FOREWORD

This workshop manual has been prepared to provide information regarding repair procedures on Hino Vehicles.

Applicable for FC6J, FC9J, FD8J, GD8J, FG8J, GH8J, FL8J, FM8J, FM1A, FM2P, SG8J, FT8J, GT8J series, equipped with J05D-TI, J05E-TI, J08E-TI, A09C, P11C engine

When making any repairs on your vehicle, be careful not to be injured through improper procedures.
As for maintenance items, refer to the Owner's Manual.
All information and specifications in this manual are based upon the latest product information available at the time of printing.
Hino Motors reserves the right to make changes at any time without prior notice.
This manual is divided into 11 sections with a thumb index for each section at the edge of the pages.

Please note that the publications below have also been prepared as relevant service manuals for the components and systems in this vehicles.

Manual Name	Pub. No.
Chassis Workshop Manual	S1-YFCE18K 2/3 S1-YFCE18K 3/3 S1-YFCE18K EWD
J05D-TI, J05E-TI Engine Workshop Manual	S5-YJ05E12D
J08E-TI Engine Workshop Manual	S5-YJ08E29E
A09C Engine Workshop Manual	S5-MA09E02A
P11C Engine Workshop Manual	S5-YP11E07B

Hino Motors, Ltd.

CHAPTER REFERENCES REGARDING THIS WORKSHOP MANUAL

Use this chart to the appropriate chapter numbers for servicing your particular vehicle.

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ABS & ASR

ES START (EASY & SMOOTH START SYSTEM)

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This manual does not contain items on half-tone dot meshing.
"BRAKE EQUIPMENT" to "POWER STEERING":
Refer to "S1-YFCE18K 2/3".
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This manual does not contain items on half-tone dot meshing.
"BRAKE EQUIPMENT" to "POWER STEERING":
Refer to "S1-YFCE18K 2/3".
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This manual does not contain items on half-tone dot meshing.
"BRAKE EQUIPMENT" to "POWER STEERING":
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GENERAL INTRODUCTION

WARNING

EN00Z0002C100001

In order to ensure safety in work and avoid possible damage to vehicle, strictly observe the following precautions:
Audience of this manual is a qualified service engineer who has acquired expertise. In case an unqualified service engineer or a service engineer without appropriate training has performed maintenance, or in case maintenance is performed without using appropriate tools and units or in accordance with the method described in this manual, the vehicle under maintenance could be damaged as well as do harm to the service engineer and the people in the maintenance site.

- Appropriate maintenance and repairs are a must for assurance of safety of the service engineer as well as the safety and reliability of the vehicle. Replace parts of the vehicle with HINO genuine parts. Avoid using degraded parts.
- This manual contains the procedures to follow in performing maintenance and repairs. When performing maintenance and repairs in accordance with the procedures, use special tools designed to meet specific needs in a proper way.
- Never use a non-recommended work method or tool; this could impair the safety of the service engineer as well as the safety and reliability of your vehicle.
- This manual contains various items classified into DANGERS, WARNINGS, CAUTIONS and NOTICES in order to avoid accidents during maintenance and repairs or damage to the vehicle resulting in impairment of its safety and reliability.
  Note that these instructions described as DANGERS, WARNINGS, CAUTIONS and NOTICES are not the minimum requirements to observe in order to avoid possible dangers.

HOW TO USE THIS MANUAL

EN00Z0002C100002

1. REPAIR WORK

(1) The repair work is roughly classified into the three processes: "diagnosis", "mounting/dismounting, replacement, assembly/disassembly and inspection/adjustment work" and "final inspection".

(2) This manual describes the first process "diagnosis" and the second process "mounting/dismounting, replacement, assembly/disassembly and inspection/adjustment work". Description on the third process "final inspection" is omitted.

(3) While this manual does not describe the following element work, the work is to be performed in practical cases:

a. Jack work and lift work

b. Cleaning of removed parts as required

c. Visual inspection

2. TROUBLESHOOTING IN THIS MANUAL

(1) This manual describes the following steps 2 and 3.

(1) Interview	"Step 1"	Thoroughly listen to the conditions and environment for the trouble and confirm the fact.
(2) Pre-inspection (3) Replication method	"Step 2"	Perform diagnostic inspection, checkup of the symptom, function inspection and basic inspection to confirm the trouble. If the trouble hardly recurs, use the replication method.
(4) Troubleshooting by diagnosis code (5) Troubleshooting by trouble	"Step 3"	Classify the inspection results obtained in step 2 to systematically perform inspection accordance with the troubleshooting procedure by diagnosis code or trouble.
(6) Checkup test	"Step 4"	Check for the trouble after the trouble is removed. In case the trouble is hardly replicated, conduct a checkup test under the conditions and environment for the trouble.

(2) Pre-inspection

Pre-inspection	• Execute the following steps to perform pre-inspection. Diagnostic inspection → diagnosis code erasure → trouble check (If the trouble does not recur, use the replication method.) → Diagnosis code re-check • Assume the faulty system before the replication test. Connect a tester and determine a probable cause of trouble together with checkup of the trouble. For a probable cause of trouble, refer to the troubleshooting chart. • In case the trouble is momentary or in case an error code is displayed but no special trouble takes place, execute related troubleshooting procedures while using the replication method. • Trouble checkup In case the trouble recurs, follow steps 2, 3 and 4 in this order. Otherwise, use the replication method, that is, reproduce the external conditions, and inspect each wire harness and connector parts.

3. DESCRIPTION IN THIS MANUAL

(1) Component Locator

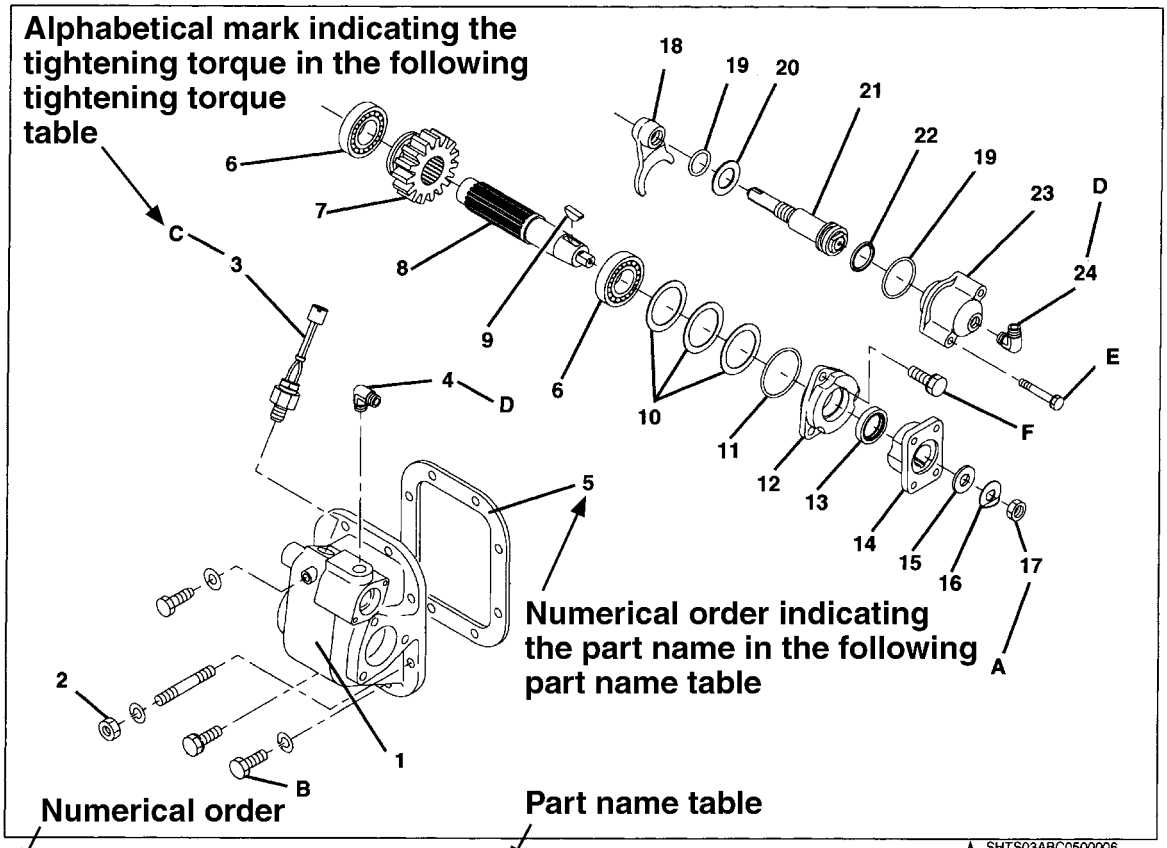
TR05–4 P.T.O. (POWER TAKE-OFF) (TRANSMISSION SERIES: HX07)

EXAMPLE

POWER TAKE-OFF UNIT

COMPONENT LOCATOR

☆ EN03ABC05D100001



☆ SHTS03ABC0500006

1	Power take-off case	13	Oil seal
2	Nut	14	Output shaft flange
3	Position switch	15	Plain washer
4	Connector	16	Lock washer
5	Power take-off case gasket	17	Lock nut
6	Taper roller bearing	18	Shift fork
7	Output gear	19	O-ring
8	Output shaft	20	Collar
9	Woodruff key	21	Shift shaft
10	Shim	22	Shift shaft piston cup
11	O-ring	23	Case cover
12	Seal cover	24	Elbow

Part name

Tightening torque table

Tightening torque — Unit: N·m {kgf·cm, lbf·ft}

A	39.2-47 {400-480, 29-34}	D	39.5-58.5 {400-600, 29-43}
B	44.5-53.5 {450-545, 33-39}	E	19-25 {200-250, 15-18}
C	48.5-67.5 {500-690, 36-49}	F	49-62 {500-630, 36-45}

Alphabetical mark — Tightening torque

SHTS00Z000200001

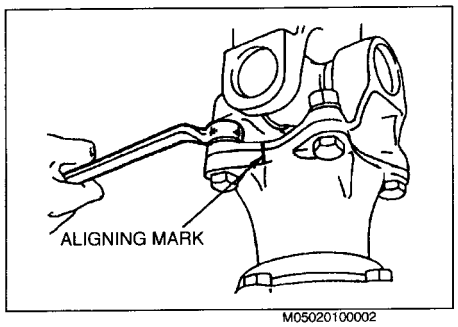
☆: This is the ID number of an item to be prepared for creating electronic data and is not necessary for repair work.

(2) Work item

EXAMPLE

OVERHAUL

M05020104BEH2004



M05020100002

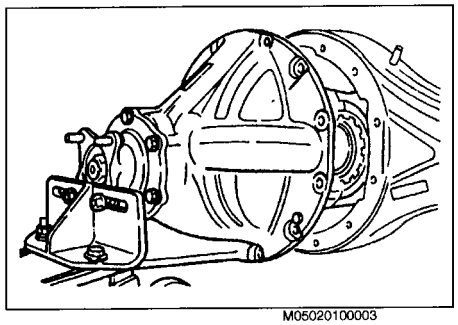
IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.

Indicating the work sequence


M05020100003

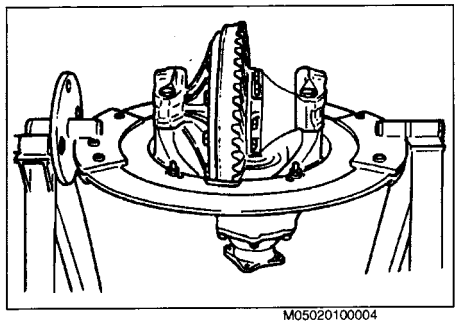
2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.

(1) Drain the gear oil and remove the axle shaft.

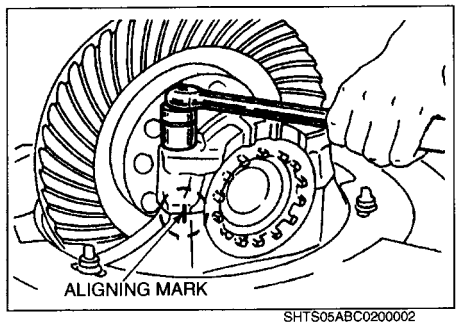
(2) Using a jack, dismount the differential carrier assembly.

Descriptive text: Indicating the work method which is gone into detail

IMPORTANT POINTS - DISASSEMBLY


M05020100004

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON THE WORK STAND.



SHTS05ABC0200002

2. DIFFERENTIAL CASE

(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

SST: Socket Wrench (S0983-93003)

(2) Using a puller, remove the taper roller bearing.

Indicating the part number of special tool required for work

SHTS00Z000200002

4. DEFINITION OF TERMS

This manual defines the terms used herein as follows:

(1) Direction

a. Chassis

- To-and-fro direction
  The direction of forward travel of the vehicle while mounted on the vehicle is forward direction; the direction of backward travel of the vehicle while mounted on the vehicle is backward direction.
- Direction of rotation
  The clockwise direction as seen from the rear of the vehicle is clockwise direction; the counterclockwise direction as seen from the rear of the vehicle is counterclockwise direction. (In case of engine, the clockwise direction as seen from the flywheel side is clockwise direction; the counterclockwise direction as seen from the flywheel side is counterclockwise direction.)
- Upward/Downward direction
  The upward direction while mounted on the vehicle is upward, and downward direction while mounted on the vehicle is downward.
- Right/Left direction
  The right direction as seen from the rear of the vehicle while mounted on the vehicle is right direction; the left direction as seen from the rear of the vehicle while mounted on the vehicle is left direction. (In case of engine, the right direction as seen from the flywheel side is right direction; the left direction as seen from the flywheel side is left direction.)

b. Standalone unit

- To-and-fro direction
  The direction of input of power is forward direction; the direction of output of power is backward direction.
- Direction of rotation
  The clockwise direction as seen from the rear of the unit is clockwise direction; the counterclockwise direction as seen from the rear of the unit is counterclockwise direction.
- Upward/Downward direction
  The upward direction while the unit is mounted on the vehicle (chassis) is upward, and downward direction while the unit is mounted on the vehicle (chassis) is downward.
- Right/Left direction
  The right direction as seen from the rear of the unit is right direction; the left direction as seen from the rear of the unit is left direction.

(2) Standard value (Assembly standard):
Indicates a basic dimension or including the tolerance and the clearance generated by the clearance of a combination of two parts

(3) Limit (Service limit):
Indicates a numeric value which requires correction or replacement.

5. DEFINITION OF SAFETY TERMS

⚠ DANGER	**Indicates an extremely hazardous situation if proper procedures are not followed and could result in death or serious injury.**
⚠ WARNING	**Indicates a potential hazardous situation if proper procedures are not followed and could result in death or serious injury.**
⚠ CAUTION	**Indicates a hazardous situation if proper procedures are not followed and could result in serious injury or damage to parts/equipment.**
NOTICE	**Indicates the need to follow proper procedures and to pay attention to precautions so that efficient service is provided.**
HINT	**Provides additional information to help you to perform the repair efficiently.**

6. UNIT

(1) This manual uses the SI unit system. The SI unit is an international unit which is based on one unit per quantity unlike the conventional unit system which differs from country to country, in order to facilitate technology exchange.

(2) This manual writes the SI unit and a conventional unit side by side, the conventional unit enclosed in parentheses { }.

	SI unit	Conventional unit	Conversion value*1 (1[Conventional unit] = X [SI unit])		SI unit	Conventional unit	Conversion value*1 (1[Conventional unit] = X [SI unit])
Force	**N**	**kgf**	**1 kgf=9.80665 N**	**Spring constant**	**N/mm**	**kgf/mm**	**1 kgf/mm= 9.80665 N/mm**
Torque*2	**N·m**	**kgf·cm**	**1 kgf·cm= 0.0980665 N·m**	**Volume**	**L**	**cc**	**1 cc=1 mL**
Pressure	**Pa**	**kgf/cm^2**	**1 kgf/cm^2= 98.0665 kPa= 0.0980665 MPa**	**Efficiency**	**W**	**PS**	**1 PS=0.735499 kW**
		mmHg	**1 mmHg= 0.133322 kPa**	**Quantity of heat**	**W·H**	**cal**	**1 kcal=1.13279 W·h**
Rotation speed	**r/min.**	**rpm**	**1 rpm=1 r/min.**	**Fuel consumption ratio**	**g/W·h**	**g/PS·h**	**1 g/PS·h= 1.3596 g/kW·h**
	min.$^{-1}$		**1 rpm=1 min.$^{-1}$**				

*1: X is a value obtained by converting 1 [conventional unit] to an SI unit and is used as a conversion factor of the conventional unit and SI unit.

*2: The torque conversion value may depend on the unit. Follow the specific value described for each unit.

PRECAUTIONS FOR WORK

EN00Z0002C100003

GENERAL PRECAUTIONS

To assure safety in work and prevent possible danger, observe the following:

1. CLOTHES AND APPEARANCE

(1) Use safety glasses.
(2) To prevent injury, remove a watch, necktie, ring, bracelet and necklace.
(3) Bind long hair behind.
(4) Wear a cap and safety boots.

2. SAFETY WORK

(1) To prevent burns, never touch a radiator, muffler, exhaust pipe, and tail pipe just after the engine is turned off.
(2) While the engine is rotating, keep your clothes and tools off the rotating sections, in particular the cooling fan and V-belt.
(3) Remove the starter key except when starting the engine.
(4) Provide good ventilation to avoid excessive CO when starting the engine.
(5) The fuel/battery gas is flammable. Never make a spark or light a cigarette.
(6) Take utmost care when working on the battery. It contains corrosive sulfuric acid.
(7) Large electric current flows through the battery cable and starter cable. Be careful not to cause a short, which can result in personal injury and/or property damage.
(8) Leaving a tool or waste in the engine room causes the tool or waste to touch the rotating section of the engine and pop out, which could result in an injury.

3. TOWING

- When being towed, always place the gear shift lever in "Neutral" and release the parking brake completely. In order to protect the bumper, fit a protection bar against the lower edge of the bumper and put a wood block under the frame near the No.1 crossmember when attaching the towing chain. Never lift or tow the vehicle if the chain is in direct contact with the bumper.

(1) Towing procedures
   a. Make sure that the propeller shaft of the vehicle to be towed is removed. When the differential gear or rear axle shaft is defective, remove both right and left rear axle shafts, then cover the hub opening to prevent loss of axle lubricant and entry of dirt or foreign matter.
   b. Use a heavy duty cable or rope when towing the vehicle. Fasten the cable securely to the towing hook on the frame. The hook should be used only if the towed vehicle is not loaded.
   c. The angle of pulling direction of the cable fastened to the towing hook must not exceed 15° in horizontal and vertical directions from the straight ahead, level direction. Avoid using the hook in a way that subjects it to jerk, as in towing a vehicle trapped in a gutter.
   d. Keep the gear shift lever in "Neutral".
   e. Make sure that the starter switch is kept in the "ON" position.
   f. Make sure that the engine of the towed vehicle is kept running. If the engine is off, no compressed air/ no vacuum will be available for the brake. This is dangerous, as the brake system does not function if the engine is not running.
      In addition, the power steering system will not function. The steering wheel, therefore, will become unusually hard to turn, making it impossible to control the vehicle.
   g. Note that the engine brake and exhaust brake cannot be applied, if the propeller shaft is removed.
   h. Make a slow start to minimize shock. Towing speed should be less than 30 km/h {18 mile/h}.

(2) If the engine of the towed vehicle is defective, make sure that the vehicle is towed only by a tow truck designed for that purpose.
   a. Front end towing (with front wheels raised off the ground)
      When towing from the front end with the front wheels raised off the ground, remove the rear axle shafts to protect the transmission and differential gears from being damaged. The hub openings should be covered to prevent the loss of axle lubricant or the entry of dirt or foreign matter.
      The above-mentioned precautions should be observed for vehicles equipped with either automatic or manual transmission, and for even short distance towing. After being towed, check and refill the rear axle housing with lubricant if necessary.
   b. Rear end towing
      When being towed with the rear wheels raised off the ground, fasten and secure the steering wheel in a straight ahead position.

