 CRANKSHAFT INSPECTION.)
2. Loosen the main bearing cap bolts in two or three steps in the order shown in the figure.

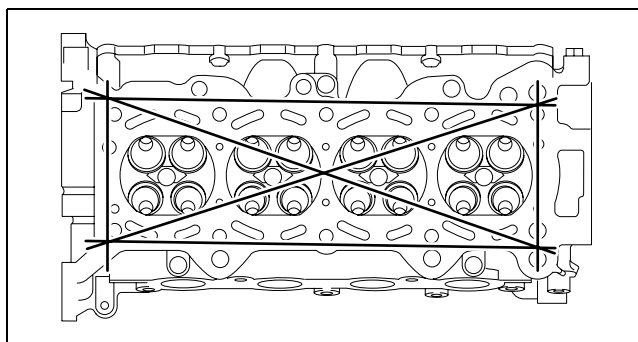


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CYLINDER HEAD INSPECTION

1. Perform color contrast penetrate examination on the cylinder head surface.
 - Replace the cylinder head if necessary.
2. Inspect for the following and repair or replace if necessary.
 - (1) Sunken valve seats
 - (2) Excessive camshaft oil clearance and end play
3. Measure the cylinder head for distortion in six directions as shown in the figure.
 - If it exceeds the maximum specification, replace the cylinder head. Do not attempt to repair the cylinder head by milling or grinding.

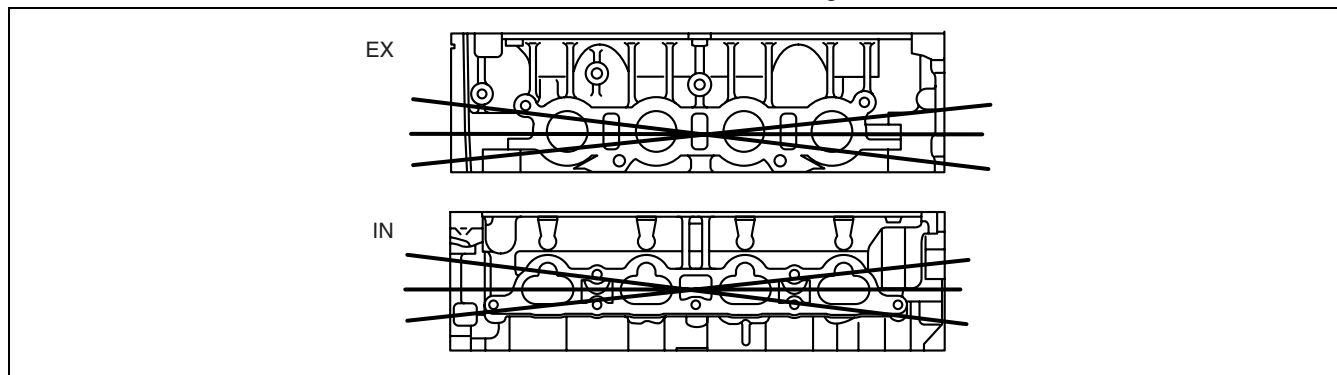
Cylinder head gasket contact surface distortion (Maximum)
0.10 mm {0.004 in}



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Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

4. Measure the manifold contact surface distortion as shown in the figure.



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- If it exceeds the maximum specification, grind the surface or replace the cylinder head.

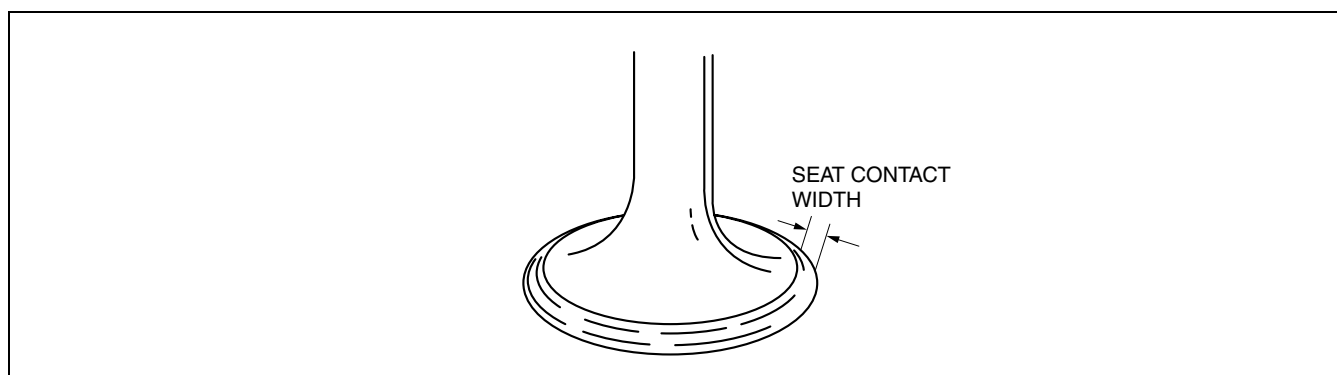
Manifold contact surfaces distortion (Maximum)
0.10 mm {0.004 in}

Manifold contact surfaces distortion (Maximum grinding)
0.15 mm {0.006 in}

VALVE SEAT INSPECTION/REPAIR

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1. Measure the seat contact width.



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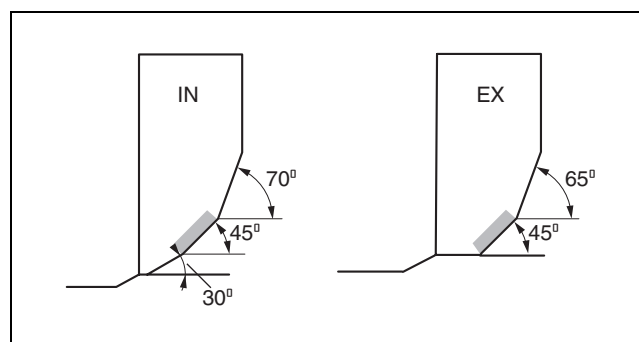
- If not within the specification, resurface the valve seat using a **45°** valve seat cutter and/or resurface the valve face.

Valve seat contact width (Standard)
1.2—1.6 mm {0.048—0.062 in}

2. Verify that the valve seating position is at the center of the valve face.

- If the seating position is too inner side, correct the valve seat using a **70°** (IN) or **65°** (EX) cutter, and a **45°** cutter.
- If the seating position is too far inside, correct the valve seat using a **30°** (IN) cutter, and a **45°** cutter.

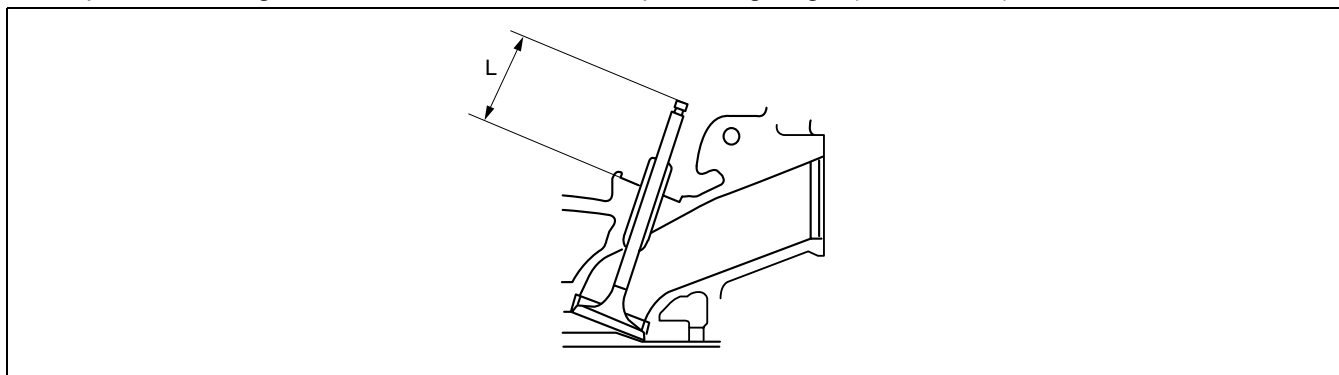
Valve seat angle
IN: 45°
EX: 45°



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MECHANICAL

3. Inspect the sinking of the valve seat. Measure the protruding length (dimension L) of the valve stem.



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- If not specified, replace the cylinder head.

Valve protrusion height (Standard)

IN: 40.64—42.24 mm {1.600—1.662 in}

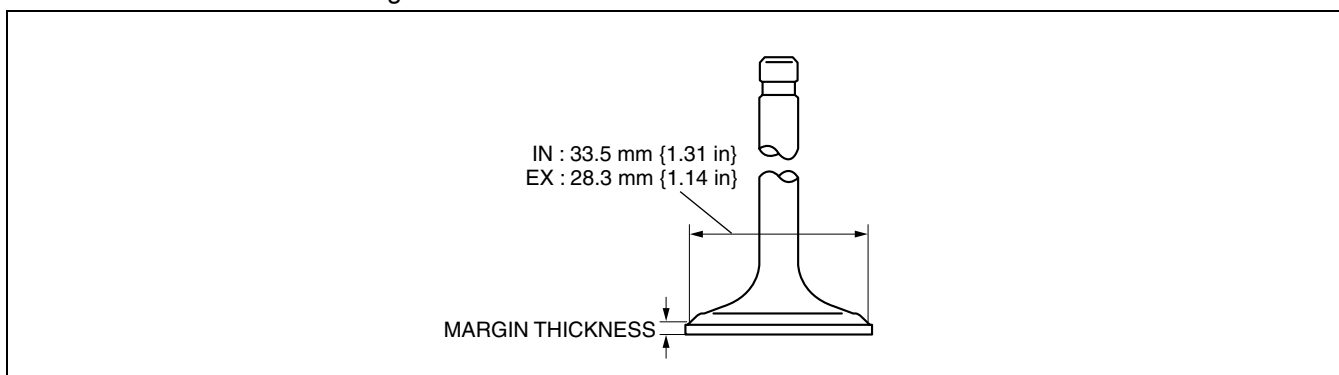
EX: 40.50—42.10 mm {1.595—1.657 in}

01-10

VALVE, VALVE GUIDE INSPECTION

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1. Measure the valve head margin thickness of each valve.



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- If it is less than the specification, replace the valve.

Valve head margin thickness (Minimum)

IN: 1.62 mm {0.0637 in}

EX: 1.82 mm {0.0716 in}

2. Measure the length of each valve. Replace the valve if necessary.

- If it is less than the specification, replace the valve.

Valve length (Standard)

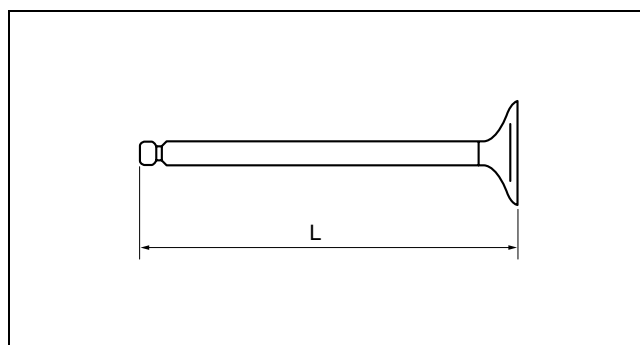
IN: 102.99—103.79 mm {4.055—4.086 in}

EX: 104.25—105.05 mm {4.105—4.135 in}

Valve length (Minimum)

IN: 102.99 mm {4.055 in}

EX: 104.25 mm {4.104 in}

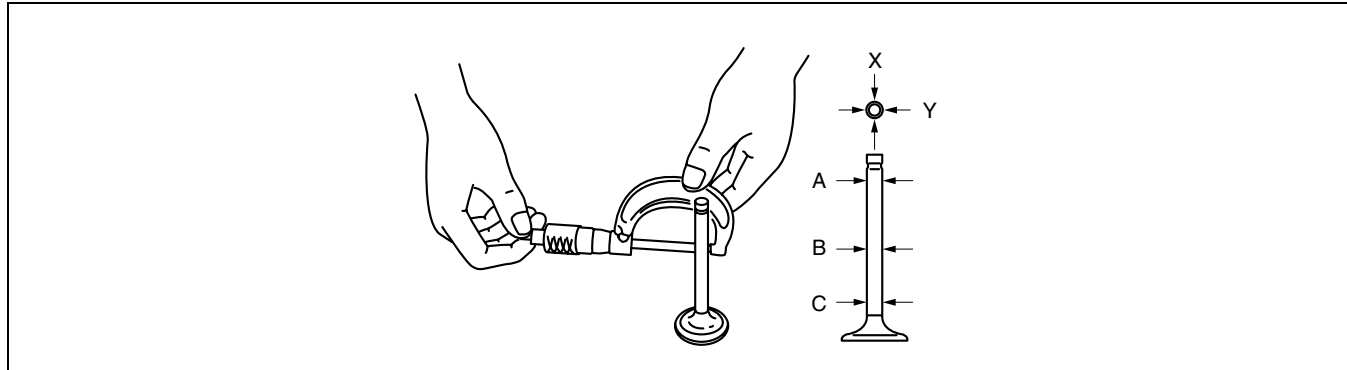


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01-10-15

MECHANICAL

3. Measure the stem diameter of each valve in X and Y directions at the three points (A, B, and C) as indicated in the figure.



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- If it exceeds the specification, replace the valve.

Valve stem diameter (Standard)

IN: 5.470—5.485 mm {0.2154—0.2159 in}

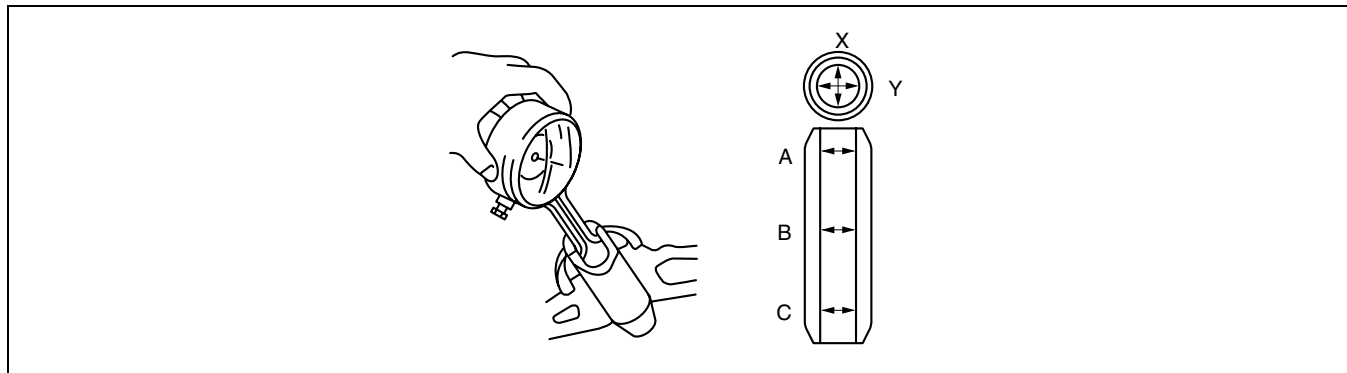
EX: 5.465—5.480 mm {0.2152—0.2157 in}

Valve stem diameter (Minimum)

IN: 5.440 mm {0.2142 in}

EX: 5.435 mm {0.2140 in}

4. Measure the inner diameter of each valve guide in X and Y directions at the three points (A, B, and C) as indicated in the figure.



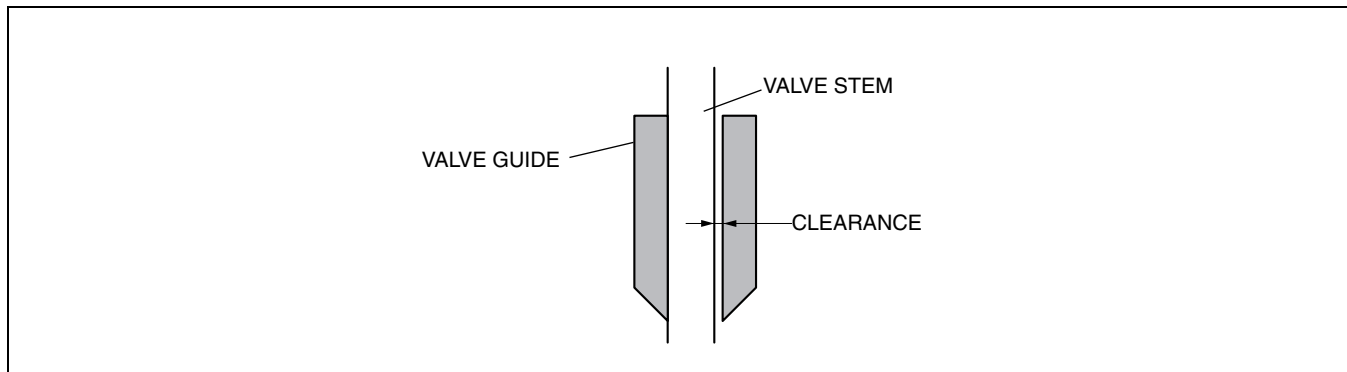
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- If not as specified, replace the valve guide.

Valve guide inner diameter (Standard)

5.509—5.539 mm {0.2169—0.2180 in}

5. Calculate the valve stem to guide clearance by subtracting the outer diameter of the valve stem from the inner diameter of the corresponding valve guide.



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MECHANICAL

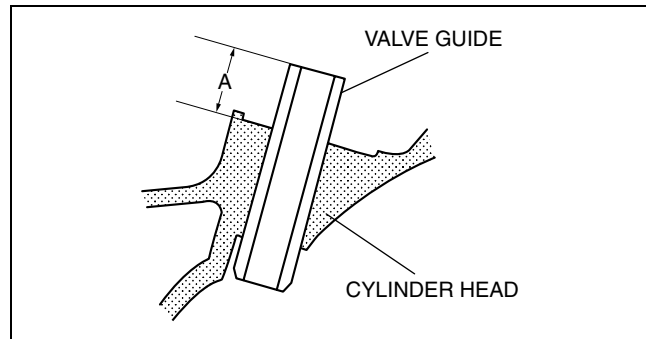
- If it exceeds the specification, replace the valve and/or the valve guide.

Valve stem to guide clearance (Standard)
IN: 0.024—0.069 mm {0.0009—0.0027 in}
EX: 0.029—0.074 mm {0.0012—0.0029 in}

Valve stem to guide clearance (Maximum)
0.10 mm {0.004 in}

6. Measure the protrusion height (dimension A) of each valve guide without lower valve spring seat.
- If not within the specified, replace the valve guide.

Valve guide protrusion height (standard)
12.2—12.8 mm {0.481—0.503 in}



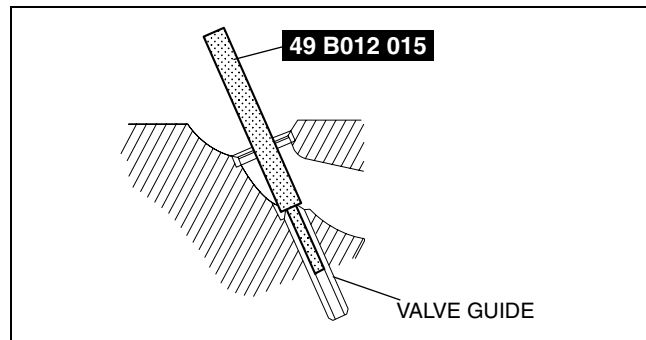
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VALVE GUIDE REPLACEMENT

Valve Guide Removal

1. Remove the valve guide from the combustion chamber side using the SST.

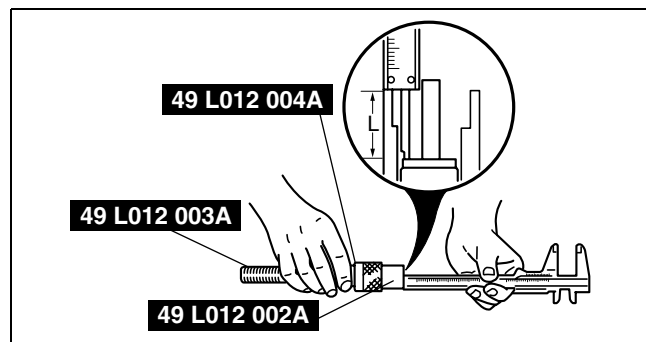


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Valve Guide Installation

1. Assemble the SSTs so that depth L is as specified.

Valve guide protrusion height (standard)
12.2—12.8 mm {0.481—0.503 in}



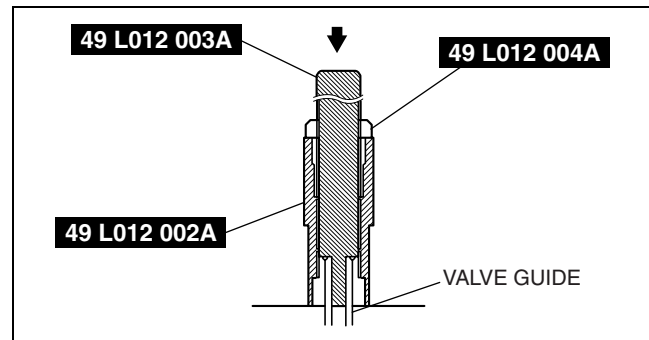
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01-10

01-10-17

MECHANICAL

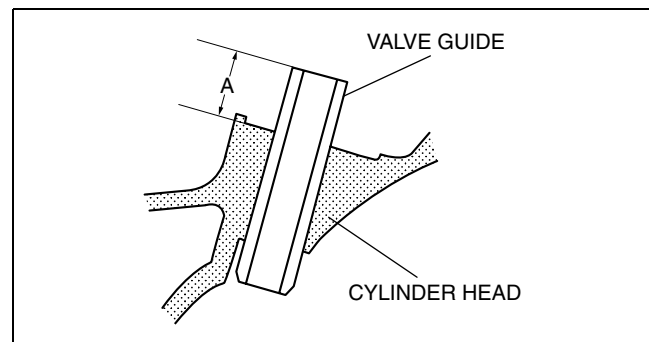
2. Tap the valve guide in from the top of the cylinder head until the **SSTs** contacts the cylinder head.



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3. Verify that the valve guide protrusion height (dimension A) is within the specification.

Valve guide protrusion height (standard)
12.2—12.8 mm {0.481—0.503 in}

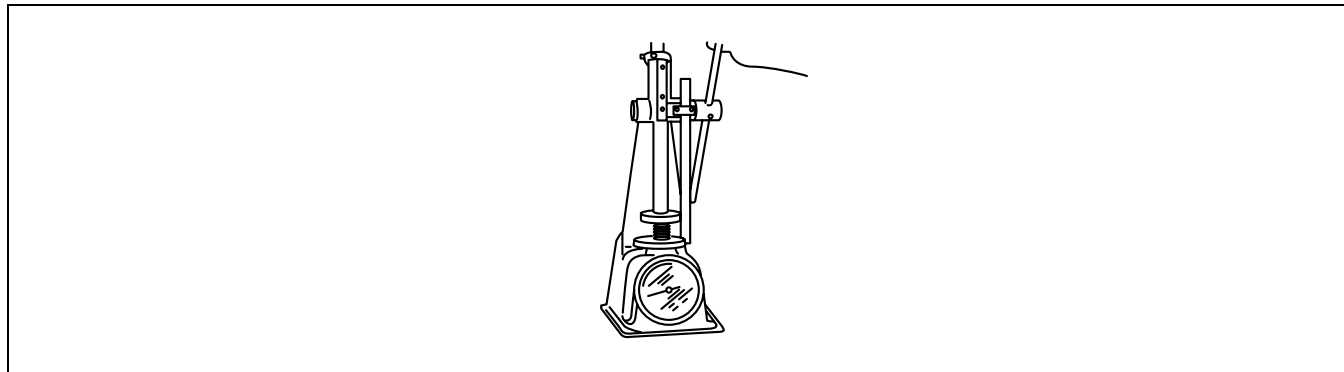


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VALVE SPRING INSPECTION

id011000501400

1. Apply pressing force to the pressure spring and inspect the spring height.
 - If it is less than the specification, replace the valve spring.



