Ranger/Drifter Overhaul Manual

FOREWORD

This Manual has been prepared to provide information covering normal service repairs and maintenance for the RANGER / DRIFTER SERIES.

As all information in this manual was the best available at the time of printing, vehicle specification and other information will be updated in Service Information.

Ford/Mazda Motor Company

WARNING

Servicing a vehicle can be dangerous. If you have not received service-related training, the risks of injury, property damage, and failure of servicing increase. The recommended servicing procedures for the vehicle in this workshop manual were developed with Ford/Mazda-trained technicians in mind. This manual may be useful to non-Ford/Mazda trained technicians, but a technician with our service-related training and experience will be at less risk when performing service operations. However, all users of this manual are excepted at least to know general safety procedures.

This manual contains "Warnings" and "Cautions" applicable to risks not normally encountered in a general technician's experience. They should be followed to reduce the risk of injury and the risk that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that the "Warnings" and "Cautions" are not exhaustive. It is impossible to warn of all the hazardous consequences that might result from failure to follow the procedures.

The procedures recommended and described in this manual are effective methods of performing service and repair. Some require tools specifically designed for a specific purpose. Persons using procedures and tools, which are not recommended by Ford/Mazda Motor Corporation, must satisfy themselves thoroughly that neither personal safety nor safety of the vehicle will be jeopardized.

The contents of this manual, including drawings and specifications, are the latest available at the time of printing, and Ford/Mazda Motor Corporation reserves the right to change the vehicle designs and alter the contents of this manual without notice and without incurring obligation.

Parts should be replaced with genuine Ford/Mazda replacement parts or with parts, which match the quality of genuine Ford/Mazda replacement parts. Persons using replacement parts of lesser quality than that of genuine Ford/Mazda replacement parts must satisfy themselves thoroughly that neither personal safety nor safety of the vehicle will be jeopardized.

Ford/Mazda Motor Corporation is not responsible for any problems, which may arise from the use of this manual. The cause of such problems includes but is not limited to insufficient service related training, use of improper tools, use of replacement parts of lesser quality than that of genuine Mazda replacement parts, or not being aware of any revision of this manual.

Ranger / Drifter Overhaul Manual

- ENGINE
- MANUAL TRANSMISSION

APPLICATION:
This manual is applicable to vehicles beginning with the Vehicle Identification Numbers (VIN) shown on the following page.

CONTENTS

PRINTED IN JAPAN, JAN.1999 Ⓧ
F161–20–99A

VEHICLE IDENTIFICATION NUMBERS (VIN)

U.K. specs.

WF0 DMB]30WW	100001 —	WF0 LMDD30WW	100001 —
WF0 LMB]30WW	100001 —	WF0 DMFE40WW	100001 —
WF0 DMDD30WW	100001 —	WF0 LMFE40WW	100001 —

European specs.

WF0 BMF]30WW	100001 —	WF0 BMFE40WW	100001 —
WF0 BME]30WW	100001 —	WF0 BMEE40WW	100001 —
WF0 DMF]30WW	100001 —	WF0 DMFE40WW	100001 —
WF0 DME]30WW	100001 —	WF0 DMEE40WW	100001 —
WF0 LMF]30WW	100001 —	WF0 LMFE40WW	100001 —
WF0 LME]30WW	100001 —	WF0 LMEE40WW	100001 —
WF0 BMD]30WW	100001 —	WF0 BMD]40WW	100001 —
WF0 BMC]30WW	100001 —	WF0 BMC]40WW	100001 —
WF0 DMD]30WW	100001 —	WF0 DMD]40WW	100001 —
WF0 DMC]30WW	100001 —	WF0 DMC]40WW	100001 —
WF0 LMD]30WW	100001 —	WF0 LMD]40WW	100001 —
WF0 LMC]30WW	100001 —	WF0 LMC]40WW	100001 —
WF0 BMB]30WW	100001 —	WF0 BMB]40WW	100001 —
WF0 BMA]30WW	100001 —	WF0 BMA]40WW	100001 —
WF0 DMB]30WW	100001 —	WF0 DMB]40WW	100001 —
WF0 DMA]30WW	100001 —	WF0 DMA]40WW	100001 —
WF0 LMB]30WW	100001 —	WF0 LMB]40WW	100001 —
WF0 LMA]30WW	100001 —	WF0 LMA]40WW	100001 —

General specs. (L.H.D.)

MNC BSF]30WW	100001 —	MNC BSB]30WW	100001 —
MNC BSE]30WW	100001 —	MNC BSA]30WW	100001 —
MNC BSF]3WWW	100001 —	MNC BSB]3WWW	100001 —
MNC BSE]3WWW	100001 —	MNC BSA]3WWW	100001 —

General specs. (R.H.D.)

MNB BSF]30WW	100001 —	MNB BSB]30WW	100001 —
MNB BSE]30WW	100001 —	MNB BSA]30WW	100001 —
MNB BSBD50WW	100001 —		
MNB BSAD50WW	100001 —		

CONTINUED

GENERAL INFORMATION

HOW TO USE THIS MANUAL

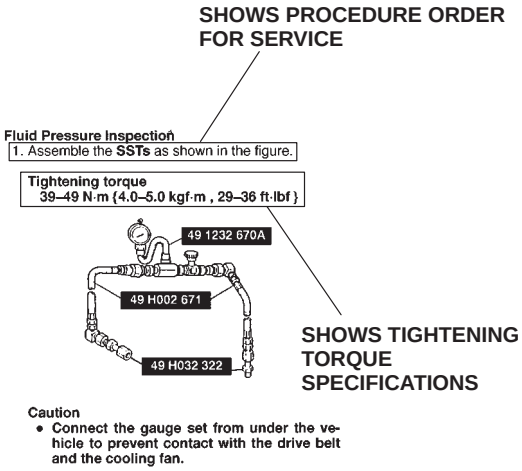
RANGE OF TOPICS

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

SERVICING PROCEDURE

Inspection, Adjustment

- The procedures for inspections and adjustments are divided into steps. Important points in regard to the location and contents of the procedures are explained in detail and are shown in the illustrations.

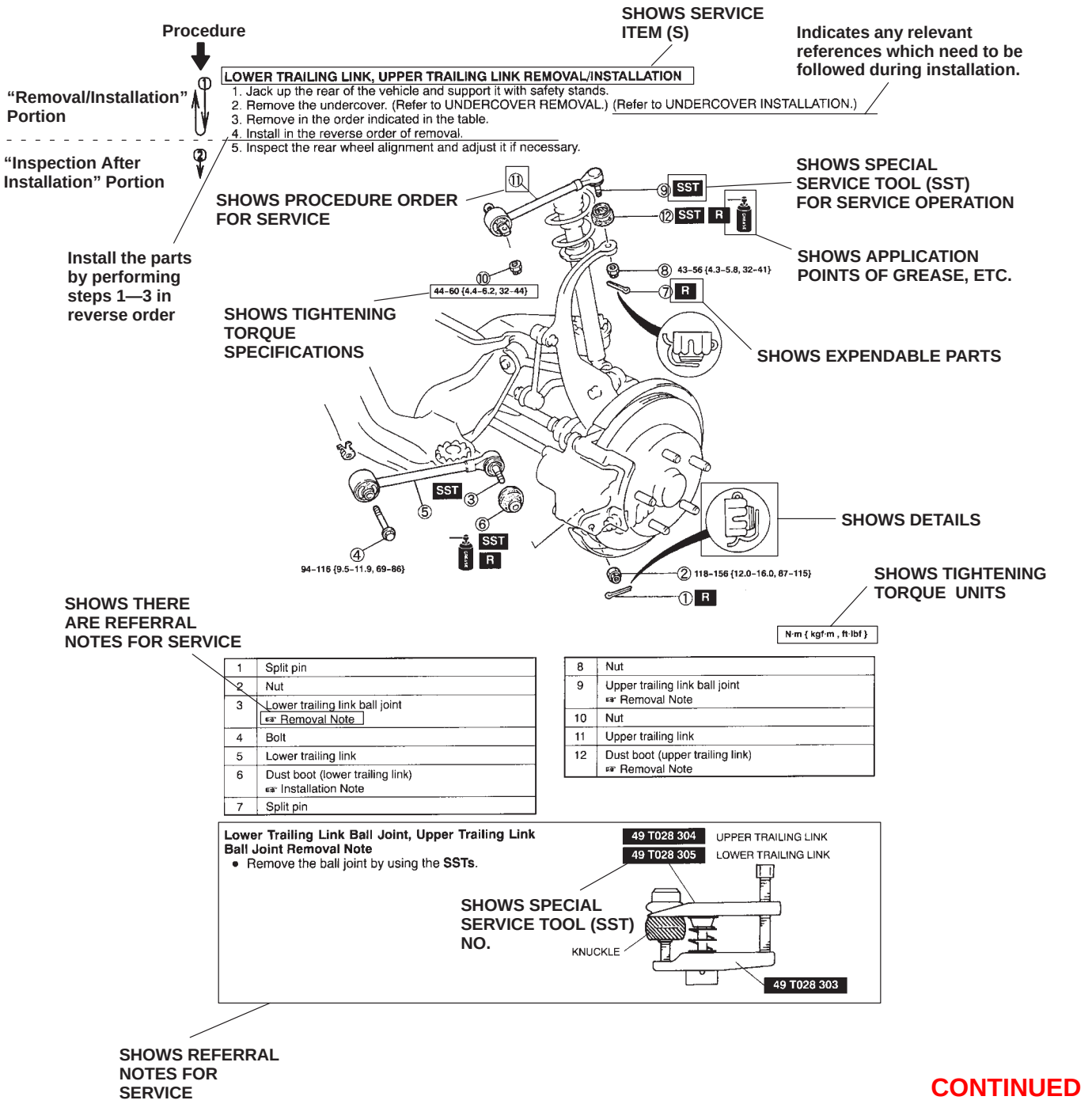


CONTINUED

HOW TO USE THIS MANUAL

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 the removal/installation procedures which 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 which require the use of special service tools for removal/installation are also shown.
3. The procedures 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 information concerning a procedure. Refer to this information when servicing the related part.



CONTINUED

HOW TO USE THIS MANUAL

SYMBOLS

- There are eight symbols indicating oil, grease, sealant, and the use of **SSTs**. These symbols show the points of applying or using such materials during service.

Symbol	Meaning	Kind
OIL	Apply oil	New appropriate engine oil or gear oil
BRAKE FLUID	Apply brake fluid	New appropriate brake fluid
ATF	Apply automatic transaxle/ transmission fluid	New appropriate automatic transaxle/ transmission fluid
GREASE	Apply grease	Appropriate grease
SEALANT	Apply sealant	Appropriate sealant
P	Apply petroleum jelly	Appropriate petroleum jelly
R	Replace part	O-ring, gasket, etc.
SST	Use SST	Appropriate SST

ADVISORY MESSAGES

You'll 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 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.

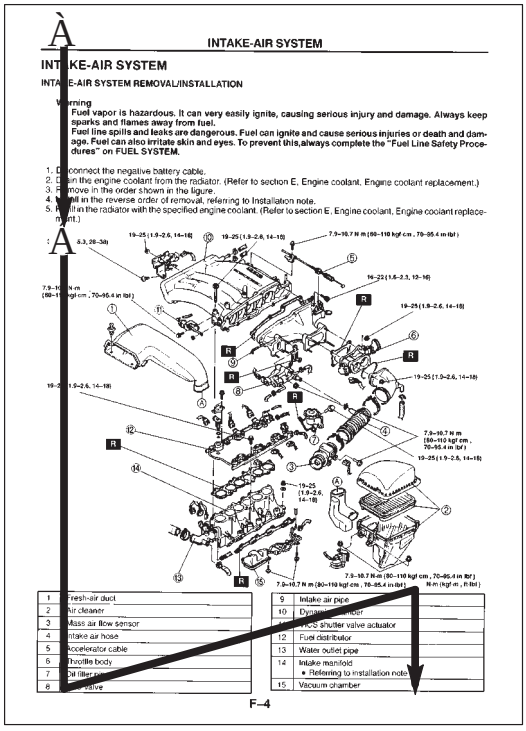
Upper and lower limits

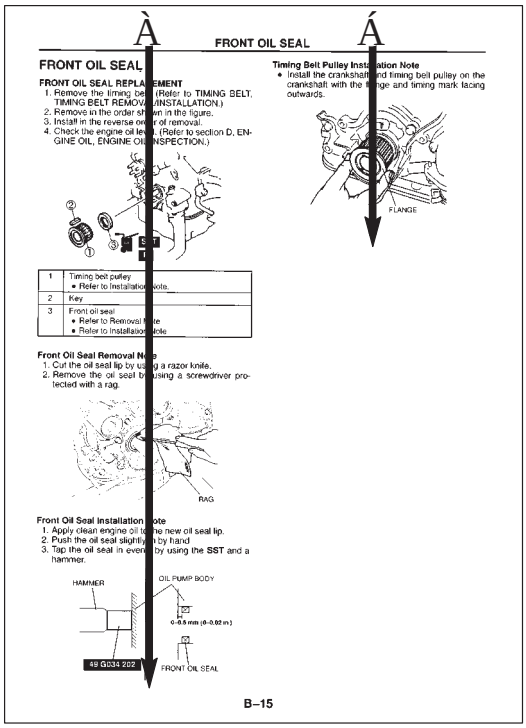
- The values indicate the upper and lower limits that must not be exceeded when performing inspections or adjustments.

TEXT SEQUENCE

- The text sequence is as indicated by the arrows shown below.

Example:





CONTINUED

UNITS

Electric current	A (ampere)
Electric power	W (watt)
Electric resistance	Ω (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/cm^2 in the following specifications:

210—260 kPa {2.1—2.7 kgf/cm^2, 30—38 psi}
270—310 kPa {2.7—3.2 kgf/cm^2, 39—45 psi}

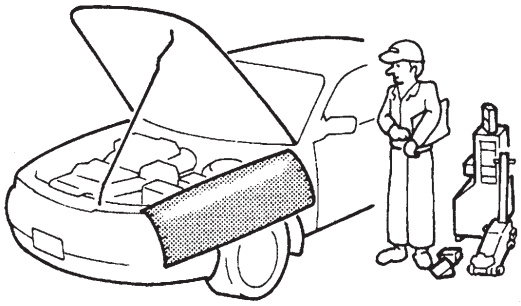
- The actual converted values for 2.7 kgf/cm^2 are 264 kPa and 38.4 psi. In the top specification, 2.7 is used as an upper limit, so its converted values are rounded down to 260 and 38. In the bottom specification, 2.7 is used as a lower limit, so its converted values are rounded up to 270 and 39.

CONTINUED

FUNDAMENTAL PROCEDURES

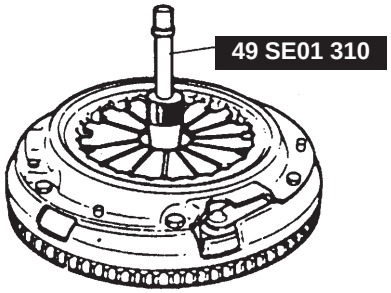
PREPARATION OF TOOLS AND MESURING EQUIPMENT

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



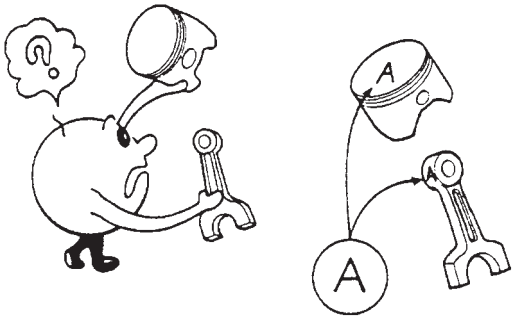
SPECIAL SERVICE TOOLS

- Use special tools when they are required.



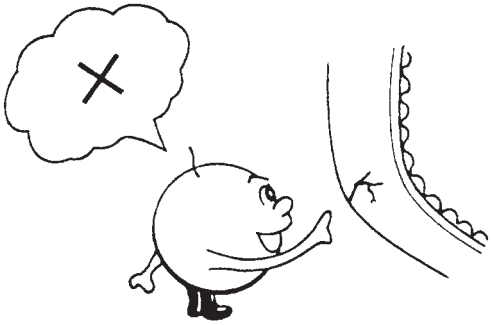
DISASSEMBLY

- 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.



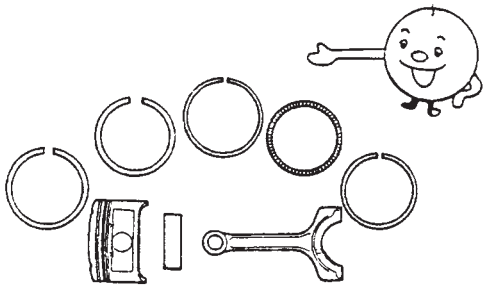
INSPECTION DURING REMOVAL, DISASSEMBLY

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



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.

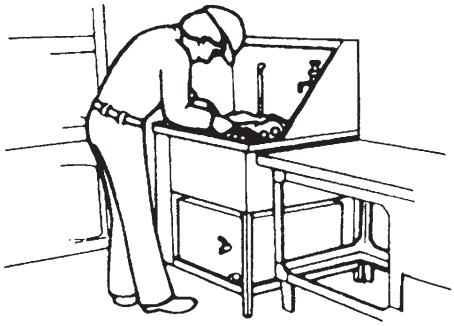


CLEANING OF PARTS

- 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.**



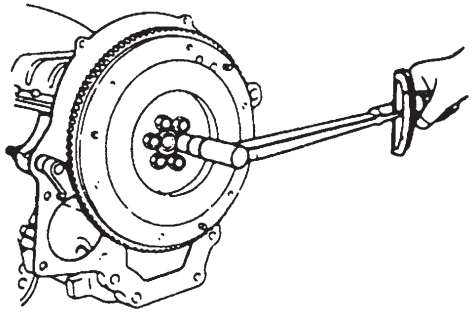
REASSEMBLY

- Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.

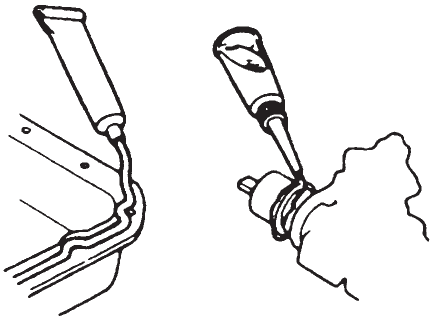
If removed, these parts should be replaced with new ones:

1	Oil seals	2	Gaskets
3	O-rings	4	Lockwashers
5	Cotter pins	6	Nylon nuts

CONTINUED

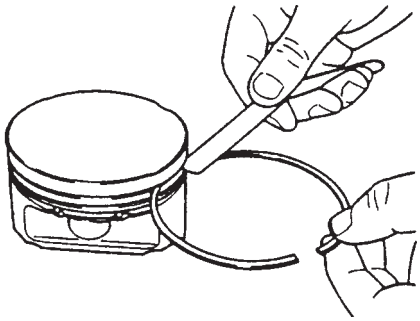


- Sealant, a gasket, or both should be applied to the specified locations. When sealant is applied, parts should be installed before sealant hardens. Hardened sealant causes leakage.
- Oil should be applied to the moving components of parts.
- Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.



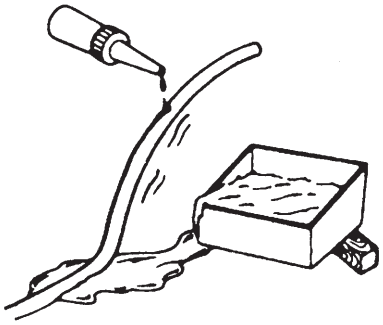
ADJUSTMENT

- Use suitable gauges and/or testers when making adjustments.



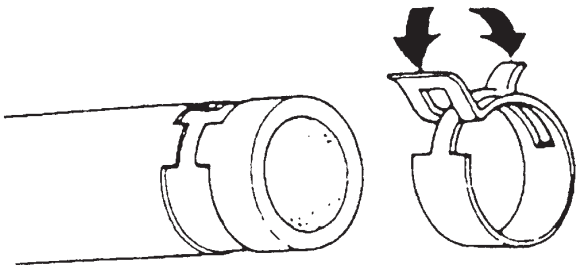
RUBBER PARTS AND TUBING

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



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.

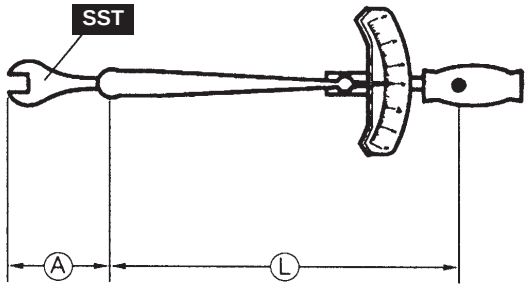


TORQUE FORMULAS

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

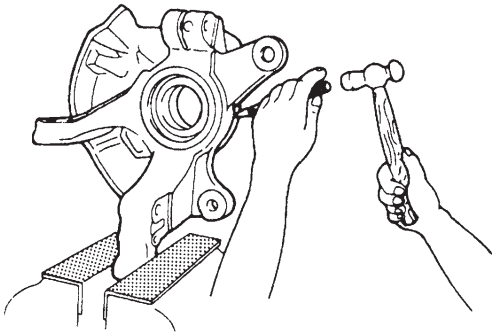
Torque Unit	Formula
N·m	N·m × [L/(L+A)]
kgf·m	kgf·m × [L/(L+A)]
kgf·cm	kgf·cm × [L/(L+A)]
ft·lbf	ft·lbf × [L/(L+A)]
in·lbf	in·lbf × [L/(L+A)]

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.



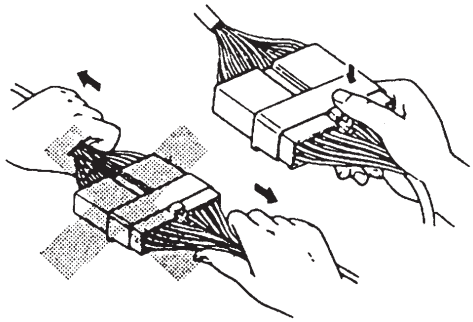
CONTINUED

ELECTRICAL SYSTEM

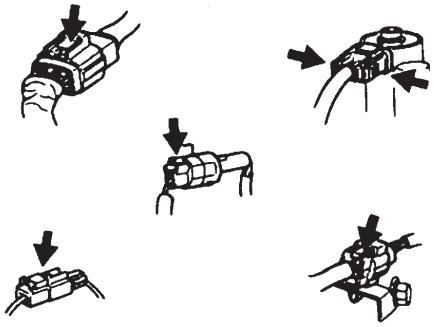
CONNECTORS

Disconnecting Connectors

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

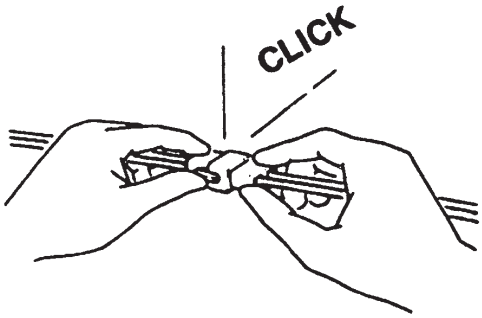


- Connectors can be disconnected by pressing or pulling the lock lever as shown.



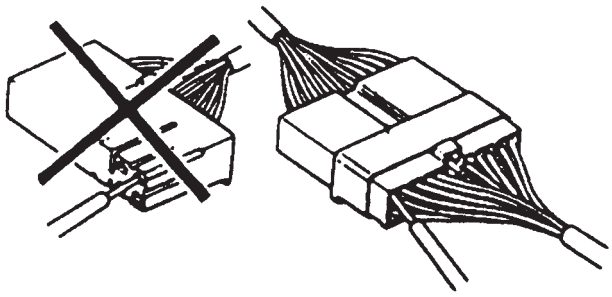
Locking Connector

- When locking connectors, listen for a click that will indicate they are securely locked.



Inspection

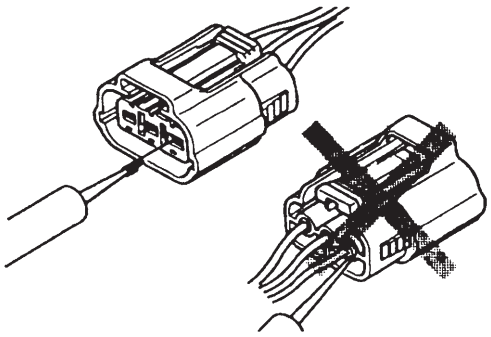
1. When a tester is used to inspect for continuity or to measure voltage, insert the tester probe from the wiring harness side.



2. Inspect the terminals of waterproof connectors from the connector side, as they cannot be accessed from the wiring harness side.

Caution

- **To prevent damage to the terminal, wrap a thin wire around the lead before inserting it into the terminal.**



CONTINUED

NEW STANDARDS

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

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
AP	Accelerator Pedal	—	Accelerator Pedal	
ACL	Air Cleaner	—	Air Cleaner	
A/C	Air Conditioning	—	Air Conditioning	
BARO	Barometric Pressure	—	Atmospheric Pressure	
B+	Battery Positive Voltage	V_B	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	
—	Closed Throttle Position Switch	—	Idle Switch	
CPP	Clutch Pedal Position	—	Clutch Position	
CIS	Continuous Fuel Injection System	EGI	Electronic Gasoline Injection System	
CS sensor	Control Sleeve Sensor	CSP sensor	Control Sleeve Position Sensor	#6
CKP sensor	Crankshaft Position Sensor	—	Crank Angle Sensor 2	
DLC	Data Link Connector	—	Diagnosis Connector	
DTM	Diagnostic Test Mode	—	Test Mode	#1
DTC	Diagnostic Trouble Code(s)	—	Service Code(s)	
DI	Distributor Ignition	—	Spark Ignition	
DLI	Distributorless Ignition	—	Direct Ignition	
EI	Electronic Ignition	—	Electronic Spark Ignition	#2
ECT	Engine Coolant Temperature	—	Water Thermo	
EM	Engine Modification	—	Engine Modification	
—	Engine Speed Input Signal	—	Engine RPM Signal	
EVAP	Evaporative Emission	—	Evaporative Emission	
EGR	Exhaust Gas Recirculation	—	Exhaust Gas Recirculation	
FC	Fan Control	—	Fan Control	
FF	Flexible Fuel	—	Flexible Fuel	
4GR	Fourth Gear	—	Overdrive	
—	Fuel Pump Relay	—	Circuit Opening Relay	#3
FSO solenoid	Fuel Shut Off Solenoid	FCV	Fuel Cut Valve	#6
GEN	Generator	—	Alternator	
GND	Ground	—	Ground/Earth	
HO2S	Heated Oxygen Sensor	—	Oxygen Sensor	With heater
IAC	Idle Air Control	—	Idle Speed Control	
—	Incorrect Gear Ratio	—	—	

#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).
#6: Part name of diesel engine

CONTINUED

NEW STANDARDS

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
—	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	Inject with compressor
SAPV	Secondary Air Pulse Valve	—	Reed Valve	
SFI	Sequential Multipoint Fuel Injection	—	Sequential Fuel Injection	
—	Shift Solenoid A	—	1–2 Shift Solenoid Valve	
		—	Shift A Solenoid Valve	
—	Shift Solenoid B	—	2–3 Shift Solenoid Valve	
		—	Shift B Solenoid Valve	
—	Shift Solenoid C	—	3–4 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	—	Lock-up Position	
TCM	Transmission (Transaxle) Control Module	—	EC-AT Control Unit	
—	Transmission (Transaxle) Fluid Temperature Sensor	—	ATF Thermosensor	
TR	Transmission (Transaxle) Range	—	Inhibitor Position	
TC	Turbocharger	—	Turbocharger	
VSS	Vehicle Speed Sensor	—	Vehicle Speed Sensor	
VR	Voltage Regulator	—	IC Regulator	

#4: Device that controls engine and powertrain
#6: Part name of diesel engine

CONTINUED

NEW STANDARDS, ABBREVIATIONS

New Standard		Previous Standard		Remark
Abbrevi-ation	Name	Abbrevi-ation	Name	
VAF sensor	Volume Air Flow Sensor	—	Air flow Sensor	
WU-TWC	Warm Up Three Way Catalytic Converter	—	Catalytic Converter	#5
WOT	Wide Open Throttle	—	Fully Open	

#5: Directly connected to exhaust manifold

ABBREVIATIONS

1ST	First
2ND	Second
2W	2-wheel
3RD	Third
4TH	Fourth
4W	4-wheel
5TH	Fifth
BTDC	Before top dead center
CARB	Carburetor
CIS	Continuous fuel injection system
EX	Exhaust
FIP	Fuel injection pump
HLA	Hydraulic lash adjuster
H	High
IN	Intake
L	Low
max.	Maximum
min.	Minimum
SST	Special service tool
TDC	Top dead center

CONTINUED

ENGINE
(WL, WL Turbo)

ENGINE OVERHAUL SERVICE WARNING

Warning

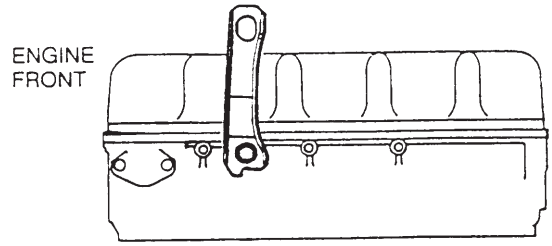
- **Continuous exposure with USED engine oil has caused skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after this work.**

ENGINE MOUNTING/DISMOUNTING

MOUNTING

1. Install the engine hanger (JE48 10 561C) to the cylinder head by using bolt (99794 0820) or (M8X1.25, 6T, Length 20mm {0.79 in}) as shown.

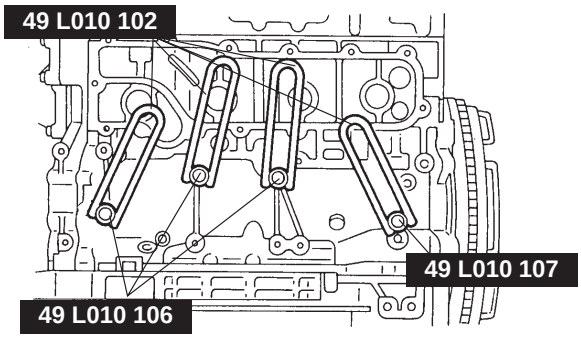
Tightening torque
19—25 N·m {1.9—2.6 kgf·m,14—18 ft·lbf}



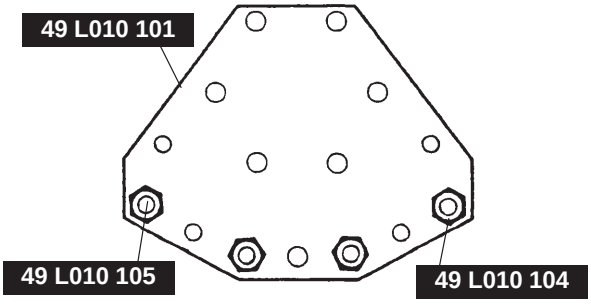
CONTINUED

ENGINE MOUNTING/DISMOUNTING

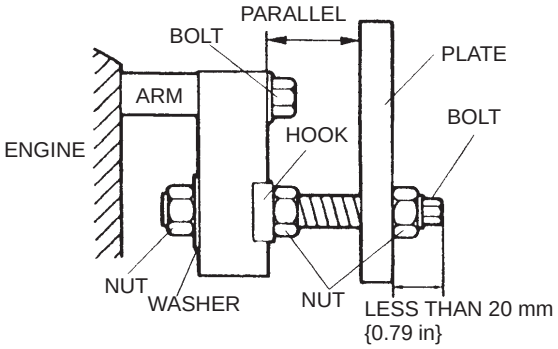
2. Install the **SSTs** (arms and attachments) to the holes as shown, and hand tighten the **SST** (bolts).



3. Assemble the **SSTs** (bolts, nuts and plate) to the specified positions.



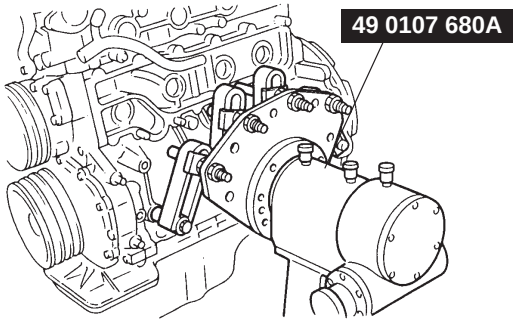
4. Adjust the **SST** (bolts) so that less than 20 mm {0.79 in} of thread is exposed.
5. Make the **SSTs** (plate and arms) parallel by adjusting the **SST** (bolts and nuts).
6. Tighten the **SST** (bolts and nuts) to affix the **SST** firmly.



Warning

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

7. Mount the engine on the **SST** (engine stand).



8. Remove the engine hanger (JE48 10 561C).
9. Drain the engine oil into a container.
10. Install the drain plug by using new washer.

Tightening torque
30—41 N·m {3.0—4.2 kgf·m, 22—30 ft·lbf}

DISMOUNTING

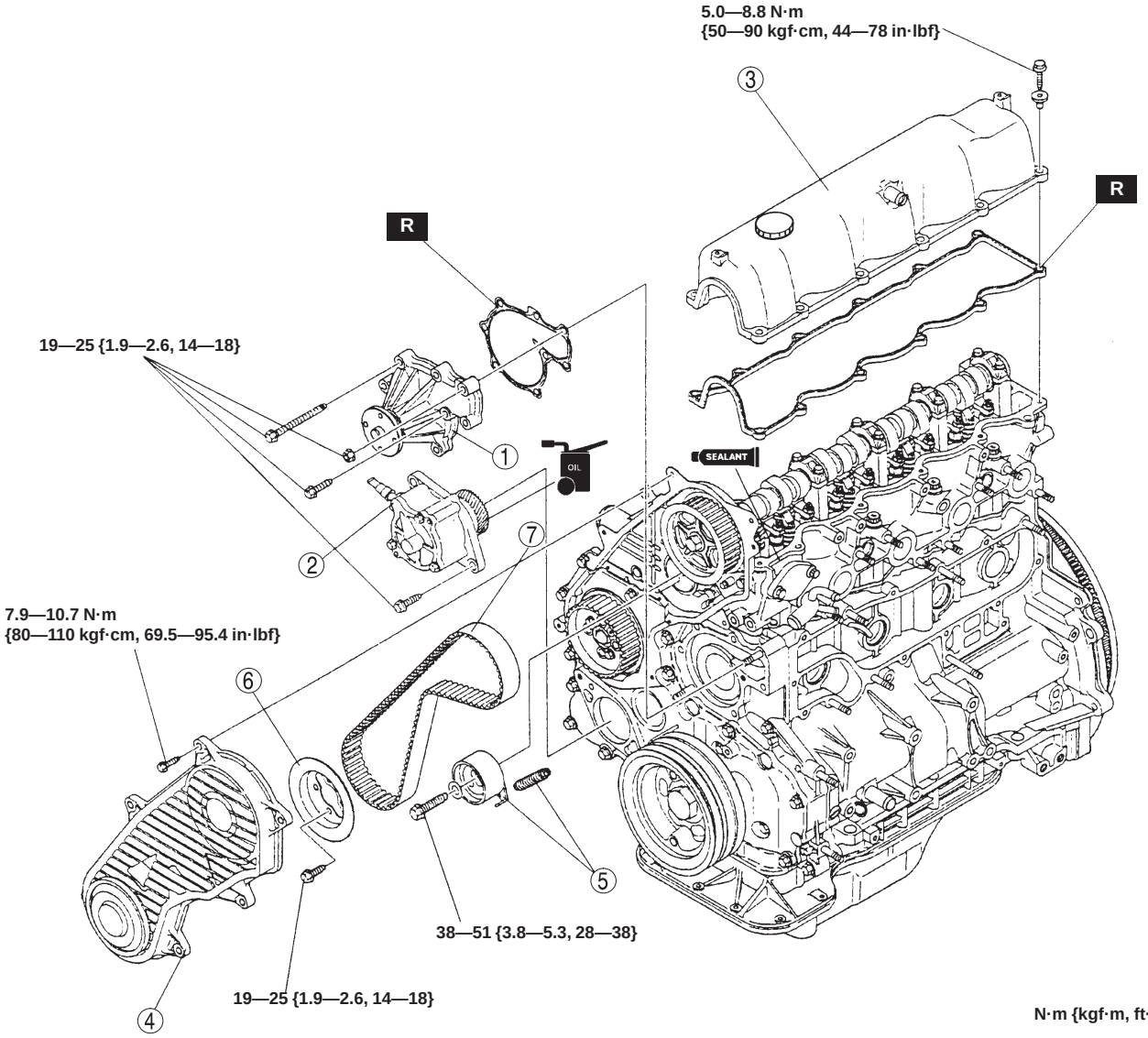
- Dismount in the reverse order of mounting.

CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

TIMING BELT DISASSEMBLY/ASSEMBLY

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



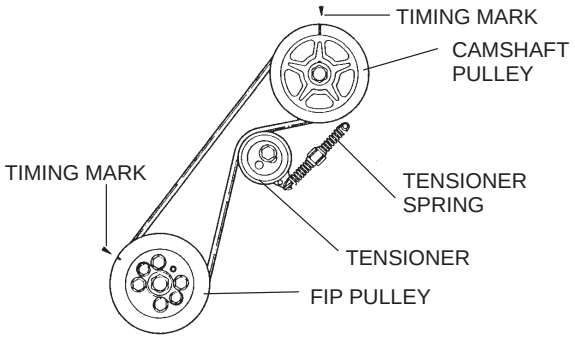
N·m {kgf·m, ft·lbf}

1	Water pump
2	Vacuum pump
3	Cylinder head cover + Assembly Note
4	Timing belt cover + Assembly Note

5	Tensioner, Tensioner spring + Disassembly Note
6	Pulley plate
7	Timing belt + Disassembly Note + Assembly Note

Tensioner, Tensioner Spring Disassembly Note

1. Turn the crankshaft clockwise and align the timing marks as shown.



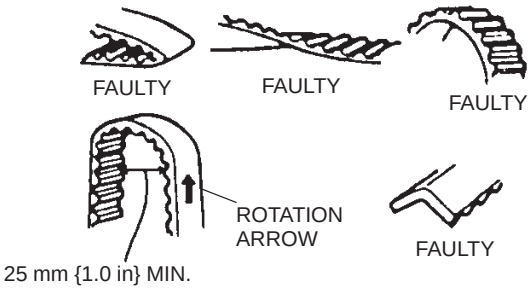
CONTINUED

2. Remove the tensioner and tensioner spring.

Timing Belt Disassembly Note

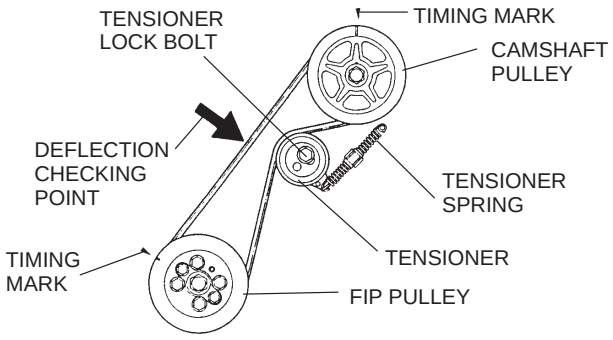
Caution
- **The following will damage the belt and shorten its life; Forcefully twisting it, turning it inside out, or allowing oil or grease on it.**

- Mark the timing belt rotation on the belt for proper reinstallation.



Timing Belt Assembly Note

1. Turn the crankshaft clockwise and align the timing marks as shown.



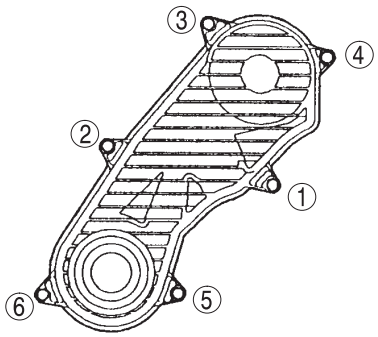
Caution
- **Overtensioning of the timing belt can cause breakage of the belt and the camshaft.**

2. Verify that the FIP attaching bolts and nuts are tightened to the specified torque.
   This must be done to prevent overtensioning of the timing belt after it has been installed.
3. Install the timing belt.
4. Install the tensioner, tensioner spring, and the lock bolt.
5. Turn the crankshaft clockwise twice, and align the timing marks. If they are not aligned, remove the timing belt and repeat from **Timing Belt Assembly Note** step 1.
6. Loosen the tensioner lock bolt to apply tension to the belt. Do not apply tension other than that of the tensioner spring.
7. Tighten the tensioner lock bolt. Be sure the tensioner does not move together with the bolt rotation.
8. Turn the crankshaft clockwise twice, and check the timing belt deflection as shown. If it is incorrect, repeat from **Tensioner, Tensioner Spring Disassembly Note**.

Timing belt deflection
9.0—10.0 mm {0.36—0.39 in} at 98 N {10 kgf, 22 lbf}

Timing Belt Cover Assembly Note

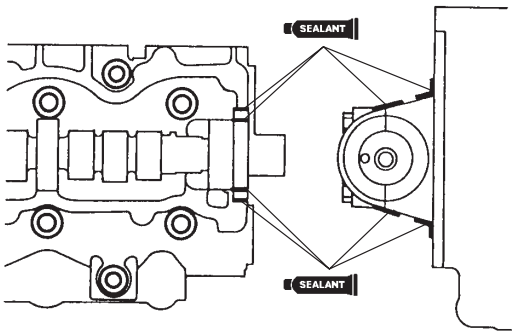
- Tighten the timing belt cover bolts in the order shown.



Cylinder Head Cover Assembly Note

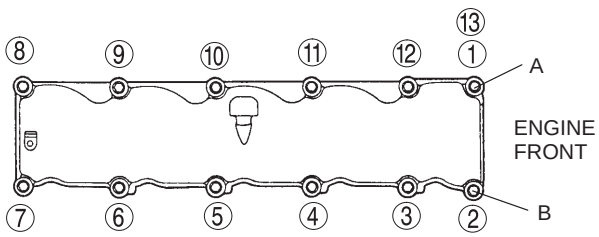
1. Before installing the cylinder head cover, inspect the valve clearance.
   (Refer to ENGINE INSPECTION/REPAIR, VALVE CLEARANCE INSPECTION.)
2. Apply silicone sealant to the cylinder head as shown.

Thickness
ø 1.5—2.5 mm {0.060—0.098 in}



3. Tighten cylinder head cover bolts A and B.

Tightening torque
1.5—2.9 N·m {15—30 kgf·cm, 14—26 in·lbf}



4. Tighten the cylinder head cover bolts in the order shown.

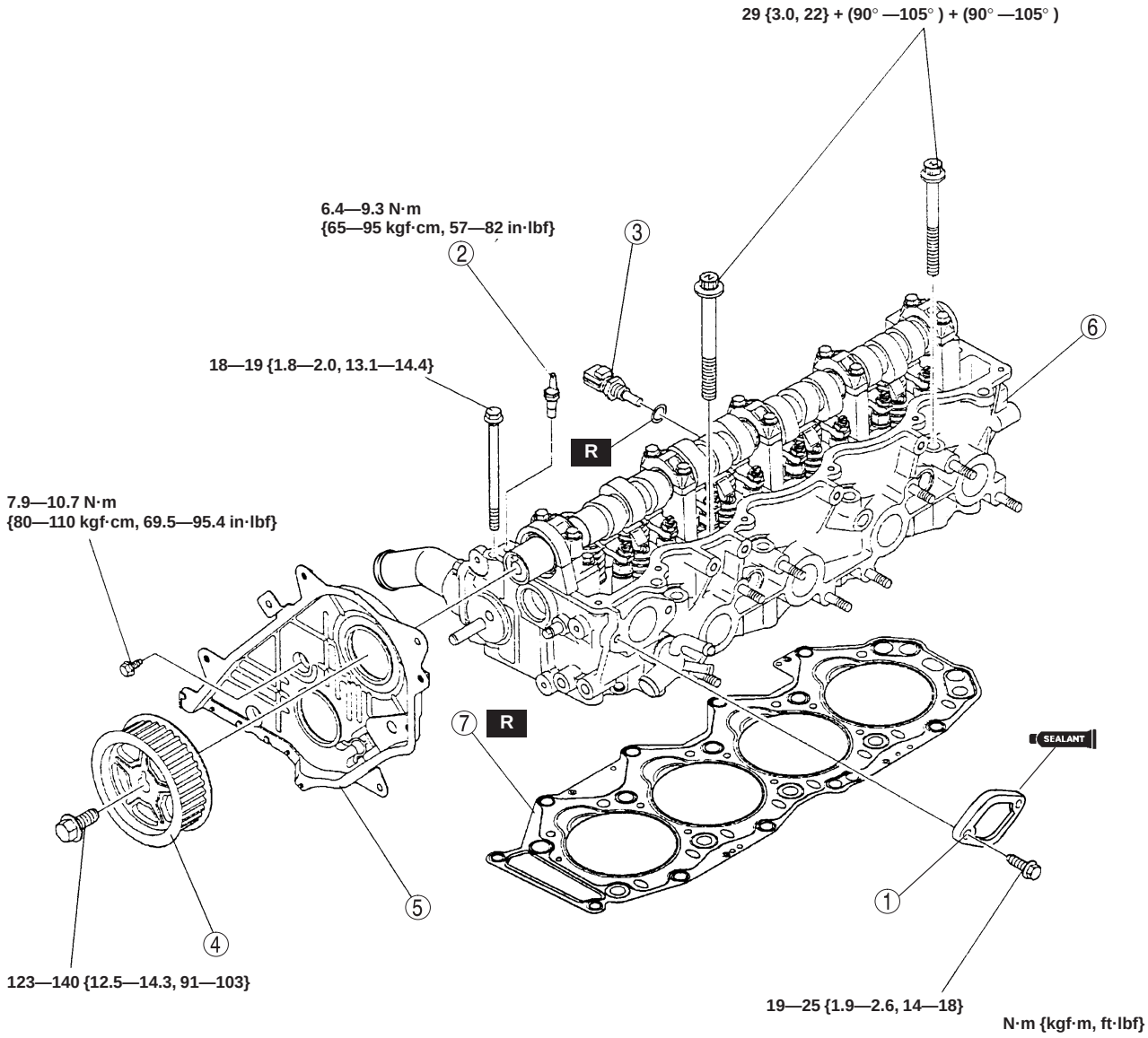
Tightening torque
5.0—8.8 N·m {50—90 kgf·cm, 44—78 in·lbf}

CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

CYLINDER HEAD DISASSEMBLY/ASSEMBLY (I)

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



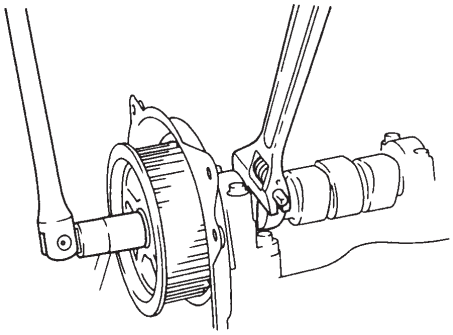
1	Blind cover + Assembly Note
2	Water temperature sender unit + Assembly Note
3	Water temperature sensor
4	Camshaft pully + Disassembly Note + Assembly Note

5	Seal plate + Assembly Note
6	Cylinder head + Disassembly Note + Assembly Note
7	Cylinder head gasket + Assembly Note

CONTINUED

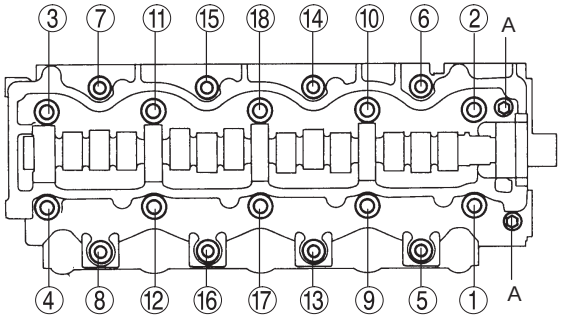
Camshaft Pulley Disassembly Note

- Hold the camshaft by using a wrench on the cast hexagon.



Cylinder Head Disassembly Note

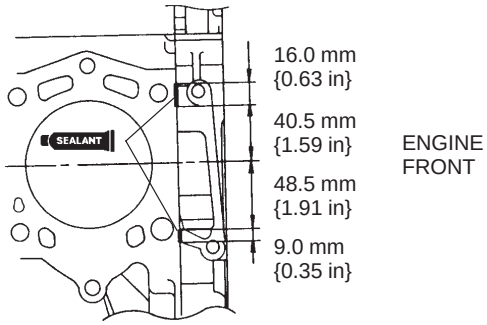
1. Remove bolts A.
2. Loosen the cylinder head bolts in two or three steps in the order shown.



Cylinder Head Gasket Assembly Note

- Apply silicone sealant to the cylinder head as shown.

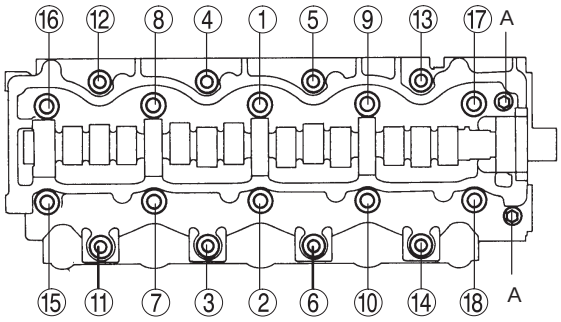
Thickness
ø 2.0–3.0 mm {0.08—0.11 in}



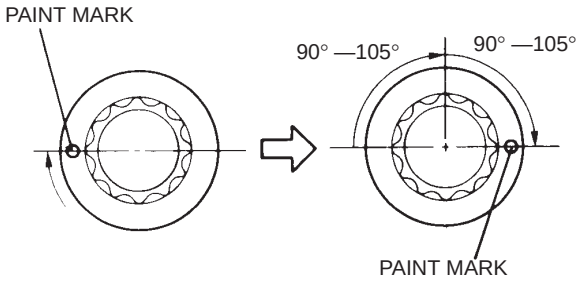
Cylinder Head Assembly Note

1. Apply clean engine oil to the threads and the seat face of each bolt and install them.
2. Tighten the bolts in two or three steps in the order shown in the figure.

Tightening torque
29 N·m {3.0 kgf·m, 22 ft·lbf}



3. Put a paint mark on each bolt head.
4. Using the marks as a reference, tighten the bolts by turning each **90° —105°** in the sequence shown.
5. Further tighten each bolt by turning another **90° —105°**.

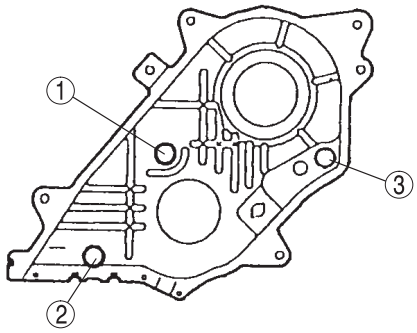


6. Tighten bolts A.

Tightening torque
18—19 N·m {1.8—2.0 kgf·m, 13.1—14.4 ft·lbf}

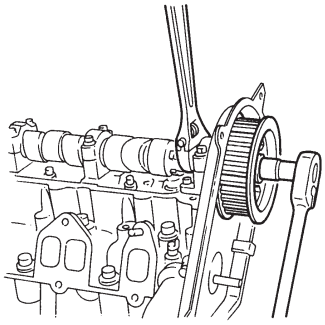
Seal Plate Assembly Note

- Tighten the seal plate bolts in the order shown.



Camshaft Pulley Assembly Note

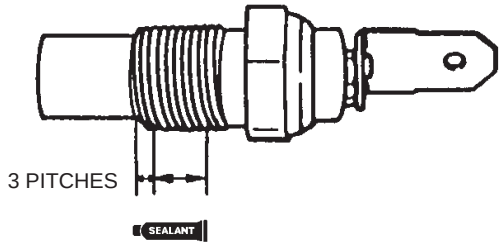
- Hold the camshaft by using a wrench on the cast hexagon and tighten the pulley lock bolt.



CONTINUED

Water Temperature Sender Unit Assembly Note

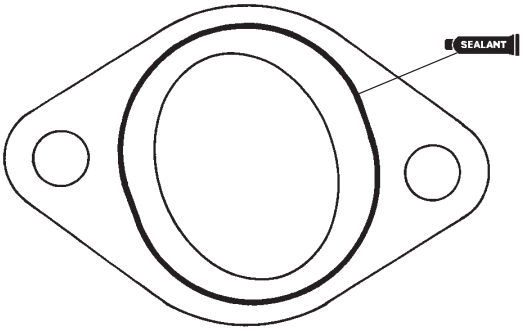
- Apply silicone sealant to the thread of the water temperature sender unit as shown.



Blind Cover Assembly Note

- Apply silicone sealant to the blind cove as shown.

Thickness
ø 1.5—2.5 mm {0.060—0.098 in}

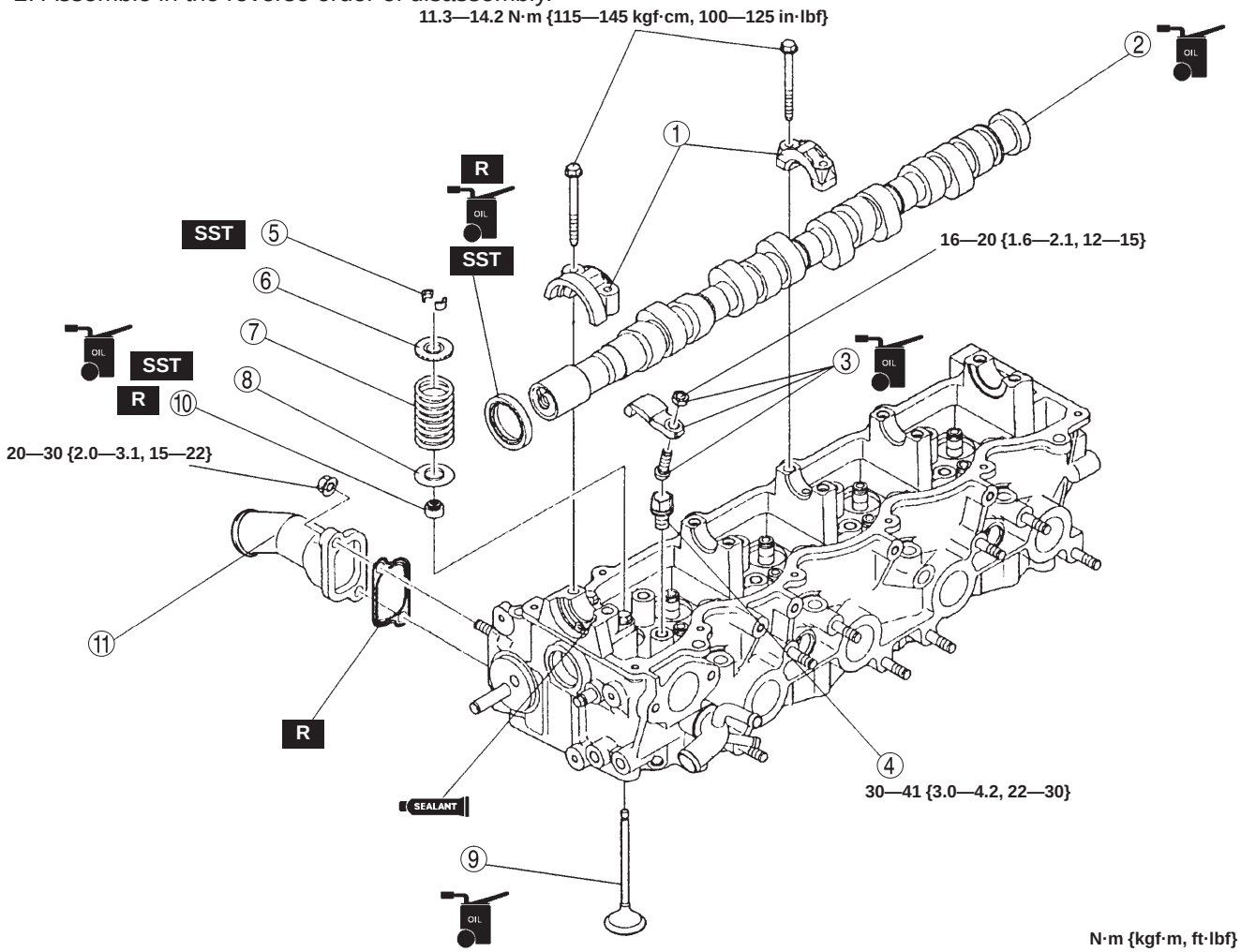


CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

CYLINDER HEAD DISASSEMBLY/ASSEMBLY (II)

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.

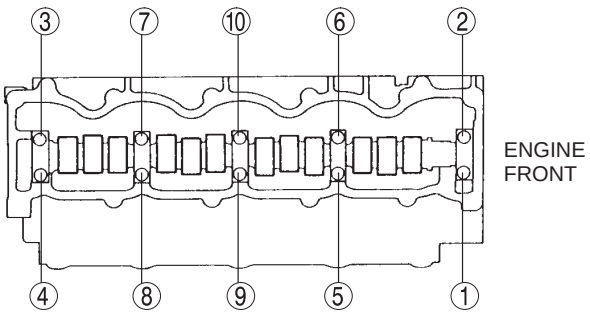


N·m {kgf·m, ft·lbf}

1	Camshaft cap + Disassembly Note + Assembly Note
2	Camshaft + Disassembly Note
3	Rocker arm + Assembly Note
4	Pivot
5	Valve keeper + Disassembly Note + Assembly Note
6	Valve spring seat, upper
7	Valve spring + Assembly Note
8	Valve spring seat, lower
9	Valve
10	Valve seal + Disassembly Note + Assembly Note
11	Water outlet pipe

Camshaft Cap Disassembly Note

1. Measure the camshaft end play.
   (Refer to ENGINE INSPECTION/REPAIR, CAMSHAFT END PLAY INSPECTION.)
2. Loosen the camshaft cap bolts in three or four steps in the order shown.

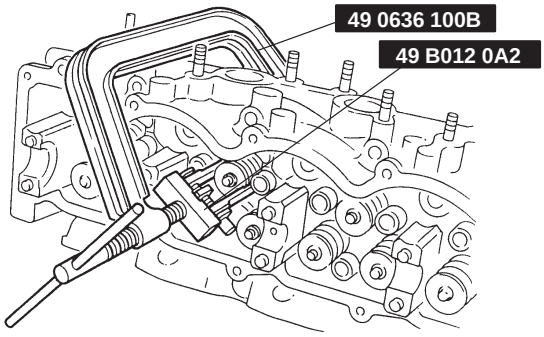


CONTINUED

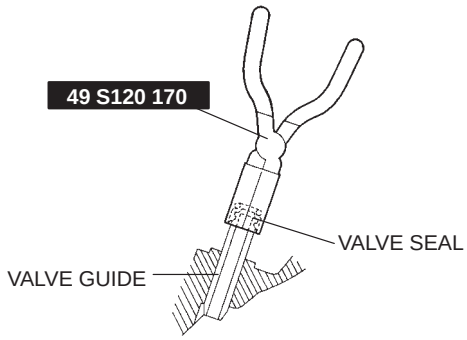
ENGINE DISASSEMBLY/ASSEMBLY

Camshaft Disassembly Note
- Measure the camshaft oil clearance. (Refer to ENGINE INSPECTION/REPAIR, CAMSHAFT OIL CLEARANCE INSPECTION.)

Valve Keeper Disassembly Note
- Remove the valve keeper by using the **SST**.

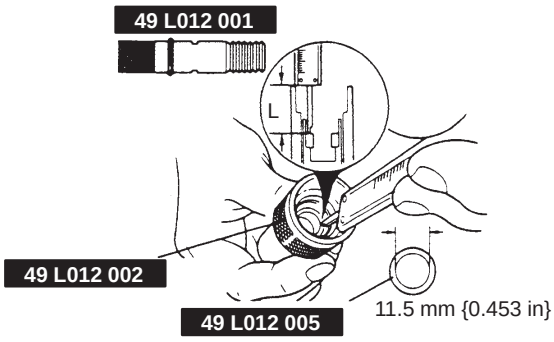


Valve Seal Disassembly Note
- Remove the valve seal by using the **SST**.

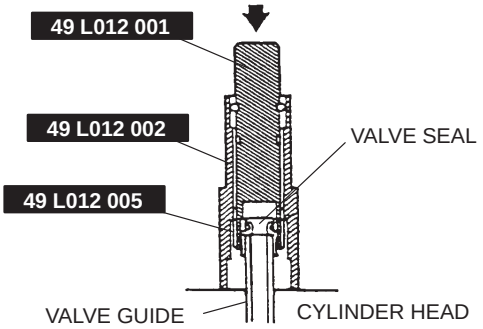


Valve Seal Assembly Note
1. Assemble the **SST** so that depth L is as specified.

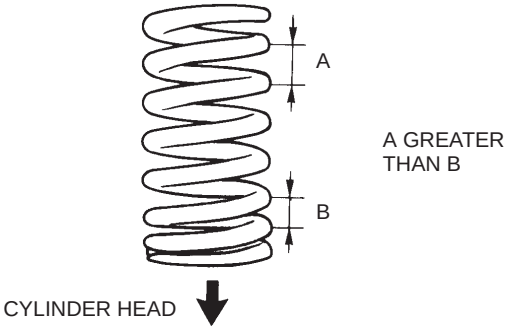
Depth L
15.6 mm {0.614 in}



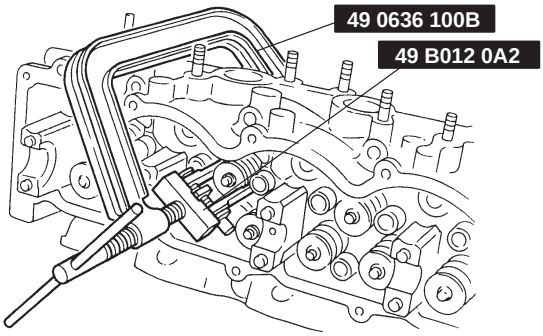
2. Press the valve seal onto the valve guide by hand.
3. Tap the **SST** by using a plastic hammer until its lower end touches the cylinder head.



Valve Spring Assembly Note
- Install the valve spring with the closer pitch toward the cylinder head.

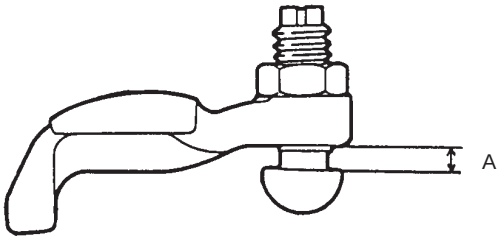


Valve Keeper Assembly Note
- Install the valve keeper by using the **SST**.



Rocker Arm Assembly Note
- If new locker arm is used, set dimension A as follows.

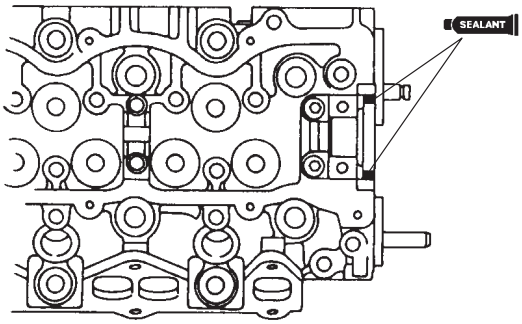
Dimension A
0—4 mm {0—0.1 in}



CONTINUED

Camshaft Cap Assembly Note

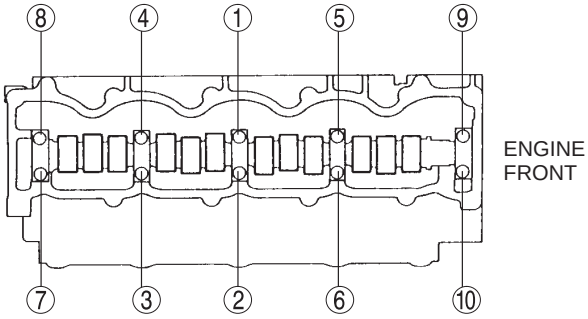
1. Apply silicone sealant to the front camshaft cap mounting surfaces as shown. Avoid sealant from projected onto the camshaft journal, oil seal surface, and camshaft thrust surface.



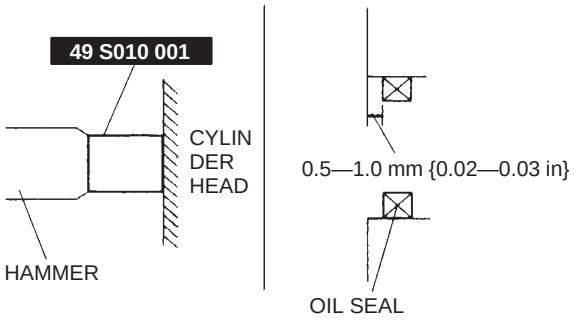
Caution

- **Because there is little camshaft thrust clearance, the camshaft must be held horizontally while it is installed. Otherwise, excessive force will be applied to the thrust area, causing burr on the thrust receiving area of the cylinder head journal. To avoid this, the following procedure must be observed.**

2. Tighten the camshaft cap bolts gradually in three or four steps in the order shown.



3. Apply clean engine oil to the new oil seal.
4. Push the oil seal slightly in by hand.
5. Tap the oil seal into the cylinder head by using the **SST** and a hammer.

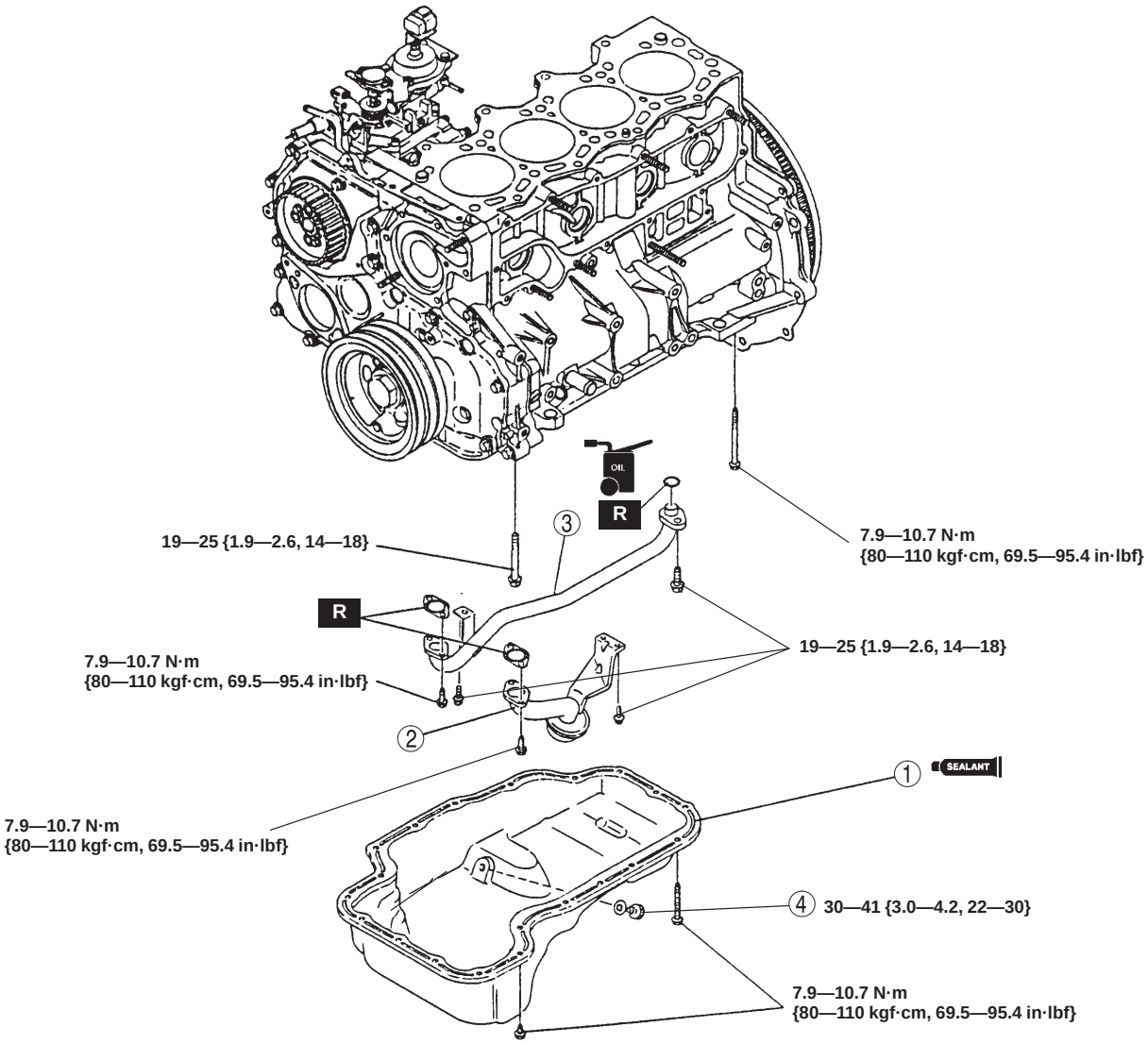


CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (I)

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



N·m {kgf·m, ft·lbf}

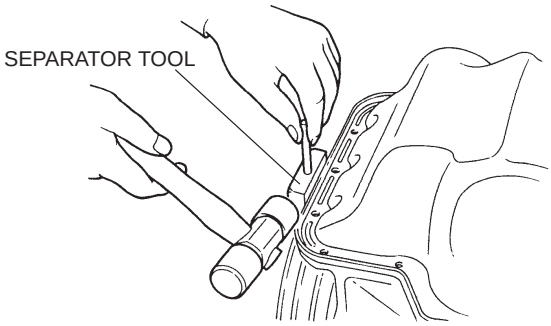
1	Oil pan + Disassembly Note + Assembly Note
2	Oil strainer

3	Oil pipe
4	Oil drain plug

CONTINUED

Oil Pan Disassembly Note

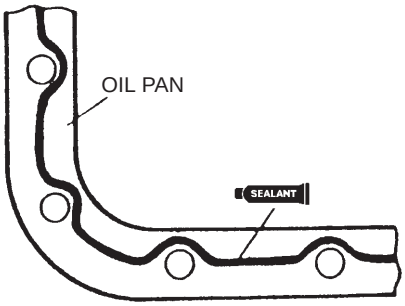
- Remove the oil pan by using a separator tool.



Oil Pan Assembly Note

- Apply silicone sealant to the oil pan as shown.

Thickness
ø2.0—3.0 mm {0.08—0.11 in}

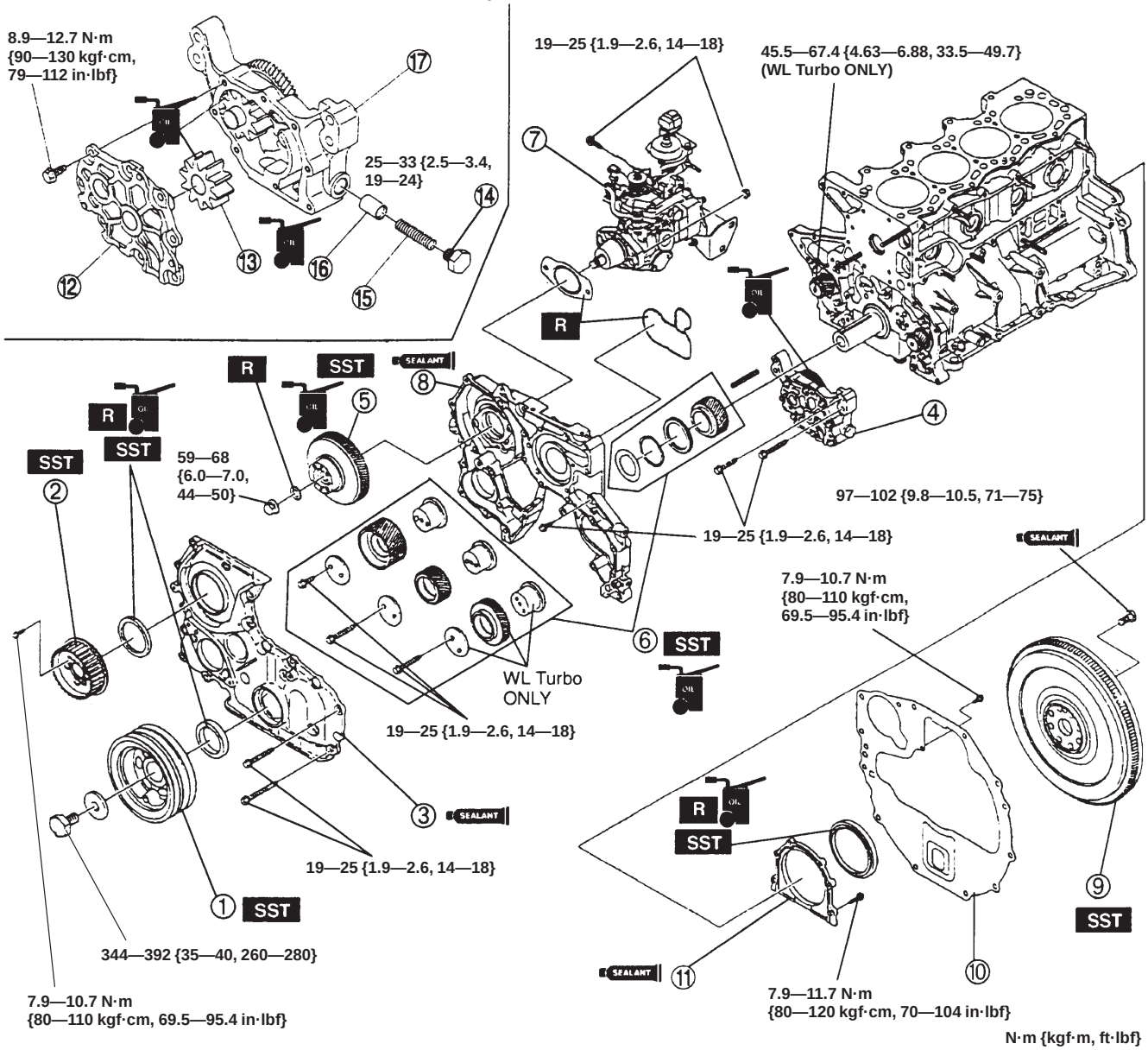


CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (II)

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



N·m {kgf·m, ft·lbf}

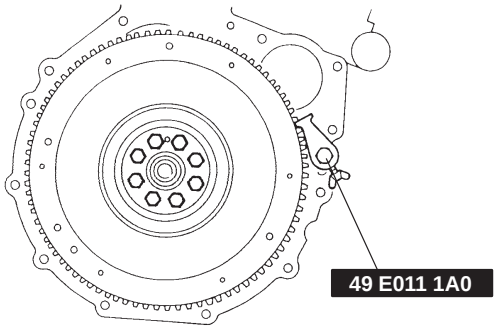
1	Crankshaft pulley + Disassembly Note + Assembly Note
2	FIP pulley + Disassembly Note + Assembly Note
3	Timing gear cover + Disassembly Note + Assembly Note
4	Oil pump
5	FIP gear + Disassembly Note
6	Timing gear + Assembly Note
7	FIP
8	Timing gear case + Disassembly Note + Assembly Note

9	Flywheel + Disassembly Note + Assembly Note
10	End plate
11	Rear cover + Disassembly Note + Assembly Note
12	Oil pump cover + Assembly Note
13	Driven gear
14	Plug
15	Plunger spring
16	Control plunger
17	Oil pump body

CONTINUED

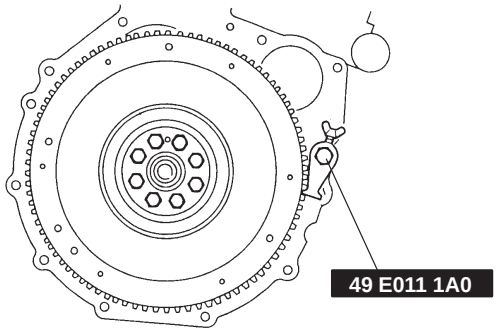
Crankshaft Pulley Disassembly Note

- Remove the crankshaft pulley by using the **SST**.