PRECAUTIONS ON MAINTENANCE

Observe following before maintenance:

1. PREPARATIONS FOR DISASSEMBLY

(1) Prepare general tools, special tools and instruments before work.
(2) Before disassembling complicated sections, make a fitting mark where functions are not affected to facilitate the assembly work. Before repair of the electrical system, remove the cable from the minus terminal of the battery.
(3) Follow the inspection procedure in this manual before disassembly

2. INSPECTION DURING DISASSEMBLY

(1) Each time you remove a part, inspect the state of the assembly of the part, deformation, damage, wear and flaws.

3. ARRANGEMENT OF DISASSEMBLED PARTS

(1) Arrange the disassembled parts in order. Discriminate parts to be reused from replacement parts.

4. CLEANING OF DISASSEMBLED PARTS

(1) Thoroughly clean the parts to be reused.

5. INSPECTION AND MEASUREMENT

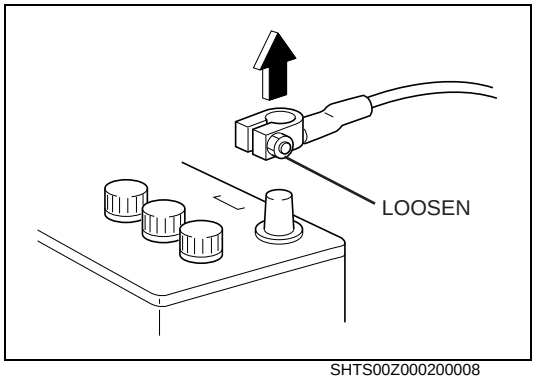
(1) Inspect and measure the parts to be reused as required.

6. ASSEMBLY

(1) Observe the specified values (tightening torque, adjustment value) to assemble conforming parts in a correct procedure.
(2) Use genuine parts for replacement.
(3) Use new packing, gasket, O-ring and cotter pin.
(4) Use a seal gasket depending on the location of gasket. Apply specified oil or grease to a sliding section where indicated. Apply specified grease to the lip of the oil seal.

7. ADJUSTMENT WORK CHECK

(1) Use a gauge and a tester to adjust to the specified maintenance value.



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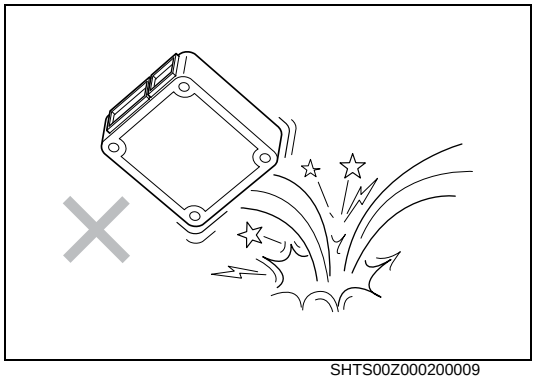
PRECAUTIONS FOR ELECTRICAL SYSTEM

1. REMOVING THE BATTERY CABLE

(1) Before electrical system work, remove the cable from the minus terminal of the battery in order to avoid burning caused by short-circuiting.

(2) To remove the battery cable, fully release the nut to avoid damage to the battery terminal. Never twist the terminal.

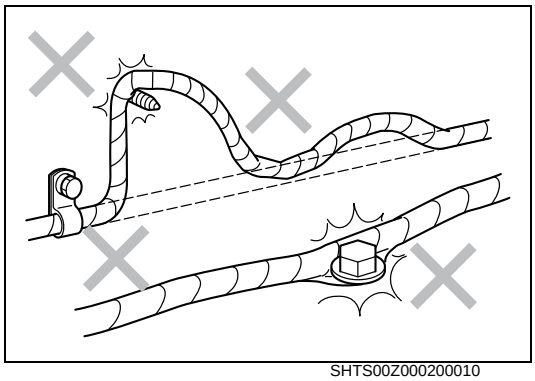

SHTS00Z000200009

2. HANDLING OF ELECTRONIC PARTS

(1) Never give an impact to electronic parts of a computer or relay.

(2) Keep electronic parts away from high temperatures and humidity.

(3) Never splash water onto electronic parts in washing the vehicle.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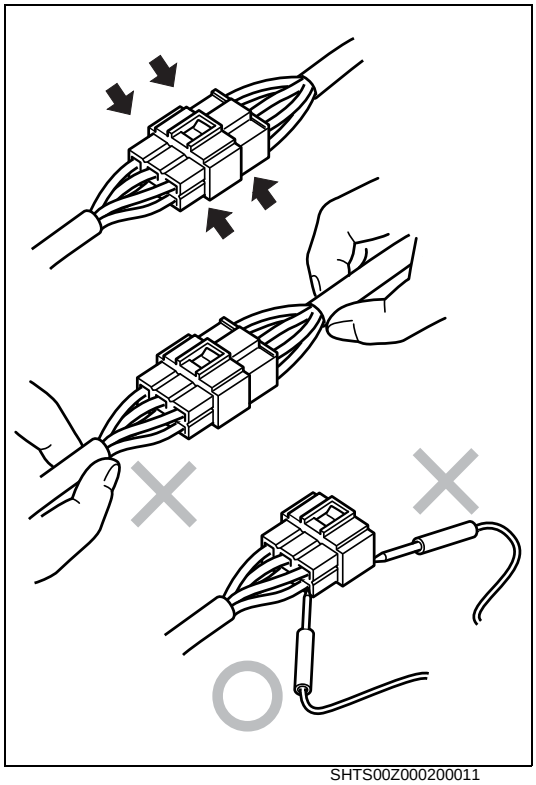
3. HANDLING OF WIRE HARNESS

(1) Perform marking on a clamp and a clip and secure then in original position so that the wire harness will not interfere with the end and acute angle section of the body and a bolt.

(2) To attach a part, take care not to bite the wire harness.



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4. HANDLING OF CONNECTOR

(1) To remove a connector, hold the connector (indicated by an arrow in the figure) to pull it out. Never pull the harness.
(2) To remove a connector with lock, release the lock then pull it out.
(3) To connect a connector with lock, insert it until it clicks.
(4) To insert a test lead into the connector, insert it from behind the connector.
(5) In case it is difficult to insert a test lead from behind the connector, prepare a harness for inspection and perform inspection.

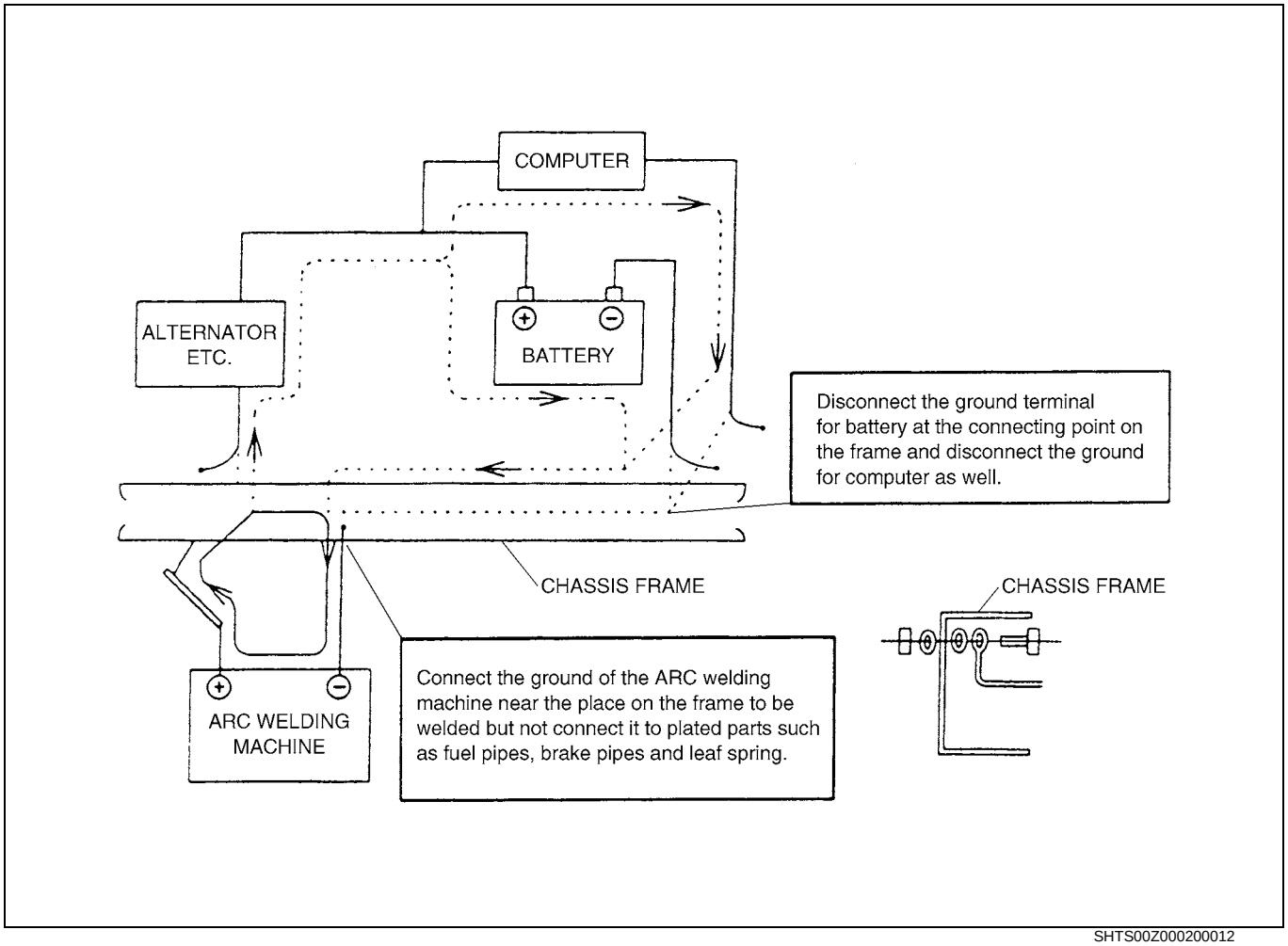
PRECAUTIONS FOR ELECTRIC WELDING

1. PRECAUTION FOR ELECTRIC WELDING

Electrical components such as the alternator and tachograph are directly connected to the battery and one end is earthed to the chassis frame. Under these conditions, welding current will flow back along the earth circuit if electric welding is carried out and damage may be caused to the alternator, tachograph, electrical components, etc. Consequently, the following precautions are always to be taken during welding.

(1) Disconnect the earth terminal of the battery at the frame fitment and earth the welding equipment securely to the frame itself. (Do not fit the welding equipment earth to such things as the tire rims, brake pipes or fuel pipes and leaf spring, etc.)

a. Turn the starter switch off.
b. Disconnect the battery's negative terminal of the battery.
c. Earth welding equipment securely, near to the area to be welded.



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(2) In order to prevent damage to ancillary equipment components from sparks during welding, take steps such as putting fire-resistant covers over things like the engine, meters, steering wheel, hoses, leaf spring and tires.

TIGHTENING OF BOLTS AND NUTS FOR ENGINE

EN00Z0002C100004

1. TIGHTENING TORQUE OF GENERAL STANDARD

(1) Washer based bolt

Unit: N·m {kgf·cm, lbf·ft}

Screw diameter x pitch	7T	9T
M8 x 1.25 (Coarse thread)	28.5 {290, 21}	36 {370, 27}
M10 x 1.25 (Fine thread)	60 {610, 44}	74.5 {760, 55}
M10 x 1.5 (Coarse thread)	55 {560, 40}	68.5 {700, 51}
M12 x 1.25 (Fine thread)	108 {1,100, 80}	136 {1,390, 101}
M12 x 1.75 (Coarse thread)	97 {990, 72}	125 {1,280, 93}
M14 x 1.5 (Fine thread)	171.5 {1,750, 127}	216 {2,210, 160}
M14 x 2 (Coarse thread)	154 {1,570, 114}	199 {2,030, 147}
Remarks	Bolt with the numeral "7" on its head	Bolt with the numeral "9" on its head

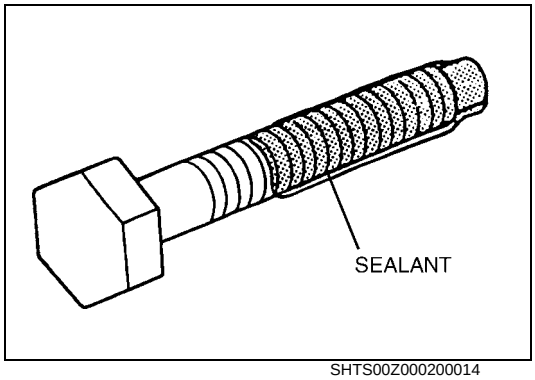
NOTICE
8T bolt conforms to the standard of 7T bolt.

(2) With washer

Unit: N·m {kgf·cm, lbf·ft}

Screw diameter x pitch	4T	7T	9T
M6 x 1 (Coarse thread)	6 {60, 4.3}	10 {100, 7.2}	13 {130, 9.4}
M8 x 1.25 (Coarse thread)	14 {140, 10}	25 {250, 18}	31 {320, 23}
M10 x 1.25 (Fine thread)	29 {300, 22}	51 {520, 38}	64 {650, 47}
M10 x 1.5 (Coarse thread)	26 {270, 20}	47 {480, 35}	59 {600, 43}
M12 x 1.25 (Fine thread)	54 {550, 40}	93 {950, 69}	118 {1,200, 87}
M12 x 1.75 (Coarse thread)	49 {500, 36}	83 {850, 61}	108 {1,100, 80}
M14 x 1.5 (Fine thread)	83 {850, 61}	147 {1,500, 108}	186 {1,900, 137}
M14 x 2 (Coarse thread)	74 {750, 54}	132 {1,350, 98}	172 {1,750, 127}
Remarks	Bolt with the numeral "4" on its head Projection bolt Stud with rounded free end face	Bolt with the numeral "7" on its head Stud with chamfered free end face	Bolt with the numeral "9" on its head

NOTICE
8T bolt conforms to the standard of 7T bolt.



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2. PRE-COATED BOLT

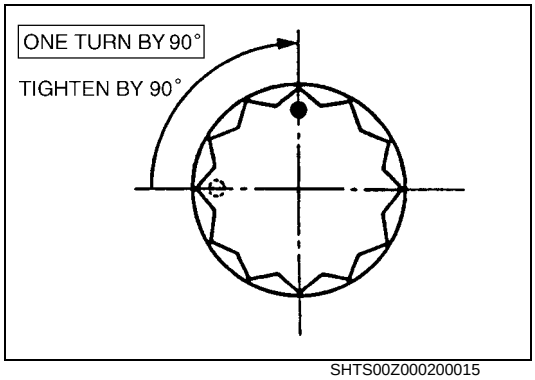
A pre-coated bolt is a bolt having a thread coated with sealant.

(1) Cases where sealant must be applied again
   a. Pre-coated bolt is removed
   b. Pre-coated bolt has moved during tightening torque inspection
      (Loosened or tightened)

HINT

Torque check is to be made using the lower limit value. In case the bolt has moved, retighten it in the following procedure:

(2) How to reuse pre-coated bolt
   a. Clean the bolt and the tapped hole (clean the tapped hole also when the bolt is to be replaced).
   b. Blow air to dry up the bolt.
   c. Apply a specified sealant to the thread of the bolt.



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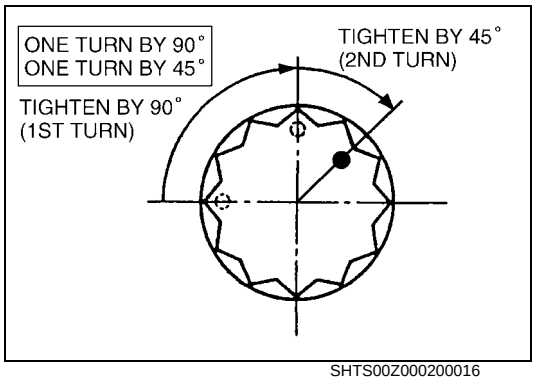
3. TENSION CONTROL WITH ANGULAR TORQUING METHOD IN PLASTIC REGION OF MATERIAL

(1) Precautions
Part of an engine uses the tension control with angular torquing method in plastic region of material.
This is different from the conventional tightening method. Follow the instructions in each chapter.



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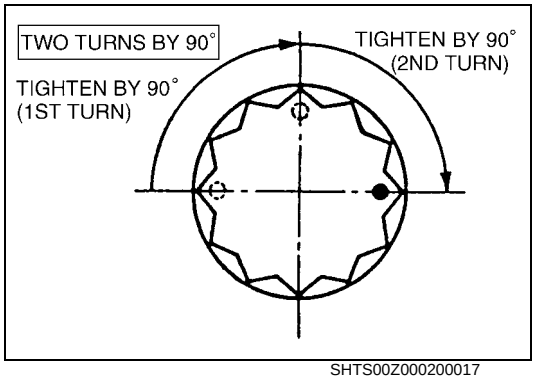
(2) Target region
Cylinder head bolt, crankshaft main bearing cap bolt, connecting rod bearing, cap bolt and so on.

⚠ CAUTION

Before assembly, measure the entire length of the bolt and if the use limit is exceeded, replace the bolt with new one.
Apply engine oil to the bolt seat face and bolt thread.



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(3) Tightening after tightening at the pre-set seating torque.
Further tighten by 90° or 135° (a turn by 90° and another by 45°) or 180° (two turns by 90°).

TIGHTENING OF BOLTS AND NUTS FOR CHASSIS

EN00Z0002C100005

1. TIGHTENING TORQUE OF GENERAL STANDARD BOLT/NUT

(1) Selection of tightening torque
   a. To select the tightening torque of a bolt, find the corresponding strength category in the table below. Select the corresponding value from the tightening torque table given later.
   b. To select the tightening torque of a nut, use the above method based on the mating bolt.

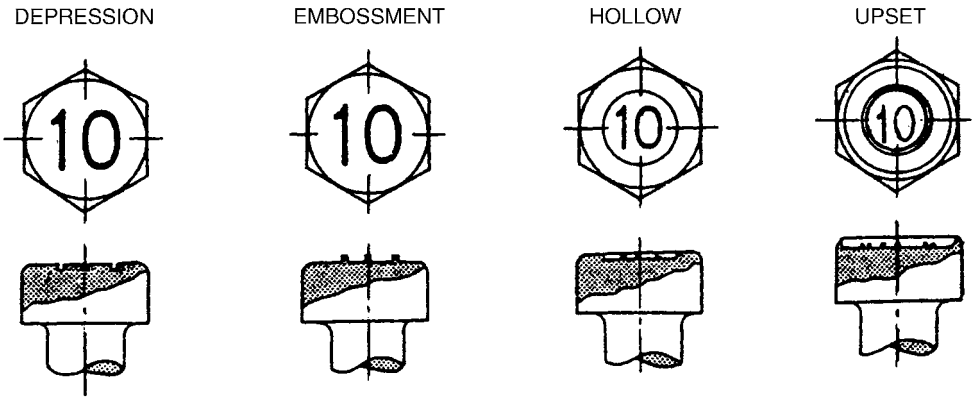
(2) Identification of bolt strength
   a. Identification on the part itself

HEXAGON BOLT

On the hexagon bolt, the strength category is generally indicated on the head of the bolt by way of depression, embossment, hollow and upset in accordance with the symbol in the table below.

Strength category	6T	7T	8T	9T	10T	11T	12T
Symbol on the part	6	7	8	q*1	10	11	12

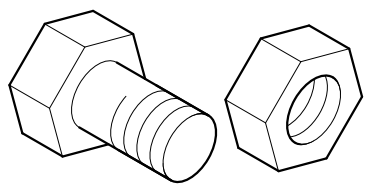
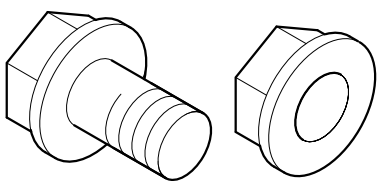
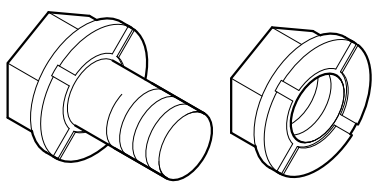
(*1): 9 is likely to be confused with 6 so that 9 is represented in q.