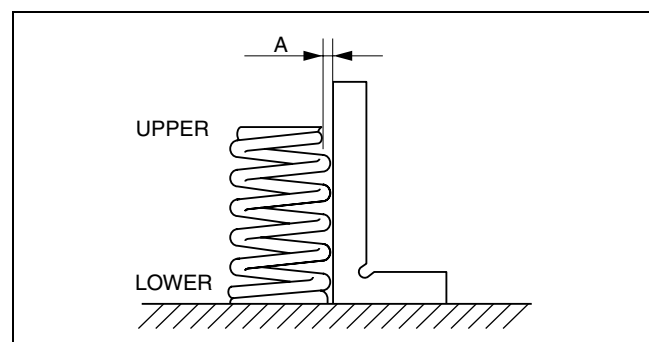
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Valve spring standard height

Valve spring with pink paint mark: 30.2 mm {1.19 in} (pressing force 388.7 N {39.64 kgf, 87.38 lbf})
Except above: 28.68 mm {1.129 in} (pressing force 390 N {39.76 kgf, 87.67 lbf})

2. Measure the out-of-square of the valve spring, using a square, as shown in the figure.
 - (1) Rotate the valve spring one full turn and measure "A" at the point where the gap is the largest.
 - If it exceeds the specification, replace the valve spring.

Valve spring out-of-square (Maximum)
1.95 mm {0.0767 in}



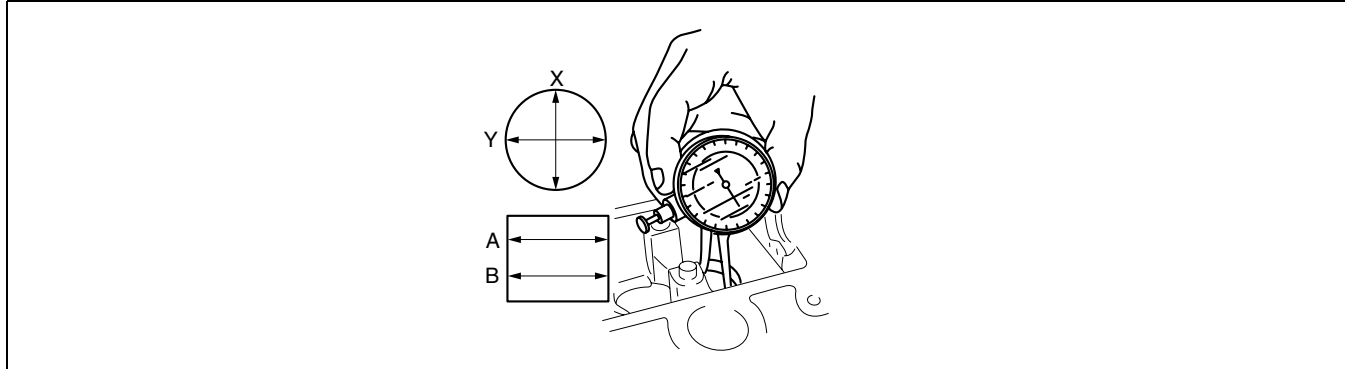
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MECHANICAL

TAPPET INSPECTION

id011000505800

1. Measure the tappet hole inner diameter in X and Y directions at the two points (A and B) shown in the figure.

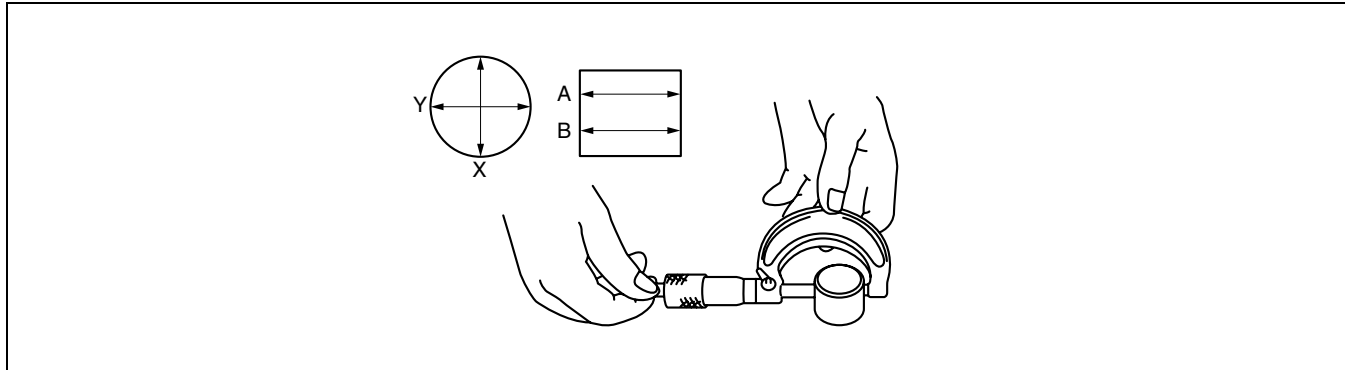


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Tappet bore diameter (Standard)
31.000—31.030 mm {1.2205—1.2216 in}

2. Measure the tappet body outer diameter in X and Y directions at the two points (A and B) shown in the figure.



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Tappet diameter (Standard)
30.970—30.980 mm {1.2193—1.2196 in}

3. Subtract the tappet body outer diameter from the tappet hole inner diameter.
 - If it exceeds the specification, replace the tappet or cylinder head.

Tappet-to-Tappet bore oil clearance (Standard)
0.02—0.06 mm {0.0008—0.0023 in}

Tappet-to-Tappet bore oil clearance (Maximum)
0.15 mm {0.006 in}

01-10-19

MECHANICAL

VARIABLE VALVE TIMING ACTUATOR INSPECTION

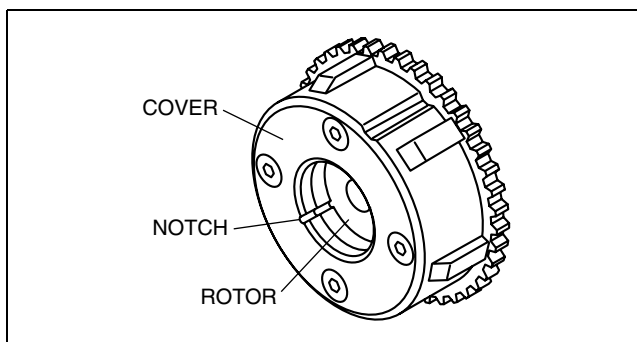
id011000506000

Caution

- Variable valve timing actuator cannot be disassembled because it is a precision unit.

1. Confirm that the groove of the rotor and notch of the cover at the variable valve timing actuator are aligned and fixed.

- If the notch and the bump are not aligned, rotate the rotor toward the valve timing retard position by hand until they are in place.
- If the rotor and cover are not fixed even though their notch and groove are aligned, replace the variable valve timing actuator.



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OIL CONTROL VALVE (OCV) INSPECTION

id011000506100

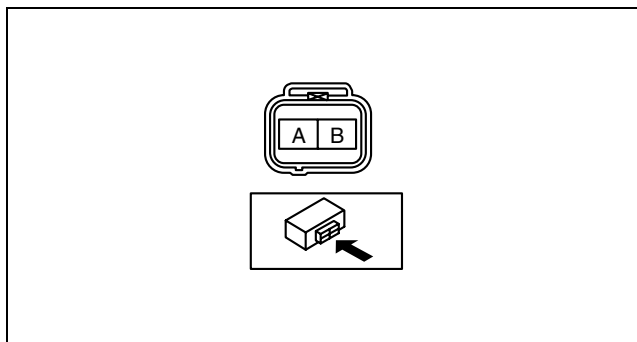
Coil Resistance Inspection

1. Measure the resistance between terminals A and B using an ohmmeter.

- If not as specified, replace the OCV.

Specification

6.9—7.9 ohms [20 °C {68 °F}]

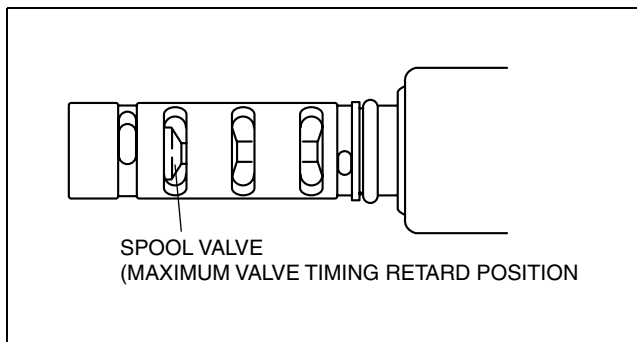


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Spool Valve Operation Inspection

1. Verify that the spool valve in the OCV is in the maximum valve timing retard position as indicated in the figure.

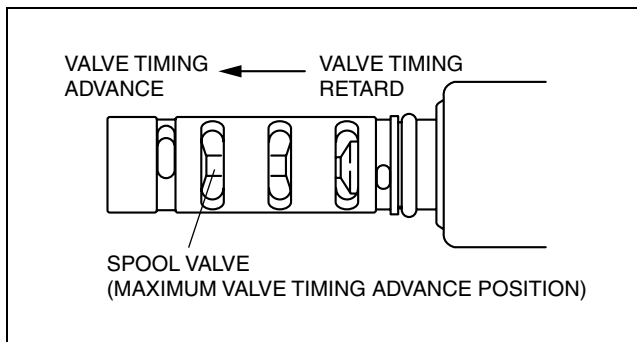
- If it exceeds the specification, replace the OCV.
2. Verify that the battery is fully charged.
 - If it is less than specification, recharge the battery.



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3. Apply battery positive voltage between the OCV terminals and verify that the spool valve operates and moves to the maximum valve timing advance position.

- If it exceeds the specification, replace the OCV.



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MECHANICAL

Note

- When applying battery positive voltage between the OCV terminals, the connection can be either of the following:
 - Positive battery cable to terminal A, negative battery cable to terminal B
 - Positive battery cable to terminal B, negative battery cable to terminal A
4. Stop applying battery positive voltage and verify that the spool valve returns to the maximum valve timing retard position.
- If it exceeds the specification, replace the OCV.

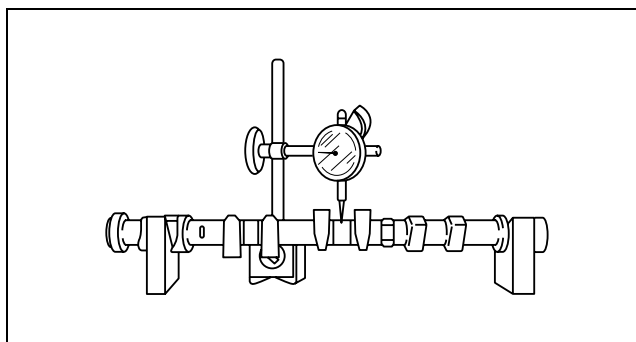
01-10

CAMSHAFT INSPECTION

id011000501500

- Set the No.1 and No.5 journals on V-blocks.
- Measure the camshaft runout.
 - If it exceeds the specification, replace the camshaft.

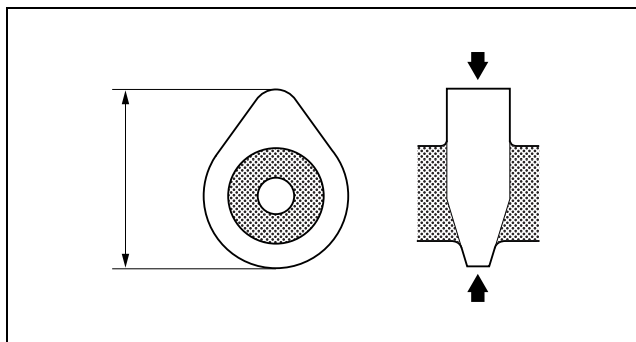
Maximum runout (Maximum)
0.03 mm {0.0012 in}



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- Measure the cam lobe height at the two points as shown in the figure.
 - If it is less than the specification, replace the camshaft.

Camshaft standard height (mm {in})
With variable valve timing mechanism
 IN: 42.44 {1.671}
 EX: 41.18 {1.621}
Without variable valve timing mechanism
 IN: 42.12 {1.659}
 EX: 41.08 {1.618}



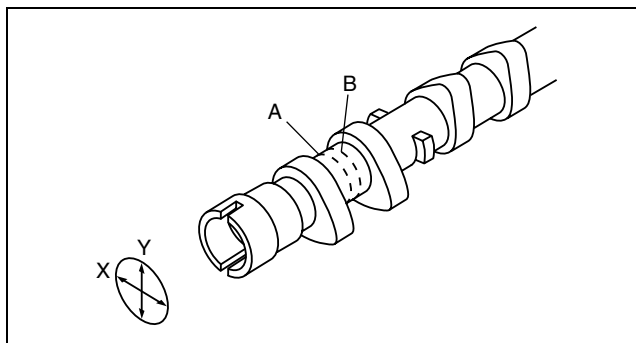
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Camshaft minimum height (mm {in})
With variable valve timing mechanism
 IN: 42.33 {1.666}
 EX: 41.06 {1.616}
Without variable valve timing mechanism
 IN: 42.01 {1.653}
 EX: 40.96 {1.612}

- Measure the journal diameters in X and Y directions at the two points (A and B) as indicated in the figure.
 - If it is less than the specification, replace the camshaft.

Camshaft journal diameter (Standard)
24.96—24.98 mm {0.9827—0.9834 in}

Camshaft journal diameter (Minimum)
24.95 mm {0.982 in}



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- Remove the tappet.

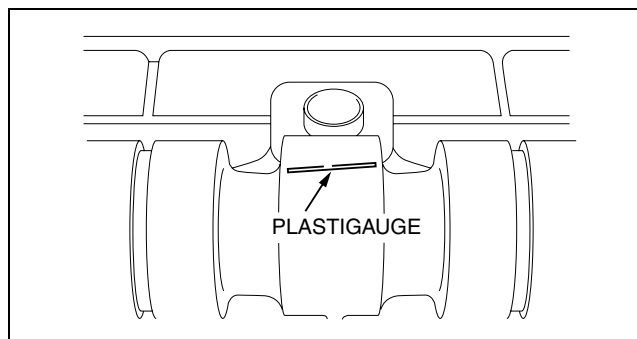
01-10-21

MECHANICAL

6. Position a plastigage atop the journals in the axial direction.
7. Install the camshaft cap. (See 01-10-42 CYLINDER BLOCK ASSEMBLY (II).)
8. Remove the camshaft cap. (See 01-10-6 CYLINDER HEAD DISASSEMBLY (I).)
9. Measure the oil clearance.
 - If it exceeds the specification, replace the cylinder head.

Camshaft journal oil clearance (Standard)
0.035—0.080 mm {0.0014—0.0031 in}

Camshaft journal oil clearance (Maximum)
0.09 mm {0.0035 in}

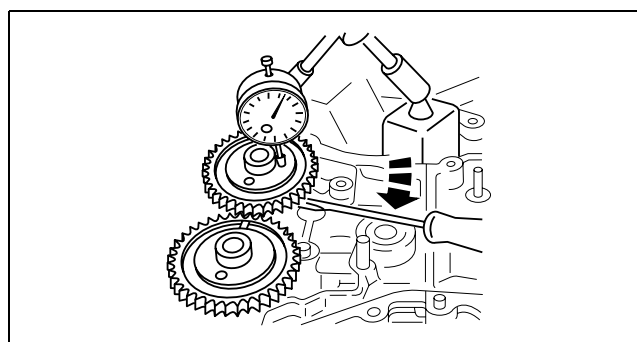


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10. Install the camshaft cap. (See 01-10-42 CYLINDER BLOCK ASSEMBLY (II).)
11. Measure the camshaft end play.
 - If it exceeds the specification, replace the cylinder head or camshaft.

Camshaft end play (Standard)
0.09—0.24 mm {0.0035—0.0094 in}

Camshaft end play (Maximum)
0.25 mm {0.0098 in}



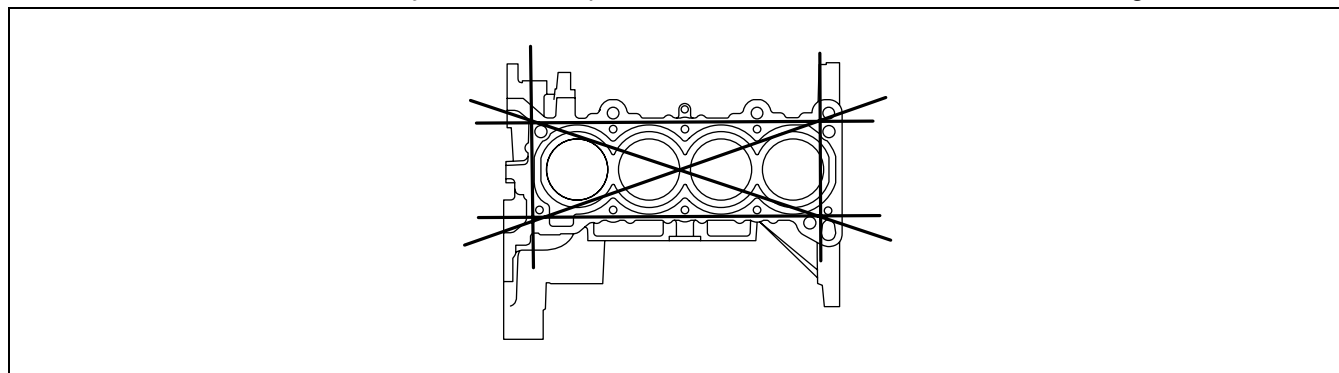
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12. Remove the camshaft cap. (See 01-10-6 CYLINDER HEAD DISASSEMBLY (I).)

CYLINDER BLOCK INSPECTION

id011000507200

1. Measure the distortion of the cylinder block top surface in six directions as indicated in the figure.



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- If it exceeds the maximum, replace the cylinder block.

Cylinder head gasket contact surfaces distortion (Maximum)
0.10 mm {0.004 in}

MECHANICAL

2. Measure the cylinder bores in X and Y directions at **42 mm {1.65 in}** below the top surface.

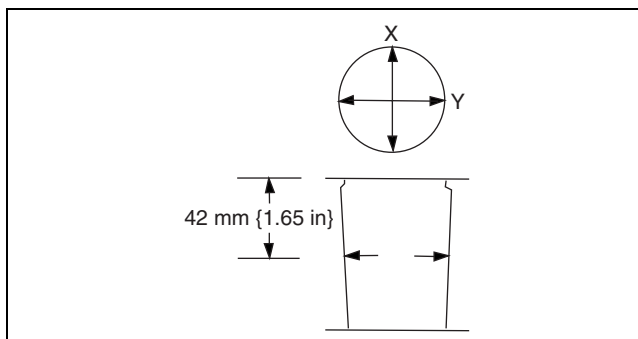
- If not within the specification, replace the cylinder block.

Cylinder bore diameter (Standard)

87.500—87.530 mm {3.4449—3.4460 in}

Minimum / maximum bore diameter limit

87.440—87.590 mm {3.4425—3.4484 in}



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01-10

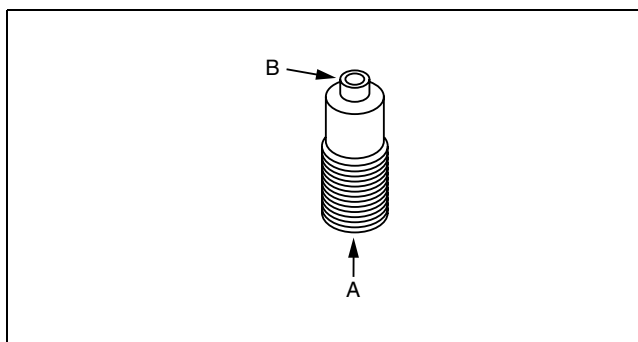
OIL JET VALVE INSPECTION

1. Apply compressed air to oil jet valve A and verify that air passes through oil jet valve B.

- If air does not flow, replace the oil jet valve.

Oil jet valve air pressure

216—274 kPa {2.2—2.7 kgf·cm² 31.4—39.7 psi}



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PISTON INSPECTION

id011000502100

Caution

- The piston, piston pin and connecting rod (semi-floating type piston pin) cannot be disassembled.
- When replacing the piston, piston pin, and connecting rod (semi-floating type piston pin), replace them together as a single unit.
- If the piston, piston pin, and connecting rod of the full floating type piston pin are disassembled, the piston, piston pin, and snap ring must be replaced as a single unit.

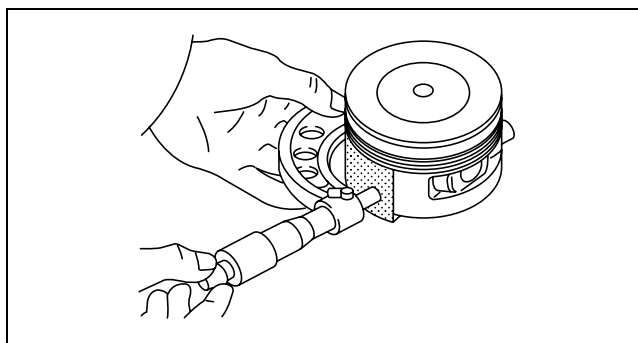
1. Measure the outer diameter of each piston at right angle 90° to the piston pin, 10.0 mm {0.40 in} above the under of the piston.

Semi-floating type piston pin

- If not within the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Full floating type piston pin

- If not within the specification, replace the piston, piston pin and snap ring as a single unit.



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Piston diameter (Standard)

87.465—87.495 mm {3.4435—3.4446 in}

2. Measure the piston-to-cylinder clearance.

Semi-floating type piston pin

- If not within the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Full floating type piston pin

- If not within the specification, replace the piston, piston pin and snap ring as a single unit.

Piston-to-cylinder clearance (Standard)

0.025—0.045 mm {0.0010—0.0017 in}

Piston-to-cylinder clearance (Maximum)

0.11 mm {0.0043 in}

MECHANICAL

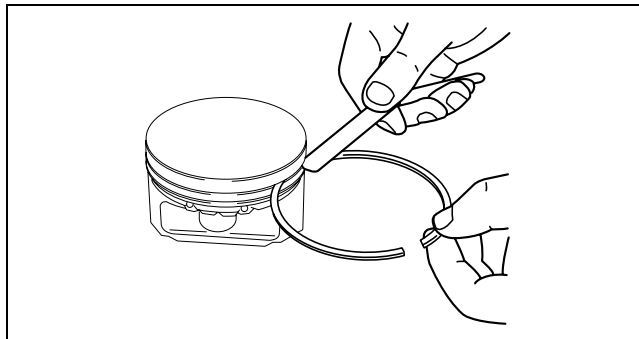
3. Measure the piston ring-to-ring groove clearance around the entire circumference.
 - If it exceeds the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Piston ring-to-ring groove clearance (Standard)

Top: 0.03—0.08 mm {0.0012—0.0031 in}
 Second: 0.03—0.07 mm {0.0012—0.0027 in}
 Oil: 0.03—0.07 mm {0.0012—0.0027 in}

Piston ring-to-ring groove clearance (Maximum)

Top: 0.17 mm {0.0067 in}
 Second, Oil: 0.15 mm {0.0059 in}



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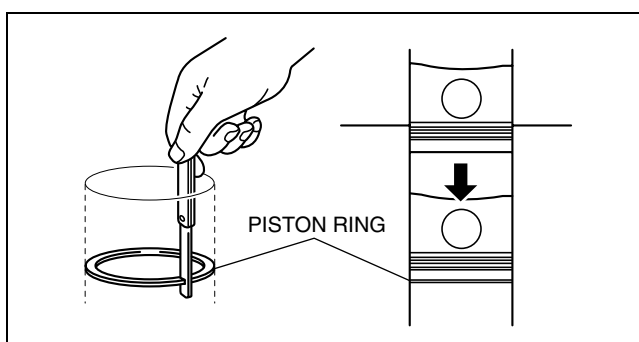
4. Insert the piston ring into the cylinder by hand and use the piston to push it to the bottom of the ring travel.
5. Measure each piston ring end gap with a feeler gauge.
 - If it exceeds the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Piston ring end gap (Standard)

Top: 0.16—0.31 mm {0.0063—0.0122 in}
 Second: 0.33—0.48 mm {0.0130—0.0189 in}
 Oil (rail): 0.20—0.70 mm {0.0079—0.0275 in}

Piston ring end gap (Maximum)

1.0 mm {0.0393 in}



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PISTON AND CONNECTING ROD INSPECTION

id011000503100

Caution

- The piston, piston pin and connecting rod (semi-floating type piston pin) cannot be disassembled.
- When replacing the piston, piston pin, and connecting rod (semi-floating type piston pin), replace them together as a single unit.

