

Engine Workshop Manual L3 WITH TC

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.

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GENERAL INFORMATION

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HOW TO USE THIS MANUAL

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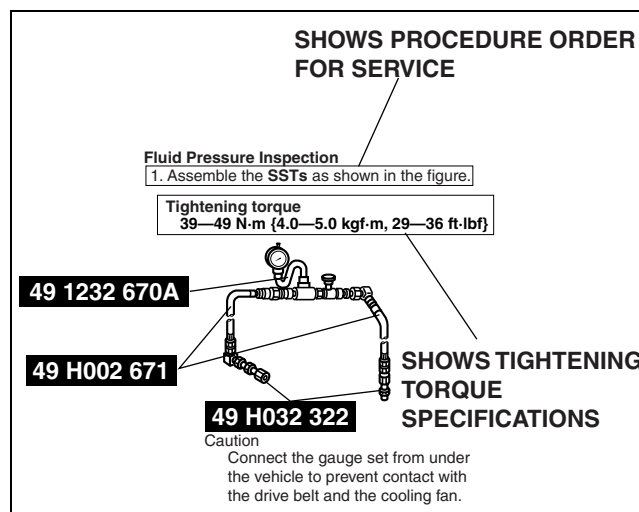
Range of Topics

- 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.

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.

Procedure

"Removal/Installation" Portion

"Inspection After Installation" Portion

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

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 TIGHTENING TORQUE SPECIFICATIONS

SHOWS THERE ARE REFERRAL NOTES FOR SERVICE

SHOWS DETAILS

SHOWS TIGHTENING TORQUE UNITS

SHOWS REFERRAL NOTES FOR SERVICE

SHOWS SPECIAL SERVICE TOOL (SST) NO.

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.

44—60 (4.4—6.2, 32—44)

94—116 (9.5—11.9, 69—86)

43—56 (4.3—5.8, 32—41)

118—156 (12.0—16.0, 87—115)

N·m (kgf·m, ft·lb)

1	Split pin	7	Split pin
2	Nut	8	Nut
3	Lower trailing link ball joint (See 02-14-5 Lower Trailing Link Ball Joint Removal Note)	9	Upper trailing link ball joint (See 02-14-5 Upper Trailing Link Ball Joint Removal Note)
4	Bolt	10	Nut
5	Lower trailing link	11	Upper trailing link
6	Dust boot (lower 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.

49 T028 304 UPPER TRAILING LINK

49 T028 305 LOWER TRAILING LINK

49 T028 303

KNUCKLE

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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

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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)

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}

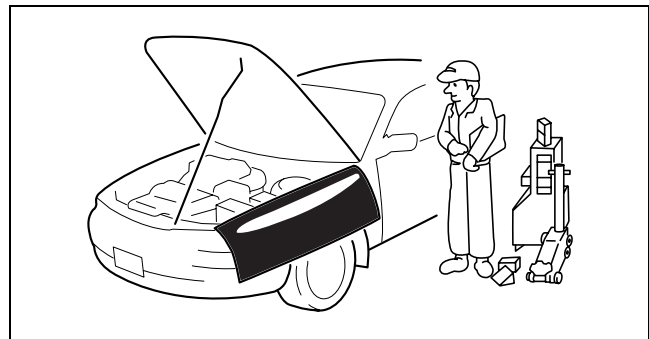
- The actual converted values for 2.7 kgf/cm² are 264 kPa and 38.4 psi. In the first specification, 2.7 is used as an upper limit, so the converted values are rounded down to 260 and 38. In the second specification, 2.7 is used as a lower limit, so the converted values are rounded up to 270 and 39.

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.

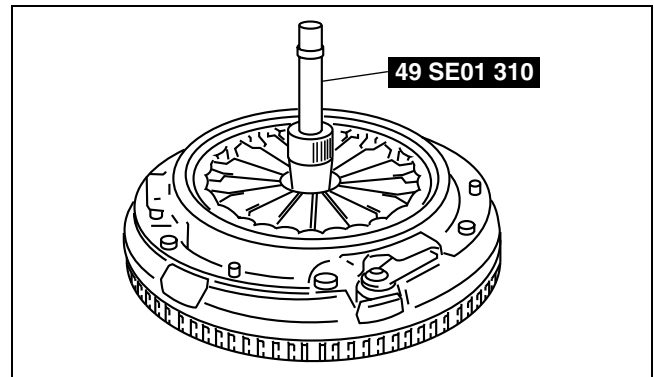


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GENERAL INFORMATION

Special Service Tools

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

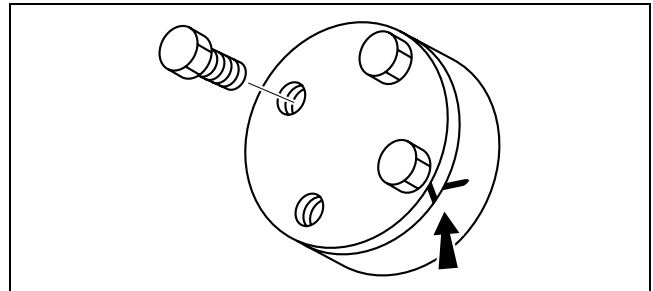


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Disassembly

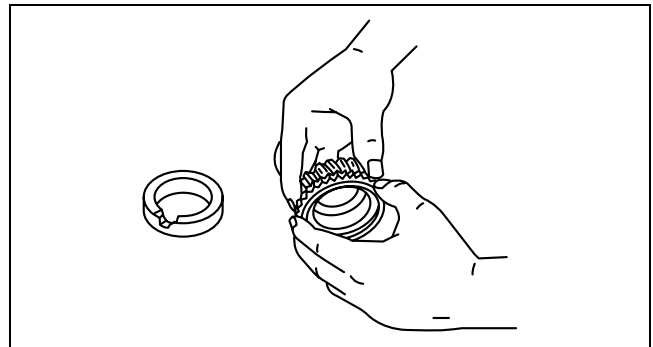
- If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be marked in a place that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.



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Inspection During Removal, Disassembly

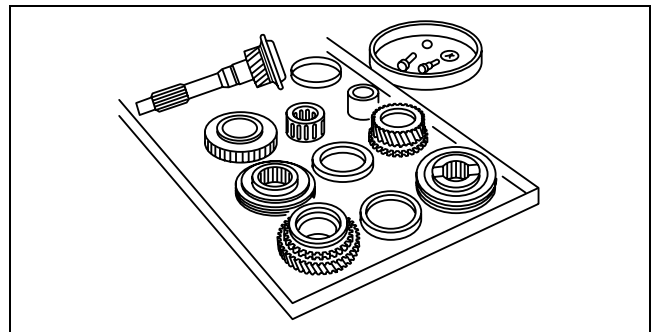
- When removed, each part should be carefully inspected for malfunction, deformation, damage and other problems.



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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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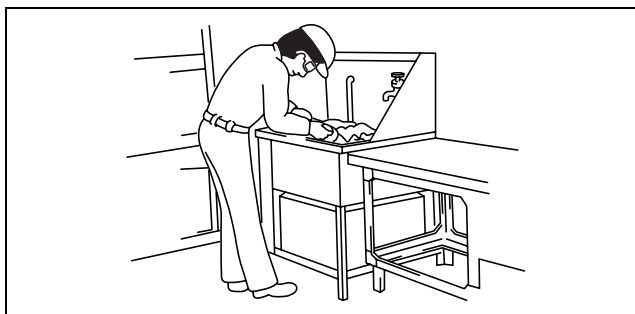
GENERAL INFORMATION

Cleaning of Parts

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

Warning

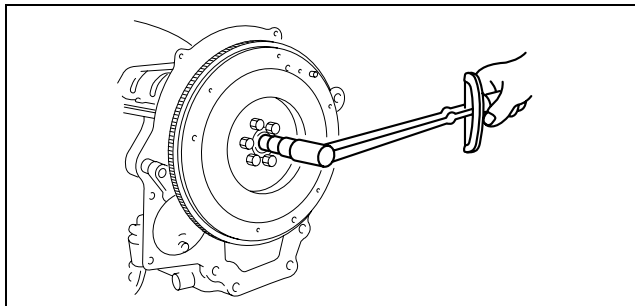
- **Using compressed air can cause dirt and other particles to fly out causing injury to the eyes. Wear protective eye wear whenever using compressed air.**



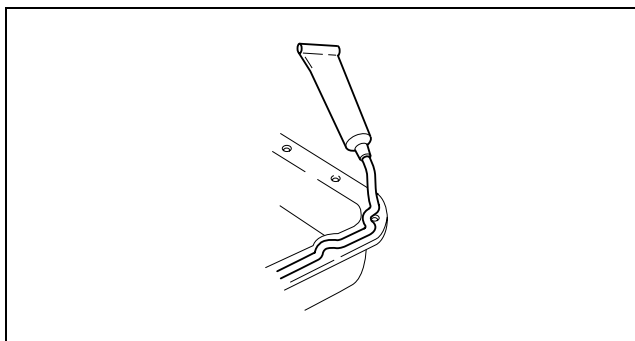
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Reassembly

- 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
- 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.



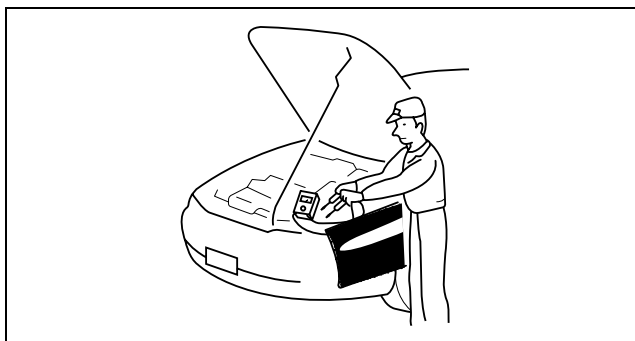
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Adjustment

- Use suitable gauges and testers when making adjustments.

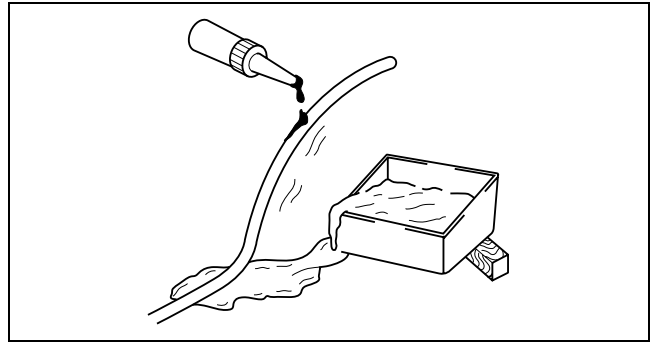


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GENERAL INFORMATION

Rubber Parts and Tubing

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

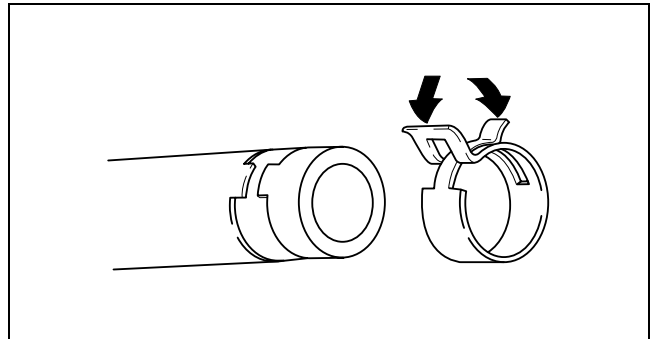


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Hose Clamps

- 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.

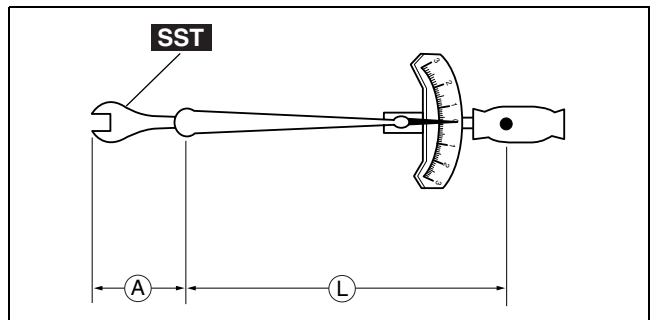


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Torque Formulas

- 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	$in \cdot lbf \times [L / (L + A)]$



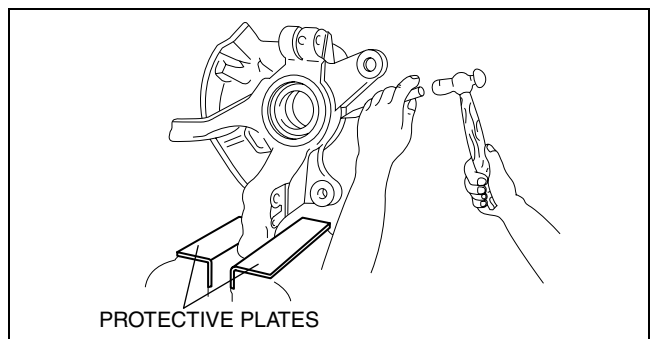
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A : The length of the **SST** past the torque wrench drive.

L : The length of the torque wrench.

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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GENERAL INFORMATION

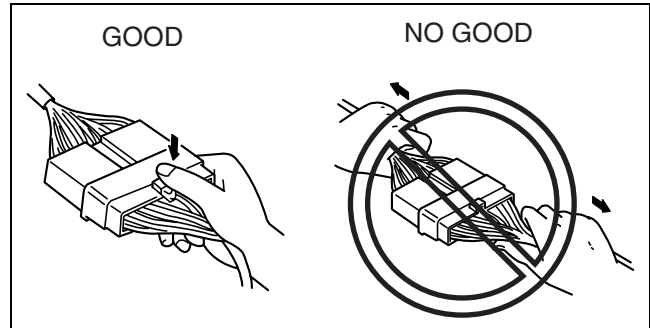
ELECTRICAL SYSTEM

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Connectors

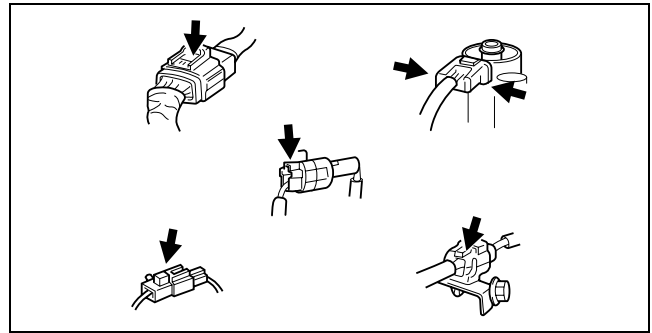
Disconnecting connectors

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



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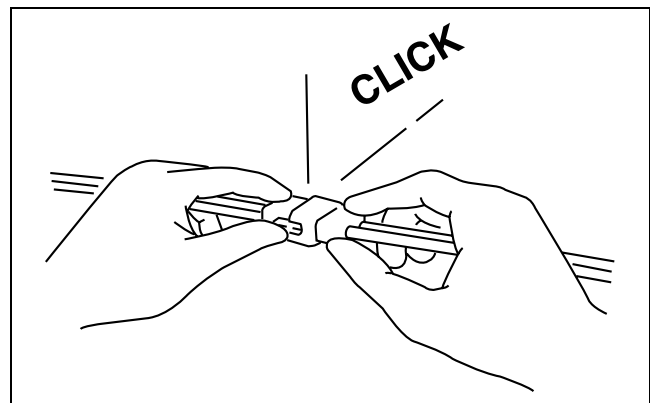
- Connectors can be disconnected by pressing or pulling the lock lever as shown.



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Locking connector

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

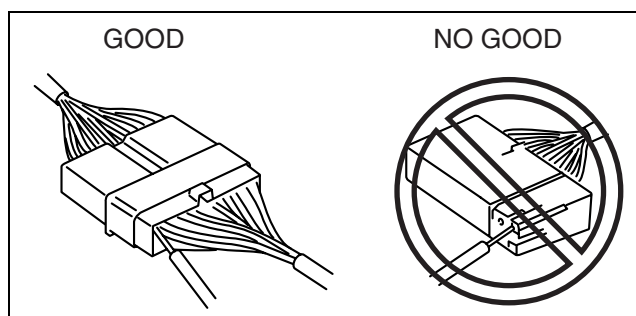


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GENERAL INFORMATION

Inspection

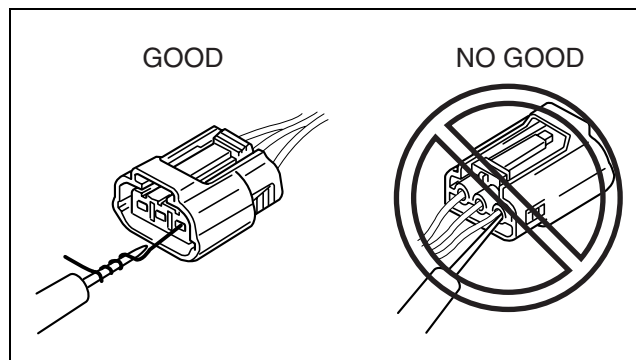
- When a tester is used to inspect for continuity or measuring voltage, insert the tester probe from the wiring harness side.
- Inspect the terminals of waterproof connectors from the connector side since they cannot be accessed from the wiring harness side.



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Caution

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



CHU0000W012

SAE STANDARDS

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

E6U000000000E05

SAE Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
AP	Accelerator Pedal	—	Accelerator Pedal	
ACL	Air Cleaner	—	Air Cleaner	
A/C	Air Conditioning	—	Air Conditioning	
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	

GENERAL INFORMATION

SAE Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
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	
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	

GENERAL INFORMATION

SAE Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
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

ABBREVIATIONS

E6U000000000E06

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

ENGINE

01 SECTION

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01-10 MECHANICAL

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MECHANICAL

Camshaft Sprocket Lock Bolt
 Assembly Note **01-10-47**
 Engine Front Cover Assembly Note . . . **01-10-48**

Crankshaft Pulley Lock Bolt
 Assembly Note **01-10-49**
 Cylinder Head Cover Assembly Note . . **01-10-50**

ENGINE OVERHAUL SERVICE WARNING

E6U011000000E02

Warning

- Continuous exposure to USED engine oil has been shown to cause skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after performing work.

ENGINE MOUNTING/DISMOUNTING

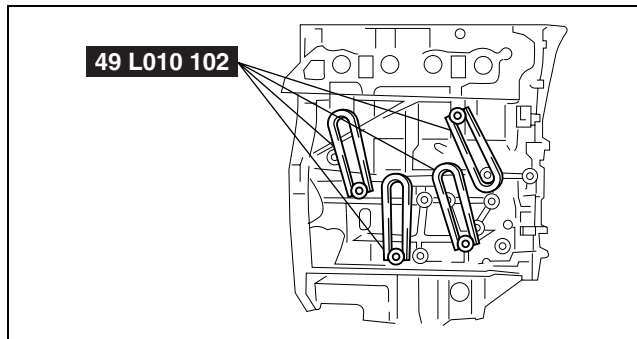
E6U011000000E01

Installation

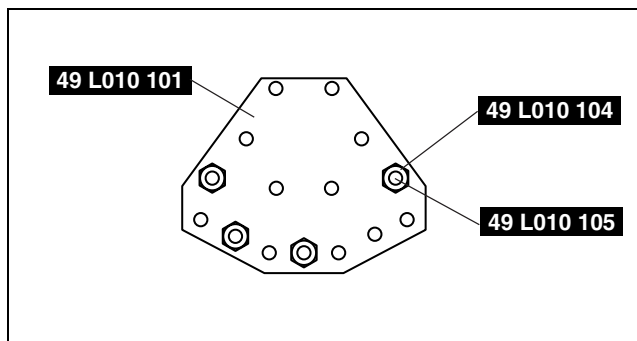
1. Install the **SST** (arms) to the four positions as shown in the figure and temporarily tighten the bolts (**Part No.: 9YA20-1003**) or **M10 × 1.5T** length 90 mm {3.55 in}.
2. Install the **SSTs** (bolts, nuts, hook, and plate) to the four positions as shown in the figure.
3. Install the **SST** (bolts, nuts, hook, and plate) set in Step 2 to the **SST** (arms and bolts) set in Step 1.
4. Adjust the bolts so that **approx. 20 mm {0.79 in}** of thread is exposed from the side of the plate.
5. Adjust the bolts and nuts so that the plate and arms are parallel.
6. Install the engine to the **SST** (engine stand).
7. Remove the oil drain plug and drain the engine oil.
8. Replace the gasket with a new one and install the oil pan drain plug.

Tightening torque

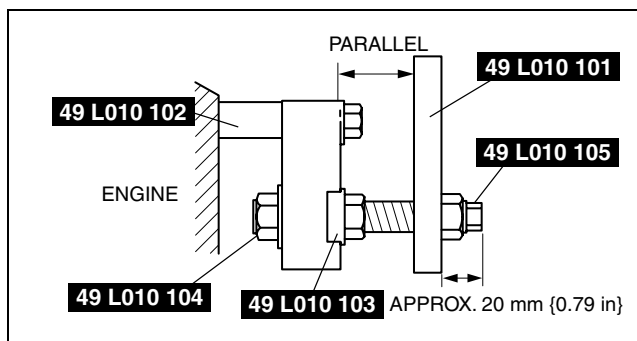
30—41 N·m {3.1—4.1 kgf·m, 23—30 ft·lbf}



B3E0110W127



C3U0110E001



E6U110ZEB040

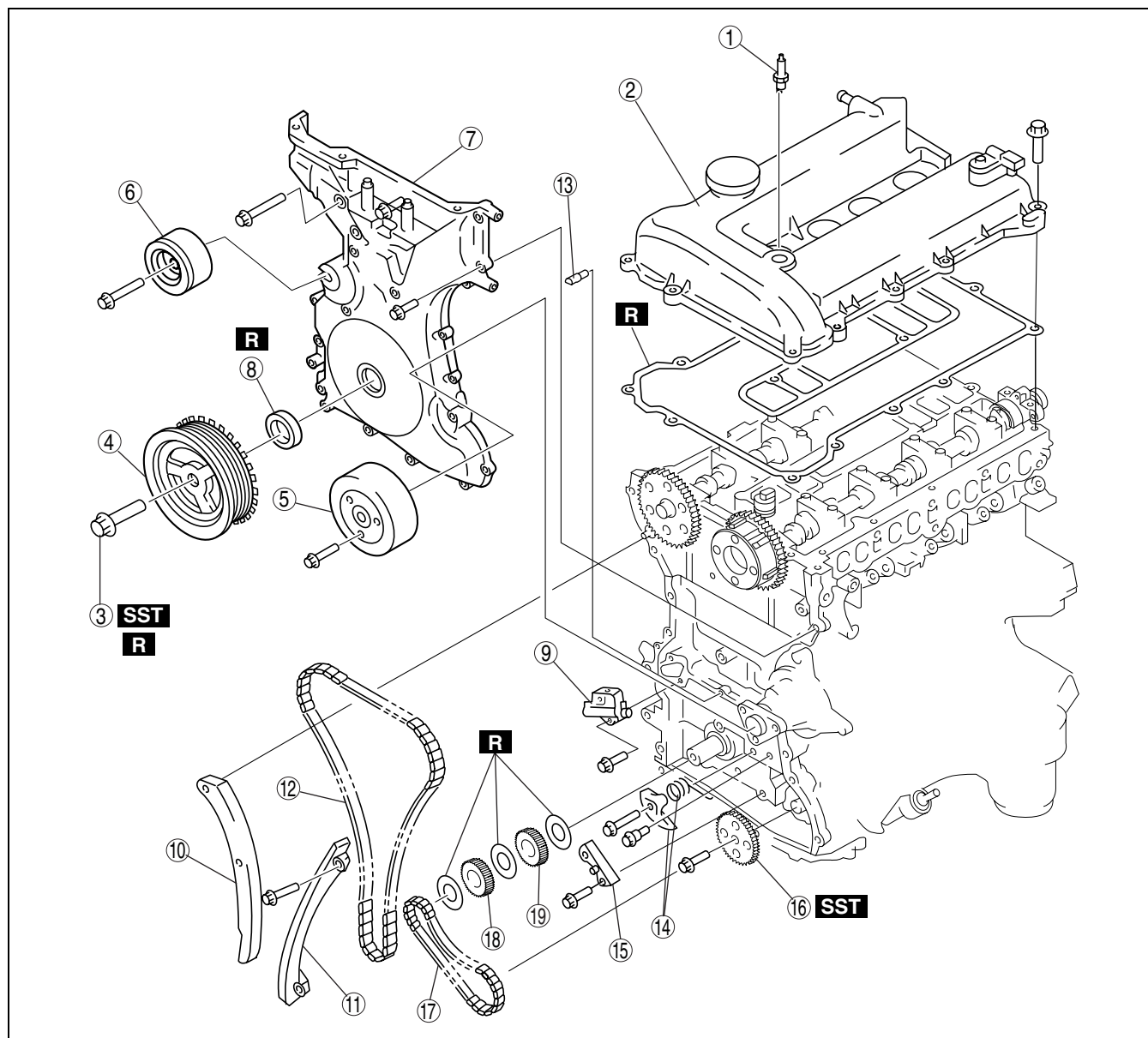
Removal

1. Remove in the reverse order of installation.

TIMING CHAIN DISASSEMBLY

E6U011012201E04

1. Disassemble in the order indicated in the table.



01-10

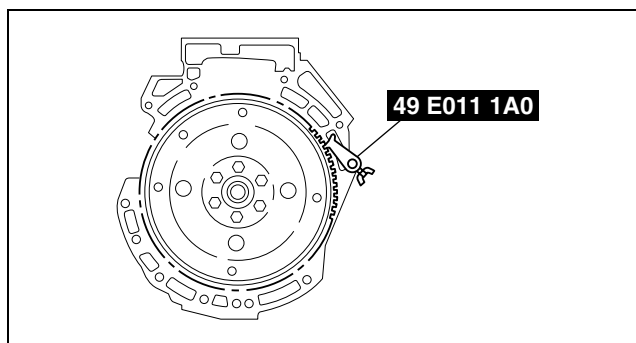
E6U110ZEB011

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

10	Timing chain tensioner arm
11	Timing chain guide
12	Timing chain
13	Oil jet
14	Oil pump chain tensioner
15	Oil pump chain guide
16	Oil pump driven sprocket (See 01-10-5 Oil Pump Driven Sprocket Disassembly Note.)
17	Oil pump chain
18	Crankshaft sprocket
19	Oil pump drive sprocket

Crankshaft Pulley Lock Bolt Disassembly Note

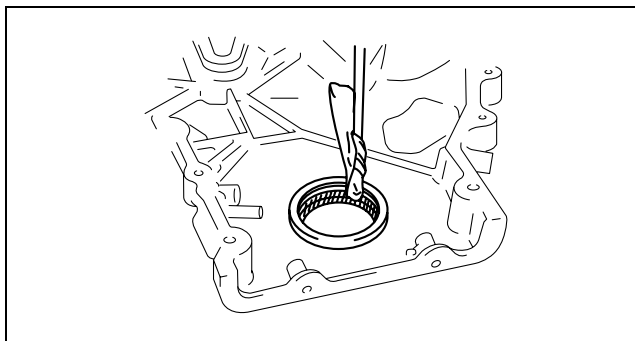
1. Install the **SST** to the ring gear to lock the crankshaft against rotation.