HEXAGON NUT

The following tables shows examples of symbols to identify the strength category of hexagon nut on the nut itself.

(3) Types of general standard bolt and nut

Standard seat face	Flanged seat face A	Flanged seat face B
		

(4) Table of tightening torque of general standard bolt and nut (Standard seat face is shown as a typical case)

Unit: N·m {kgf·cm, lbf·ft}

Strength category / Bolt diameter	4T	7T	9T
M6	4.5±1.8 {50±20, 3.6±1.4} (Cab) 5.5±1.1 {60±10, 4.4±0.7} (Chassis)	9.0±1.8 {90±20, 6.5±1.4}	11.5±2.0 {117±23, 8.5±1.6}
M8	14.0±3.5 {140±40, 10.1±2.8} (Cab) 17.0±3.0 {170±30, 12.3±2.1} (Chassis)	22.0±4.0 {220±40, 15.9±2.8}*2	29.0±5.5 {300±60, 21.7±4.3}*2
M10	27.0±5.0 {276±55, 20.0±3.9}	43.0±8.5 {440±90, 31.8±6.5}*2 (Cab) 51.5±10.0 {530±100, 38.3±7.2} (Chassis)	57.0±11.0 {580±110, 41.9±7.9}*2 (Cab) 68.5±13.5 {700±140, 51±10} (Chassis)
M12	48.0±9.5 {490±98, 35.4±7.0}	76.0±15.0 {776±150, 56±10}*2 (Cab) 91.0±18.0 {930±180, 67±13} (Chassis)	100.0±20.0 {1,020±200, 74±14}*2 (Cab) 120.0±24.0 {1,220±240, 88±17} (Chassis)
M14	77.0±15.0 {786±157, 57±11}	120.0±24.0 {1,220±240, 88±17}	160.0±32.0 {1,630±326, 118±23}
M16	120.0±24.0 {1,220±244, 88±17}	190.0±38.0 {1,940±390, 140±28}	250.0±50.0 {2,550±510, 184±37}
M18	165.0±33.0 {1,680±336, 121±24}	260.0±52.0 {2,650±530, 192±38}	345.0±69.0 {3,520±704, 255±50}
M20	235.0±47.0 {2,400±480, 174±34}	370.0±74.0 {3,770±750, 273±54}	490.0±98.0 {5,000±1,000, 362±72}
M22	320.0±64.0 {3,270±654, 236±47}	505.0±100.0 {5,150±1,030, 372±74}	670.0±130.0 {6,840±1,370, 495±99}
M24	405.0±81.0 {4,130±826, 299±59}	640.0±125.0 {6,530±1,310, 472±94}	845.0±165.0 {8,620±1,720, 623±124}

⚠ CAUTION

- **In case of tightening the bolt/nut with the flanged seat face A, the tightening torque value except *2 in the table is to be increased by 10% from the indicated tightening torque value.**
- **In case of tightening the bolt/nut with the flanged seat face B, the tightening torque value *2 in the table is to be increased by 20% from the indicated tightening torque value.**
  Note that for M8 the tightening torque value is constant for the flanged seat face B also.
- **The bolt/nut with flanged seat B which is marked *2 in the table is compatible with a standard seat face as a pair. Its tightening torque is the same as that of the standard seat face.**

TIGHTENING OF FLARE NUTS AND HOSES

EN00Z0002C100006

1. TIGHTENING TORQUE OF PIPE FLARE NUT

Unit: N·m {kgf·cm, lbf·ft}

Pipe outer diameter / Material	ϕ4.76	ϕ6.35	ϕ8	ϕ10	ϕ12	ϕ15
Steel pipe	15±5 {150±50, 10.8±3.6}	25±5 {250±50, 18.1±3.6}	36±5 {370±50, 26.8±3.6}	52±7 {530±70, 38.3±5.0}	67±7 {680±70, 49.2±5.0}	88±8 {900±80, 65.1±5.7}

2. TIGHTENING TORQUE OF HOSE

Unit: N·m {kgf·cm, lbf·ft}

	Hose outer diameter ϕ10.5 metal fitting	Hose outer diameter ϕ13, ϕ20, ϕ22 metal fitting for packing	Hose outer diameter PF3/8 metal fitting
Air hose	21.5±1.5 {215±15, 15.5±1.0} Meter gauge only 10 {100, 7.2}	41.5±2.5 {425±25, 30.7±1.8}	—
Brake hose	Packing 51.5±7.5 {525±75, 38.0±5.4}	—	—

3. TIGHTENING TORQUE OF FLARE JOINT FOR NYLON TUBE

Unit: N·m {kgf·cm, lbf·ft}

Nominal diameter of screw	M12	M16	M20
Tightening torque	14.7±2 {150±20, 10.8±1.4}	29.4±5 {300±50, 21.7±3.6}	51.9±5 {530±50, 38.3±3.6}

4. TIGHTENING TORQUE OF LOCK NUT FOR BRASS JOINT

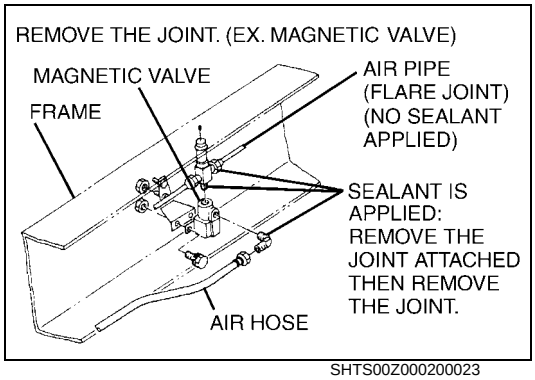
Unit: N·m {kgf·cm, lbf·ft}

Nominal diameter of screw	M12	M16	M20	M27
Tightening torque	15±2 {150±20, 10.8±1.4}	66±6 {670±60, 48.4±4.3}	97±9 {990±90, 71.6±6.5}	209±19 {2,130±190, 154±13}

SEALANT ON THE TAPERED SCREW FOR PIPING

EN00Z0002C100007

To the tapered thread of the air pipe joint is applied the sealant "LOCTITE #575". Follow the procedure below to remove/attach the piping.



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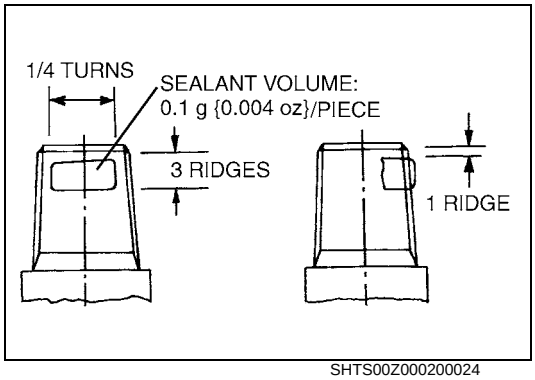
1. REMOVAL

(1) The sealant (LOCTITE #575) has a high sealing capability. The return torque of taper joint is about 1.5 times as high as the initial tightening torque. To remove the joint, use a longer wrench.

(2) For replacement of joint in a place with poor workability, remove the auxiliaries with the joint attached then remove the joint.



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2. ATTACHING

(1) To apply sealant (LOCTITE #575), use waste and thinner to wipe the dirt off the sealing section, directly apply the sealant by a quarter turn (three ridges) starting from the second ridge from the tip, then assemble in accordance with the tightening torque table below.
Wipe dirt off the mating part (female screw) before tightening it.

⚠ WARNING

In case the sealant has entered your eye or attached to your skin, wash it away in running water.

Tightening torque of tapered joint **Unit: N·m {kgf·cm, lbf·ft}**

Screw diameter / Material	1/4	3/8	1/2
Steel	49±10 {500±100, 36.2±7.2}	64±15 {650±150, 47±10}	
Aluminum, brass	25±5 {250±50, 18.1±3.6}	34±5 {350±50, 25.3±3.6}	44±5 {450±50, 32.5±3.6}

(2) To replace vulcanized tape with sealant, remove the tape beforehand, same as (1).

NOTICE

Take special care not to let dirt and foreign matters enter the piping.

(3) In the event of air leakage after sealant is applied and piping attached, retightening cannot check the air leakage. Follow the steps (1) and (2) to reassemble the piping.

NYLON TUBE

EN00Z0002C100008

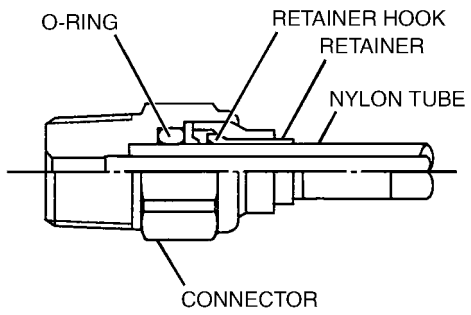
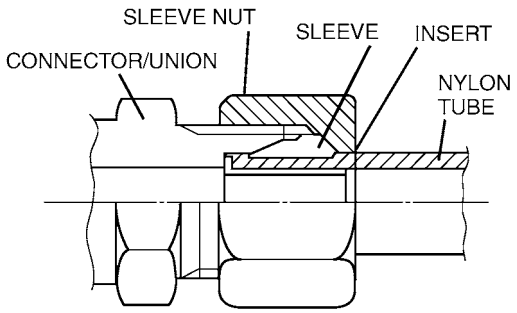
1. TYPES OF JOINT

(1) Nylon tube joints have two types: one-touch connector joint and sleeve nut joint.

⚠ CAUTION

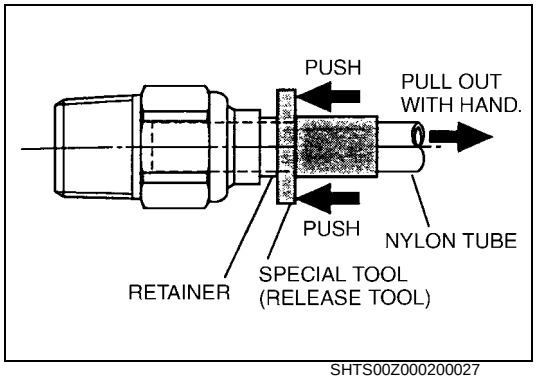
Function and quality of a nylon tube and each joint are guaranteed as a set. Use HINO genuine parts. Otherwise a burst or break may result.

Structure of joint and components

One-touch connector joint	Sleeve nut joint
	

2. ONE-TOUCH CONNECTOR JOINT

(1) Remove the one-touch connector joint.



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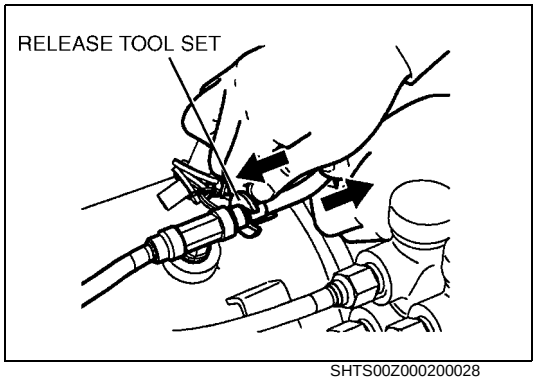

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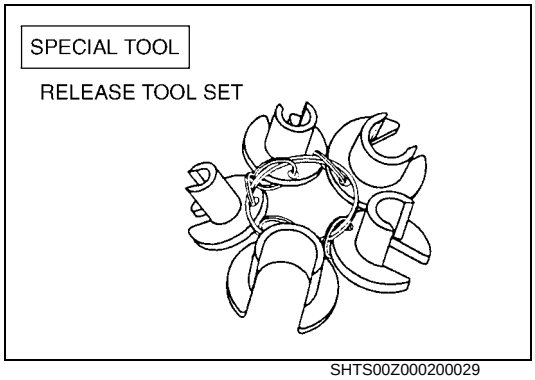
a. Check that there is no dust or dirt in the proximity of the connector end. If any, use air blow to remove dust or dirt before removal.



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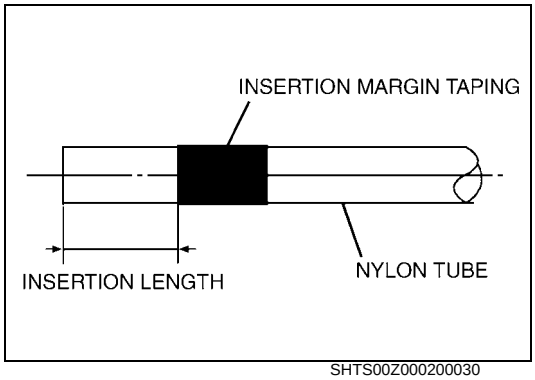
b. To remove the connector, pull out the nylon tube at a stroke in the axial direction while holding down the retainer of the connector. Use a dedicated special tool to hold down the retainer of the connector.

Size of special tool

Tube outer diameter	Part No.	Name
ϕ6	S0942-11510	Release tool
ϕ8	S0942-11520	
ϕ10	S0942-11530	
ϕ12	S0942-11540	
ϕ15	S0942-11550	
Set in above five sizes	S0942-11560	Release tool set



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c. To connect the connector joint, give a mark such as taping at the tube insertion length and insert the tube to the position of the mark.

⚠ CAUTION
Fully insert the nylon tube to the position although shock is felt two times as the nylon tube passes through the retainer hook and O-ring.

Tube outer diameter	Tube insertion length (mm {in.})
ϕ6	21.5-22.5 {0.847-0.885}
ϕ8, ϕ10	22.0-23.0 {0.867-0.905}
ϕ12	22.5-23.5 {0.886-0.925}
ϕ15	24.0-25.0 {0.945-0.984}

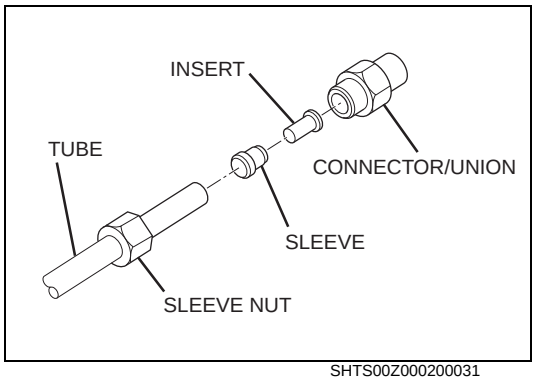
d. After connection, pull the tube and check that the distance from the connector end (retainer) to the taping at the insertion length position is 5 mm {0.197 in.} or less.

3. SLEEVE NUT JOINT

(1) Connection of sleeve nut

a. Thread the sleeve nut and sleeve in this order into the tube. Then push in the insert at the tip.

⚠ CAUTION
Take care of the assembling direction.



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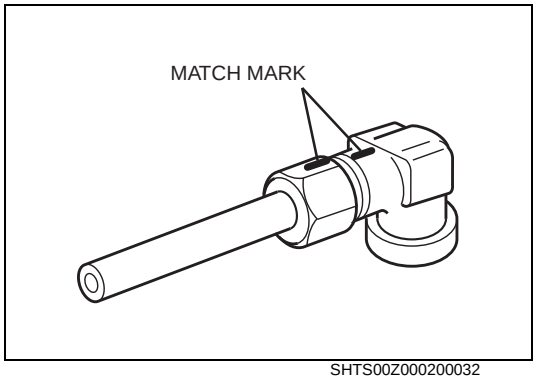
b. For connection, push the insert until its end strikes the connector/union while taking care not to let the sleeve nut, sleeve and insert drop. In this state, fully tighten the sleeve nut with hand. The position of sleeve nut is referred to as the "hand-tightening position".

c. Hold down the tube so that it will not move (come loose) and tighten the sleeve nut in accordance with the torque in the table below.

Tightening torque of sleeve nut **Unit: N·m {kgf·cm, lbf·ft}**

Nominal diameter of screw x pitch	Tightening torque
M12 x 1 (ϕ6)	23±5 {230±50, 16.6±3.6}
M14 x 1.5 (ϕ8)	37±4 {380±40, 27.5±2.8}
M16 x 1.5 (ϕ10)	40±5 {410±50, 29.6±3.6}
M18 x 1.5 (ϕ12)	55±5 {560±50, 40.5±3.6}



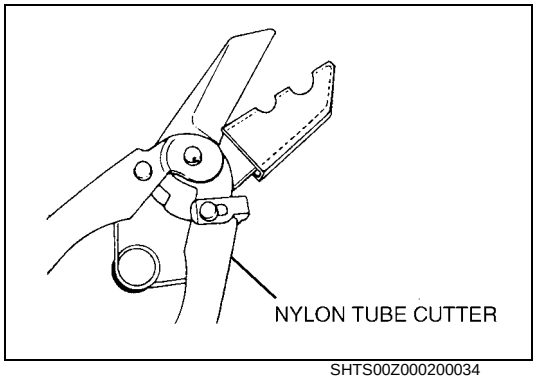
SHTS00Z000200032

(2) Assembly of sleeve nut (removing the tube from the joint and re-attaching it in the same position)
   a. Give a match mark between the connector/union and the sleeve nut before loosening the sleeve nut so as to memorize the position.
   b. For reassembly, tighten the sleeve nut up to the previous position (match mark position). After that, retighten by 60°.
   c. After reassembly, check for air leakage, if any, retighten until the leakage stops.
   d. If the leakage persists, replace the tube, sleeve and insert with new ones. If this does not stop the leakage, replace the sleeve nut and connector/union as well.

4. HANDLING OF NYLON TUBE

(1) Types of nylon tube

	Tube indication	Tube outer diameter	Operating temperature range
DIN tube	DIN 74324 6X1 PA11PL NITTA MOORE YY123456789101112 JAPAN	**ϕ6, ϕ10, ϕ12**	**-40-90°C {-40-194°F}**

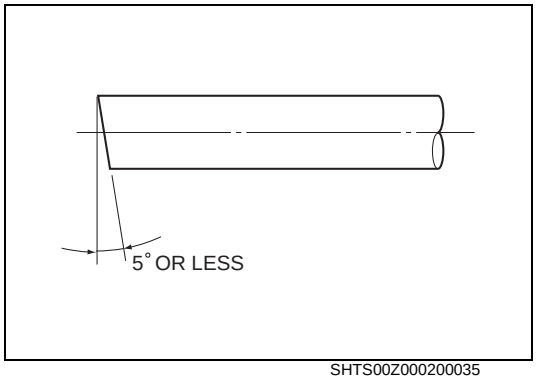


SHTS00Z000200034

(2) Cut the nylon tube.
   a. To cut a nylon tube in a predetermined length, use a dedicated special tool.
   SST: Nylon Tube Cutter (S0946-01020)

⚠ CAUTION

- **Cut a tube only when there is extra length or when using a new tube.**
- **When cutting a nylon tube, set the squareness of the tube end with respect to the axis core within 90±5°.**

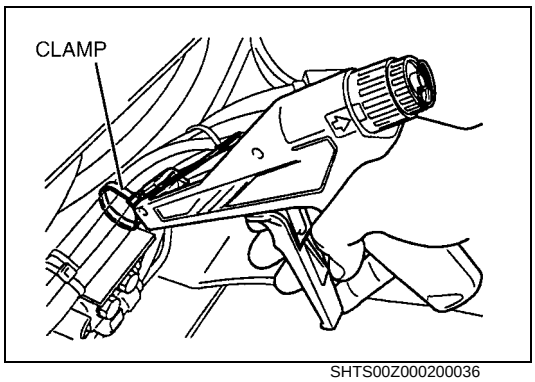


SHTS00Z000200035

⚠ CAUTION

- **Never repair a nylon tube under high temperatures exceeding the operating temperature range, in particular when drying the coating.**
- **For punching, welding and sanding, protect a nylon tube from tools, cutting, heat source or spark or remove the nylon tube.**
- **Never attach the clamp of the welder near the tube.**
- **Never splash acidic liquid such as battery liquid onto the tube.**
- **Never exceed the minimum bending radius R of the nylon tube listed in the table below. Avoid using a tube with trace of bending line.**

Tube outer diameter	Minimum bending radius in use: R (mm {in.})
ϕ6	30 {1.181}
ϕ8	50 {1.969}
ϕ10	65 {2.559}
ϕ12	70 {2.756}
ϕ15	80 {3.150}



SHTS00Z000200036

(3) Fixing the nylon tube

a. To fix the nylon tube to a vehicle, use a dedicated clamp and a dedicated special tool or clamping tool available on the market.