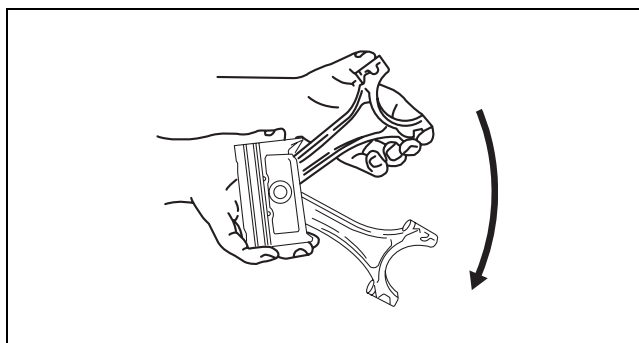
1. Check the oscillation torque as shown in the figure. Verify that the large end drops under its own weight with no resistance.

Semi-floating type piston pin

- If the piston shakes heavily or unsmoothly, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Full floating type piston pin

- If the piston shakes heavily or unsmoothly, disassemble the piston and connecting rod, replace the piston and snap ring, piston pin, then inspect the inner diameter of the connecting rod at the small end. (See 01-10-25 CONNECTING ROD INSPECTION.)



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CONNECTING ROD INSPECTION

id011000502800

Caution

- The piston, piston pin and connecting rod (semi-floating type piston pin) cannot be disassembled.
- When replacing the piston, piston pin, snap ring and connecting rod (semi-floating type piston pin), replace them together as a single unit.

1. Install the connecting rod cap. (See 01-10-35 CYLINDER BLOCK ASSEMBLY (I).)
2. Measure the connecting rod large end side clearance.

Semi-floating type piston pin

- If it exceeds the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Full floating type piston pin

- If it exceeds the specification, replace the piston, piston pin, snap ring and connecting rod.

Connecting rod side clearance (Standard)
0.14—0.36 mm {0.0056—0.0141 in}

Connecting rod side clearance (Maximum)
0.435 mm {0.0172 in}

3. Remove the connecting rod cap.
4. Position plastigage atop the journals in the axial direction.
5. Install the connecting rod bearing and connecting rod cap. (See 01-10-35 CYLINDER BLOCK ASSEMBLY (I).)
6. Remove the connecting rod cap.
7. Measure the connecting rod oil clearance.
 - If it exceeds the specification, replace the connecting rod bearing or grind the crank pin and use oversize bearings so that the specified clearance is obtained.

Connecting rod bearing oil clearance (Standard)
0.026—0.052 mm {0.0011—0.0020 in}

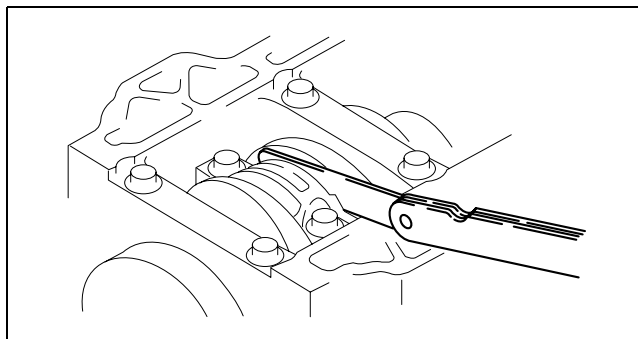
Connecting rod bearing oil clearance (Maximum)
0.1 mm {0.0039 in}

Connecting rod bearing size [LF]
STD: 1.498—1.522 mm {0.05863—0.05992 in}
OS0.25: 1.623—1.629 mm {0.06390—0.06413 in}
OS0.50: 1.748—1.754 mm {0.06882—0.06905 in}

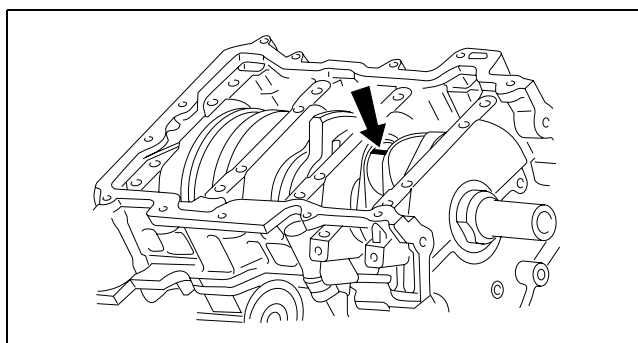
Connecting rod bearing size [L3]
STD: 1.496—1.520 mm {0.05890—0.05984 in}
OS0.25: 1.621—1.627 mm {0.06382—0.06405 in}
OS0.50: 1.746—1.752 mm {0.06875—0.06897 in}

Caution

- If a malfunction is found during the Piston and connecting rod oscillation torque for the full floating type piston pin, inspect the inner diameter of the connecting rod at the small end.



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8. Measure the connecting rod small end using a caliper gauge.
- If not exceeds the specification, replace the connecting rod.

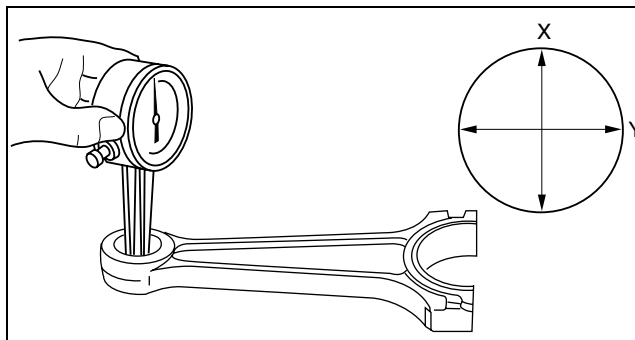
Standard inner diameter

LF (Full floating type piston pin): 20.935—20.946 mm {0.82422—0.82464 in}

9. Calculate the clearance between the connecting rod small end inner diameter and the new piston pin outer diameter.
- If not exceeds the specification, replace the connecting rod.

Standard clearance

0.010—0.026 mm {0.0004—0.0010 in}



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CRANKSHAFT INSPECTION

id011000502500

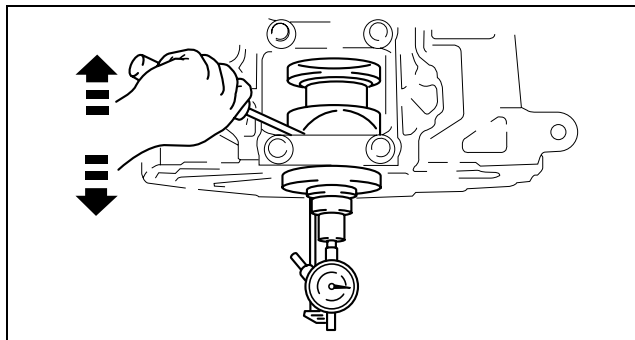
1. Install the main bearing cap. (See 01-10-35 CYLINDER BLOCK ASSEMBLY (I).)
2. Measure the crankshaft end play.
 - If it exceeds the specification, replace the thrust bearing or crankshaft so that the specified end play is obtained.

Crankshaft end play (Standard)

0.22—0.45 mm {0.0087—0.0177 in}

Crankshaft end play (Maximum)

0.55 mm {0.0216 in}

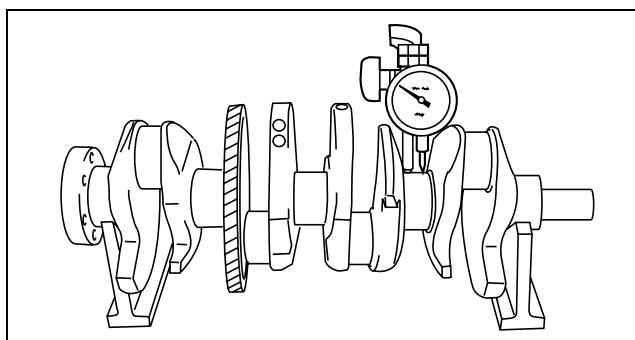


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3. Remove the main bearing cap. (See 01-10-11 CYLINDER BLOCK DISASSEMBLY (II).)
4. Measure the crankshaft runout.
 - If it exceeds the specification, replace the crankshaft.

Crankshaft runout (Maximum)

0.05 mm {0.0019 in}



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5. Measure the journal diameter in X and Y directions at the two points (A and B) as indicated in the figure.
 - If it exceeds the specification, replace the crankshaft or grind the journal and install the undersize bearing.

Main journal bearing size

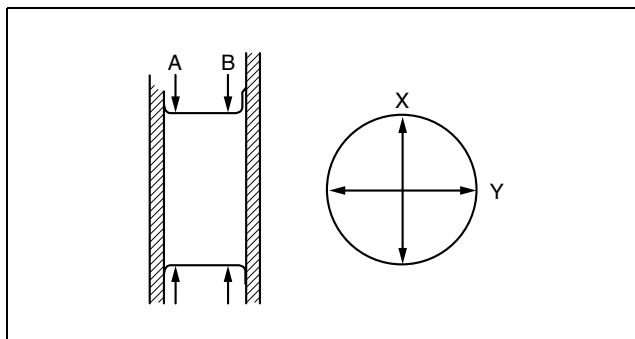
STD: 51.980—52.000 mm {2.0464—2.0472 in}

OS0.25: 51.730—51.750 mm {2.0366—2.0373 in}

OS0.50: 51.480—51.500 mm {2.0268—2.0275 in}

Main journal out of round (Maximum)

0.05 mm {0.0019 in}



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Crank pin journal diameter [LF]

STD: 46.980—47.000 mm {1.8497—1.8503 in}

OS0.25: 46.730—46.750 mm {1.8398—1.8405 in}

OS0.50: 46.480—46.500 mm {1.8300—1.8307 in}

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Crank pin journal diameter [L3]
STD: 49.980—50.000 mm {1.9677—1.9685 in}
OS0.25: 49.730—49.750 mm {1.9579—1.9586 in}
OS0.50: 49.480—49.500 mm {1.9481—1.9488 in}

Crank pin out of round (Maximum)
 0.05 mm {0.0019 in}

6. Install the main bearing caps and crankshaft.
7. Position a plastigage atop the journals in the axial direction.
8. Install the main bearing caps and cylinder block. (See 01-10-35 CYLINDER BLOCK ASSEMBLY (I).)
9. Remove the main bearing caps. (See 01-10-11 CYLINDER BLOCK DISASSEMBLY (II).)
10. Measure the main journal oil clearance.

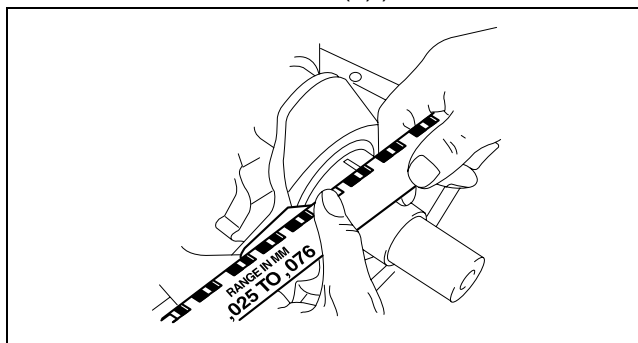
- If it exceeds the specification, replace the main bearing using the main bearing selection table or grind the main journal and install the oversize bearings so that the specified oil clearance is obtained.

Main journal oil clearance (Standard)
 0.019—0.035 mm {0.0007—0.0013 in}

Main journal oil clearance (Maximum)
 0.10 mm {0.0039 in}

Main bearing size (UPPER)
STD: 2.501—2.522 mm {0.0985—0.0992 in}
OS0.25: 2.623—2.629 mm {0.1033—0.1035 in}
OS0.50: 2.748—2.754 mm {0.1082—0.1084 in}

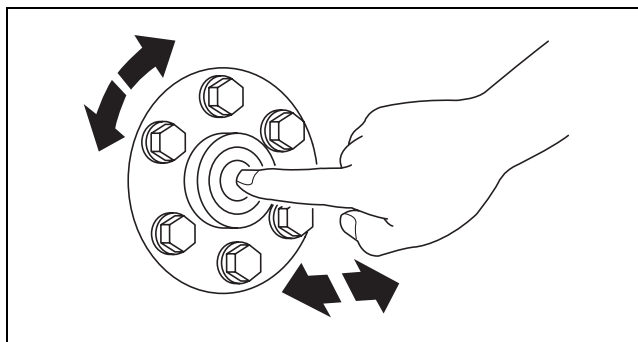
Main bearing size (LOWER)
STD: 2.501—2.529 mm {0.0985—0.0995 in}
OS0.25: 2.624—2.630 mm {0.1034—0.1035 in}
OS0.50: 2.749—2.755 mm {0.1083—0.1084 in}



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PILOT BEARING INSPECTION

1. Without removing the pilot bearing, turn the bearing while applying force in the axial direction.
 - If there is any malfunction, replace the pilot bearing.



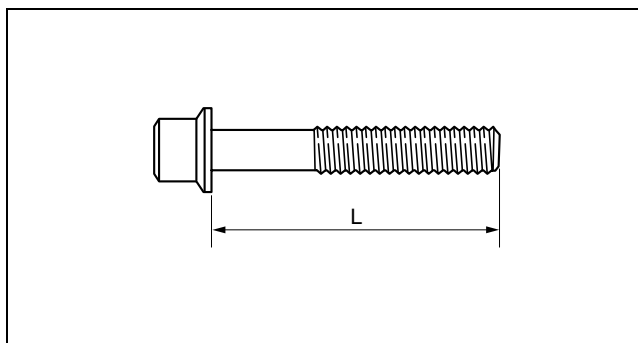
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BOLT INSPECTION

1. Measure the length of each bolt.
 - If it exceeds the specification, replace the bolt.

Bolt length (mm {in})
Cylinder head bolt (With washer)
Standard: 149.2—149.8 {5.87—5.90}
Maximum: 150.5 {5.91}
Cylinder head bolt (Without washer)
Standard: 145.2—145.8 {5.72—5.74}
Maximum: 146.5 {5.77}
Connecting rod bolt
Standard: 44.7—45.3 {1.75—1.78}
Maximum: 46.0 {1.81}
Main bearing cap bolt (Plastic region tightening bolt only)
Standard: 110.0—110.6 {4.33—4.35}
Maximum: 111.3 {4.38}



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Revised 6/2009 (Ref. No. R107/09)

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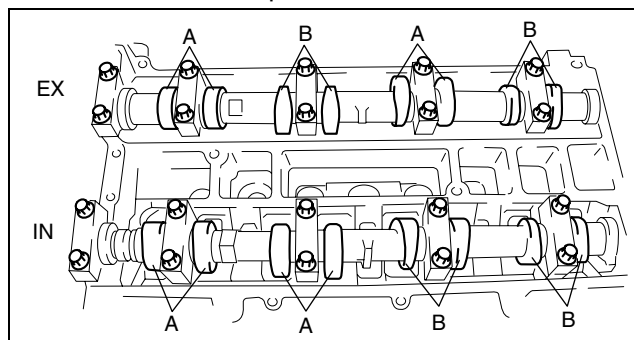
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VALVE CLEARANCE INSPECTION

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1. Measure the valve clearance as follows.
 - (1) Turn the crankshaft clockwise so that the No.1 piston is at TDC of the compression stroke.
 - (2) Measure the valve clearance at A in the figure.
 - If the valve clearance exceeds the standard, replace the tappet. (See 01-10-28 VALVE CLEARANCE ADJUSTMENT.)



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Note

- Make sure to note the measured values for choosing the suitable replacement tappets.

Valve clearance [Engine cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

EX: 0.27—0.33 mm {0.0106—0.0130 in}

- (3) Turn the crankshaft **360°** clockwise so that the No.4 piston is at TDC of the compression stroke.
- (4) Measure the valve clearance at B in the figure.
 - If the valve clearance exceeds the standard, replace the tappet. (See 01-10-28 VALVE CLEARANCE ADJUSTMENT.)

Note

- Make sure to note the measured values for choosing the suitable replacement tappets.

Valve clearance [Engine cold]

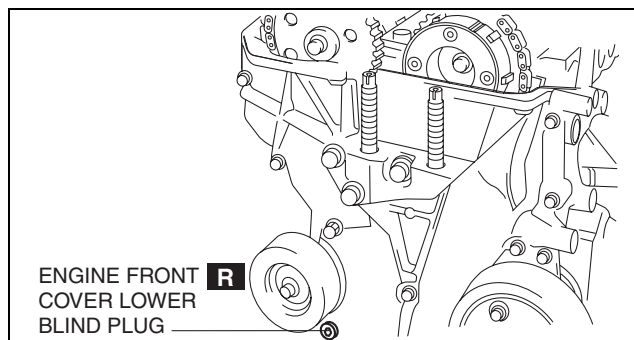
IN: 0.22—0.28 mm {0.0087—0.0110 in}

EX: 0.27—0.33 mm {0.0106—0.0130 in}

VALVE CLEARANCE ADJUSTMENT

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1. Remove the engine front cover lower blind plug.

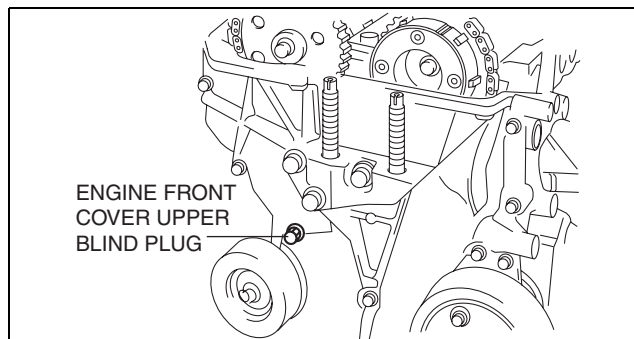


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2. Remove the engine front cover upper blind plug.
3. Remove the cylinder block lower blind plug.
4. Install the **SST** as shown in the figure.

Caution

- **Removal of this SST is extremely important. If you crank the engine with this SST installed, the cylinder block will be damaged.**

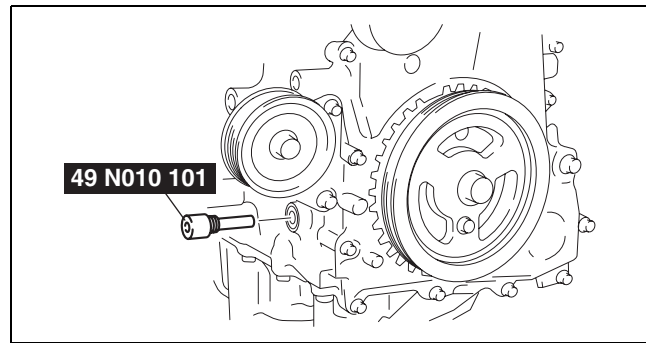


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MECHANICAL

Cylinder block lower blind plug hole diameter: M8

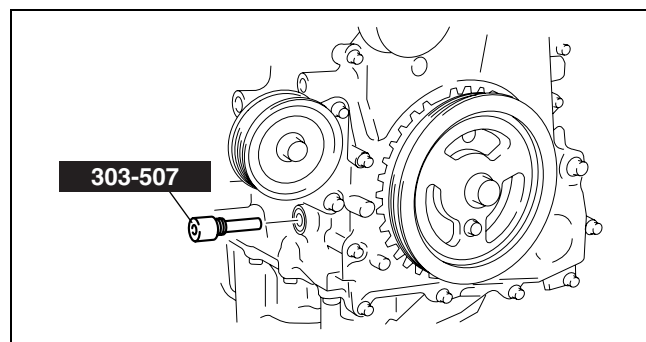


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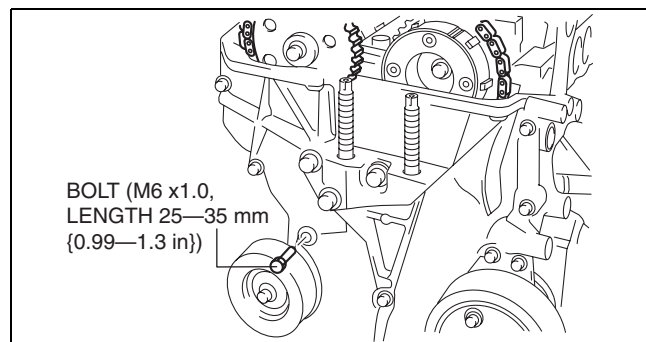
Cylinder block lower blind plug hole diameter: M10

5. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.
6. Loosen the timing chain.



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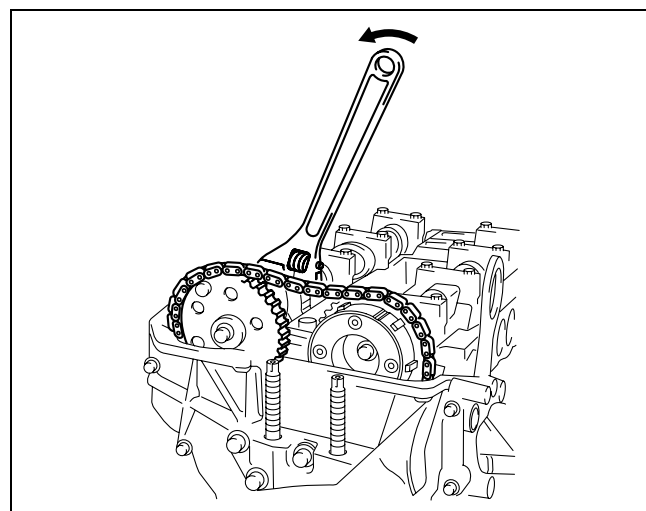
- (1) Insert a suitable bolt (M6 X 1.0, length 25—35mm {0.99—1.3 in}) into the engine front cover upper blind plug and tighten it until it contacts the chain tensioner arm, and then rotate it back one turn. (Set the bolt slightly away from the chain tensioner arm so that it does not contact it.)



BOLT (M6 x1.0,
LENGTH 25—35 mm
{0.99—1.3 in})

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- (2) Using the cast hexagon on the exhaust camshaft, apply force counterclockwise to facilitate unlocking the chain tensioner ratchet.

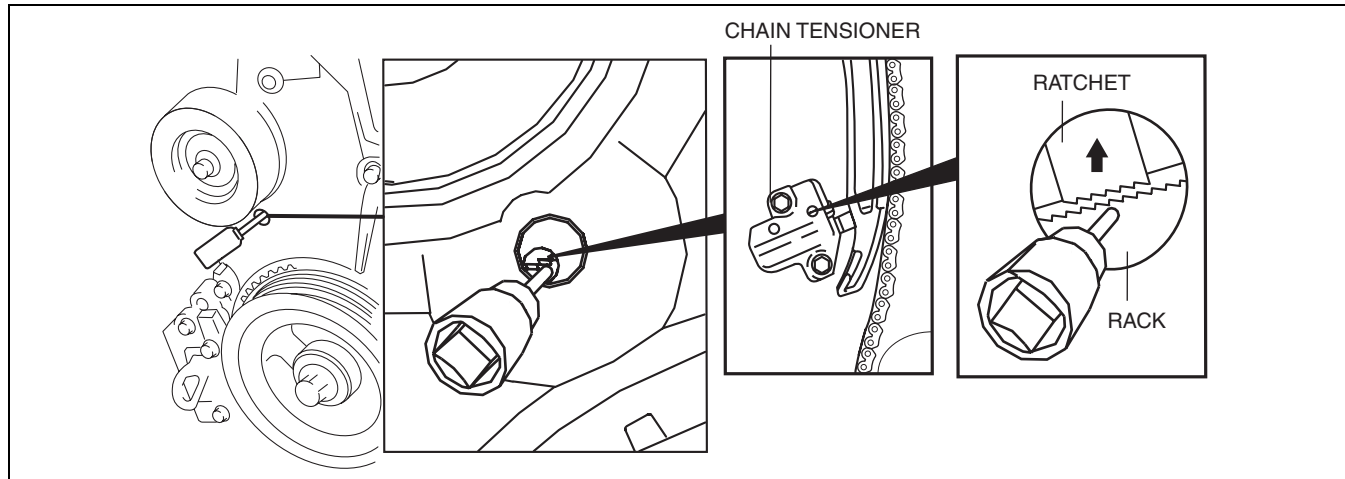


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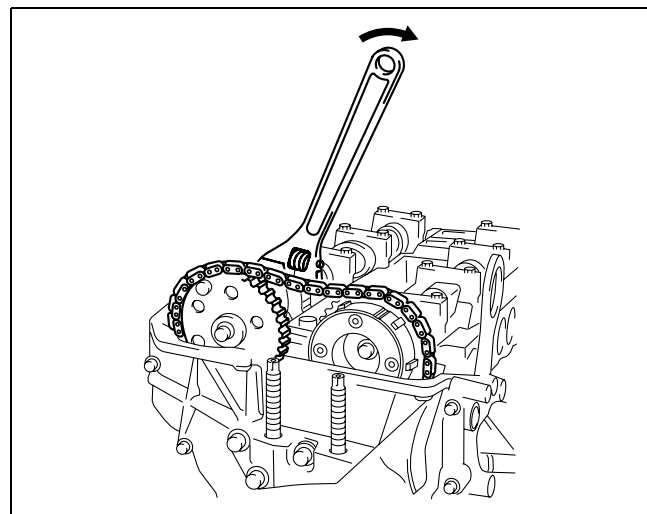
MECHANICAL

- (3) Using a Hex bit socket (2.5 mm {0.098 in}) or T15 Torx bit socket, unlock the chain tensioner ratchet so that it can be lifted up.