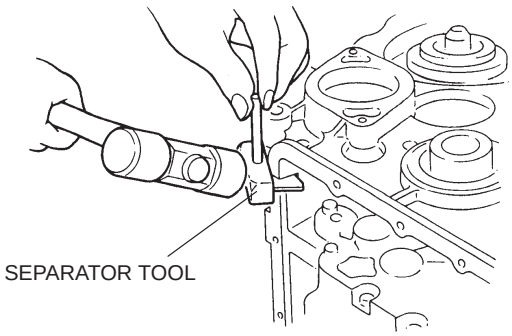
FIP Pulley Disassembly Note

- Remove the FIP pulley by using the **SST**.

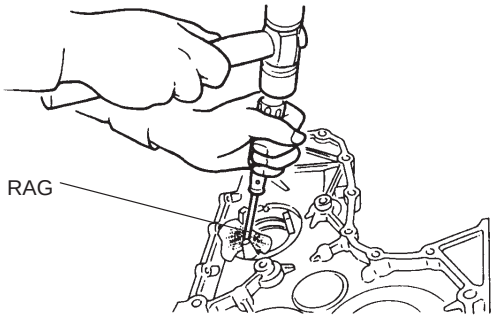


Timing Gear Cover Disassembly Note

1. Remove the timing gear cover by using a separator tool.

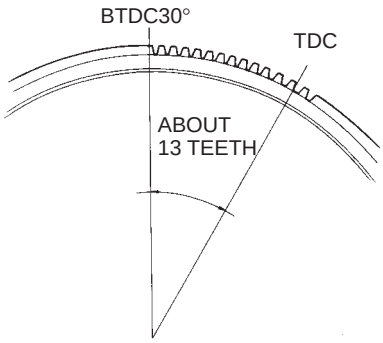


2. Remove the oil seal by using a screwdriver protected with a rag.



FIP Gear Disassembly Note

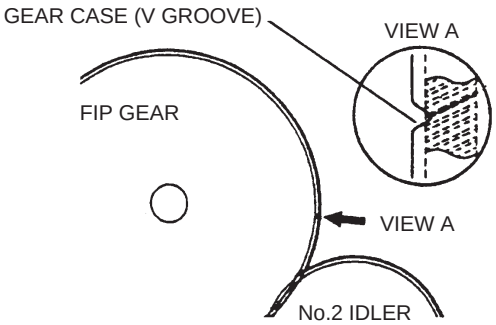
1. Set the No.1 cylinder to compression TDC.
2. Rotate the flywheel ring gear from TDC to approximately 30° BTDC (About 13 teeth on the gear).

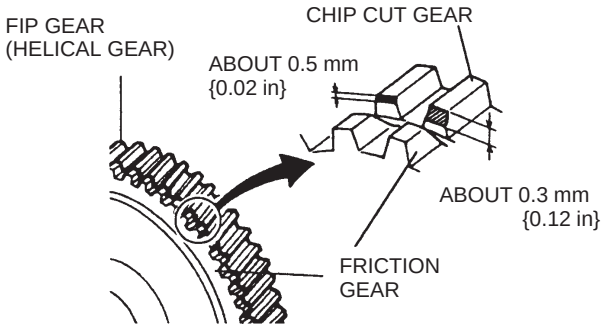


3. Verify that the end-gap (V groove) of the timing gear case and the chip cut gear of the FIP gear are aligned.

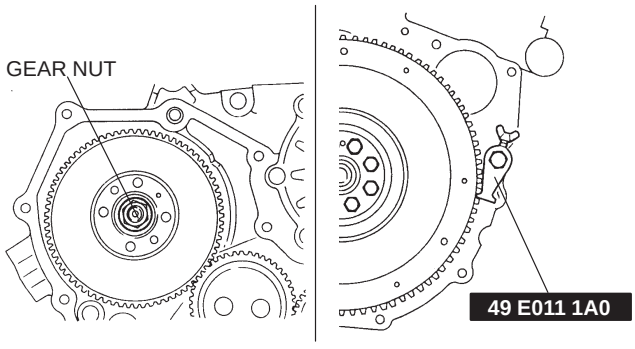
Note

- If the chip cut gear is hard to find, move the FIP gear on notch back and forth, then check the chip cut gear.





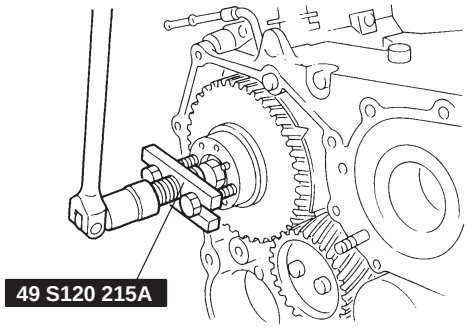
4. Hold the crankshaft by using the **SST** and loosen the gear nut.



5. Remove the FIP gear by using the **SST**.

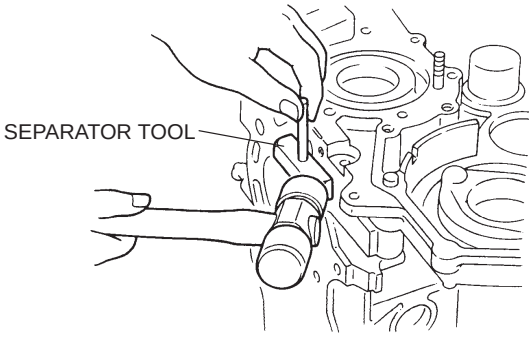
CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY



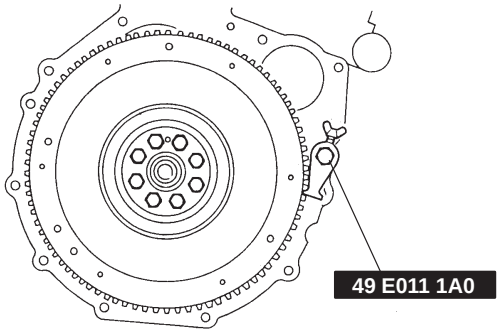
Timing Gear Case Disassembly Note

- Remove the timing gear case by using the separator tool.



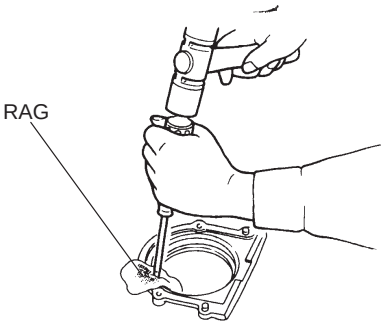
Flywheel Disassembly Note

- Remove the flywheel by using the **SST**.



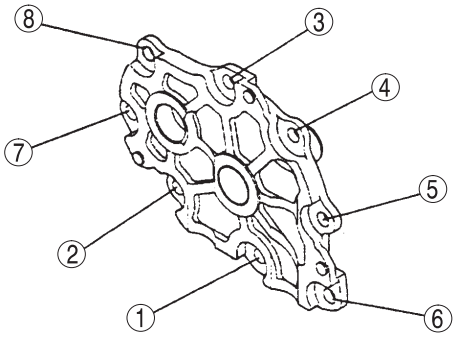
Rear Cover Disassembly Note

- Remove the oil seal by using a screwdriver protected with a rag.



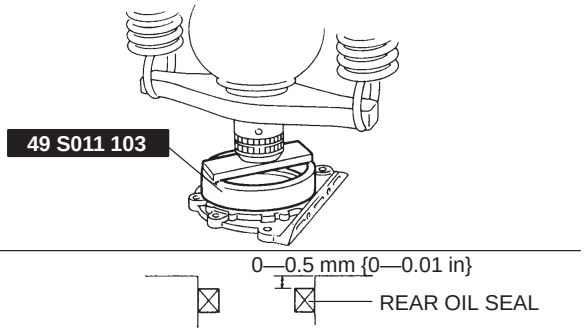
Oil Pump Cover Assembly Note

- Tighten the bolts in two or three steps in the order shown.



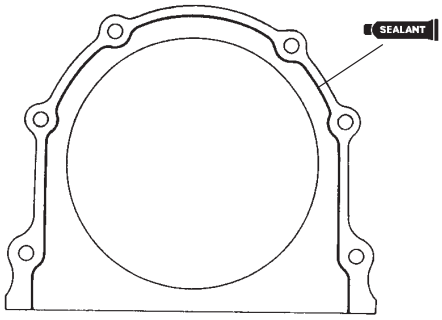
Rear Cover Assembly Note

1. Apply clean engine oil to the oil seal.
2. Push the oil seal slightly in by hand.
3. Press the oil seal in evenly by using the **SST**.



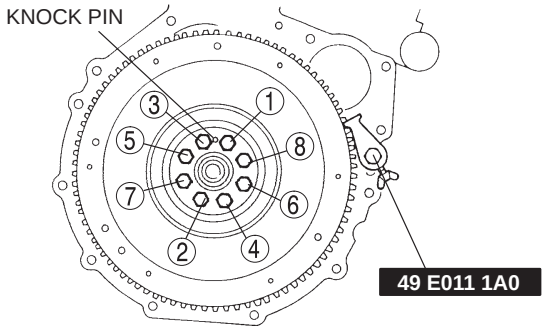
4. Apply silicone sealant to the rear cover as shown.

Thickness
ø 2 mm {0.07 in}



Flywheel Assembly Note

1. Hold the crankshaft by using the **SST**.
2. Tighten the bolts in the order shown.



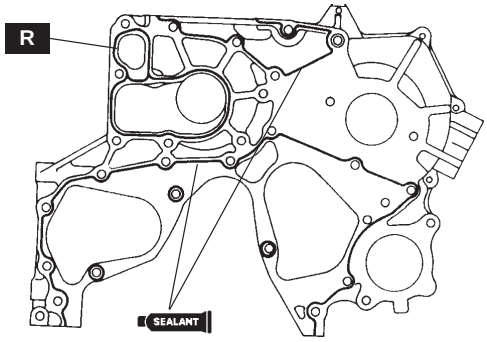
Timing Gear Case Assembly Note

1. Install the new O-ring.

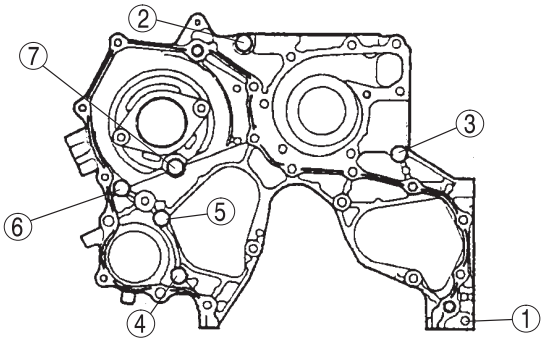
CONTINUED

2. Apply silicone sealant to the timing gear case as shown. Do not apply sealant to the O-ring.

Thickness
ø 1.5—2.5 mm {0.060—0.098 in}

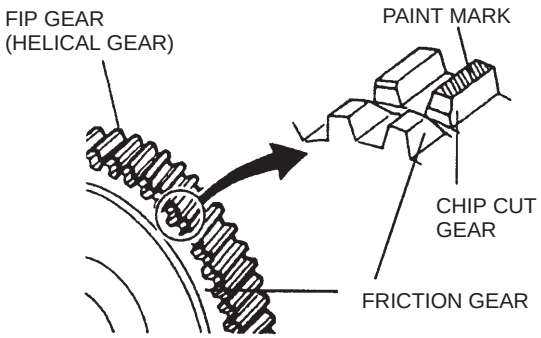


3. Tighten the bolts in two or three steps in the order shown.

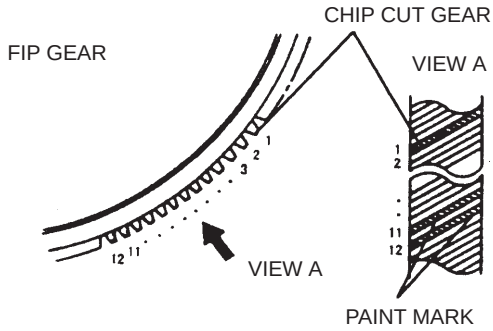


Timing Gear Assembly Note

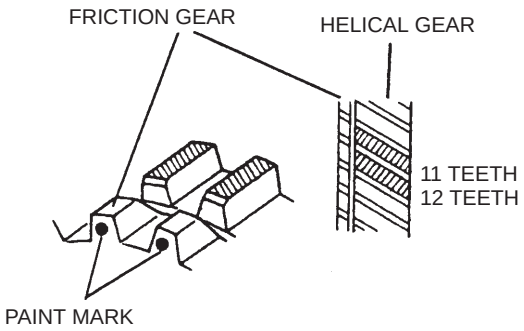
1. Make a paint mark on the side chip cut gear of the FIP gear.



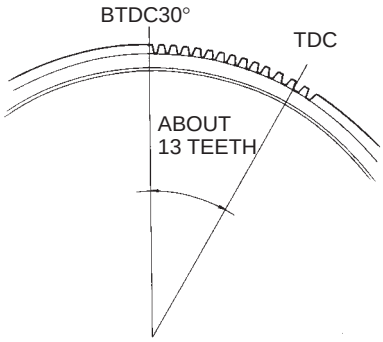
2. Make a paint mark on the 11th and 12th teeth of the helical gear counted from chip cut gear.



3. Verify that the 11th and 12th teeth of the FIP gear (helical gear) and the teeth of the friction gear are aligned, then mark a paint mark on the friction gear. If not aligned, move the friction gear by using a screwdriver.



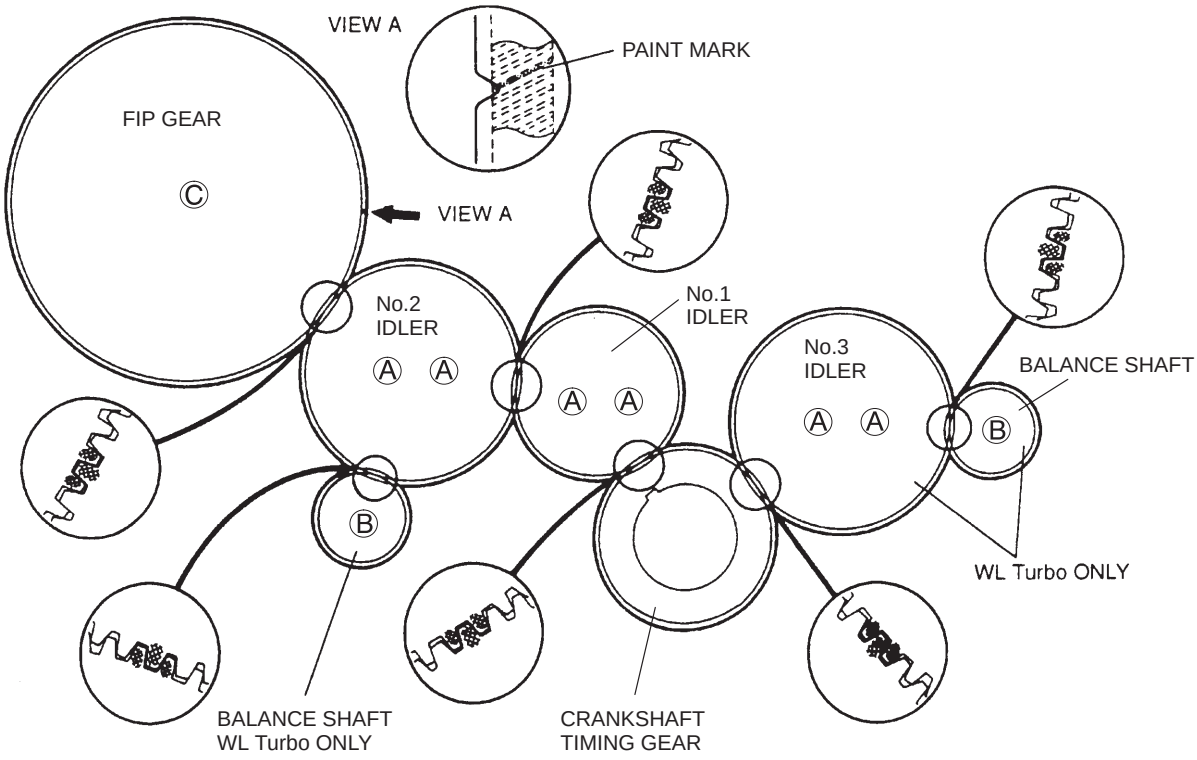
4. Set the No.1 cylinder to compression TDC.
5. Rotate the flywheel ring gear from TDC to approximatey 30° BTDC (About 13 teeth on the gear.)



CONTINUED

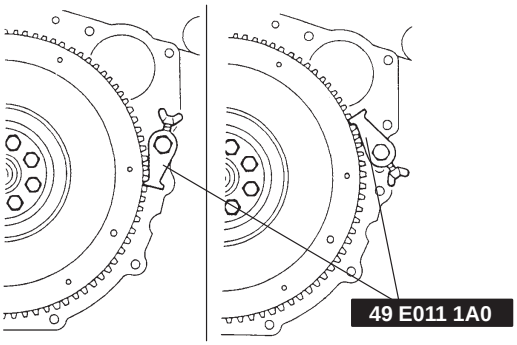
Note
- The helical gears except for the FIP gear have a punch mark as the timing mark. The timing mark of each gear can be aligned easily if the paint mark is made on the punch mark.

6. Align the timing marks and temporarily install the timing gears. For the FIP gear, verify that the paint marks (view A) are also aligned.



7. Hold the crankshaft by using the **SST**, and tighten the bolts.

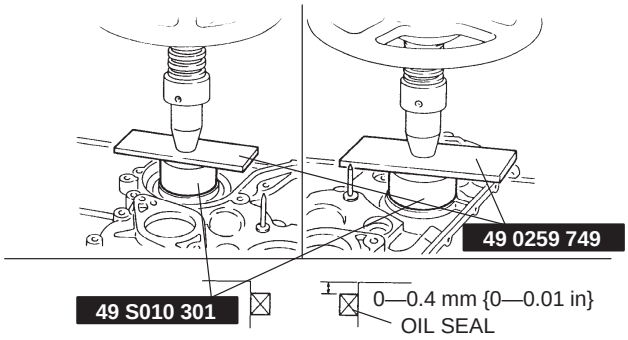
Tightening Torque
A: 19—25 N·m {1.9—2.6 kgf·m, 14—18 ft·lbf}
B: 45.5—67.4 N·m {4.63—6.88 kgf·m, 33.5—49.7 ft·lbf}
C: 59—68 N·m {6.0—7.0 kgf·m, 44—50 ft·lbf}



CONTINUED

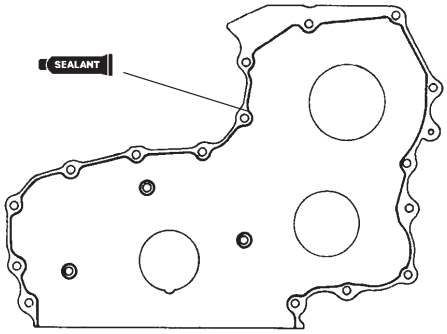
Timing Gear Cover Assembly Note

1. Apply clean engine oil to the oil seal.
2. Push the oil seal slightly in by hand.
3. Press the oil seal in evenly by using the **SST**.

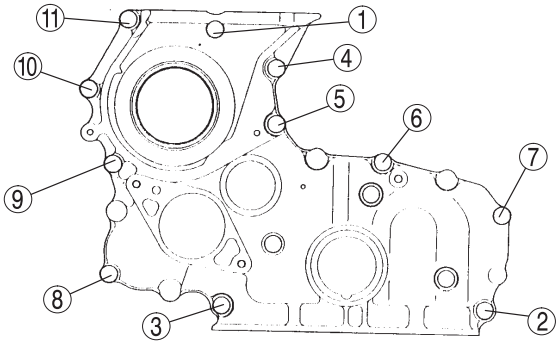


4. Apply silicone sealant to the timing gear cover as shown.

Thickness
ø 1.5—2.5 mm {0.060—0.098 in}

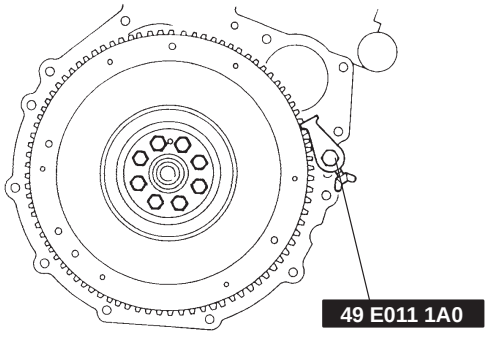


5. Tighten the bolts in two or three steps in the order shown.



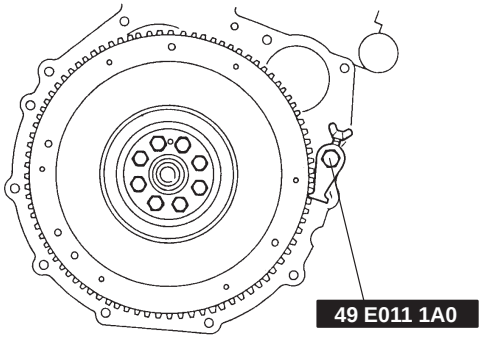
FIP Pulley Assembly Note

- Install the FIP pulley by using the **SST**.



Crankshaft Pulley Assembly Note

- Install the crankshaft pulley by using the **SST**.

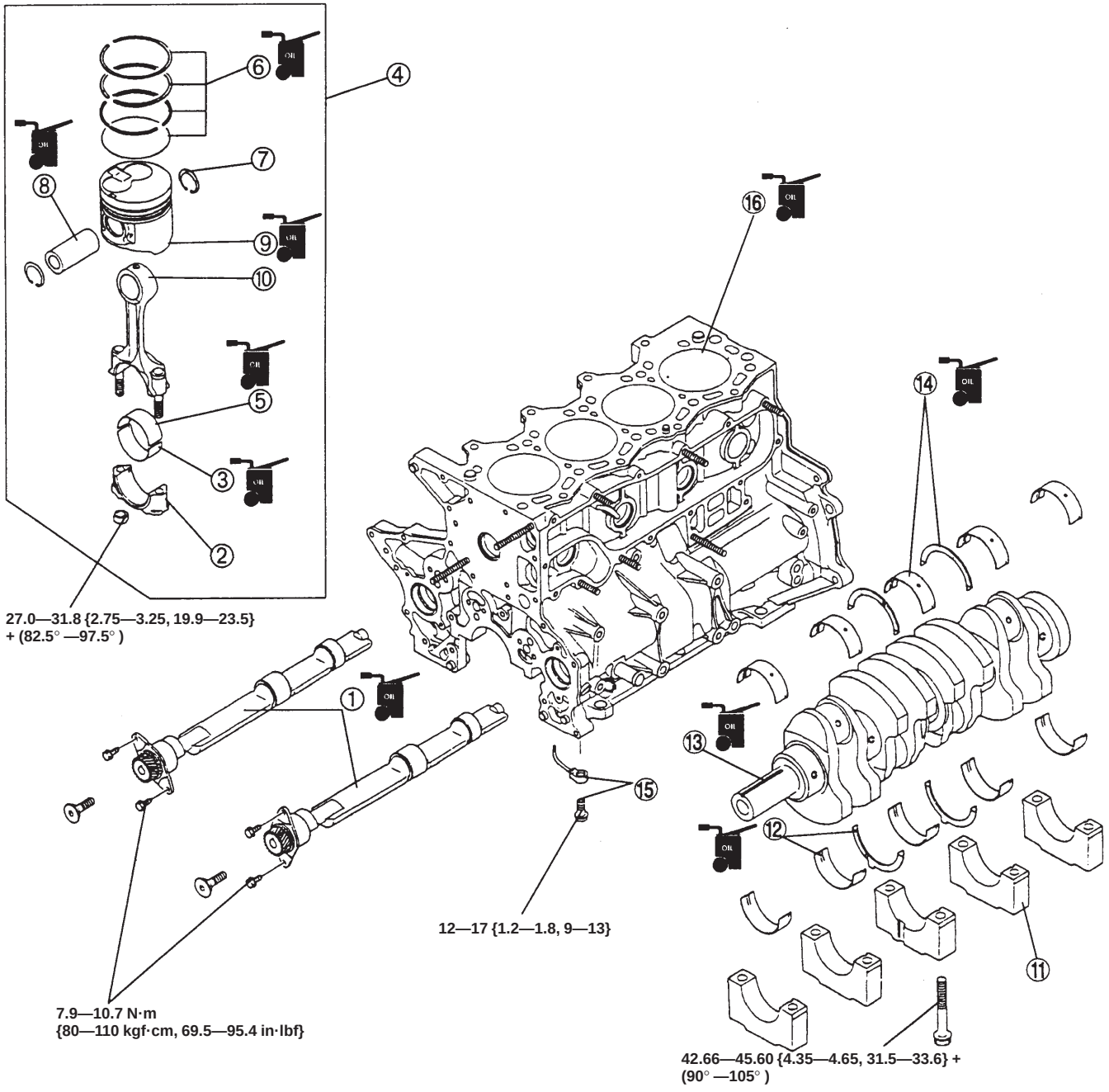


CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III)

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



1	Balance shaft (WL Turbo) + Disassembly Note
2	Connecting rod cap + Disassembly Note
3	Connecting rod bearing, lower
4	Piston, Connecting rod + Disassembly Note + Assembly Note
5	Connecting rod bearing, upper
6	Piston ring
7	Piston pin clip
8	Piston pin
9	Piston

10	Connecting rod
11	Main bearing cap + Disassembly Note + Assembly Note
12	Main bearing, lower, Thrust bearing, lower
13	Crankshaft + Disassembly Note
14	Main bearing, upper, Thrust bearing, upper
15	Oil jet valve, Nozzle
16	Cylinder block

CONTINUED

ENGINE DISASSEMBLY/ASSEMBLY

Balance shaft (WL Turbo) Disassembly Note

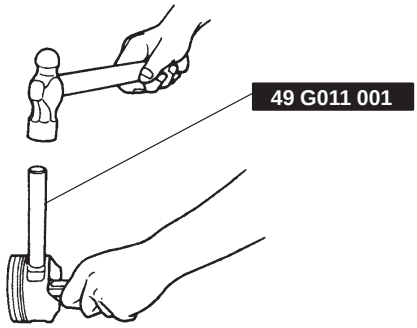
- Measure the balance shaft end play.
  (Refer to ENGINE INSPECTION/REPAIR, BALANCE SHAFT INSPECTION.)
  (WL Turbo)

Connecting Rod Cap Disassembly Note

- Measure the connecting rod side clearance.
  (Refer to ENGINE INSPECTION/REPAIR, CONNECTING ROD SIDE CLEARANCE INSPECTION.)

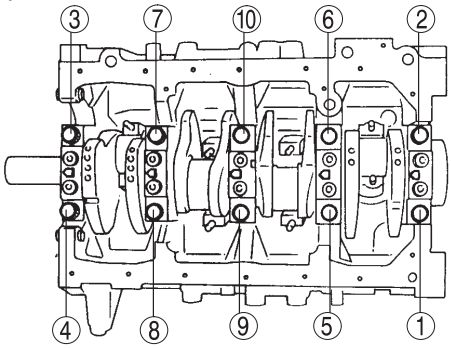
Piston, Connecting Rod Disassembly Note

1. Measure the connecting rod oil clearance.
   (Refer to ENGINE INSPECTION/REPAIR, CONNECTING ROD OIL CLEARANCE INSPECTION/REPAIR.)
2. Check the oscillation torque.
   (Refer to ENGINE INSPECTION/REPAIR, PISTON AND CONNECTING ROD INSPECTION.)
3. Remove the piston pin by using the **SST**.



Main Bearing Cap Disassembly Note

1. Measure the crankshaft end play.
   (Refer to ENGINE INSPECTION/REPAIR, CRANKSHAFT END PLAY INSPECTION/REPAIR.)
2. Loosen the main bearing cap bolts in two or three steps in the order shown.



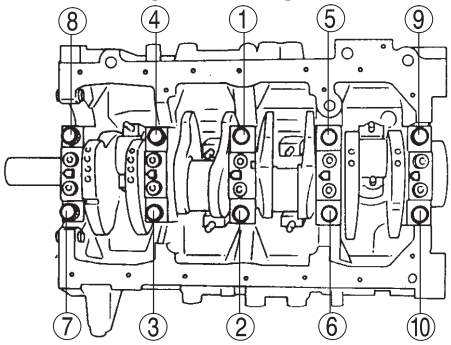
Crankshaft Disassembly Note

- Measure the main journal oil clearance.
  (Refer to ENGINE INSPECTION/REPAIR, CRANKSHAFT OIL CLEARANCE INSPECTION/REPAIR.)

Main Bearing Cap Assembly Note

1. Apply clean engine oil to the bolt threads and seat faces of the lower cylinder block bolts.
2. Tighten the bolts in two or three steps in the order shown.

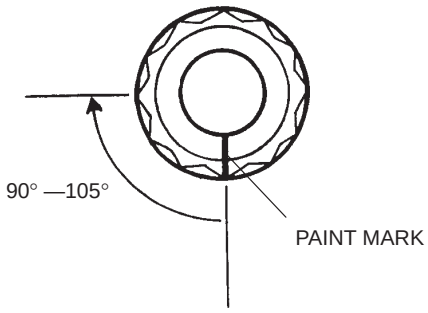
Tightening torque
75—82 N·m {7.6—8.4 kgf·m, 55—60 ft·lbf}



3. Loosen all bolts.
4. Tighten them in two or three steps as in step 2.

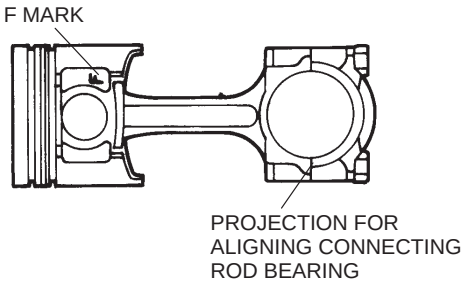
Tightening torque
42.66—45.60 N·m
{4.35—4.65 kgf·m, 31.5—33.6 ft·lbf}

5. Put a paint mark on each bolt head.
6. Using the marks as a reference, tighten the bolts by turning each **90**° **—105**° as in step 2.



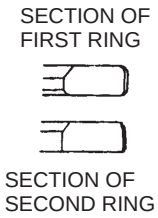
Piston, Connecting Rod Assembly Note

1. Assemble the piston and the connecting rod in the direction from which they were disassembled.
2. Apply clean engine oil to the piston pin.
3. Install the piston pin until the pin contacts the clip as shown. If the pin cannot be installed easily, heat the piston.

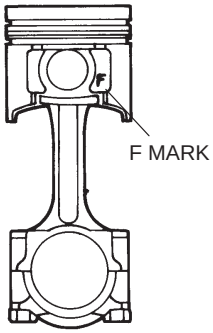


4. Verify that the second ring is installed with tapered face upward.
5. Verify that the top ring is installed with tapered face side upward.

CONTINUED



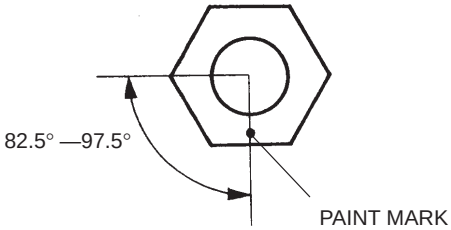
6. Insert the piston and connecting rod assembly into the cylinder with the F mark facing the front of the engine.



7. Align the matching marks on the connecting rod and the connecting rod cap. Install the connecting rod cap.
8. tighten the nuts in two or three steps.

Tightening torque
27.0—31.8 N·m
{2.75—3.25 kgf·m, 19.9—23.5 ft·lbf}

9. Put a paint mark on each nut.
10. Using the marks as a reference, tighten the nuts by turning each **82.5**° **—97.5**°.



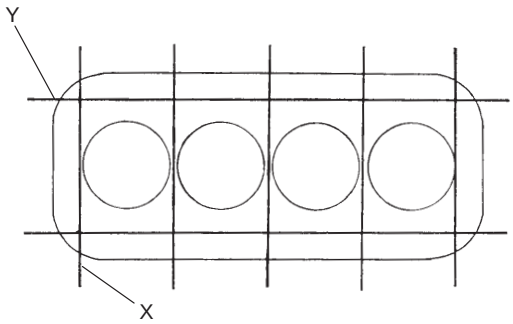
CONTINUED

ENGINE INSPECTION/REPAIR

CYLINDER HEAD INSPECTION/REPAIR

1. Carry out cooling flaw detection on the cylinder head surface. Replace the cylinder head if necessary.
2. Inspect for the following and repair or replace.
   (1) Sunken valve seats
   (2) Excessive camshaft oil clearance and end play
3. Measure the cylinder head for distortion in the seven directions as shown.

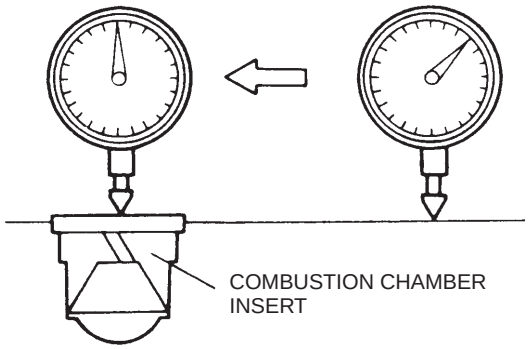
   Distortion
   X direction: 0.020 mm {0.0008 in} max.
   Y direction: 0.050 mm {0.0020 in} max.



4. If the cylinder head distortion exceeds the maximum, replace the cylinder head. Do not attempt to repair a cylinder head by milling or grinding.
5. Measure the receded or projected amount of combustion chamber insert from cylinder head surface.

   Recession: 0.020 mm {0.0008 in} max.
   Projection: 0.005 mm {0.0002 in} max.

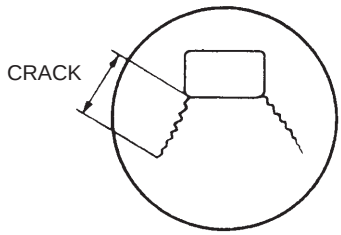
6. If it exceeds the maximum,replace the cylinder head.



7. Inspect the combustion chamber insert crack.

   Crack
   Limit: 10.0 mm {0.39 in}

8. If it exceeds the specification, replace the cylinder head.

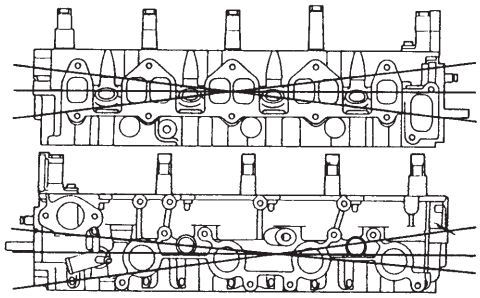


9. Measure the manifold contact surface distortion as shown.

   Distortion
   0.05 mm {0.002 in} max.

10. If the distortion exceeds the maximum, grind the surface or replace the cylinder head.

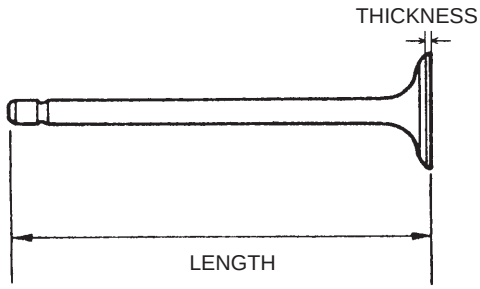
    Grinding
    0.15 mm {0.006 in} max.



VALVE INSPECTION

1. Measure the valve head margin thickness of each valve. Replace the valve if necessary.

   Margin thickness
   IN: 1.50 mm {0.059 in}
   EX: 0.75 mm {0.030 in}



CONTINUED

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

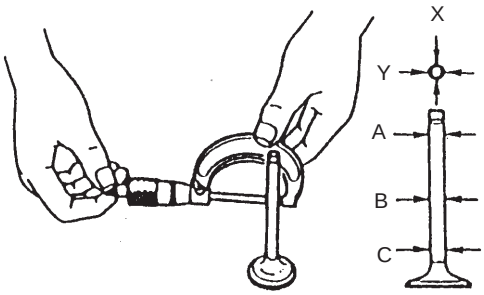
Standard length
IN: 111.60—112.10 mm {4.394—4.413 in}
EX: 111.50—112.00 mm {4.390—4.409 in}

Minimum length
IN: 111.35 mm {4.384 in}
EX: 111.25 mm {4.380 in}

3. Measure the stem diameter of each valve in X and Y directions at the three points (A, B, and C) shown. Replace the valve if necessary.

Standard diameter
IN: 6.970—6.985 mm {0.2745—0.2749 in}
EX: 6.965—6.980 mm {0.2743—0.2748 in}

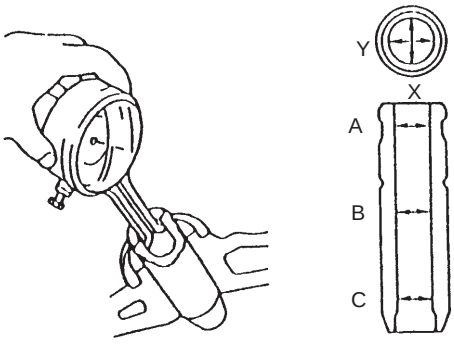
Minimum diameter
IN: 6.920 mm {0.2724 in}
EX: 6.915 mm {0.2722 in}



VALVE GUIDE INSPECTION

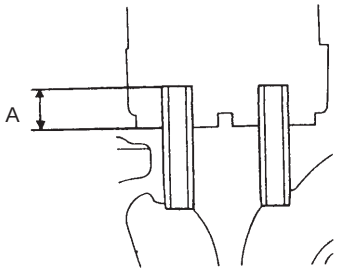
1. Measure the inner diameter of each valve guide in X and Y directions at the three points (A, B, and C)shown. Replace the valve guide if necessary.