SST:
Clamp (S4783-71230)
Nylon Tube Tensioning Tool Assembly (S0962-01010)

Tool available on the market: Clamping tool (Tyton MK6)
Clamping torque (reference): 166.6 N {17 kgf, 37.5 lbf}

⚠ CAUTION

- **Set the tool clamping force to "3" on the dial.**
- **If the nylon tube is fixed with nonconforming clamping force, the nylon tube may be damaged.**

ASSEMBLY OF JOINT/GASKET FOR PIPING

EN00Z0002C100009

1. TIGHTENING TORQUE OF JOINT

Unit: N·m {kgf·cm, lbf·ft}

Seal system	Gasket seal system (aluminum+rubber or copper)	Metal seal system (Flare pipe system, nipple connector system)	
Tightening screw size		Type A	Type B
M8	13 {130, 9.4}		
M10	20 {200, 14}		11 {110, 8.0}
M12	25 {250, 18}	20 {200, 14}	
M14	25 {250, 18}	31 {320, 23}	
M16	29 {300, 22}	39 {400, 29}	
M18	39 {400, 29}	59 {600, 43}	
M20	*39 {400, 29}	64 {650, 47}	
M24	69 {700, 51}		20 {200, 14}
M28	*127 {1,300, 94}		

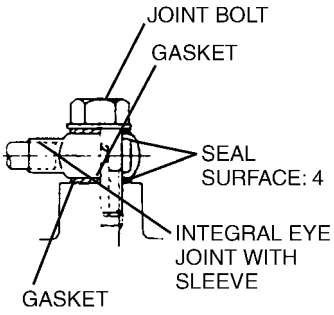
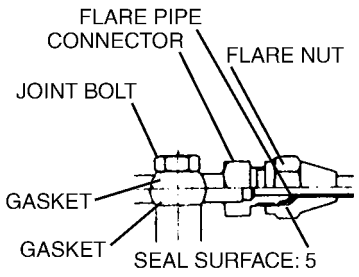
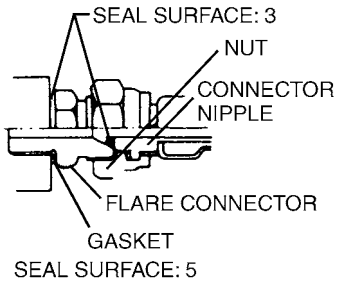
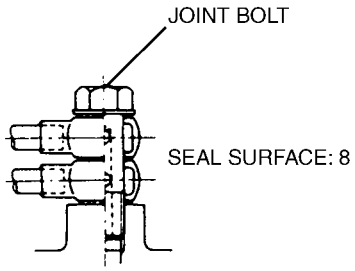
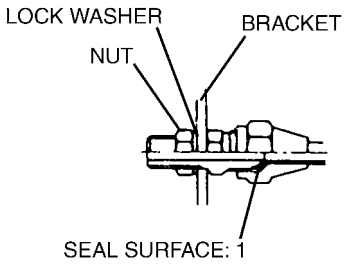
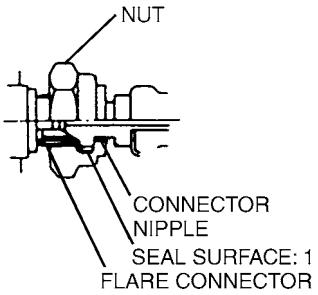
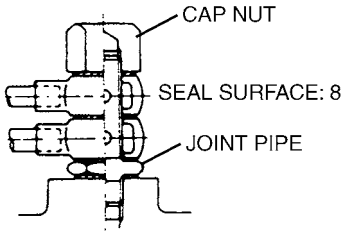
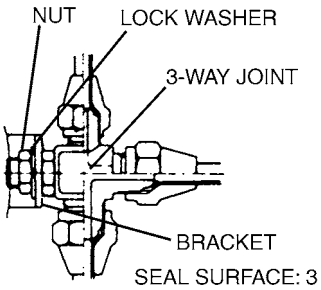
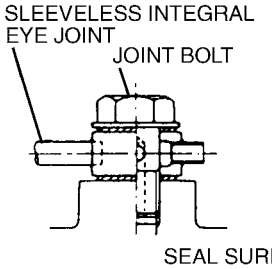
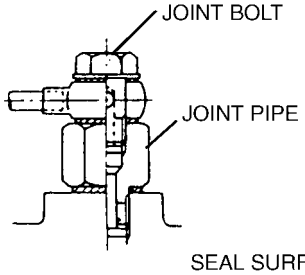
2. JOINT ASSEMBLY PROCEDURE AND POST-INSPECTION

(1) Before starting assembly, check that there is no dust or burr on each seat surface (mating part, pipe joint, gasket).
(2) Pipes are provided with the degree of freedom in assembly. The seat face is likely to be tilted. Temporarily tighten the pipe then perform final tightening in order to avoid leakage.
(3) When the tightening is complete, apply a regular pressure to each pipe joint and check that there is no leakage.
(4) Observe the above tightening torque values.

NOTICE

When a soft washer of the aluminum plus rubber carbon press-fitting type is once mounted then loosened or removed, replace it with a new one. This does not apply to normal retightening.

3. EXAMPLES OF JOINT SYSTEM FOR PIPING

Gasket seal system	Metal seal system	
	Type A (Flare pipe system)	Type B (Nipple connector system)
		
		
		
		
		

HANDLING OF LIQUID GASKET

EN00Z0002C100010

1. APPLICATION OF LIQUID GASKET AND ASSEMBLY OF PARTS

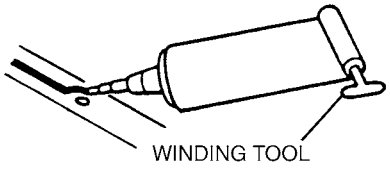
(1) Thoroughly remove the old liquid gasket on each part and mating part and clean the parts by using waste to wipe off oil, water and dust.
Overlap the coating at the beginning and end of coating.
(2) To assemble coated part, beware of any dislocation from the mating part. If any dislocation is found, coat the part again.
(3) Finish assembly within 20 minutes of completion of liquid gasket application.
If 20 minutes is exceeded, remove the liquid gasket and apply it again.
(4) Wait at least 15 minutes after assembly of parts before starting the engine.

2. REMOVING PARTS

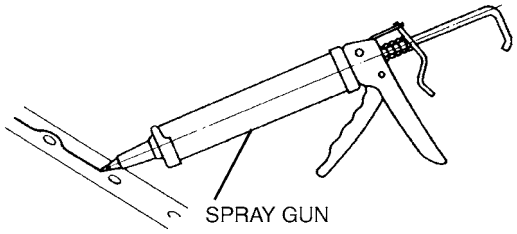
(1) To remove each part, never twist a single section but twist the part in alternate directions at the collar or clearance on the flange. When removing gasket, take care not to let the refuse of gasket enter the engine.

3. OTHER

(1) When the liquid gasket comes in a tube, use the supplied winding tool. When the gasket comes in a cartridge, use a spray gun.

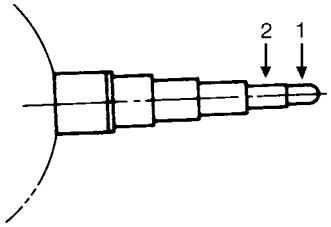


TUBE



CARTRIDGE TYPE

Note that the cutting position of the nozzle of the tube provides necessary width of application.



NOZZLE OF THE TUBE

1: Approx. 2 mm {0.079 in.} when cut at the first segment
2: Approx. 5 mm {0.197 in.} when cut at the second segment

TROUBLESHOOTING USING THE TROUBLE LIST

EN00Z0002F200001

EXAMPLE

TROUBLESHOOTING

A possible cause and remedy/prevention are indicated for every item, respectively.

EN01ABC01F300001

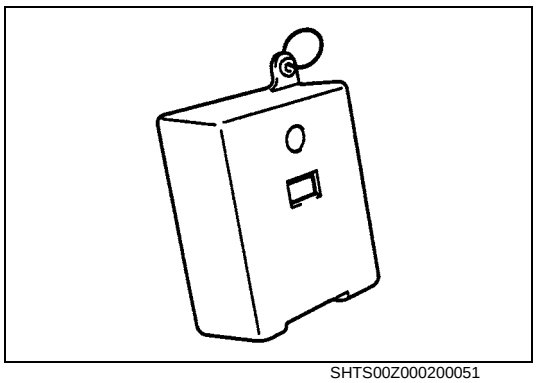
Engine overheating

Symptom	Possible cause	Remedy/Prevention
Engine overheating (Coolant)	Insufficient coolant	Add coolant.
	Defective thermostat	Replace thermostat.
	Overflow of coolant due to leakage of exhaust into cooling system	Repair.
	Damaged rubber hose	Replace rubber hose.
	Coolant leakage due to deteriorated rubber hose	Replace rubber hose.
	Coolant leakage from coolant pump	Replace the coolant pump.
	Coolant leakage from rubber hose connection	Retighten or replace clamp.
	Coolant leakage from cylinder head gasket	Replace gasket.
Engine overheating (Coolant pump)	Bearing seizure	Replace.
	Damaged (corroded) vane	Replace vane.
Engine overheating (Radiator)	Clogged with rust or scale	Clean radiator.
	Clogged with iron oxide due to leakage of exhaust into cooling system	Clean coolant passage and correct exhaust leakage.
	Coolant leakage	Repair or replace radiator.
	Damaged cooling fan	Replace cooling fan.
	Clogged radiator core due to mud or other debris	Clean radiator.
	Defective radiator cap pressure valve	Replace radiator cap.
Engine overheating (Abnormal combustion)	Poor fuel	Use good quality fuel.
	Breakdown of injector	Replace the injector.
Engine overheating (Other problems)	Defective or deteriorated engine oil	Change engine oil.
	Unsatisfactory operation of oil pump	Replace or repair.
	Insufficient oil	Add oil.
	Brake drag	Repair or adjust.
	Break water temperature sensor	Replace it.
Engine overheating (Severe operating condition)	Lugging the engine	Operate engine properly.

SHTS00Z000200050

TROUBLESHOOTING USING A DIAGNOSIS MONITOR

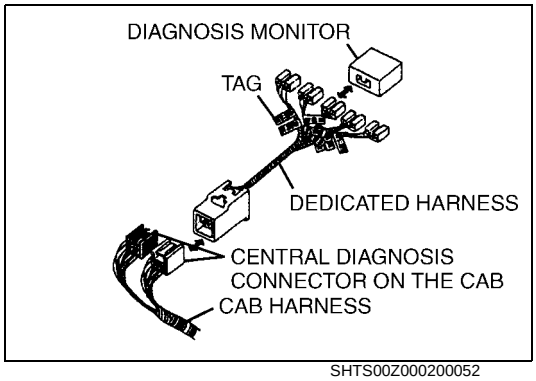
EN00Z0002F200002



SHTS00Z000200051

1. DIAGNOSIS MONITOR

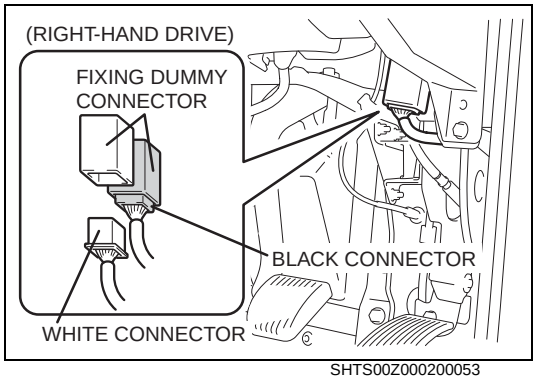
(1) When connected to the diagnosis connector dedicated to each system, the diagnosis monitor indicates a faulty section with sound and light.
SST: Diagnosis Monitor (S0963-01370)



SHTS00Z000200052

2. CONNECTION OF DIAGNOSIS MONITOR

(1) Turn "ON" the starter switch.
(2) Connect a dedicated harness to the black (or white) connector out of the central diagnosis connectors (total 2) at the lower right section of the instrumental panel at the driver's seat, and connect the diagnosis monitor to the connector having the tag of "each system name".
SST: Dedicated Harness (S0963-02300)



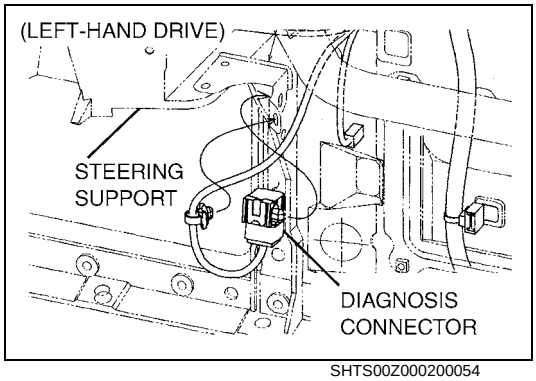
SHTS00Z000200053

⚠ CAUTION

The central diagnosis connectors are normally connected to the fixing dummy connectors. Remove the central diagnosis connectors from the dummy connectors before using them. When the central diagnosis connectors are not used, they should be engaged into the fixing dummy connectors.

HINT

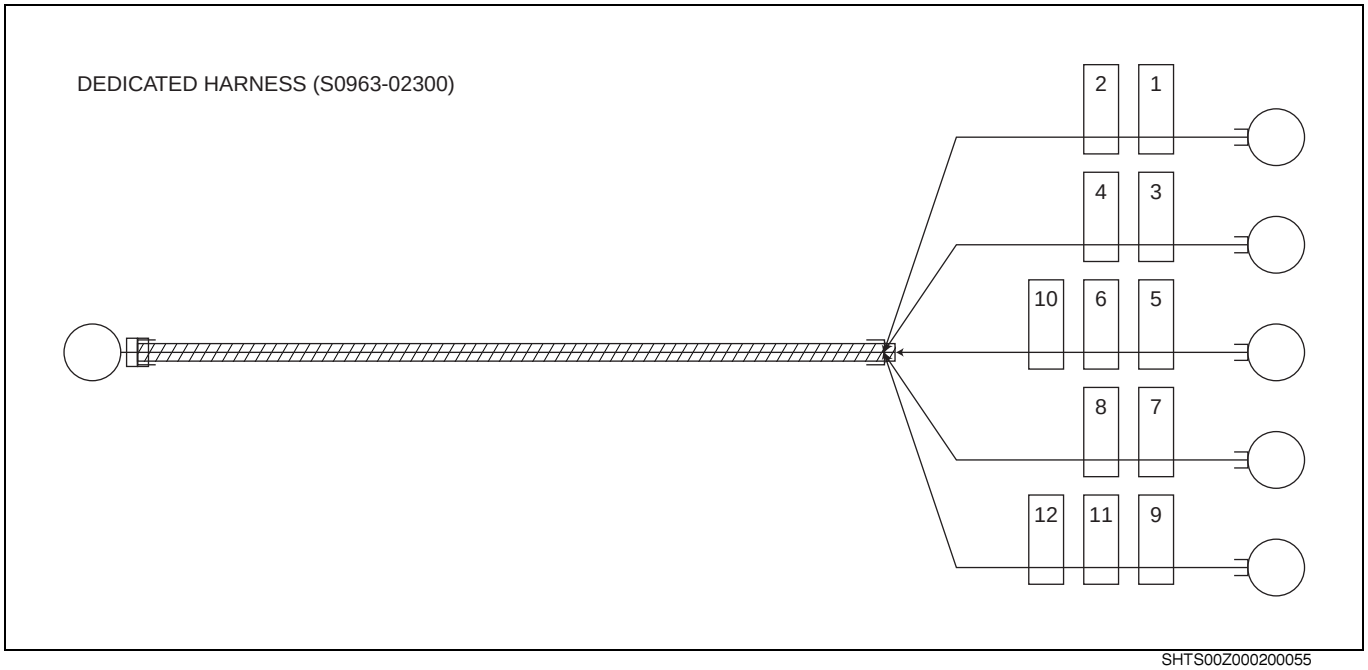
- **Turning "ON" the starter switch with the diagnosis monitor connected causes the diagnosis monitor to keep sounding without outputting diagnosis monitor codes. First turn "ON" the starter switch, wait at least ten seconds, and connect the diagnosis monitor.**
- **The method for outputting diagnosis monitor codes differs from system to system. Follow the instruction in the chapter for each system.**



SHTS00Z000200054

TAG AND SYSTEM NAME OF DEDICATED HARNESS

	Tag name	Name of system to be diagnosed
1	STD: ENG	Common rail
3	STD: AIR BAG	AIR BAG (SEAT BELT WITH PRETENSIONER)
5	STD: ABS/ASR	ABS
7	STD: ES START	ES START
10	STD: VSC	Not used
11	STD: TIRE	Not used
2	OPT: RTD/4WD	Not used
4	OPT: SHAKAN	Not used
6	OPT: AIR SUS	Not used
8	OPT: IDL STOP	Not used
9	OPT: ATM	Not used
12	OPT: PRO SHIFT	Not used



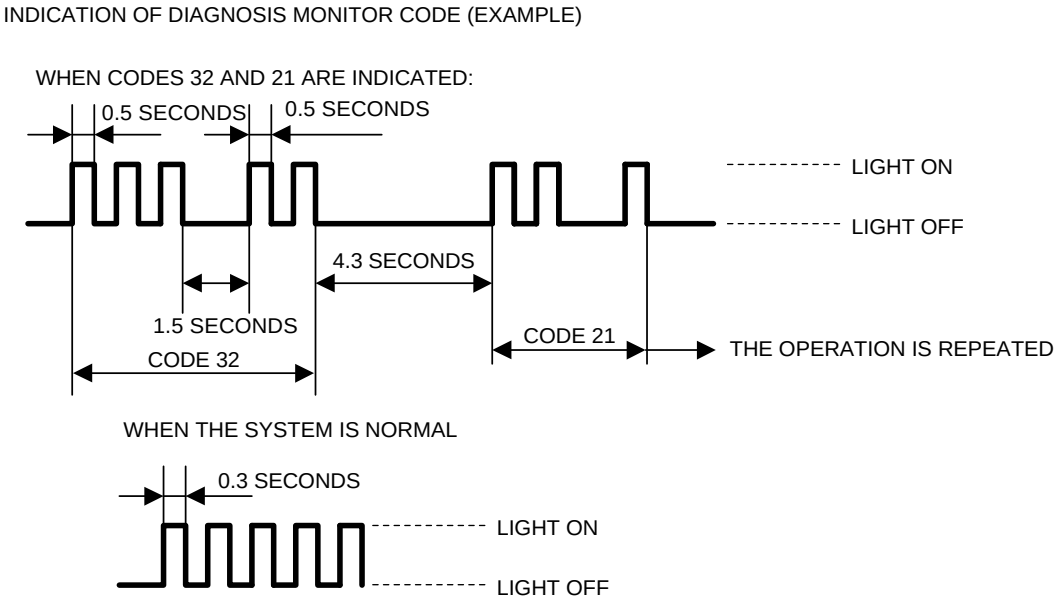
SHTS00Z000200055

3. INDICATION OF DIAGNOSIS MONITOR CODE

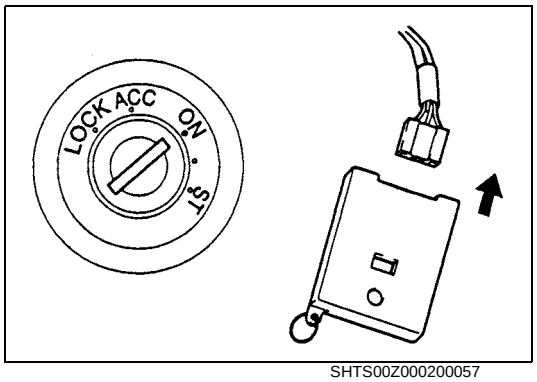
(1) Diagnosis code can be checked on the diagnosis monitor and check engine light. For example, diagnosis codes 32 and 21 are indicated as described below. The indication method uses the blinking interval of light. For the first code, "3" in the ten place illuminates for 0.5 seconds three times and twice after 1.5 seconds. For the second code, the light illuminates twice and once for the same period as the first code after an interval of 4.3 seconds; this operation is repeated. In case there is no fault in the system, light repeats blinking for 3 seconds.