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- (4) Using the cast hexagon on the exhaust camshaft, apply force in the direction of the engine rotation to increase tension on the chain.



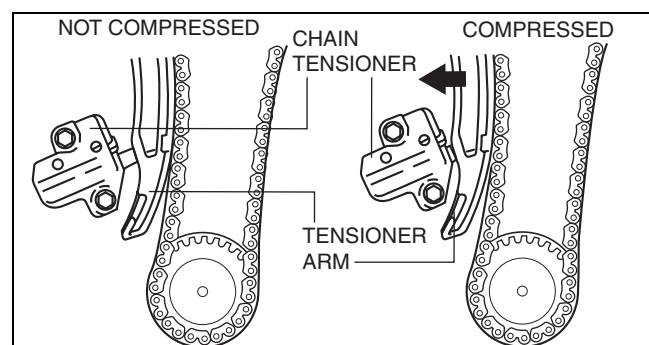
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Note

- The chain tensioner rack is compressed using the chain tension generated by applying force to the exhaust camshaft in the direction of the engine rotation.

Note

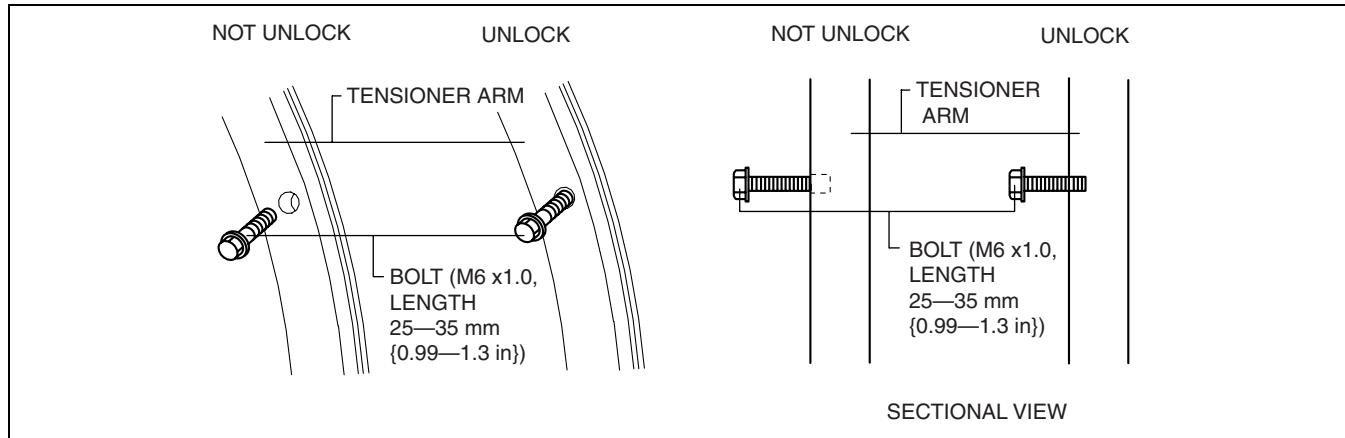
- The ratchet has not been unlocked if the bolt cannot be pressed in approx. 5 mm {0.2 in}.



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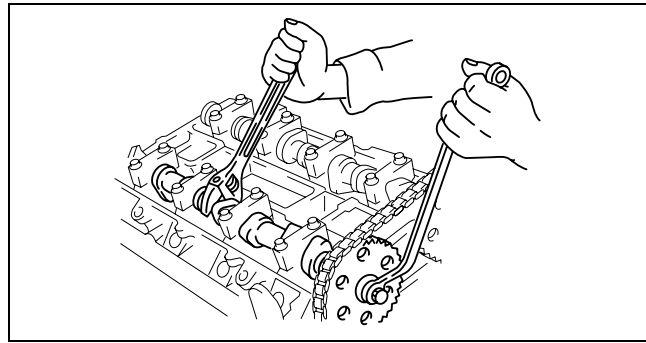
- (5) Screw in the bolt set in Step 1 approx. 5 mm {0.2 in} and secure the tensioner arm with the rack compressed.



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- If the tensioner arm cannot be secured, return the bolt to its original position and repeat the procedure from Step 3.
7. Hold the exhaust camshaft using a suitable wrench on the cast hexagon as shown in the figure.



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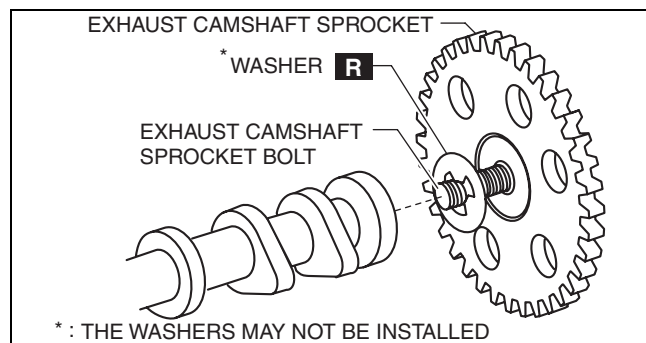
8. Remove the exhaust camshaft sprocket bolt, exhaust camshaft sprocket, and washer (The washers may not be installed.) as a single unit.

Caution

- Perform the work carefully so that the washer does not drop out. (The washers may not be installed.)

Note

- The washers do not have to be installed on the LF-VE (ATX) and LF-DE (ATX) vehicles other than MX-5 (there is no problem with installing them).
- Be careful not to install a washer on only the IN or EX side.

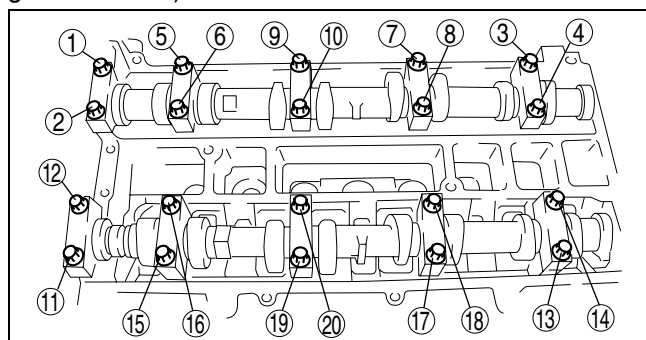


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9. Remove the oil control valve (OCV). (With variable timing mechanism.)
10. Loosen the camshaft cap bolts in several passes in the order shown in the figure.

Note

- The cylinder head and the camshaft caps are numbered to make sure they are reassembled in their original position. When removed, keep the caps with the cylinder head they were removed from. Do not mix the caps.



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11. Remove the camshaft.
12. Remove the tappet.

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13. Select proper adjustment shim.

New adjustment shim

= Removed shim thickness + Measured valve clearance - Standard valve clearance (IN: 0.25 mm {0.0098 in}, EX: 0.30 mm {0.0118 in})

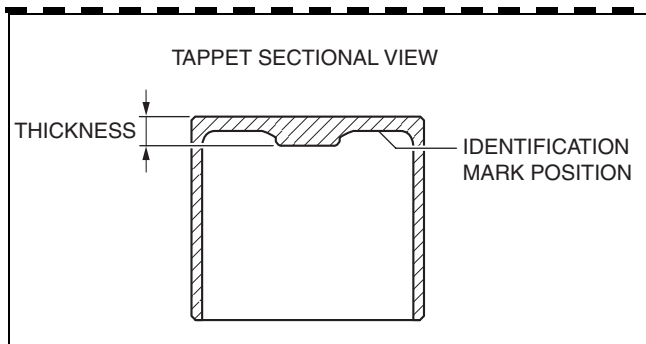
Valve clearance [Engine cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

EX: 0.27—0.33 mm {0.0106—0.0130 in}

Caution

- Do not use a removed tappet on another vehicle.
- If a tappet is reused, measure the thickness of the tappet and select the tappet in which the valve clearance is within the specification.



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Tappet specification

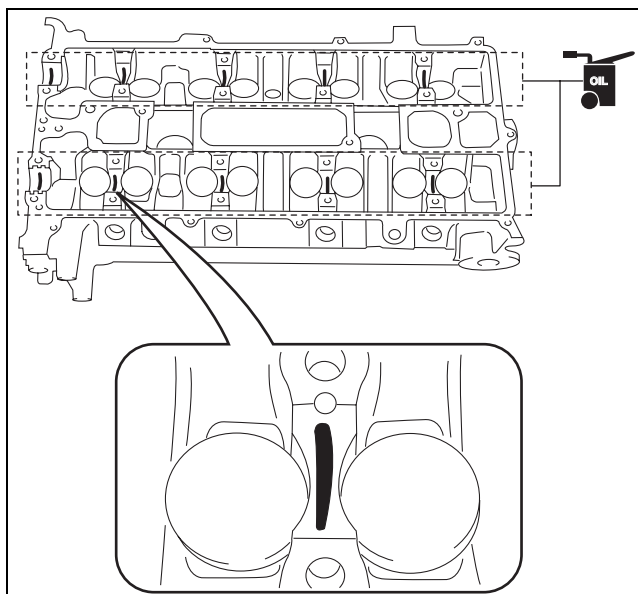
Identification mark	Thickness (mm {in})	Tolerance (mm {in})
000	3.000 {0.1181}	±0.0125 {0.000492}
025	3.025 {0.1191}	±0.0125 {0.000492}
050	3.050 {0.1201}	±0.0125 {0.000492}
075	3.075 {0.1211}	±0.0125 {0.000492}
100	3.100 {0.1220}	±0.0125 {0.000492}
122	3.122 {0.1229}	±0.0100 {0.000394}
142	3.142 {0.1237}	±0.0100 {0.000394}
162	3.162 {0.1245}	±0.0100 {0.000394}
182	3.182 {0.1253}	±0.0100 {0.000394}
202	3.202 {0.1261}	±0.0100 {0.000394}
222	3.222 {0.1269}	±0.0100 {0.000394}
242	3.242 {0.1276}	±0.0100 {0.000394}
262	3.262 {0.1284}	±0.0100 {0.000394}
282	3.282 {0.1292}	±0.0100 {0.000394}
302	3.302 {0.130}	±0.0100 {0.000394}
322	3.322 {0.1308}	±0.0100 {0.000394}
342	3.342 {0.1316}	±0.0100 {0.000394}
362	3.362 {0.1324}	±0.0100 {0.000394}
382	3.382 {0.1331}	±0.0100 {0.000394}
402	3.402 {0.1339}	±0.0100 {0.000394}
422	3.422 {0.1347}	±0.0100 {0.000394}
442	3.442 {0.1355}	±0.0100 {0.000394}
462	3.462 {0.1363}	±0.0100 {0.000394}
482	3.482 {0.1371}	±0.0100 {0.000394}
502	3.502 {0.1379}	±0.0100 {0.000394}
522	3.522 {0.1387}	±0.0100 {0.000394}
542	3.542 {0.1394}	±0.0100 {0.000394}
562	3.562 {0.1402}	±0.0100 {0.000394}
582	3.582 {0.1410}	±0.0100 {0.000394}
602	3.602 {0.1418}	±0.0100 {0.000394}
625	3.625 {0.1427}	±0.0125 {0.000492}
650	3.650 {0.1437}	±0.0125 {0.000492}
675	3.675 {0.1447}	±0.0125 {0.000492}
700	3.700 {0.1457}	±0.0125 {0.000492}
725	3.725 {0.1467}	±0.0125 {0.000492}

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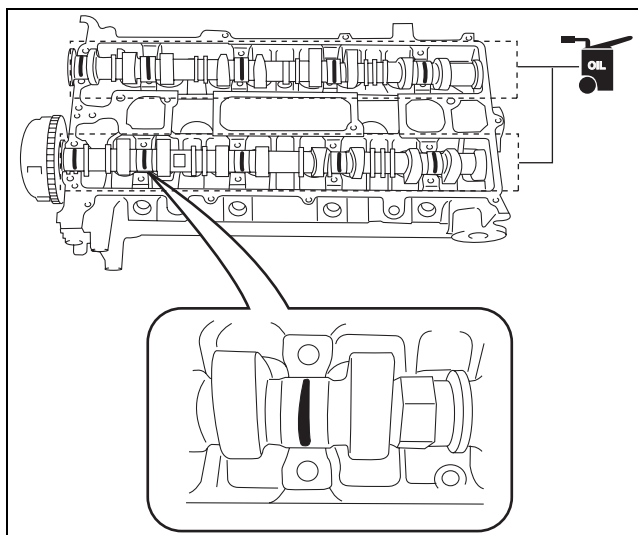
14. Apply the gear oil (SAE No. 90 or equivalent) to each journal of the cylinder head as shown in the figure.
15. Install the camshaft with No.1 cylinder aligned with the TDC position.



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16. Apply the gear oil (SAE No. 90 or equivalent) to each journal of the camshaft as shown in the figure.



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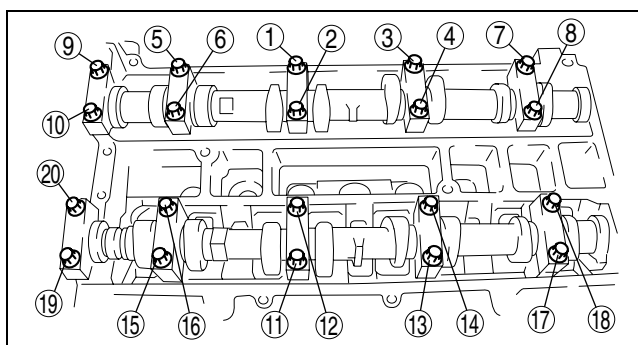
17. Tighten the camshaft cap bolt using the following two steps.

Tightening torque

(1) 5.0—9.0 N·m {51.0—91.7 kgf·cm, 44.3—79.5 in·lbf}

(2) 14.0—17.0 N·m {1.43—1.73 kgf·m, 10.4—12.5 ft·lbf}

18. Install the OCV. (With variable value timing mechanism.)



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Tightening torque

8.0—11.5 N·m {8.16—117.2 kgf·cm, 70.9—101.7 in·lbf}

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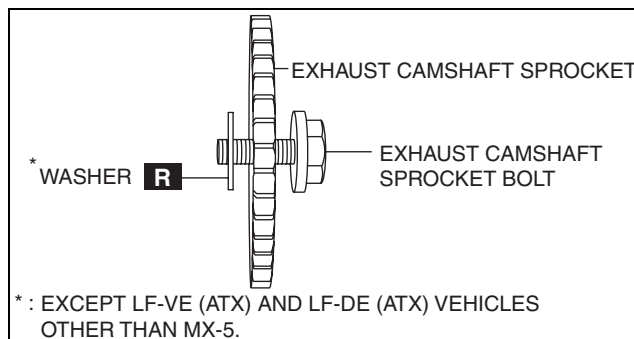
19. Install the exhaust camshaft sprocket bolt, exhaust camshaft sprocket, and a new washer (Except LF-VE (ATX) and LF-DE (ATX) vehicles other than MX-5.) as a single unit.

Caution

- Install a washer to the fourth or fifth thread of the exhaust camshaft sprocket bolt being careful not to drop the washer. (Except LF-VE (ATX) and LF-DE (ATX) vehicles other than MX-5.)
- Do not tighten the camshaft sprocket bolt at this stage. Verify the valve timing before performing the bolt tightening.

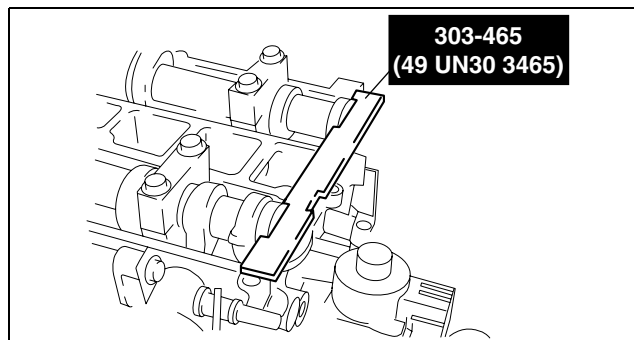
Note

- The washers do not have to be installed on the LF-VE (ATX) and LF-DE (ATX) vehicles other than MX-5 (there is no problem with installing them).
- Be careful not to install a washer on only the IN or EX side.
 - If the washers are not installed, do not install the washers to both the IN and EX sides.
 - If the washers are to be installed, install them on both the IN and EX sides.



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20. Install the **SST** to the camshaft as shown in the figure.
21. Remove the M6 × 1.0 bolt from the engine front cover to apply tension to the timing chain.
22. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.



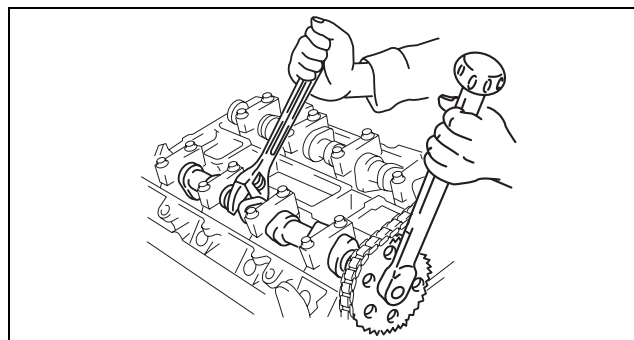
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23. Hold the exhaust camshaft using a suitable wrench on the cast hexagon as shown in the figure.
24. Tighten the exhaust camshaft sprocket lock bolt.

Tightening torque

69—75 N·m {7.1—7.6 kgf·m, 50.9—55.3 ft·lbf}

25. Remove the **SST** from the camshaft.
26. Remove the **SST** from the block lower blind plug.
27. Rotate the crankshaft clockwise two turns until the TDC position.
- If not aligned, loosen the camshaft sprocket lock bolt and repeat from Step 20.



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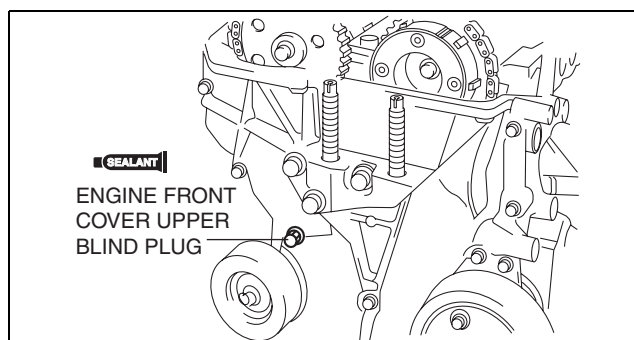
28. Apply the silicone sealant and install the engine front cover upper blind plug.

Note

- Install the engine front cover upper blind plug before the applied silicone sealant starts to harden.

Tightening torque

8.0—11.5 N·m {82—117 kgf·cm, 71—101 in·lbf}

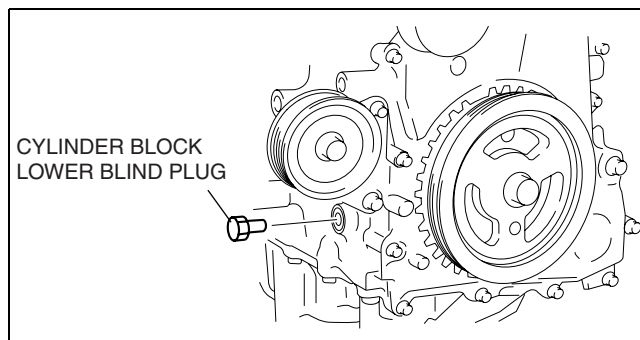


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29. Install the cylinder block lower blind plug.

Tightening torque
18—22 N·m {1.9—2.2 kgf·m, 13.3—16.2 ft·lbf}

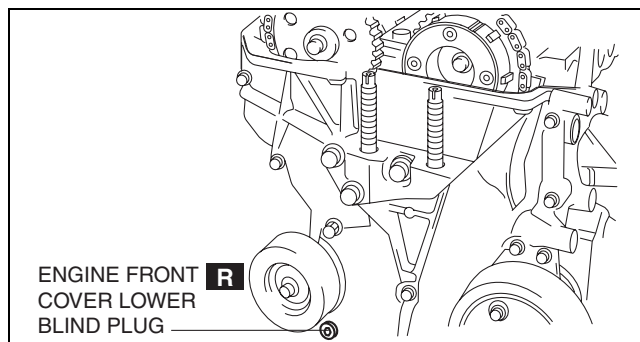


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30. Install the new engine front cover lower blind plug.

Tightening torque
10—14 N·m {102—142 kgf·cm, 89—123 in·lbf}



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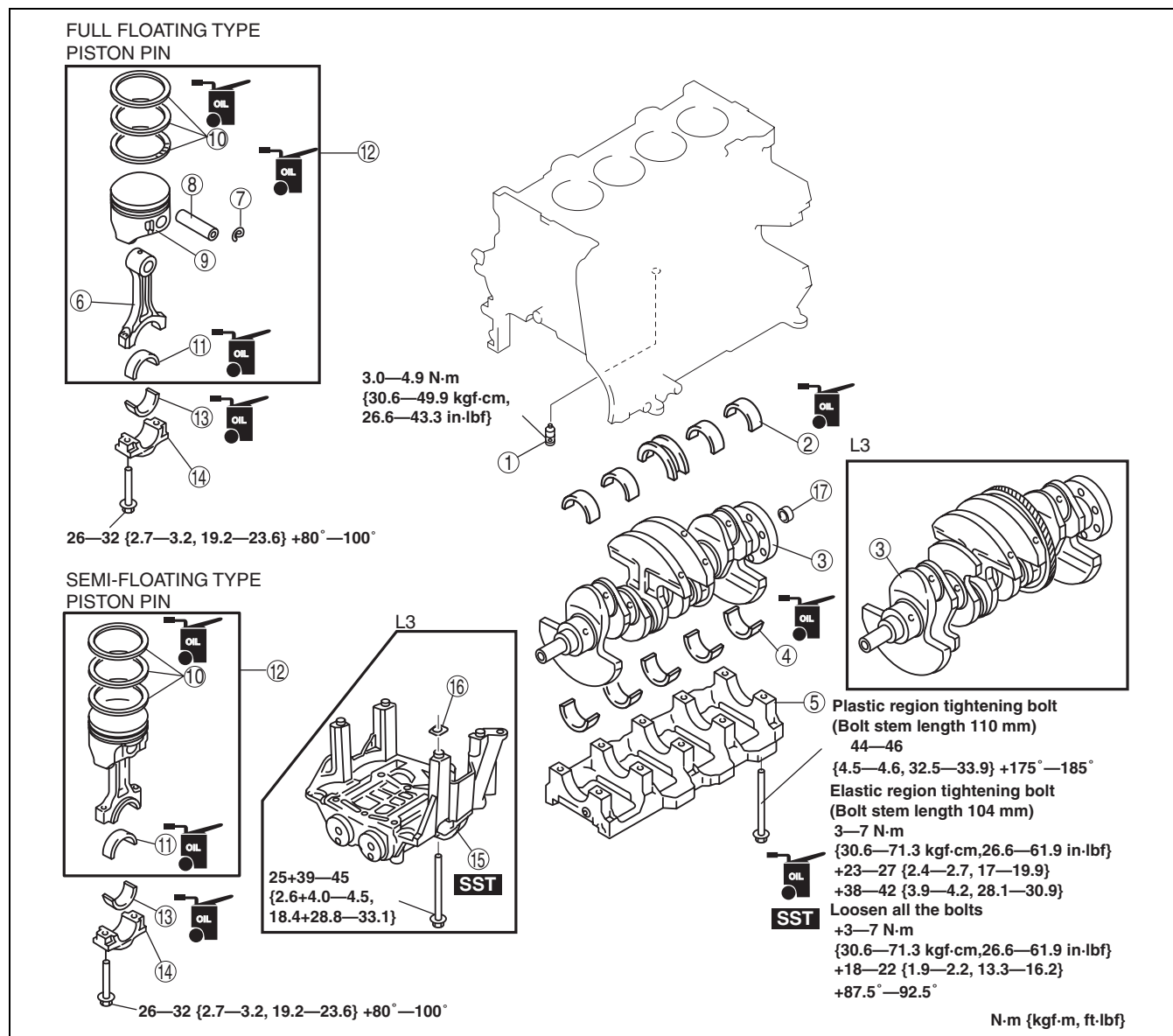
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CYLINDER BLOCK ASSEMBLY (I)

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1. Assemble in the order indicated in the table.