E6U110ZEB033

Front Oil Seal Disassembly Note

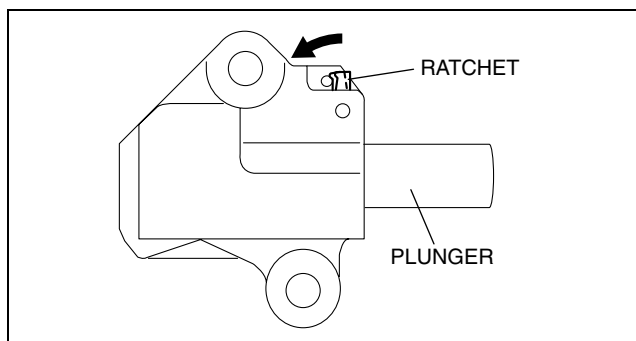
1. Remove the oil seal using a flathead screwdriver.



E6U110ZWB044

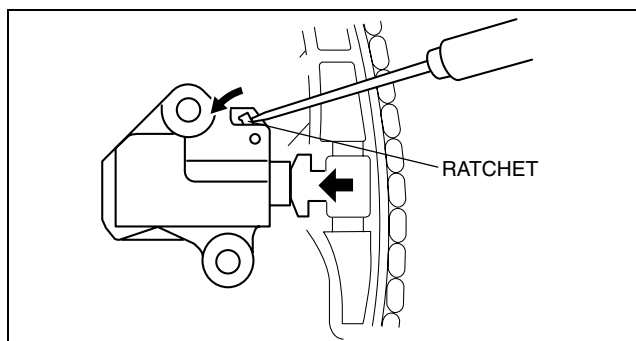
Timing Chain Tensioner Disassembly Note

1. Press the timing chain tensioner ratchet to the left using a thin flathead screwdriver (precision screwdriver) to unlock the plunger.



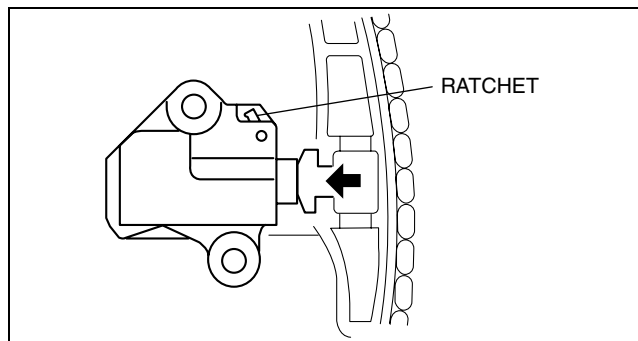
E6U110ZWB054

2. Slowly press the plunger back in the direction shown in the figure while pressing the ratchet.



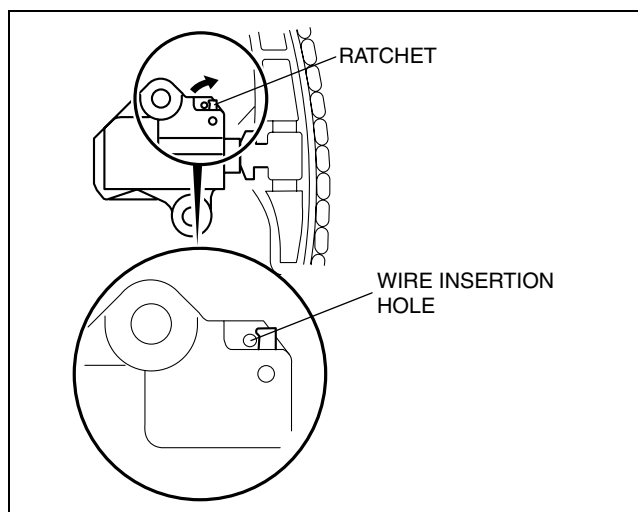
E6U110ZWB055

3. Release the ratchet with the plunger still pressed down.



E6U110ZWB056

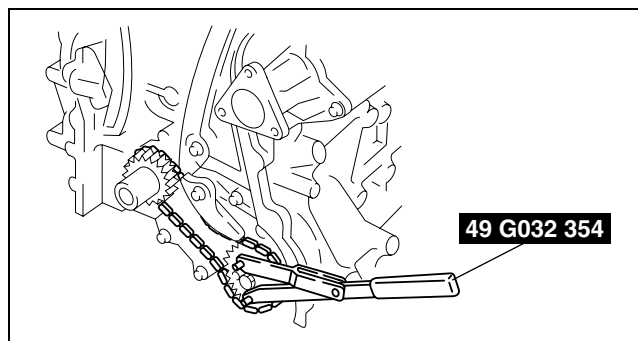
4. Press-in the plunger until the ratchet position is as indicated in the figure, and then insert the wire to lock the plunger.



E6U110ZWB053

Oil Pump Driven Sprocket Disassembly Note

1. Install the **SST** on the oil pump driven sprocket to lock the oil pump against rotation.

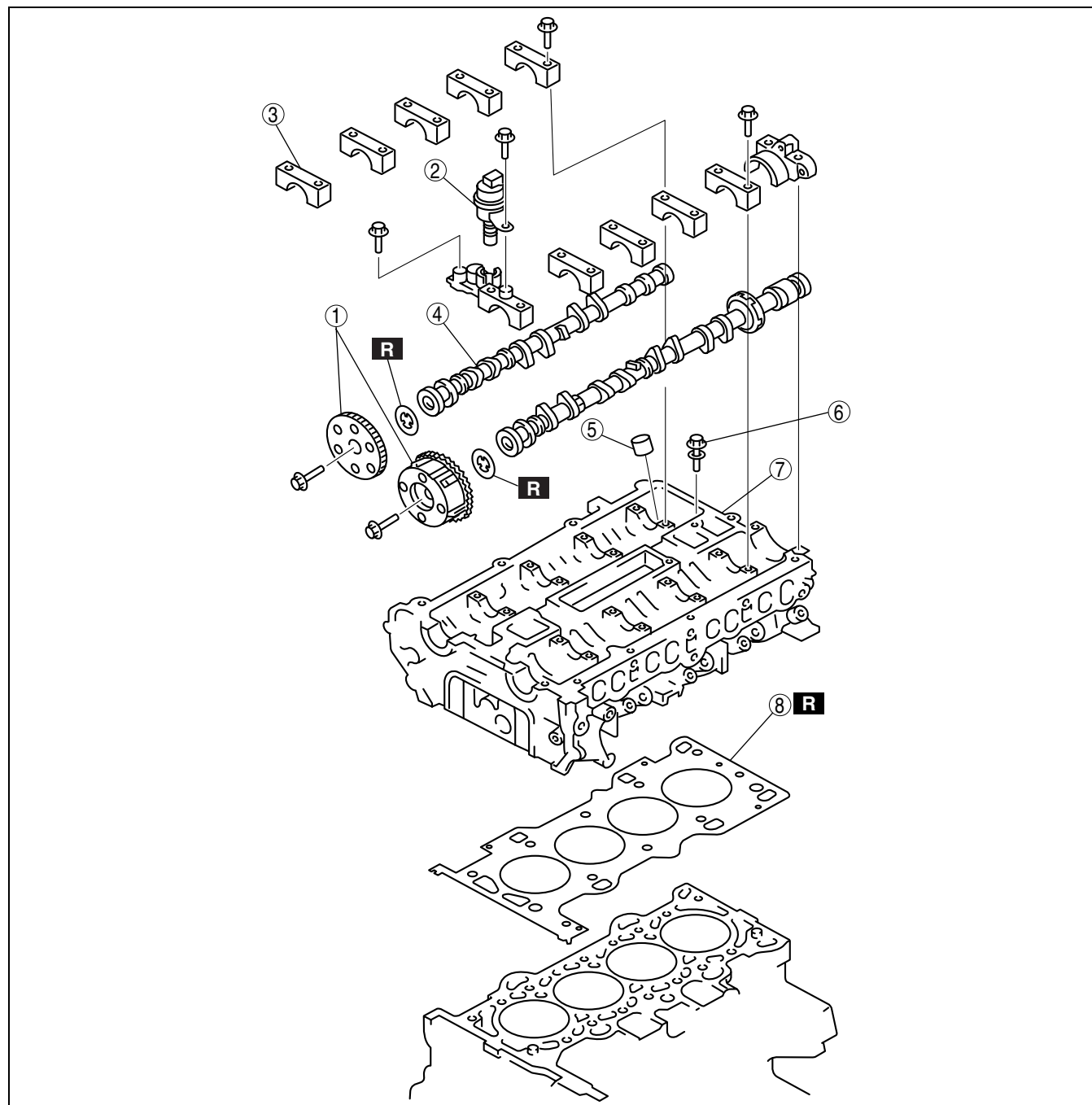


B3E0110E054

CYLINDER HEAD (I) DISASSEMBLY

E6U011010100E01

1. Disassemble in the order indicated in the table.



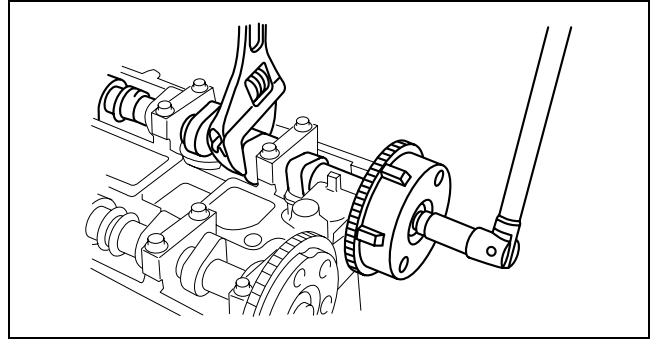
E6U110ZE024

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

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

Camshaft Sprocket, Variable Valve Timing Actuator Disassembly Note

1. Before removing the camshaft, hold the camshaft using a wrench on the cast hexagon and loosen the camshaft sprocket installation bolt.



B3E0110E058

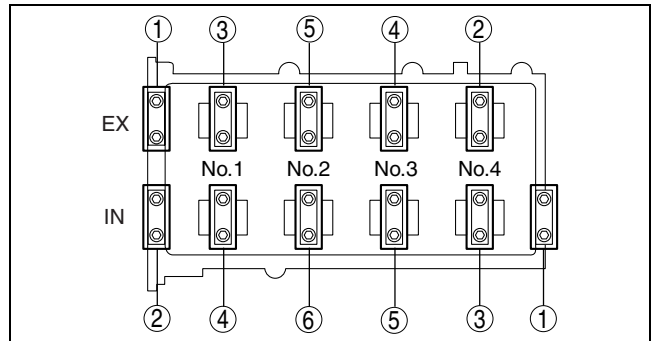
01-10

Camshaft Cap Disassembly Note

1. Before removing the camshaft cap, inspect the camshaft end play. (See 01-10-20 CAMSHAFT INSPECTION.)

Note

- Determine the position of each removed camshaft cap.
2. Loosen the camshaft cap bolts in two to three passes in the order shown in the figure and remove the camshaft caps.



E6U110ZEB001

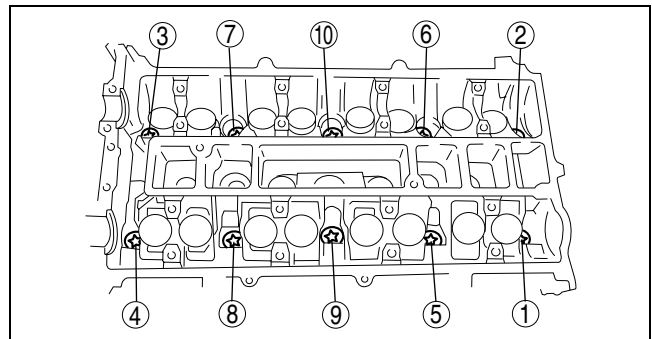
Tappet Disassembly Note

Note

- Determine the position of each removed tappet.

Cylinder Head Disassembly Note

1. Loosen the cylinder head installation bolts in two to three passes in the order shown in the figure and remove them.



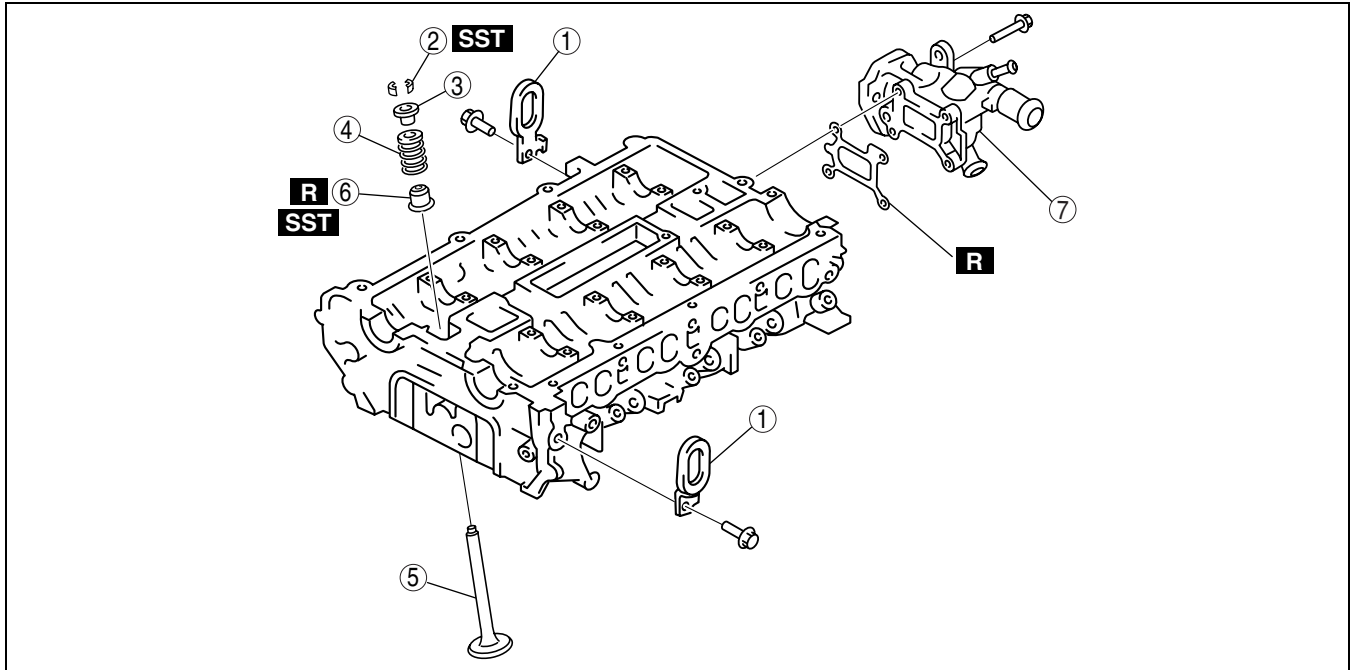
B3E0110E059

MECHANICAL

CYLINDER HEAD (II) DISASSEMBLY

E6U011010100E02

1. Disassemble in the order indicated in the table.



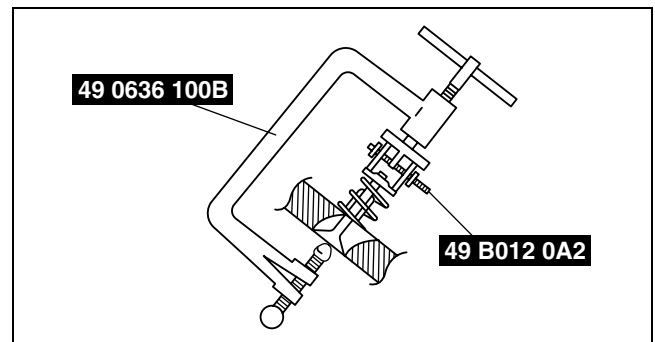
E6U110ZEB014

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 01-10-8 Valve Seal Disassembly Note.)
7	Water outlet case

Valve Keeper Disassembly Note

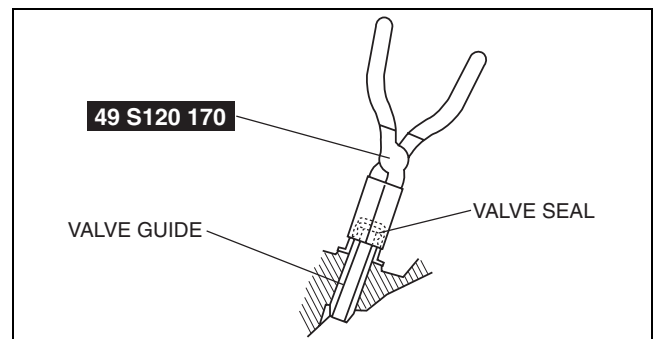
1. Remove the valve keeper using the SSTs.



B3E0110E124

Valve Seal Disassembly Note

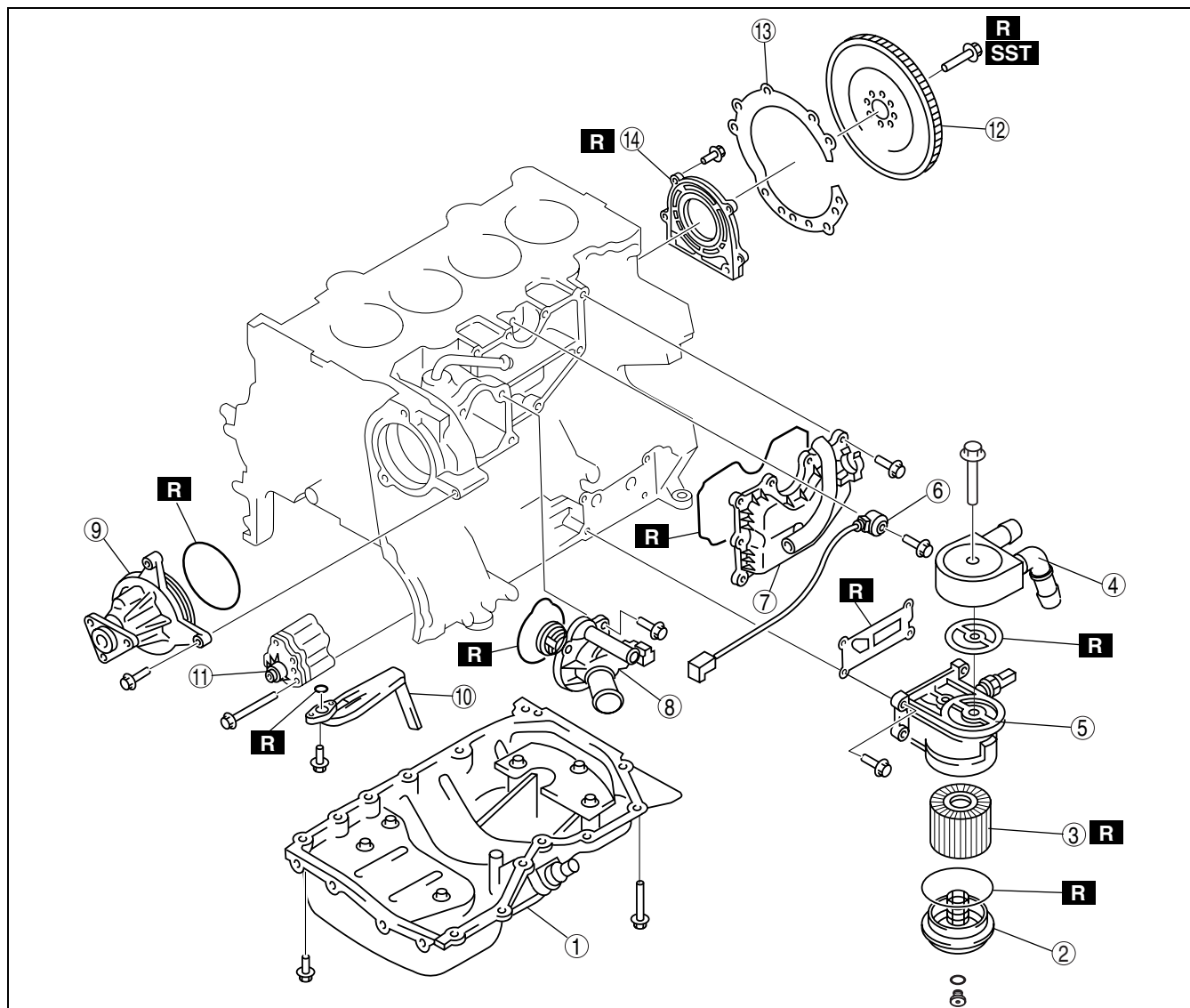
1. Remove the valve seal using the SST.



B3E0110E061

CYLINDER BLOCK (I) DISASSEMBLY

1. Disassemble in the order indicated in the table.



E6U110ZEB013

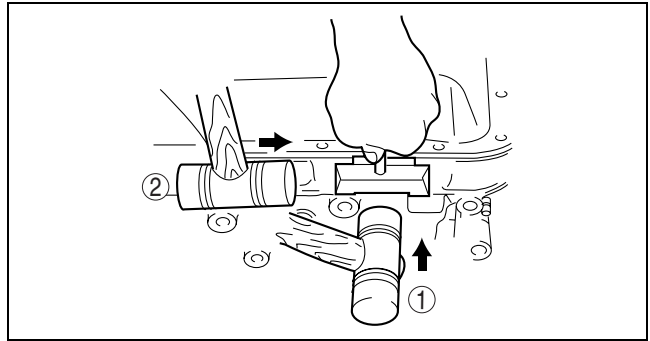
1	Oil pan (See 01-10-10 Oil Pan Disassembly Note.)
2	Oil filter cover
3	Oil filter
4	Oil cooler
5	Oil filter adapter
6	Knock sensor
7	Crankcase ventilation cover

8	Thermostat
9	Water pump
10	Oil strainer
11	Oil pump
12	Flywheel (See 01-10-10 Flywheel Disassembly Note.)
13	End plate
14	Rear oil seal

MECHANICAL

Oil Pan Disassembly Note

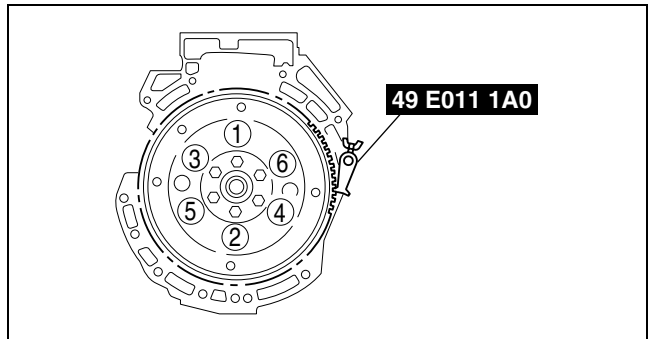
1. Remove the oil pan using a oil pan seal cutter.