HINT

Indication of a diagnosis code in the figure below is a typical example. For details, refer to chapter on each system.



SHTS00Z000200056



SHTS00Z000200057

4. ERASURE OF PAST FAULTS

(1) Record the first output diagnosis monitor code.

(2) Remove the diagnosis monitor with the starter key in the "ON" position.

⚠ CAUTION

- **If the starter key is placed in "LOCK" position, the past faults are not erased. Keep the starter key "ON".**
- **Erase the malfunction code memory using the PC DIAGNOSIS TOOL (Hino DX).**

(3) Wait at least 5 seconds. Connect the diagnosis monitor to output the current fault information.

5. HOW TO USE TROUBLESHOOTING BY DIAGNOSIS MONITOR CODE

(1) The "diagnosis code table" and "Troubleshooting by code" are shown for each system which outputs diagnosis codes. In case the diagnosis code is identified, troubleshooting may be initiated referring to the code list.

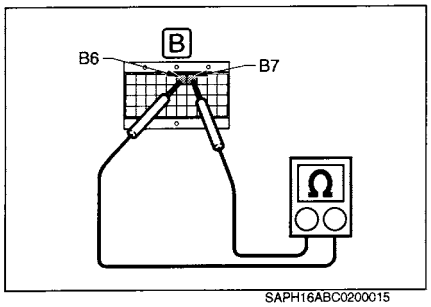
EXAMPLE

DN02–32 FUEL CONTROL (E13C)

ENGINE SPEED MAIN SENSOR

EN16ABC02F200008

MC No.	13	DTC No.	P0335	Engine speed main sensor circuit malfunction



SAPH16ABC0200015

1. CHECK THE RESISTANCE BETWEEN TERMINALS.

(1) Set the starter switch to "LOCK" and connect the signal check harness.

(2) Disconnect the signal check harness connector on the ECU side.

(3) Measure the resistance between NE1+ (B6) and NE1- (B7) terminals.

Standard: APPROX. 108.5 — 142.5 Ω at 20°C {68°F}

Working description

NO → Proceed to 3

YES

2. RECHECK THE MC or DTC.

(1) Connect the signal check harness connector on the ECU side.

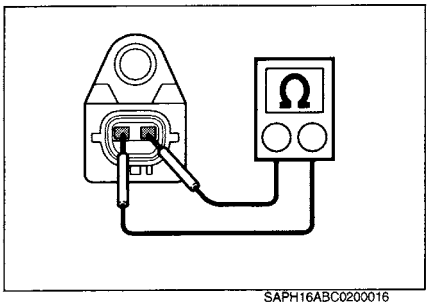
(2) Erase the MC or DTC memory.

(3) Check the MC or DTC.

NO →
- Bad contact of ECU connectors
- Malfunction of ECU
- Malfunction of harness (Short circuit)

YES

Normal



SAPH16ABC0200016

3. CHECK THE ENGINE SPEED MAIN SENSOR.

(1) Disconnect the connectors of engine speed main sensor.

(2) Measure the resistance between terminals of engine speed main sensor.

Standard: APPROX. 108.5 — 142.5 Ω at 20°C {68°F}

Indicating the need for replacement of the engine speed main sensor.

NO → Malfunction of engine speed main sensor

YES

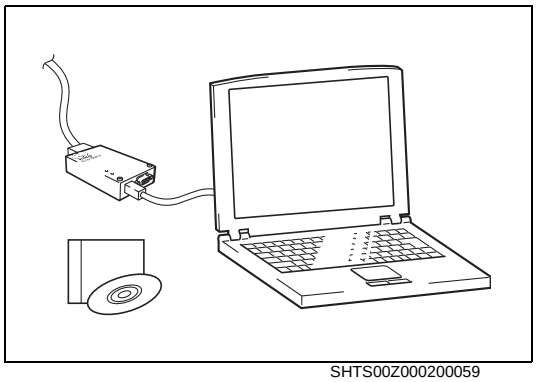
Check the harness of related circuit and repair the defective section.

- Harness disconnection
- Bad contact of connectors

SHTS00Z000200058

DIAGNOSIS USING THE PC (PERSONAL COMPUTER) DIAGNOSIS TOOL WITH INTERFACE

EN00Z0002F200003



SHTS00Z000200059

1. DIAGNOSIS TOOL

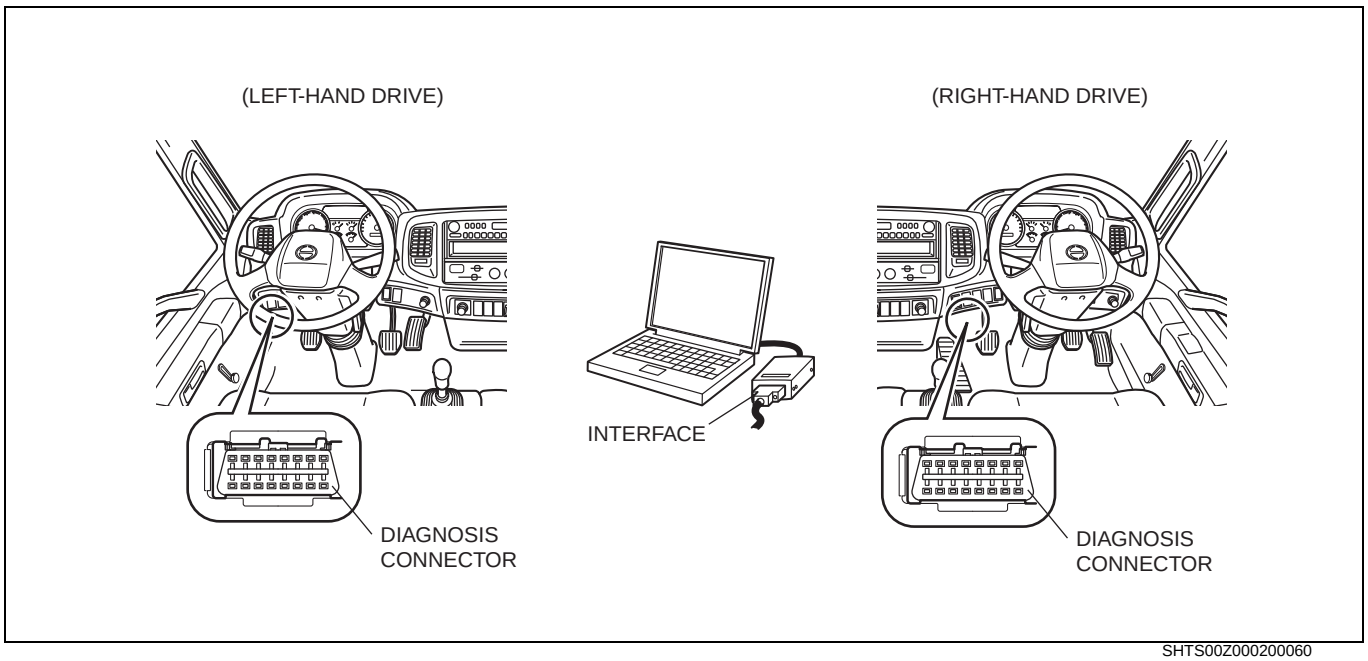
- Trouble diagnosis can be performed using the PC diagnosis tool. By connection to the diagnosis connector, the trouble location is indicated.

SST:
Interface Box (Hino-Bowie) (09993-E9070)
Cable between vehicle & Hino-Bowie (S0904-21220)
Diagnosis software: HINO Diagnostic explorer (DX)
Reprogramming software: HINO Reprog Manager

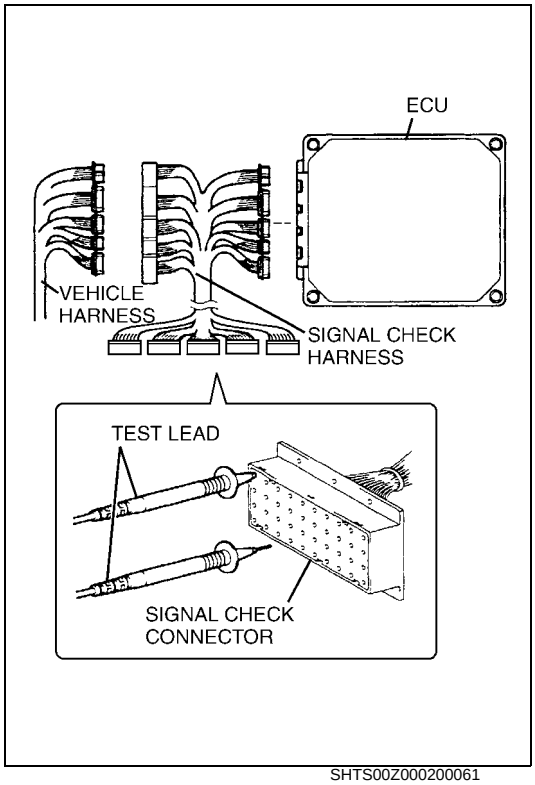
NOTICE
Only ECU reprogramming can be performed by authorized HINO dealer.

2. CONNECT THE PC DIAGNOSIS TOOL

(1) Turn the starter switch to the "LOCK" position.
(2) Connect the diagnosis cable between diagnosis connector and interface.
(3) Connect the interface to the PC.
(4) Turn the starter switch to the "ON" position.
(5) The opening menu will be displayed on the PC screen.



SHTS00Z000200060



SHTS00Z000200061

3. CONNECTION OF SIGNAL CHECK HARNESS

(1) To prevent damage to ECU connector and improve workability, connect a signal check harness. Perform measurement while placing the test lead on the signal check connector of the signal check harness.

a. Remove the connector from ECU.

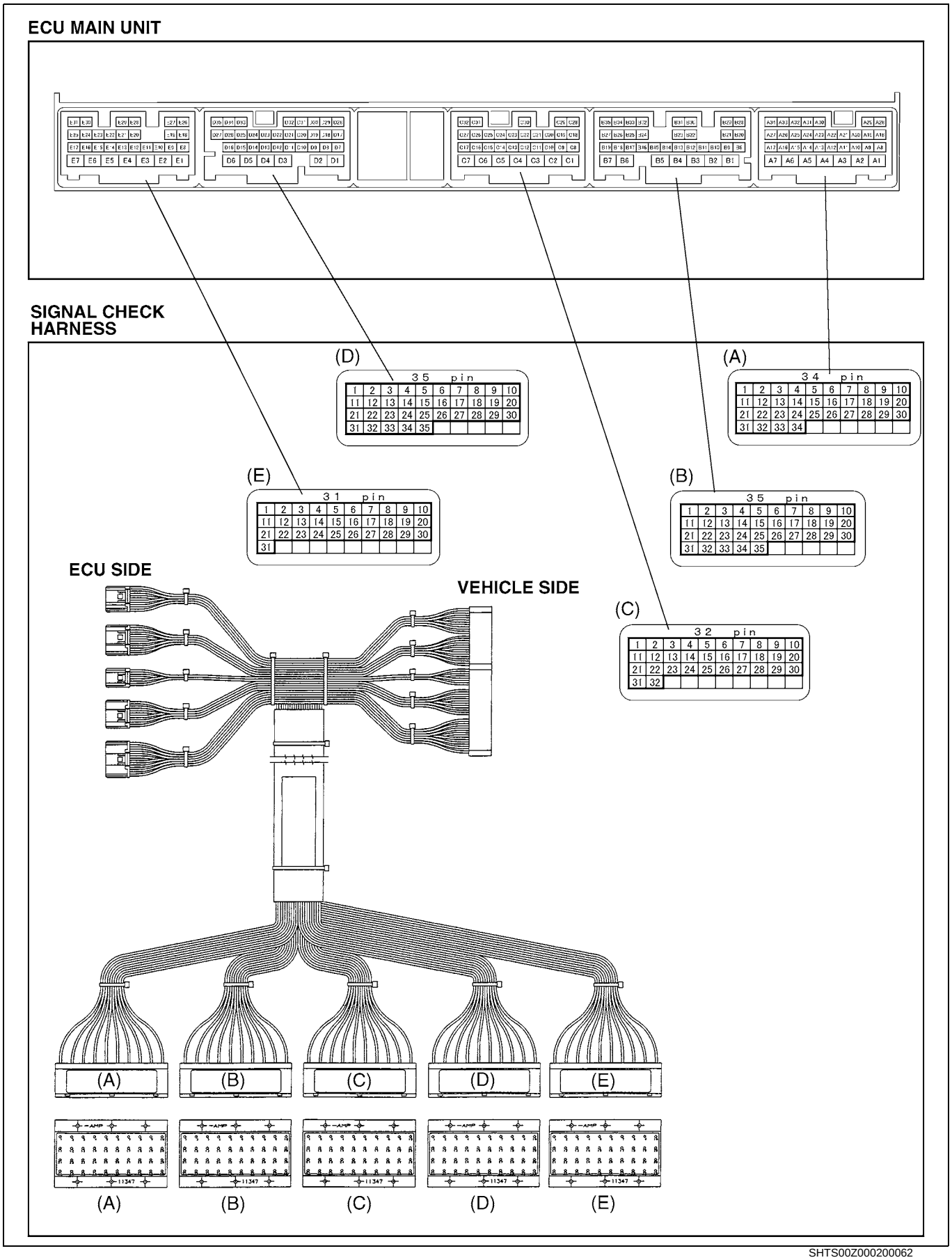
⚠ CAUTION

Take care not to snap off the lock lug of the connector.

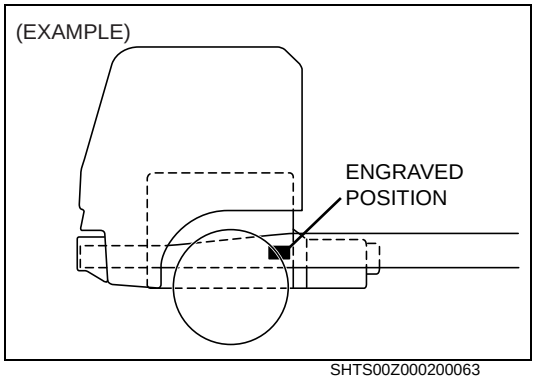
b. Connect a signal check harness to the vehicle harness and ECU.

SST: Signal Check Harness (for common rail type fuel injection system) (S0904-91080)

(2) Terminal number
ECU terminal numbers in the text correspond to connectors of signal check harness as shown below.



SHTS00Z000200062



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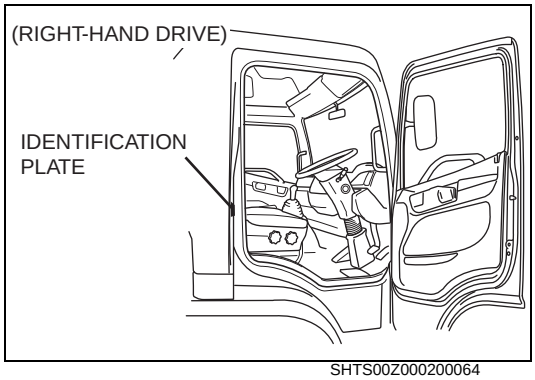
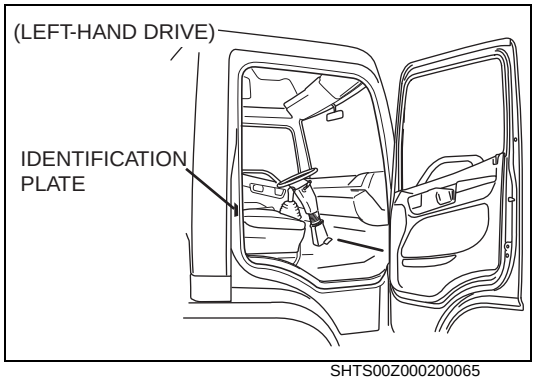


SHTS00Z000200064



SHTS00Z000200065

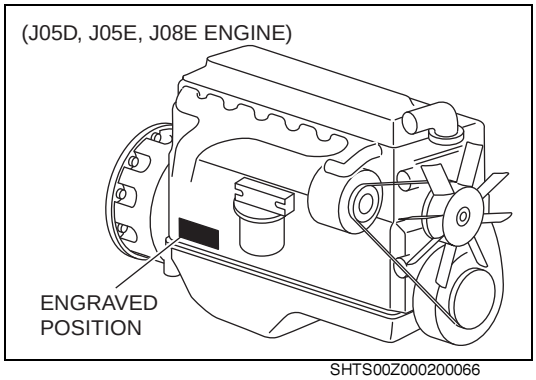
CHASSIS SERIAL NUMBER, VEHICLE IDENTIFICATION NUMBER AND ENGINE SERIAL NUMBER

EN00Z0002C100011

1. VEHICLE MODEL AND CHASSIS SERIAL NUMBER OR VEHICLE IDENTIFICATION NUMBER

(1) Vehicle model and chassis serial number or vehicle identification number are engraved near the front wheel of the right or left frame of the vehicle. When ordering parts, notify us of these numbers for quick support.

(2) At the step inside the right door of the cab is attached an identification plate stamped the vehicle model and chassis serial number or vehicle identification number.



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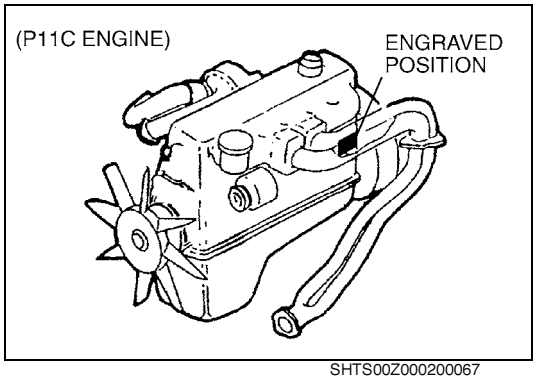

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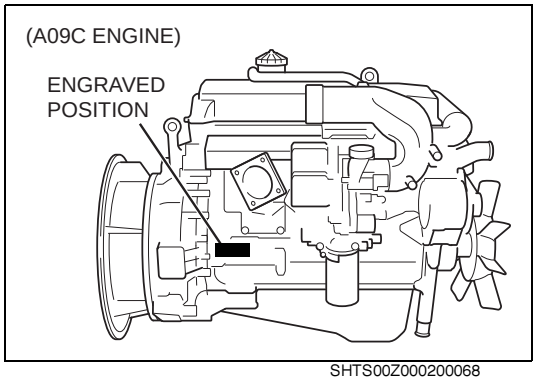


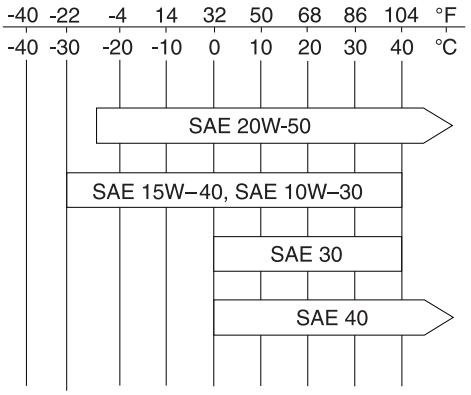
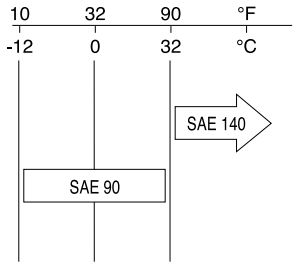
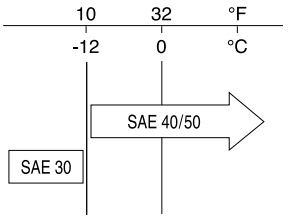
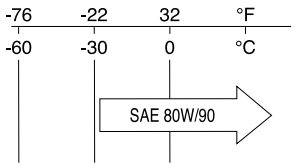
SHTS00Z000200068

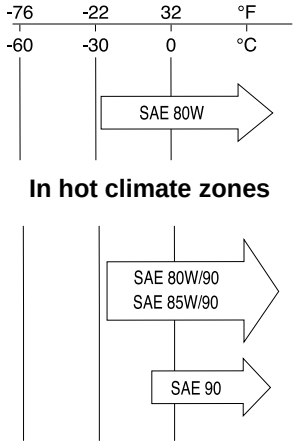
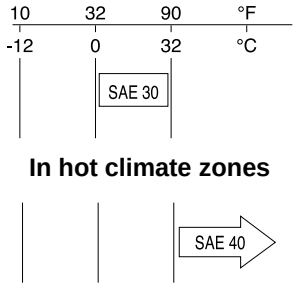
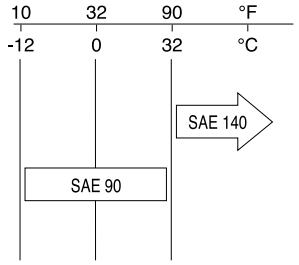
2. ENGINE MODEL AND ENGINE SERIAL NUMBER

(1) Engine model and engine serial number are engraved on the right side of the cylinder block.
When ordering parts, notify us of these numbers for quick support.