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1	Oil jet valve
2	Upper main bearing, thrust bearing
3	Crankshaft
4	Lower main bearing
5	Main bearing cap (See 01-10-36 Main Bearing Cap Assembly Note.)
6	Connecting rod (Full floating type piston pin)
7	Snap ring (Full floating type piston pin)
8	Piston pin (Full floating type piston pin) (See 01-10-36 Piston Pin Assembly Note.)
9	Piston (Full floating type piston pin)
10	Piston ring (See 01-10-36 Piston Ring Assembly Note.)
11	Upper connecting rod bearing (See 01-10-37 Connecting Rod Bearing Assembly Note.)

12	Connecting rod, piston assembly (See 01-10-37 Connecting Rod Bearing Assembly Note.)
13	Lower connecting rod bearing (See 01-10-37 Connecting Rod Bearing Assembly Note.)
14	Connecting rod cap (See 01-10-37 Connecting Rod Cap Assembly Note.)
15	Balancer unit (L3) (See 01-10-38 Balancer Unit Assembly Note.)
16	Adjustment shim (L3) (See 01-10-38 Balancer Unit Assembly Note.)
17	Pilot bearing (If equipped) (See 01-10-41 Pilot Bearing Assembly Note.)

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Main Bearing Cap Assembly Note

1. Install the main bearing caps in the order indicated in the figure.
2. Tighten the main bearing cap bolts using the SST (49 D032 316).

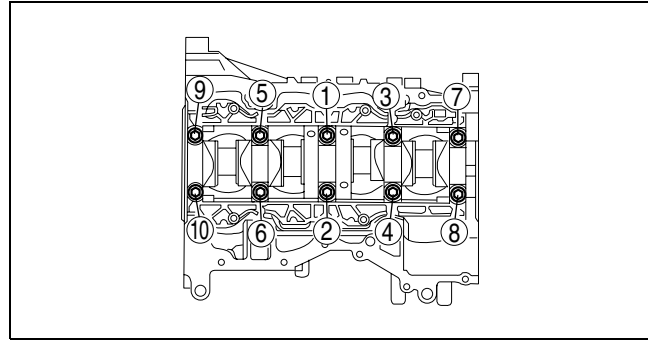
Tightening torque

Plastic region tightening bolt (Bolt stem length 110 mm)

- (1) 44—46 N·m {4.5—4.6 kgf·m, 32.5—33.9 ft·lbf}
- (2) 175°—185°

Elastic region tightening bolt (Bolt stem length 104 mm)

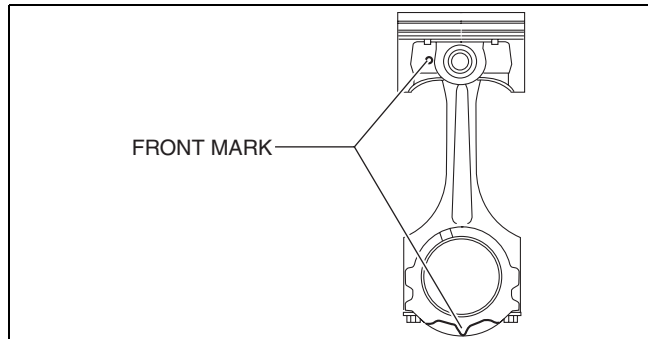
- (1) Apply engine oil to all bolts.
- (2) 3—7 N·m {30.6—71.3 kgf·cm, 26.6—61.9 in·lbf}
- (3) 23—27 N·m {2.4—2.7 kgf·m, 17—19.9 ft·lbf}
- (4) 38—42 N·m {3.9—4.2 kgf·m, 28.1—30.9 ft·lbf}
- (5) Loosen all the bolts. (no remaining torque.)
- (6) 3—7 N·m {30.6—71.3 kgf·cm, 26.6—61.9 in·lbf}
- (7) 18—22 N·m {1.9—2.2 kgf·m, 13.3—16.2 ft·lbf}
- (8) 87.5°—92.5°



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Piston Pin Assembly Note

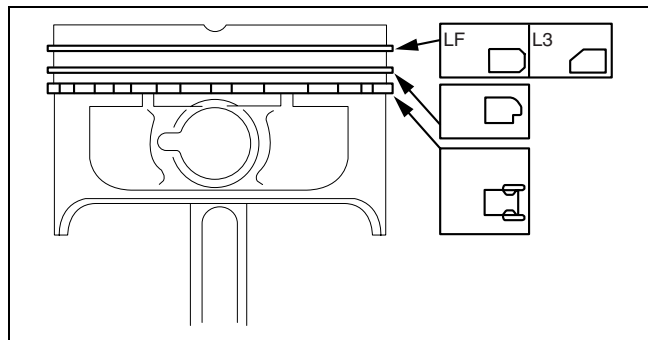
1. Assemble the piston pin so that the front marks of the piston and the connecting rod are positioned on the same surface.



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Piston Ring Assembly Note

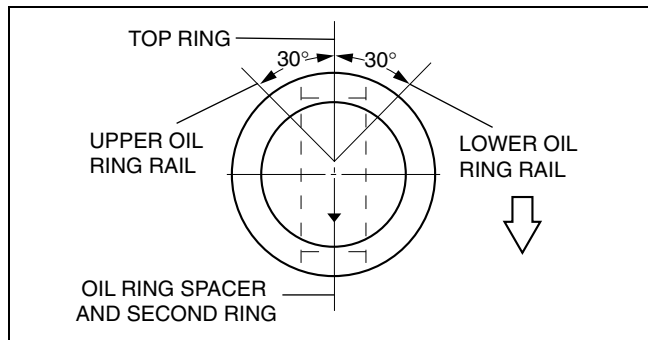
1. Install the two oil control ring segments and spacer.
2. Verify that the second ring is installed with scraper face side downward.
3. Verify that the top ring is installed with scraper face side inner of upper.



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Piston Assembly Note

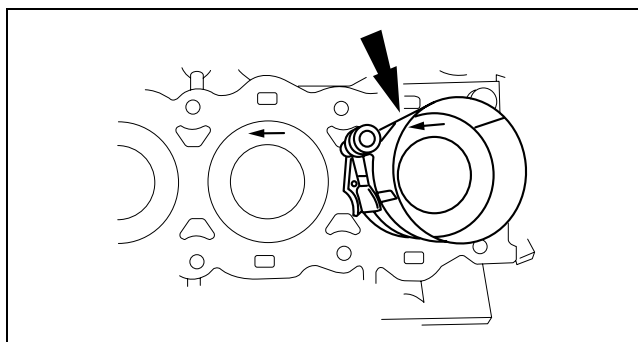
1. Position the end gap of each ring as indicated in the figure.



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2. Insert the piston and connecting rod into the cylinder with the arrow mark to front of the engine.



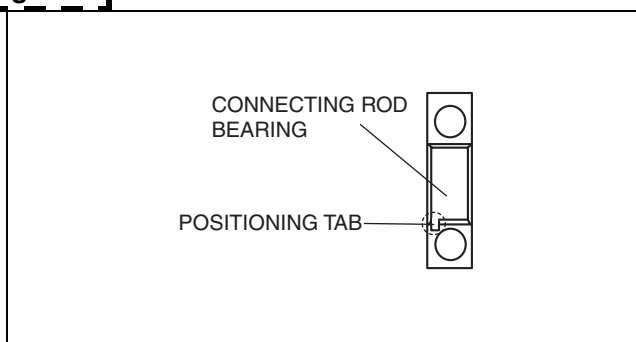
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Connecting Rod Bearing Assembly Note

1. Install the connecting rod bearing to the connecting rod and connecting rod caps, as shown in the figure.

If engine has connecting rod bearing with positioning tab

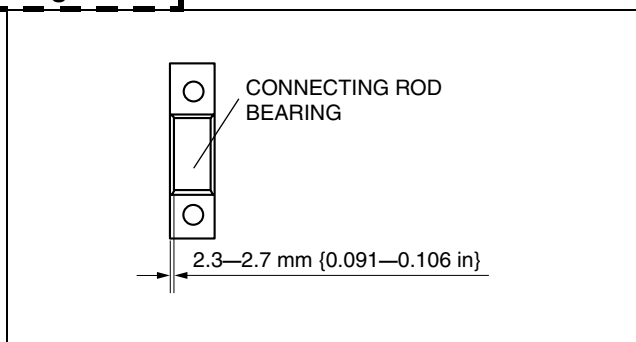


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If engine has no connecting rod bearing with positioning tab

Caution

- If there is no connecting rod bearing with positioning tabs at the large end of the connecting rod, install the connecting rod bearing so that the bearing is at the center of the connecting rod cap.



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Connecting Rod Cap Assembly Note

Caution

- When assembling the connecting rod caps, align the broken, rough faces of the connecting rods and connecting rod caps.

1. Tighten the connecting rod bolts in two steps using the **SST (49 D032 316)**.

Tightening torque

- (1) 26—32 N·m {2.7—3.2 kgf·m, 19.2—23.6 ft·lbf}
(2) 80°—100°

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Balancer Unit Assembly Note

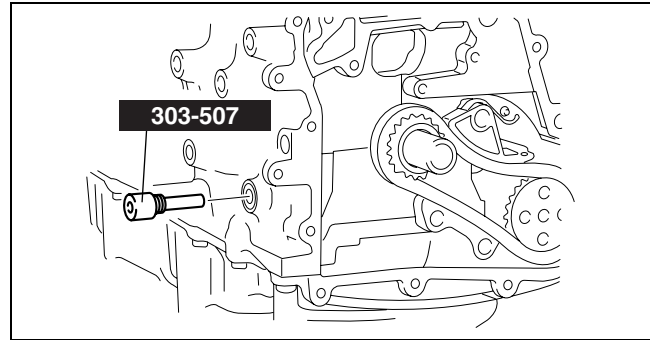
Caution

- The balancer unit cannot be disassembled due to the precision interior construction of the balancer unit.

1. Visually inspect the balancer unit gear for damage and verify that the shaft rotates smoothly.
 - If there is any malfunction, replace the balancer unit.
2. Remove the cylinder block lower blind plug and install the **SST**.
3. Rotate the crankshaft in the direction of engine rotation so that the No. 1 cylinder is at top dead center (TDC). (Until the counterweight contacts the **SST** and stops.)

Note

- If the cylinder block, crankshaft, crankshaft main bearing, and balancer unit are not replaced, use the adjustment shim as it is. In this case, go to Step 12.

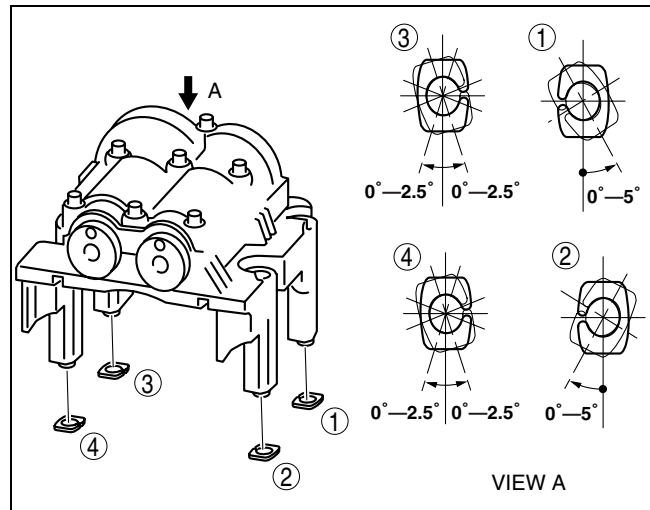


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4. Assemble the master shims (No. 50) to the shim seating face of the balancer unit at the angles shown in the figure.

Caution

- Engage the gears slowly and place the balancer unit on the cylinder block while being careful not to contact the balancer unit gear strongly with the crankshaft drive gear and damage it.

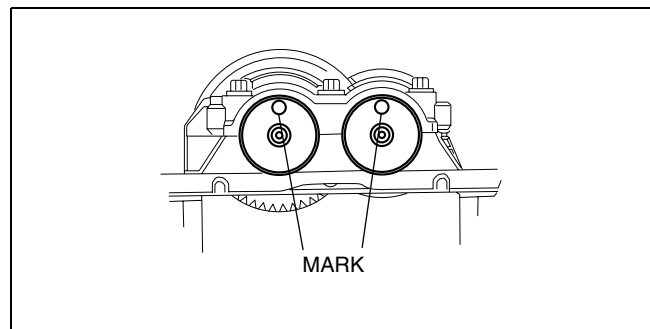


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5. With the balancer unit marks at the exact top center positions, assemble the balancer unit to the cylinder block and tighten the bolts in a criss-cross pattern in two steps.

Tightening torque

- 1st step: 25 N·m {2.5 kgf·m, 18 ft·lbf}
2nd step: 44—46 N·m {4.5—4.6 kgf·m, 32.5—33.9 ft·lbf}

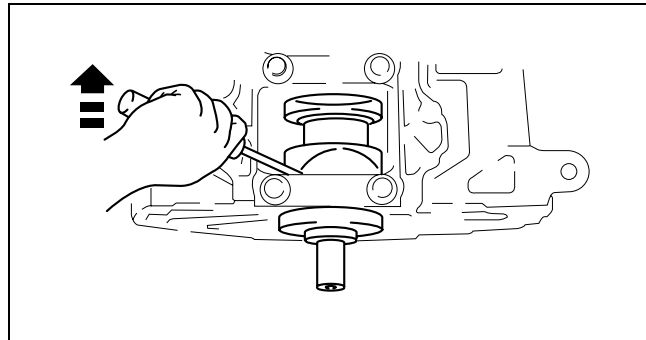


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6. Remove the **SST** installed in Step 2.
7. Measure the gear backlash using the following procedure.
 - (1) Place the ATDC marks 10°, 30°, 100°, 190°, 210°, 280° on the rear side of the crankshaft to indicate the angles.

MECHANICAL

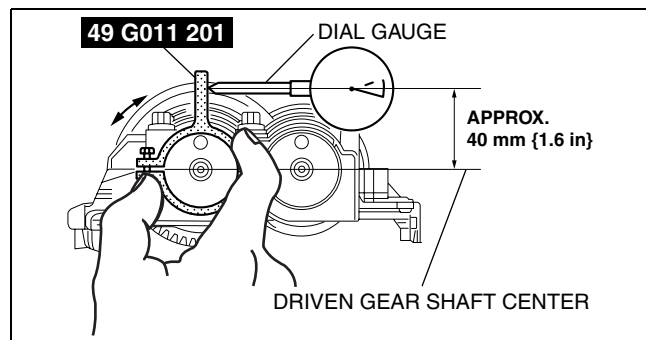
- (2) Insert a flathead screwdriver into the crankshaft No.1 counterweight area and set both the rotation and the thrust direction with the flathead screwdriver, using a prying action, as shown in the figure for accurate measurement of the backlash.



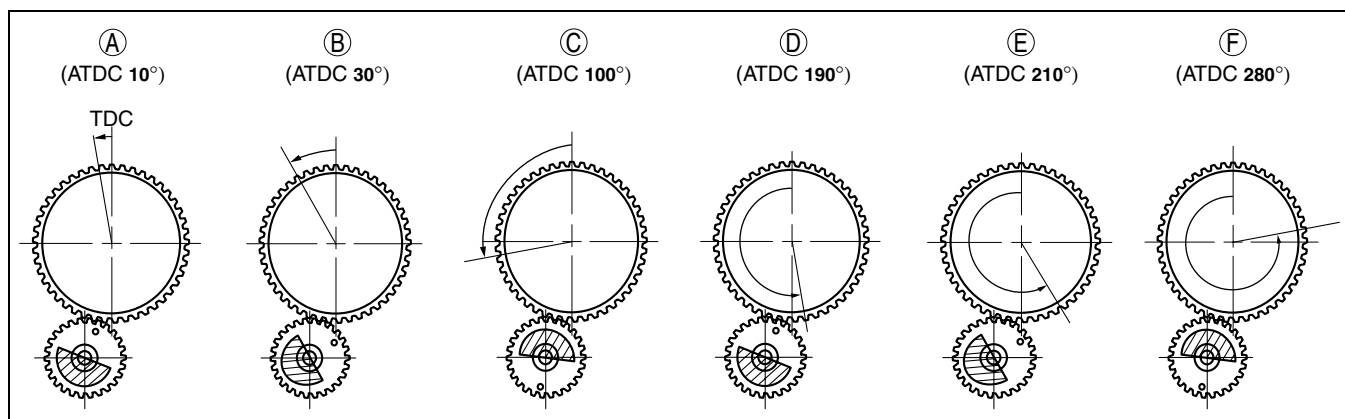
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- (3) Set the **SST** and a dial gauge as shown in the figure.
 (4) Rotate the driven gear to the left and right so that the crankshaft drive gear and balancer unit gear contact each other lightly.
 8. Measure the gear backlash using the following procedure.
 (1) When measuring the backlash, rotate the crankshaft one full rotation and measure the backlash at 6 locations (A to F) as shown in the figure.



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9. Select the adjustment shim from the selection table based on the measured minimum value of the backlash.

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Adjustment shim selection table

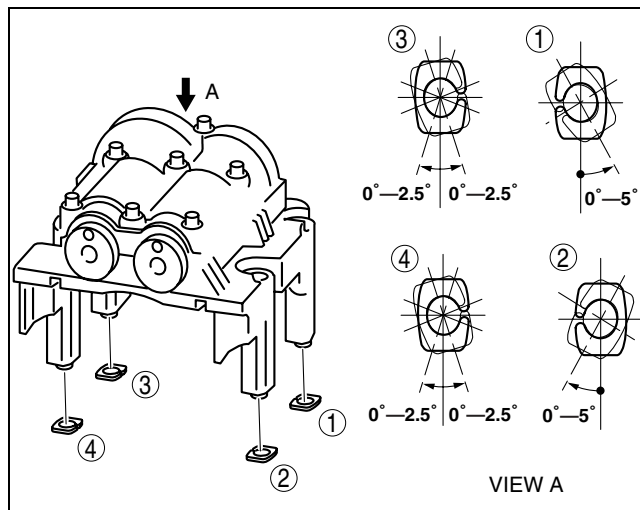
Measured backlash mm {in}	Selection shim (No.)	Shim thickness mm {in}	Measured backlash mm {in}	Selection shim (No.)	Shim thickness mm {in}
0.267—0.273 {0.01051— 0.01074}	15	1.15 {0.0452}	0.127—0.133 {0.00500— 0.00523}	35	1.35 {0.0531}
0.260—0.266 {0.01023— 0.01047}	16	1.16 {0.0456}	0.120—0.126 {0.00472— 0.00496}	36	1.36 {0.0535}
0.253—0.259 {0.00996— 0.01019}	17	1.17 {0.0460}	0.113—0.119 {0.00444— 0.00468}	37	1.37 {0.0539}
0.246—0.252 {0.00968— 0.00992}	18	1.18 {0.0464}	0.106—0.112 {0.00417— 0.00440}	38	1.38 {0.0543}
0.239—0.245 {0.00940— 0.00964}	19	1.19 {0.0468}	0.099—0.105 {0.00389— 0.00413}	39	1.39 {0.0547}
0.232—0.238 {0.00913— 0.00937}	20	1.20 {0.0472}	0.092—0.098 {0.00362— 0.00385}	40	1.40 {0.0551}
0.225—0.231 {0.00885— 0.00909}	21	1.21 {0.0476}	0.085—0.091 {0.00334— 0.00358}	41	1.41 {0.0555}
0.218—0.224 {0.00858— 0.00881}	22	1.22 {0.0480}	0.078—0.084 {0.00307— 0.00330}	42	1.42 {0.0559}
0.211—0.217 {0.00830— 0.00854}	23	1.23 {0.0484}	0.071—0.077 {0.00279— 0.00303}	43	1.43 {0.0562}
0.204—0.210 {0.00803— 0.00826}	24	1.24 {0.0488}	0.064—0.070 {0.00251— 0.00275}	44	1.44 {0.0566}
0.197—0.203 {0.00775— 0.00799}	25	1.25 {0.492}	0.057—0.063 {0.00224— 0.00248}	45	1.45 {0.0570}
0.190—0.196 {0.00748— 0.00771}	26	1.26 {0.496}	0.050—0.056 {0.00196— 0.00220}	46	1.46 {0.0574}
0.183—0.189 {0.00720— 0.00744}	27	1.27 {0.499}	0.043—0.049 {0.00169— 0.00192}	47	1.47 {0.0578}
0.176—0.182 {0.00692— 0.00716}	28	1.28 {0.503}	0.036—0.042 {0.00141— 0.00165}	48	1.48 {0.0582}
0.169—0.175 {0.00665— 0.00688}	29	1.29 {0.507}	0.029—0.035 {0.00114— 0.00137}	49	1.49 {0.0586}
0.162—0.168 {0.00637— 0.00661}	30	1.30 {0.511}	0.022—0.028 {0.000866— 0.0110}	50 (master shim)	1.50 {0.0590}
0.155—0.161 {0.00610— 0.00633}	31	1.31 {0.515}	0.015—0.021 {0.00059— 0.000826}	51	1.51 {0.0594}
0.148—0.154 {0.00582— 0.00606}	32	1.32 {0.519}	0.008—0.014 {0.000314— 0.000551}	52	1.52 {0.0598}
0.141—0.147 {0.00555— 0.00578}	33	1.33 {0.523}	0.001—0.007 {0.00003— 0.000275}	53	1.53 {0.0602}
0.134—0.140 {0.00527— 0.00551}	34	1.34 {0.527}	0.000—0.000 {0.000—0.000}	54	1.54 {0.0606}

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10. Verify that the No. 1 cylinder is at TDC.
 - If not aligned, perform Steps 2—3.
11. Remove the master shim from the balancer unit and assemble the selected adjustment shim at the angles shown in the figure.
12. Perform Steps 5—7.
13. Verify that the measured backlash is within the specified range.
 - If the backlash exceeds the maximum specification, replace the adjustment shim and repeat Steps 4—12.

Measured backlash maximum
0.01—0.1 mm {0.0004—0.0039 in}

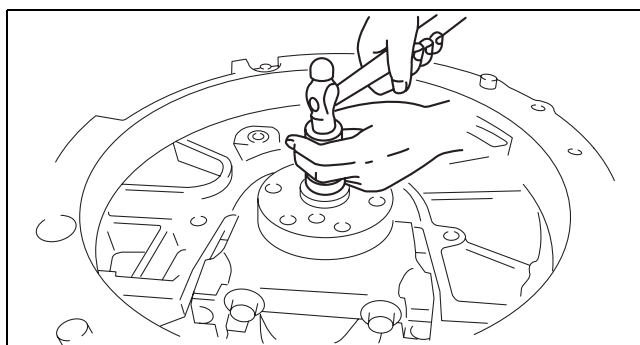


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Pilot Bearing Assembly Note

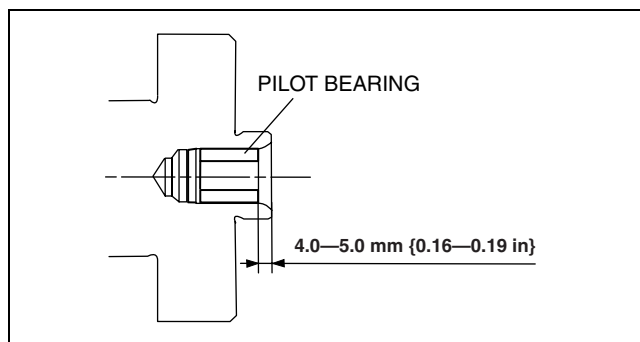
1. Assemble the pilot bearing using the corresponding 20 mm {0.79 in} side of a Snap-on brand millimeter size bushing driver set A160M adapter A160M7 (20—22 mm {0.79—0.86 in}) or substitution tool.