Standard inner diameter
7.025—7.045 mm {0.2766—0.2773 in}



2. Measure the protrusion height (dimension A) of each valve guide without lower valve spring seat. Replace the valve guide if necessary.

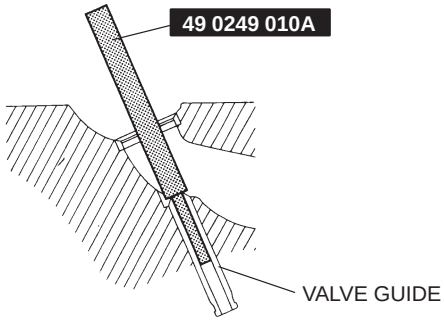
Standard height
14.0—14.5 mm {0.56—0.57 in}



VALVE GUIDE REPLACEMENT

Valve Guide Removal

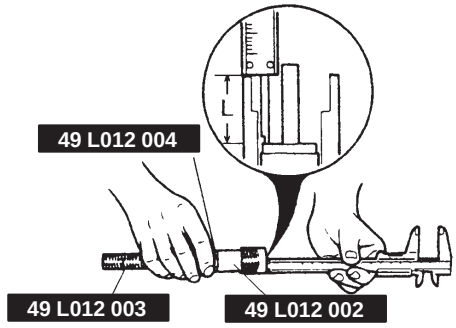
- Remove the valve guide from the combustion chamber side by using the **SST**.



Valve Guide Installation

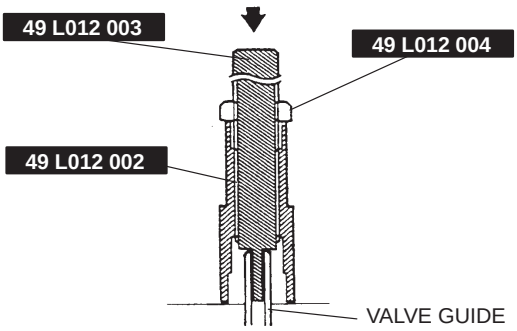
1. Assemble the **SSTs** so that depth **L** is as specified.

Depth L
14.0—14.5 mm {0.56—0.57 in}



2. Tap the valve guide in from the side opposite the combustion chamber until the **SST** contacts the cylinder head.
3. Verify that the valve guide projection height is within the specification.

Standard height
14.0—14.5 mm {0.56—0.57 in}



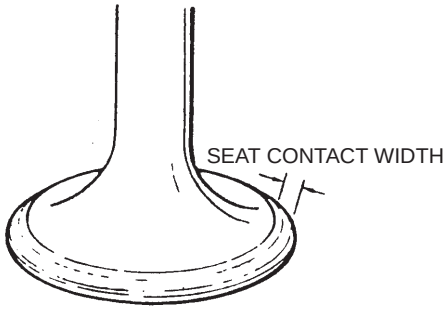
CONTINUED

ENGINE INSPECTION/REPAIR

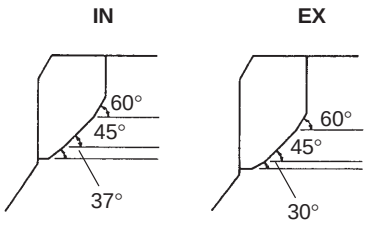
VALVE SEAT INSPECTION/REPAIR

1. Measure the seat contact width. If necessary, resurface the valve seat by using a 45° valve seat cutter and/or resurface the valve face.

   Standard width
   IN: 1.6—2.2 mm {0.07—0.08 in}
   EX: 1.7—2.3 mm {0.07—0.09 in}



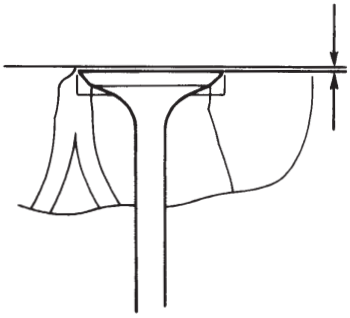
2. Verify that the valve seating position is at the center of the valve face.
   (1) If the seating position is too high, correct the valve seat using a **60**° cutter and a **45**° cutter.
   (2) If the seating position is too low, correct the valve seat using a **37**° (IN) or **30**° (EX) cutter and a **45**° cutter.



3. Measure the receded amount from the cylinder head surface. If it exceeds the maximum, replace the cylinder head.

   Recession
   IN: 0.61—1.09 mm {0.025—0.042 in}
   EX: 0.71—1.19 mm {0.028—0.046 in}

   Maximum
   IN: 1.50 mm {0.059 in}
   EX: 1.60 mm {0.063 in}

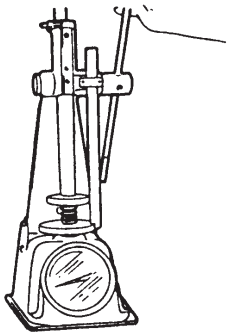


VALVE SPRING INSPECTION

1. Apply pressing force to the pressure spring and check the spring height. Replace the valve spring if necessary.

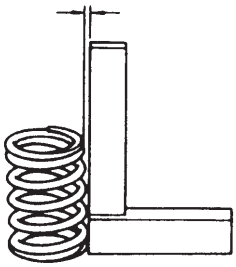
   Pressing force
   239—268 N {24.3—27.4 kgf, 53.5—60.2 lbf}

   Standard height
   35.5 mm {1.40 in}



2. Measure the out-of-square of the valve spring. Replace the valve spring if necessary.

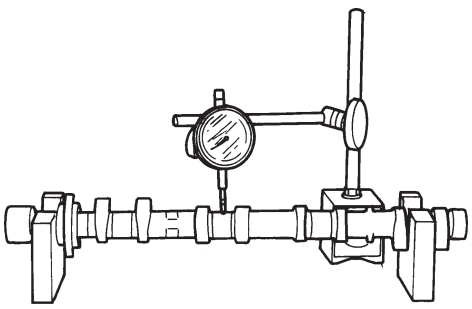
   Valve spring out-of-square
   1.70 mm {0.0670} max.



CAMSHAFT INSPECTION

1. Set the No.1 and No.5 journals on V-blocks. Measure the camshaft runout. Replace the camshaft if necessary.

   Runout
   0.03 mm {0.001 in} max.

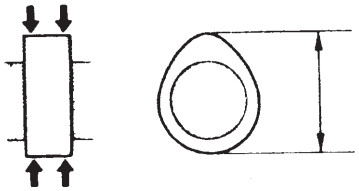


CONTINUED

2. Measure the cam lobe height at the two points as shown. Replace the camshaft if necessary.

Standard height
IN: 42.40—42.50 mm {1.670—1.673 in} (WL)
41.221—41.321 mm {1.623—1.626 in} (WL Turbo)
EX: 42.395—42.495 mm {1.670—1.673 in}

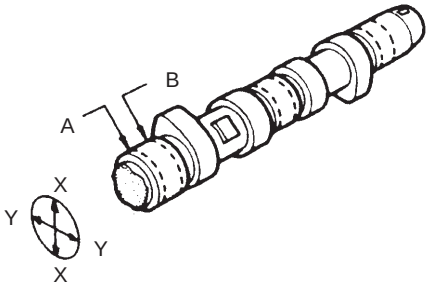
Minimum height
IN: 42.050 mm {1.6555 in} (WL)
40.871 mm {1.6091 in} (WL Turbo)
EX:42.045 mm {1.6553 in}



3. Measure the journal diameters in X and Y directions at the two points (A and B) as shown. Replace the camshaft if necessary.

Standard diameter
No.1, No.5:
25.940—25.965 mm {1.0213—1.0222 in}
No.2—No.4:
25.910—25.935 mm {1.0201—1.0210 in}

Minimum diameter
No.1, No.5: 25.890 mm {1.0193 in}
No.2—No.4: 25.860 mm {1.0181 in}

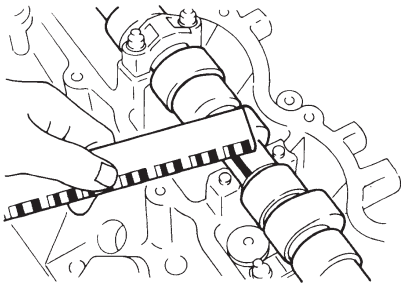


CAMSHAFT OIL CLEARANCE INSPECTION

1. Position plastigage atop the journals in the axial direction.
2. Install the camshaft cap.
(Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER HEAD DISASSEMBLY/ASSEMBLY (II), Camshaft Cap Assembly Note.)
3. Remove the camshaft cap.
(Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER HEAD DISASSEMBLY/ASSEMBLY (II), Camshaft Cap Disassembly Note.)
4. Measure the oil clearance. Replace the cylinder head if necessary.

Standard clearance
No.1, 5: 0.035—0.081 mm {0.0014—0.0031 in}
No.2—4: 0.065—0.111 mm {0.0026—0.0043 in}

Maximum clearance
No.1, 5: 0.12 mm {0.0047 in}
No.2—4: 0.15 mm {0.0059 in}

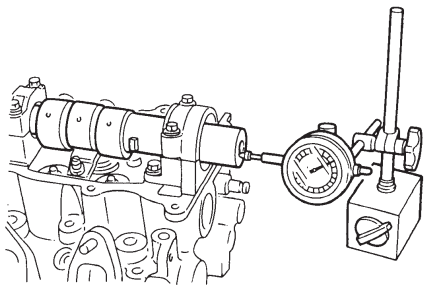


CAMSHAFT END PLAY INSPECTION

1. Install the camshaft cap.
(Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER HEAD DISASSEMBLY/ASSEMBLY (II), Camshaft Cap Assembly Note.)
2. Measure the camshaft end play. Replace the cylinder head or camshaft if necessary.

Standard end play
0.030—0.160 mm {0.0012—0.0062 in}

Maximum end play
0.200 mm {0.0078 in}



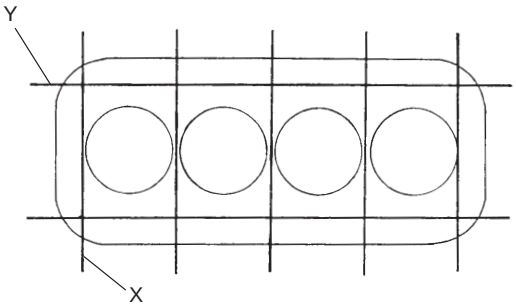
3. Remove the camshaft cap.
(Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER HEAD DISASSEMBLY/ASSEMBLY (II), Camshaft Cap Disassembly Note.)

CONTINUED

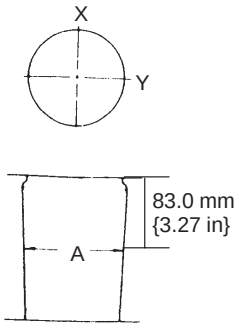
CYLINDER BLOCK INSPECTION/REPAIR

1. Measure the distortion of the cylinder block top surface in the seven directions as shown. Replace if necessary.

Cylinder block distortion
X Direction: 0.020 mm {0.0008 in} max.
Y Direction: 0.050 mm {0.0020 in} max.



2. Measure the cylinder bores in X and Y directions at three leves A in each cylinder as shown.



3. If the cylinder bore exceeds the wear limit, replace the cylinder block or rebore the cylinder and install the oversize pistons so that the specified piston-to-cylinder clearance is obtained.

Note
- Base the boring diameter on the diameter of an oversize piston. All cylinder must be the same diameter.

Cylinder bore mm {in}

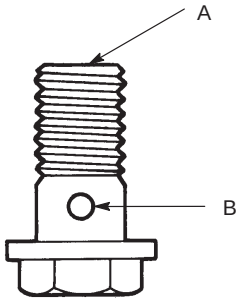
Size	Bore
Standard	93.000—93.022 {3.6615—3.6622}
0.25 {0.01} oversize	93.250—93.272 {3.6713—3.6721}
0.50 {0.02} oversize	93.500—93.522 {3.6811—3.6819}

Wear limit
0.150 mm {0.0059 in}

OIL JET VALVE, NOZZLE INSPECTION

1. Apply compressed air to oil jet valve A and verify that air passes through oil jet valve B If not, replace the oil jet valve.

Air pressure
138—196 kPa {1.4—2.0 kgf/cm^2, 20—28 psi}
2. Check the oil jet nozzle for clogs. Replace the nozzle if necessary.

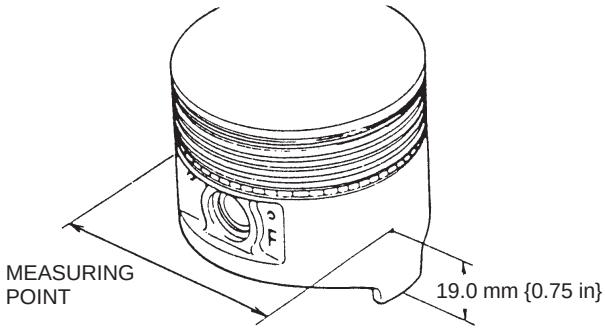


PISTON INSPECTION

- Measure the outer diameter of each piston at right angle (**90**°) to the piston pin, **19 mm {0.75 in}** above the buttom of piston.

Piston diameter mm {in}

Size	Bore
Standard	92.951—92.977 {3.6595—3.6605}
0.25 {0.01} oversize	93.186—93.212 {3.6688—3.6697}
0.50 {0.02} oversize	93.436—93.462 {3.6786—3.6795}



PISTON CLEARANCE INSPECTION/REPAIR

1. Measure the piston-to-cylinder clearance. Replace the piston or rebore the cylinders to fit oversize piston if necessary.

Standard clearance
0.038—0.056 mm {0.0015—0.0022 in}

Maximum clearance
0.150 mm {0.0059 in}

2. If the piston is replaced,the piston rings must also be replaced.

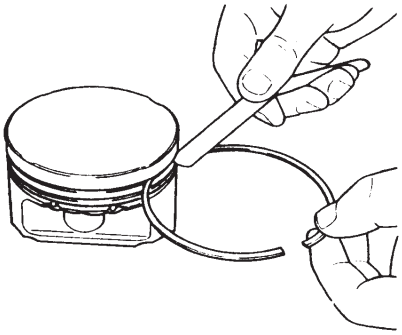
PISTON RING CLEARANCE INSPECTION

1. Measure the piston ring-to-ring land clearance around the entire circumference. Replace the piston and piston ring if necessary.

Standard clearance
Top: 0.06—0.10 mm {0.0024—0.0039 in}
Second: 0.04—0.08 mm {0.0016—0.0031 in}
Oil: 0.03—0.07 mm {0.0012—0.0027 in}

CONTINUED

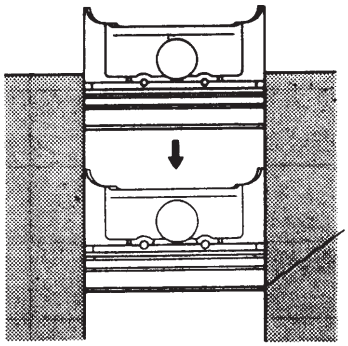
Maximum clearance
0.150 mm {0.0059 in}



2. Insert the piston ring into the cylinder by hand and use the piston to push it to the bottom of the ring travel.
3. Measure each piston ring end gap with a feeler gauge. Replace the piston ring if necessary.

Standard end gap
Top: 0.22—0.32 mm {0.009—0.012 in}
Second: 0.32—0.47 mm {0.013—0.018 in}
Oil: 0.22—0.32 mm {0.009—0.012 in}

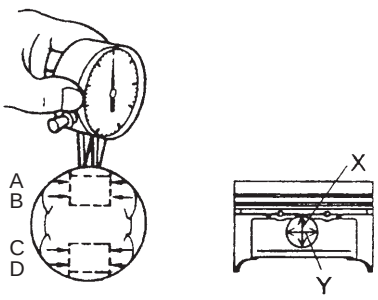
Maximum end gap
1.00 mm {0.039 in}



PISTON PIN CLEARANCE INSPECTION

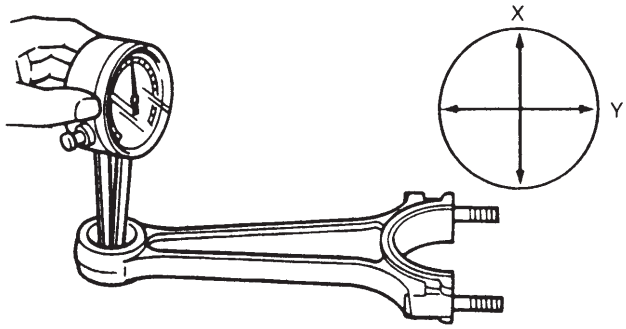
1. Measure each piston pin bore diameter in X and Y directions at the four points (A, B, C, and D) as shown.

Standard diameter
31.997—32.007 mm {1.2598—1.2601 in}



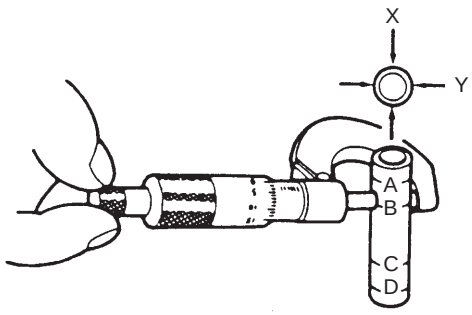
2. Measure each connecting rod small end inner diameter in X and Y directions as shown.

Standard diameter
32.012—32.033 mm {1.2604—1.2611 in}



3. Measure each piston pin diameter in X and Y directions at the four points (A, B, C, and D) as shown.

Standard diameter
31.994—32.000 mm {1.2597—1.2598 in}



4. Calculate the piston pin-to-piston pin bore clearance. Replace the piston and/or piston pin if necessary.

Standard clearance
–0.003—0.013 mm {–0.0001—0.0005 in}

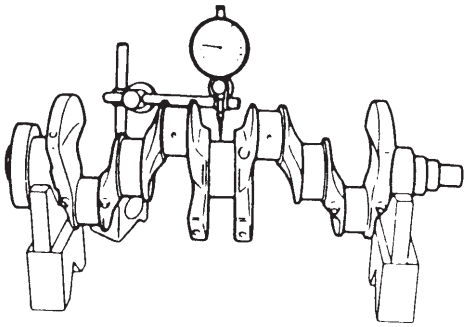
5. Calculate the connecting rod small end-to-piston pin clearance. Replace the connecting rod or piston pin.

Standard clearance
0.012—0.039 mm {0.0005—0.0015 in}

CRANKSHAFT INSPECTION

1. Measure the crankshaft runout. Replace the crankshaft if necessary.

Runout
0.05 mm {0.002 in} max.



2. Measure the journal diameter in X and Y direction at the two points (A and B) as shown. Replace the crankshaft or grind the journal and install the undersize bearing if necessary.

CONTINUED

Main journal mm {in}

Bearing	Diameter	
Journal No.	1, 2, 4, 5	3
Standard	66.937—66.955 {2.6354—2.6360}	66.920—66.938 {2.6347—2.6353}
0.25 {0.01} undersize	66.687—66.705 {2.6255—2.6261}	66.670—66.688 {2.6248—2.6255}
0.50 {0.02} undersize	66.437—66.455 {2.6157—2.6163}	66.420—66.438 {2.6150—2.6156}
0.75 {0.03} undersize	66.187—66.205 {2.6058—2.6064}	66.170—66.188 {2.6052—2.6058}

Wear limit
0.05 mm {0.002 in}

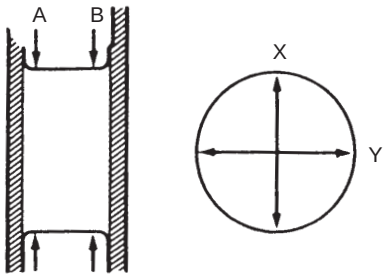
Out–of–round
0.03 mm {0.001 in}

Crank pin mm {in}

Bearing size	Diameter
Standard	54.940—54.955 {2.1630—2.1635}
0.25 {0.01} undersize	54.690—54.705 {2.1532—2.1537}
0.50 {0.02} undersize	54.440—54.455 {2.1434—2.1438}
0.75 {0.03} undersize	54.190—54.205 {2.1335—2.1340}

Wear limit
0.05 mm {0.002 in}

Out–of–round
0.03 mm {0.001 in}



CRANKSHAFT OIL CLEARANCE INSPECTION/REPAIR

1. Position Plastigage atop the journals in the axial direction.
2. Install the main bearig cap.
   (Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III), Main Bearing Cap Assembly Note.)
3. Remove the main bearing cap.
   (Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III), Main Bearing Cap Disassembly Note.)
4. Measure the main journal oil clearance. If the clearance exceeds the maximum, replace the main bearing or grind the main journal and install the undersize bearings so that the specified oil clearance is obtained.

Standard clearance
No.1, 2, 4, 5:
0.033—0.052 mm {0.0013—0.0020 in}
No.3:
0.050 mm —0.069 mm {0.0020—0.0026 in}

Maximum clearance
0.08 mm {0.003 in}

mm {in}

Bearing size	Diameter
Standard	2.003—2.018 {0.0789—0.0794}
0.25 {0.01} undersize	2.121—2.131 {0.0836—0.0838}
0.50 {0.02} undersize	2.246—2.256 {0.0885—0.0888}
0.75 {0.03} undersize	2.371—2.381 {0.0934—0.0937}

CRANKSHAFT END PLAY INSPECTION/REPAIR

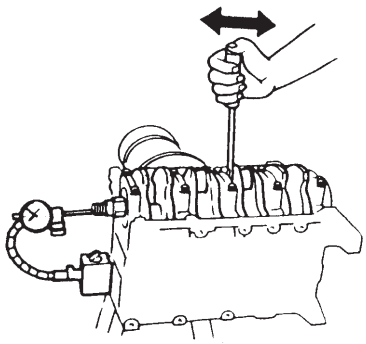
1. Install the main bearing cap.
   (Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III), Main Bearing Cap Assembly Note.)
2. Measure the crankshaft end play. If the end play exceeds the maximum, replace the thrust bearing or grind the crankshaft and install an undersize bearing so that the specified end play is obtained.

Standard end play
0.040—0.282 mm {0.0016—0.0111 in}

Maximum end play
0.300 mm {0.012 in}

mm {in}

Bearing size	Bearing thickness
Standard	2.455—2.505 {0.0967—0.0986}
0.35 {0.014} undersize	2.630—2.680 {0.1036—0.1055}



3. Remove the main bearing cap.
   (Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III), Main Bearing Cap Disassembly Note.)

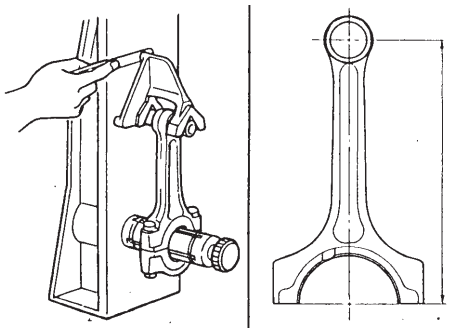
CONTINUED

CONNECTING ROD INSPECTION

1. Measure each connecting rod for bending and distortion. Replace the connecting rod if necessary.

   Bending
   0.075 mm {0.0030 in} max. /50 mm {2.0 in}

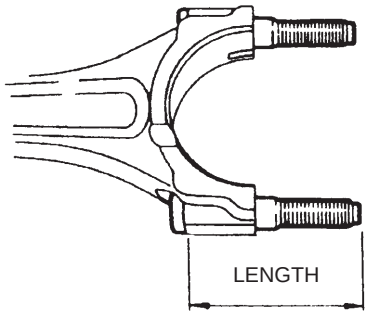
   Center-to-center distance
   151.95—152.05 mm {5.983—5.986 in}



2. Measure the length of connecting rod bolt. Replace the connecting rod and connecting rod cap if necessary.

   Standard length
   67.5—68.5 mm {2.66—2.69 in}

   Maximum length
   69 mm {2.7 in}



CONNECTING ROD OIL CLEARANCE INSPECTION/REPAIR

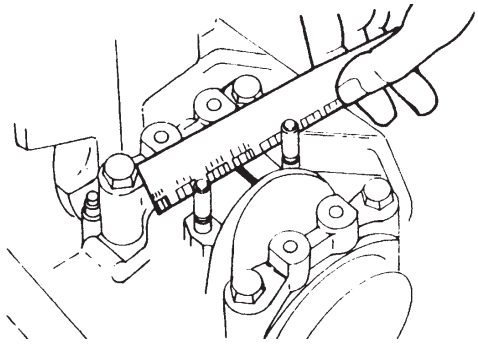
1. Position Plastigage atop the journals in the axial direction.
2. Install the connecting rod cap.
   (Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III), Piston and Connecting Rod Assembly Note.)
3. Remove the connecting rod cap.
4. Measure the crankpin oil clearance. If the clearance exceeds the maximum, replace the connecting rod bearing or grind the crankpin and use undersize bearings so that the specified clearance is obtained.

   Standard clearance
   0.031—0.058 mm {0.0013—0.0022 in}

   Maximum clearance
   0.080 mm {0.003 in}

mm {in}

Bearing size	Bearing thickness
Standard	1.504—1.513 {0.0592—0.0595}
0.25 {0.01} undersize	1.621—1.631 {0.0638—0.0642}
0.50 {0.02} undersize	1.746—1.756 {0.0687—0.0691}
0.75 {0.03} undersize	1.871—1.881 {0.0737—0.0740}

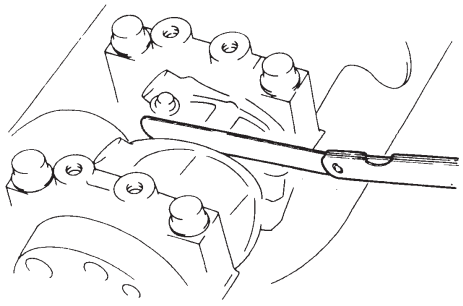


CONNECTING ROD SIDE CLEARANCE INSPECTION

1. Install the connecting rod cap.
   (Refer to ENGINE DISASSEMBLY/ASSEMBLY, CYLINDER BLOCK DISASSEMBLY/ASSEMBLY (III), Piston and Connecting Rod Assembly Note.)
2. Measure the connecting rod large end side clearance. Replace the connecting rod and cap if necessary.

   Standard clearance
   0.110—0.262 mm {0.0044—0.0103 in}

   Maximum clearance
   0.350 mm {0.037 in}

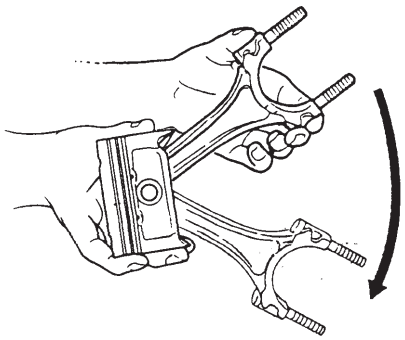


3. Remove the connecting rod cap

PISTON AND CONNECTING ROD INSPECTION

- Check the oscillation torque as shown. If the large end does not drop by its own weight, replace the piston or the piston pin.

CONTINUED



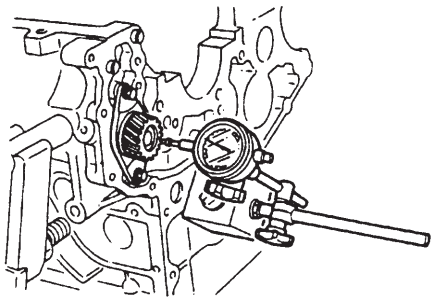
BALANCE SHAFT INSPECTION (WL Turbo)

1. Install the balance shaft and tighten the thrust plate fitting bolt.

   Tightening torque
   7.9—10.7 N·m
   {80—110 kgf·cm, 69.5—95.4 in·lbf}

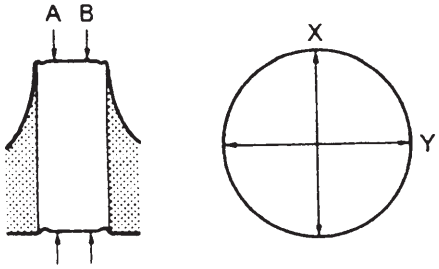
2. Measure the balance shaft end play. Replace the balance shaft and/or cylinder block if necessary.

   Standard end play
   0.04—0.16 mm {0.002—0.006 in}



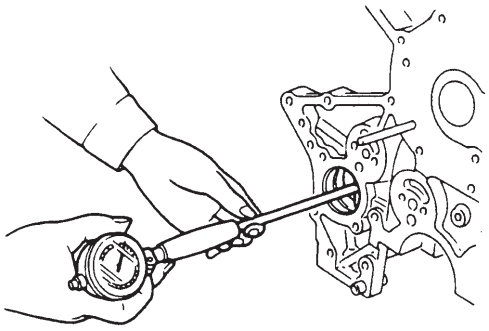
3. Measure the journal diameters in X and Y directions at the two points (A and B) as shown. Replace the balance shaft if necessary.

   Standard diameter
   Front:
   41.945—41.960 mm {1.6514—1.6519 in}
   Center:
   39.945—39.960 mm {1.5727—1.5732 in}
   Rear;
   37.975—37.990 mm {1.4951—1.4956 in}



4. Measure the balance shaft bore in the cylinder block. Calculate the clearance between the balance shaft and balance shaft bore. Replace the balance shaft and/or cylinder block if necessary.

   Standard clearance
   Front, rear:
   0.050—0.115 mm {0.0020—0.0045 in}
   Center:
   0.080—0.145 mm {0.0032—0.0057 in}



BOLT INSPECTION

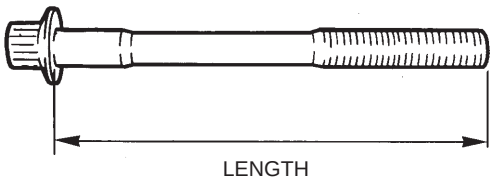
- Measure the length of each bolt. Replace the bolt if necessary.

Cylinder head bolt mm {in}

Bolt head mark	Standard length	Maximum length
W	101.2—101.8 {3.985—4.007}	102.5 {4.035}
N	113.2—113.8 {4.457—4.480}	114.5 {4.508}

Main bearing cap bolt mm {in}

Standard length	84.7—85.3 {3.34—3.35}
Maximum length	86.0 {3.39}

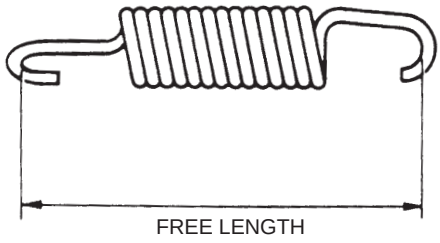


TENSIONER SPRING INSPECTION

- Measure the free length of the tensioner spring. Replace the tensioner spring if necessary.

  Free length
  63.0 mm {2.48 in}

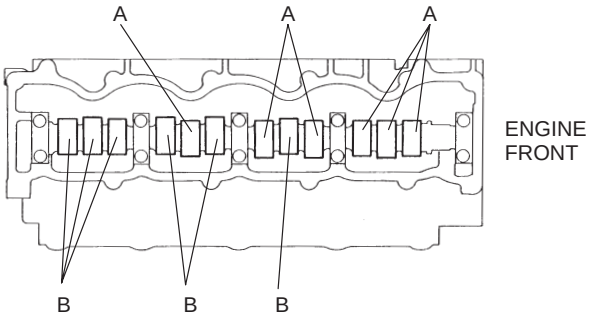
CONTINUED



VALVE CLEARANCE INSPECTION

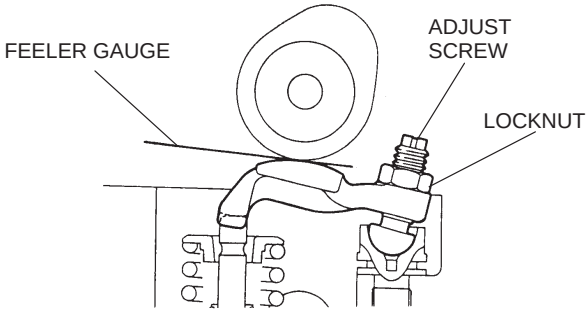
1. Turn the crankshaft and align the timing mark so that the piston of the No.1 or No.4 cylinder is at TDC of compression.
2. Measure the valve clearances A with the No.1 cylinder at TDC of compression, and those of B with the No.4 cylinder at TDC of compression.

Valve clearance [engine cold]
IN: 0.05—0.15 mm {0.0020—0.0059 in}
EX: 0.15—0.25 mm {0.0060—0.0098 in}



3. If it is not within the specification, adjust and recheck the valve clearance.
4. Turn the crankshaft one full turn and measure the remaining valve clearances. Adjust if necessary.

Tightening torque (locknut)
16—20 N·m {1.6—2.1 kgf·m, 12—15 ft·lbf}

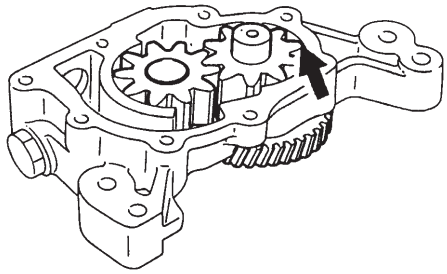


GEAR CLEARANCE INSPECTION

- Measure the following clearance. Replace the gear and/or pump body if necessary.

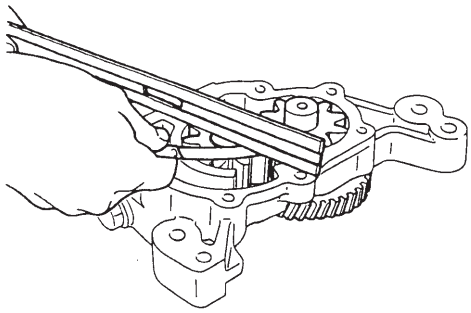
Standard clearance
0.10—0.19 mm {0.004—0.007 in}

Maximum clearance
0.20 mm {0.008 in}



Standard side clearance
0.04—0.09 mm {0.002—0.003 in}

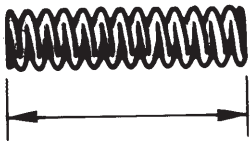
Maximum side clearance
0.15 mm {0.006 in}



PLUNGER SPRING INSPECTION

- Measure the free length of the pressure spring. Replace the plunger spring if necessary.

Free length
43.8 mm {1.72 in}



CONTINUED

MANUAL TRANSMISSION (R15M–D, R15MX–D)

MANUAL TRANSMISSION

PRECAUTION

1. Clean the transmission exterior thoroughly by using a steam cleaner or cleaning solvents before disassembly.

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.**

Caution

- **Cleaning sealed bearings by using cleaning fluids or a steam cleaner can wash the grease out of the bearing.**

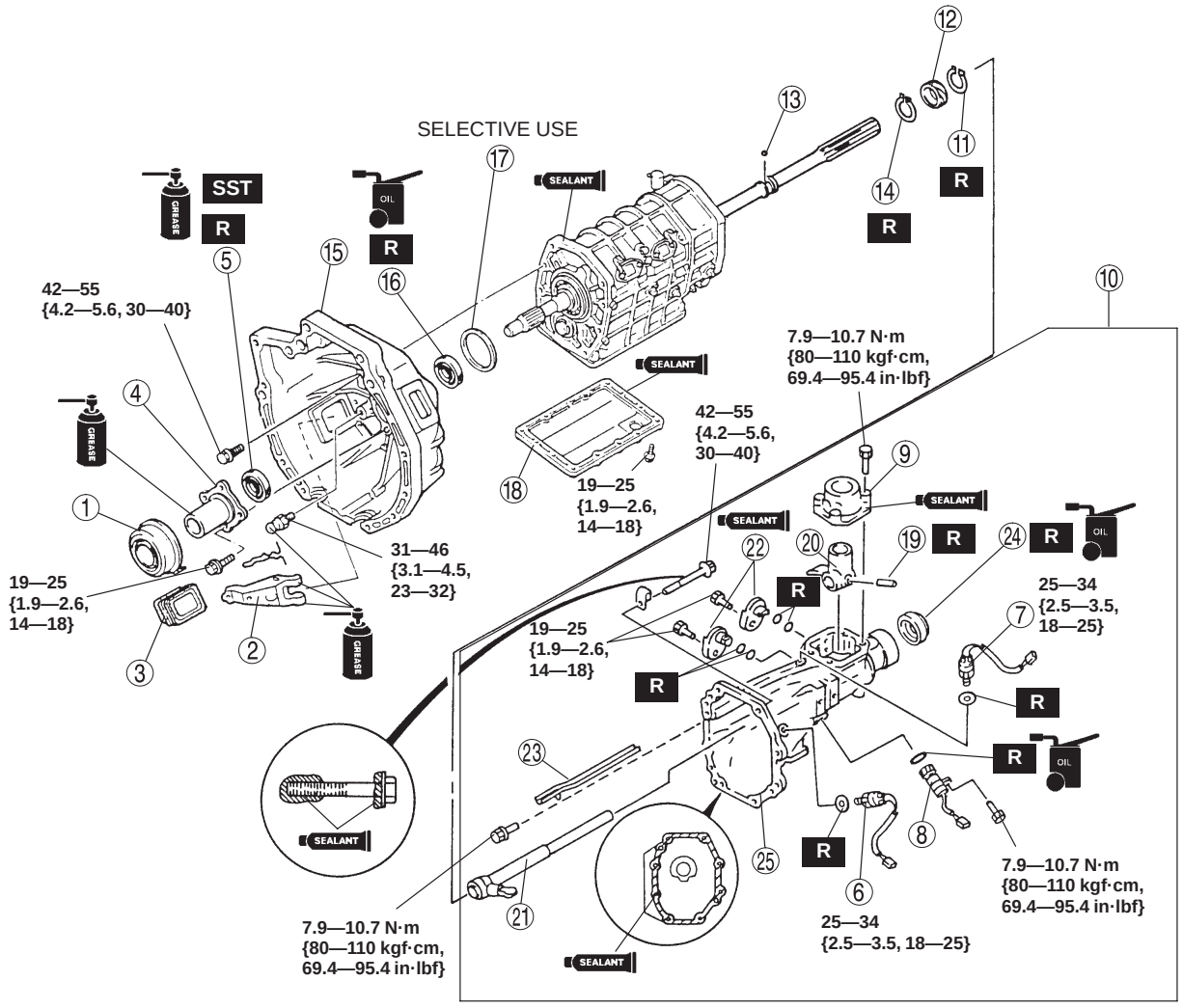
2. Clean the removed parts by using cleaning solvent, and dry them by using compressed air. Clean out all holes and passages by using compressed air, and check that there are no obstructions.
3. Use a plastic hammer when disassembling the transmission case and other light alloy metal parts.
4. Make sure each part is cleaned before assembling.
5. Coat all movable parts with the specified oil.
6. Replace parts whenever required.
7. Remove old sealant from contact surfaces before applying new sealant.
8. Assemble the parts within **10 minutes** after applying sealant. Allow all sealant to cure at least **30 minutes** after assembly before filling the transmission with transmission oil.