E6U110ZEB022

Flywheel Disassembly Note

1. Use the **SST** to lock the crankshaft against rotation.

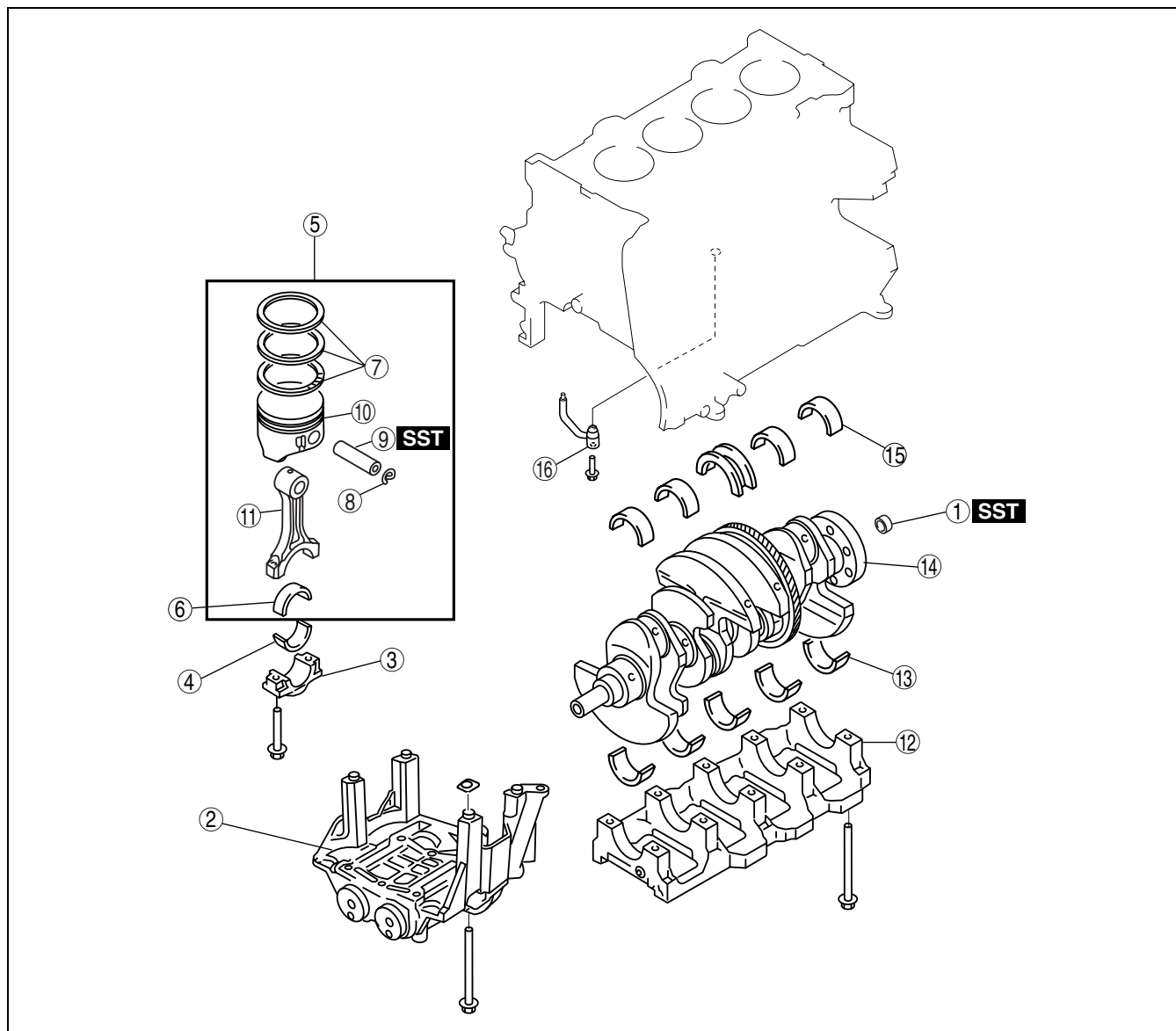


B3E0110E051

CYLINDER BLOCK (II) DISASSEMBLY

E6U011010300E02

1. Disassemble in the order indicated in the table.



E6U110ZEB015

1	Pilot bearing (See 01-10-12 Pilot Bearing Disassembly Note.)
2	Engine balancer
3	Connecting rod cap (See 01-10-12 Connecting Rod Cap Disassembly Note.)
4	Lower connecting rod bearing
5	Upper connecting rod bearing
6	Connecting rod piston (See 01-10-12 Connecting Rod, Piston Disassembly Note.)
7	Piston ring
8	Snap ring

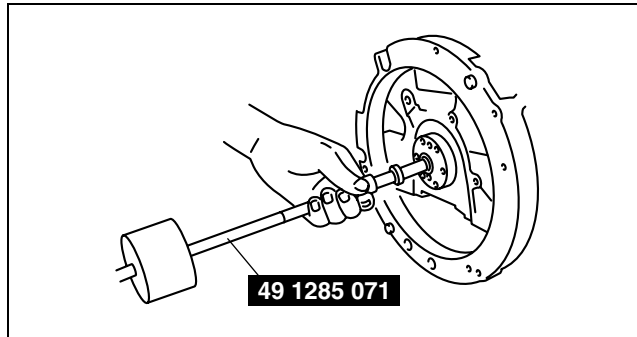
9	Piston pin (See 01-10-12 Piston Pin Disassembly Note.)
10	Piston
11	Connecting rod
12	Main bearing cap (See 01-10-13 Main Bearing Cap Disassembly Note.)
13	Lower main bearing
14	Crankshaft
15	Upper main bearing, thrust bearing
16	Oil jet valve

Pilot Bearing Disassembly Note

Note

- The pilot bearing does not need to be removed unless you are replacing it.

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



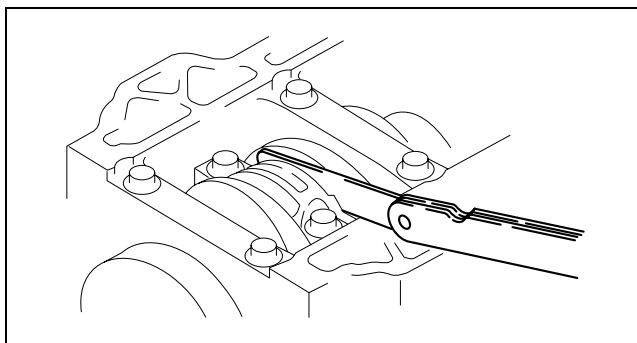
E6U110ZWB048

Connecting Rod Cap Disassembly Note

1. Before removing the connecting rod cap, inspect the connecting rod side clearance. (See 01-10-24 CONNECTING ROD CLEARANCE INSPECTION.)

Note

- Determine the position of each removed connecting rod cap.



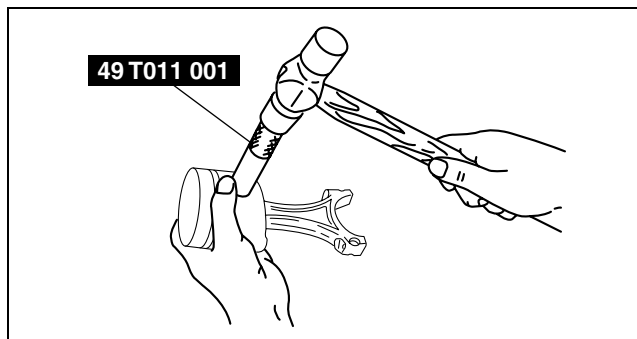
B3E0110E087

Connecting Rod, Piston Disassembly Note

1. Before removing the connecting rod and piston, remove the carbon in the cylinder.
2. Before removing the connecting rod piston, inspect the oil clearance at the large end of the connecting rod. (See 01-10-24 CONNECTING ROD CLEARANCE INSPECTION.)

Piston Pin Disassembly Note

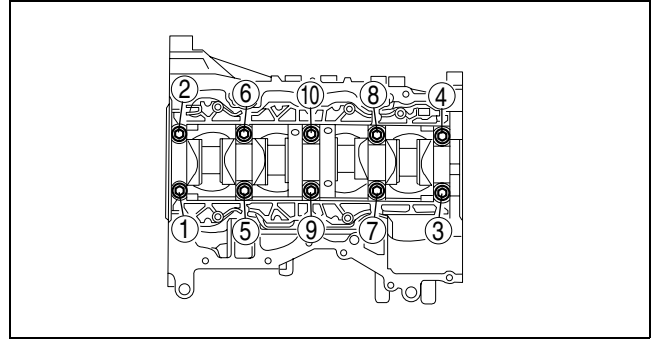
1. Before removing the piston pin, weigh the connecting rod. (See 01-10-24 PISTON, CONNECTING ROD INSPECTION.)
2. Remove the piston pin using the **SST**.



E6U110ZEB034

Main Bearing Cap Disassembly Note

1. Before removing the main bearing cap, inspect the crankshaft end play. (See 01-10-25 CRANKSHAFT INSPECTION.)
2. Loosen the main bearing cap bolts in two to three passes in the order shown in the figure and remove them.



B3E0110E067

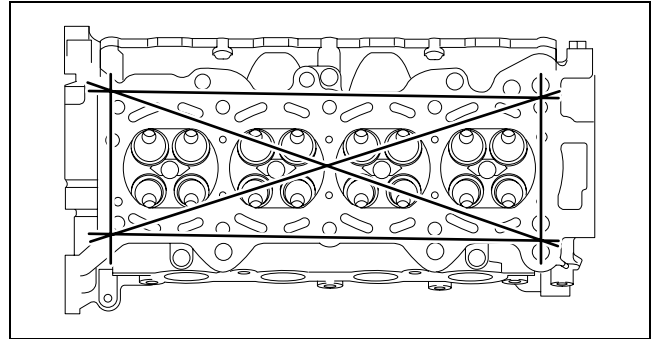
01-10

CYLINDER HEAD INSPECTION

E6U011012201E02

1. Inspect the cylinder head surface for cracks and other damage using a red dye penetrant.
 - If there is a malfunction, replace the cylinder head.
2. Measure the combustion chamber side of the cylinder head for distortion in six directions as shown in the figure using a straight edge and feeler gauge.
 - If the distortion exceeds the maximum specification, replace the cylinder head.

Maximum distortion, head gasket side
0.10 mm {0.004 in}

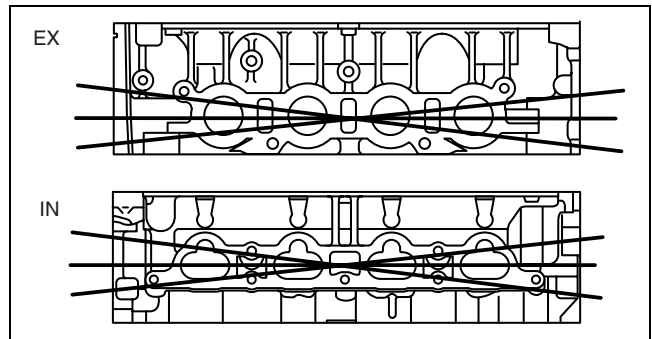


B3E0110E008

3. Inspect the contact surface of the exhaust manifold and the intake manifold for distortion by measuring as shown in the figure using a straight edge and feeler gauge.
 - If the distortion exceeds the maximum specification, grind the surface or replace the cylinder head.

Maximum distortion, manifold side
0.10 mm {0.004 in}

Maximum cutting length, manifold side
0.15 mm {0.006 in}



C3U0110E003

VALVE SEAT INSPECTION/REPAIR

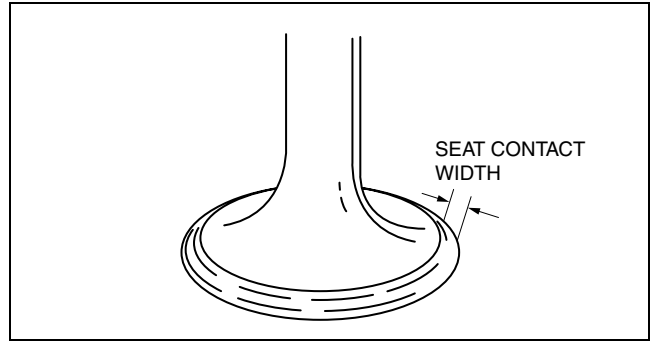
E6U011010102E01

1. Measure the contact width of the valve face and the valve seat using the valve lapping compound.
 - If it is not within the specification, resurface the valve seat using the 45° valve seat cutter.

Standard valve seat contact width

IN: 0.7—1.3mm {0.0276—0.0511 in}

EX: 0.7—1.3mm {0.0276—0.0511 in}



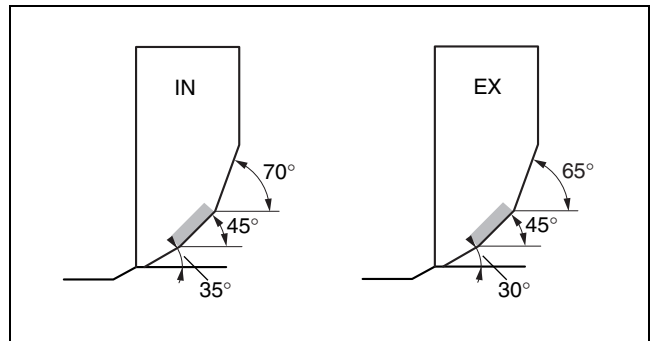
ADA2224E019

2. Verify that the area where the valve seat contacts the valve face is centered.
 - If the seating position is too high, resurface the valve seat using a 70° (IN) 65° (EX) valve seat cutter and a 45° valve seat cutter.
 - If the seating position is too low, resurface the valve seat using a 35° (IN) 30° (EX) valve seat cutter and a 45° valve seat cutter.

Valve seat angle

IN: 45°

EX: 45°



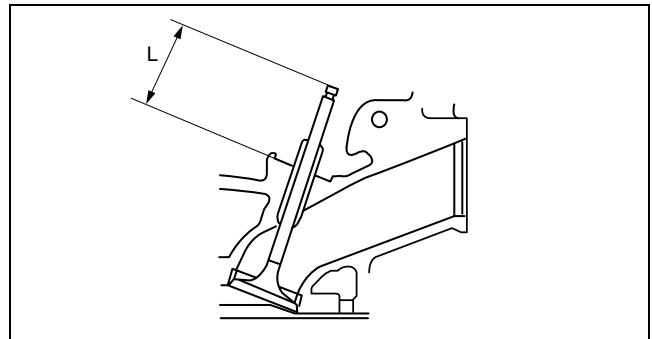
B3E0110E133

3. Inspect the valve seat for sinkage. Measure the protruding length (dimension L) of the valve stem using a valve of standard length.
 - If it is not within the specification, replace the cylinder head.

Standard valve seat sinkage amount (Dimension L)

IN: 40.64—42.24 mm {1.600—1.662 in}

EX: 40.50—42.10 mm {1.595—1.657 in}



C3U0110E006

VALVE, VALVE GUIDE INSPECTION

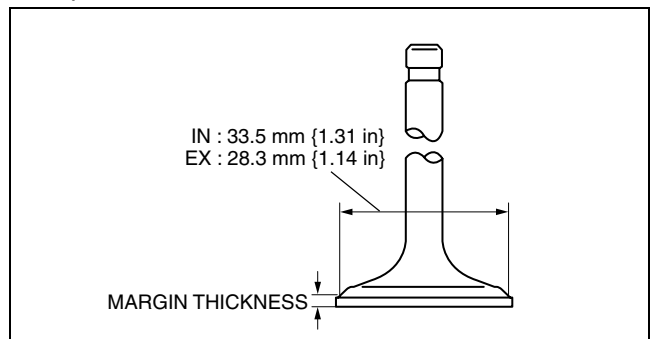
E6U01101010280E01

1. Measure the valve head margin thickness using a vernier caliper.
 - If it is less than the minimum specification, replace the valve.

Minimum valve head margin thickness

IN: 1.62 mm {0.0637 in}

EX: 1.82 mm {0.0716 in}



C3U0110E051

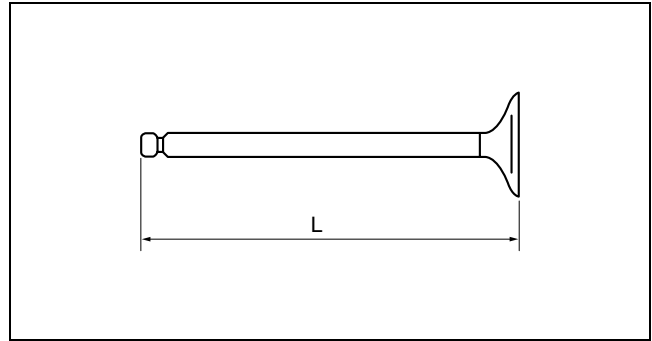
2. Measure the length of the each valve using a vernier caliper.

- If it is not within the specification, replace the valve.

Standard valve length (Dimension L)

IN: 102.99—103.79 mm {4.055—4.086 in}

EX: 104.25—105.05 mm {4.105—4.135 in}



B3E0110E068

3. Measure the stem diameter of each valve using the micrometer. Measurement positions total six and are in the X and Y directions, at three points (A, B, and C) as shown in the figure.

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

Valve stem diameter

Standard

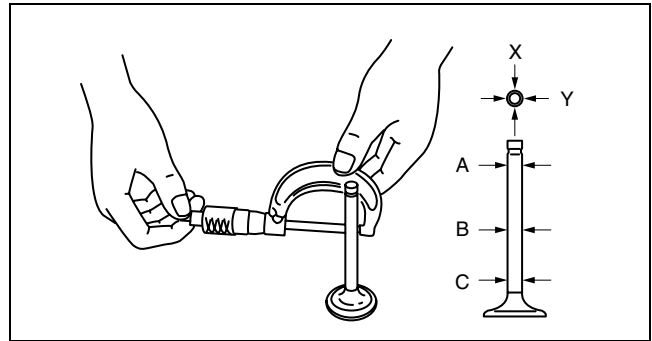
IN: 5.970—5.985 mm {0.2351—0.2356 in}

EX: 5.965—5.980 mm {0.2349—0.2354 in}

Minimum

IN: 5.940 mm {0.2339 in}

EX: 5.935 mm {0.2336 in}



ADJ2224E024

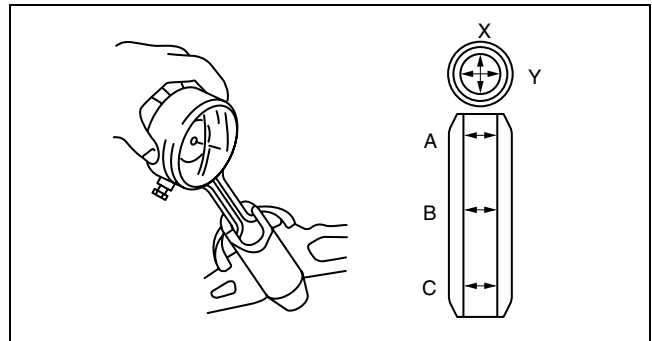
4. Measure the inner diameter of each valve guide using the caliper gauge. Measurement positions total six and are in the X and Y directions, at three points (A, B, and C) as shown in the figure.

- If it is not within the specification, replace the valve guide.

Standard valve guide inner diameter

IN: 6.009—6.039 mm {0.2366—0.2377 in}

EX: 6.009—6.039 mm {0.2366—0.2377 in}



ADJ2224E026

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

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

Clearance between valve stem and guide

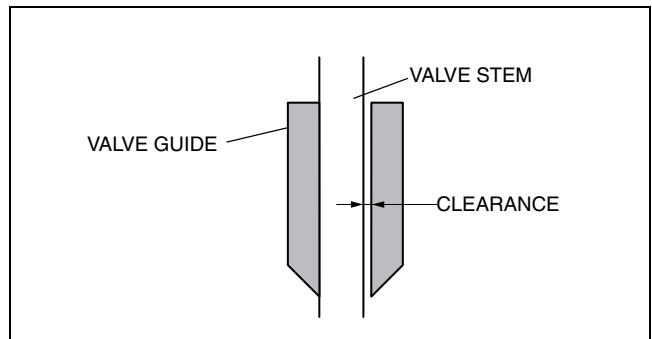
Standard

IN: 0.024—0.069 mm {0.0009—0.0027 in}

EX: 0.029—0.074 mm {0.0012—0.0029 in}

Maximum

0.10 mm {0.004 in}



ADA2224E027

MECHANICAL

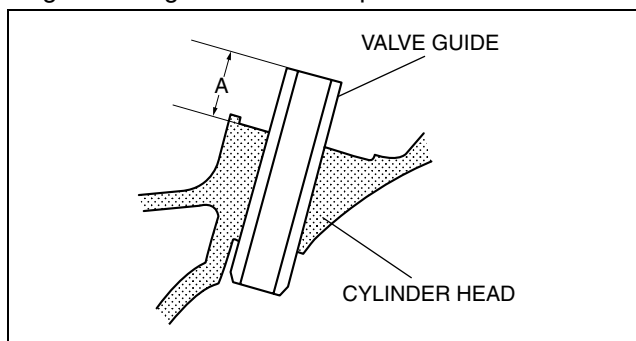
6. Measure the projection height (dimension A) of each valve guide using the vernier caliper.

- If it is not within the specification, replace the valve guide.

Standard valve guide projection height

IN: 12.2—12.8 mm {0.481—0.503 in}

EX: 12.2—12.8 mm {0.481—0.503 in}

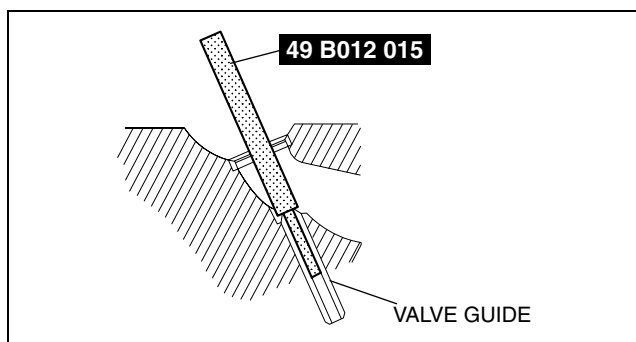


C3U0110E004

VALVE GUIDE REPLACEMENT

Removal

1. Tap the valve guide out from combustion chamber side using the **SST**.



C3U0110E005

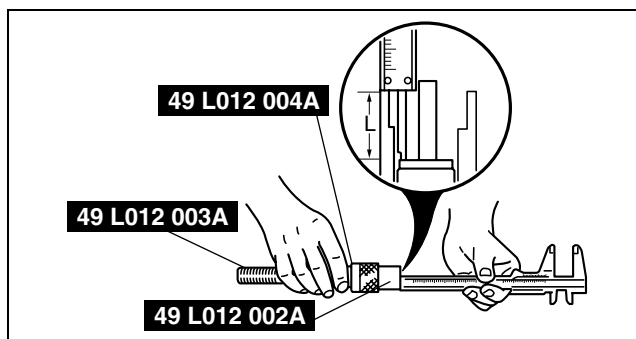
Installation

1. Assemble the **SSTs** so that dimension L is as specified.

Standard valve guide projection height

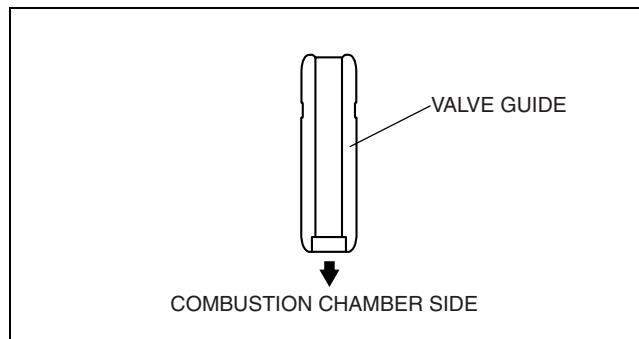
IN: 12.2—12.8 mm {0.481—0.503 in}

EX: 12.2—12.8 mm {0.481—0.503 in}

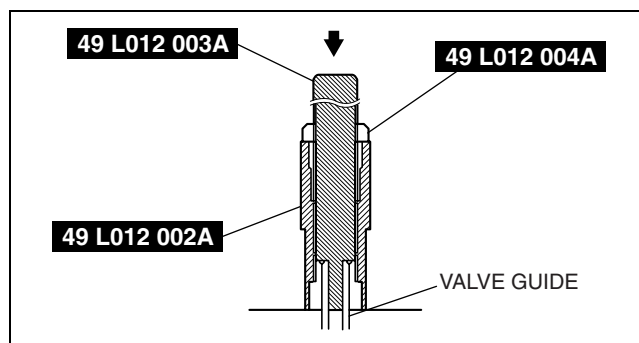


B3E0110E071

2. Tap the valve guide in from the cam side using the **SSTs** assembled in Step 1.



E6U110ZWB061



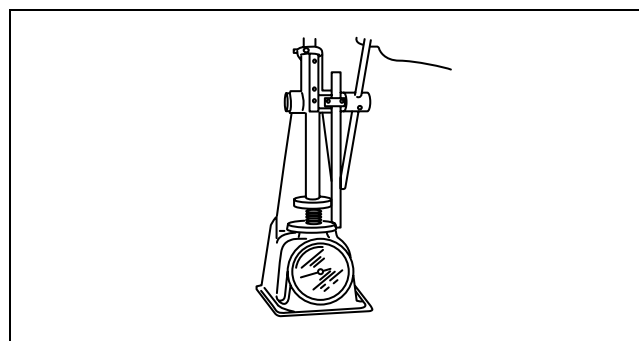
B3E0110E072

E6U011012125E01

VALVE SPRING INSPECTION

1. Measure the valve spring height using the spring tester.
 - If it is not within the specification, replace the valve spring.