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Substitution tool

Outer diameter: 21 mm {0.83 in}
Inner diameter: 19 mm {0.75 in}



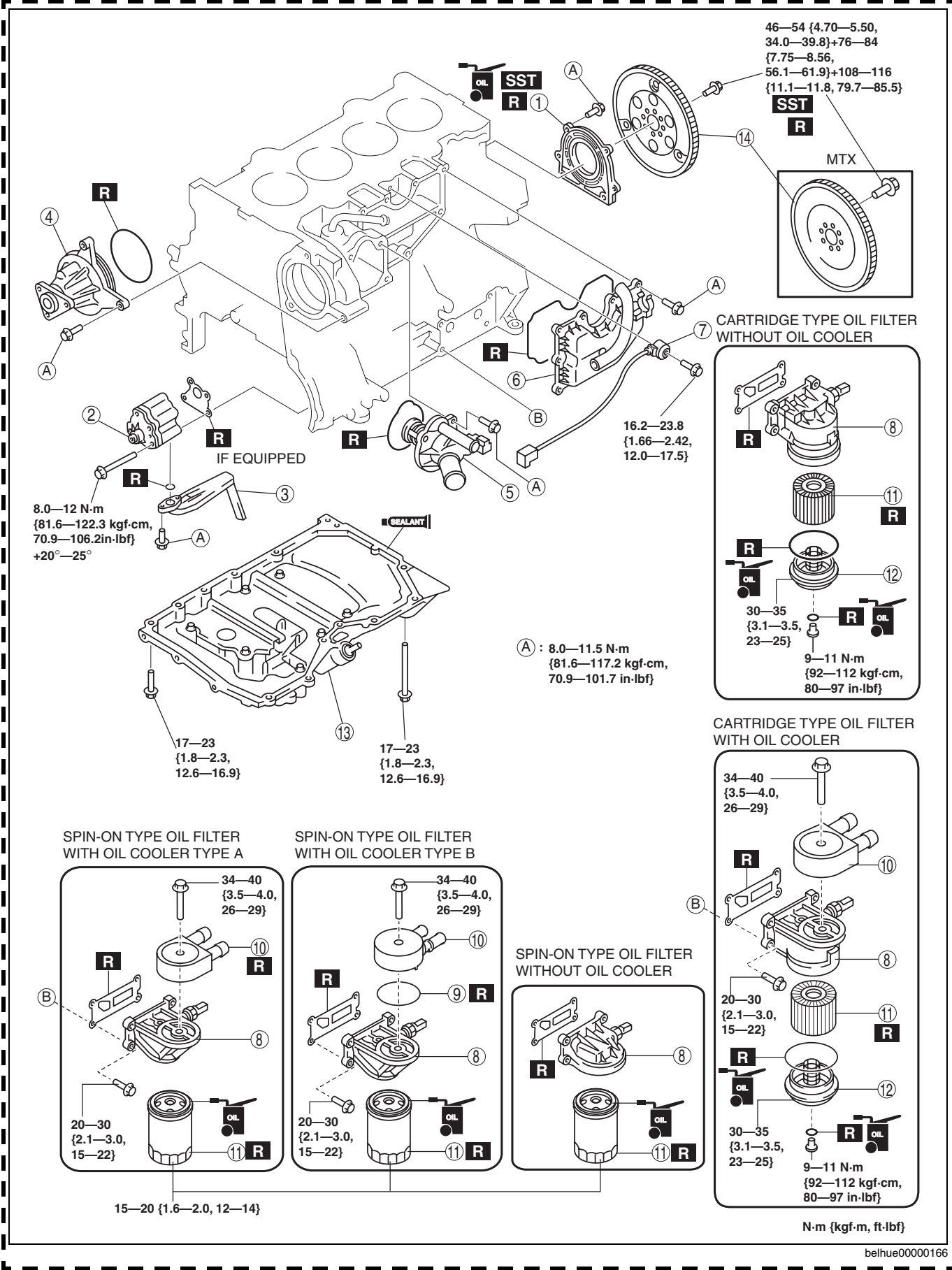
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CYLINDER BLOCK ASSEMBLY (II)

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1. Assemble in the order indicated in the table.



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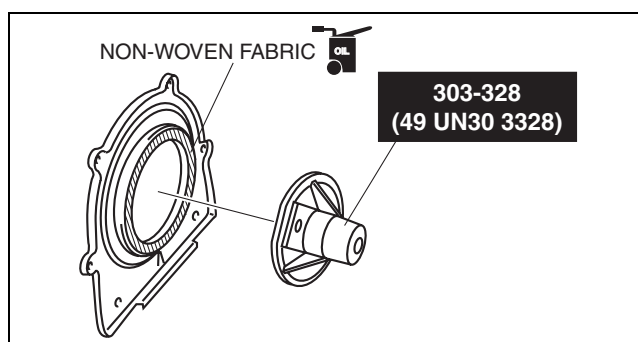
1	Rear oil seal (See 01-10-43 Rear Oil Seal Assembly Note.)
2	Oil pump
3	Oil strainer
4	Water pump
5	Thermostat
6	Oil separator
7	Knock sensor
8	Oil filter adapter

9	Gasket (See 01-10-44 Gasket Assembly Note.)
10	Oil cooler (See 01-10-44-1 Oil Cooler Type B Assembly Note.)
11	Oil filter
12	Oil filter cover (cartridge type)
13	Oil pan (See 01-10-44-2 Oil pan Assembly Note)
14	Flywheel (MTX), Drive plate (ATX) (See 01-10-44 Drive Plate (ATX), Flywheel (MTX) Assembly Note.)

01-10

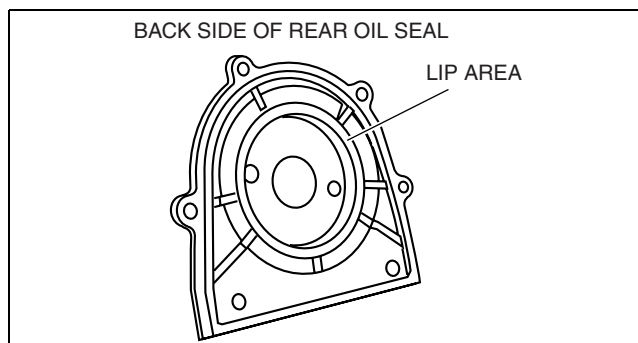
Rear Oil Seal Assembly Note

1. Apply clean engine oil to the new oil seal lip.
2. Install the **SST** to the non-woven fabric side of the rear oil seal.



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3. From the back side of the rear oil seal, verify that there is no damage or separation in the lip area of the rear oil seal.
4. Install the rear oil seal to the engine as shown in the figure.

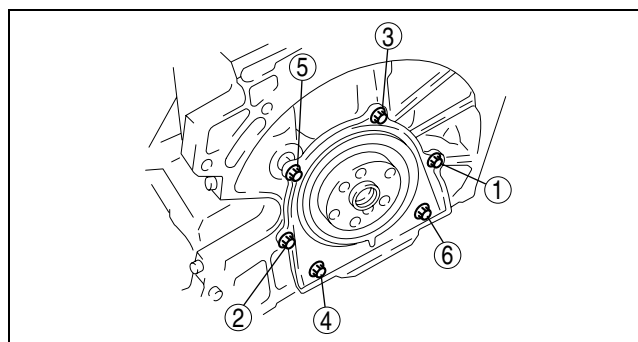


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5. Tighten the rear oil seal bolts in the order as shown in the figure.

Tightening torque

8.0—11.5 N·m {81.6—117.2 kgf·cm, 70.9—101.7 in·lbf}



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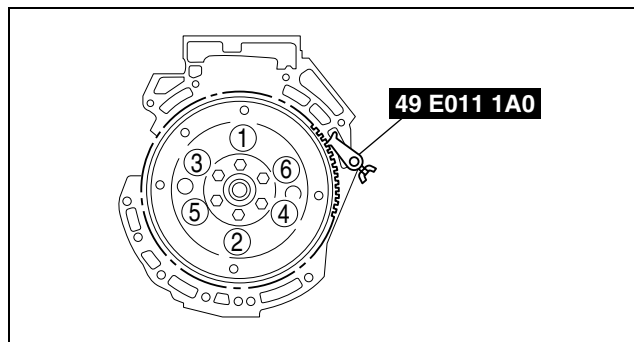
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Drive Plate (ATX), Flywheel (MTX) Assembly Note

1. Hold the crankshaft using the SST.
2. Tighten the bolts in the 3 steps in the figure.

Tightening torque

- (1) 46—54 N·m {4.70—5.50 kgf·m, 34.0—39.8 ft·lbf}
- (2) 76—84 N·m {7.75—8.56 kgf·m, 56.1—61.9 ft·lbf}
- (3) 108—116 N·m {11.1—11.8 kgf·m, 79.7—85.5 ft·lbf}



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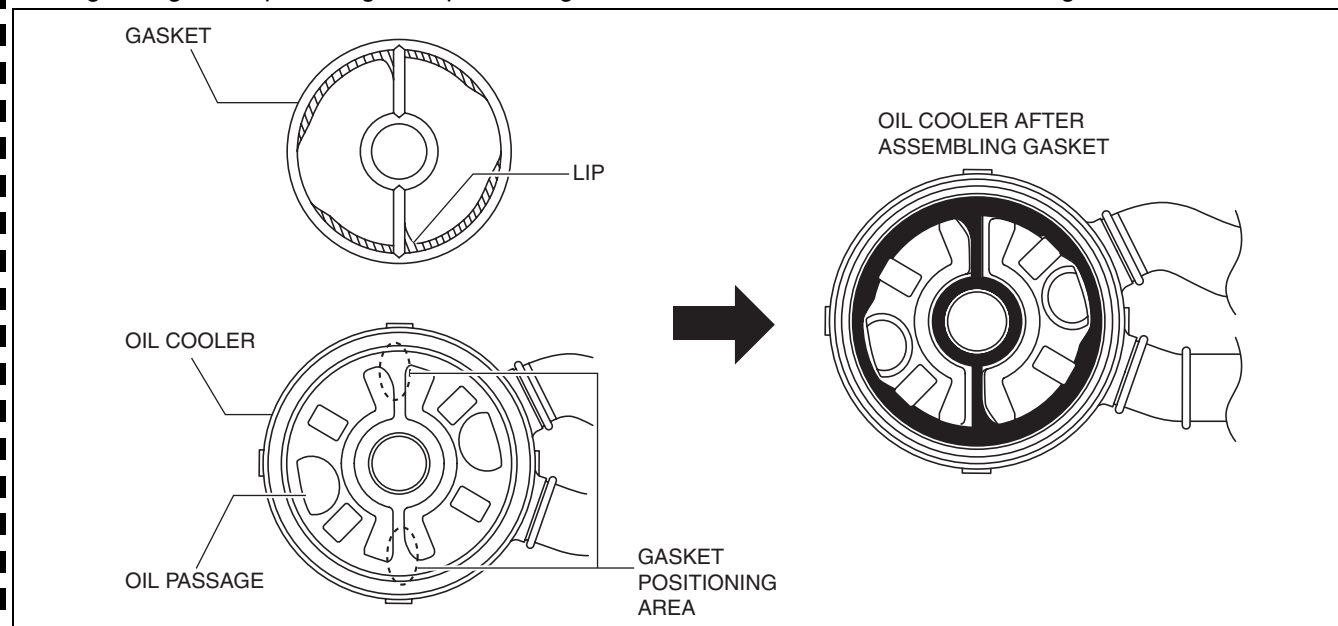
Gasket Assembly Note

1. Apply engine oil to a new gasket.

Caution

- Assemble the gasket to the correct position using the following procedure so that the gasket lip does not overlap the oil passage for the oil cooler. Otherwise, it could leak engine oil and damage the engine.

2. Align the gasket lip to the gasket positioning areas of the oil cooler and assemble the gasket to the oil cooler.



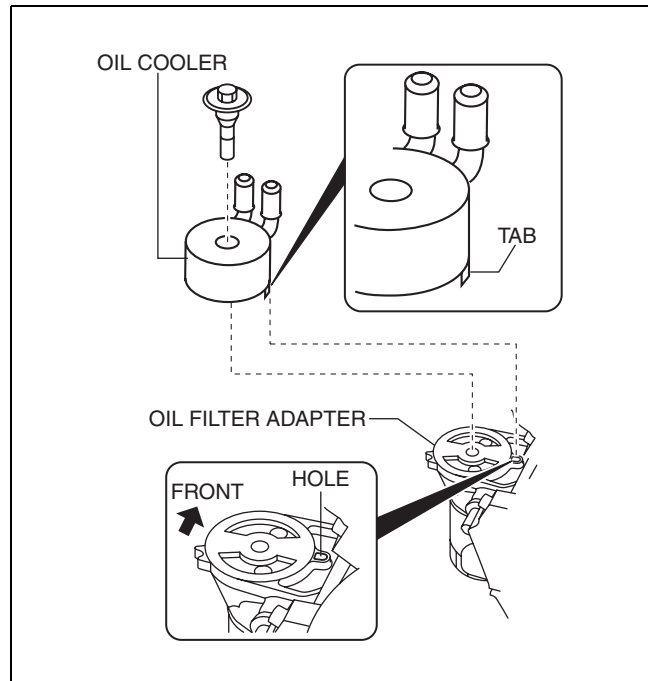
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Oil Cooler Type B Assembly Note

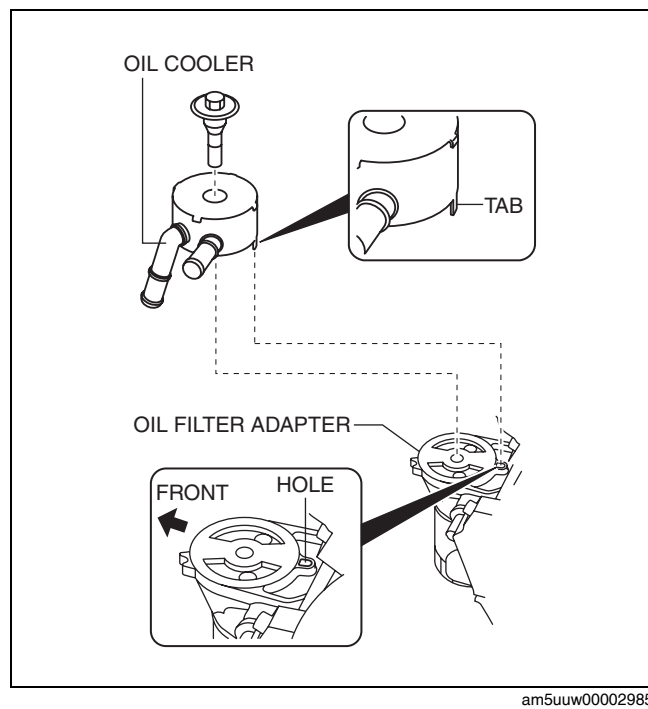
1. Align one of the positioning tabs on the oil cooler as shown in the figure to the oil filter adapter hole, and install the oil cooler.

Both pipes pointed above oil cooler



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Both pipes not pointed above oil cooler



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Oil pan Assembly Note

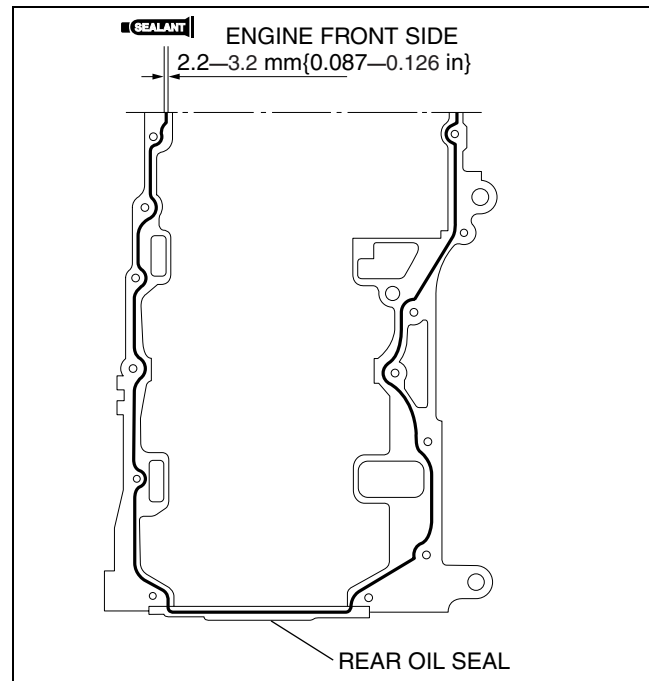
1. Apply a continuous bead of silicone sealant to the oil pan as indicated in the figure.

Note

- Install the oil pan before the applied silicone sealant starts to harden.

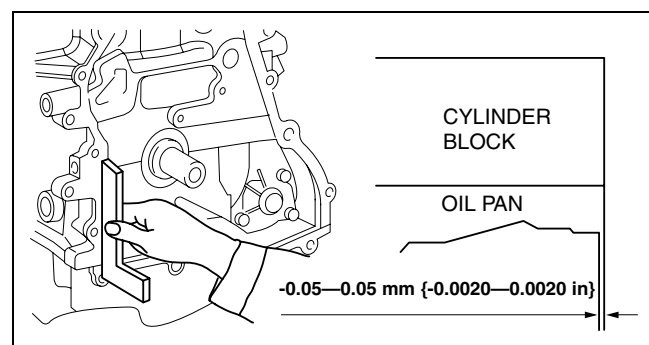
Caution

- Install the oil pan before the applied silicone sealant starts to harden.
- Make sure that there is no oil or dust on the seal side of oil pan.



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2. Use a square ruler to unite the oil pan and the cylinder block junction side on the engine front cover side.

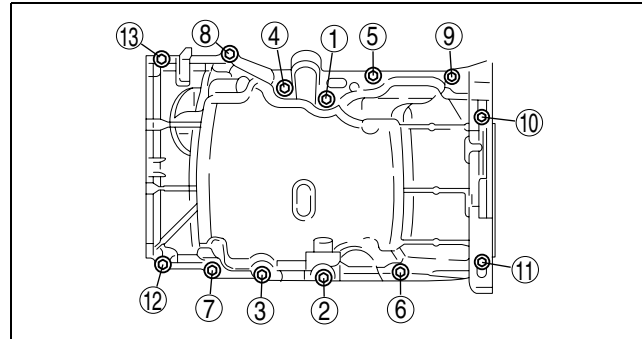


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3. Tighten the rear oil pan bolts in the order as shown in the figure.

Tightening torque
 17—23 N·m {1.8—2.3 kgf·m, 12.6—16.9 ft·lbf}



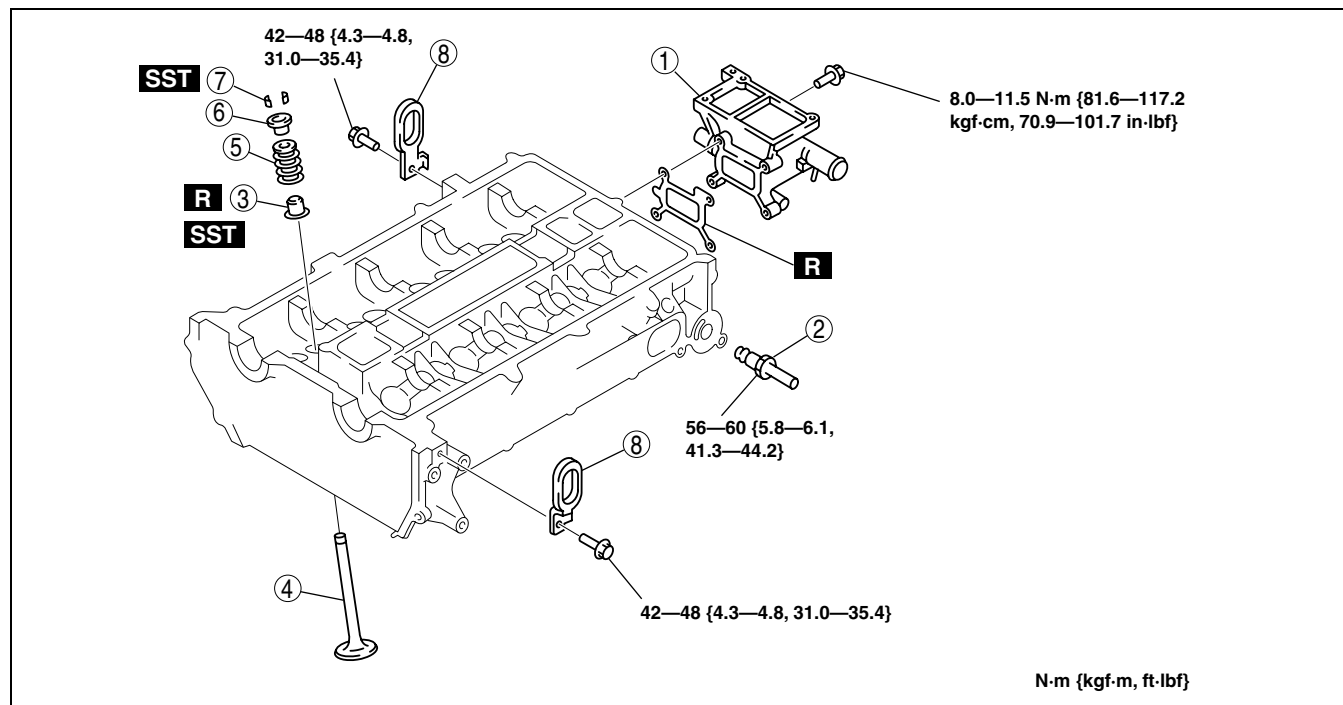
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CYLINDER HEAD ASSEMBLY (I)

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1. Assemble in the order indicated in the table.