CONTINUED

CLUTCH HOUSING, EXTENSION HOUSING, AND TRANSFER CASE DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.

4×2 (R15M–D)



N·m {kgf·m, ft·lbf}

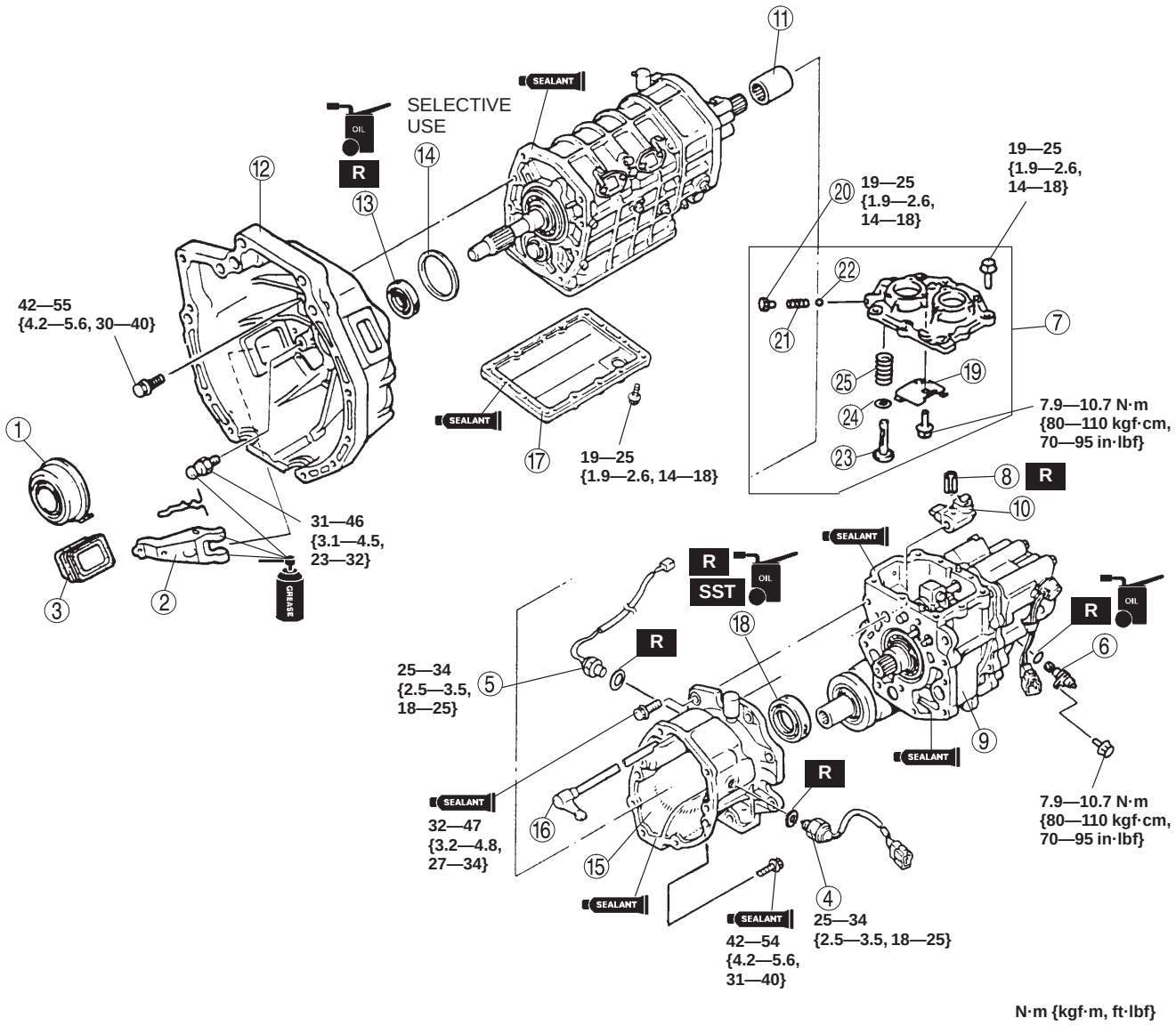
1	Clutch release collar
2	Clutch release fork
3	Boot
4	Front cover (F2 engine)
5	Oil seal (F2 engine) + Assembly Note
6	Back-up light switch
7	Neutral switch (F2 CIS and G6 engine)
8	Vehicle speedometer sensor
9	Control case
10	Extension housing component
11	Snap ring
12	Speedometer drive gear
13	Steel ball

14	Snap ring
15	Clutch housing
16	Oil seal (except F2 engine)
17	Adjustment shim + Assembly Note
18	Under cover
19	Roll pin
20	Control lever end
21	Control rod
22	Stopper pin
23	Oil pass
24	Oil seal (rear) + Assembly Note
25	Extension housing

CONTINUED

MANUAL TRANSMISSION

4×4 (R15MX–D)



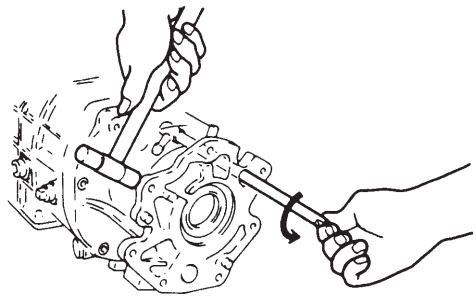
1	Clutch release collar
2	Clutch release fork
3	Boot
4	Back-up light switch
5	Neutral switch (G6 engine)
6	Vehicle speedometer sensor
7	Control cover component
8	Roll pin
9	Transfer case
10	Control lever end
11	Input sleeve
12	Clutch housing
13	Oil seal (front)
14	Adjustment shim + Assembly Note

15	Extension housing + Disassembly Note
16	Control rod
17	Under cover
18	Oil seal + Assembly Note
19	Oil pass
20	Plug
21	Spring
22	Steel ball
23	Select lock spindle
24	Washer
25	Spring

CONTINUED

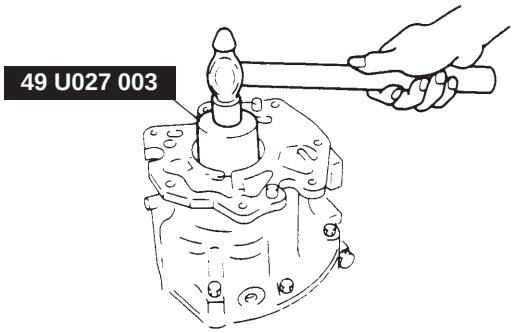
Extension Housing Disassembly Note

- Turn the control rod in the direction of the arrow, and remove the extension housing.



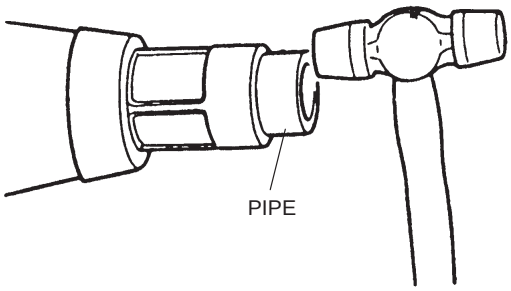
Oil Seal Assembly Note

- Apply oil to a new oil seal lip and install it in the extension housing using the **SST**.



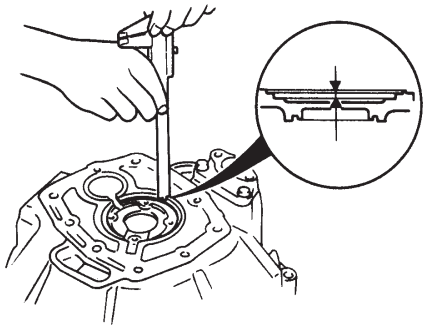
Oil Seal (Rear) Assembly Note

1. Apply the transmission oil to a new oil seal.
2. Install the oil seal until it touches the case by using a suitable piece of pipe.

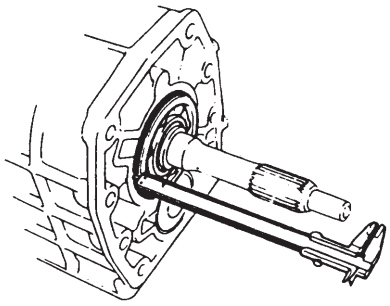


Adjustment Shim Assembly Note

1. Measure the depth of the main drive gear bearing bore in the clutch housing with vernier calipers.



2. Measure the main drive gear bearing height.

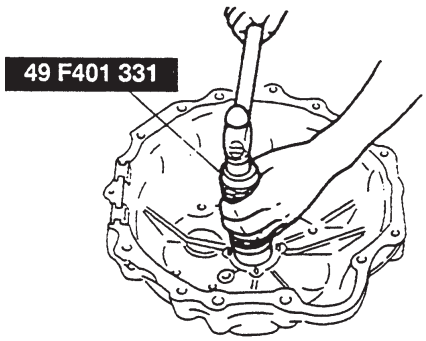


3. The difference between the two measurements indicates the required thickness of the adjustment shim.

Standard thrust play
0—0.1 mm {0—0.004 in}
Adjustment shim thickness
0.3 mm {0.012 in}, 0.4 mm {0.016 in}
0.5 mm {0.020 in}, 0.6 mm {0.024 in}
0.7 mm {0.028 in}

Oil Seal (F2 Engine) Assembly Note

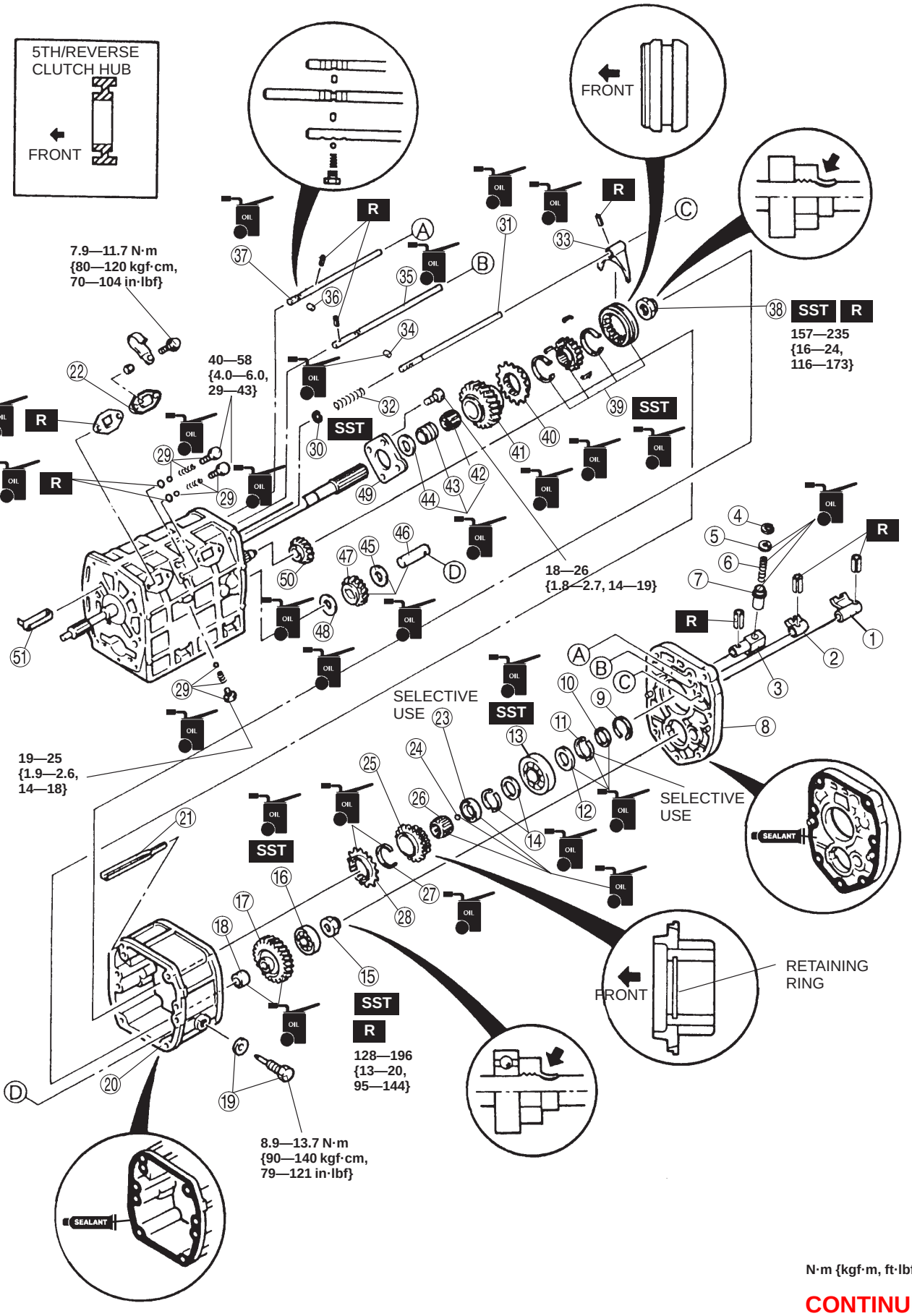
- Apply the transmission oil to a new oil seal lip, and install it to the clutch housing by using the **SST**.



CONTINUED

5TH/REVERSE GEAR AND HOUSING PARTS DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



N·m {kgf·m, ft·lbf}

CONTINUED

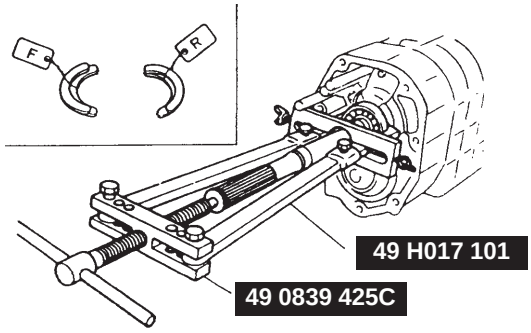
MANUAL TRANSMISSION

1	5th/reverse shift rod end
2	3rd/4th shift rod end
3	1st/2nd shift rod end
4	Retaining ring
5	Spring retainer
6	Spring
7	Pin and retaining ring
8	Bearing housing
9	Snap ring
10	Thrust washer
11	C-washer + Assembly Note
12	Retaining ring
13	Mainshaft rear bearing + Disassembly Note + Assembly Note
14	C-washer and retaining ring
15	Locknut (counter shaft) + Disassembly Note + Assembly Note
16	Counter shaft rear bearing + Disassembly Note + Assembly Note
17	Counter 5th gear
18	Spacer
19	Set bolt and washer
20	Center housing
21	Oil pass
22	Blind cover
23	Thrust lock washer + Assembly Note
24	Steel ball
25	5th gear
26	Bearing
27	Retaining ring
28	5th synchronizer ring + Disassembly Note
29	Cap plug, spring, and detent ball
30	Retaining ring + Disassembly Note + Assembly Note
31	5th/reverse shift rod
32	Spring
33	5th/reverse shift fork
34	Interlock pin + Assembly Note
35	3rd/4th shift rod + Disassembly Note + Assembly Note
36	Interlock pin + Assembly Note
37	1st/2nd shift rod + Disassembly Note + Assembly Note
38	Locknut (Mainshaft) + Disassembly Note + Assembly Note
39	5th/reverse clutch hub component + Disassembly Note
40	Reverse synchronizer ring + Disassembly Note
41	Reverse gear
42	Bearing
43	Inner race
44	Thrust washer
45	Thrust washer
46	Reverse idler gear shaft
47	Reverse idler gear
48	Thrust washer
49	Bearing cover
50	Counter reverse gear
51	Oil pass

Mainshaft Rear Bearing Disassembly Note

Note
- The front and rear C-washers may have different thicknesses.

1. Remove the snap ring, washer, retaining ring, and C-washers.
2. For proper reassembly, identify the front and rear C-washers.
3. Remove the mainshaft rear bearing by using the **SSTs**.



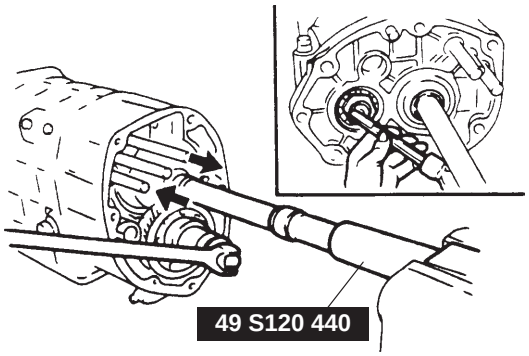
Locknut (Counter Shaft) Disassembly Note

1. Uncrimp the tab of the locknut.
2. Shift the clutch hub sleeves to 1st gear and reverse gear to put the gears in a double-engaged condition.

Note
- Use the protective plates to prevent damage to the **SST**.

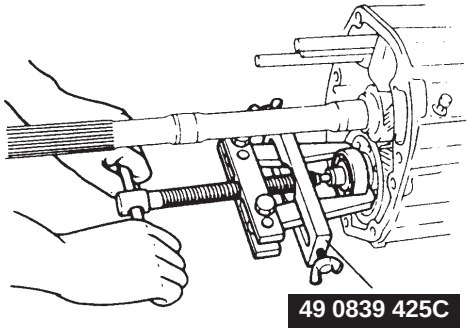
3. Hold the mainshaft by using the **SST** and a vise.
4. Remove the locknut.

CONTINUED



Counter Shaft Rear Bearing Disassembly Note

- Remove the counter shaft rear bearing by using the **SST**.

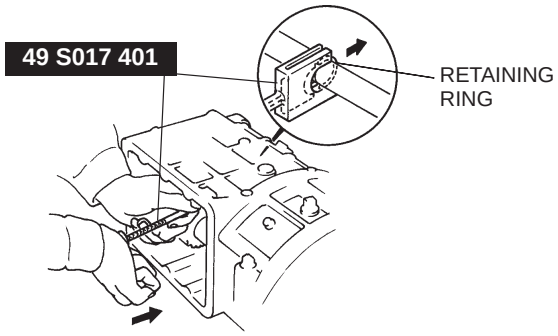


5th/reverse Synchronizer Ring Disassembly Note

- Tag and identify each synchronizer ring.

Retaining Ring Disassembly Note

1. Remove the roll pin from the 5th/reverse shift fork.
2. Remove the retaining ring by using the **SST**.

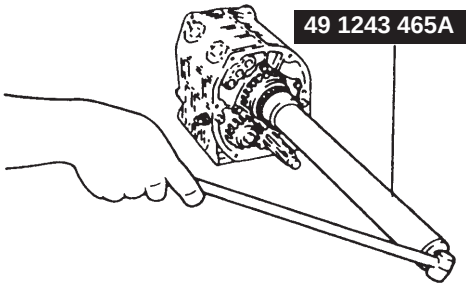


3rd/4th Shift Rod, 1st/2nd Shift Rod Disassembly Note

1. Shift the transmission into 4th gear. This will provide adequate space to drive out the spring pin. Drive the spring pin from the 3rd/4th shift fork.
2. Slide the 3rd/4th shift rod out from the rear of the transmission case.
3. Drive the spring pin from the 1st/2nd shift fork. Slide the 1st/2nd shift rod out from the rear of the transmission case.
4. Remove the interlock pins.

Locknut (Mainshaft) Disassembly Note

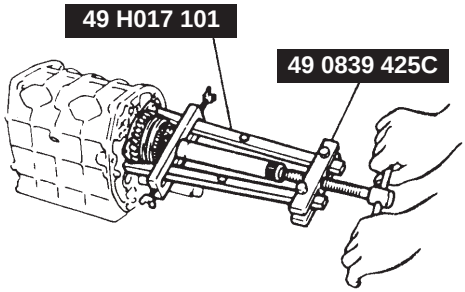
1. Uncrimp the tab of the locknut.
2. Shift into 1st gear and 4th gear to lock the rotation of the mainshaft.
3. Remove the locknut by using the **SST**.



5th/reverse Clutch Hub Component Disassembly Note

- Attach the **SSTs** to the bearing cover and remove the component which consists of the following parts:

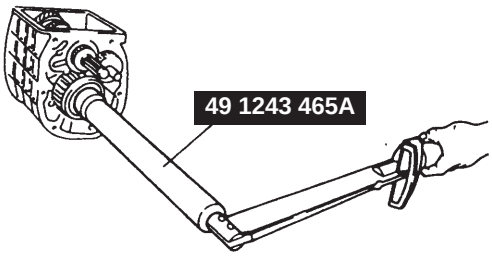
(1) 5th/reverse clutch hub component
(2) Reverse synchronizer ring
(3) Reverse gear



Locknut (Mainshaft) Assembly Note

1. Shift into 1st gear and 4th gear to lock the rotation of the mainshaft.
2. Install a new locknut and tighten it by using the **SST**.

Tightening torque
157—235 N·m {16—24 kgf·m, 116—173 ft·lbf}



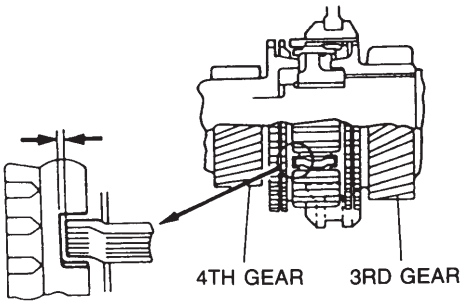
Note

- The total combined thickness of the front and rear thrust washers must equal 6.0 mm {0.236 in}.

3. Inspect the clearance between the synchronizer key and the exposed edge of the synchronizer ring. If it is not as specified, adjust with the thrust washers on the front and rear of the mainshaft bearing.

CONTINUED

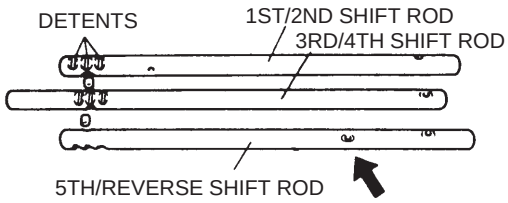
Clearance
2.0 mm {0.079 in} max.
Available thrust washer thickness
2.5 mm {0.098 in}, 3.0 mm {0.118 in}
3.5 mm {0.138 in}



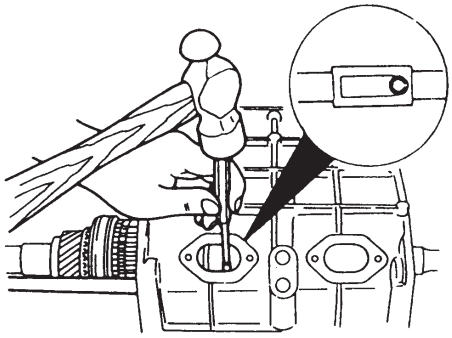
4. Stake the locknut into the mainshaft groove.

1st/2nd Shift Rod, 3rd/4th Shift Rod, Interlock Pin Assembly Note

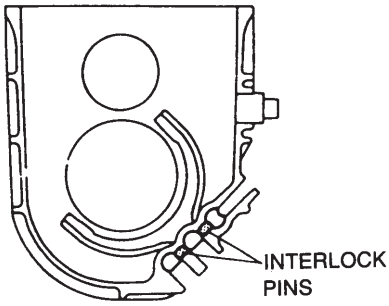
1. Refer to the figure to identify each shift rod when installing the shift rods in the following procedure. Install them so that the detent grooves are facing the detent balls.



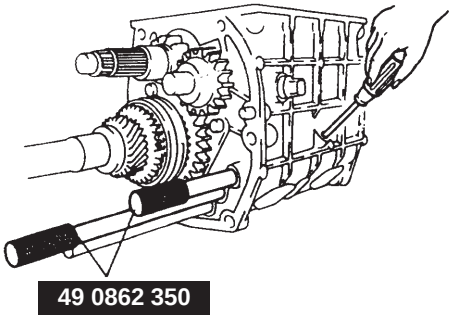
2. Slide the 1st/2nd shift rod into the case.
3. Secure the 1st/2nd shift fork to the rod with a new roll pin. The split in the roll pin must be facing in the direction shown in the figure.



4. Install the interlock pins as shown in the figure when doing steps 4 through 8.

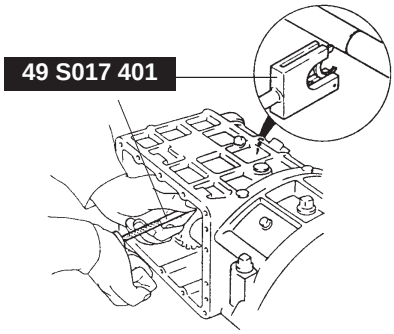


5. Slide the two **SSTs** into the transmission case to guide the interlock pins, and insert the first pin.
6. Remove the 3rd/4th shift fork guide from the case.
7. Slide the 3rd/4th shift rod containing the interlock pin (small) into the case.
8. Secure the 3rd/4th shift rod onto the fork with the new roll pin.
9. Insert the remaining interlock pin and remove the **SSTs**.



Retaining Ring Assembly Note

- Push back the spring, and install a new clip to the 5th/Reverse shift rod by using the **SST**.



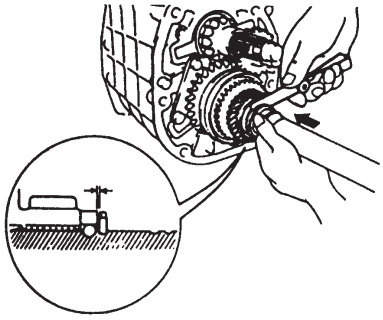
Thrust Lock Washer Assembly Note

1. Install the steel ball and thrust lock washer.
2. Install the **3.0 mm {0.118 in}** C-washers and hold them with a retaining ring.
3. Push the C-washers toward 5th gear and measure the clearance between the C-washers and thrust lock washer. If the clearance is not as specified, select the proper thrust lock washer.

Standard
0.1—0.2 mm {0.004—0.008 in}

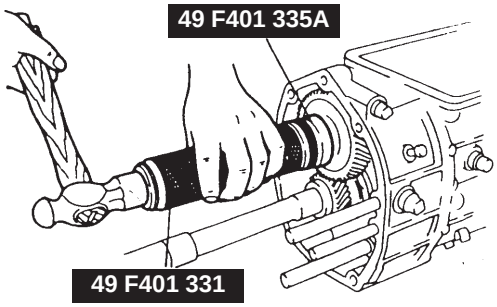
Available thrust lock washer thickness
6.2 mm {0.244 in}, 6.3 mm {0.248in},
6.4 mm {0.252 in}, 6.5 mm {0.256in},
6.6 mm {0.260 in}, 6.7 mm {0.264in}

CONTINUED



Counter Shaft Rear Bearing Assembly Note

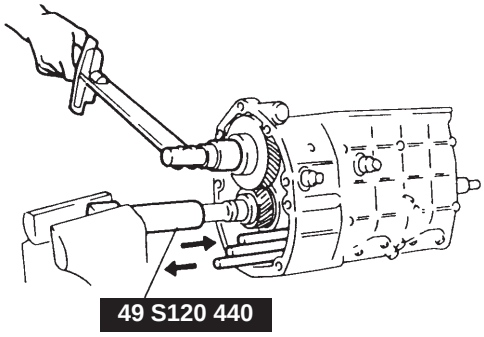
- Drive on the counter shaft rear bearing by using the **SST**.



Locknut (Counter Shaft) Assembly Note

1. Connect the **SST** to the mainshaft and mount it securely in a vise.
2. Shift into 1st gear to lock the counter shaft. Install the new counter shaft lock nut.

Tightening torque
128—196 N·m {13—20 kgf·m, 95—144 ft·lbf}

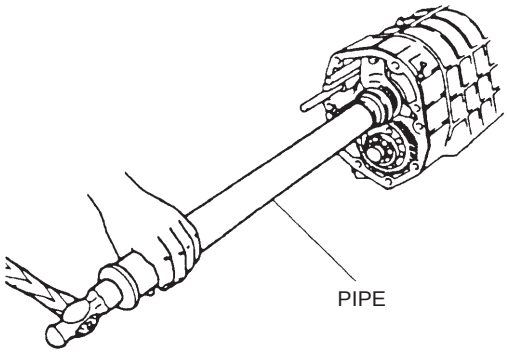


3. Stake the locknut into the counter shaft groove.

Main shaft Rear Bearing Assembly Note

- Drive on the mainshaft rear bearing by using a suitable pipe.

Bearing inner diameter
22 mm {0.87 in}
Bearing outer diameter
56 mm {2.2 in}

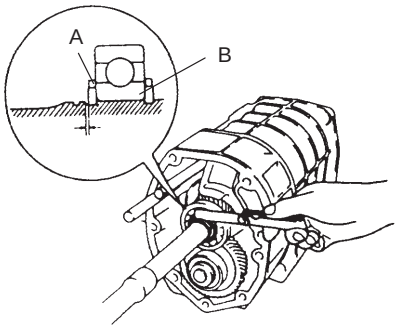


C-washer Assembly Note

1. Install the C-washers and hold them in place with a new retaining ring.
2. With points A and B pressed tightly together, measure the clearance between the C-washers and the groove. If the clearance is not as specified, select the proper C-washers.

Standard
0—0.1 mm {0—0.004 in}

Available C-washer thickness
2.9 mm {0.114 in}, 3.0 mm {0.118 in}, 3.1 mm {0.122 in}, 3.2 mm {0.126 in}

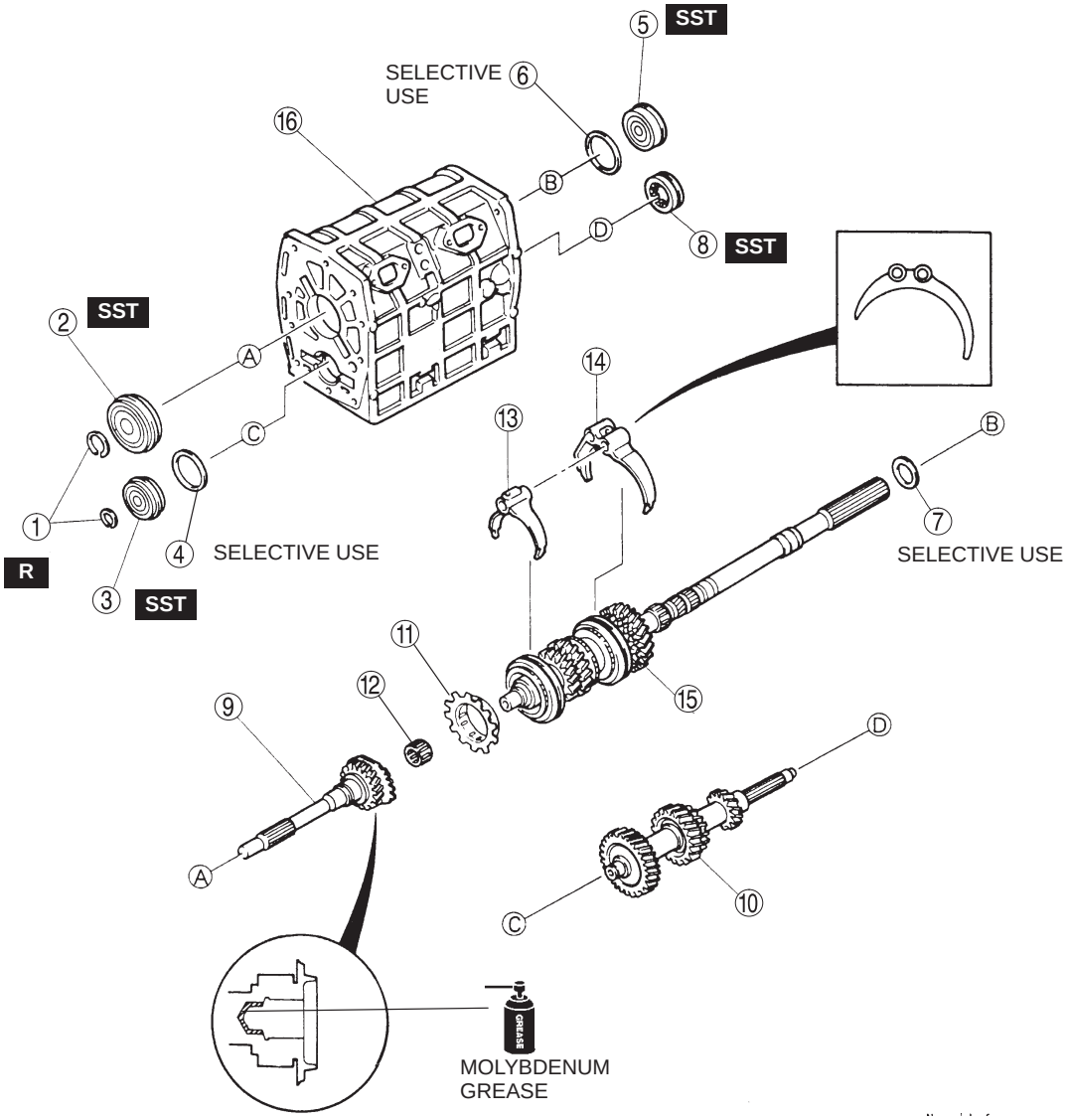


CONTINUED

MANUAL TRANSMISSION

TRANSMISSION CASE COMPONENTS DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



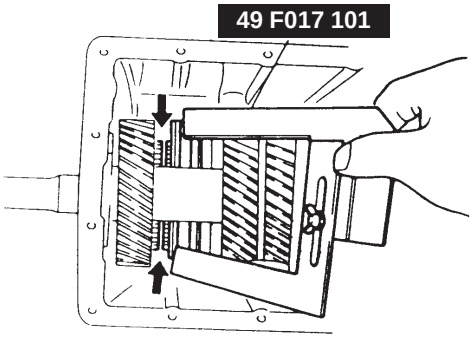
1	Snap ring
2	Main drive gear bearing + Disassembly Note + Assembly Note
3	Counter shaft front bearing + Disassembly Note + Assembly Note
4	Adjustment shim (counter shaft front bearing) + Assembly Note
5	Mainshaft center bearing + Disassembly Note + Assembly Note
6	Adjustment shim (mainshaft center bearing) + Assembly Note

7	Thrust washer + 5TH/REVERSE GEAR AND HOUSING PARTS DISASSEMBLY/ASSEMBLY, Locknut (Mainshaft) Assembly Note
8	Counter shaft center bearing + Disassembly Note + Assembly Note
9	Main drive gear
10	Counter shaft component
11	4th synchronizer ring
12	Bearing
13	3rd/4th shift fork
14	1st/2nd shift fork
15	Mainshaft gear component
16	Transmission case

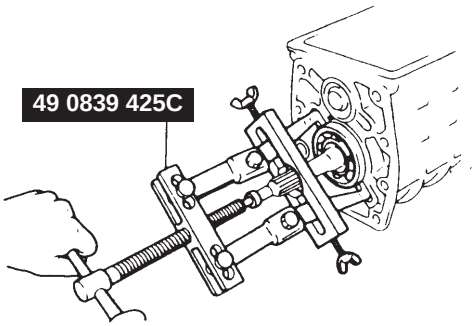
CONTINUED

Main Drive Gear Bearing Disassembly Note

1. Install the **SST** between the 4th gear synchronizer ring and main drive synchromesh gear.

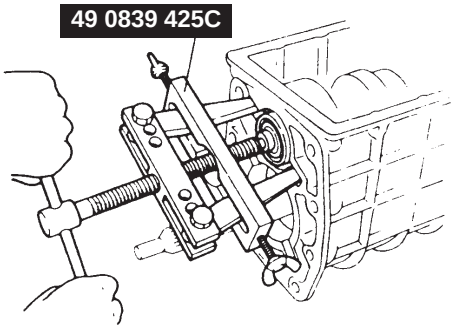


2. Turn the bearing snap rings so that the ends are 90° to the transmission case grooves.
3. Install the **SST** making sure to hand-tighten the side screws as tightly as possible, and remove the main drive gear bearing.



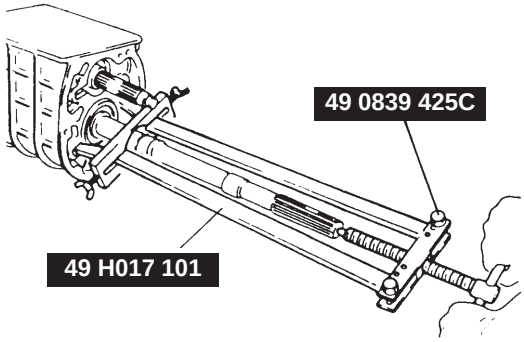
Counter Shaft Front Bearing Disassembly Note

1. Turn the bearing snap rings so that the ends are 90° to the transmission case grooves.
2. Remove the counter shaft front bearing by using the **SST**.