RECOMMENDED LUBRICANTS

EN00Z0002C100012

No.	LUBRICANTS	POSITIONS	VISCOSITY RECOMENDATIONS (SAE)
1	**Engine oil** **(JASO: DH-1, DH-2*1)** **(API: CD*2, CE*2, CF, CH-4, CI-4, CJ-4)** **(ACEA: E-3, E-4, E-5*1, E-6)** ***1: HINO recommends these oil to the EURO4/EPA07 regulation countries, and use ultra-low sulfur fuel only.** ***2: These oil grades do not comply with the latest exhaust emission (EURO4/EPA07 etc.) regulations, and HINO cannot recommend the use of these oil grades.**	**Cylinder block**	
2	**Gear oil** **(API: GL-4)**	**Transmission:** **LX06S, LJ06S, MF06S, HK06S**	
	Gear oil **[API: CD (Mineral oil)]**	**Transmission:** **EATON** **FS6109, FS8209** **FULLER** **RT8908LL, RTO11909ALL**	
	Gear oil **(API: GL-4)**		
	Eaton Approved Synthetic oil **Eaton Approved Semi-Synthetic oil**		**—**

No.	LUBRICANTS	POSITIONS	VISCOSITY RECOMENDATIONS (SAE)
2	Gear oil (API: GL-4) (MIL-L-2105)	Transmission: ZF9S109	
	Engine oil (API: CD, CE, CF, SF, SG) (MIL-L-2104C, D, E) (MIL-L-46152C, D, E)		
	Gear oil (ZF-Ecofluid M 02B/02D/02E/02L)	Transmission: ZF9S1110, ZF9S1310	SAE 75W-80/75W-85/75W-90: Above -40°C {-40°F}
	(ZF-Ecofluid M 02A/02B)		SAE 80W/80W-85/80W-90: Above -20°C {-4°F}
3	Hypoid gear oil (API: GL-5)	Differential (Rear): SH13, SH14, SH16, SH17, SH18, THD17	
4	Gear oil (API: GL-4)	Steering	

No.	LUBRICANTS	POSITIONS
5	Power steering fluid (ATF DEXRON)	Integral power steering gear
6	Brake fluid (DOT-3) or (DOT-4)	Brake
7	Clutch fluid (DOT-3) or (DOT-4)	Clutch
8	Wheel bearing grease Lithium base wheel bearing grease NLGI No.2 LITHIUM-SOAP	Wheel hub
9	Chassis grease Lithium base multipurpose grease No.2	Steering, suspension, etc.

CLUTCH MAIN UNIT (CS350)

CL02-001

CLUTCH ASSEMBLY (CS350) CL02-2
DATA AND SPECIFICATIONS.....CL02-2
DESCRIPTION CL02-3
TROUBLESHOOTING.....CL02-4
SPECIAL TOOL.....CL02-5
COMPONENT LOCATOR CL02-6
OVERHAUL CL02-7
INSPECTION AND REPAIR.....CL02-13

CLUTCH ASSEMBLY (CS350)

DATA AND SPECIFICATIONS

EN0220402I200001

CLUTCH FACING **Unit: mm {in.}**

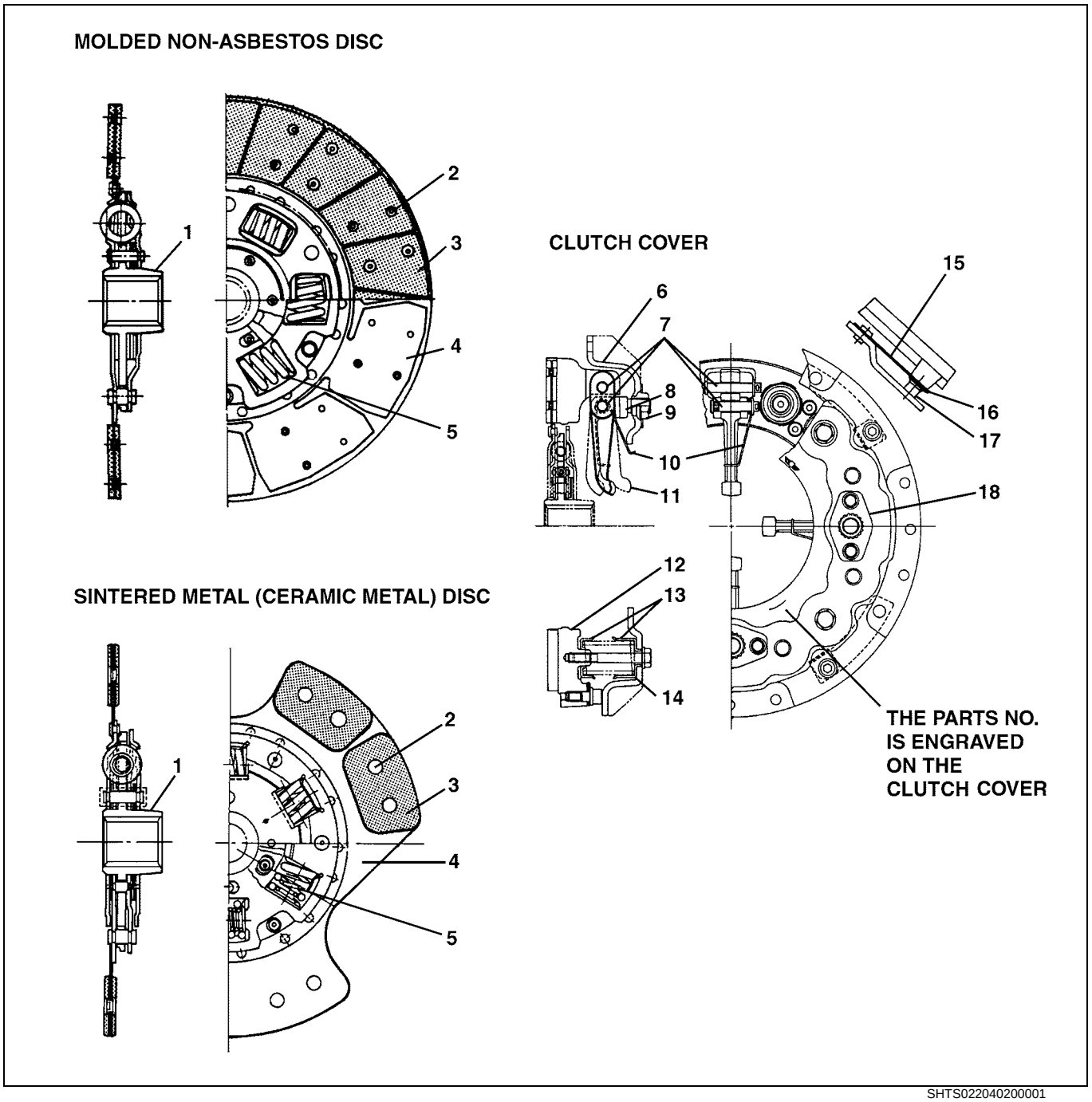
Material	**Molded non-asbestos**	**Sintered metal (Ceramic metal)**
Type	**Dry single plate with damper spring**	
Outside diameter	**350 {13.780}**	
Inside diameter	**220 {8.661}**	
Thickness	**4.5 {0.1772}**	**4.41 {0.1736}**

COMPRESSION SPRING **Unit: mm {in.}**

Clutch cover parts No.	**31210-E0190**
Free length	**83.4 {3.283}**
Coil outside diameter	**30.5 {1.201}**
Diameter of wire	**5.5 {0.217}**
Quantity	**12**
Setting load	**1,243.5 N {126.8 kgf, 279.5 lbf}**
Setting length	**54.8 {2.157}**

DESCRIPTION

EN0220402C100001



SHTS022040200001

1	Clutch disc hub	10	Torsion spring
2	Rivet	11	Release lever
3	Clutch facing	12	Pressure plate
4	Clutch plate	13	Spring seat
5	Damper spring	14	Compression spring
6	Clutch cover	15	Strap plate
7	Release lever pin	16	Friction washer
8	Release lever support	17	Strap plate bolt
9	Release lever support nut	18	Lock plate

TROUBLESHOOTING

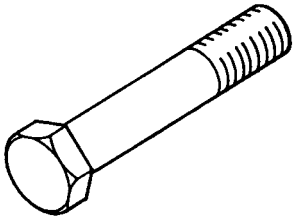
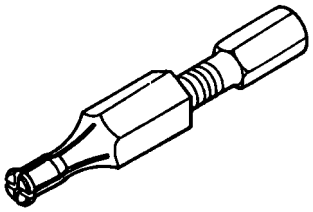
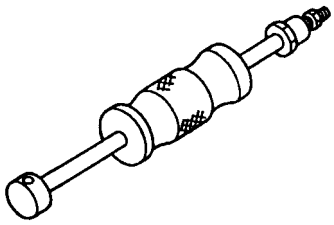
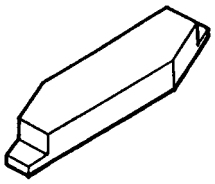
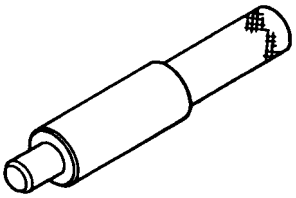
EN0220402F300001

Symptom	Possible cause	Remedy/Prevention
Clutch dragging	Clutch disc distorted or warped.	Replace clutch disc.
	Release lever incorrectly adjusted.	Adjust release lever.
	Transmission input shaft worn.	Replace input shaft and check clutch hub for excessive wear. If worn, replace disc. Check flywheel housing alignment.
Clutch slipping	Release lever and release bearing clearance incorrectly adjusted.	Adjust clearance.
	Clutch disc facing gummed with oil or grease.	Replace facing or disc assembly.
	Release bearing worn.	Replace bearing.
	Clutch pedal free-play incorrectly adjusted.	Adjust free-play.
	Compression spring weak.	Replace compression spring.
	Clutch facing worn.	Replace facing or disc assembly.
Vehicle vibrates when starting.	Improper engine idling.	Adjust idling.
	Clutch control incorrectly adjusted.	Adjust clutch control.
	Clutch disc facing gummed with oil or grease.	Replace facing or disc assembly.
	Glazed flywheel friction surface.	Unglazed flywheel surface with coarse emery cloth, stroking parallel to machining lines.
	Clutch disc distorted or warped.	Replace disc.
	Improper clutch cover tightening.	Tighten bolts.
	Flywheel housing misalignment.	Replace flywheel housing.
	Release lever incorrectly adjusted.	Adjust release lever.
Noisy clutch	Release bearing worn or dried.	Replace release bearing.
	Pilot bearing worn.	Replace pilot bearing.
	Clutch disc distorted or warped.	Replace clutch disc.
	Flywheel housing misalignment.	Replace flywheel housing.
	Transmission input shaft or clutch disc spline worn.	Clean and lubricate or replace.
	Release lever incorrectly adjusted.	Adjust release lever.
	Insufficient lubrication of pedal and its accessories.	Lubricate.
	Insufficient lubrication of release bearing hub.	Lubricate.
	Transmission input shaft retainer rusted or soiled.	Clean or replace if rusted.
	Clutch pedal free-play incorrectly adjusted.	Adjust free-play.
Clutch pedal can not be depressed.	Clutch control incorrectly adjusted.	Adjust clutch control.
	Insufficient lubricant release bearing hub.	Lubricate.
Change in clutch pedal give.	Air trapped in clutch fluid.	Bleed air.

SPECIAL TOOL

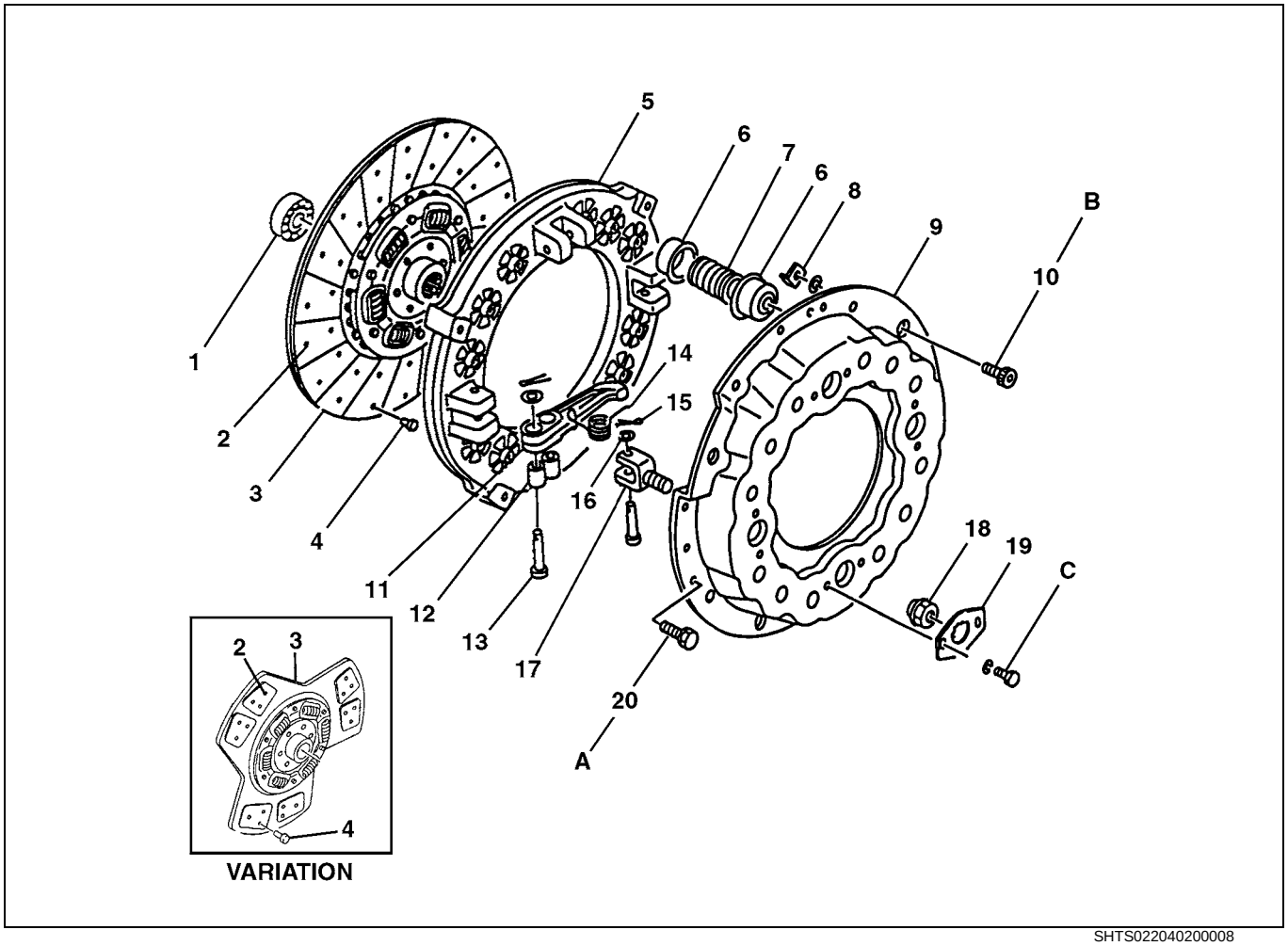
EN0220402K100001

Prior to starting a clutch main unit overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	SH112-61070	CLUTCH PRESSURE PLATE FIXING BOLT	
	SL611-01024	PLAIN WASHER	
	S0965-01970	CLUTCH PILOT BEARING PULLER	
	S0942-01442	SLIDING HAMMER	
	S0966-11030	CLUTCH RELEASE LEVER HEIGHT GAUGE	
	S0966-21200	CLUTCH ALIGNING ARBOR	

COMPONENT LOCATOR

EN0220402D100001



SHTS022040200008

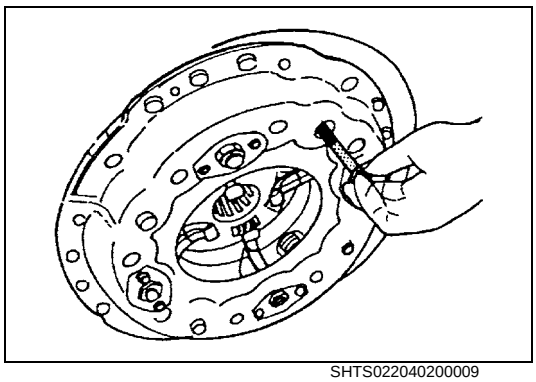
1	Pilot bearing	11	Release lever
2	Clutch facing	12	Bushing
3	Disc assembly	13	Release lever pin
4	Rivet	14	Torsion spring
5	Pressure plate	15	Cotter pin
6	Spring seat	16	Plain washer
7	Compression spring	17	Release lever support
8	Friction washer	18	Release lever support nut
9	Clutch cover	19	Lock plate
10	Strap plate bolt	20	Fitting bolt

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	37.5-48.5 {380-500, 28-36}	C	9.8-14.7 {100-150, 7-10}
B	39.2-49.0 {400-500, 29-36}		

OVERHAUL

EN0220402H200001


SHTS022040200009

IMPORTANT POINT - DISMOUNTING

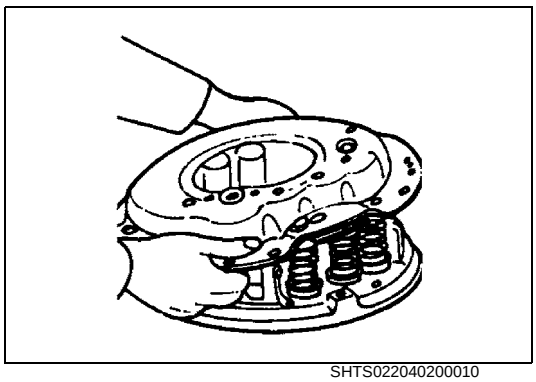
1. REMOVE THE CLUTCH COVER AND DISC.

(1) Install the four pressure plate fixing bolts and plain washers through the clutch cover into the tapped holes in the pressure plate.
SST:
Pressure Plate Fixing Bolt (SH112-61070)
Plain Washer (SL611-01024)

(2) Tighten the bolts in diagonal direction alternately and evenly to the compress the compression springs and release pressure plate tension.

(3) Loosen the fitting bolts.

⚠ CAUTION
When removing the clutch cover and clutch disc, be careful not to drop them on your foot.