N·m {kgf·m, ft·lbf}

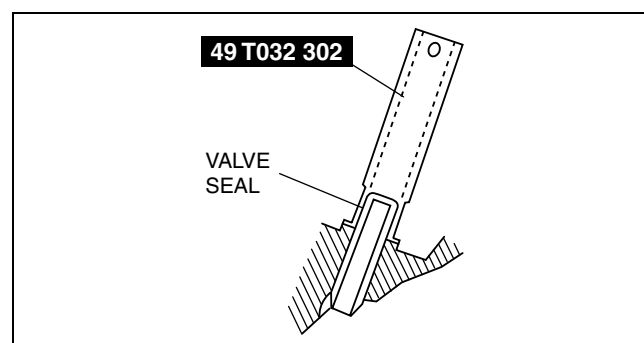
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1	Water outlet
2	EGR pipe
3	Valve seal (See 01-10-45 Valve Seal Assembly Note.)
4	Valve

5	Valve spring
6	Upper valve spring seat
7	Valve keeper (See 01-10-46 Valve Keeper Assembly Note.)
8	Engine hanger

Valve Seal Assembly Note

1. Press the valve seal onto the valve guide by hand.
2. Lightly tap the SST using a plastic hammer.



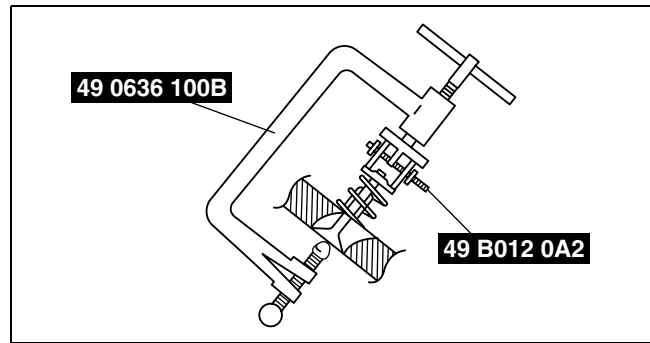
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Valve Keeper Assembly Note

1. Install the valve keeper using the SSTs.



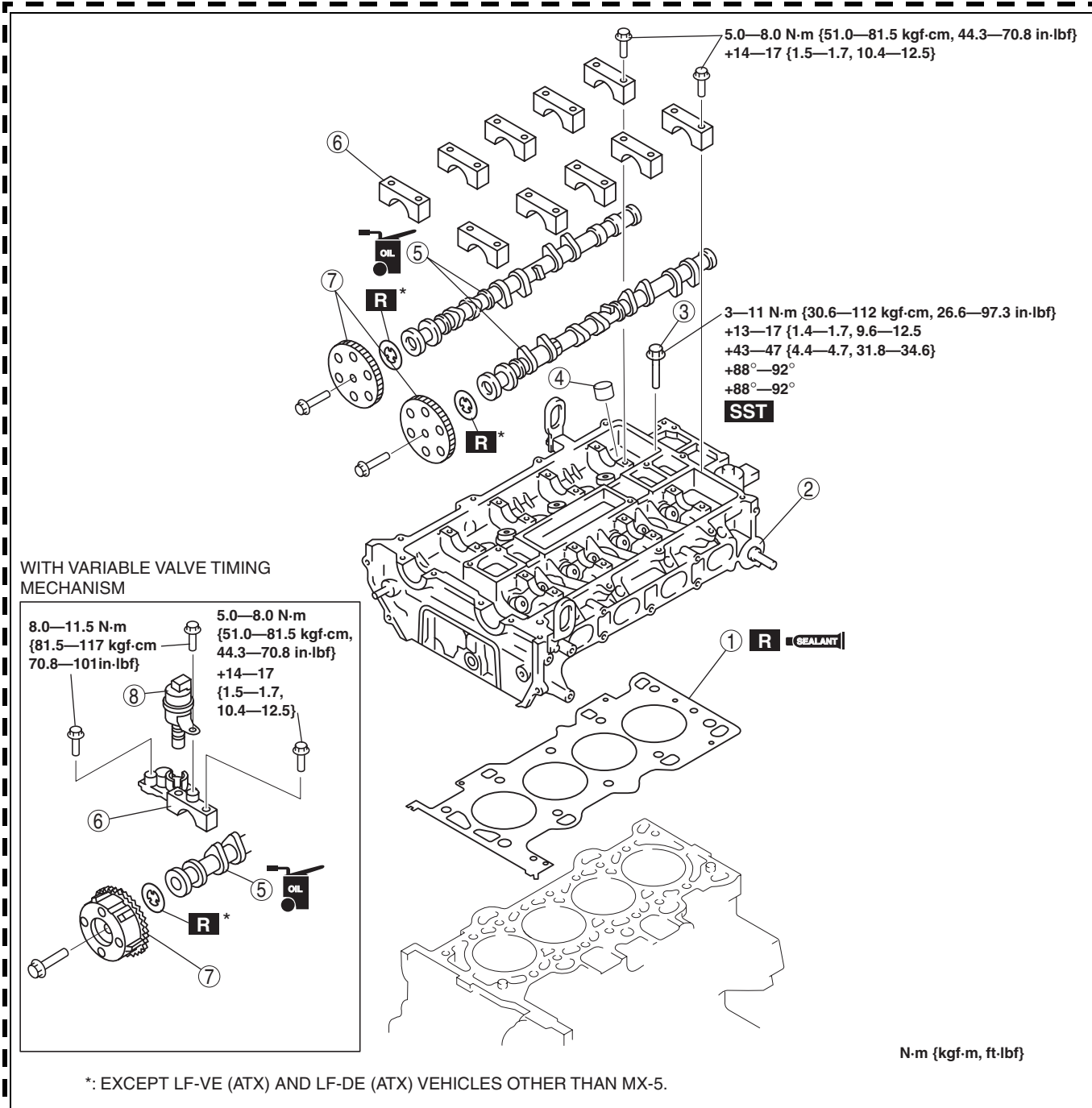
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CYLINDER HEAD ASSEMBLY (II)

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1. Assemble in the order indicated in the table.



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1	Cylinder head gasket (See 01-10-48 Cylinder Head Gasket Assembly Note.)
2	Cylinder head
3	Cylinder head bolt (See 01-10-48 Cylinder Head Bolt Assembly Note.)
4	Tappet

5	Camshaft (See 01-10-49 Camshaft Assembly Note.)
6	Camshaft cap
7	Camshaft sprocket, variable valve timing actuator (See 01-10-49 Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note.)
8	OCV (With variable valve timing mechanism)

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Cylinder Head Gasket Assembly Note

1. Apply silicone sealant to the areas shown in the figure.

Caution

- Install the cylinder head gasket and cylinder head before the applied silicone sealant starts to harden.

Thickness

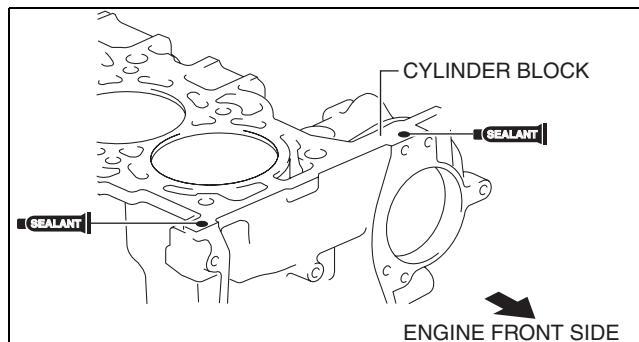
4—7 mm {0.16—0.27 in}

2. Install the cylinder block with a new cylinder head gasket.
3. Apply silicone sealant to the areas shown in the figure.

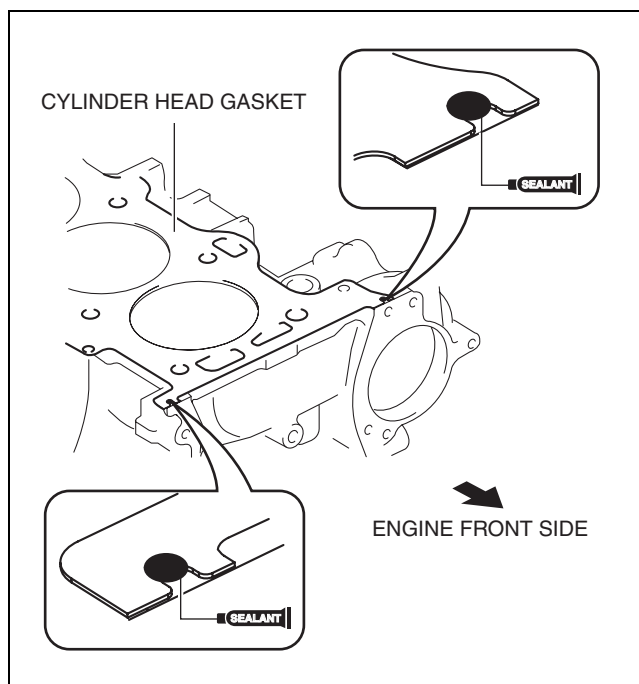
Thickness

4—7 mm {0.16—0.27 in}

4. Install the cylinder head referring to the Cylinder Head Assembly Note.



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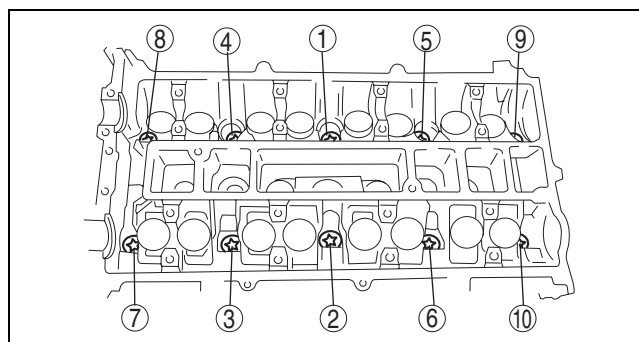
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Cylinder Head Bolt Assembly Note

1. Tighten the cylinder head bolts in the order indicated in the figure in 5 steps using the **SST (49 D032 316)**.

Tightening torque

- (1) 3—11 N·m {30.6—112 kgf·cm, 26.6—97.3 in·lbf}
- (2) 13—17 N·m {1.4—1.7 kgf·m, 9.6—12.5 ft·lbf}
- (3) 43—47 N·m {4.4—4.7 kgf·m, 31.8—34.6 ft·lbf}
- (4) 88°—92°
- (5) 88°—92°

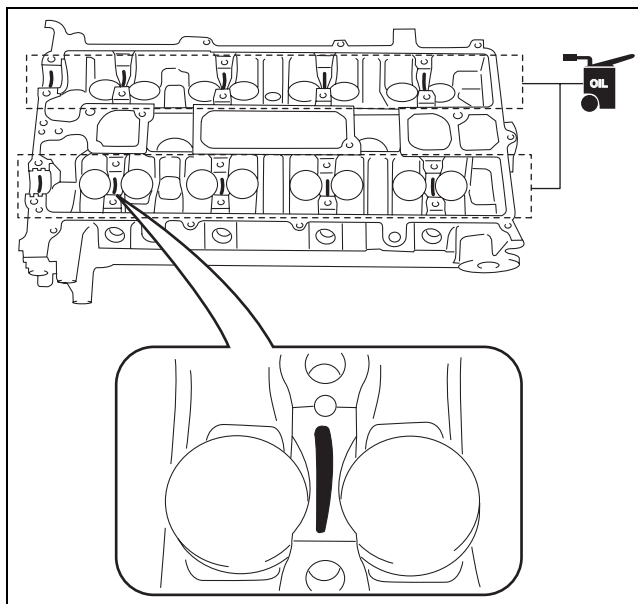


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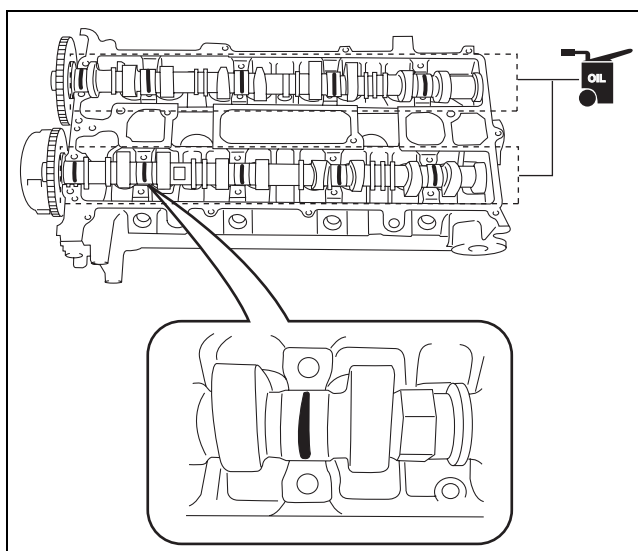
Camshaft Assembly Note

1. Apply the gear oil (SAE No. 90 or equivalent) to each journal of the cylinder head as shown in the figure.
2. Set the cam position of No.1 cylinder at the top dead center (TDC) and install the camshaft.



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3. Apply the gear oil (SAE No. 90 or equivalent) to each journal of the camshaft as shown in the figure.
4. Temporarily tighten the camshaft bearing caps evenly in 2—3 passes.

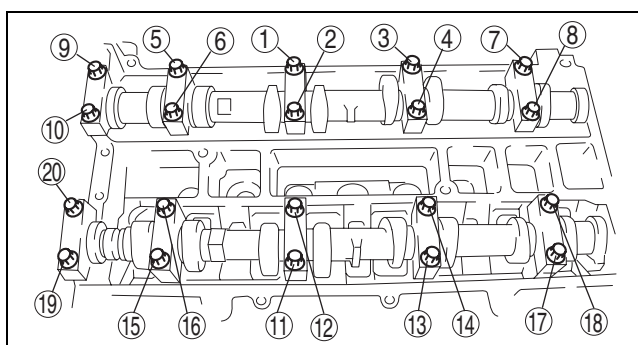


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5. Tighten the camshaft cap bolts in the order shown with the following two steps.

Tightening torque

- (1) 5.0—8.0 N·m {51.0—81.5 kgf·cm, 44.3—70.8 in·lbf}
- (2) 14—17 N·m {1.5—1.7 kgf·m, 10.4—12.5 ft·lbf}



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Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note

1. Temporarily tighten the camshaft sprocket or variable valve timing actuator installation bolts by hand until the timing chain is installed.
2. Fully tighten the camshaft sprocket or variable valve timing actuator installation bolts after timing chain installation.

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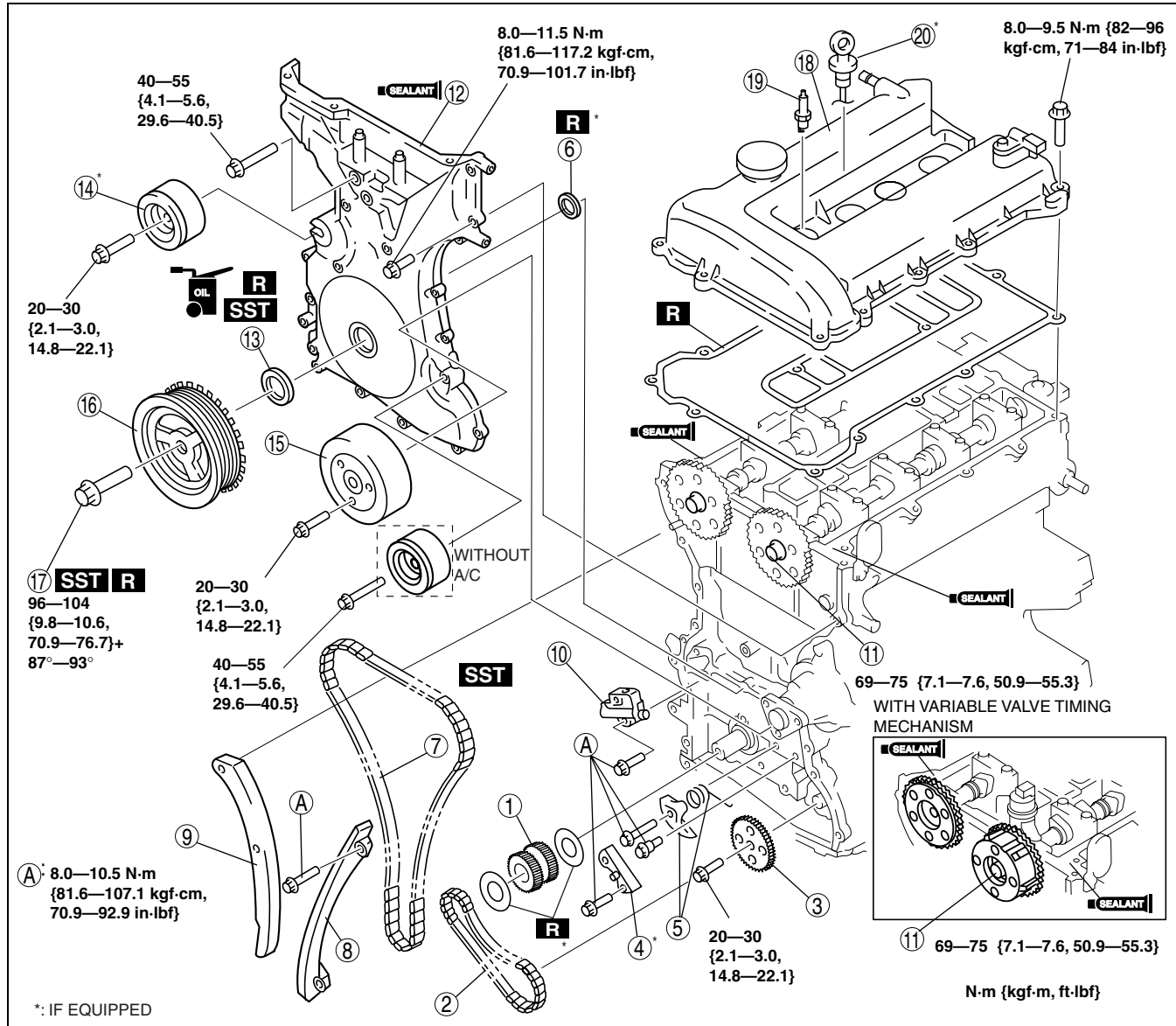
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TIMING CHAIN ASSEMBLY

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1. Assemble in the order indicated in the table.



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1	Crankshaft sprocket
2	Oil pump chain
3	Oil pump sprocket (See 01-10-51 Oil Pump Sprocket Assembly Note.)
4	Oil pump chain guide (if equipped)
5	Oil pump chain tensioner
6	Seal (if equipped)
7	Timing chain (See 01-10-51 Timing Chain Assembly Note.)
8	Chain guide
9	Tensioner arm
10	Chain tensioner
11	Camshaft sprocket, variable valve timing actuator (See 01-10-52 Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note.)

12	Engine front cover (See 01-10-53 Engine Front Cover Assembly Note.)
13	Front oil seal (See 01-10-52 Front Oil Seal Assembly Note.)
14	Drive belt idler pulley (if equipped)
15	Water pump pulley
16	Crankshaft pulley
17	Crankshaft pulley lock bolt (See 01-10-54 Crankshaft Pulley Lock Bolt Assembly Note.)
18	Cylinder head cover (See 01-10-55 Cylinder Head Cover Assembly Note)
19	Spark plug
20	Dipstick (if equipped)

01-10-50

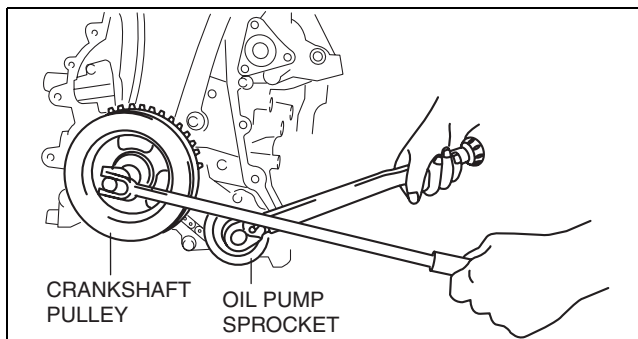
MECHANICAL

Oil Pump Sprocket Assembly Note

1. Temporarily install the crankshaft pulley and crankshaft pulley lock bolt to the crankshaft, and lock the oil pump against rotation as shown in figure.
2. Install the oil pump sprocket, and then remove the crankshaft pulley and crankshaft pulley lock bolt.

Tightening torque

20—30 N·m {2.1—3.0 kgf·m, 14.8—22.1 ft·lbf}



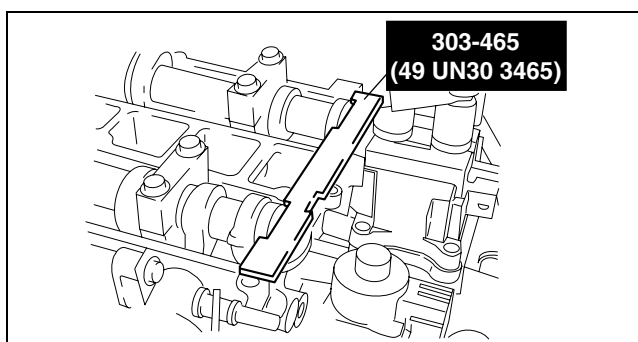
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01-10

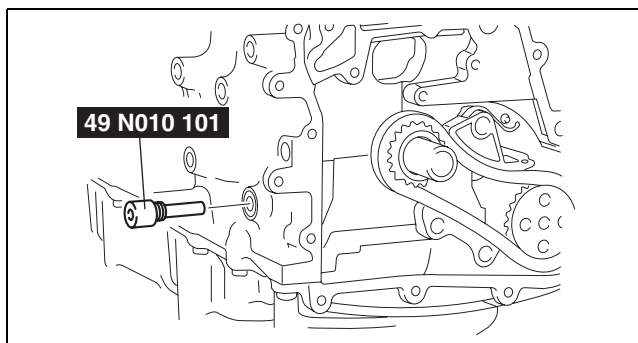
Timing Chain Assembly Note

1. Install the **SST** to the camshaft, then align the No. 1 camshaft position with the TDC.
2. Remove the cylinder block lower blind plug.
3. Install the **SST** as shown in the figure.

Cylinder block lower blind plug hole diameter: M8



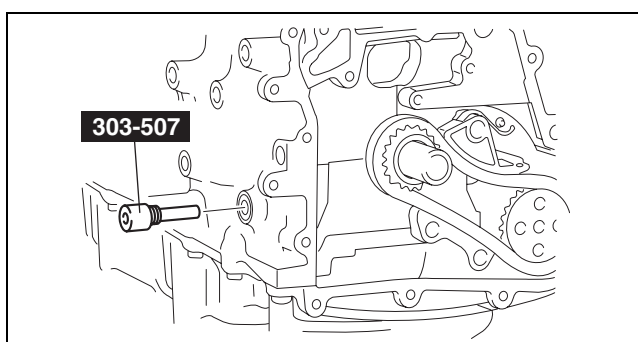
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Cylinder block lower blind plug hole diameter: M10

4. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.
5. Install the timing chain.

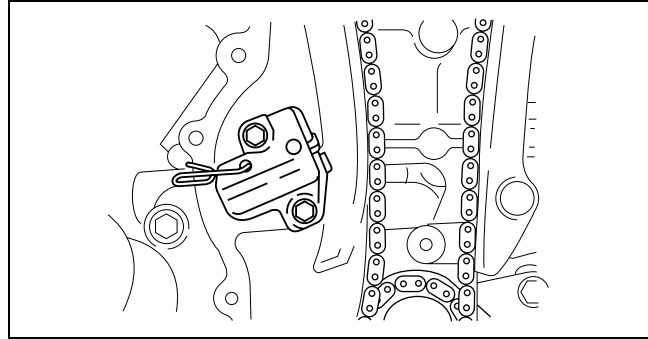


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01-10-51

MECHANICAL

6. Install the chain tensioner and remove the retaining wire.



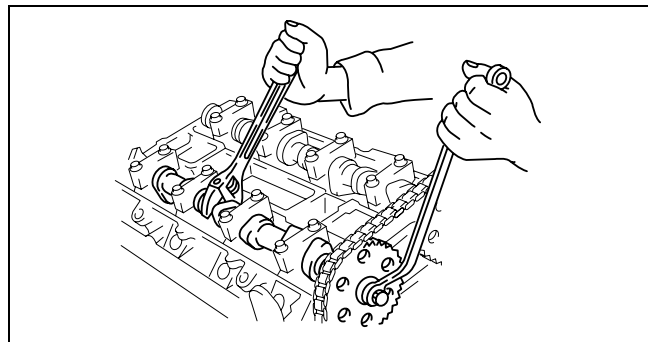
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Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note

1. Hold the camshaft using a suitable wrench on the cast hexagon as shown in the figure.
2. Tighten the camshaft sprocket lock bolt.

Tightening torque

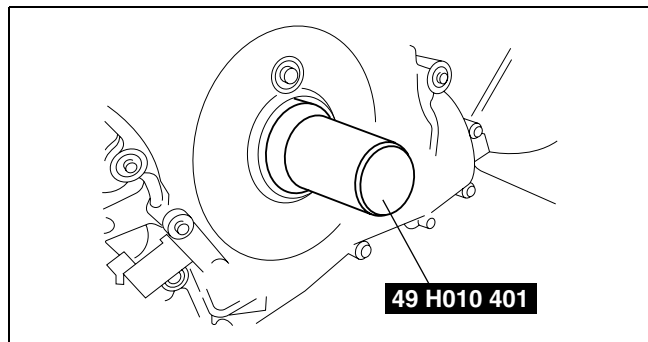
69—75 N·m {7.1—7.6 kgf·m, 50.9—55.3 ft·lbf}



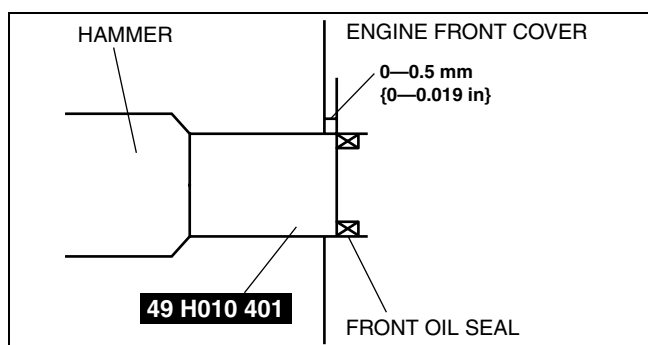
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Front Oil Seal Assembly Note

1. Apply clean engine oil to the oil seal.
2. Push the oil seal slightly in by hand.
3. Compress the oil seal using the **SST** and a hammer.