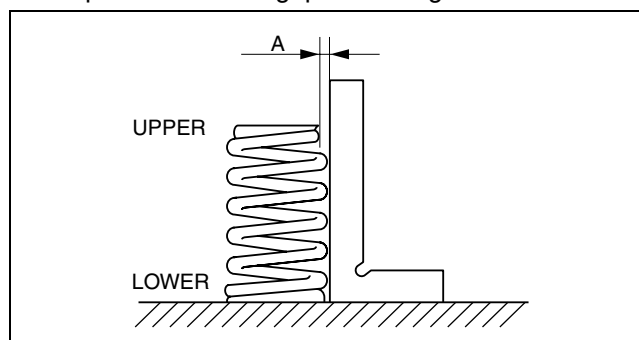
Valve spring installation height
 37.90 mm {1.492 in} (171.5 N {17.49 kgf, 38.55 lbf})



ADJ2224E028

2. Measure the amount of off-square on the valve spring using a square.
 - (1) Rotate the valve spring one full turn and measure A at the point where the gap is the largest.
 - If it exceeds the maximum specification, replace the valve spring.

Maximum valve spring off-square
 2.55 mm {0.100 in}



B3E0110E073

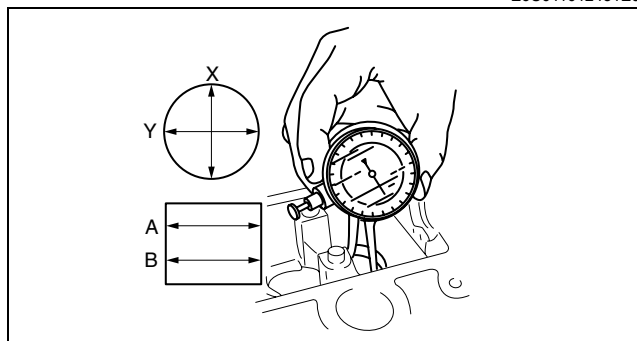
TAPPET INSPECTION

E6U011012431E01

1. Measure the diameter of each tappet bore using the caliper gauge. Measurement positions total four and are in the X and Y directions, at two points (A and B) as shown in the figure.

Standard tappet bore diameter

31.000—31.030 mm {1.2205—1.2216 in}

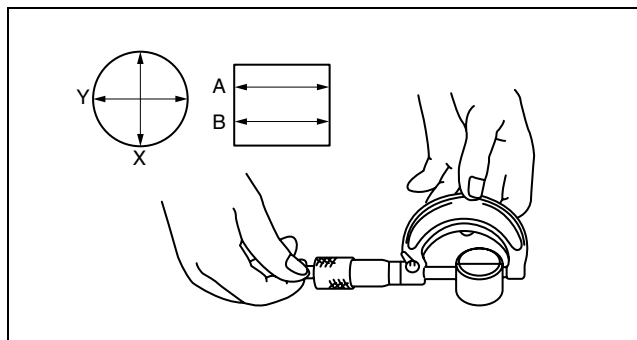


ADJ2224E023

2. Measure the tappet body outer diameter of each valve using the micrometer. Measurement positions total four and are in the X and Y directions, at two points (A and B) as shown in the figure.

Standard tappet body outer diameter

30.970—30.980 mm {1.2193—1.2196 in}



ADJ2224E029

3. Calculate the clearance between the tappet and the related tappet bore by subtracting the outer diameter of the tappet from the inner diameter of the tappet bore.

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

Clearance between tappet and tappet bore

Standard

0.02—0.06 mm {0.0008—0.0023 in}

Maximum

0.15 mm {0.006 in}

VARIABLE VALVE TIMING ACTUATOR INSPECTION

E6U011012420E01

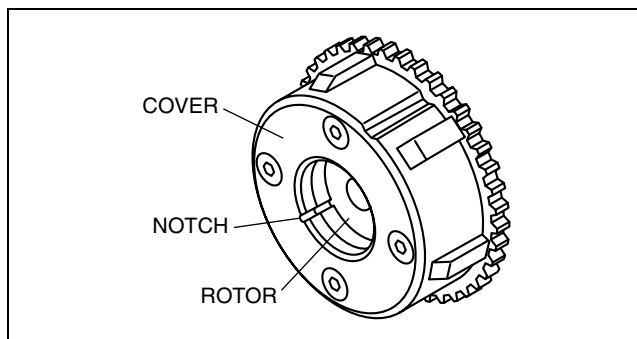
1. Rotate the variable valve timing actuator by hand and verify that the groove of the rotor and notch of the cover on the variable valve timing actuator are aligned and fitted.

Caution

- If the groove and notch are not aligned, rotate the rotor toward the valve timing retard position until a locking sound is heard and verify that they are set in place.
- If the rotor and cover are not secured even though their notch and groove are aligned, replace the variable valve timing actuator.

Caution

- Due to the precision interior construction of the variable valve timing actuator, it cannot be disassembled.



B3E0110E089

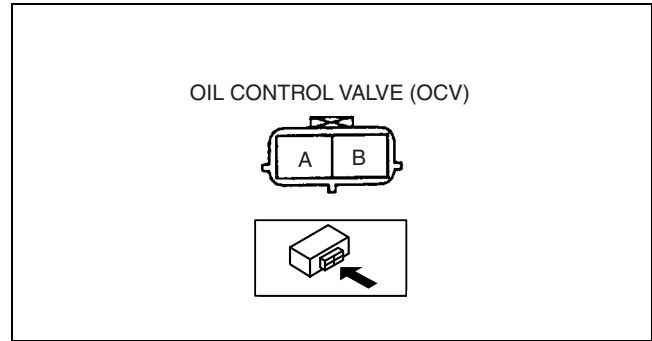
OIL CONTROL VALVE (OCV) INSPECTION

E6U011012420E02

Coil Resistance Inspection

1. Measure the coil resistance between terminals A and B using a tester.
 - If it is not within the specification, replace the oil control valve.

Oil control valve coil resistance
6.9—7.9 ohms [20°C {68°F}]

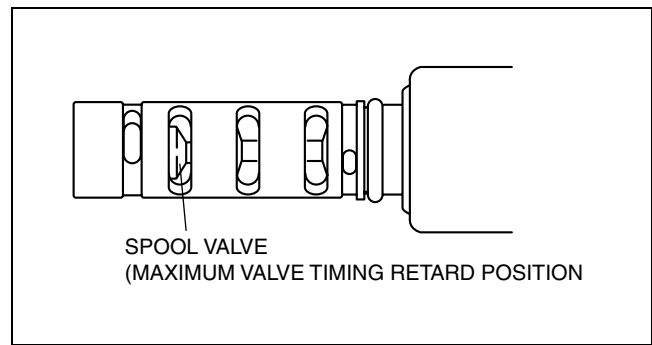


AME2226W002

01-10

Spool Valve Operation Inspection

1. Verify that the spool valve inside the oil control valve is at the maximum valve timing retard position as shown in the figure.
 - If there is any malfunction, replace the oil control valve.



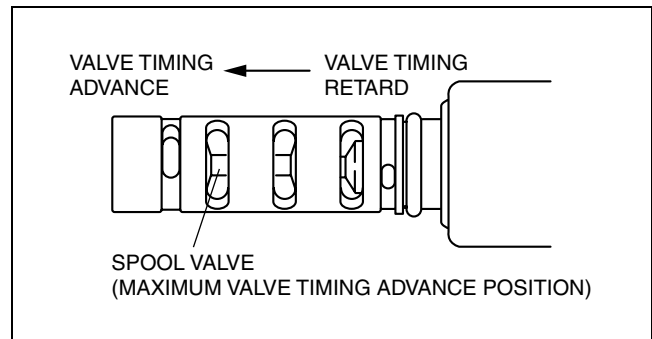
B3E0110E090

2. Apply battery positive voltage between the oil control valve terminals A and B and verify that the spool valve operates and move to the maximum valve timing advance position.
 - If there is any malfunction, replace the oil control valve.

Note

- When applying battery positive voltage between the oil control valve terminals, the connection of the positive and negative cables can be either terminal A or B.

3. Stop applying battery positive voltage and verify that the spool valve returns to the maximum valve timing retard position.
 - If there is any malfunction, replace the oil control valve.



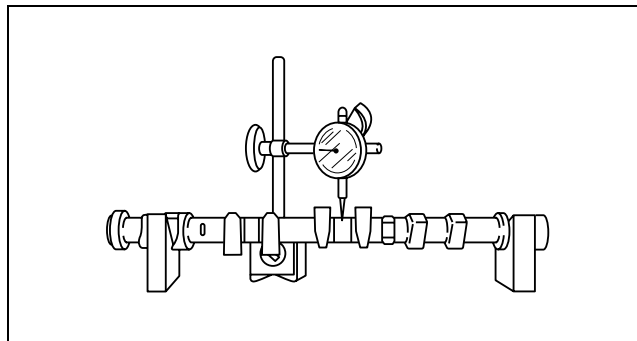
B3E0110E091

CAMSHAFT INSPECTION

E6U011012420E03

1. Set the No.1 and No.5 journals of the camshaft on V-blocks.
2. Measure the camshaft runout using the dial gauge.
 - If it is not within the specification, replace the camshaft.

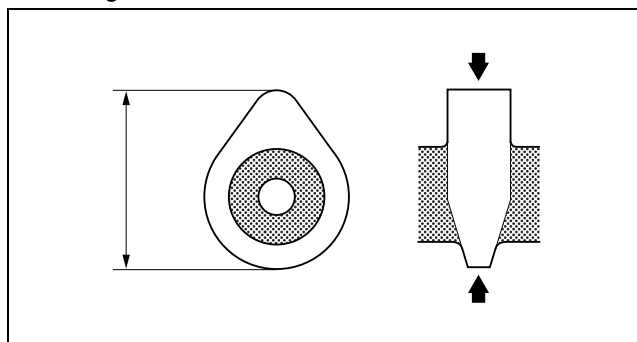
Maximum camshaft runout
0.03 mm {0.0012 in}



B3E0110E074

3. Measure the cam height using the micrometer as shown in the figure.
 - If it is less than the minimum specification, replace the camshaft.

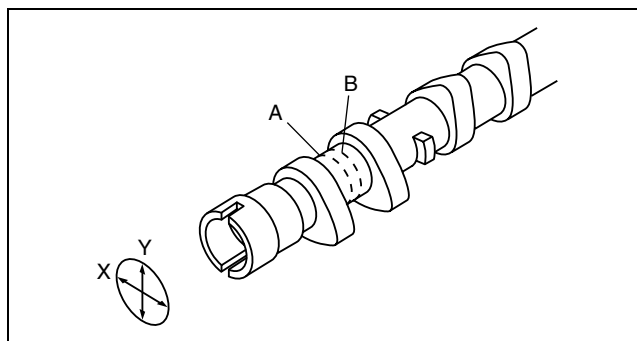
Cam height
Standard
IN: 42.44 mm {1.671 in}
EX: 41.18 mm {1.622 in}
Minimum
IN: 42.34 mm {1.667 in}
EX: 41.08 mm {1.618 in}



B3E0110E076

4. Measure the journal diameter using the micrometer. Measurement positions total four and are in the X and Y directions, at two points (A and B) as shown in the figure.
 - If it is less than the minimum specification, replace the camshaft.

Camshaft journal diameter
Standard
24.96—24.98 mm {0.9827—0.9834 in}
Minimum
24.95 mm {0.982 in}



B3E0110E075

- Measure the camshaft journal oil clearance using the plastigauge with the tappet removed.
 - If it exceeds the maximum specification, replace the cylinder head.

Note

- Clean the camshaft journal and the journal receptacle part.
- Cut the plastigauge to the same length as the journal width and position it parallel to the camshaft.

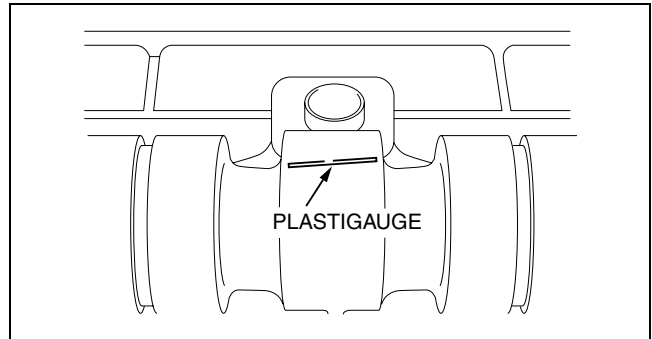
Camshaft journal oil clearance

Standard

0.04—0.08 mm {0.002—0.003 in}

Maximum

0.09 mm {0.0035 in}



B3E0110E077

01-10

- Measure the camshaft end play using a dial gauge.
 - If it exceeds the maximum specification, replace the cylinder head or camshaft.

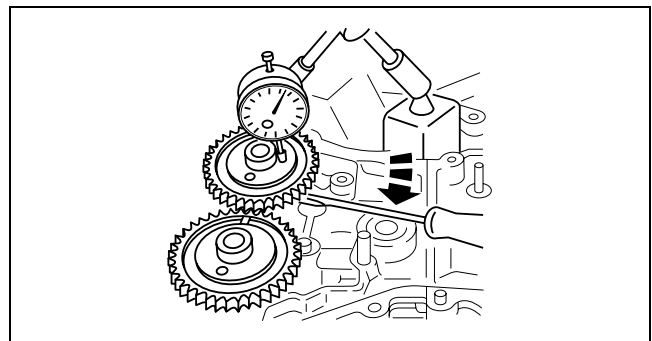
Camshaft end play

Standard

0.09—0.24 mm {0.0035—0.0094 in}

Maximum

0.25 mm {0.0099 in}



B3E0110E078

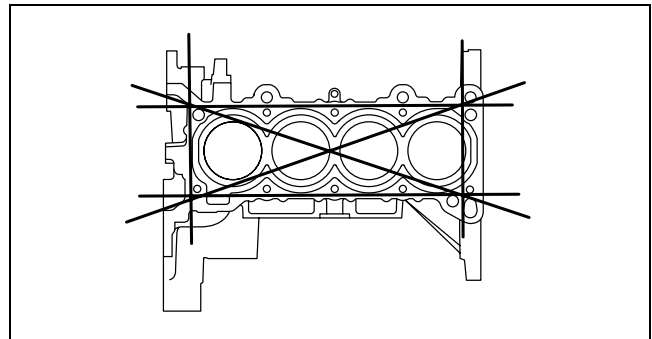
CYLINDER BLOCK INSPECTION

- Measure the cylinder block for distortion in six directions as shown in the figure using a straight edge and feeler gauge.
 - If it exceeds the maximum specification, replace the cylinder block.

E6U011010300E03

Maximum distortion, head gasket side

0.10 mm {0.004 in}

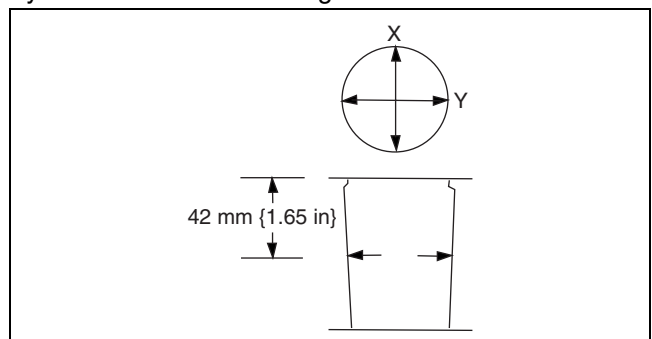


ADJ2224E089

- Measure the cylinder bore diameter using the cylinder gauge. The measurement position is in the X and Y directions at a point 42 mm below the top surface of the cylinder as shown in the figure.
 - If it exceeds the maximum specification, replace the cylinder block.

Maximum bore inner diameter

87.500—87.530 mm {3.4449—3.4460 in}

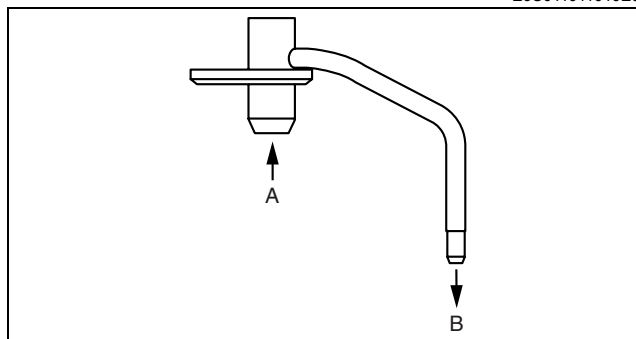


C3U0110E007

OIL JET VALVE INSPECTION

E6U011011010E01

1. Apply 0.17—0.23 MPa or more of compressed air to oil jet valve A and verify that air passes through oil jet valve B. If this cannot be verified, replace the oil jet valve.



E6U110ZE003

PISTON INSPECTION

E6U011011010E02

1. Measure the piston outer diameter using the micrometer.
The measurement position is **10.0 mm {0.40 in}** from the lower end of the piston and in the thrust direction.

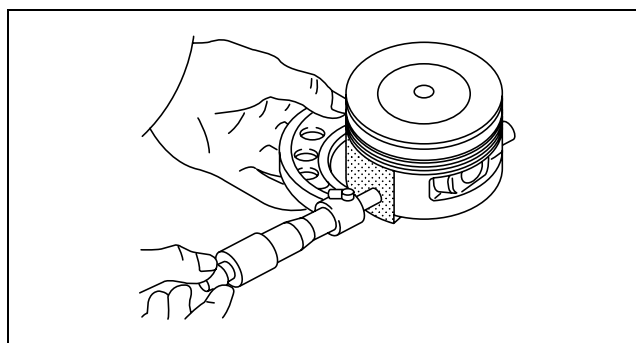
- If it is not within the specification, replace the piston.

Standard piston outer diameter

87.465—87.495 mm {3.4435—3.4446 in}

2. Calculate the cylinder-to-piston clearance from the cylinder bore diameter and the piston outer diameter.

- If the clearance is at the maximum specification or more, replace the piston or cylinder block.



B3E0110E080

Clearance between piston and cylinder

Standard

0.025—0.045 mm {0.0010—0.0017 in}

Maximum

0.11 mm {0.0043 in}

3. Measure the piston-to-ring groove clearance along the perimeter using a feeler gauge.

- If the clearance is at the maximum specification or more, replace the piston or piston ring.

Clearance between piston ring and ring groove

Standard

Top: 0.005—0.08 mm {0.0020—0.0031 in}

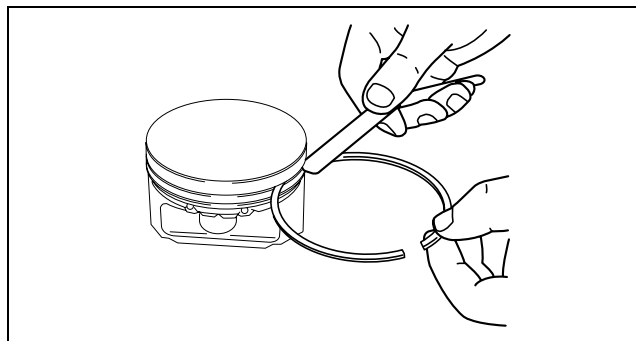
Second: 0.03—0.07 mm {0.0012—0.0027 in}

Oil: 0.02—0.06 mm {0.0008—0.0023 in}

Maximum

Top: 0.17 mm {0.0067 in}

Second, Oil: 0.15 mm {0.0059 in}



B3E0110E081

4. Measure the piston ring end gap using a feeler gauge.
 - If it is at the maximum specification or more, replace the piston ring.

Piston ring end gap

Standard

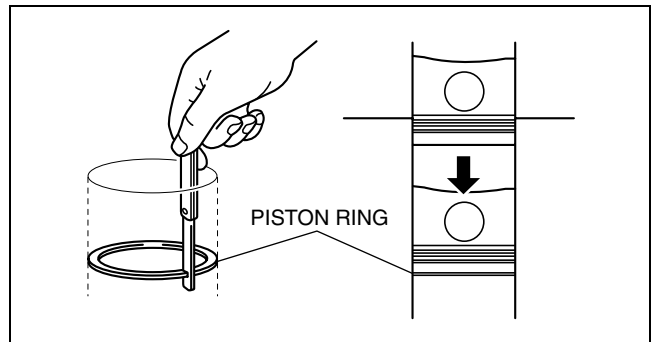
Top: 0.14—0.24 mm {0.0056—0.0094 in}

Second: 0.34—0.44 mm {0.0134—0.0173 in}

Oil (rail): 0.15—0.40 mm {0.0060—0.0157 in}

Maximum

1.0 mm {0.0393 in}



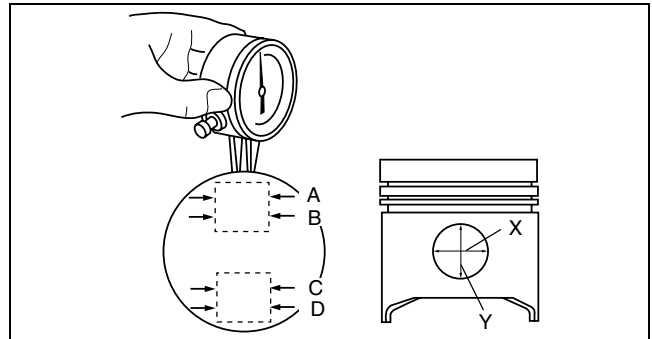
B3E0110E082

PISTON PIN INSPECTION

1. Measure the piston pin hole diameter using the caliper gauge. Measurement positions total eight and are in the X and Y directions, at four points (A, B, C, and D) as shown in the figure.

Standard piston pin hole diameter

22.504—22.508 mm {0.8860—0.8861 in}



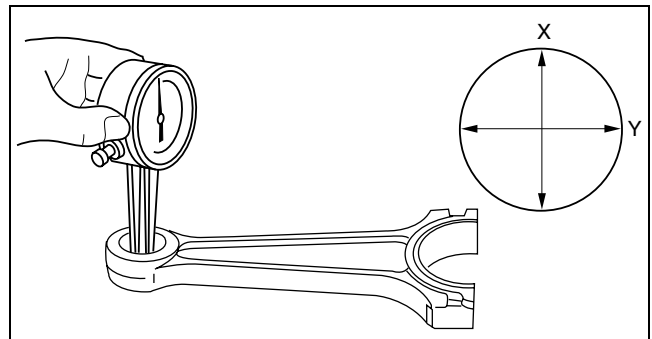
E6U011011010E03

ADJ2224E253

2. Measure the inner diameter on the small end of the connecting rod using the caliper gauge. Measurement positions total eight and are in the X and Y directions, at four points (A, B, C, and D) as shown in the figure.

Standard connecting rod small end inner diameter

22.510—22.521 mm {0.8863—0.8866 in}



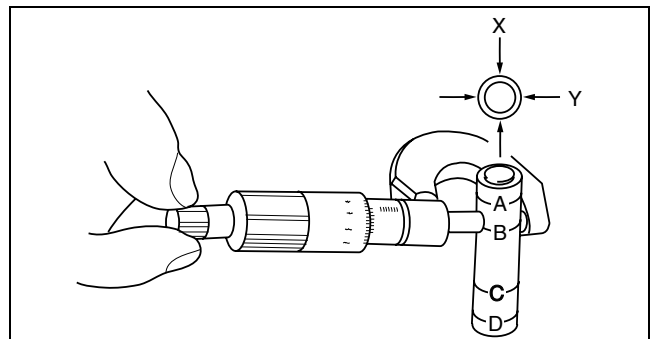
ADJ2224E254

3. Measure the piston pin outer diameter using the micrometer. Measurement positions total eight and are in the X and Y directions, at four points (A, B, C, and D) as shown in the figure.

Standard piston pin outer diameter

22.495—22.500 mm {0.8857—0.8858 in}

4. Calculate the clearance between the piston pin hole diameter and the piston pin outer diameter.
 - If it is not within the specification, replace the piston or the piston pin.



ADJ2224E255

Standard clearance between piston pin hole diameter and piston outer diameter

0.004—0.013 mm {0.0002—0.0005 in}

5. Calculate the clearance between the inner diameter on the small end of the connecting rod and the piston pin outer diameter.
 - If it is not within the specification, replace the connecting rod or the piston pin.

Standard clearance between connecting rod small end inner diameter and piston pin outer diameter

0.010—0.026 mm {0.0004—0.0010 in}

CONNECTING ROD CLEARANCE INSPECTION

E6U011011211E04

1. Measure the side clearance at the large end of the connecting rod using a feeler gauge.
 - If it is at the maximum specification or more, replace the connecting rod or crankshaft.