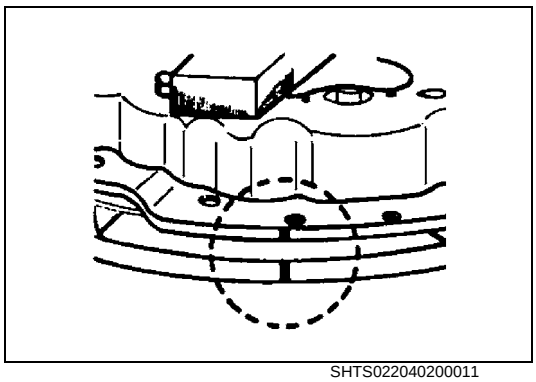

SHTS022040200010

IMPORTANT POINTS - DISASSEMBLY

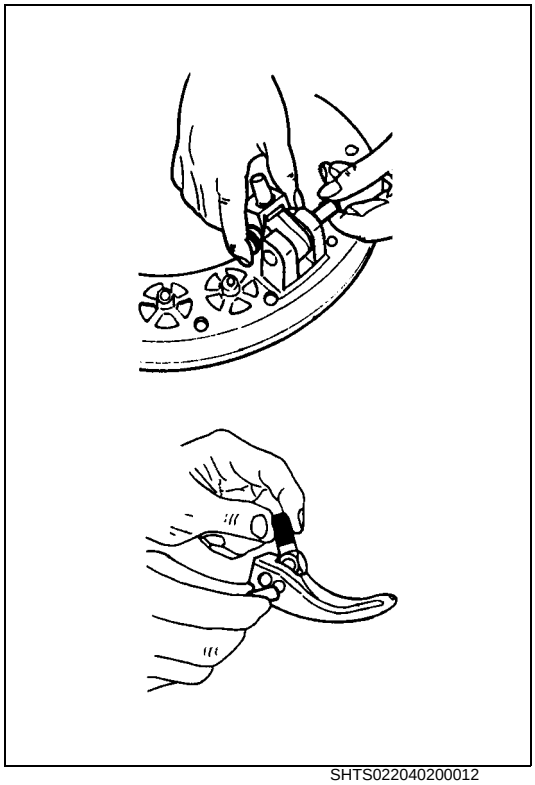
1. DISASSEMBLE THE CLUTCH COVER.

(1) Before removing the special tools and the strap plate bolt, compress the clutch cover to release the compression spring tension.

(2) Slowly release the press.


SHTS022040200011

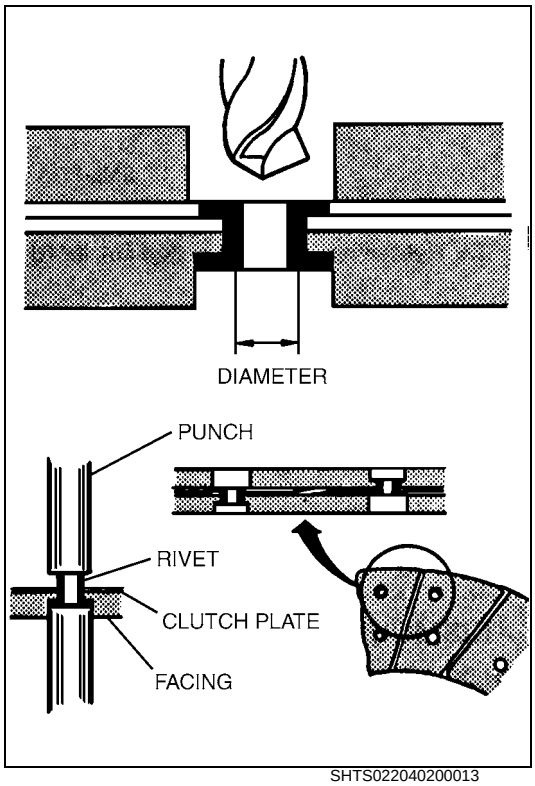
NOTICE
Before disassembling, make aligning marks on the clutch cover and pressure plate.



SHTS022040200012

2. DISASSEMBLE THE RELEASE LEVER ASSEMBLY.

(1) Remove the pin and the release lever.



SHTS022040200013

IMPORTANT POINTS - ASSEMBLY

1. REPLACE THE CLUTCH FACING.

(1) Drill off the rivets with a 5 mm {0.197 in.} diameter drill.

NOTICE

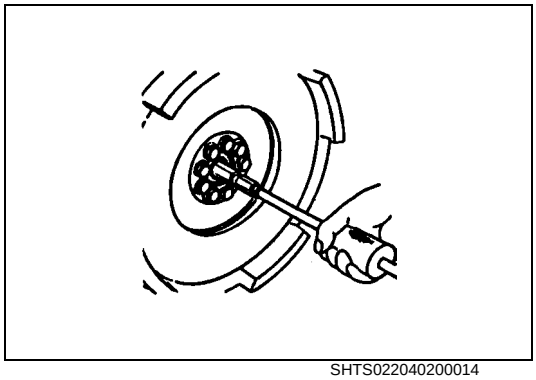
Do not remove the clutch facing with a tapping rod and a hammer or a press.

(2) Remove the old facing.

(3) Place the new facing on the clutch plate and insert the rivets into the holes so that the facing is held in position. (Secure the rivets with adhesive tape to prevent loosing them.)

(4) Using a suitable riveter, rivet the new facing. In order to distribute pressure evenly, rivet in diagonal direction alternately.

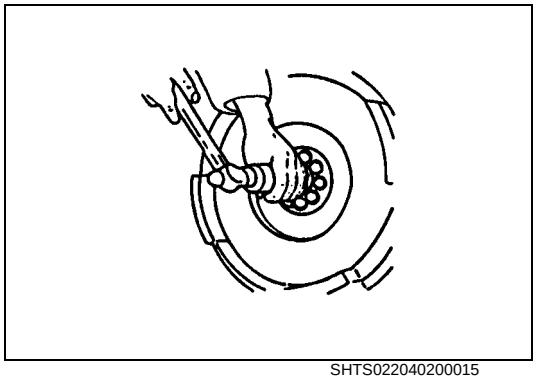
(5) Using a dial gauge, check the misalignment of the clutch disc after riveting.



SHTS022040200014

2. REPLACE THE PILOT BEARING.

(1) Remove the pilot bearing.
SST:
Pilot Bearing Puller (S0965-01970)
Sliding Hammer (S0942-01442)

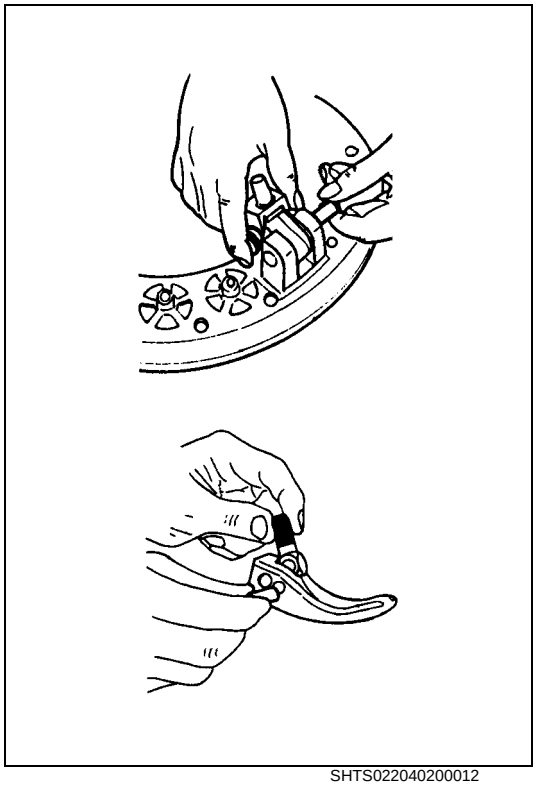


SHTS022040200015

(2) Using a suitable tapping rod, install the pilot bearing.

NOTICE

After installing the pilot bearing, ensure that it rotates smoothly.



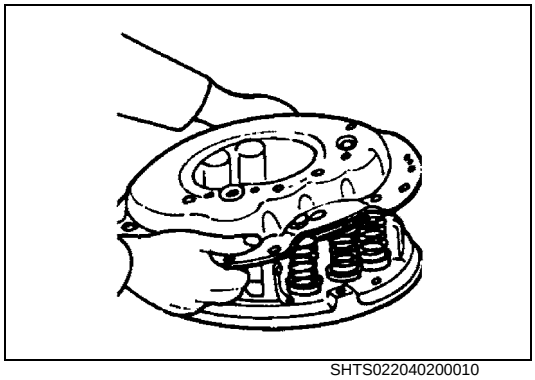
SHTS022040200012

3. INSTALL THE RELEASE LEVER.

(1) Assemble the release lever, release lever support and torsion spring, then install the release lever assembly on the pressure plate.

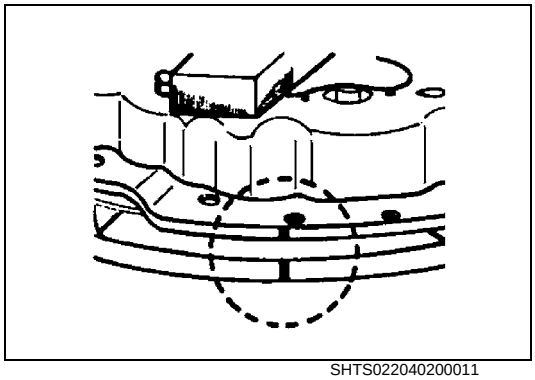
NOTICE

- **Do not coat any grease on the bushing.**
- **Coat lithium base grease to the sliding part between the clutch release lever and the pressure plate.**


SHTS022040200010

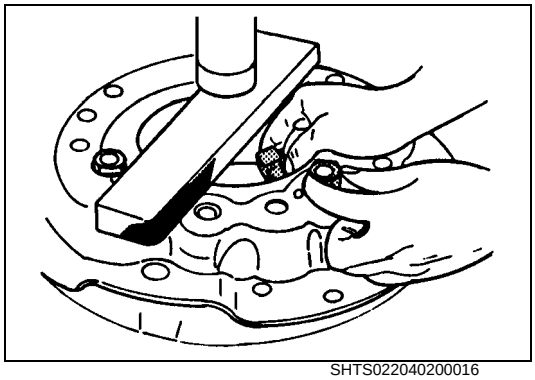
4. INSTALL THE CLUTCH COVER.

(1) Install the clutch cover in position according to the aligning marks. Compress the clutch cover to relieve the compression spring tension.


SHTS022040200011

NOTICE

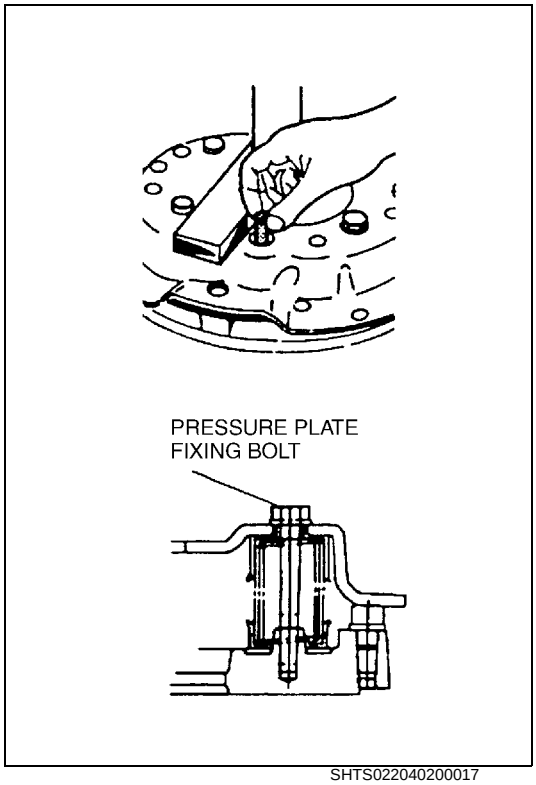
- **When compressing the clutch cover, be sure to hook up the torsion springs between clutch cover and release lever.**
- **When compressing the clutch cover, pull the release lever support up through the holes in the clutch cover.**
- **Be sure to insert the compression spring upper seats in the pressure cover.**


SHTS022040200016

(2) Temporarily tighten the release lever support nuts.

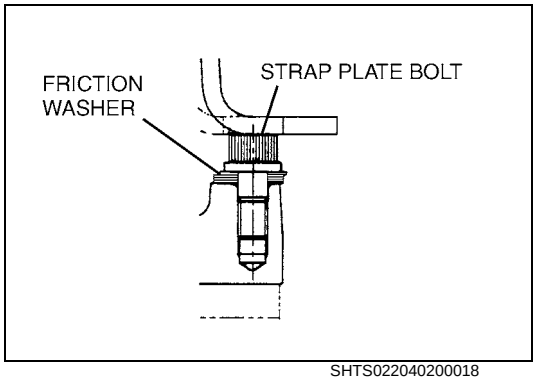
NOTICE

Coat the spherical seat of the clutch cover and threaded section of the release lever support with a small amount of anti-seizure agent.



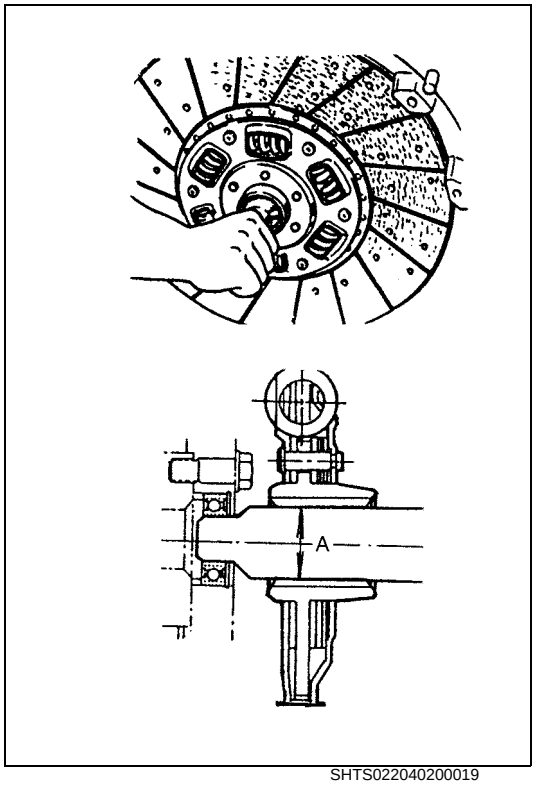
SHTS022040200017

(3) Install the four pressure plate fixing bolts with the plain washers through the clutch cover into the tapped holes in the pressure plate.
SST:
Pressure Plate Fixing Bolt (SH112-61070)
Plain Washer (SL611-01024)



SHTS022040200018

(4) Install the strap plate bolt with the friction washer and lock washer.



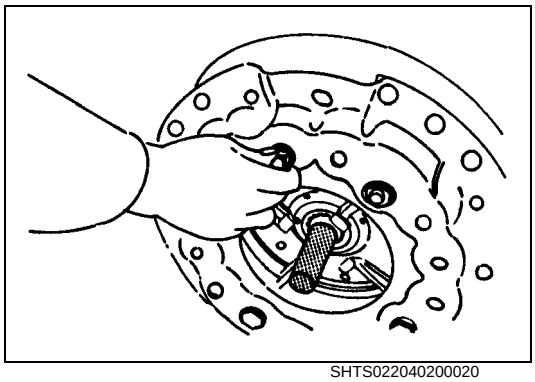
SHTS022040200019

IMPORTANT POINTS - MOUNTING

1. INSTALL THE CLUTCH DISC ON THE FLYWHEEL.

(1) Insert an aligning arbor or splined input shaft through the clutch disc hub and into the flywheel pilot bearing to position the clutch disc.
SST: Clutch Aligning Arbor (S0966-21200)

Disc hub diameter A: 36 mm {1.417 in.}

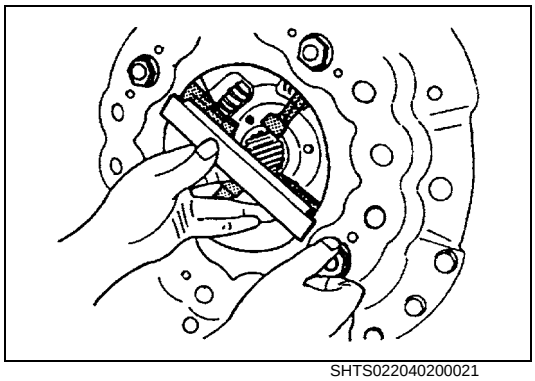

SHTS022040200020

2. INSTALL THE CLUTCH COVER ASSEMBLY.

(1) Insert the clutch cover aligning pins into each place of the clutch cover.

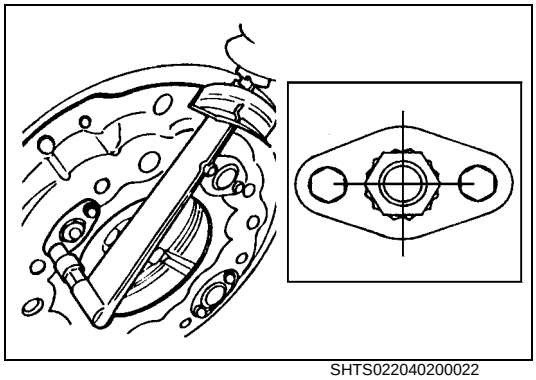
(2) Tighten the bolts evenly. Make several presses around the clutch cover until it is snug.
(3) Remove the pressure plate fixing bolts and plain washer.
(4) Remove the clutch aligning arbor.

NOTICE
When installing a new clutch cover assembly, do not forget to remove the four pressure plate fixing bolts from the clutch cover.


SHTS022040200021

3. ADJUST THE RELEASE LEVER HEIGHT WHEN INSTALLING A NEW CLUTCH DISC.

(1) Adjust the clearance of the contact surface between the special tool and the release lever by turning the release lever support nut.
Clearance: Zero
SST: Clutch Release Lever Height Gauge (S0966-11030)



SHTS022040200022

4. INSTALL THE LOCK PLATE.

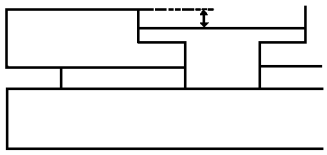
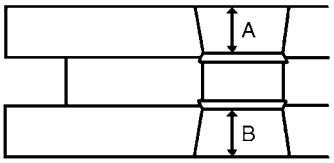
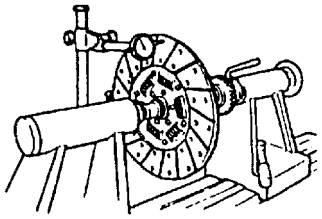
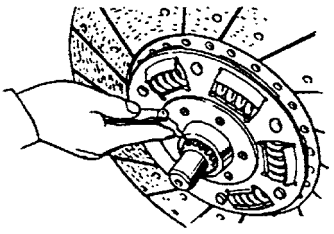
NOTICE

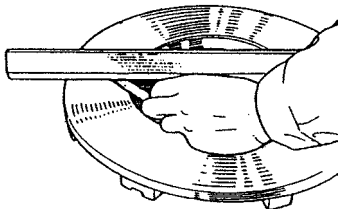
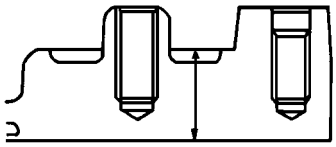
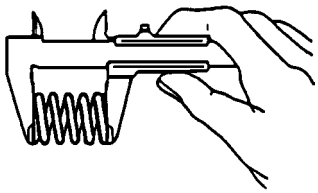
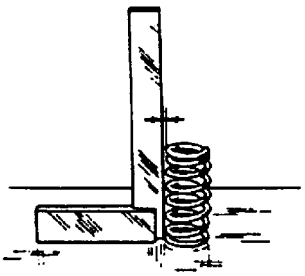
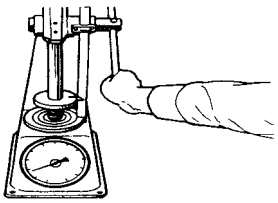
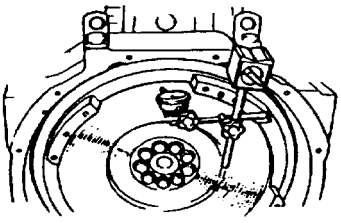
Be sure to lock the support nut with the lock plate.