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Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

Engine Front Cover Assembly Note

1. Apply silicone sealant to the engine front cover as shown in the figure.

Caution

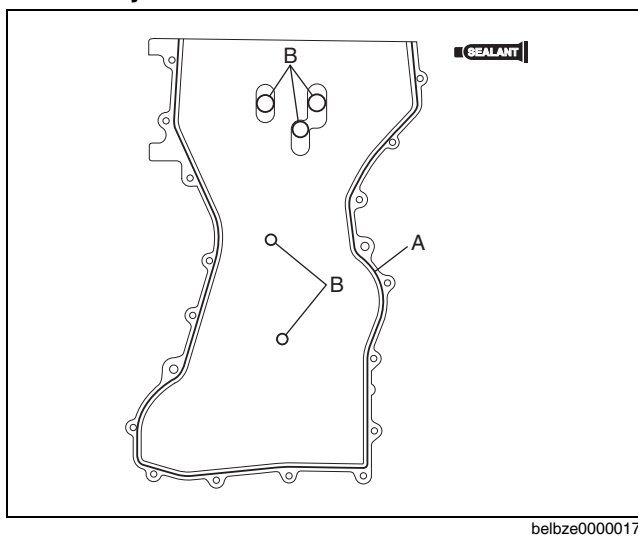
- **Install the engine front cover before the applied silicone sealant starts to harden.**
- **Completely remove any oil, dirt, sealant, or other foreign matter adhering to the engine front cover and engine front cover installation surface. If any oil, dirt, sealant, or other foreign matter is not removed from the space between the engine front cover and engine front cover installation surface, it may cause a sealing malfunction.**

01-10

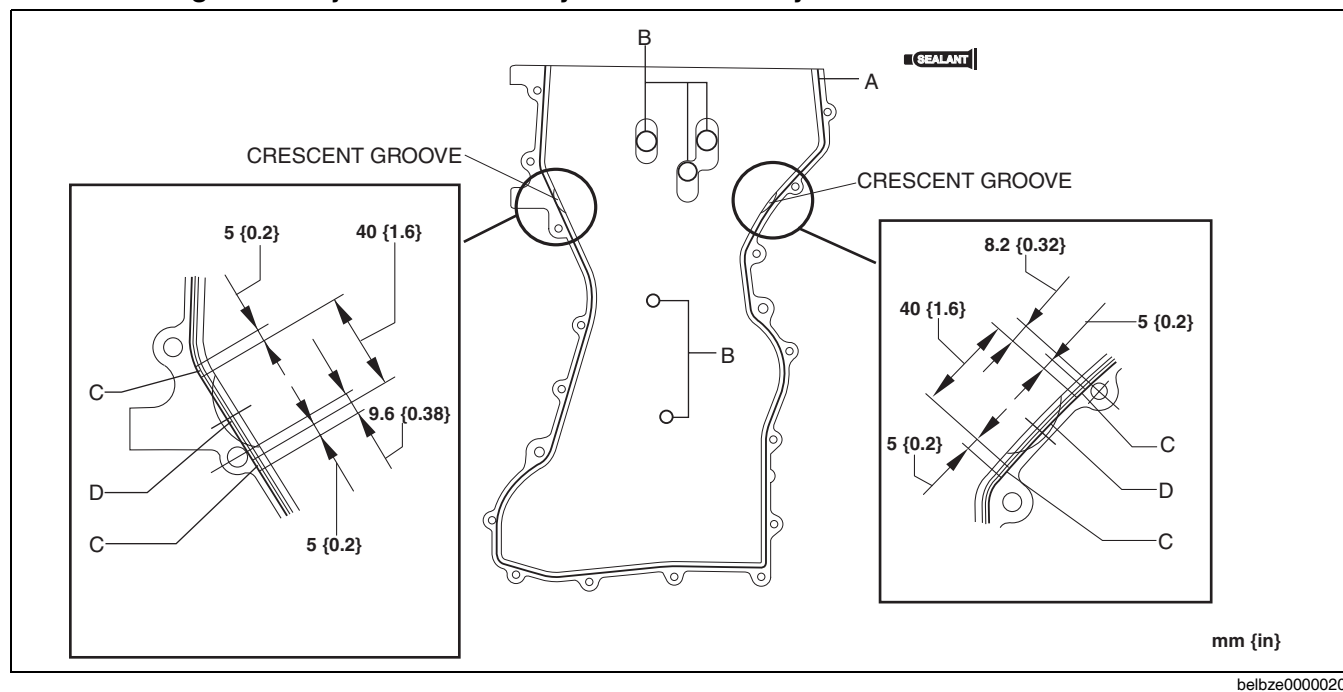
Without crescent grooves at joint sections of cylinder head and cylinder block

Thickness

- A: 2.2—3.2 mm {0.087—0.12 in}
B: 1.5—2.5 mm {0.06—0.098 in}



With crescent grooves at joint sections of cylinder head and cylinder block



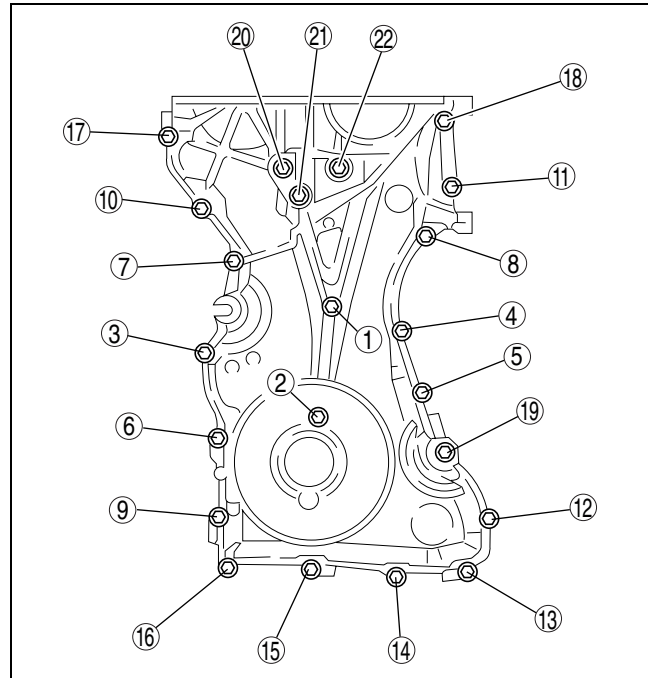
Thickness

- A: 2.2—3.2 mm {0.087—0.12 in}
B: 1.5—2.5 mm {0.06—0.098 in}
C: 2.2—4.3 mm {0.09—0.16 in}
D: 3.3—4.3 mm {0.13—0.16 in}

Engine Workshop Manual LF L3 (1972-1U-08K) MECHANICAL

2. Install the cylinder head cover bolts in the order as shown in the figure.

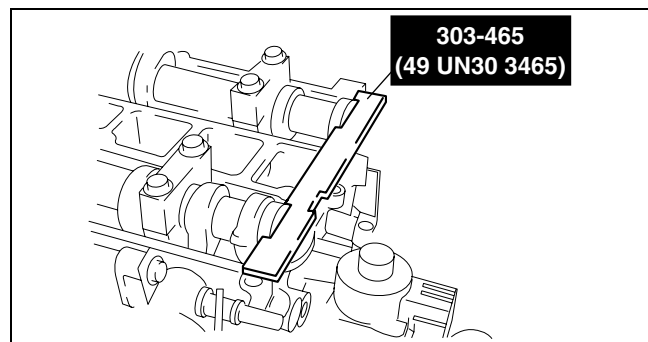
Bolt No.	Tightening torque N·m {kgf·m, ft·lbf}
1—18	8.0—11.5 N·m {81.6—117.2 kgf·cm, 70.9—101.7 in·lbf}
19—22	40—55 {4.1—5.6, 29.6—40.5}



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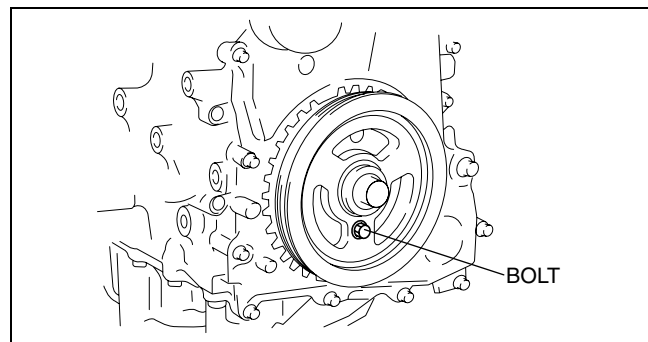
Crankshaft Pulley Lock Bolt Assembly Note

1. Install the **SST** to the camshaft as shown in the figure.



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2. Install the M6 ¥ 1.0 bolt in by hand.
3. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.



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MECHANICAL

4. Hold the crankshaft pulley using the **SST**.
5. Tighten the crankshaft pulley lock bolt in the order shown following two steps using the **SST (49 D032 316)**.

Tightening torque

- (1) 96—104 N·m {9.8—10.6 kgf·m, 70.9—76.7 ft·lbf}
- (2) 87°—93°

6. Remove the M6 × 1.0 bolt.
7. Remove the **SST** from the camshaft.
8. Remove the **SST** from the block lower blind plug.
9. Rotate the crankshaft clockwise two turns until the TDC position.
 - If not aligned, loosen the crankshaft pulley lock bolt and repeat from Step 1.
10. Install the cylinder block lower blind plug.

Tightening torque

- 18—22 N·m {1.9—2.2 kgf·m, 13.3—16.2 ft·lbf}

Cylinder Head Cover Assembly Note

1. Apply silicone sealant to the mating faces as shown in the figure.

Caution

- Install the cylinder head cover before the applied silicone sealant starts to harden.

Dot diameter

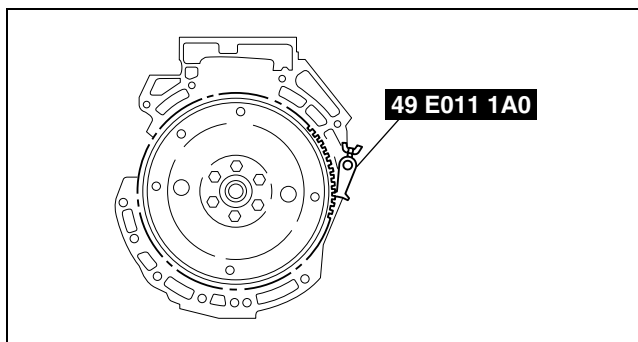
- 4.0—6.0 mm {0.16—0.23 in}

2. Install the cylinder head cover with a new gasket.

3. Tighten the bolts in the order shown in the figure.

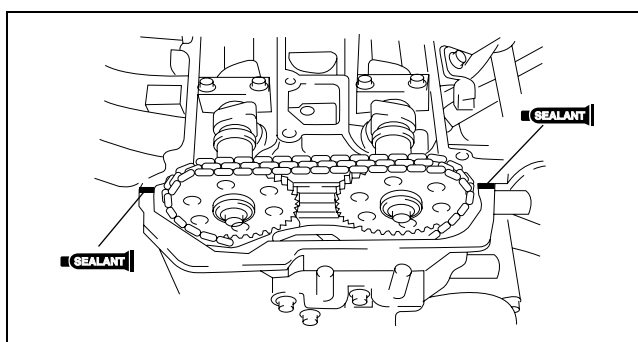
Tightening torque

- 8.0 —9.5 N·m {82—96 kgf·cm, 71—84 in·lbf}

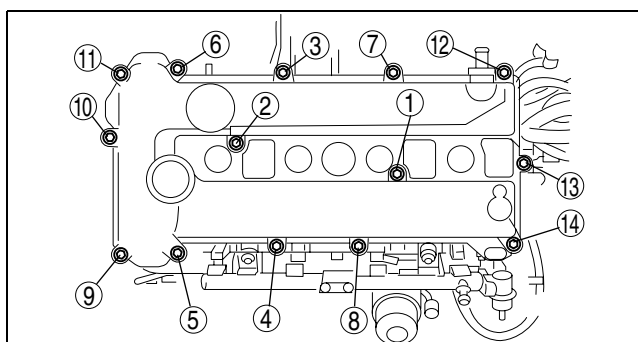


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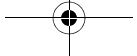
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Engine Workshop Manual LF L3 (1972-1U-08K)
TECHNICAL DATA

01-50 TECHNICAL DATA

ENGINE TECHNICAL DATA 01-50-1

ENGINE TECHNICAL DATA

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01-50

Item	Specification
Cylinder head gasket contact surface distortion (Maximum)	0.10 mm {0.004 in}
Manifold contact surfaces distortion (Maximum)	0.10 mm {0.004 in}
Manifold contact surfaces distortion (Maximum grinding)	0.15 mm {0.006 in}
Valve head margin thickness (Minimum)	IN: 1.62 mm {0.0637 in} EX: 1.82 mm {0.0716 in}
Valve length (Standard)	IN: 102.99—103.79 mm {4.055—4.086 in} EX: 104.25—105.05 mm {4.105—4.135 in}
Valve length (Minimum)	IN: 102.99 mm {4.055 in} EX: 104.25 mm {4.104 in}
Valve stem diameter (Standard)	IN: 5.470—5.485 mm {0.2154—0.2159 in} EX: 5.465—5.480 mm {0.2152—0.2157 in}
Valve stem diameter (Minimum)	IN: 5.440 mm {0.2142 in} EX: 5.435 mm {0.2140 in}
Valve guide inner diameter (Standard)	5.509—5.539 mm {0.2169—0.2180 in}
Valve stem to guide clearance (Standard)	IN: 0.024—0.069 mm {0.0009—0.0027 in} EX: 0.029—0.074 mm {0.0012—0.0029 in}
Valve stem to guide clearance (Maximum)	0.10 mm {0.004 in}
Valve guide protrusion height (standard)	12.2—12.8 mm {0.481—0.503 in}
Valve seat contact width (Standard)	1.2—1.6 mm {0.048—0.062 in}
Valve protrusion height (Standard)	IN: 40.64—42.24 mm {1.600—1.662 in} EX: 40.50—42.10 mm {1.595—1.657 in}
Valve spring standard height	Valve spring with pink paint mark: 30.2 mm {1.19 in} (pressing force 388.7 N {39.64 kgf, 87.38 lbf}) Except above: 28.68 mm {1.129 in} (pressing force 390 N {39.76 kgf, 87.67 lbf})
Valve spring out-of-square (Maximum)	1.95 mm {0.0767 in}
Maximum runout (Maximum)	0.03 mm {0.0012 in}
Camshaft standard height	With variable valve timing mechanism IN: 42.44 mm {1.671 in} EX: 41.18 mm {1.621 in} Without variable valve timing mechanism IN: 42.12 mm {1.659 in} EX: 41.08 mm {1.618 in}
Camshaft minimum height	With variable valve timing mechanism IN: 42.33 mm {1.666 in} EX: 41.06 mm {1.616 in} Without variable valve timing mechanism IN: 42.01 mm {1.653 in} EX: 40.96 mm {1.612 in}
Camshaft journal diameter (Standard)	24.96—24.98 mm {0.9827—0.9834 in}
Camshaft journal diameter (Minimum)	24.95 mm {0.982 in}
Camshaft journal oil clearance (Standard)	0.035—0.080 mm {0.0014—0.0031 in}
Camshaft journal oil clearance (Maximum)	0.09 mm {0.0035 in}
Camshaft end play (Standard)	0.09—0.24 mm {0.0035—0.0094 in}
Camshaft end play (Maximum)	0.25 mm {0.0098 in}
Tappet bore diameter (Standard)	31.000—31.030 mm {1.2205—1.2216 in}
Tappet diameter (Standard)	30.970—30.980 mm {1.2193—1.2196 in}
Tappet-to-Tappet bore oil clearance (Standard)	0.02—0.06 mm {0.0008—0.0023 in}
Tappet-to-Tappet bore oil clearance (Maximum)	0.15 mm {0.006 in}
Cylinder head gasket contact surfaces distortion (Maximum)	0.10 mm {0.004 in}

01-50-1

Engine Workshop Manual LF L3 (1972-1U-08K) TECHNICAL DATA

Item	Specification
Cylinder bore diameter (Standard)	87.500—87.530 mm {3.4449—3.4460 in}
Minimum / maximum bore diameter limit	87.440—87.590 mm {3.4425—3.4484 in}
Oil jet valve air pressure	216—274 kPa {2.2—2.7 kgf·cm ² 31.4— 39.7 psi }
Piston diameter (Standard)	87.465—87.495 mm {3.4435—3.4446 in}
Piston-to-cylinder clearance (Standard)	0.025—0.045 mm {0.0010—0.0017 in}
Piston-to-cylinder clearance (Maximum)	0.11 mm {0.0043 in}
Piston ring-to-ring groove clearance (Standard)	Top: 0.03—0.08 mm {0.0012—0.0031 in} Second: 0.03—0.07 mm {0.0012—0.0027 in} Oil: 0.03—0.07 mm {0.0012—0.0027 in}
Piston ring-to-ring groove clearance (Maximum)	Top: 0.17 mm {0.0067 in} Second, Oil: 0.15 mm {0.0059 in}
Piston ring end gap (Standard)	Top: 0.16—0.31 mm {0.0063—0.0122 in} Second: 0.33—0.48 mm {0.0130—0.0189 in} Oil (rail): 0.20—0.70 mm {0.0079—0.0275 in}
Piston end gap (Maximum)	1.0 mm {0.0393 in}
Crankshaft end play (Standard)	0.22—0.45 mm {0.0087—0.0177 in}
Crankshaft end play (Maximum)	0.55 mm {0.0216 in}
Crankshaft runout (Maximum)	0.05 mm {0.0019 in}
Main journal bearing size	STD: 51.980—52.000 mm {2.0464—2.0472 in} OS0.25: 51.730—51.750 mm {2.0366—2.0373 in} OS0.50: 51.480—51.500 mm {2.0268—2.0275 in}
Main journal out of round (Maximum)	0.05 mm {0.0019 in}
Crank pin journal diameter [LF]	STD: 46.980—47.000 mm {1.8497—1.8503 in} OS0.25: 46.730—46.750 mm {1.8398—1.8405 in} OS0.50: 46.480—46.500 mm {1.8300—1.8307 in}
Crank pin journal diameter [L3]	STD: 49.980—50.000 mm {1.9677—1.9685 in} OS0.25: 49.730—49.750 mm {1.9579—1.9586 in} OS0.50: 49.480—49.500 mm {1.9481—1.9488 in}
Crank pin out of round (Maximum)	0.05 mm {0.0019 in}
Main journal oil clearance (Standard)	0.019—0.035 mm {0.0007—0.0013 in}
Main journal oil clearance (Maximum)	0.10 mm {0.0039 in}
Main bearing size (UPPER)	STD: 2.501—2.522 mm {0.0985—0.0992 in} OS0.25: 2.623—2.629 mm {0.1033—0.1035 in} OS0.50: 2.748—2.754 mm {0.1082—0.1084 in}
Main bearing size (LOWER)	STD: 2.501—2.529 mm {0.0985—0.0995 in} OS0.25: 2.624—2.630 mm {0.1034—0.1035 in} OS0.50: 2.749—2.755 mm {0.1083—0.1084 in}
Connecting rod side clearance (Standard)	0.14—0.36 mm {0.0056—0.0141 in}
Connecting rod side clearance (Maximum)	0.435 mm {0.0172 in}
Connecting rod bearing oil clearance (Standard)	0.026—0.052 mm {0.0011—0.0020 in}
Connecting rod bearing oil clearance (Maximum)	0.1 mm {0.0039 in}
Connecting rod bearing size [LF]	STD: 1.498—1.522 mm {0.05863—0.05992 in} OS0.25: 1.623—1.629 mm {0.06390—0.06413 in} OS0.50: 1.748—1.754 mm {0.06882—0.06905 in}
Connecting rod bearing size [L3]	STD: 1.496—1.520 mm {0.05890—0.05984 in} OS0.25: 1.621—1.627 mm {0.06382—0.06405 in} OS0.50: 1.746—1.752 mm {0.06875—0.06897 in}
Bolt length	Cylinder head bolt (With washer) Standard: 149.2—149.8 mm {5.87—5.90 in} Maximum: 150.5 mm {5.91 in} Cylinder head bolt (Without washer) Standard: 145.2—145.8 mm {5.72—5.74 in} Maximum: 146.5 mm {5.77 in} Connecting rod bolt Standard: 44.7—45.3 mm {1.75—1.78 in} Maximum: 46.0 mm {1.81 in} Main bearing cap bolt (Plastic region tightening bolt only) Standard: 110.0—110.6 mm {4.33—4.35 in} Maximum: 111.3 mm {4.38 in}
Valve clearance [Engine cold]	IN: 0.22—0.28 mm {0.0087—0.0110 in} EX: 0.27—0.33 mm {0.0106—0.0130 in}
Value range	0.005—0.101 mm {0.00019—0.0039 in}

SERVICE TOOLS

01-60 SERVICE TOOLS

ENGINE SST 01-60-1

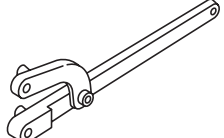
ENGINE SST

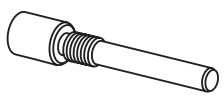
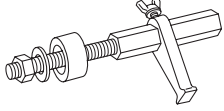
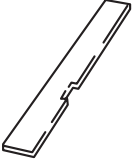
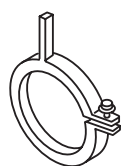
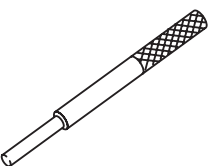
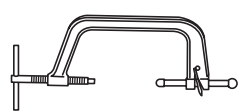
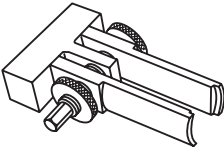
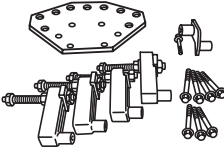
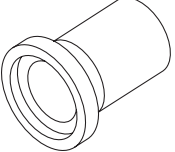
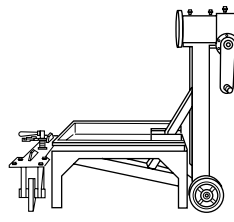

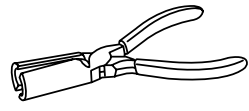
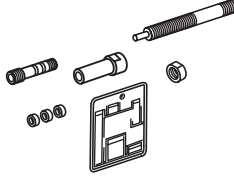
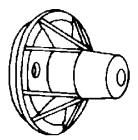
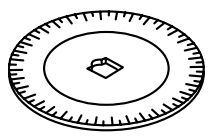
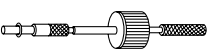
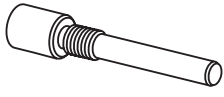
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01-60

1: Mazda **SST** number
2: Global **SST** number

Example

1:49 UN20 5072 2:205-072	
Holder	

1: - 2:303-507 Crankshaft TDC setting peg (Cylinder block lower blind plug hole: M10)		1:49 E011 1A0 2: - Ring gear brake set		1:49 UN30 3465 2: 303-465 Camshaft Alignment timing Tool	
1:49 G011 201 2: - Attachment		1:49 B012 015 2: - Valve guide installer		1:49 0636 100B 2: - Valve spring lifter arm	
1:49 B012 0A2 2: - Pivot		1:49 L010 1A0 2: - Engine hanger set		1:49 H010 401 2: - Oil seal installer	
1:49 0107 680A 2: - Engine stand		1:49 T032 302 2: - Bearing installer		1:49 S120 170 2: - Valve seal remover	
1:49 L012 0A0B 2: - Valve seal and valve guide installer set		1:49 UN30 3328 2: 303-328 Rear oil seal replacer		1:49 D032 316 2: - Protractor	
1:49 1285 071 2: - Bearing puller		1:49 N010 101 2:- Crankshaft TDC setting pin (Cylinder block lower blind plug hole: M8)			

01-60-1