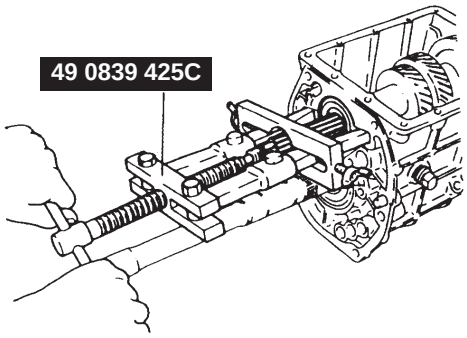
Mainshaft Center Bearing Disassembly Note

- Remove the mainshaft center bearing by using the **SST**.



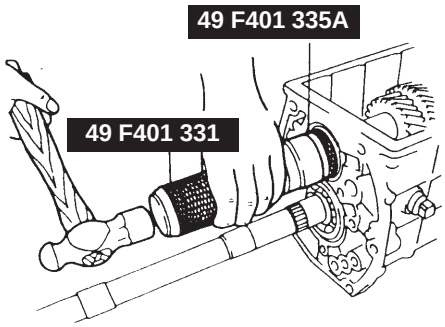
Counter Shaft Center Bearing Disassembly Note

- Remove the counter shaft center bearing by using the **SST**.



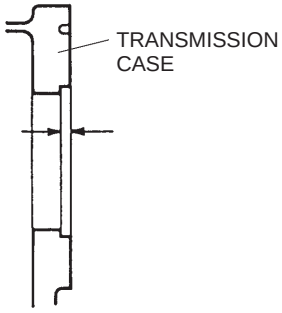
Counter Shaft Center Bearing Assembly Note

- Install the counter shaft center bearing onto the rear of the counter shaft by using the **SST**.



Adjustment Shim (Mainshaft Center Bearing) Assembly Note

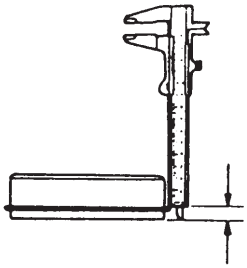
- Measure the mainshaft center bearing thrust play as follows.
  (1) Measure the depth of the mainshaft center bearing bore in the rear of the transmission case.



CONTINUED

(2) Measure the mainshaft center bearing height. The difference between the two measurements indicates the required thickness of the adjustment shim.

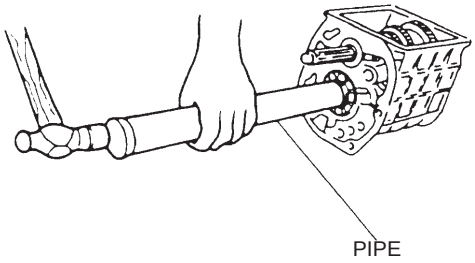
Standard thrust play
R15M–D: 0—0.1 mm {0—0.004 in}
R15MX–D: 0—0.05 mm {0—0.002 in}
Adjustment shim thickness
0.1 mm {0.004 in}, 0.3 mm {0.012 in}



Mainshaft Center Bearing Assembly Note

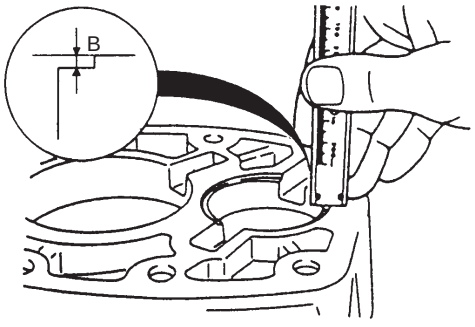
1. Install the correct shim onto the mainshaft center bearing. Refer to Adjustment Shim (Mainshaft Center Bearing) Assembly Note.
2. Install the mainshaft center bearing by using a suitable pipe.

Bearing inner diameter
35 mm {1.4 in}
Bearing outer diameter
80 mm {3.1 in}



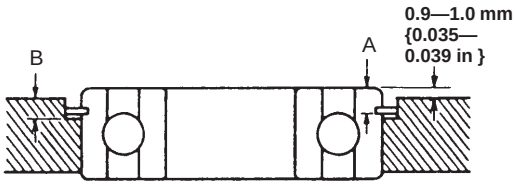
Adjustment Shim (Counter Shaft Front Bearing) Assembly Note

- Measure the counter shaft front bearing thrust play as follows.
  (1) Measure depth B of the counter shaft front bearing bore in the transmission case.



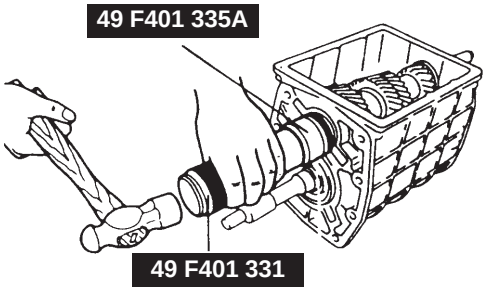
(2) Measure the counter shaft front bearing snap ring height A.
(3) Choose an adjustment shim that will allow the difference between the two measurements to be equal to the standard bearing height.

A–B + Adjustment shim (s) =
0.9—1.0 mm {0.036—0.039}
Standard bearing height on installing
0.9—1.0 mm {0.035—0.039}
Adjustment shim thickness
0.1 mm {0.004 in}, 0.3 mm {0.012 in}



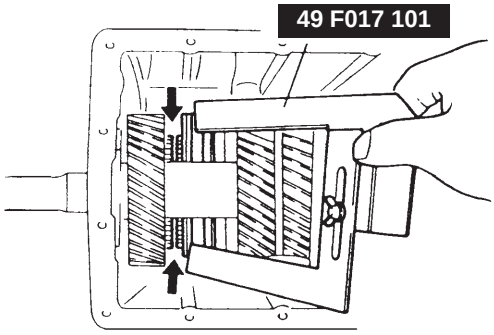
Counter Shaft Front Bearing Assembly Note

1. Install the correct shim onto the counter shaft front bearing. Refer to Adjustment Shim (Counter Shaft Front Bearing) Assembly Note.
2. Install the counter shaft front bearing by using the **SST**. If the counter shaft front bearing or counter shaft front bearing spacer is being replaced, replace them as a component.



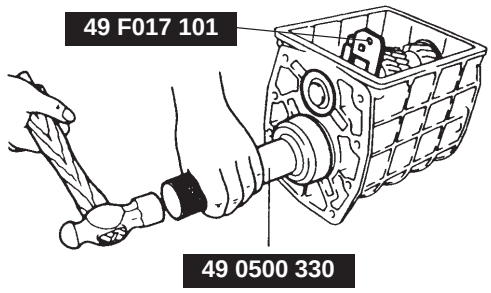
Main Drive Gear Bearing Assembly Note

1. Install the **SST** between the 4th synchronizer ring and the main drive synchromesh gear.



CONTINUED

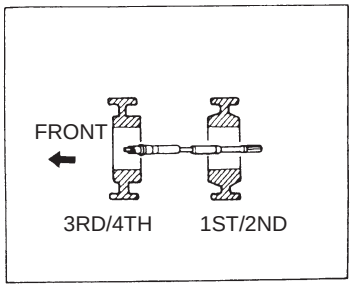
2. Install the main drive gear bearing by using the **SSTs**.



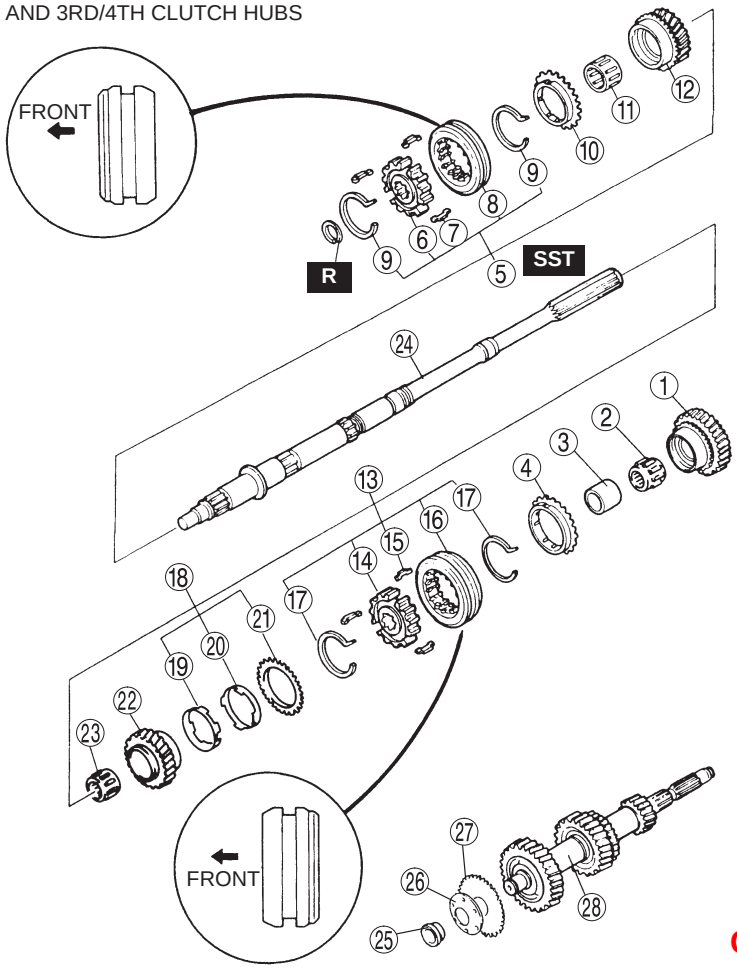
MAINSHAFT AND COUNTER SHAFT COMPONENTS DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.

OIL APPLY SPECIFIED OIL TO INDIVIDUAL PARTS



1ST/2ND AND 3RD/4TH CLUTCH HUBS

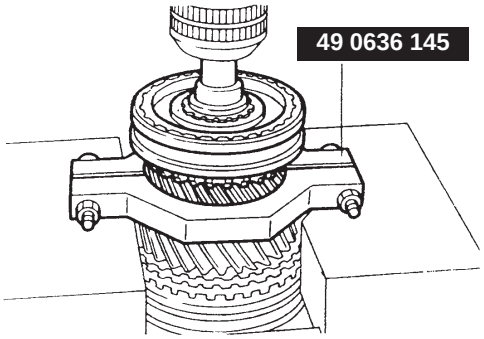


CONTINUED

1	1st gear
2	Bearing
3	Bearing race
4	1st synchronizer ring
5	3rd/4th clutch hub component + Disassembly Note + Assembly Note
6	3rd/4th clutch hub
7	Synchronizer key
8	Clutch hub sleeve
9	Synchronizer key spring
10	3rd synchronizer ring
11	Bearing
12	3rd gear
13	1st/2nd clutch hub component + Disassembly Note + Assembly Note
14	1st/2nd clutch hub
15	Synchronizer key
16	Clutch hub sleeve
17	Synchronizer key spring
18	2nd synchronizer component + Assembly Note
19	Inner cone
20	Double cone
21	Synchronizer ring
22	2nd gear
23	Bearing
24	Mainshaft
25	Counter shaft front bearing spacer + Assembly Note
26	Diaphragm spring
27	Friction gear
28	Counter shaft

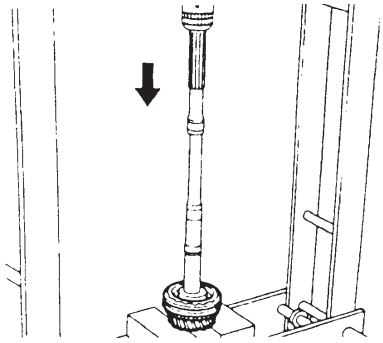
3rd/4th Clutch Hub Component Disassembly Note

1. Remove the snap ring from the front of the mainshaft.
2. Position the **SST** between 2nd and 3rd gears, and hold the mainshaft from underneath.
3. Press the mainshaft out from the 3rd gear, 3rd synchronizer ring, and the 3rd/4th clutch hub component.



1st/2nd Clutch Hub Component Disassembly Note

- Hold the mainshaft, and press the 1st/2nd clutch hub component, 2nd synchronizer ring component, and 2nd gear from the mainshaft.

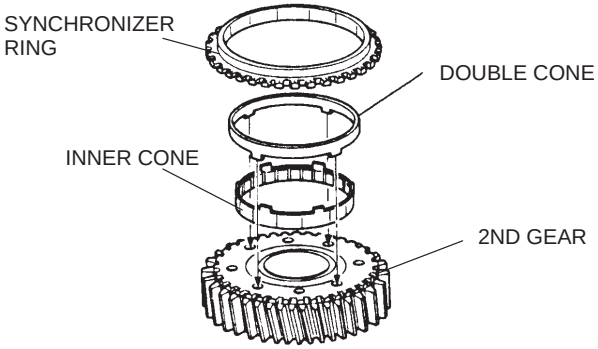


Counter Shaft Front Bearing Spacer Assembly Note

- Install the counter shaft front bearing spacer. If the counter shaft front bearing or counter shaft front bearing spacer is being replaced, replace them as a component.

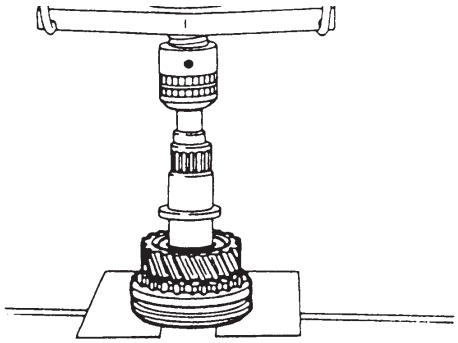
2nd Synchronizer Component Assembly Note

- Install the inner cone, double cone, and synchronizer ring as shown in the figure.



1st/2nd Clutch Hub Component Assembly Note

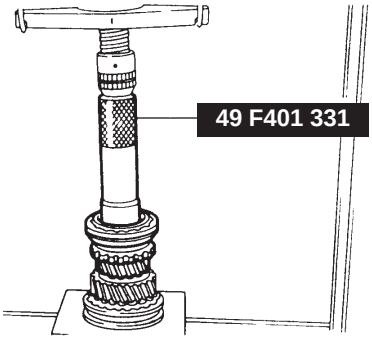
- Set the needle bearing, 2nd gear, 2nd synchronizer component, and the 1st/2nd clutch hub component on the mainshaft. Press the parts onto the mainshaft while keeping the parts from becoming crooked or misaligned.



CONTINUED

3rd/4th Clutch Hub Component Assembly Note

- Set the needle bearing, 3rd gear, 3rd synchronizer ring, and the 3rd/4th clutch hub component on the mainshaft. Press the parts onto the mainshaft by using the **SST**, while keeping the parts from becoming crooked or misaligned.

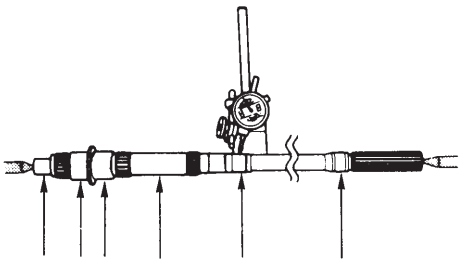


MANUAL TRANSMISSION INSPECTION

Mainshaft Inspection

1. Measure the mainshaft runout.

Runout
0.03 mm {0.0012 in} max.

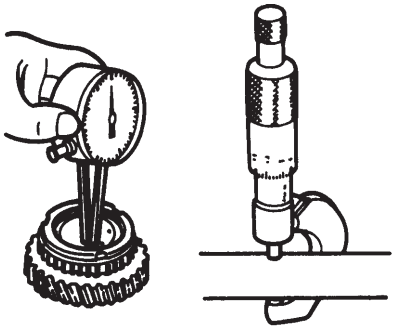


2. If not as specified, replace the mainshaft.

Gear (Bushing) Inspection

1. Measure the clearance between mainshaft and gear (or bushing).

Clearance
0.15 mm {0.006 in} max.

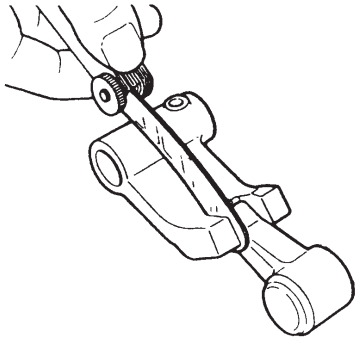


2. If not as specified, replace the gear.

Control Rod Lever and Shift Rod Inspection

1. Measure the clearance between the control rod lever and the shift rod gate.

Clearance
0.8 mm {0.031 in} max.

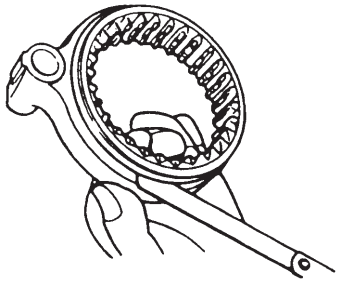


2. If not as specified, replace the control rod lever and shift rod.

Shift Fork and Clutch Hub Sleeve Inspection

1. Measure the clearance between the hub sleeve groove and shift fork.

Clearance
0.2—0.3 mm {0.008—0.012 in}
Maximum
0.5 mm {0.020 in}



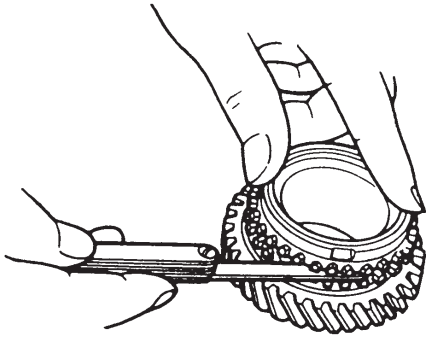
2. If not as specified, replace the shift fork and clutch hub sleeve.

Synchronizer Ring Inspection

1. Inspect the following, and replace the synchronizer ring as necessary.
   (1) Individual synchronizer ring teeth for wear and cracks.
   (2) The tapered surface for wear and cracks.
2. Set the synchronizer ring squarely in the gear.
3. Measure the clearance between the synchronizer ring and flank surface of gear all around the circumference.

Standard clearance
1.5 mm {0.059 in}
Minimum
0.8 mm {0.031 in}

CONTINUED

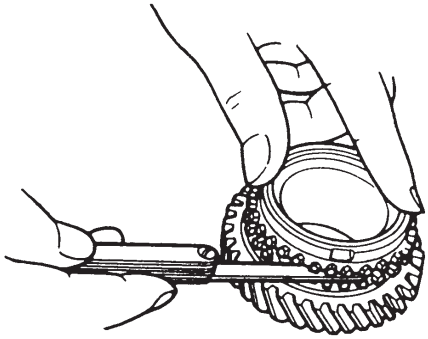


4. If not as specified, replace the synchronizer ring.

2nd Synchronizer Component Inspection

1. Inspect individual synchronizer ring gear teeth for damage, wear, and cracks. Replace the synchronizer component if any such damage is found.
2. Inspect for wear and damage to the tapered surfaces of the inner cone, double cone and synchronizer ring. Replace the synchronizer component if any such damage is found.
3. Set the synchronizer component squarely in the gear.
4. Measure the clearance between the synchronizer ring and flank surface of the gear.

Clearance
1.5 mm {0.059 in}
Maximum
0.8 mm {0.013 in}



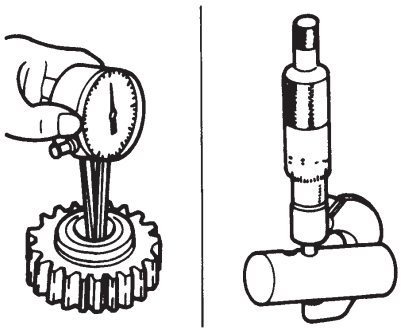
5. If not as specified, replace the 2nd synchronizer component.

Reverse Idler Gear and Shaft Inspection

1. Measure the clearance between the reverse idler gear bushing and shaft.

Clearance
0.02—0.05 mm {0.0008—0.0020 in}

Maximum
0.15 mm {0.006 in}



2. If not as specified, replace the reverse idler gear and shaft.

CONTINUED

TRANSFER

TRANSFER

PRECAUTION

1. Clean the transfer exterior thoroughly by using a steam cleaner or cleaning solvents before disassembly.

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.**

Caution
- **Cleaning sealed bearings by using cleaning fluids or a steam cleaner can wash the grease out of the bearing.**

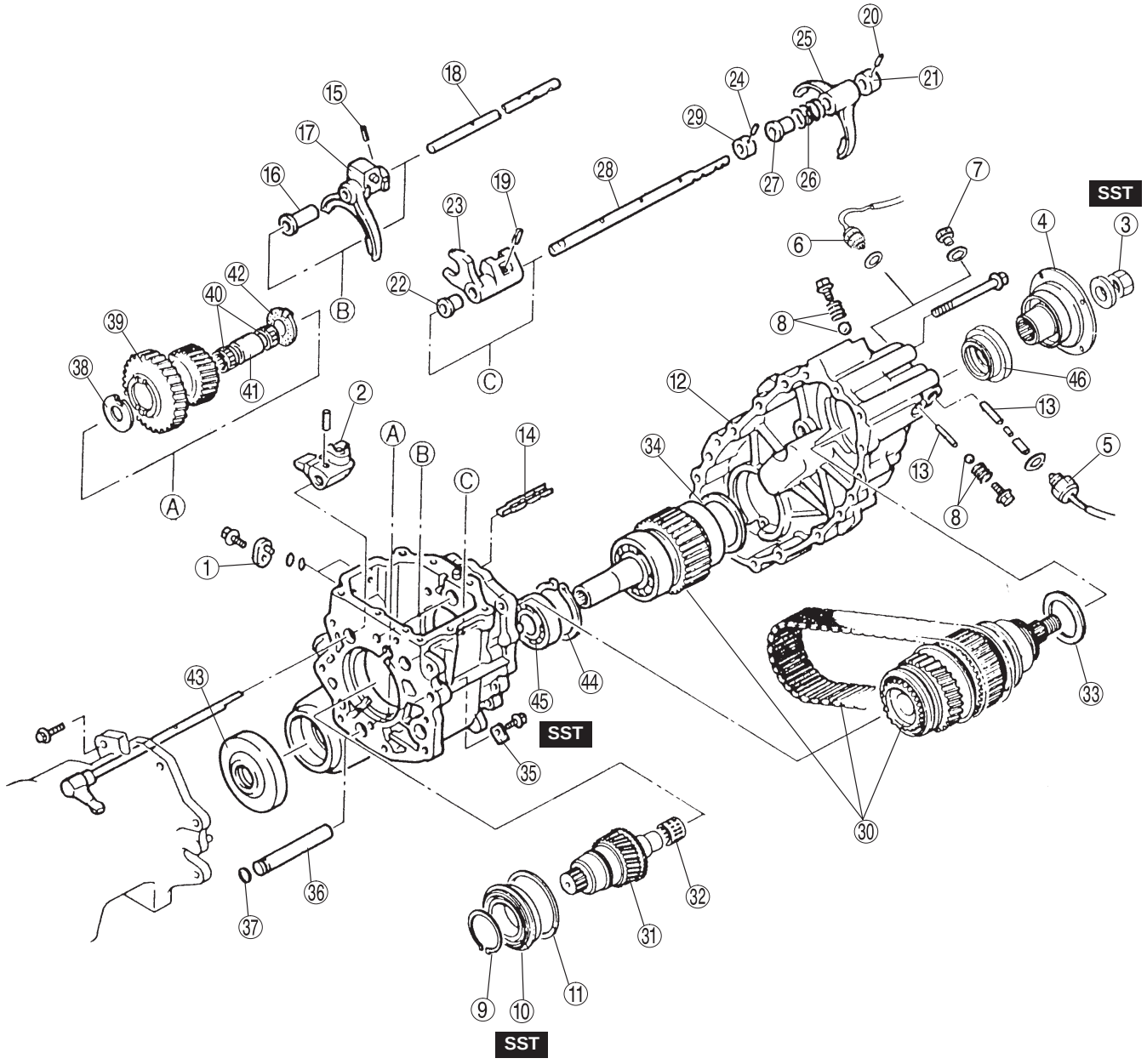
2. Clean the removed parts by using cleaning solvent, and dry them by using compressed air. Clean out all holes and passages by using compressed air, and check that there are no obstructions.
3. Use a plastic hammer when disassembling the transfer case and other light alloy metal parts.
4. Make sure each part is cleaned before assembling.
5. Coat all movable parts with the specified oil.
6. Replace parts whenever required.
7. Remove old sealant from contact surfaces before applying new sealant.
8. Assemble the parts within **10 minutes** after applying sealant. Allow all sealant to cure at least **30 minutes** after assembly before filling the transmission with transmission oil.

CONTINUED

TRANSFER

TRANSFER COMPONENT DISASSEMBLY

- Disassemble in the order indicated in the table.



1	Stopper pin
2	Control lever end
3	Locknut + Disassembly Note
4	Companion flange
5	4×4 indicator switch
6	Transfer neutral switch (RFW model)
7	Plug (except RFW model)
8	Detent ball and spring
9	Snap ring
10	Bearing (input shaft gear) + Disassembly Note
11	Adjustment shim
12	Chain cover
13	Interlock pin

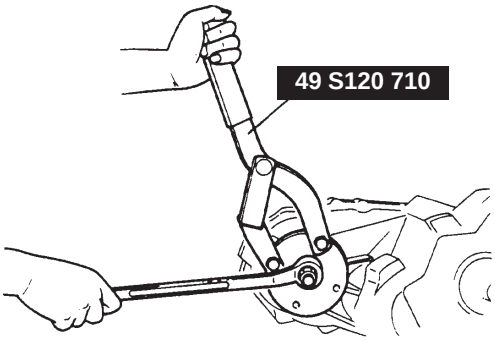
14	Oil passage
15	Roll pin
16	Spacer
17	H—L shift fork
18	H—L shift rod
19	Roll pin
20	Roll pin
21	Retainer
22	Spacer
23	2W—4W shift end
24	Roll pin
25	2W—4W shift fork
26	Spring
27	Spacer
28	2W—4W shift rod

CONTINUED

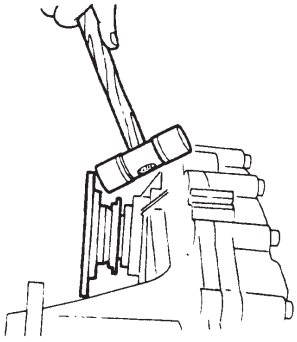
29	Retainer
30	Output shaft component, chain, and front drive sprocket component + Disassembly Note
31	Input shaft gear
32	Bearing
33	Adjustment shim
34	Adjustment shim
35	Lock plate
36	Counter shaft gear support + Disassembly Note
37	O-ring
38	Thrust washer
39	Counter gear
40	Bearing
41	Spacer
42	Thrust washer
43	Oil seal
44	Snap ring
45	Bearing (front drive sprocket) + Disassembly Note
46	Oil seal

Locknut Disassembly Note

1. Hold the companion flange by using the **SST** and remove the locknut.

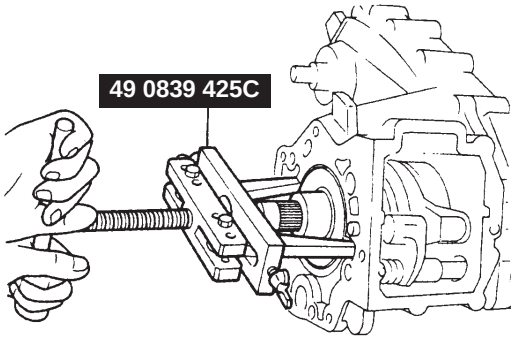


2. Remove the companion flange by lightly tapping the back side by using a plastic hammer.



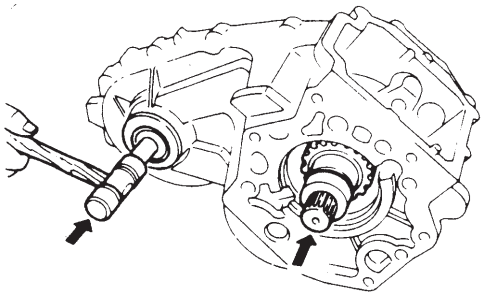
Bearing (Input Shaft Gear) Disassembly Note

- Remove the bearing by using the **SST**.



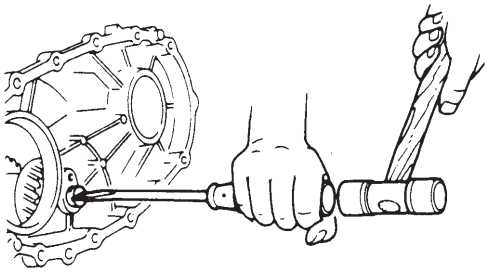
Output Shaft Component, Chain, and Front Drive Sprocket Component Disassembly Note

- Remove the output shaft and the front drive sprocket from the transfer case housing by lightly tapping the input shaft gear and the front drive sprocket by using a plastic hammer.



Counter Shaft Gear Support Disassembly Note

- Tap out the counter shaft gear support by using a tape-wrapped screwdriver and a plastic hummer.



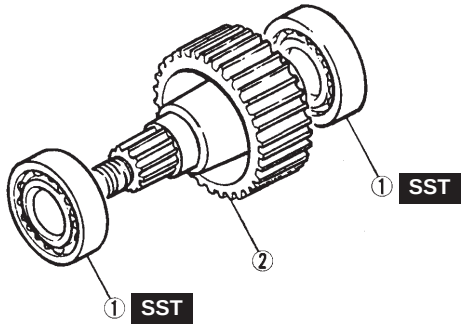
Bearing (Front Drive Sprocket) Disassembly Note

- Remove the bearing by using the **SST**.

CONTINUED

FRONT DRIVE SPROCKET COMPONENT DISASSEMBLY/ASSEMBLY

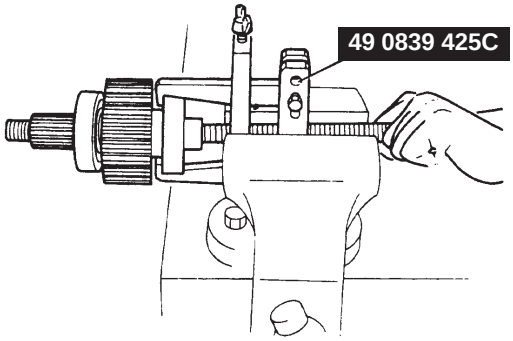
1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



1	Bearing + Disassembly Note + Assembly Note
2	Front drive sprocket

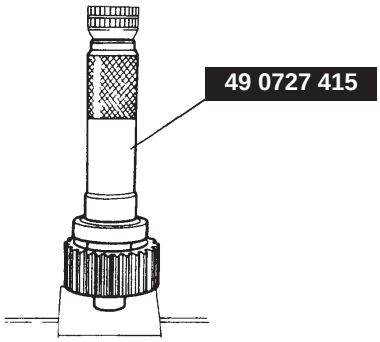
Bearing Disassembly Note

- Remove the bearings from both sides of the front drive sprocket by using the **SST**.



Bearing Assembly Note

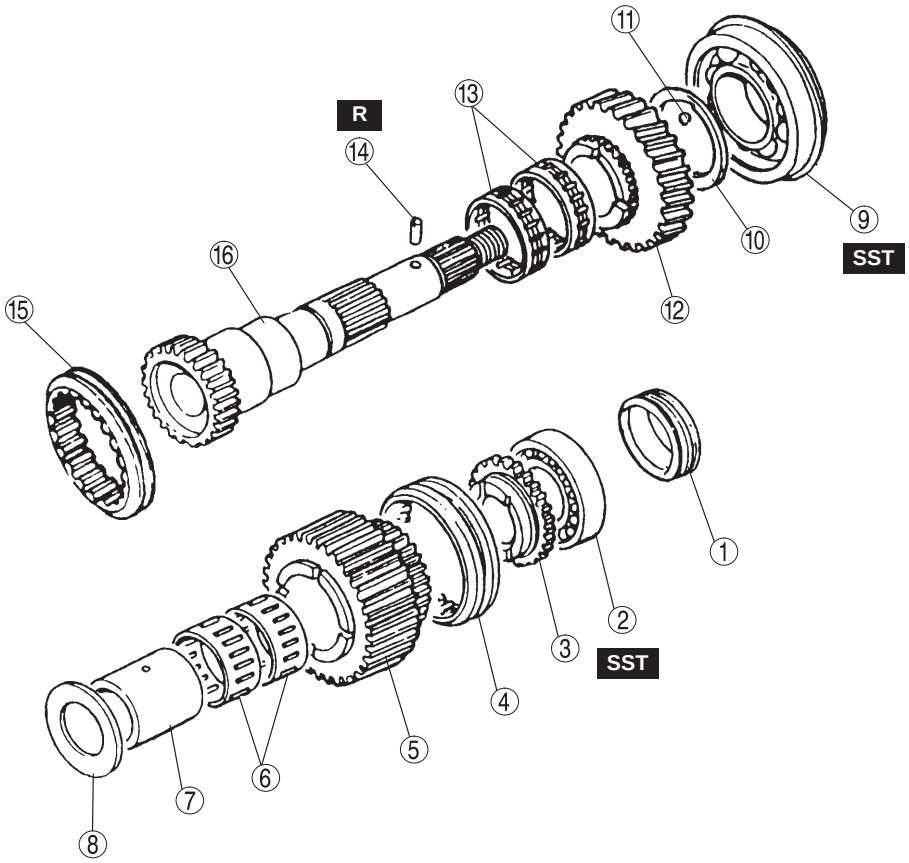
- Press the bearings on both sides of the front drive sprocket by using the **SST**. Press the bearings on until they stop.



CONTINUED

OUTPUT SHAFT COMPONENT DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



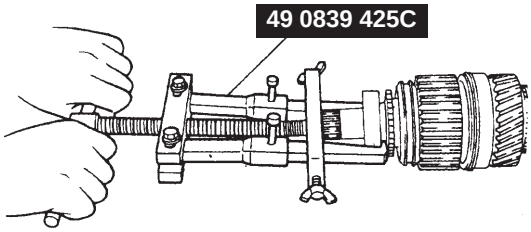
1	Speedometer drive gear
2	Bearing (2W—4W clutch hub side) + Disassembly Note + Assembly Note
3	2W—4W clutch hub
4	2W—4W hub sleeve
5	Drive sprocket
6	Needle bearing
7	Spacer
8	Thrust washer

9	Bearing (low gear side) + Disassembly Note + Assembly Note
10	Thrust lock washer
11	Steel ball
12	Low gear
13	Needle bearing
14	Roll pin
15	H—L hub sleeve
16	Output shaft

CONTINUED

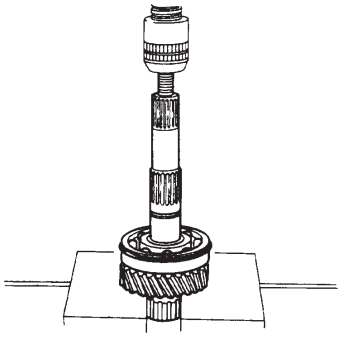
Bearing (2W—4W Clutch Hub Side) Disassembly Note

- Remove the bearing from output shaft by using the **SST**.



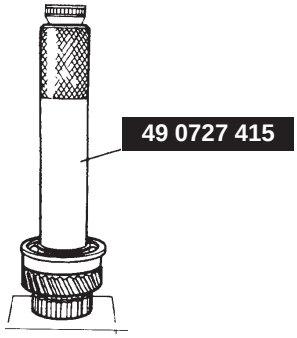
Bearing (Low Gear Side) Disassembly Note

- Remove the bearing, lock washer, steel ball and low gear by using the press.



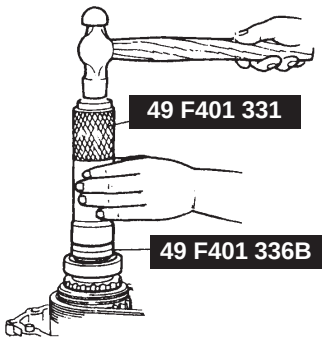
Bearing (Low Gear Side) Assembly Note

- Install the bearing by using the **SST**.



Bearing (2W—4W Clutch Hub Side) Assembly Note

- Install the bearing by using the **SST**.