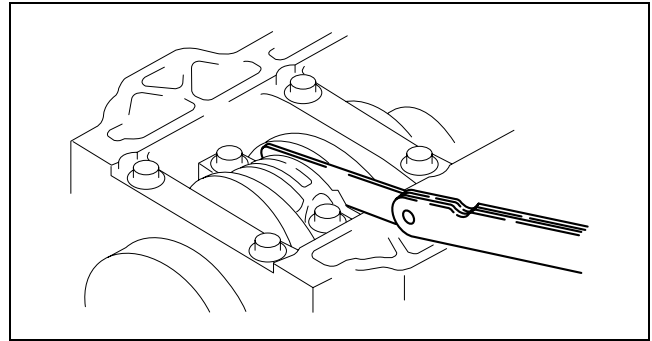
Connecting rod large end side clearance

Standard

0.14—0.36 mm {0.0056—0.0141 in}

Maximum

0.435 mm {0.0172 in}



B3E0110E087

2. Using a plastigauge, measure the oil clearance at the large end of the connecting rod.
 - If it is at the maximum specification or more, replace the bearing or grind the crank pin and use oversize bearings so that the specified clearance is obtained.

Note

- Cut the plastigauge as wide as the connecting rod bearing width, place it parallel to the crankshaft, keeping away from the oil hole.

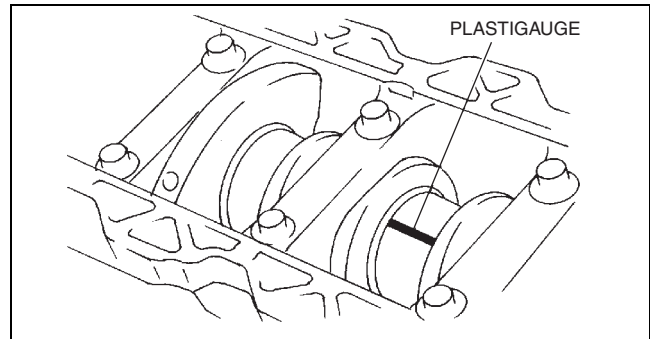
Bearing oil clearance at the large end of connecting rod

Standard

0.027—0.051 mm {0.0011—0.0020 in}

Maximum

0.1 mm {0.0039 in}



E6U110ZEB025

Connecting rod bearing size

STD

1.495—1.519 mm {0.0589—0.0598 in}

OS0.25

1.614—1.626 mm {0.0636—0.0640 in}

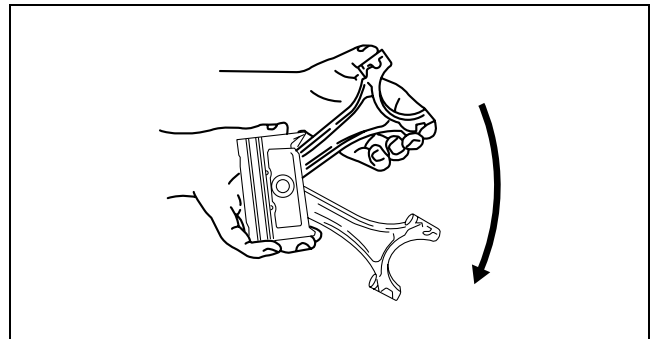
OS0.50

1.739—1.751 mm {0.0685—0.0689 in}

PISTON, CONNECTING ROD INSPECTION

E6U011011211E02

1. Check the oscillation torque as shown in the figure. Verify that the large end drops under its own weight with no resistance. If the piston shakes heavily or unsmoothly, replace the connecting rod and piston pin.



E6U110ZEB009

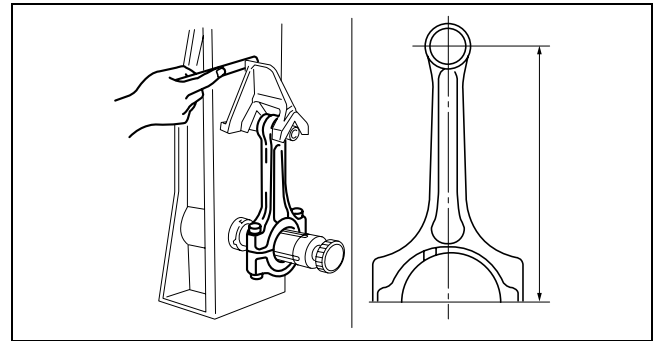
CONNECTING ROD INSPECTION

1. Inspect the connecting rod for bending and distortion using the connecting rod aligner. If it is at the maximum specification or more, replace the connecting rod.

Maximum connecting rod bending [per 50 mm {1.968 in}]
0.070 mm {0.0019 in}

Maximum connecting rod distortion [per 50 mm {1.968 in}]
0.060 mm {0.0027 in}

Connecting rod center-to-center distance
150.65—150.75 mm {5.9311—5.9350 in}



E6U011011211E03

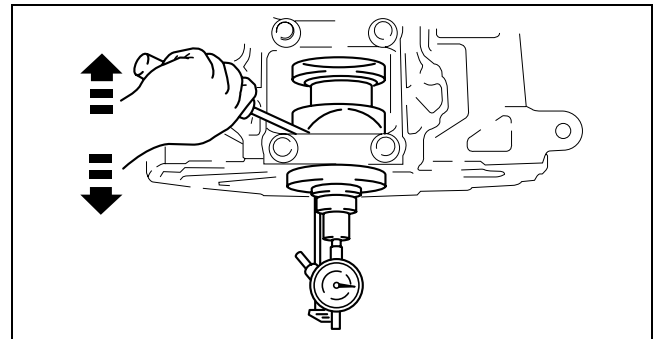
AMJ2224E255

01-10

CRANKSHAFT INSPECTION

1. Measure the crankshaft end play using a dial gauge.
 - If it exceeds the maximum 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}
Maximum
0.55 mm {0.021 in}

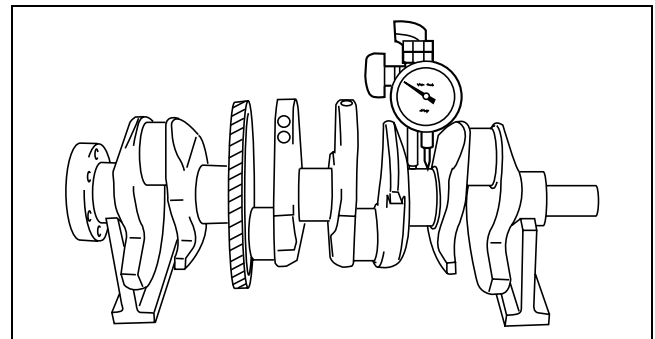


E6U011011301E01

B3E0110E083

2. Measure the runout of the main journal using a V-block and dial gauge.
 - If it is at the maximum specification or more, replace the crankshaft.

Maximum main journal runout
0.05 mm {0.0019 in}



AME2224E311

3. Inspect the main journal diameter and crank pin diameter. Measurement positions total four and are in the X and Y directions, at two points (A and B) as shown in the figure.

- If it is not within the specification or if it exceeds the maximum off-round, grind the journal with an oversized bearing.

Main journal diameter

STD

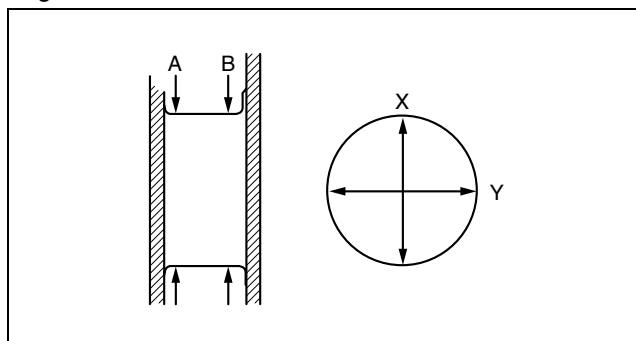
51.980—52.000 mm {2.0465—2.0472 in}

OS0.25

51.730—51.750 mm {2.0367—2.0374 in}

Maximum main journal off-round

0.05 mm {0.0019 in}



B3E0110E085

Crank pin diameter

STD

51.980—52.000 mm {2.0465—2.0472 in}

OS0.25

51.730—51.750 mm {2.0367—2.0374 in}

Maximum crank pin off-round

0.05 mm {0.0019 in}

4. Inspect the main journal oil clearance using the following procedure.

- (1) Install the upper main bearing and crankshaft.
- (2) Position a plastigauge on the journals.
- (3) Install the lower main bearing and main bearing cap and tighten the bolts in the order shown in the figure.

Tightening procedure

- (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}

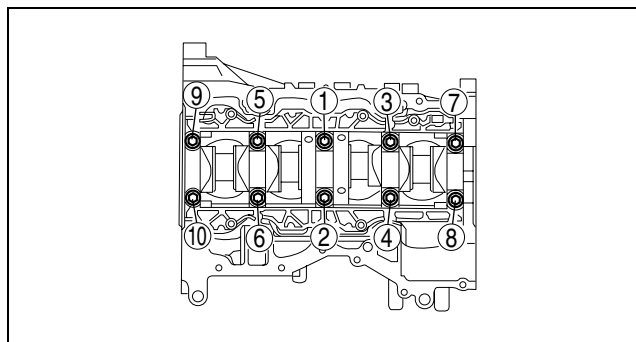
- (5) Loosen all the bolts (until bolts are torque-free).

- (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°

- (4) Loosen the bolts in the reverse order of tightening.



B3E0110E267

- (5) Measure the main journal oil clearance.
 - If it is not within the specification, replace the main bearing, or grind the main journal and use oversized bearings so that the specified oil clearance is obtained.

Main journal oil clearance

Standard

0.016—0.039 mm {0.0007—0.0015 in}

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

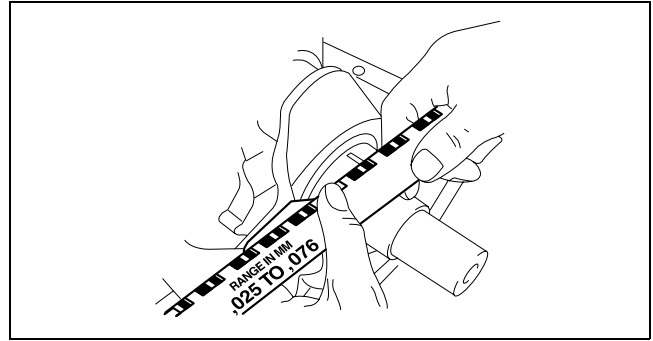
2.501—2.529 mm {0.0985—0.0995 in}

OS0.25

2.624—2.630 mm {0.1034—0.1035 in}

OS0.50

2.749—2.755 mm {0.1083—0.1084 in}



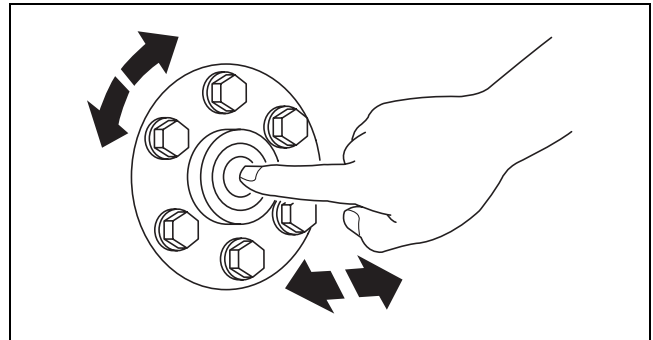
B3E0110E086

01-10

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.

E6U011011301E02



ADJ4920W002

BOLT INSPECTION

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

E6U011010135E01

Cylinder head bolt length

Standard

144.7—145.3 mm {5.696—5.720 in}

Maximum

146 mm {5.748 in}

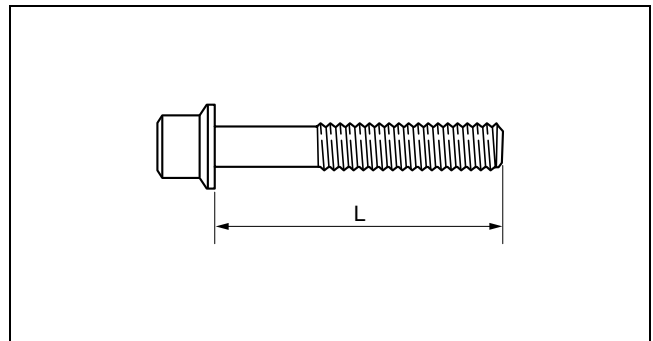
Connecting rod bolt length

Standard

43.7—44.3 mm {1.720—1.744 in}

Maximum

46 mm {1.811 in}



B3E0110E088

VALVE CLEARANCE INSPECTION/ADJUSTMENT

E6U011012111E01

VALVE CLEARANCE INSPECTION

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 it is not within the specification, replace the tappet and adjust the valve clearance to the standard clearance. (See 01-10-28 VALVE CLEARANCE ADJUSTMENT.)

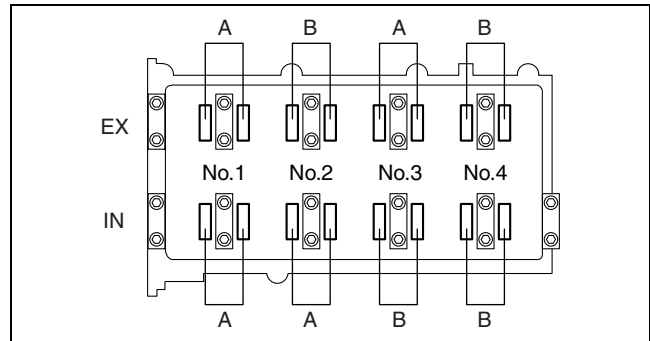
Standard valve clearance [when cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

EX: 0.27—0.33 mm {0.0106—0.0130 in}

Note

- When replacing the tappet, select the tappet according to the measured value and note down the measured value.
3. Rotate the crankshaft clockwise **360°** so that the No.4 piston is at the TDC of the compression stroke.
 4. Measure the valve clearance at B in the figure.
 - If it is not within the specification, replace the tappet and adjust the valve clearance to the standard clearance. (See 01-10-28 VALVE CLEARANCE ADJUSTMENT.)



E6U110ZEB002

Standard valve clearance [when cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

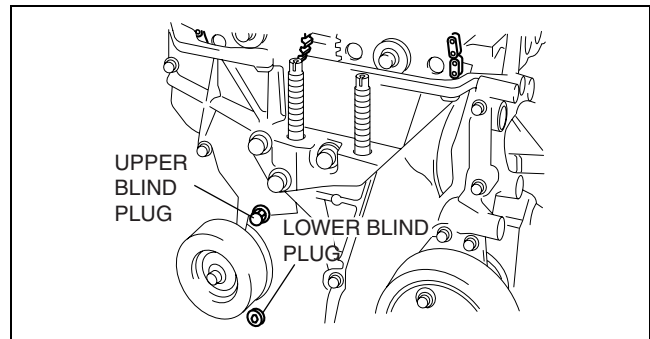
EX: 0.27—0.33 mm {0.0106—0.0130 in}

Note

- When replacing the tappet, select the tappet according to the measured value and note down the measured value.

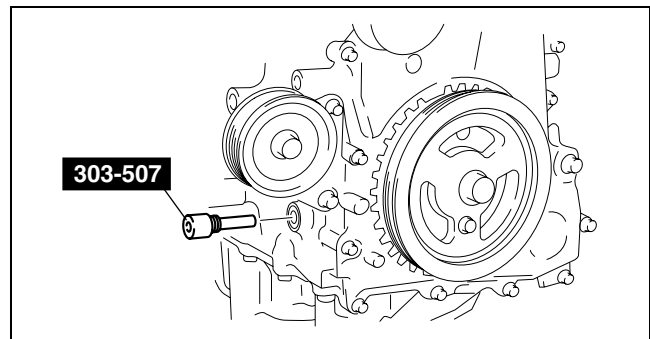
VALVE CLEARANCE ADJUSTMENT

1. Remove the engine front cover lower blind plug.
2. Remove the engine front cover upper blind plug.



B3E0110E093

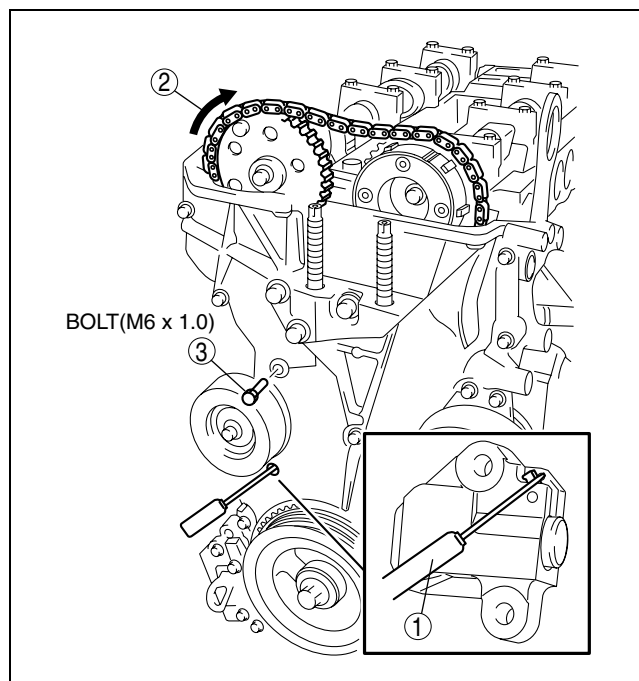
3. Remove the cylinder block lower blind plug and install the **SST**.
4. Rotate the crankshaft clockwise so that the No.1 piston is at TDC of the compression stroke. (The position crank weight contacts the **SST**.)



E6U110ZWB050

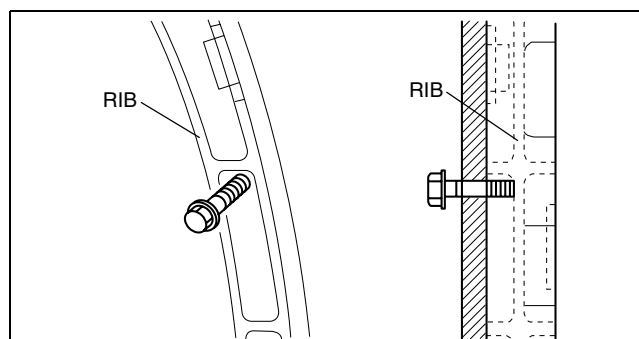
5. Loosen the timing chain.

- (1) Using a suitable screwdriver or equivalent tool, unlock the timing chain tensioner ratchet.
- (2) Rotate the exhaust camshaft clockwise using a suitable wrench on the cast hexagon and loosen the timing chain tensioner.



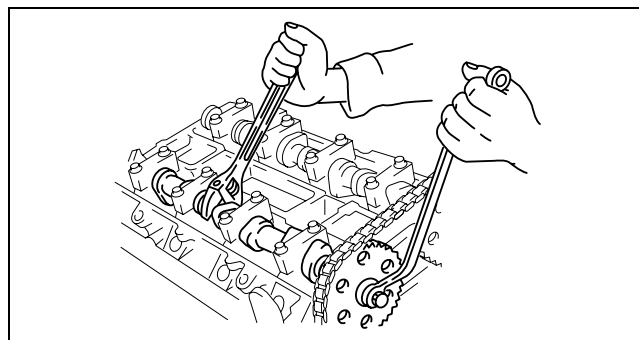
E6U110ZWB052

- (3) Using a suitable bolt (**M6 X 1.0 length 25—35 mm {0.99—1.37 in}**) at the engine front cover upper blind plug, secure the tensioner arm at the position where the tension is released.



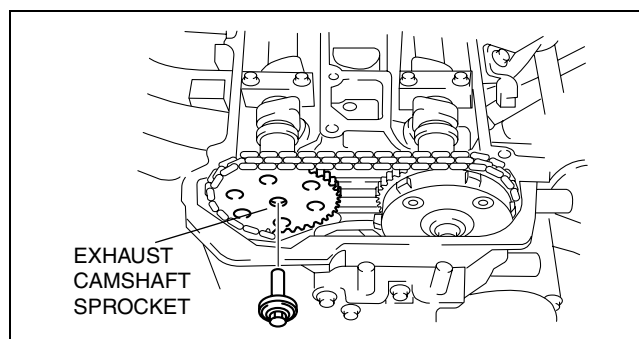
E6U110ZWB045

6. Secure the exhaust camshaft using a wrench on the cast hexagon and loosen the camshaft sprocket installation bolt.



B3E0110E095

7. Remove the installation bolt and exhaust camshaft sprocket.



E6U110ZWB008

MECHANICAL

8. Loosen the camshaft cap bolts in two or three passes in the order shown in the figure, and remove the camshaft bearing caps.

Note

- The camshaft caps are to be kept ordered for correct reassembly in their original positions. Do not mix the caps.

9. Remove the camshafts for intake and exhaust sides.
10. Remove the tappet.
11. Select and install the suitable tappet according to the result of valve clearance inspection.
Selected tappet = Removed tappet thickness + Measured valve clearance - Standard valve clearance

Standard valve clearance [when cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

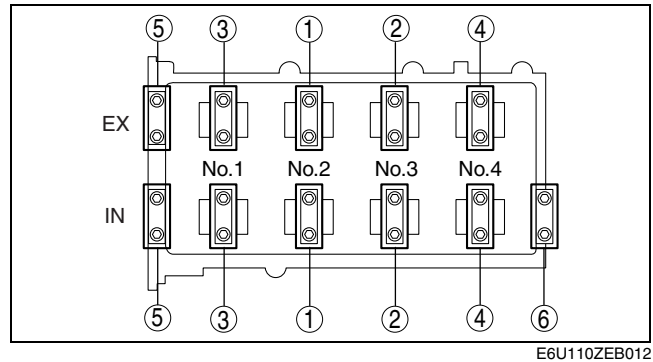
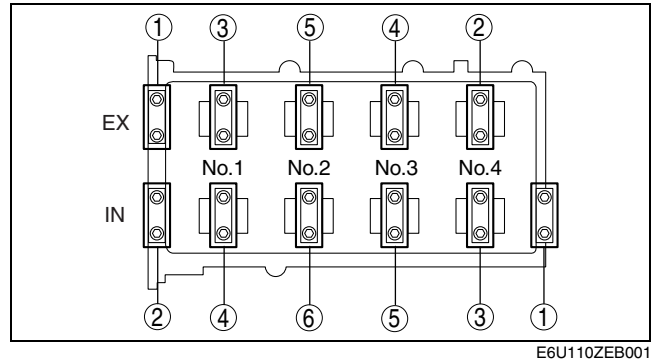
EX: 0.27—0.33 mm {0.0106—0.0130 in}

12. Install the camshaft with the No.1 cylinder cam aligned at TDC of the compression stroke.
13. Install the camshaft bearing cap and tighten the camshaft bearing cap bolts in two passes in the order shown in the figure.

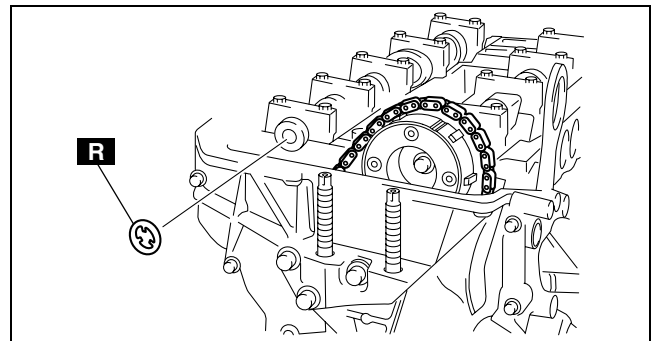
Tightening procedure

(1) 5.0—9.0 N·m {51.0—91.7 kgf·cm, 44.3—79.6 in·lbf}

(2) 14.0—17.0 N·m {1.5—1.7 kgf·m, 10.4—12.5 ft·lbf}



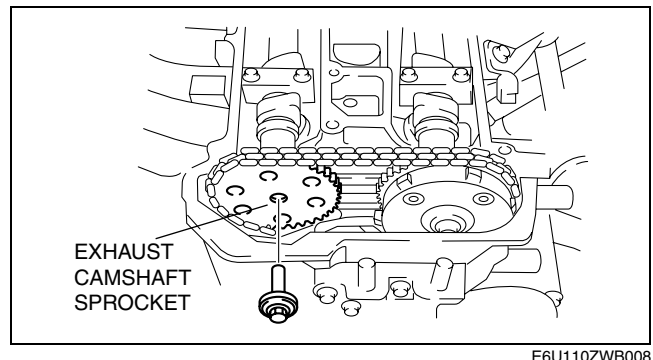
14. Install a new washer.



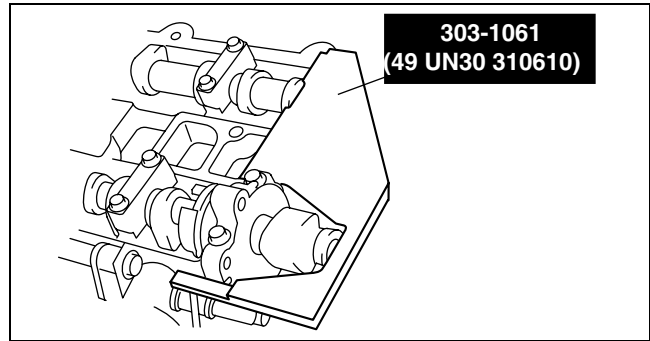
15. Install the exhaust camshaft sprocket.

Caution

- Do not tighten the camshaft sprocket installation bolt during this step.



16. Install the **SST** on the camshaft as shown in the figure.
17. Remove the bolt (**M6 X 1.0 length 25—35 mm {0.99—1.37 in}**) from the engine front cover upper blind plug and apply tension to the timing chain.
18. Rotate the crankshaft clockwise and verify that the No.1 piston is at TDC of the compression stroke.

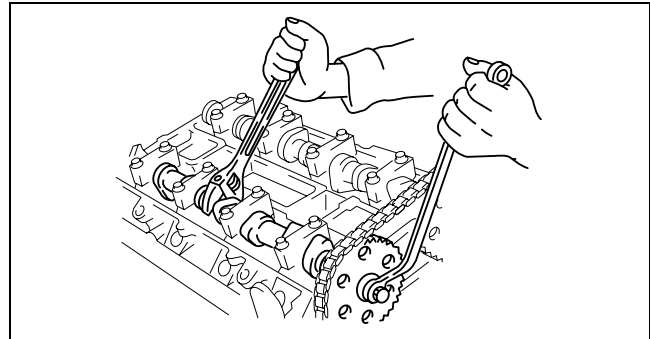


19. Secure the exhaust camshaft using a wrench on the cast hexagon and tighten the sprocket installation bolt.

Tightening torque

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

20. Remove the **SST** from the camshaft.
21. Remove the **SST** installed in the cylinder block lower blind plug hole.
22. Rotate the crankshaft clockwise two turns and inspect the valve timing.
23. Apply silicone sealant and install the engine front cover upper blind plug.



Tightening torque

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

24. 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}

25. Install a new engine front cover lower blind plug.

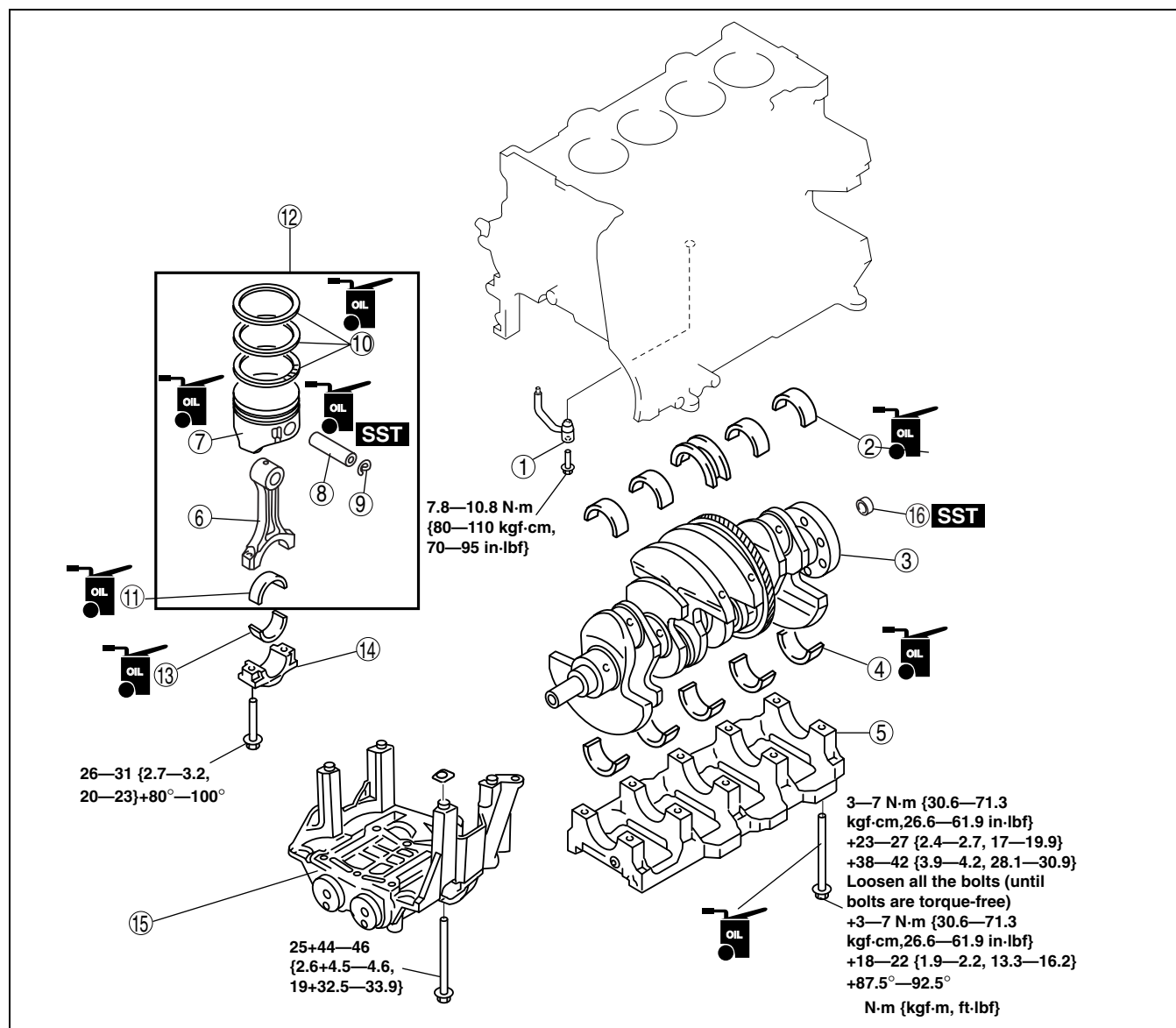
Tightening torque

10.0—14.0 N·m {102.0—142.7 kgf·cm, 88.6—123.9 in·lbf}

CYLINDER BLOCK (I) ASSEMBLY

E6U011010300E04

1. Assemble in the order indicated in the table.



E6U110ZE016

1	Oil jet valve
2	Upper main bearing, thrust bearing
3	Crankshaft
4	Lower main bearing
5	Main bearing cap (See 01-10-33 Main Bearing Cap Assembly Note.)
6	Connecting rod
7	Piston
8	Piston pin (See 01-10-33 Piston Pin Assembly Note.)
9	Snap ring
10	Piston ring (See 01-10-33 Piston Ring Assembly Note.)
11	Upper connecting rod bearing (See 01-10-34 Connecting Rod Bearing Assembly Note.)

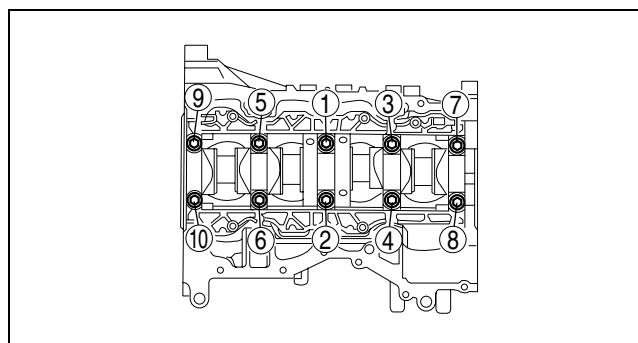
12	Connecting rod, piston (See 01-10-34 Piston Assembly Note.)
13	Lower connecting rod bearing (See 01-10-34 Connecting Rod Bearing Assembly Note.)
14	Connecting rod cap (See 01-10-34 Connecting Rod Cap Assembly Note.)
15	Engine balancer (See 01-10-35 Balancer Unit Assembly Note.)
16	Pilot bearing (See 01-10-37 Pilot Bearing Assembly Note.)

Main Bearing Cap Assembly Note

1. Tighten the crank bearing caps in the order shown in the figure.

Tightening procedure

- (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 (until bolts are torque-free).
- (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°

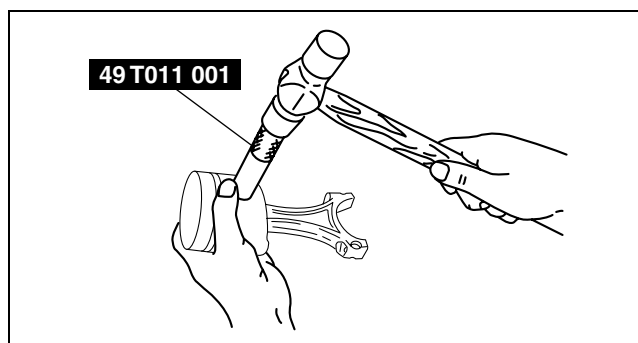


B3E0110E267

01-10

Piston Pin Assembly Note

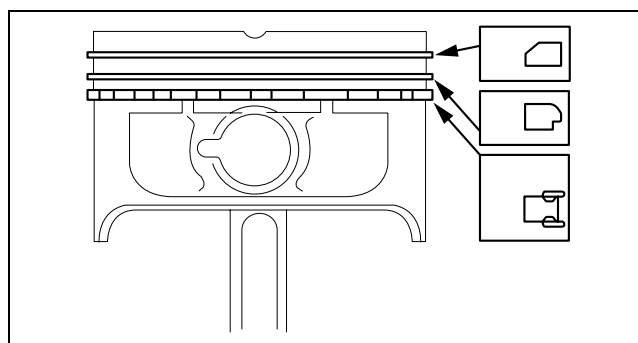
1. Assemble the piston pin using the SST.



E6U110ZEB034

Piston Ring Assembly Note

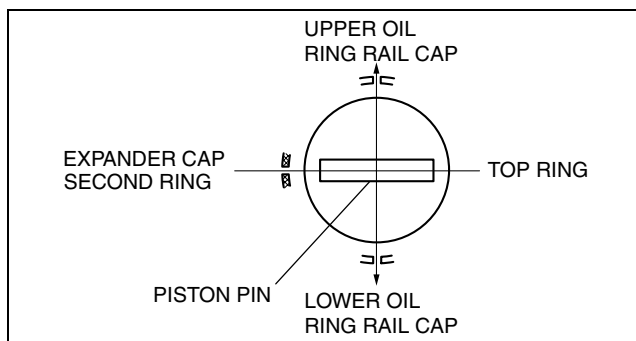
1. Assemble the oil ring.
2. Assemble the second ring with the notch facing downward.
3. Assemble the top ring with scraper face side upward.



C3U0110E256

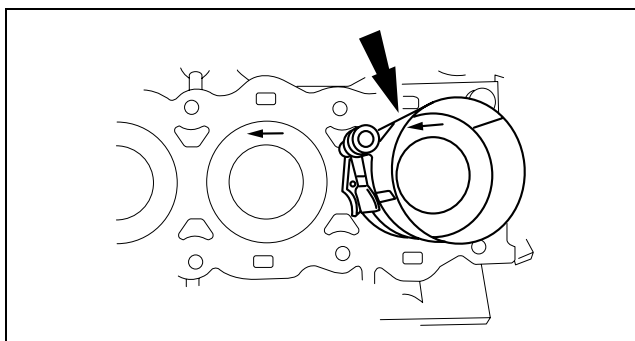
Piston Assembly Note

1. Position the end gap of each ring so they are not aligned as shown in the figure.



E6U110ZEB004

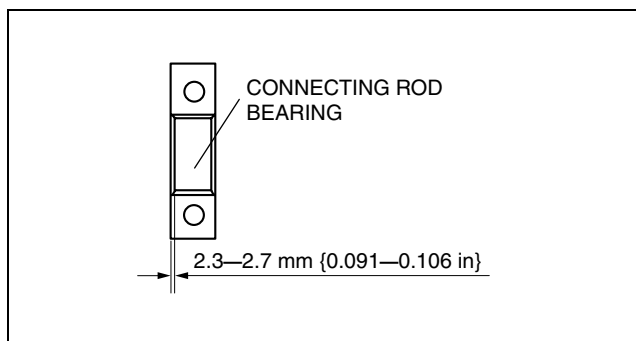
2. Insert the piston into the cylinder with the arrow on top of the piston facing the front of the engine.



B3E0110E108

Connecting Rod Bearing Assembly Note

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



B3E0110E109

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 installation bolts using the following procedure.

Tightening procedure

- (1) 26—31 N·m {2.7—3.1 kgf·m, 19.2—22.8 ft·lbf}
- (2) 80°—100°

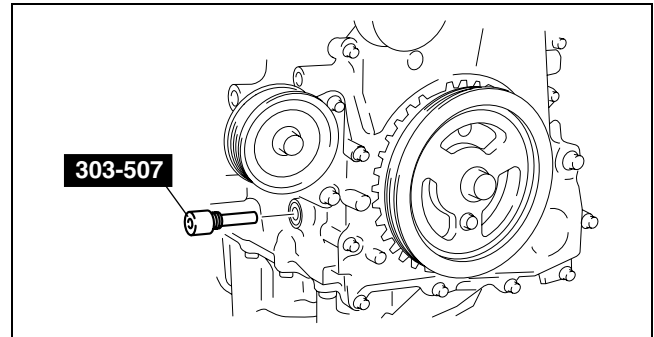
Balancer Unit Assembly Note

- Confirm by visual inspection that there is no damage to the balancer unit gear and verify that the shaft rotates smoothly.
 - If there is any malfunction, replace the balancer unit.

Caution

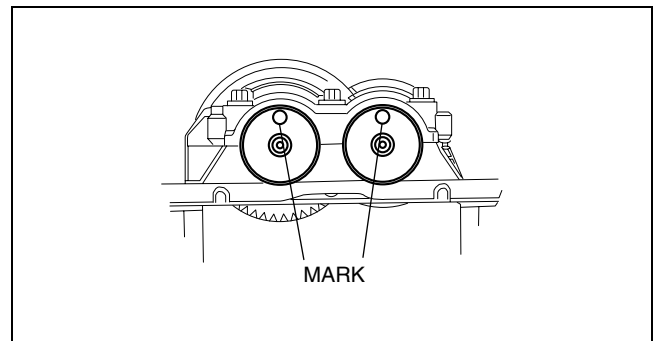
- Due to the precision interior construction of the balancer unit, it cannot be disassembled.

- Remove the cylinder block lower blind plug and install the **SST**.
- Rotate the crankshaft clockwise so that the No.1 piston is at TDC of the compression stroke. (The position crank weight contacts the **SST**.)
- Install the adjustment shim to the seating face of the balancer unit.



E6U110ZW050

- With the balancer unit marks at the exact top center, assemble the balancer unit to the cylinder block.

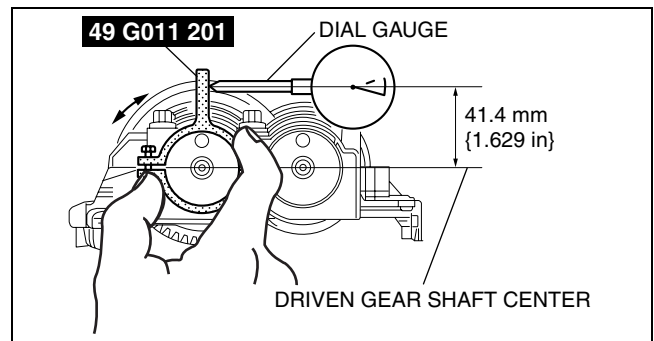


B3E0110E111

- Set the SST as shown in the figure and measure the gear backlash using a dial gauge.

Note

- To measure the backlash precisely, insert a flathead screwdriver into the crankshaft No.1 crank weight area and set both the rotation and the thrust direction with the flathead screwdriver, using a prying action, as shown in the figure.

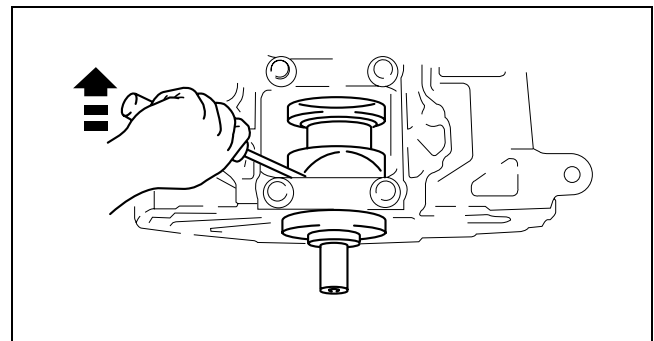


B3E0110E112

- If it exceeds the maximum specification, remeasure the backlash and, using the adjustment shim selection table, select the proper shim, according to the following procedure.

Caution

- When measuring the backlash, rotate the crankshaft one full rotation and verify that it is within the specified range at all of the following six positions: 10, 30, 100, 190, 210, 280 ATDC.



B3E0110E113

Maximum gear backlash

0.005—0.101 mm {0.00019—0.0039 in}

- Using master shim (No.50), assemble the balancer unit to the cylinder block and measure the backlash.
- Select the proper adjustment shim according to the measured value.
- Install the selected adjustment shim to the balancer unit and assemble the balancer unit to the cylinder block.

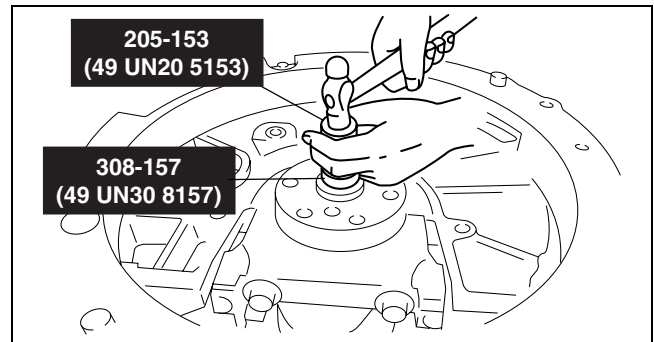
MECHANICAL

Adjustment shim selection table

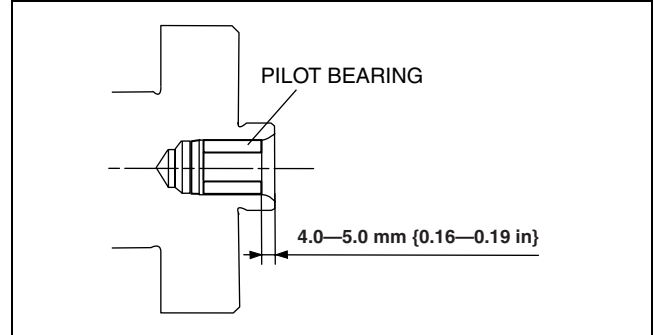
Backlash mm {in}	Selection shim (No.)	Shim thickness mm {in}	Backlash mm {in}	Selection shim (No.)	Shim thickness mm {in}
0.267—0.273 {0.01051— 0.01074}	15	1.15 {0.0452}	0.127—0.133 {0.00500— 0.00523}	35	1.35 {0.0531}
0.260—0.266 {0.01023— 0.01047}	16	1.16 {0.0456}	0.120—0.126 {0.00472— 0.00496}	36	1.36 {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 .087 {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— 0.00110}	50 (master)	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}

Pilot Bearing Assembly Note

1. Use the **SSTs** to install the pilot bearing.



E6U110ZWB049



C3U0510W013

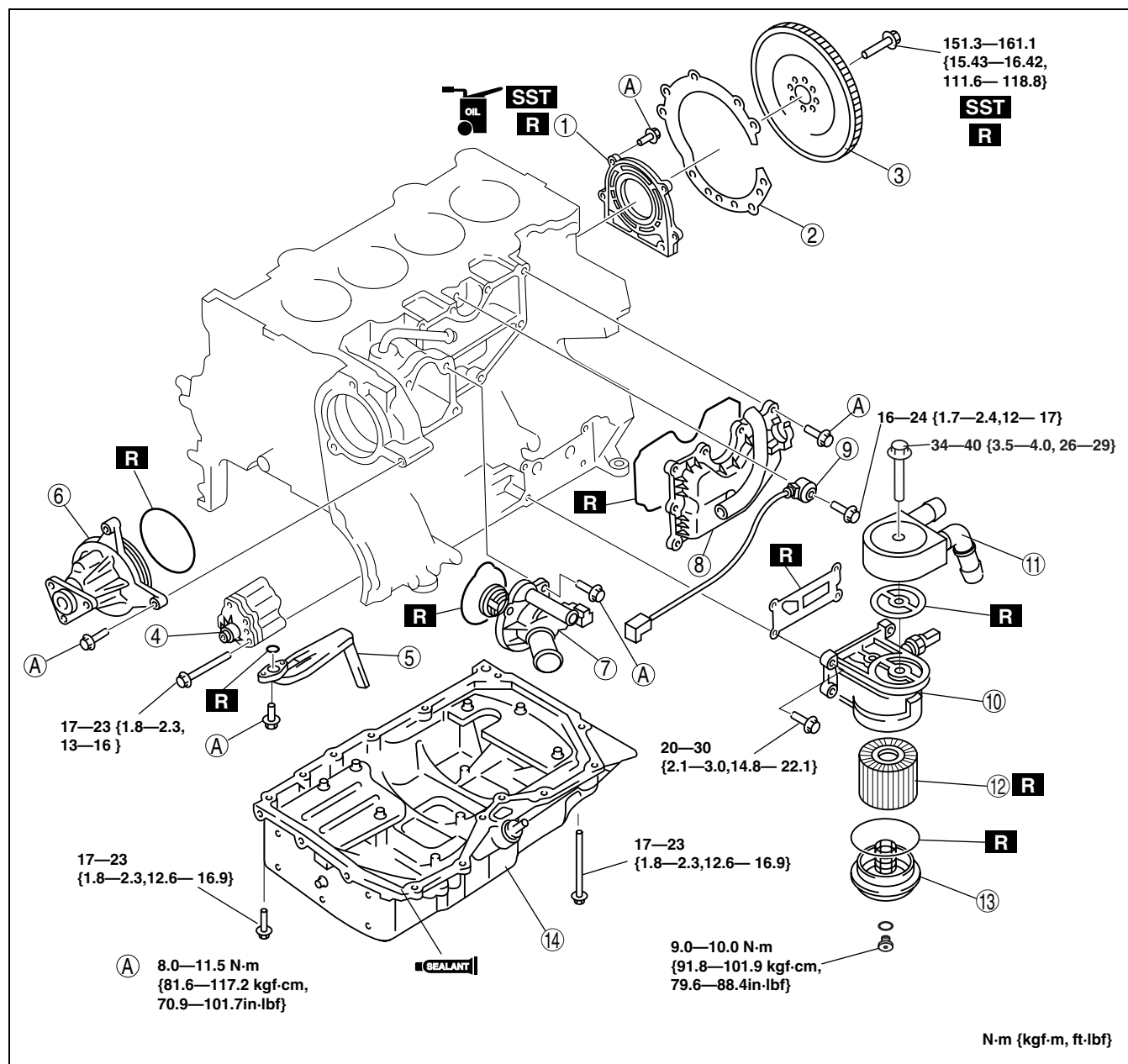
01-10

MECHANICAL

CYLINDER BLOCK (II) ASSEMBLY

E6U011010300E05

1. Assemble in the order indicated in the table.



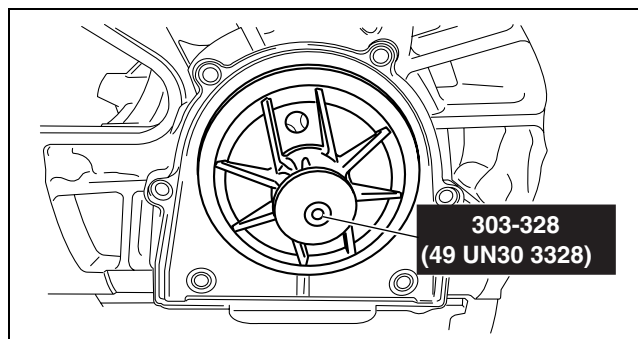
E6U110ZE017

1	Rear oil seal (See 01–10–39 Rear Oil Seal Assembly Note.)
2	End plate
3	Flywheel (See 01–10–39 Flywheel Assembly Note.)
4	Oil pump
5	Oil strainer
6	Water pump
7	Thermostat

8	Crankcase ventilation cover
9	Knock sensor
10	Oil filter adapter
11	Oil cooler
12	Oil filter
13	Oil filter cover
14	Oil pan (See 01–10–39 Oil Pan Assembly Note.)