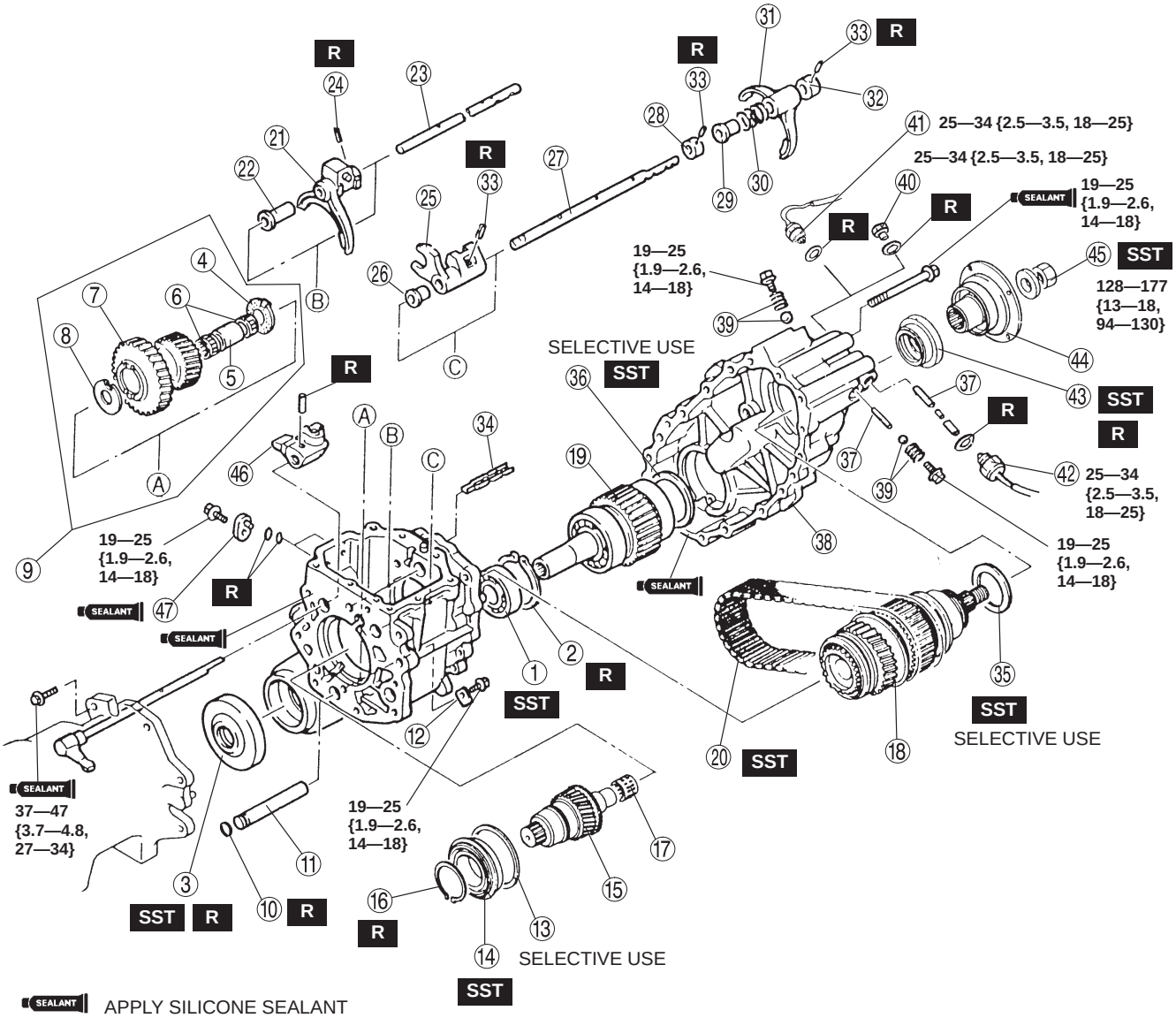


CONTINUED

TRANSFER

TRANSFER COMPONENT ASSEMBLY

- Assemble in the order indicated in the table.



1	Bearing (front drive sprocket) + Assembly Note
2	Snap ring
3	Oil seal + Assembly Note
4	Thrust washer
5	Spacer
6	Bearing
7	Counter gear
8	Thrust washer
9	Counter gear component
10	O-ring
11	Counter shaft gear support
12	Lock plate

13	Adjustment shim + Assembly Note
14	Bearing (input shaft gear) + Assembly Note
15	Input shaft
16	Snap ring
17	Bearing
18	Output shaft component
19	Front drive sprocket component
20	Chain + Assembly Note
21	H—L shift fork
22	Spacer
23	H—L shift rod
24	Roll pin

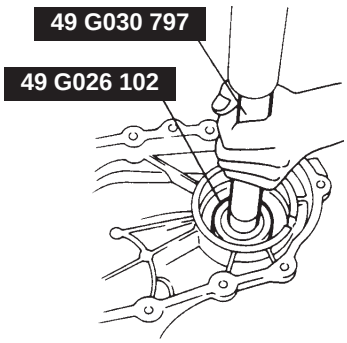
CONTINUED

TRANSFER

25	2W—4W shift end
26	Spacer
27	2W—4W shift rod
28	Retainer
29	Spacer
30	Spring
31	2W—4W shift fork
32	Retainer
33	Roll pin
34	Oil passage
35	Adjustment shim + Assembly Note
36	Adjustment shim + Assembly Note
37	Interlock pin
38	Chain cover
39	Detent ball and spring
40	Plug (except RFW model)
41	Transfer neutral switch (RFW model)
42	4×4 indicator switch
43	Oil seal + Assembly Note
44	Companion flange
45	Locknut + Assembly Note
46	Control lever end
47	Stopper pin

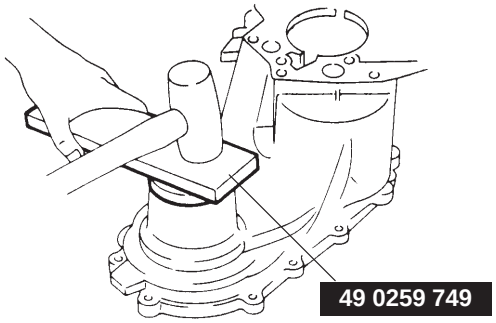
Bearing (Front Drive Sprocket) Assembly Note

- Install the bearing to the transfer case by using the **SSTs**.



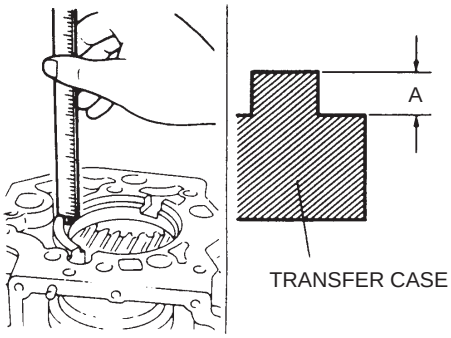
Oil Seal Assembly Note

- Apply oil to the lip of a new oil seal and install the oil seal in the transfer case by using the **SST**.

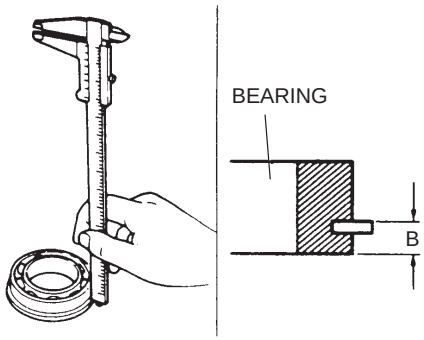


Adjustment Shim Assembly Note

1. Measure the bearing bore depth (A) of the transfer case by using vernier calipers.

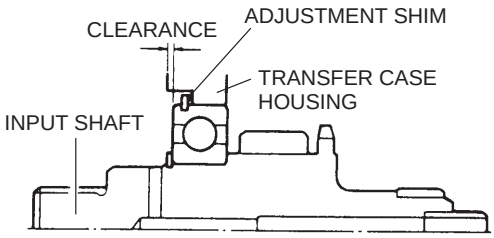


2. Measure height (B) of the bearing clip by using vernier calipers and a surface plate.



3. Calculate the difference between (A) and (B) to determine the clearance.

Clearance=(A)–(B)



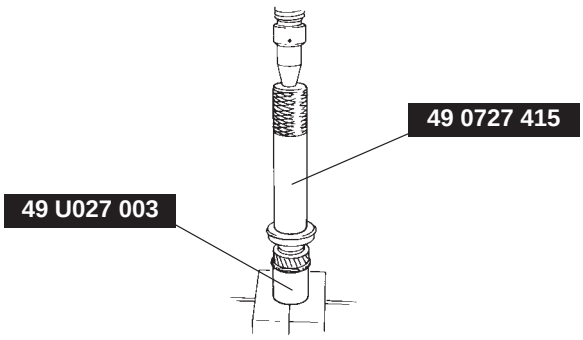
4. Select and install the proper shim to obtain the standard clearance.

Standard clearance
0—0.1 mm {0—0.0039 in}
Adjustment shim thickness
0.6 mm {0.024 in}, 0.7 mm {0.028 in},
0.8 mm {0.032 in}, 0.9 mm {0.035 in},
1.0 mm {0.039 in}, 1.1 mm {0.043 in},
1.2 mm {0.047 in}, 1.3 mm {0.051 in},
1.4 mm {0.055 in}

CONTINUED

Bearing (Input Shaft Gear) Assembly Note

- Press the bearing on the input shaft gear by using the **SSTs**.

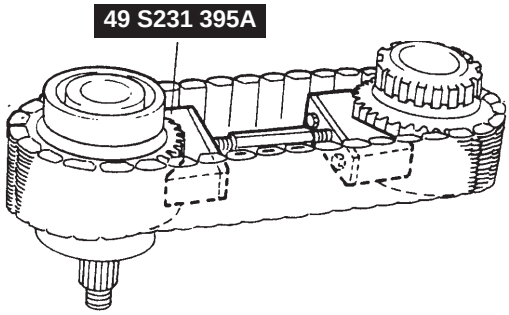


Chain Assembly Note

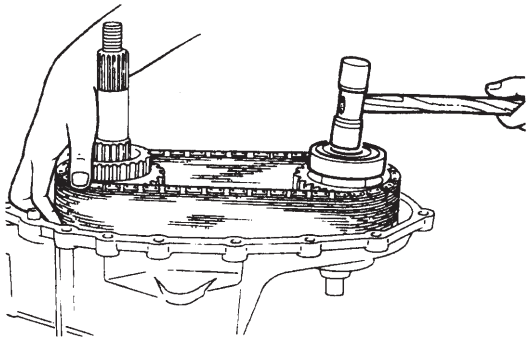
Note

- Do not overtighten the chain expansion tool.

1. Install the chain on the drive sprocket component and the front drive sprocket, and expand the chain by using the **SST** to set the center to center distance for easy installation into the transfer case.



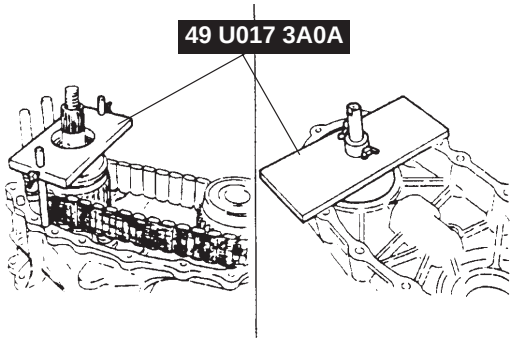
2. Install the front drive sprocket component into the transfer case by lightly tapping it with a plastic hammer, keeping the chain horizontal.

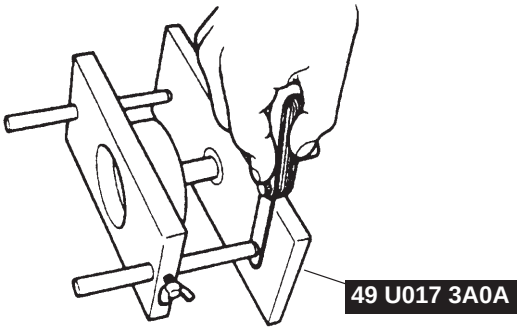


3. After installing, check that the chain rotates smoothly.

Adjustment Shim Assembly Note

1. Measure the bearing height and the bearing bore depth for the output shaft by using the **SST**.
2. Put the two pieces of the gauge set together and measure the clearance.





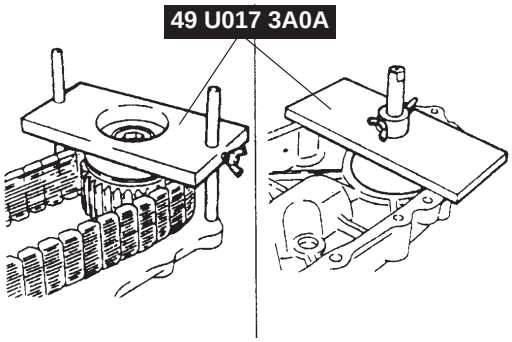
3. Select the proper adjustment shim to adjust the clearance.

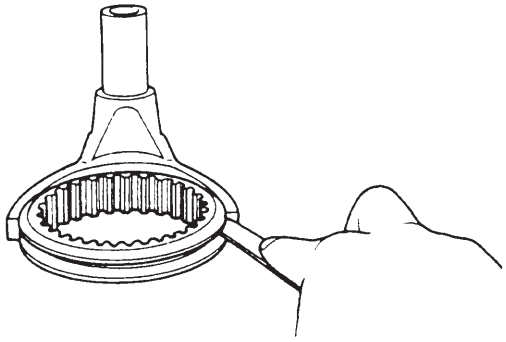
Standard clearance
0.1—0.3 mm {0.004—0.011 in}
Adjustment shim thickness
0.5 mm {0.020 in}, 0.6 mm {0.024 in}, 0.7 mm {0.028 in}, 0.8 mm {0.031 in}, 0.9 mm {0.035 in}, 1.0 mm {0.039 in}, 1.1 mm {0.043 in}, 1.2 mm {0.047 in}, 1.3 mm {0.051 in}, 1.4 mm {0.055 in}, 1.5 mm {0.059 in}, 1.6 mm {0.063 in}, 1.7 mm {0.067 in}

4. Select the proper adjustment shim for the front drive sprocket bearing in same way as for the output shaft side.

Standard clearance
0—0.1 mm {0—0.0039 in}
Adjustment shim thickness
0.5 mm {0.020 in}, 0.6 mm {0.024 in}, 0.7 mm {0.028 in}, 0.8 mm {0.031 in}, 0.9 mm {0.035 in}, 1.0 mm {0.039 in}, 1.1 mm {0.043 in}, 1.2 mm {0.047 in},

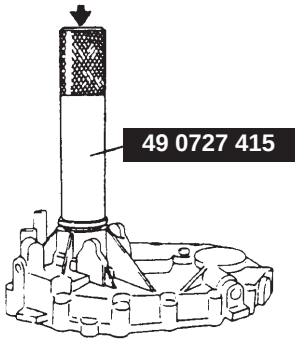
CONTINUED





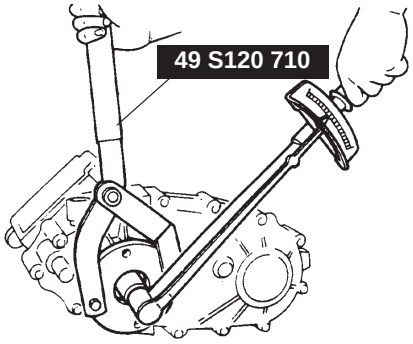
Oil Seal Assembly Note

- Apply oil to the lip of a new oil seal and install the oil seal in the chain cover case by using the **SST**.



Locknut Assembly Note

1. Apply silicone sealant to the companion flange spline.
2. Use a new locknut and tighten the flange. Hold the companion flange by using the **SST**.



TRANSFER INSPECTION

Hub Sleeve and Shift Fork Inspection

1. Measure the clearance between the hub sleeve and shift fork.

Clearance
0.38—0.52 mm {0.015—0.020 in}
Maximum
0.8 mm {0.031 in}

2. If not as specified, replace the shift fork and hub sleeve.

CONTINUED

TECHNICAL DATA

TECHNICAL DATA

ENGINE

F2

Item			Specification
Cylinder head			
Height	(mm {in})	Standard	91.95—92.05 {3.621—3.624}
		Maximum grinding	0.20 {0.008}
Cylinder head gasket contact surfaces distortion	(mm {in})	Maximum	0.15 {0.006}
Manifold contact surface distortion	(mm {in})	Maximum	0.15 {0.006}
		Maximum grinding	0.20 {0.008}
Valve and valve guide			
Margin thickness	(mm {in})	IN	CARB: 1.80—2.20 {0.071—0.086} CIS: 0.8—1.2 {0.032—0.047}
		EX	CARB: 1.30—1.70 {0.052—0.066} CIS: 1.30—1.70 {0.052—0.066}
Valve length	(mm {in})	IN	Standard	CARB: 115.61—116.01 {4.552—4.567} CIS: 111.69—112.09 {4.398—4.412}
			Minimum	CARB: 115.51 {4.548} CIS: 111.39 {4.386}
		EX	Standard	CARB: 116.01—116.41 {4.568—4.583} CIS: 111.49—111.89 {4.390—4.405}
			Minimum	CARB: 115.71 {4.556} CIS: 111.19 {4.378}
Valve stem diameter	(mm {in})	IN	Standard	CARB: 6.970—6.985 {0.2745—0.2749} CIS: 8.030—8.045 {0.3162—0.3167}
			Maximum	CARB: 6.920 {0.2724} CIS: 7.980 {0.3142}
		EX	Standard	CARB: 6.965—6.980 {0.2743—0.2748} CIS: 8.025—8.040 {0.3160—0.3165}
			Maximum	CARB: 6.915 {0.2722} CIS: 7.975 {0.3140}
Valve guide inner diameter	(mm {in})	Standard	CARB: 7.010—7.030 {0.2760—0.2767} CIS: 8.070—8.090 {0.3178—0.3185}
Valve guide protrusion height	(mm {in})		CARB: 19.8—20.3 {0.780—0.799} CIS: 19.1—19.6 {0.752—0.771}
Valve seat			
Valve seat contact width	(mm {in})		1.2—1.6 {0.048—0.062}
Valve seat angle		IN	45 °
		EX	45 °
Valve seat sinking (valve protrusion height)	(mm {in})	Standard	CARB: 49.7 {1.957} CIS: 46.5 {1.831}
		Maximum	CARB: 51.2 {2.016} CIS: 47.0 {1.850}

CONTINUED

TECHNICAL DATA

Item			Specification
Valve spring			
Pressing force at valve spring height H (N {kgf, lbf})	IN	H: 41.0 mm {1.614 in} (CARB)	203.10—229.86 {20.71—23.44, 45.57—51.56}
		H Inner: 36.5 mm {1.437 in} Outer: 41.0 mm {1.614 in} (CIS)	Inner: 116.41—131.80 {11.87—13.44, 26.12—30.51} Outer: 243.70—267.03 {24.85—27.23, 54.67—59.90}
	EX	H: 41.0 mm {1.614 in} (CARB)	240.37—272.03 {24.51—27.74,53.93—61.02}
		H Inner: 36.5 mm {1.437 in} Outer: 41.0 mm {1.614 in} (CIS)	Inner: 116.41—131.80 {11.87—13.44, 26.12—30.51} Outer: 243.70—267.03 {24.85—27.23, 54.67—59.90}
Out–of–square (mm {in})	IN	Maximum	CARB: 1.73 {0.068} CIS: Inner 1.6 {0.063}, Outer 1.8 {0.071}
	EX	Maximum	CARB: 1.76 {0.069} CIS: Inner 1.6 {0.063}, Outer 1.8 {0.071}
Valve seal			
Depth L (mm {in})			CARB: 21.4—22.2 {0.843—0.874} CIS: 19.1—19.6 {0.752—0.771}
Camshaft			
Camshaft runout (mm {in})		Maximum	0.03 {0.0012}
Cam lobe height (mm {in})	IN	Standard	CARB: 41.341 {1.6276} CIS: 38.059 {1.4984}
	EX	Standard	CARB: 41.851 {1.6477} CIS: 38.059 {1.4984}
Journal diameter (mm {in})		Standard	No.1, 5: 31.940—31.965 {1.2575—1.2585} No.2, 3, 4: 31.910—31.935 {1.2563—1.2572}
		Minimum	No.1, 5: 31.910 {1.2563} No.2, 3, 4: 31.880 {1.2551}
Journal oil clearance (mm {in})	Stan-dard	No.1, 5	CARB: 0.035—0.060 {0.00138—0.00236} CIS: 0.035—0.085 {0.00138—0.0033}
		No.2, 3, 4	CARB: 0.065—0.090 {0.00256—0.00354} CIS: 0.065—0.115 {0.00256—0.00453}
	Maximum		0.15 {0.006}
End play (mm {in})		Standard	0.08—0.16 {0.00315—0.00629}
		Maximum	0.20 {0.008}
Pushing distance of the camshaft oil seal [from the edge of the cylinder head] (mm {in})			0 {0}
Rocker arm and rocker arm shaft			
Rocker arm inner diameter (mm {in})		Standard	CARB: 19.000—19.033 {0.7481—0.7493} CIS: 16.000—16.027 {0.6300—0.6309}
Rocker arm shaft outer diameter (mm {in})		Standard	CARB: 18.959—18.980 {0.7465—0.7472} CIS: 15.966—15.984 {0.6286—0.6292}
Oil clearance between rocker arm and shaft (mm {in})		Standard	CARB: 0.020—0.074 {0.00079—0.00291} CIS: 0.016—0.061 {0.00063—0.00240}
Cylinder block			
Height (mm {in})		Standard	301.43—301.57 {11.868—11.872}
		Maximum grinding	0.20 {0.008}
Distortion (mm {in})		Maximum	0.15 {0.006}

CONTINUED

TECHNICAL DATA

Item			Specification
Cylinder bore diameter [Measure the cylinder bore at 70 mm {2.76 in} below the top surface] (mm {in})	Standard		86.000—86.019 {3.3859—3.3865}
	0.25 {0.01} oversize		86.250—86.269 {3.3957—3.3964}
	0.50 {0.02} oversize		86.500—86.519 {3.4056—3.4062}
Wear limit (mm {in})			0.15 {0.006}
Piston			
Piston diameter [Measured at 90 ° to pin bore axis and 18.0 mm {0.709 in} below oil ring groove] (mm {in})	Standard		85.943—85.965 {3.38358—3.38444}
	0.25 {0.01} oversize		86.193—86.215 {3.39342—3.39428}
	0.50 {0.02} oversize		86.443—86.465 {3.40327—3.40412}
Clearance between piston and cylinder oil (mm {in})		Standard	0.035—0.076 {0.0014—0.0029}
		Maximum	0.15 {0.006}
Piston ring			
Clearance between piston ring and ring groove (mm {in})	Top	Standard	CARB: 0.035—0.070 {0.0014—0.0027} CIS: 0.030—0.070 {0.012—0.0027}
	Second	Standard	0.030—0.070 {0.0012—0.0027}
	Oil	Standard	0.070—0.160 {0.0028—0.0062}
	Top, Second	Maximum	0.15 {0.0059}
	Oil	Maximum	0.17 {0.0067}
End gap [Measured in cylinder] (mm {in})		Top	0.20—0.35 {0.008—0.013}
		Second	0.15—0.30 {0.006—0.011}
		Oil	0.20—0.70 {0.008—0.027}
		Maximum	1.0 {0.039}
Piston pin			
Piston pin diameter (mm {in})		Standard	21.974—21.980 {0.8652—0.8653}
Piston pin bore diameter (mm {in})		Standard	21.988—21.998 {0.8657—0.8660}
Oil clearance between connecting rod and piston pin (mm {in})		Standard	–0.037—–0.013 {–0.0014—–0.0006}
Oil clearance between piston pin bore and piston pin (mm {in})		Standard	0.008—0.024 {0.00032—0.0094}
Connecting rod and connecting rod bearing			
Length (center to center) (mm {in})		Standard	158.45—158.55 {6.239—6.242}
Bending (mm {in})		Maximum	0.075 {0.0029}/50 {1.97}
Distortion (mm {in})		Maximum	0.180 {0.0070}/50 {1.97}
Connecting rod small end inner diameter (mm {in})		Standard	21.943—21.961 {0.8639—0.8646}
Connecting rod side clearance (mm {in})		Standard	0.110—0.262 {0.005—0.010}
		Maximum	0.30 {0.012}
Connecting rod bearing size (mm {in})	Standard		1.505—1.510 {0.0593—0.0594}
	0.25 {0.01} undersize		1.630—1.635 {0.0642—0.0643}
	0.50 {0.02} undersize		1.755—1.760 {0.0691—0.0692}
	0.75 {0.03} undersize		1.880—1.885 {0.0741—0.0742}
Connecting rod bearing oil clearance (mm {in})		Standard	0.027—0.067 {0.0011—0.0026}
		Maximum	0.10 {0.004}
Crankshaft			
Crankshaft runout (mm {in})		Maximum	0.03 {0.0012}

CONTINUED

TECHNICAL DATA

Item		Specification
Main journal diameter (mm {in})	Standard	59.937—59.955 {2.3598—2.3604}
	0.25 {0.01} undersize	59.687—59.705 {2.3499—2.3505}
	0.50 {0.02} undersize	59.437—59.455 {2.3401—2.3407}
	0.75 {0.03} undersize	59.187—59.205 {2.3302—2.3309}
Main journal oil clearance (mm {in})	Standard	No.1, 2, 4, 5: 0.025—0.043 {0.00099—0.00169} No.3: 0.031—0.049 {0.00123—0.00192}
	Maximum	0.10 {0.004}
Main bearing size (mm {in})	Standard	No.1, 2, 4, 5: 2.004—2.022 {0.07890—0.07960} No.3: 2.004—2.019 {0.07890—0.07948}
	0.25 {0.01} undersize	2.129—2.139 {0.08382—0.08421}
	0.50 {0.02} undersize	2.254—2.264 {0.08874—0.08913}
	0.75 {0.03} undersize	2.379—2.389 {0.09367—0.09405}
Crank pin journal diameter (mm {in})	Standard	50.940—50.955 {2.0056—2.0060}
	0.25 {0.01} undersize	50.690—50.705 {1.9957—1.9962}
	0.50 {0.02} undersize	50.440—50.455 {1.9859—1.9864}
	0.75 {0.03} undersize	50.190—50.205 {1.9760—1.9765}
No.3 bearing width (mm {in})	Standard	27.94—27.99 {1.1000—1.1019}
	0.25 {0.01} undersize	28.04—28.09 {1.1040—1.1060}
	0.50 {0.02} undersize	28.12—28.17 {1.1071—1.1090}
	0.75 {0.03} undersize	28.20—28.25 {1.1103—1.1122}
Crankshaft end play (mm {in})	Standard	0.08—0.18 {0.00315—0.00708}
	Maximum	0.30 {0.012}
Timing belt		
Timing belt deflection [Applied pressure 98 N {10 kgf, 22 lbf}] (mm {in})		New: 8.0—9.0 {0.32—0.35} Used: 9.0—10.0 {0.36—0.39}
Tensioner spring free length (mm {in})		63.0 {2.48}
Oil pump		
Clearance between inner rotor tooth tip and outer rotor (mm {in})	Maximum	0.18 {0.007}
Clearance between outer rotor and body (mm {in})	Standard	0.090—0.176 {0.0036—0.0069}
	Maximum	0.20 {0.008}
Side clearance (mm {in})	Standard	0.03—0.09 {0.0012—0.0035}
	Maximum	0.10 {0.004}
Pressure spring free length (mm {in})		46.4 {1.827}
Pushing distance of the front oil seal [from the edge of the oil pump body] (mm {in})		0 {0}
Rear oil seal		
Pushing distance of the rear oil seal [from the edge of the rear cover] (mm {in})		0—0.5 {0—0.019}

CONTINUED

TECHNICAL DATA

G6

Item				Specification
Cylinder head				
Cylinder head gasket contact surfaces distortion (mm {in})		Maximum		0.15 {0.006}
		Maximum grinding		0.20 {0.008}
Manifold contact surfaces distortion (mm {in})		Maximum		0.15 {0.006}
		Maximum grinding		0.20 {0.008}
Valve and valve guide				
Margin thickness (mm {in})		IN	Maximum	1.0 {0.0394}
		EX	Maximum	1.5 {0 .0591}
Valve length (mm {in})	IN	Standard		112.29—113.09 {4.421—4.452}
		Maximum		112.215 {4.418}
	EX	Standard		113.42—114.22 {4.466—4.496}
		Maximum		112.945 {4.447}
Valve stem diameter (mm {in})	IN	Standard		6.970—6.985 {0.2744—0.2749}
		Maximum		6.920 {0.2724}
	EX	Standard		6.965—6.980 {0.2743—0.2748}
		Maximum		6.915 {0.2722}
Valve guide inner diameter (mm {in})				7.01—7.03 {0.2760—0.2767}
Valve guide protrusion height (mm {in})		IN		23.5—24.1 {0.926—0.948}
		EX		23.5—24.1 {0.926—0.948}
Valve seat contact width (mm {in})				1.2—1.6 {0.048—0.062}
Valve seat angle		IN		45°
		EX		45°
Valve dimension (mm {in})	IN	Standard		49.0 {1.929}
		Maximum		49.6 {1.953}
	EX	Standard		49.0 {1.929}
		Maximum		49.6 {1.953}
Valve spring				
Pressing force at valve spring height H (N {kgf, lbf})		IN	H: 43.0 mm {1.69 in}	195.2—221.6 {19.9—22.6, 43.78—49.72}
		EX	H: 43.0 mm {1.69 in}	195.2—221.6 {19.9—22.6, 43.78—49.72}
Out-of-square (mm {in})		Maximum		1.73 {0.068}

CONTINUED

TECHNICAL DATA

Item			Specification
Camshaft			
Runout (mm {in})		Maximum	0.03 {0.0012}
Cam lobe height (mm {in})	IN	Standard	41.714 {1.6423}
		Minimum	41.514 {1.6344}
	EX	Standard	41.988 {1.6531}
		Minimum	41.788 {1.6452}
Journal diameter (mm {in})	Standard	No.1, 5	29.940—29.965 {1.1788—1.1797}
		No.2, 3, 4	29.910—29.935 {1.1776—1.1785}
	Minimum	No.1, 5	29.890 {1.1768}
		No.2, 3, 4	29.860 {1.1756}
Journal oil clearance (mm {in})	Standard	No.1, 5	0.035—0.085 {0.0014—0.0033}
		No.2, 3, 4	0.065—0.115 {0.026—0.0045}
	Minimum		0.15 {0.006}
End play (mm {in})		Standard	0.02—0.15 {0.0008—0.0059}
		Maximum	0.20 {0.0079}
Rocker arm and Rocker arm shaft			
Rocker arm inner diameter (mm {in})			21.000—21.033 {0.8268—0.8280}
Rocker arm shaft diameter (mm {in})			20.959—20.980 {0.8252—0.8259}
Clearance between rocker arm and shaft (mm {in})			0.020—0.074 {0.0008—0.0029}
Cylinder block			
Cylinder head gasket contact surfaces distortion (mm {in})		Maximum	0.15 {0.006}
		Maximum grinding	0.20 {0.008}
Cylinder bore diameter (mm {in})	Standard		92.000—92.022 {3.6221—3.6229}
	0.25 {0.01} oversize		92.250—92.272 {3.6319—3.6327}
	0.50 {0.02} oversize		92.500—92.522 {3.6418—3.6425}
Wear limit (mm {in})			0.15 {0.006}
Oil jet valve,nozzle			
Nozzle opening pressure (kPa {kgf/cm^2, psi})			167—225 {1.7—2.3, 25—32}
Piston			
Piston diameter [Measured at 90° to pin bore axis and 18 mm {0.71 in} above the bottom of piston] (mm {in})	Standard		91.933—92.957 {3.6194—3.6203}
	0.25 {0.01} oversize		92.183—92.207 {3.6293—3.6301}
	0.50 {0.02} oversize		92.433—92.457 {3.6391—3.6400}
Clearance between piston and cylinder (mm {in})		Standard	0.058—0.074 {0.0023—0.0029}
		Maximum	0.15 {0.006}
Piston pin bore diameter (mm {in})			22.988—23.000 {0.9051—0.9055}
Piston ring			
Clearance between piston ring and ring groove (mm {in})		Top	0.03—0.07 {0.0012—0.0027}
		Second	0.03—0.07 {0.0012—0.0027}
		Maximum	0.15 {0.0059}
End gap [Measured in cylinder] (mm {in})		Top	0.20—0.35 {0.008—0.013}
		Second	0.20—0.40 {0.008—0.015}
		Oil (rail)	0.20—0.70 {0.008—0.027}
		Maximum	1.0 {0.039}
Piston pin			
Diameter (mm {in})			22.974—22.980 {0.9045—0.9047}
Clearance between connecting rod and piston pin (mm {in})			–0.037— –0.013 {–0.0015— –0.0005}
Clearance between piston and piston pin (mm {in})			0.008—0.026 {0.0004—0.0010}

CONTINUED

TECHNICAL DATA

Item			Specification
Crankshaft			
Runout (mm {in})			0.03 {0.0012}
Main journal diameter (mm {in})	Standard		59.937—59.955 {2.3598—2.3604}
	0.25 {0.01} undersize		59.687—59.705 {2.3499—2.3505}
	0.50 {0.02} undersize		59.437—59.455 {2.3401—2.3407}
	0.75 {0.03} undersize		59.187—59.205 {2.3302—2.3309}
Out-of-round (mm {in})			0.03 {0.001}
Crank pin diameter (mm {in})	Standard		50.940—50.955 {2.0056—2.0060}
	0.25 {0.01} undersize		50.690—50.705 {1.9957—1.9962}
	0.50 {0.02} undersize		50.440—50.455 {1.9859—1.9864}
	0.75 {0.03} undersize		50.190—50.205 {1.9760—1.9765}
Out-of-round (mm {in})			0.03 {0.001}
Main journal oil clearance (mm {in})		Standard	0.025—0.044 {0.0010—0.0017}
		Maximum	0.08 {0.003}
Main journal bearing thickness (mm {in})	Standard		2.007—2.022 {0.0790—0.0796}
	0.25 {0.01} undersize		2.132—2.137 {0.0840—0.0841}
	0.50 {0.02} undersize		2.257—2.262 {0.0889—0.0890}
	0.75 {0.03} undersize		2.382—2.387 {0.0938—0.0939}
Crankshaft end play (mm {in})		Standard	0.08—0.18 {0.00315—0.00708}
		Maximum	0.30 {0.012}
No.4 main bearing width (mm {in})	Standard		25.94—25.99 {1.022—1.023}
	0.25 {0.01} undersize		26.04—26.09 {1.026—1.027}
	0.50 {0.02} undersize		26.12—26.17 {1.029—1.030}
	0.75 {0.03} undersize		26.20—26.25 {1.032—1.033}
Connecting rod			
Small end inner diameter (mm {in})			22.943—22.961 {0.9033—0.9039}
Length [Center to center] (mm {in})			166.45—166.55 {6.554—6.557}
Bending (mm {in})			0.075 {0.0030} max./50 {2.0}
Distortion (mm {in})			0.180 {0.0071} max./50 {2.0}
Connecting rod bearing oil clearance (mm {in})		Standard	0.027—0.067 {0.0011—0.0026}
		Maximum	0.10 {0.0039}
Connecting rod bearing thickness (mm {in})	Standard		1.505—1.510 {0.0593—0.0594}
	0.25 {0.01} undersize		1.630—1.635 {0.0642—0.0643}
	0.50 {0.02} undersize		1.755—1.760 {0.0691—0.0692}
	0.75 {0.03} undersize		1.880—1.885 {0.0741—0.0742}
Connecting rod side clearance (mm {in})		Standard	0.110—0.262 {0.0044—0.0103}
		Maximum	0.30 {0.012}
Balance shaft			
Clearance between balance shaft and balance shaft bore (mm {in})		Front	0.050—0.115 {0.0020—0.0045}
		Center	0.080—0.145 {0.0032—0.0057}
		Rear	0.080—0.145 {0.0032—0.0057}

CONTINUED

TECHNICAL DATA

Item		Specification
Oil pump		
Relief spring free length (mm {in})		46.4 {1.827}
Clearance between inner rotor tooth tip and outer rotor (mm {in})	Standard	0.02—0.18 {0.008—0.0070}
	Maximum	0.22 {0.0087}
Clearance between outer rotor and body (mm {in})	Standard	0.113—0.186 {0.0045—0.0073}
	Maximum	0.20 {0.079}
Side clearance (mm {in})	Standard	0.035—0.105 {0.0014—0.0041}
	Maximum	0.14 {0.0055}
Oil seal		
Rear oil seal tapping amount (mm {in})		0—0.5 {0—0.019}
Front oil seal tapping amount (mm {in})		0—0.7 {0—0.027}

WL, WL Turbo

Item				Specification
Cylinder head	Distortion (mm {in})			X: 0.020 {0.0008} max. Y: 0.050 {0.0020} max.
Valve and valve guide	Margin thickness (mm {in})		IN	1.50 {0.059}
			EX	0.75 {0.030}
	Valve length (mm {in})	IN	Standard	111.60—112.10 {4.394—4.413}
			Minimum	111.35 {4.384}
		EX	Standard	111.50—112.00 {4.390—4.409}
			Minimum	111.25 {4.380}
	Valve stem diameter (mm {in})	IN	Standard	6.970—6.985 {0.2745—0.2749}
			Minimum	6.920 {0.2724}
		EX	Standard	6.965—6.980 {0.2743—0.2748}
			Minimum	6.915 {0.2722}
	Guide inner diameter (mm {in})			7.025—7.045 {0.2766—0.2773}
	Valve guide protrusion height (mm {in})		IN	14.0—14.5 {0.56—0.57}
			EX	14.0—14.5 {0.56—0.57}
Valve seat	Seat contact width (mm {in})		IN	1.6—2.2 {0.07—0.08}
			EX	1.7—2.3 {0.07—0.09}
	Seat angle		IN	45 °
			EX	45 °
	Valve recession (mm {in})	IN	Standard	0.61—1.09 {0.025—0.042}
			Maximum	1.50 {0.059}
		EX	Standard	0.71—1.19 {0.028—0.046}
			Maximum	1.60 {0.063}
Valve spring	Pressing force at valve spring height H (N {kgf, lbf})	IN	H: 35.5 mm {1.40 in}	239—268 {24.3—27.4, 53.5—60.2}
		EX	H: 35.5 mm {1.40 in}	239—268 {24.3—27.4, 53.5—60.2}
	Out-of-square (mm {in})		IN	1.70 {0.0670}
			EX	1.70 {0.0670}

CONTINUED

TECHNICAL DATA

Item					Specification
Camshaft	Camshaft runout (mm {in})				0.03 {0.001} max.
	Lobe height (mm {in})	WL	IN	Standard	42.40—42.50 {1.670—1.673}
				Minimum	42.050 {1.6555}
			EX	Standard	42.395—42.495 {1.670—1.673}
				Minimum	42.045 {1.6553}
		WL Tur -bo	IN	Standard	41.221—41.321 {1.623—1.626}
				Minimum	40.871 {1.6091}
			EX	Standard	42.395—42.495 {1.670—1.673}
				Minimum	42.045 {1.6553}
	Journal diameter (mm {in})	No.1, 5		Standard	25.940—25.965 {1.0213—1.0222}
				Minimum	25.890 {1.0193}
		No.2, 3, 4		Standard	25.910—25.935 {1.0201—1.0210}
				Minimum	25.860 {1.0181}
	Camshaft journal oil clearance (mm {in})			No.1, 5	0.035—0.081 {0.0014—0.0031}
				No.2, 3, 4	0.065—0.111 {0.0026—0.0043}
	Camshaft end play (mm {in})			Standard	0.030—0.160 {0.0012—0.0062}
				Maximum	0.200 {0.0078}
Cylinder block	Distortion (mm {in})				X: 0.020 {0.0008} max. Y: 0.050 {0.0020} max.
	Cylinder bore diameter (mm {in})	Standard			93.000—93.022 {3.6615—3.6622}
		0.25 {0.01} oversize			93.250—93.272 {3.6713—3.6721}
		0.50 {0.02} oversize			93.500—93.522 {3.6811—3.6819}
	Wear limit (mm {in})				0.150 {0.0059}
Piston	Piston diameter measured at 90° to pin bore axis and 19.0 mm {0.75} above the bottom of piston (mm {in})	Standard			92.951—92.977 {3.6595—3.6605}
		0.25 {0.01} oversize			93.186—93.212 {3.6688—3.6697}
		0.50 {0.02} oversize			93.436—93.462 {3.6786—3.6795}
	Clearance between piston and cylinder (mm {in})			Standard	0.038—0.056 {0.0015—0.0022}
				Maximum	0.150 {0.0059}
Piston ring	Clearance between piston ring and ring groove (mm {in})			Top	0.06—0.10 {0.0024—0.0039}
				Second	0.04—0.08 {0.0016—0.0031}
				Oil	0.03—0.07 {0.0012—0.0027}
				Maximum	0.150 {0.0059}
	End gap [Measured in cylinder] (mm {in})			Top	0.22—0.32 {0.009—0.012}
				Second	0.32—0.47 {0.013—0.018}
				Oil (rail)	0.22—0.32 {0.009—0.012}
				Maximum	1.00 {0.039}
Piston pin	Diameter (mm {in})				31.994—32.007 {1.2598—1.2601}
	Clearance between connecting rod and piston pin (mm {in})				–0.003—0.013 {–0.0001—0.0005}
	Clearance between piston and piston pin (mm {in})				0.012—0.039 {0.0005—0.0015}

CONTINUED

TECHNICAL DATA

Item			Specification
Crankshaft	Crankshaft runout (mm {in})		0.05 {0.002} max.
	Main journal diameter (mm {in})	Standard	66.937—66.955 {2.6354—2.6360}, 66.920—66.938 {2.6347—2.6353} (No.3)
		0.25 {0.01} undersize	66.687—66.705 {2.6255—2.6261}, 66.670—66.688 {2.6248—2.6255} (No.3)
		0.50 {0.02} undersize	66.437—66.455 {2.6157—2.6163}, 66.420—66.438 {2.6150—2.6156} (No.3)
		0.75 {0.03} undersize	66.187—66.205 {2.6058—2.6040}, 66.170—66.188 {2.6052—2.6058} (No.3)
	Out-of-round (mm {in})		0.03 {0.001} max.
	Crankpin diameter (mm {in})	Standard	54.940—54.955 {2.1630—2.1635}
		0.25 {0.01} undersize	54.690—54.705 {2.1532—2.1537}
		0.50 {0.02} undersize	54.440—54.455 {2.1434—2.1438}
		0.75 {0.03} undersize	54.190—54.205 {2.1335—2.1340}
	Out-of-round (mm {in})		0.03 {0.001} max.
	Main journal oil clearance (mm {in})	Standard	0.033—0.052 {0.0013—0.0020} 0.050—0.069 {0.0020—0.0026} (No.3)
		Maximum	0.080 {0.003}
	Crankshaft end play (mm {in})	Standard	0.040—0.282 {0.0016—0.0111}
		Maximum	0.300 {0.012}
Connecting rod and connecting rod bearing	Length [Center to center] (mm {in})		151.95—152.05 {5.983—5.986}
	Bending (mm {in})		0.075 {0.0030} max. /50 {2.0}
	Connecting rod side clearance (mm {in})	Standard	0.110—0.262 {0.0044—0.0103}
		Maximum	0.350 {0.037}
	Connecting rod bearing oil clearance (mm {in})	Standard	0.031—0.058 {0.0013—0.0022}
		Maximum	0.080 {0.003}
Tensioner spring	Free length		63.0 {2.48}
Oil pump	Gear clearance (mm {in})	Standard	0.10—0.19 {0.004—0.007}
		Maximum	0.20 {0.008}
	Side clearance (mm {in})	Standard	0.04—0.09 {0.002—0.003}
		Maximum	0.15 {0.006}
Plunger spring	Free length (mm {in})		43.8 {1.72}

CONTINUED

TECHNICAL DATA

MANUAL TRANSMISSION
M15M–D, M15MX–D

Item				Manual transmission	
				M15M–D	M15MX–D
Manual transmission					
Transmission oil	Type			A.P.I. Service GL–4 or GL–5	
	Viscosity	All-season		SAE 75W–90	
		Above 10 °C {50 °F}		SAE 80W–90	
	Capacity (L {US qt, Imp qt})			2.0 {2.1, 1.8}	2.5 {2.6, 2.2}
Mainshaft	Runout (mm {in})		Maximum	0.03 {0.0012}	
	Clearance between mainshaft and gear (or bush) (mm {in})		Wear limit	0.15 {0.006}	
Reverse idler gear and shaft	Clearance between reverse idler gear bush and shaft (mm {in})		Standard	0.02—0.05 {0.0008—0.0019}	
			Wear limit	0.15 {0.006}	
Shift fork and clutch hub sleeve	Clearance between shift fork and clutch hub sleeve (mm {in})		Standard	0.2—0.3 {0.008—0.011}	
			Wear limit	0.5 {0.020}	
Synchronizer ring	Clearance between synchronizer ring and side of gear when fitted (mm {in})		Standard	1.5 {0.059}	
			Wear limit	0.8 {0.031}	
Spring	Free length (mm {in})	Shift rod (5th/reverse)		66.5 {2.62}	
		Detent ball (1st/2nd)		22.5 {0.89}	
		Detent ball (3rd/4th)			
Transfer					
Transfer oil	Type			–	A.P.I. Service GL–4 or GL–5
	Viscosity	All-season			SAE 75W–90
		Above 10 °C {50 °F}			SAE 80W–90
	Capacity (L {US qt, Imp qt})				2.0 {2.1, 1.8}
Hub sleeve and shift fork	Clearance between hub sleeve and shift fork (mm {in})		Standard		0.38—0.52 {0.015—0.020}
			Wear limit		0.8 {0.031}

CONTINUED

TECHNICAL DATA

R15M–D, R15MX–D

Item				Manual transmission	
				R15M–D	R15MX–D
Manual transmission					
Transmission oil	Type			A.P.I. Service GL–4 or GL–5	
	Viscosity	All-season		SAE 75W–90	
		Above 10 °C {50 °F}		SAE 80W–90	
	Capacity (L {US qt, Imp qt})			2.8 {3.0, 2.5}	3.2 {3.4, 2.8}
Mainshaft	Runout (mm {in})		Maximum	0.03 {0.0012}	
	Clearance between mainshaft and gear (or bush) (mm {in})		Wear limit	0.15 {0.006}	
Reverse idler gear and shaft	Clearance between reverse idler gear bush and shaft (mm {in})		Standard	0.02—0.05 {0.0008—0.0019}	
			Wear limit	0.15 {0.006}	
Shift fork and clutch hub sleeve	Clearance between shift fork and clutch hub sleeve (mm {in})		Standard	0.2—0.3 {0.008—0.011}	
			Wear limit	0.5 {0.020}	
Synchronizer ring	Clearance between synchronizer ring and side of gear when fitted (mm {in})		Standard	1.5 {0.059}	
			Wear limit	0.8 {0.031}	
Control rod lever and shift rod	Clearance between control rod lever and shift rod gate (mm {in})		Clearance	0.8 {0.031}	
Transfer					
Transfer oil	Type			–	A.P.I. Service GL–4 or GL–5
	Viscosity	All-season			SAE 75W–90
		Above 10 °C {50 °F}			SAE 80W–90
	Capacity (L {US qt, Imp qt})				2.0 {2.1, 1.8}
Hub sleeve and shift fork	Clearance between hub sleeve and shift fork (mm {in})		Standard		0.38—0.52 {0.015—0.020}
			Wear limit		0.8 {0.031}

CONTINUED

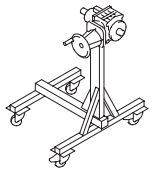
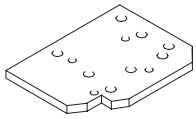
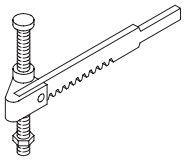
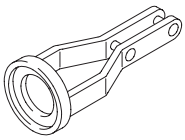
SPECIAL TOOLS

SPECIAL TOOLS

CONTINUED

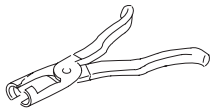
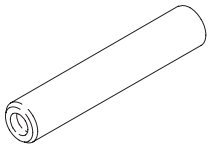
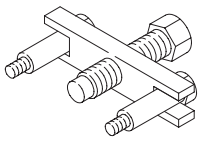
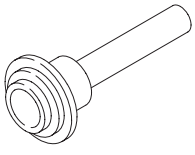
SPECIAL TOOLS

Engine

Mazda Tool Number	Ford Tool Number	
49 L010 1A0	Mounting Stand 303-435 (21-187)	
	Mounting Plate for 303-435-06 303-435-11 (21-146C)	
49 S013 102	Commercially available	Not applicable
49 S010 1A0	Commercially available	Not applicable
49 9014 001	Commercially available	Not applicable
49 0636 100B	Compressor, Valve Spring 303-060 (21-024)	
49 B012 0A2	Adapter for 303-060 303-060-02 (21-024-02)	

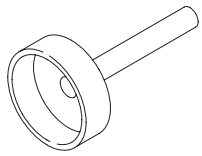
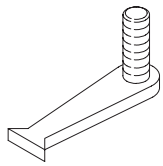
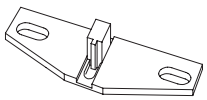
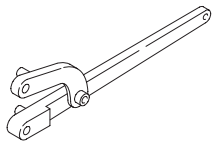
CONTINUED

SPECIAL TOOLS

49 S120 170	Pliers, Valve Stem Oil Seal 303-508 (21-211)	
49 L012 0A0A	Installer, Intake Valve Stem Oil Seal 303-247 (21-130A)	
49 0249 010A	Commercially available	Not applicable
49 G011 001	Commercially available	Not applicable
49 S015 1A1	Commercially available	Not applicable
49 S120 215A	Remover, Crankshaft Timing Pulley 303-249 (21-132)	
49 S010 301	Installer, Driver Pinion Oil Seal 204-088 (14-030)	

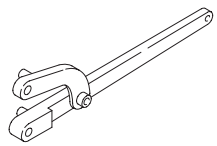
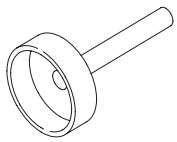
CONTINUED

SPECIAL TOOLS

49 0259 749	Commercially available	Not applicable
49 S010 001	Installer, Timing Cover Oil Seal 303-427 (21-178)	
49 S011 103	Installer, Wheel Speed Sensor Ring 205-307 (15-089)	
49 S011 102A	Locking Tool, Flywheel 303-254 (21-135)	
	Socket, Cylinder Head Bolt 303-393 (21-168)	
49 E011 1A0	Universal Flange Holding Wrench 205-072 (15-030A)_	
49 0187 280	Commercially available	Not applicable

CONTINUED

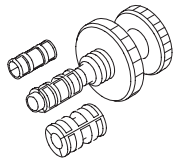
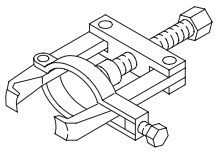
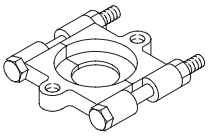
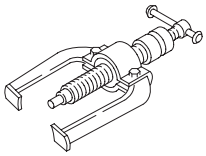
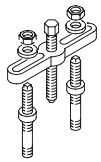
SPECIAL TOOLS

49 G014 001	Wrench, Oil Filter Use OTC tool GV 6883	Not applicable
49 L011 2A0	Adapter for 205-047-07 205-047-05 (15-011-06)	**Graphic not available**
	Adapter for 205-047-07 205-047-06 (15-011-07)	**Graphic not available**
	Adapter for 205-047-07 205-047-07 (15-011-08)	**Graphic not available**
49 S120 710	Universal Flange Holding Wrench 205-072 (15-030A)	
49 S011 103	Installer, Wheel Speed Sensor Ring 205-307 (15-089)	

CONTINUED

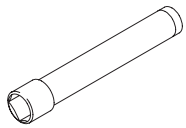
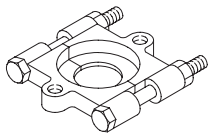
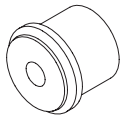
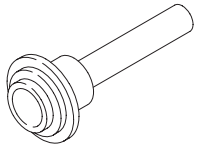
SPECIAL TOOLS

Transmission

Mazda Tool Number	Ford Tool Number	
49 SE01 310A	Aligner, Clutch Plate 308-204 (16-067)	
49 0839 425C	Remover, Mainshaft Needle Bearing Sleeve 308-191 (16-056)	
	Remover, Bearing/Gear 205-310 (15-091)	
	Thrust Pad for 205-071 307-115 (17-019)	
	Remover, Drop Arm 204-015 (14-008)	
	Remover, Bearing/Gear 205-311 (15-092)	
	Center Screw 205-034 (15-002)	**Graphic not available**

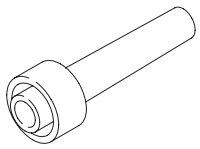
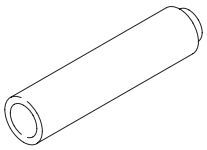
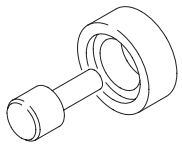
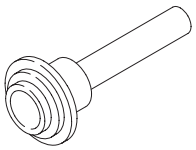
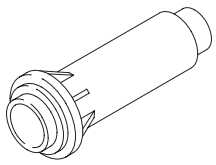
CONTINUED

SPECIAL TOOLS

49 H017 101	Adapter for 307-272 307-272-01 (17-061-01)	**Graphic not available**
49 1243 465A	Socket, Output Shaft Nut 308-108 (16-039)	
49 0710 520	Remover, Bearing/Gear 205-310 (15-091)	
49 F027 005	Adapter for 205-066 205-066-03 (15-033-03)	
49 F027 007	Installer, Drive Pinion Oil Seal 204-088 (14-030)	

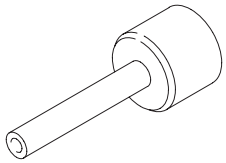
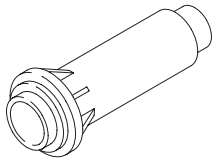
CONTINUED

SPECIAL TOOLS

49 F401 331	Installer, Extension Housing Oil Seal 307-028 (17-002)	
	Installer, Drive Pinion Bearing 205-068 (15-042)	
	Remover/Installer, Lower Arm Bushing 204-058 (14-027)	
	Installer, Drive Pinion Oil Seal 204-088 (14-030)	
49 0862 350	Commercially available	Not applicable
49 F017 101	Holding Tool, Synchronizer Ring 308-422 (16-093)	**Graphic not available**
49 G030 795	Installer, Oil Pump Oil Seal 307-032 (17-010A)	

CONTINUED

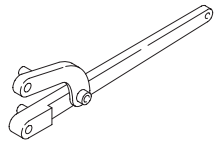
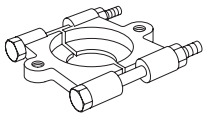
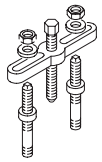
SPECIAL TOOLS

49 F401 335A	Installer, Input Shaft Oil Seal 307-210 (17-041)	
49 U027 003	Installer, Oil Pump Oil Seal 307-032 (17-010A)	
49 S120 440	Screwdriver	Not applicable
49 S017 401	Gears	Not applicable

CONTINUED

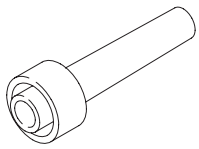
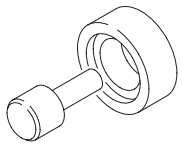
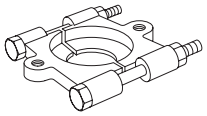
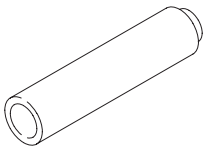
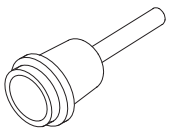
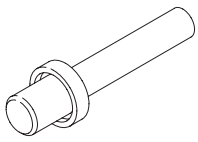
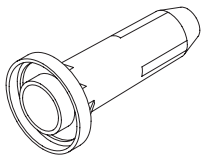
SPECIAL TOOLS

Transfer Box

Mazda Tool Number	Ford Tool Number	
49 S120 710	Universal Flange Holding Wrench 205-072 (15-030A)	
49 0839 425C	Remover, Bearing/Gear 205-310 (15-091)	
	Remover, Bearing/Gear 205-311 (15-092)	

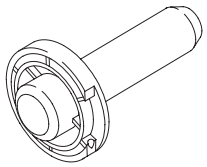
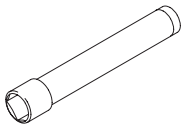
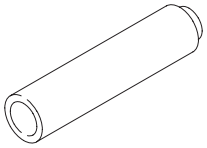
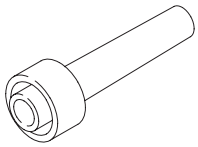
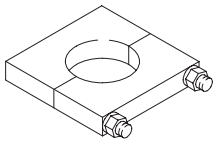
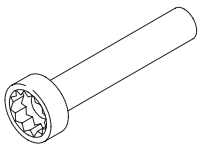
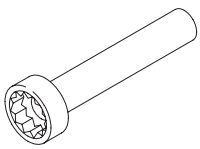
CONTINUED

SPECIAL TOOLS

49 F401 331	Installer, Extension Housing Oil Seal 307-028 (17-002)	
	Remover/Installer, Lower Arm Bushing 204-058 (14-027)	
	Remover, Bearing/Gear 205-310 (15-091)	
	Installer, Driver Pinion Bearing 205-068 (15-042)	
	Installer, Differential Double Lip Oil Seal 308-203 (16-066)	
49 0727 415	Installer, Differential Bearing 205-082 (15-037)	
	Installer, Torque Converter Oil Seal 307-273 (17-052)	

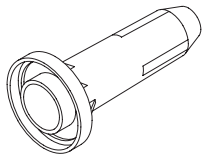
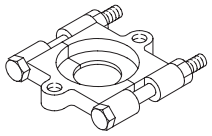
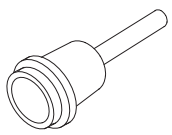
CONTINUED

SPECIAL TOOLS

49 0727 415	Installer, Halfshaft Oil Seal 308-119 (16-071)	
	Socket, Output Shaft Nut 308-108 (16-039)	
49 0727 415	Installer, Drive Pinion Bearing 205-068 (15-042)	
	Installer, Extension Housing Oil Seal 307-028 (17-002)	
49 G030 370	Support Plate, Gear Removal 308-198 (16-063)	
49 G030 797	Socket, Guide Sleeve 308-109 (16-040A)	
49 G026 102	Socket, Guide Sleeve 308-109 (16-040A)	

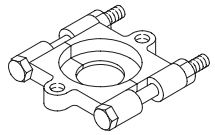
CONTINUED

SPECIAL TOOLS

49 0258 749	Installer, Torque Converter Oil Seal 307-273 (17-052)	
49 S231 395A	Spreader, Transfer Chain 308-423 (16-094)	**Graphic not available**
49 0500 330	Remover, Bearing/Gear 205-310 (15-091)	
	Depth Gauge Commercially available	Not applicable
49 U017 3A0A	Adjustment Tool, Transfer Case 308-424 (16-095)	**Graphic not available**
	Commercially available	Not applicable
49 F401 336B	Installer, Differential Double Lip Oil Seal 308-203 (16-066)	

CONTINUED

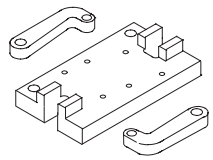
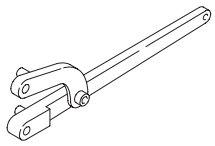
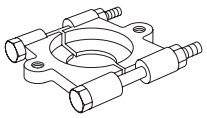
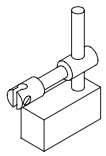
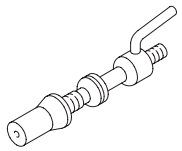
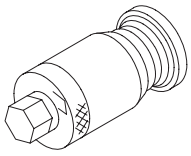
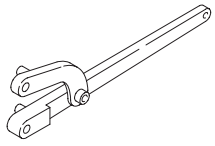
SPECIAL TOOLS

49 0636 145	Remover, Bearing/Gear 205-310 (15-091)	

CONTINUED

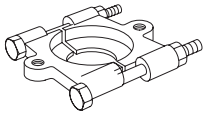
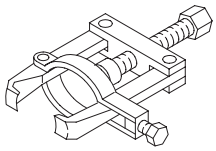
SPECIAL TOOLS

Front Differential

Mazda Tool Number	Ford Tool Number	
49 M005 581	Mounting Bracket, Engine/Differential 205-329 (15-105A)	
49 S120 710	Universal Flange Holding Wrench 205-072 (15-030A)	
49 H027 002	Remover, Bearing/Gear 205-310 (15-091)	
49 0727 570	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)	
49 8531 565	Gauge, Master Pinion 205-059 (15-020)	
49 0305 555	Preload Sleeve 205-060 (15-023)	
49 0259 720	Universal Flange Holding Wrench 205-072 (15-030A)	

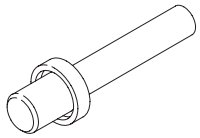
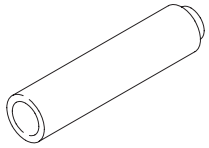
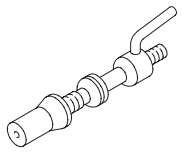
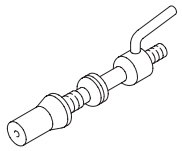
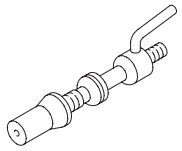
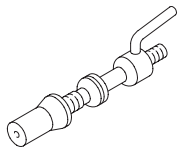
CONTINUED

SPECIAL TOOLS

49 0839 425C	Remover, Bearing/Gear 205-310 (15-091)	
	Thurst Pad for 205-071 307-115 (17-019)	
	Remover, Mainshaft Needle Bearing Sleeve 308-191 (16-056)	
49 G030 338	Installer, Front Differential Bearing Cup 204-281 (14-056)	**Graphic not available**
49 F027 004	Commercially available	Not applicable
49 F027 005	Installer, Front Differential Oil Seal 204-282 (14-057)	**Graphic not available**

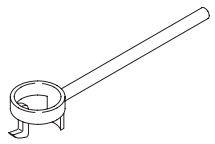
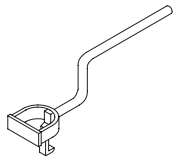
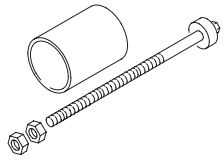
CONTINUED

SPECIAL TOOLS

49 U027 003	Installer, Drive Pinion Bearing 205-082 (15-037)	
	Installer, Drive Pinion Bearing 205-068 (15-042)	
49 G030 795	Installer, Front Differential Oil Seal 204-283 (14-058)	**Graphic not available**
49 0350 555	Gauge, Master Pinion 205-059 (15-020)	
49 0350 565	Gauge, Master Pinion 205-059 (15-020)	
49 0350 567	Gauge, Master Pinion 205-059 (15-020)	
49 0350 568	Gauge, Master Pinion 205-059 (15-020)	

CONTINUED

Remote Free Wheel (4x4)

Mazda Tool Number	Ford Tool Number	
49 U027 005	Installer, Remote Freewheel Bearing 204-284 (14-059)	**Graphic not available**
49 U027 006	Installer, Remote Freewheel Bearing 204-285 (14-060)	**Graphic not available**
49 U027 004	Remover, Rear Wheel Hub Oil Seal 205-174 (15-072)	
49 U027 004	Remover, Oil Seal 303-112 (21-051)	
49 M005 796	Installer, Remote Freewheel Dust Seal 204-286 (14-061)	**Graphic not available**
49 0813 215 A	Commercially available	Not applicable
49 W027 001	Remover/Installer, Pivot Bushing 205-342 (15-110)	

CONTINUED

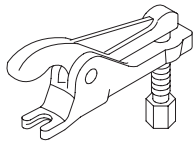
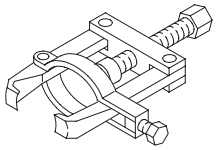
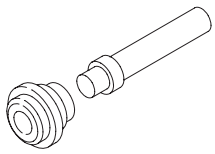
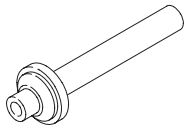
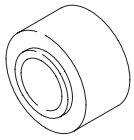
SPECIAL TOOLS

49 U027 007	Installer, Remote Freewheel Oil Seal 204-287 (14-062)	**Graphic not available**

CONTINUED

SPECIAL TOOLS

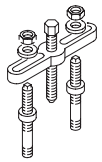
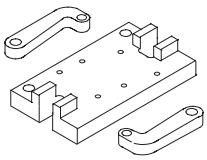
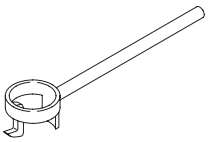
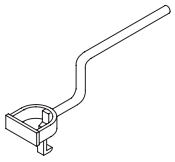
Front Axle

Mazda Tool Number	Ford Tool Number	
49 T028 3A0	Separator, Ball Joint 211-020 (13-006)	
	Remover, Mainshaft Needle Bearing Sleeve 308-191 (16-056)	
49 H033 101	Installer, Rear Wheel Hub Bearing Cone/Oil Seal 205-101 (15-051)	
49 B025 001	Installer, Input Shaft Bearing Cone 308-041 (16-020)	
49 F019 001	Installer, Timing Cover Oil Seal 303-427 (21-178)	

CONTINUED

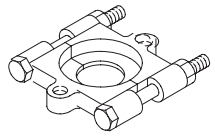
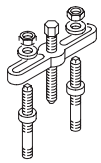
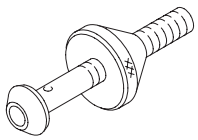
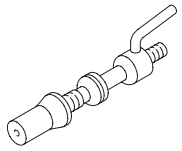
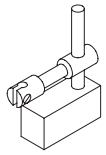
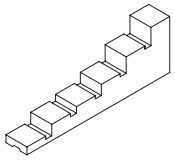
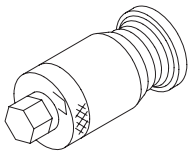
SPECIAL TOOLS

Rear Axle

Mazda Tool Number	Ford Tool Number	
49 S120 645A	Holding Tool, Rear Axle Shaft 205-496 (15-112)	**Graphic not available**
49 0603 635A	Wrench, Rear Axle Shaft Bearing 205-497 (15-113)	**Graphic not available**
49 S126 204	Remover, Bearing/Gear 205-311 (15-092)	
T57L-500-B	Mounting Bracket, Engine/Differential 205-329 (15-105-A)	
308-047 (T77F-1102-A)	Remover, Rear Wheel Hub Oil Seal 205-174 (15-072)	
	Remover, Oil Seal 303-112 (21-051)	

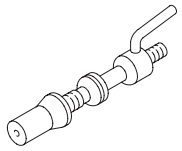
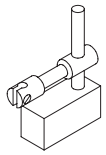
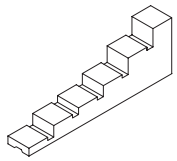
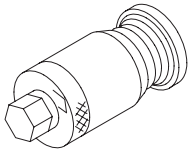
CONTINUED

SPECIAL TOOLS

205-D064 (D84L-1123-A)	Remover, Bearing/Gear 205-310 (15-091)	
	Remover, Bearing/Gear 205-311 (15-092)	
205-456	Adjustment Gauge, Drive Pinion 205-058 (15-019)	
205-110 (T76P-4020-A10)	Gauge, Master Pinion 205-059 (15-020)	
	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)	
	Adapter for 205-044 (Step Gauge) 205-044-02 (15-008-03A)	
	Installer, Differential Bearing 205-062 (15-023)	

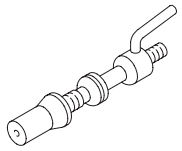
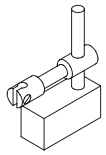
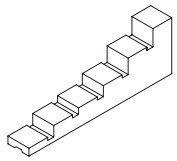
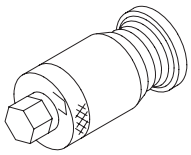
CONTINUED

SPECIAL TOOLS

205-457	Gauge, Master Pinion 205-059 (15-020)	
	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)	
	Adapter for 205-044 (Step Gauge) 204-044-03A (15-008-03A)	
	Installer, Differential Bearing 205-062 (15-023)	

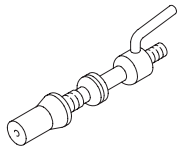
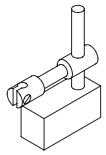
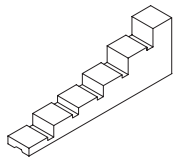
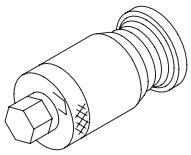
CONTINUED

SPECIAL TOOLS

205-105 (T76P-4020-A3)	Gauge, Master Pinion 205-059 (15-020)	
	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)	
	Adapter for 205-044 (Step Gauge) 204-044-03A (15-008-03A)	
	Installer, Differential Bearing 205-062 (15-023)	

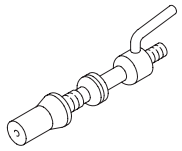
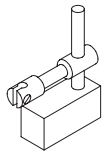
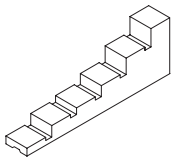
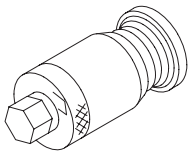
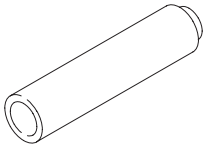
CONTINUED

SPECIAL TOOLS

205-109 (T76P-4020-A9)	Gauge, Master Pinion 205-059 (15-020)	
	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)	
	Adapter for 205-044 (Step Gauge) 204-044-03A (15-008-03A)	
	Installer, Differential Bearing 205-062 (15-023)	

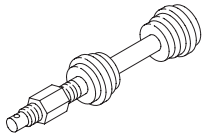
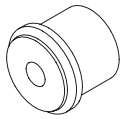
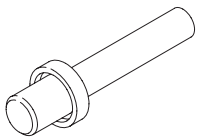
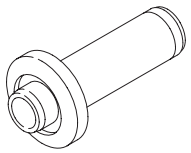
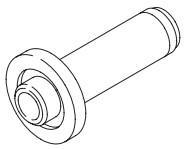
CONTINUED

SPECIAL TOOLS

205-111 (T76P-4020-A11)	Gauge, Master Pinion 205-059 (15-020)	
	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)	
	Adapter for 205-044 (Step Gauge) 204-044-03A (15-008-03A)	
	Installer, Differential Bearing 205-062 (15-023)	
205-090 (T75L-1165-B)	Installer, Drive Pinion Bearing 205-068 (15-042)	

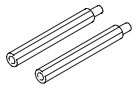
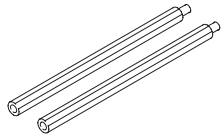
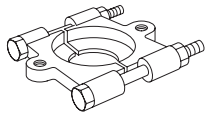
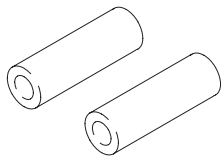
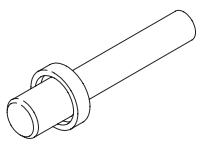
CONTINUED

SPECIAL TOOLS

205-024 (T76P-4616-A)	Installer, Differential Bearing Cone 205-066 (15-033)	
	Adapter for 205-066 205-066-02 (15-033-02A)	
	Adapter for 205-066 205-066-03 (15-033-03)	
205-092 (T57L-1165-DA)	Installer, Differential Bearing 205-081 (15-032)	
205-007 (T56T-4676-B)	Installer, Drive Pinion Oil Seal 205-077 (15-047A)	
	Installer, Drive Pinion Oil Seal 205-115 (15-058)	

CONTINUED

SPECIAL TOOLS

49 S126 205	Adapter for 205-311 (Extension) 205-311-02 (15-092-02)	
	Adapter for 205-311 (Extension) 205-311-03 (15-092-03)	
49 S126 208	Remover, Bearing/Gear 205-310 (15-091)	
	Adapter for 205-311 (Extension) 205-311-04 (15-092-04)	
49 S120 748	Commercially available	Not applicable
49 F027 004	Commercially available	Not applicable
49 U027 003	Installer, Differential Bearing 205-082 (15-037)	

CONTINUED

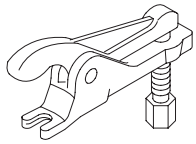
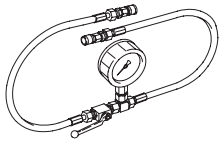
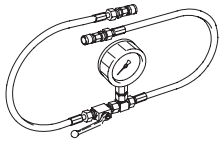
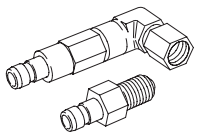
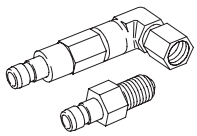
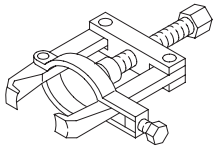
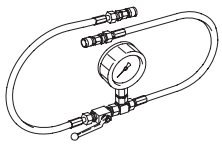
SPECIAL TOOLS

49 H025 001	Commercially available	Not applicable
T83T-4205-A1	Not essential	Not applicable
T83T-4205-A2	Not essential	Not applicable
T83T-4205-A3	Not essential	Not applicable
T83T-4205-A4	Not essential	Not applicable

CONTINUED

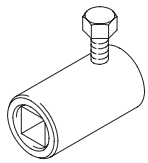
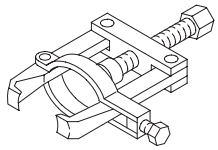
SPECIAL TOOLS

Steering

Mazda Tool Number	Ford Tool Number	
49 T028 3A0	Separator, Ball Joint 211-020 (13-006)	
49 1232 670 A	Pressure Gauge, Power Steering 211-190 (13-018)	
49 H002 671	Pressure Gauge, Power Steering 211-190 (13-018)	
	Adapter for 211-190 (Connector) 211-190-01 (13-018-01)	
49 G032 3A4	Adapter for 211-190 (Connector) 211-190-01 (13-018-01)	
49 T028 3A0	Remover, Mainshaft Bearing 308-200 (16-056)	
49 B032 304	Pressure Gauge, Power Steering 211-190 (13-018)	

CONTINUED

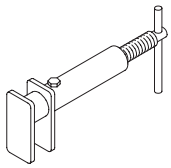
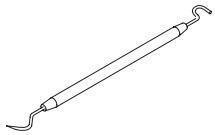
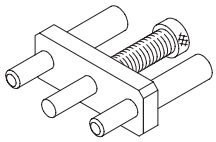
SPECIAL TOOLS

49 0180 510B	Clamp Connector, Preload Gauge 211-021 (13-004A)	**Graphic not available**
	Clamp Connector, Preload Gauge 211-041 (13-008A)	
49 0223 695E	Remover, Mainshaft Bearing 308-200 (16-056)	

CONTINUED

SPECIAL TOOLS

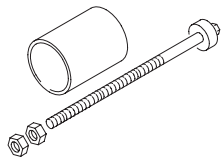
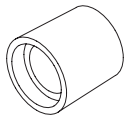
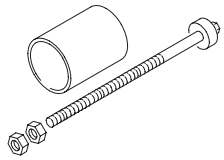
Brakes

Mazda Tool Number	Ford Tool Number	
49 0259 770B	Commercially available	Not applicable
49 U043 0A0	Commercially available	Not applicable
49 0221 600C	Retractor, Brake Caliper Piston 206-005 (12-014)	
49 0208 701A	Remover, O-Ring Seal 100-010 (17-063)	
49 B043 001	Setter, Brake Servo Push Rod 206-016 (12-010)	
49 EC43 003A	Commercially available	Not applicable
49 B043 004	Commercially available	Not applicable

CONTINUED

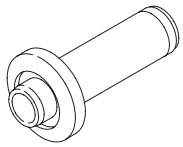
SPECIAL TOOLS

Suspension

Mazda Tool Number	Ford Tool Number	
49 U034 2AO	Remover/Installer, Pivot Bushing 205-342 (15-110)	
	Installer, Crankshaft Rear Oil Seal 303-395 (21-171)	
49 U039 615	Remover/Installer, Pivot Bushing 205-342 (15-110)	
	Remover/Installer, Rear Axle Bush 205-035 (15-003)	**Graphic not available**

CONTINUED

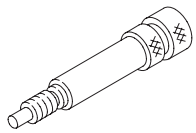
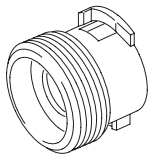
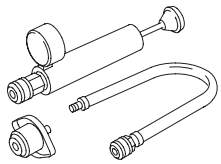
Air Conditioning

Mazda Tool Number	Ford Tool Number	
49 C081 0A0A	Commercially available	Not applicable
49 C061 012	Commercially available	Not applicable
49 C061 013	Commercially available	Not applicable
49 H061 005	Installer, Drive Pinion Oil Seal 205-046 (15-010A)	

CONTINUED

SPECIAL TOOLS

General

Mazda Tool Number	Ford Tool Number	
49 0305 870A	Commercially available	Not applicable
49 9140 074	Holding Fixture, Dial Indicator Gauge 310-017 (23-018)	
49 9200 146	Adapter for 303-396 303-396-02 (24-001-02)	
49 9200 147	Pressure Tester, Cooling System 303-396 (24-001A)	
49 0259 888A	Commercially available	Not applicable
49 01670280	Commercially available	Not applicable
49 N088 0A0	Commercially available	Not applicable

CONTINUED

SPECIAL TOOLS

49 L018 901	Commercially available	Not applicable