Rear Oil Seal Assembly Note

1. Apply clean engine oil to a new rear oil seal.
2. Install the rear oil seal using a **SST**.



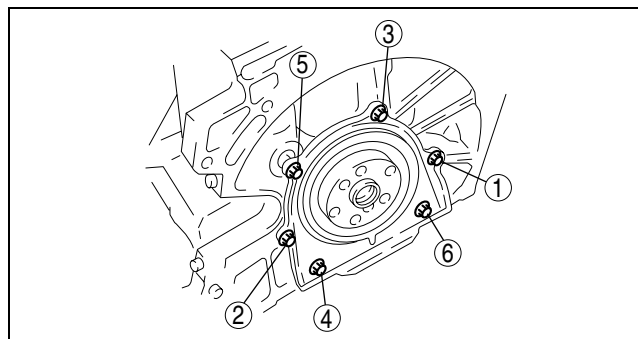
CUE110BW2005

01-10

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

Tightening torque

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



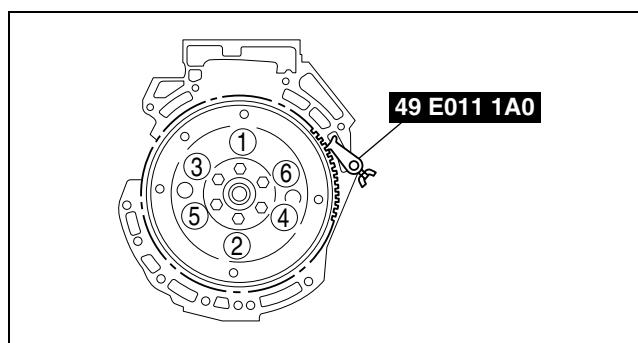
B3E0110E116

Flywheel Assembly Note

1. Secure the crankshaft using the **SST**.
2. Tighten the installation bolts in two or three passes in the order shown in the figure.

Tightening torque

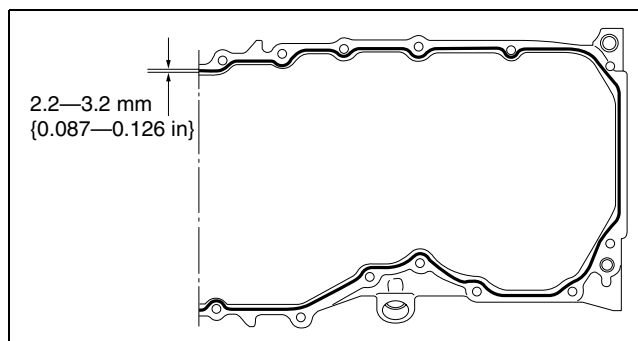
151.3—161.1 N·m {15.43—16.42 kgf·m, 111.6—118.8 ft·lbf}



B3E0110E119

Oil Pan Assembly Note

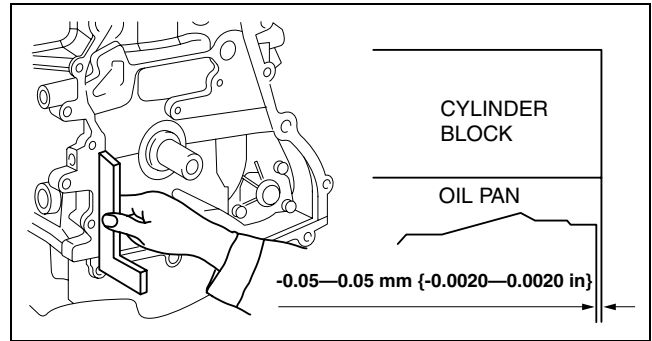
1. Apply silicone sealant to the areas shown in the figure.
2. Assemble the oil pan.



E6U111ZWB006

MECHANICAL

3. Use a straight edge to align the junction of the oil pan and the cylinder block on the engine front cover side.

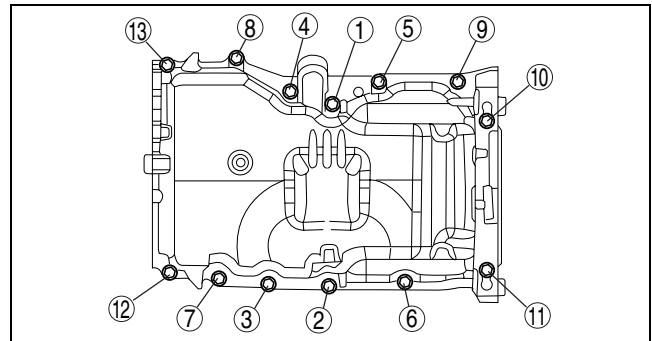


B3E0110E120

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

Tightening torque

$17—23\text{ N}\cdot\text{m}$ $\{1.8—2.3\text{ kgf}\cdot\text{m}, 12.6—16.9\text{ ft}\cdot\text{lbf}\}$

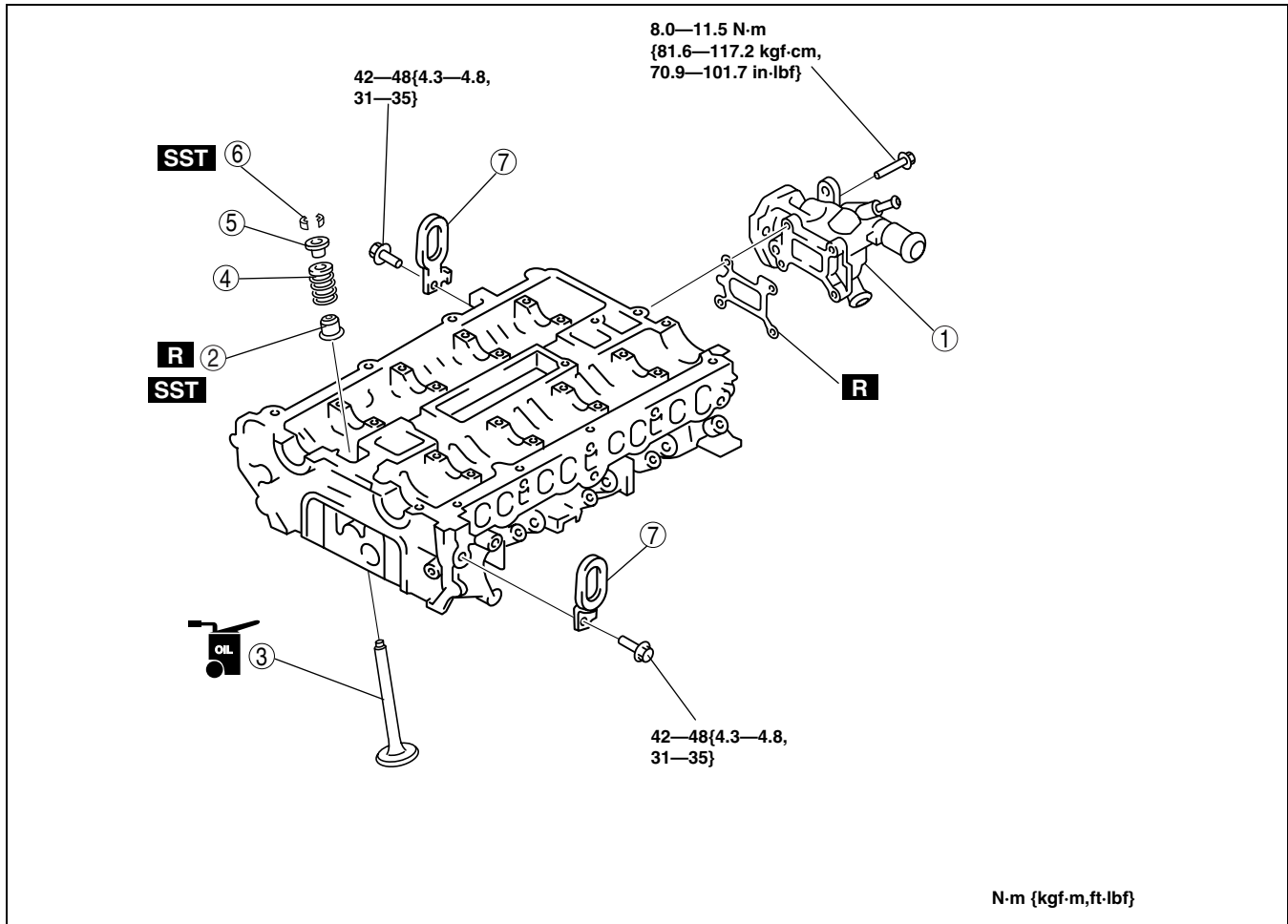


E6U110ZEB021

CYLINDER HEAD (I) ASSEMBLY

E6U011010100E03

1. Disassemble in the order indicated in the table.



01-10

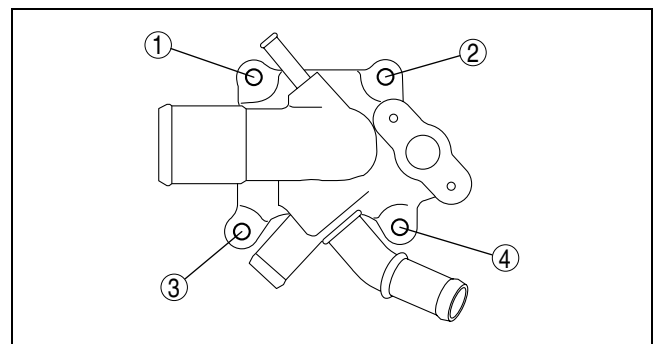
E6U110ZEB018

1	Water outlet case
2	Valve seal (See 01-10-42 Valve Seal Assembly Note.)
3	Valve
4	Valve spring

5	Upper valve spring seat
6	Valve keeper (See 01-10-42 Valve Keeper Assembly Note.)
7	Engine hanger

Water Outlet Case Assembly Note

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

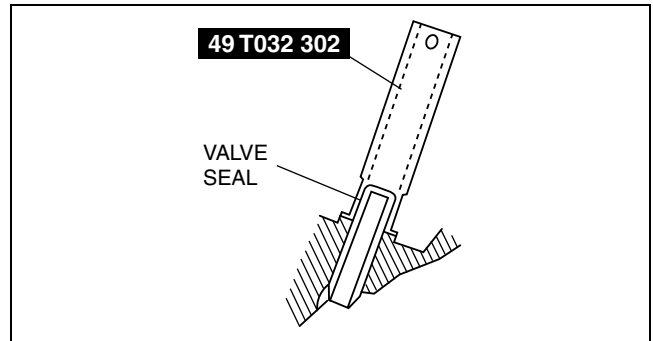


E6U110ZEB037

MECHANICAL

Valve Seal Assembly Note

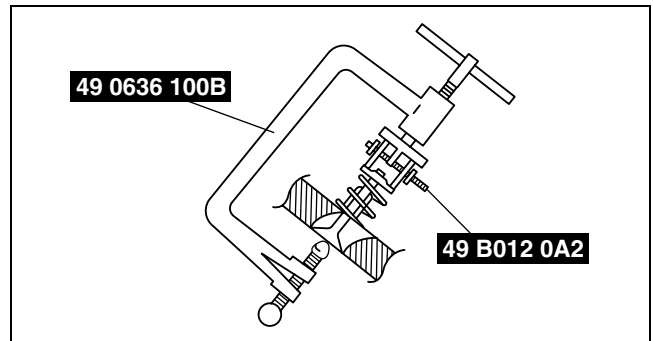
1. Press in the valve seal to the valve guide by hand.
2. Set the **SST** and tap it using a plastic hammer.



B3E0110E123

Valve Keeper Assembly Note

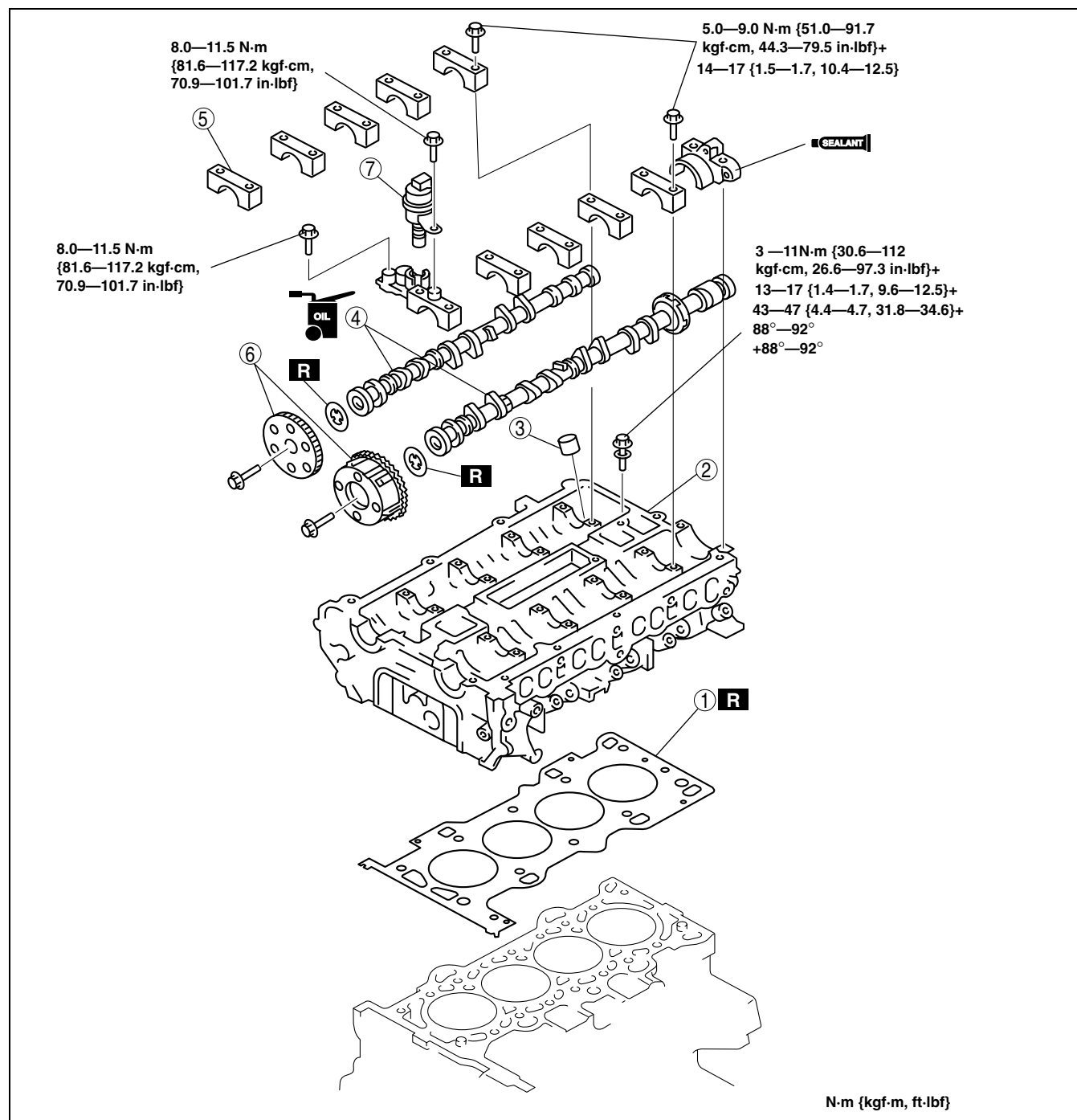
1. Assemble the valve keeper using the **SST**.



B3E0110E124

01-10

1. Assemble in the order indicated in the table.



E6U110ZEB019

1	Cylinder head gasket
2	Cylinder head (See 01-10-44 Cylinder Head Assembly Note.)
3	Tappet
4	Camshaft (See 01-10-44 Camshaft Assembly Note.)

5	Camshaft cap (See 01-10-44 Camshaft Assembly Note.)
6	Camshaft sprocket, variable valve timing actuator (See 01-10-44 Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note.)
7	OCV

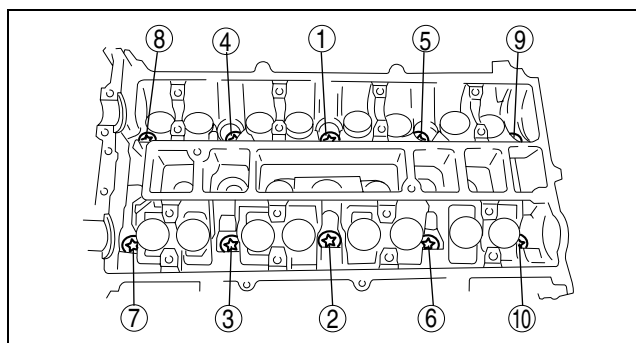
MECHANICAL

Cylinder Head Assembly Note

1. Tighten the cylinder head installation bolts in five passes in the order shown in the figure.

Tightening procedure

- (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°



C3U0110E054

Camshaft Assembly Note

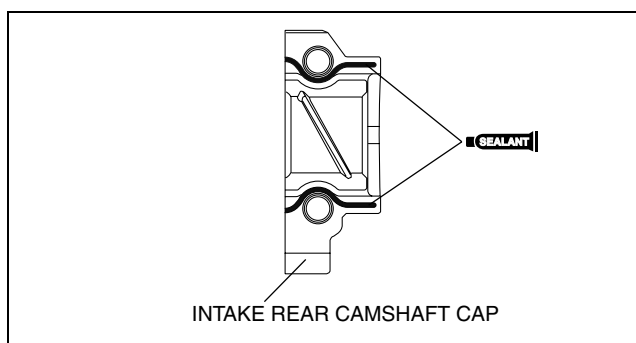
Note

- Install the camshaft with the No.1 cylinder cam aligned at TDC of the compression stroke.

1. Carefully apply adhesive agent to the area indicated in the figure so that it does not leak into the sliding part.

Thickness

1.0 mm {0.039 in}

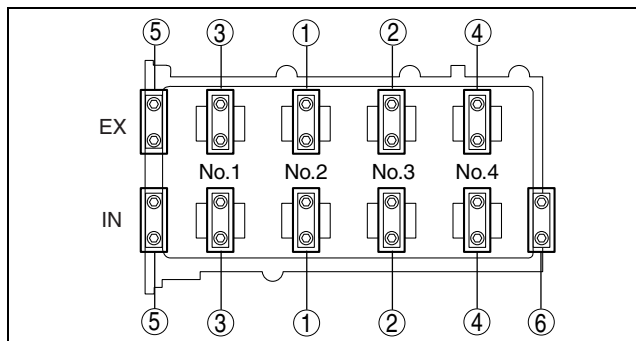


E6U110ZWB063

2. Install the camshaft caps and hand-tighten the camshaft cap bolts evenly in two or three passes, and then tighten the camshaft cap bolts in two passes, in the order shown in the figure.

Tightening procedure

- (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 {1.5—1.7 kgf·m, 10.4—12.5 ft·lbf}



E6U110ZEB012

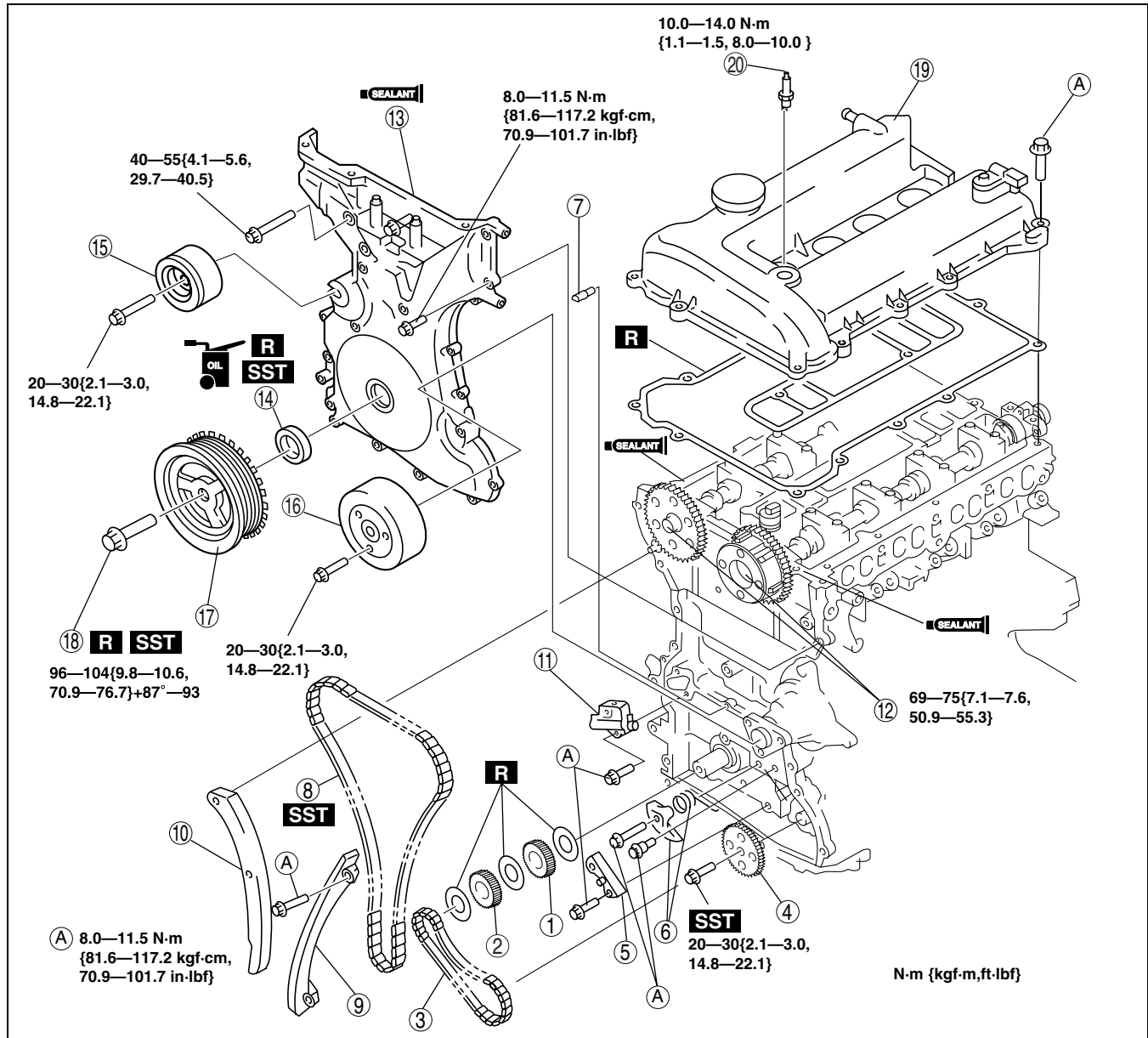
Camshaft Sprocket, Variable Valve Timing Actuator Assembly Note

1. Leave the camshaft sprocket installation bolt temporarily tightened until the timing chain is installed. After the timing chain is installed, tighten it to the specified torque.

TIMING CHAIN ASSEMBLY

E6U011012201E03

1. Assemble in the order indicated in the table.



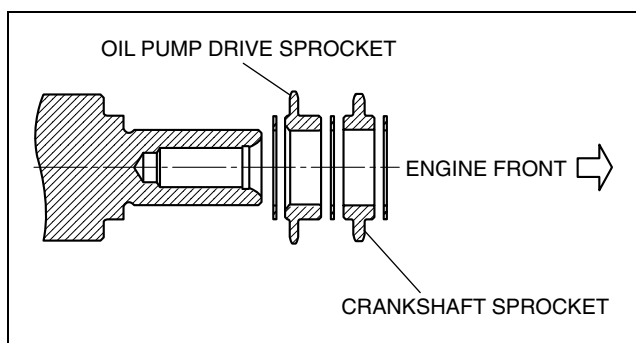
E6U1102EB020

1	Oil pump drive sprocket (See 01-10-46 Drive Sprocket Assembly Note.)
2	Crankshaft sprocket (See 01-10-46 Drive Sprocket Assembly Note.)
3	Oil pump chain
4	Oil pump driven sprocket (See 01-10-46 Oil Pump Driven Sprocket Assembly Note.)
5	Oil pump chain guide
6	Oil pump chain tensioner
7	Oil jet
8	Timing chain (See 01-10-46 Timing Chain Assembly Note.)
9	Timing chain guide
10	Timing chain tensioner arm
11	Timing chain tensioner

12	Camshaft sprocket lock bolt (See 01-10-47 Camshaft Sprocket Lock Bolt Assembly Note.)
13	Front oil seal
14	Engine front cover (See 01-10-48 Engine Front Cover Assembly Note.)
15	Drive belt idler pulley
16	Water pump pulley
17	Crankshaft pulley
18	Crankshaft pulley lock bolt (See 01-10-49 Crankshaft Pulley Lock Bolt Assembly Note.)
19	Cylinder head cover (See 01-10-50 Cylinder Head Cover Assembly Note.)
20	Spark plug

Drive Sprocket Assembly Note

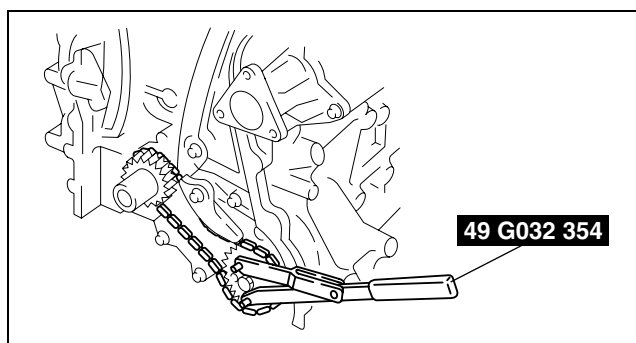
1. The oil pump drive sprocket has the assembly direction as shown in the figure.



E6U110ZWB059

Oil Pump Driven Sprocket Assembly Note

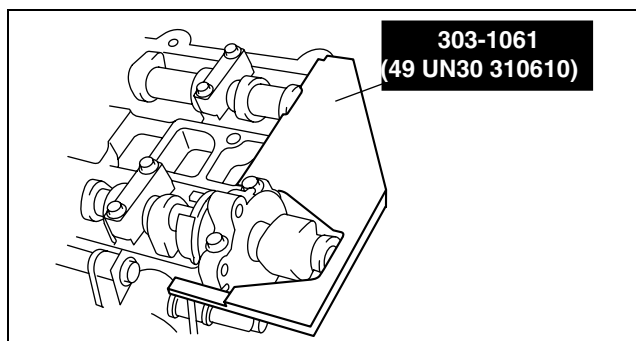
1. Install the **SST** on the oil pump driven sprocket to lock the oil pump against rotation.



B3E0110E125

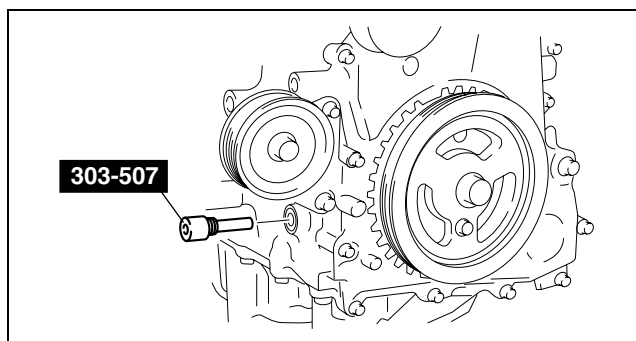
Timing Chain Assembly Note

1. Install the **SST** on the camshaft and align the No.1 camshaft position at TDC of the compression stroke.



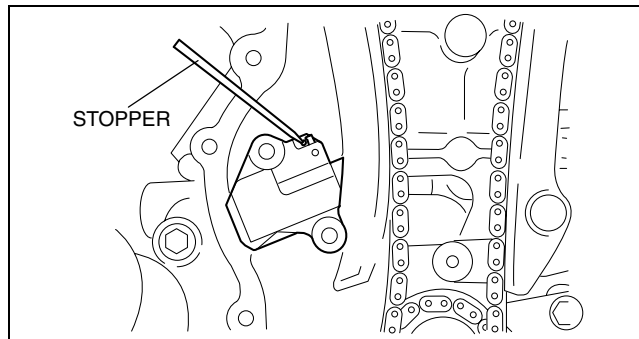
E6U110ZEB036

2. Remove the cylinder block lower blind plug from the cylinder block and install the **SST**.
3. Rotate the crankshaft clockwise so that the No.1 piston is at TDC of the compression stroke. (The position crank weight contacts the **SST**.)
4. Install the timing chain.



E6U110ZWB050

5. After the chain adjuster is installed, remove the paper clip (stopper).



E6U110ZWB057

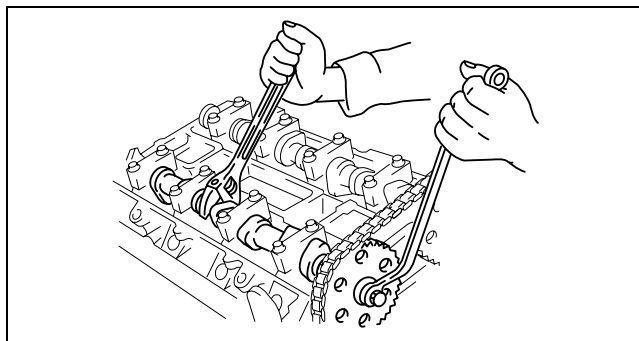
01-10

Camshaft Sprocket Lock Bolt Assembly Note

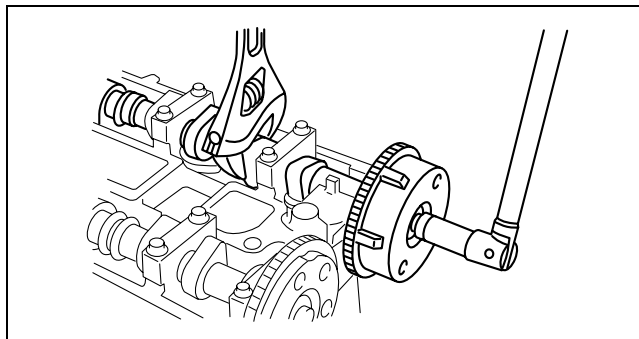
1. Lock the camshaft against rotation using a wrench on the cast hexagon.
2. Tighten the camshaft sprocket installation bolt.

Tightening torque

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



B3E0110E095



E6U110ZWB047

Engine Front Cover Assembly Note

1. Apply silicone sealant to the engine front cover.

Caution

- Install the engine front cover within 10 minutes of applying the silicone sealant.
- Silicone sealant is not need in area C as indicated below due to an existing.

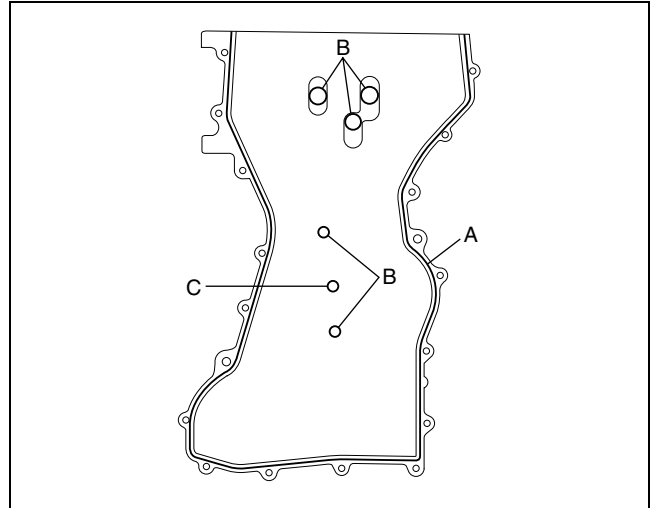
Note

- Install the engine front cover within 10 min after applying the silicone sealant.

Thickness

A: 2.2—3.2 mm {0.087—0.125 in}

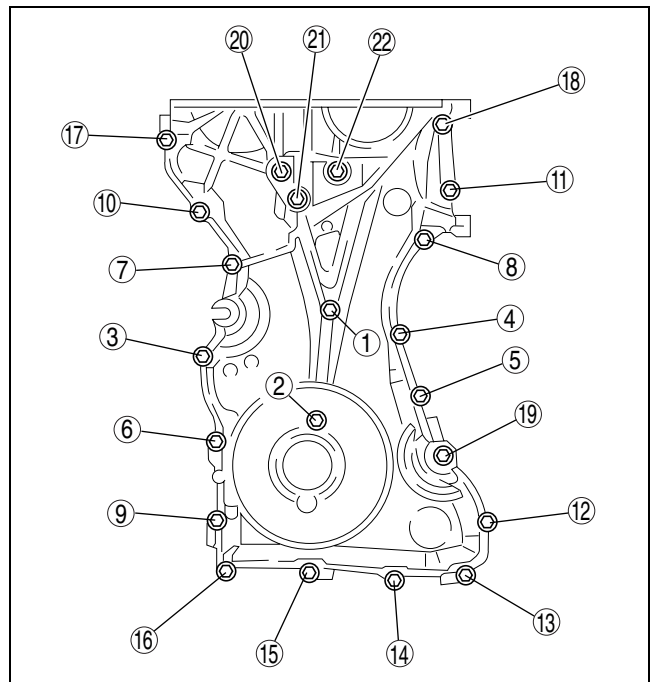
B: 1.5—2.5 mm {0.059—0.098 in}



B3E0110E129

2. Tighten the engine front cover installation bolts in the order shown in the figure.

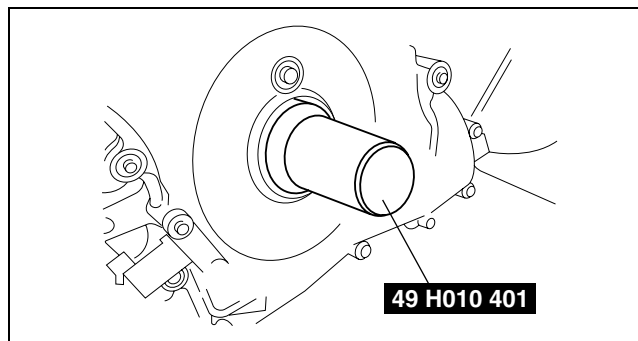
Installation position	Tightening torque N·m {kgf·m, ft·lbf}
1—18	8.0—11.5 N·m {81.6—117.2 kgf·cm, 70.9—101.7 in·lbf}
19—22	40—55 {4.1—5.6, 29.7—40.5}



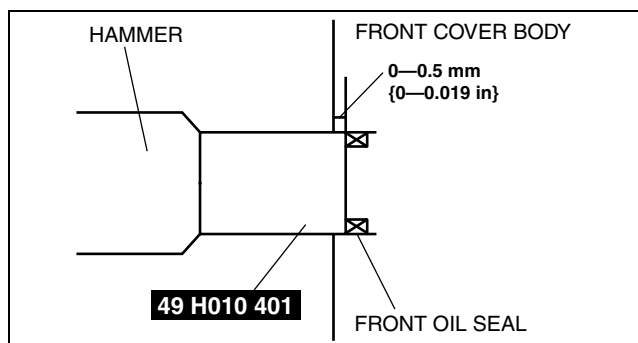
B3E0110E062

3. Install the oil seal using the **SST**.

Front oil seal press-in amount
0—0.5 mm {0—0.019 in}



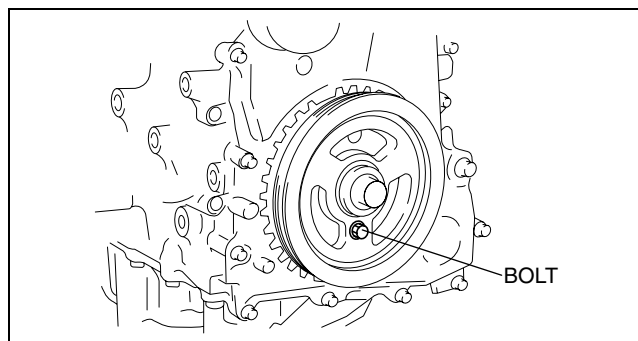
B3E0110E127



C3U0110W057

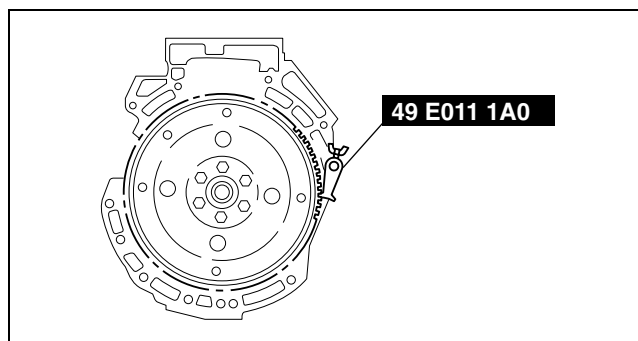
Crankshaft Pulley Lock Bolt Assembly Note

1. Install the crankshaft pulley to the front cover using a bolt (**M6 X 1.0**). Temporarily tighten the bolt.



B3E0110E063

2. Use the **SST** to lock the crankshaft against rotation.



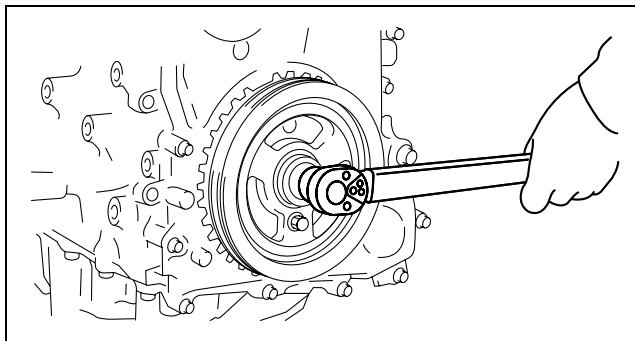
E6U110ZE039

3. Tighten the pulley lock bolt.

Tightening procedure

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

4. Remove the **SST** from the camshaft, and remove the bolt from the crankshaft pulley.
5. Remove the **SST** from the cylinder block lower blind plug, and install the cylinder block lower blind plug.



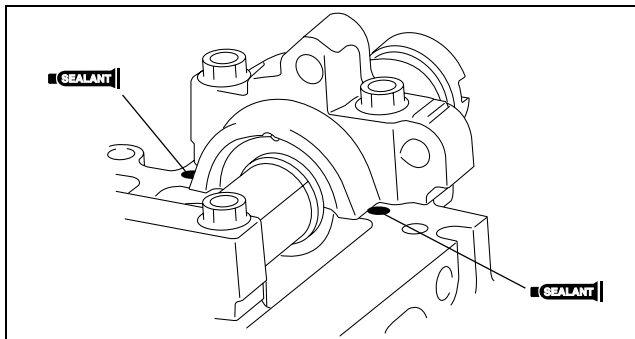
E6U110ZEB038

Cylinder Head Cover Assembly Note

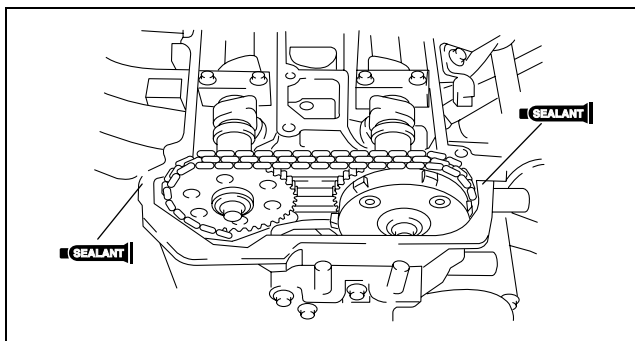
1. Apply silicone sealant to the areas shown in the figure.

Thickness

5.0 mm {0.196 in}



E6U110ZWB058

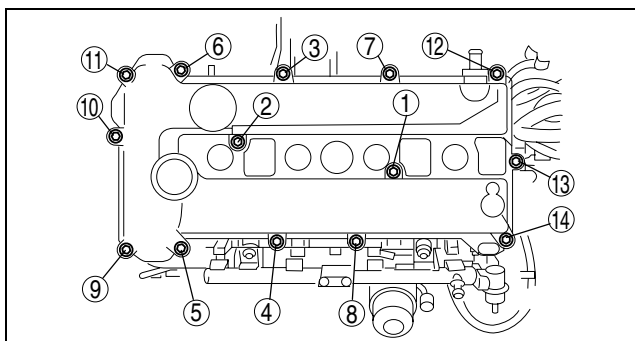


E6U110ZWB007

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

Tightening torque

8.0—10.5 N·m {81.6—107 kgf·cm, 70.9—92.9 in·lbf}



B3E0110W050

01-50 TECHNICAL DATA

ENGINE TECHNICAL DATA 01-50-1

ENGINE TECHNICAL DATA

E6U01500000E01

01-50

Item	Specification
Maximum distortion, head gasket side	0.10 mm {0.004 in}
Maximum distortion, manifold side	0.10 mm {0.004 in}
Maximum cutting length, manifold side	0.15 mm {0.006 in}
Standard valve seat contact width	IN: 0.7—1.3mm {0.0276—0.0511 in} EX: 0.7—1.3mm {0.0276—0.0511 in}
Valve seat angle	IN: 45° EX: 45°
Standard valve seat sinkage amount (Dimension L)	IN: 40.64—42.24 mm {1.600—1.662 in} EX: 40.50—42.10 mm {1.595—1.657 in}
Minimum valve head margin thickness	IN: 1.62 mm {0.0637 in} EX: 1.82 mm {0.0716 in}
Standard valve length (Dimension L)	IN: 102.99—103.79 mm {4.055—4.086 in} EX: 104.25—105.05 mm {4.105—4.135 in}
Valve stem diameter	Standard IN: 5.970—5.985 mm {0.2351—0.2356 in} EX: 5.965—5.980 mm {0.2349—0.2354 in} Minimum IN: 5.940 mm {0.2339 in} EX: 5.935 mm {0.2336 in}
Standard valve guide inner diameter	IN: 6.009—6.039 mm {0.2366—0.2377 in} EX: 6.009—6.039 mm {0.2366—0.2377 in}
Clearance between valve stem and guide	Standard IN: 0.024—0.069 mm {0.0009—0.0027 in} EX: 0.029—0.074 mm {0.0012—0.0029 in} Maximum 0.10 mm {0.004 in}
Standard valve guide projection height	IN: 12.2—12.8 mm {0.481—0.503 in} EX: 12.2—12.8 mm {0.481—0.503 in}
Valve spring installation height	37.90 mm {1.492 in} (171.5 N {17.49 kgf, 38.55 lbf})
Maximum valve spring off-square	2.55 mm {0.100 in}
Standard tappet bore diameter	31.000—31.030 mm {1.2205—1.2216 in}
Standard tappet body outer diameter	30.970—30.980 mm {1.2193—1.2196 in}
Clearance between tappet and tappet bore	Standard 0.02—0.06 mm {0.0008—0.0023 in} Maximum 0.15 mm {0.006 in}
Oil control valve coil resistance	6.9—7.9 ohms [20°C {68°F}]
Maximum camshaft runout	0.03 mm {0.0012 in}
Cam height	Standard IN: 42.44 mm {1.671 in} EX: 41.18 mm {1.622 in} Minimum IN: 42.34 mm {1.667 in} EX: 41.08 mm {1.618 in}
Camshaft journal diameter	Standard 24.96—24.98 mm {0.9827—0.9834 in} Minimum 24.95 mm {0.982 in}
Camshaft journal oil clearance	Standard 0.04—0.08 mm {0.002—0.003 in} Maximum 0.09 mm {0.0035 in}

TECHNICAL DATA

Item	Specification
Camshaft end play	Standard 0.09—0.24 mm {0.0035—0.0094 in} Maximum 0.25 mm {0.0099 in}
Maximum distortion, head gasket side	0.10 mm {0.004 in}
Maximum bore inner diameter	87.500—87.530 mm {3.4449—3.4460 in}
Standard piston outer diameter	87.465—87.495 mm {3.4435—3.4446 in}
Clearance between piston and cylinder	Standard 0.025—0.045 mm {0.0010—0.0017 in} Maximum 0.11 mm {0.0043 in}
Clearance between piston ring and ring groove	Standard Top: 0.005—0.08 mm {0.0020—0.0031 in} Second: 0.03—0.07 mm {0.0012—0.0027 in} Oil: 0.02—0.06 mm {0.0008—0.0023 in} Maximum Top: 0.17 mm {0.0067 in} Second, Oil: 0.15 mm {0.0059 in}
Piston ring end gap	Standard Top: 0.14—0.24 mm {0.0056—0.0094 in} Second: 0.34—0.44 mm {0.0134—0.0173 in} Oil (rail): 0.15—0.40 mm {0.0060—0.0157 in} Maximum 1.0 mm {0.0393 in}
Standard piston pin hole diameter	22.504—22.508 mm {0.8860—0.8861 in}
Standard connecting rod small end inner diameter	22.510—22.521 mm {0.8863—0.8866 in}
Standard piston pin outer diameter	22.495—22.500 mm {0.8857—0.8858 in}
Standard clearance between piston pin hole diameter and piston outer diameter	0.004—0.013 mm {0.0002—0.0005 in}
Standard clearance between connecting rod small end inner diameter and piston pin outer diameter	0.010—0.026 mm {0.0004—0.0010 in}
Connecting rod large end side clearance	Standard 0.14—0.36 mm {0.0056—0.0141 in} Maximum 0.435 mm {0.0172 in}
Bearing oil clearance at the large end of connecting rod	Standard 0.027—0.051 mm {0.0011—0.0020 in} Maximum 0.1 mm {0.0039 in}
Connecting rod bearing size	STD 1.495—1.519 mm {0.0589—0.0598 in} OS0.25 1.614—1.626 mm {0.0636—0.0640 in} OS0.50 1.739—1.751 mm {0.0685—0.0689 in}
Maximum connecting rod bending [per 50 mm]	0.070 mm {0.0019 in}
Maximum connecting rod distortion [per 50 mm]	0.060 mm {0.0027 in}
Connecting rod center-to-center distance	150.65—150.75 mm {5.9311—5.9350 in}
Crankshaft end play	Standard 0.22—0.45 mm {0.0087—0.0177 in} Maximum 0.55 mm {0.021 in}
Maximum main journal runout	0.05 mm {0.0019 in}
Main journal diameter	STD 51.980—52.000 mm {2.0465—2.0472 in} OS0.25 51.730—51.750 mm {2.0367—2.0374 in}
Maximum main journal off-round	0.05 mm {0.0019 in}
Crank pin diameter	STD 51.980—52.000 mm {2.0465—2.0472 in} OS0.25 51.730—51.750 mm {2.0367—2.0374 in}
Maximum crank pin off-round	0.05 mm {0.0019 in}

TECHNICAL DATA

Item	Specification
Main journal oil clearance	Standard 0.016—0.039 mm {0.0007—0.0015 in} 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}
Cylinder head bolt length	Standard 144.7—145.3 mm {5.696—5.720 in} Maximum 146 mm {5.748 in}
Connecting rod bolt length	Standard 43.7—44.3 mm {1.720—1.744 in} Maximum 46 mm {1.811 in}
Standard valve clearance [when cold]	IN: 0.22—0.28 mm {0.0087—0.0110 in} EX: 0.27—0.33 mm {0.0106—0.0130 in}
Maximum gear backlash	0.005—0.101 mm {0.00019—0.0039 in}
Front oil seal press-in amount	0—0.5 mm {0—0.019 in}

01-50

01-60 SERVICE TOOLS

ENGINE SST [L3 WITH T/C]..... 01-60-1

ENGINE SST [L3 WITH T/C]

E6U01600000E02

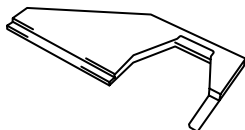
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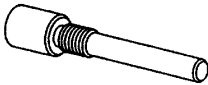
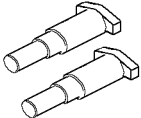
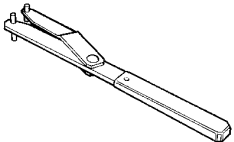
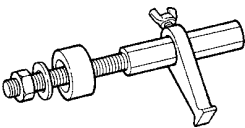
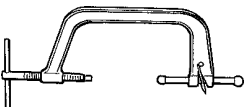
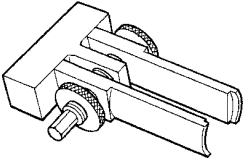
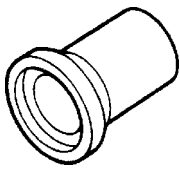
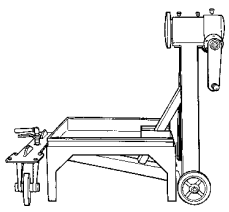
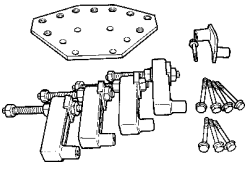
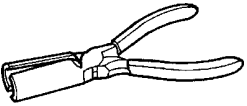
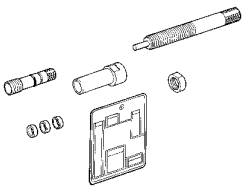
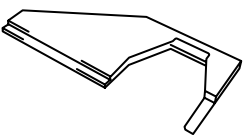
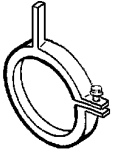
2: Global SST number

Example

1:49 UN30
310610
2:303-1061

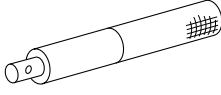
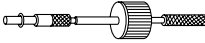
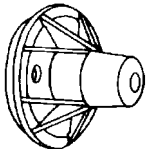
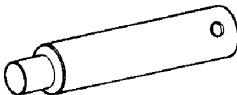
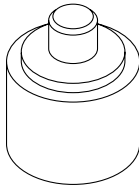
Camshaft
alignment
timing tool



1: – 2:303-507 Crankshaft TDC timing peg 	1: – 2:205-072-02 Crankshaft holding tool pins 	1:49 G032 354 2: – Adjusting wrench 
1:49 E011 1A0 2: – Ring gear brake set 	1:49 0636 100B 2: – Valve spring lifter arm 	1:49 B012 0A2 2: – Pivot 
1:49 B012 015 2: – Valve guide installer 	1:49 H010 401 2: – Oil seal installer 	1:49 0107 680A 2: – Engine stand 
1:49 L010 1A0 2: – Engine hanger set 	1:49 S120 170 2: – Valve seal remover 	1:49 L012 0A0B 2: – Valve seal and valve guide installer set 
1:49 T032 302 2: – Bearing installer 	1:49 UN30 310610 2:303-1061 Camshaft alignment timing tool 	1:49 G011 201 2: – Attachment 

01-60

SERVICE TOOLS

1:49 UN20 5153 2:205-153 Handle 	1:49 1285 071 2: – Bearing puller 	1:49 UN30 3328 2:303-328 Rear oil seal replacer 
1: 49 T011 001 2: – Piston pin installer 	1:49 UN30 8157 2:308-157 Pilot bearing installer 	–