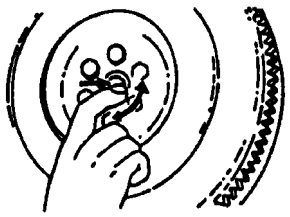
INSPECTION AND REPAIR

EN0220402H300001

Unit: mm {in.}

Inspection item		Standard		Limit	Remedy	Inspection procedure
Rivet head depth	Molded Non-asbestos	2.0-2.6 {0.0788-0.1023}		0.1 {0.0039}	Replace disc assembly or facing.	Measure 
	Sintered metal (Ceramic metal)	Flywheel side "A"	1.2 {0.0472}	0.1 {0.0039}	Replace disc assembly or facing.	Measure 
		Flywheel side "B"	2.4 {0.0945}			
Clutch disc misalignment		0-0.7 {0-0.0275}		0.7 {0.0275}	Replace.	Measure 
Oily facings Loose rivets Broken or loose damper springs		—		—	Replace disc assembly, if necessary.	Visual check
Clearance between clutch disc hub and transmission input shaft spline		0.05-0.15 {0.0020-0.0059}		0.3 {0.0118}	Replace the clutch disc or the transmission input shaft.	Measure 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pressure plate misalignment	Less than 0.1 {0.0039}	0.5 {0.0197}	Regrind the friction surface or replace.	Measure 
Pressure plate thickness	24 {0.945}	23 {0.906}	Replace.	Measure 
Pressure plate friction surface scoring or roughness	—	—	Regrind the friction surface or replace, if necessary.	Visual check
Compression spring free length	83.4 {3.283}	79.2 {3.118}	Replace.	Measure 
Compression spring squareness	—	5.0 {0.197}	Replace.	Measure 
Compression spring setting load at the specified setting length	1,243.5 N {126.8 kgf, 279.5 lbf} at 54.8 {2.157}	1,181.3 N {120.5 kgf, 266 lbf} at 54.8 {2.157}	Replace.	Measure 
Flywheel misalignment	—	0.15 {0.059}	Regrind the friction surface or replace.	Measure 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Flywheel friction surface scoring or roughness	**—**	**—**	**Regrind the friction surface or replace, if necessary.**	**Visual check**
Pilot bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

CLUTCH MAIN UNIT (CS380)

CL02-002

CLUTCH ASSEMBLY (CS380) CL02-2
DATA AND SPECIFICATIONS.....CL02-2
DESCRIPTION CL02-3
TROUBLESHOOTING.....CL02-4
SPECIAL TOOL.....CL02-5
COMPONENT LOCATOR CL02-6
OVERHAUL CL02-7
INSPECTION AND REPAIR.....CL02-13

CLUTCH ASSEMBLY (CS380)

DATA AND SPECIFICATIONS

EN0220502I200001

CLUTCH FACING **Unit: mm {in.}**

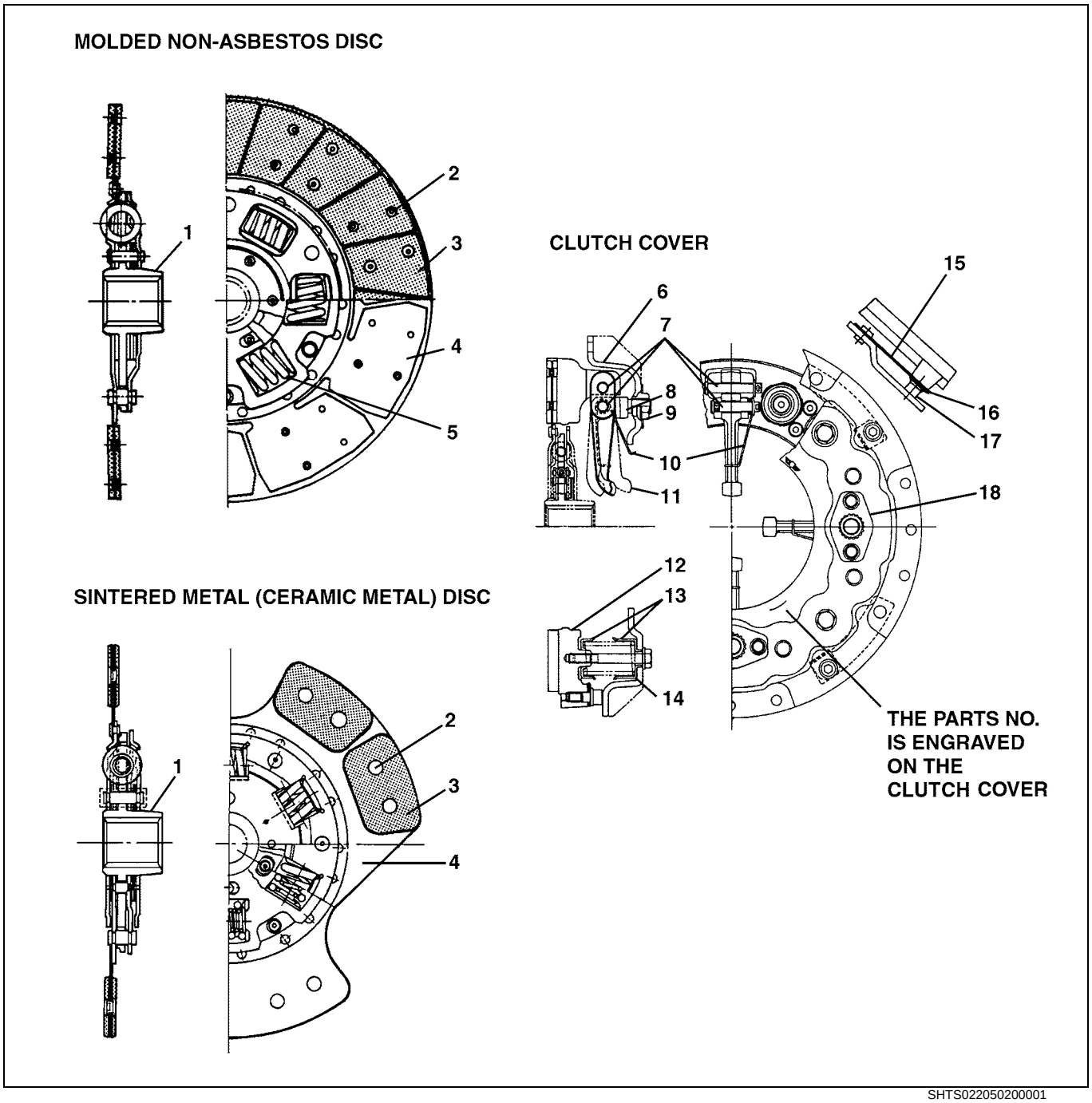
Material	**Molded non-asbestos**	**Sintered metal (Ceramic metal)**
Type	**Dry single plate with damper spring**	
Outside diameter	**380 {14.961}**	
Inside diameter	**220 {8.661}**	**—**
Thickness	**5.0 {0.197}**	**4.75 {0.187}**

COMPRESSION SPRING **Unit: mm {in.}**

Clutch cover parts No.	**31210-E0240**
Free length	**92.9 {3.657}**
Coil outside diameter	**30.5 {1.201}**
Diameter of wire	**5.5 {0.217}**
Quantity	**12**
Setting load	**1,285.5 N {131 kgf, 288.8 lbf}**
Setting length	**59.6 {2.346}**

DESCRIPTION

EN0220502C100001



SHTS022050200001

1	Clutch disc hub	10	Torsion spring
2	Rivet	11	Release lever
3	Clutch facing	12	Pressure plate
4	Clutch plate	13	Spring seat
5	Damper spring	14	Compression spring
6	Clutch cover	15	Strap plate
7	Release lever pin	16	Friction washer
8	Release lever support	17	Strap plate bolt
9	Release lever support nut	18	Lock plate

TROUBLESHOOTING

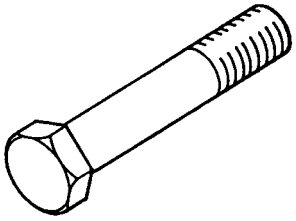
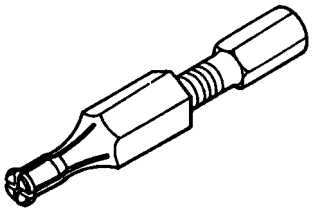
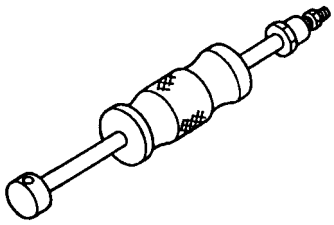
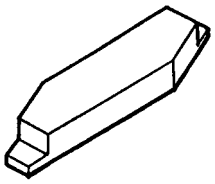
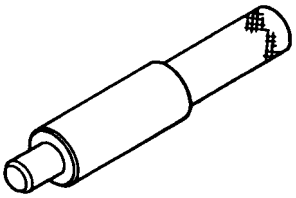
EN0220502F300001

Symptom	Possible cause	Remedy/Prevention
Clutch dragging	Clutch disc distorted or warped.	Replace clutch disc.
	Release lever incorrectly adjusted.	Adjust release lever.
	Transmission input shaft worn.	Replace input shaft and check clutch hub for excessive wear. If worn, replace disc. Check flywheel housing alignment.
Clutch slipping	Release lever and release bearing clearance incorrectly adjusted.	Adjust clearance.
	Clutch disc facing gummed with oil or grease.	Replace facing or disc assembly.
	Release bearing worn.	Replace bearing.
	Clutch pedal free-play incorrectly adjusted.	Adjust free-play.
	Compression spring weak.	Replace compression spring.
	Clutch facing worn.	Replace facing or disc assembly.
Vehicle vibrates when starting.	Improper engine idling.	Adjust idling.
	Clutch control incorrectly adjusted.	Adjust clutch control.
	Clutch disc facing gummed with oil or grease.	Replace facing or disc assembly.
	Glazed flywheel friction surface.	Unglazed flywheel surface with coarse emery cloth, stroking parallel to machining lines.
	Clutch disc distorted or warped.	Replace disc.
	Improper clutch cover tightening.	Tighten bolts.
	Flywheel housing misalignment.	Replace flywheel housing.
	Release lever incorrectly adjusted.	Adjust release lever.
Noisy clutch	Release bearing worn or dried.	Replace release bearing.
	Pilot bearing worn.	Replace pilot bearing.
	Clutch disc distorted or warped.	Replace clutch disc.
	Flywheel housing misalignment.	Replace flywheel housing.
	Transmission input shaft or clutch disc spline worn.	Clean and lubricate or replace.
	Release lever incorrectly adjusted.	Adjust release lever.
	Insufficient lubrication of pedal and its accessories.	Lubricate.
	Insufficient lubrication of release bearing hub.	Lubricate.
	Transmission input shaft retainer rusted or soiled.	Clean or replace if rusted.
	Clutch pedal free-play incorrectly adjusted.	Adjust free-play.
Clutch pedal can not be depressed.	Clutch control incorrectly adjusted.	Adjust clutch control.
	Insufficient lubricant release bearing hub.	Lubricate.
Change in clutch pedal give.	Air trapped in clutch fluid.	Bleed air.

SPECIAL TOOL

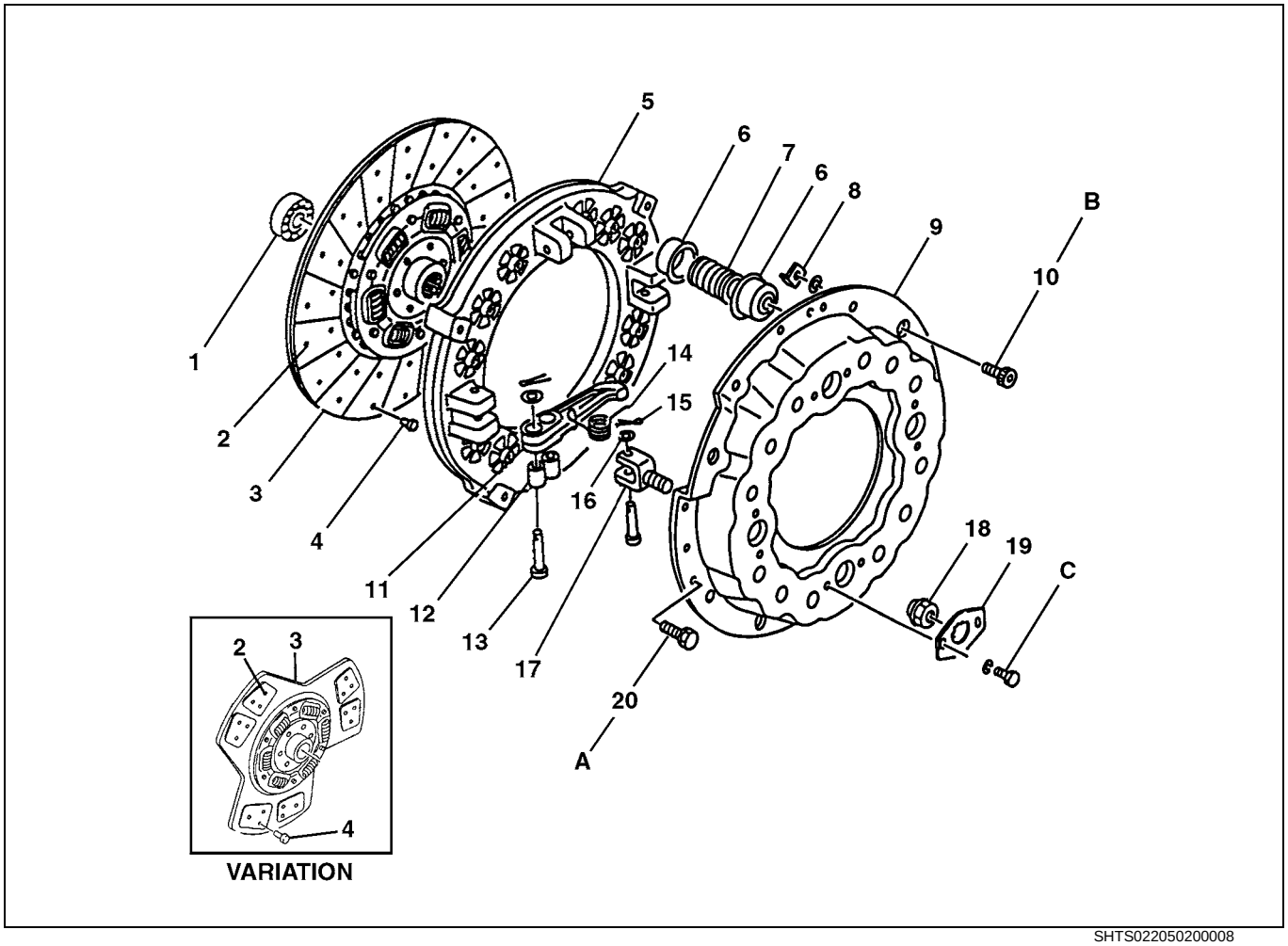
EN0220502K100001

Prior to starting a clutch main unit overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	SH112-61070	CLUTCH PRESSURE PLATE FIXING BOLT	
	SL611-01024	PLAIN WASHER	
	S0965-01970	CLUTCH PILOT BEARING PULLER	
	S0942-01442	SLIDING HAMMER	
	S0966-11030	CLUTCH RELEASE LEVER HEIGHT GAUGE	
	S0966-21200	CLUTCH ALIGNING ARBOR	

COMPONENT LOCATOR

EN0220502D100001



SHTS022050200008

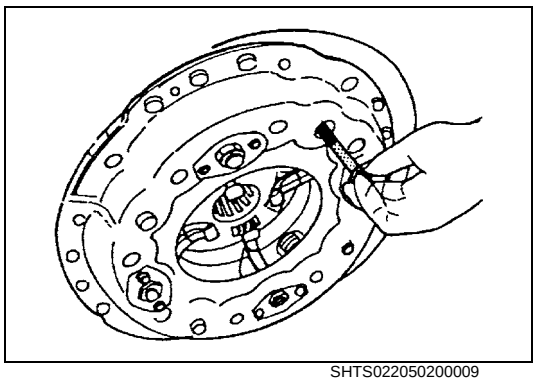
1	Pilot bearing	11	Release lever
2	Clutch facing	12	Bushing
3	Disc assembly	13	Release lever pin
4	Rivet	14	Torsion spring
5	Pressure plate	15	Cotter pin
6	Spring seat	16	Plain washer
7	Compression spring	17	Release lever support
8	Friction washer	18	Release lever support nut
9	Clutch cover	19	Lock plate
10	Strap plate bolt	20	Fitting bolt

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	64-84 {653-856, 48-61}	C	9.8-14.7 {100-150, 7-10}
B	39.2-49.0 {400-500, 29-36}		

OVERHAUL

EN0220502H200001


SHTS022050200009

IMPORTANT POINT - DISMOUNTING

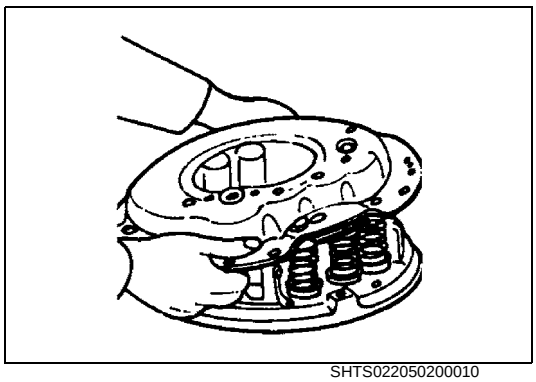
1. REMOVE THE CLUTCH COVER AND DISC.

(1) Install the four pressure plate fixing bolts and plain washers through the clutch cover into the tapped holes in the pressure plate.
SST:
Pressure Plate Fixing Bolt (SH112-61070)
Plain Washer (SL611-01024)

(2) Tighten the bolts in diagonal direction alternately and evenly to the compress the compression springs and release pressure plate tension.

(3) Loosen the fitting bolts.

⚠ CAUTION
When removing the clutch cover and clutch disc, be careful not to drop them on your foot.

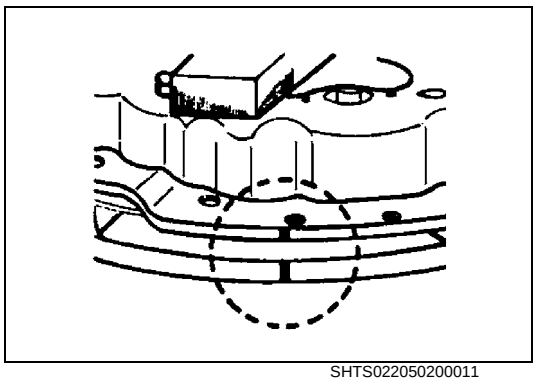

SHTS022050200010

IMPORTANT POINTS - DISASSEMBLY

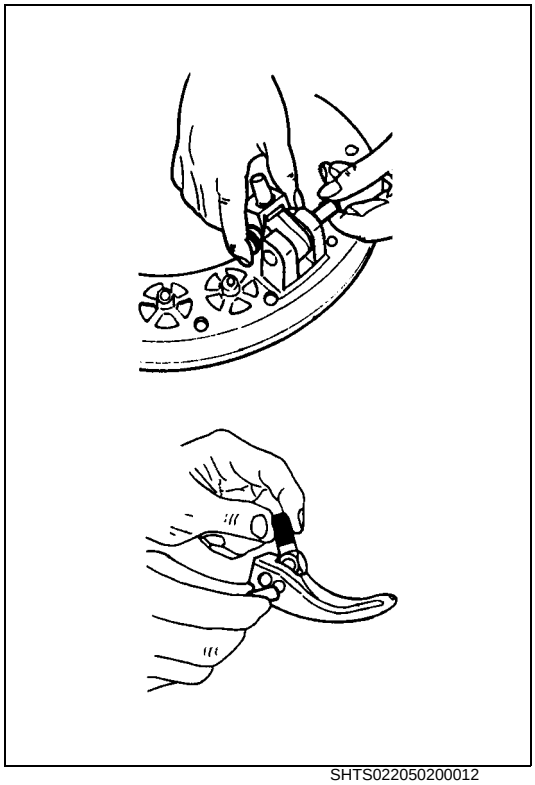
1. DISASSEMBLE THE CLUTCH COVER.

(1) Before removing the special tools and the strap plate bolt, compress the clutch cover to release the compression spring tension.

(2) Slowly release the press.


SHTS022050200011

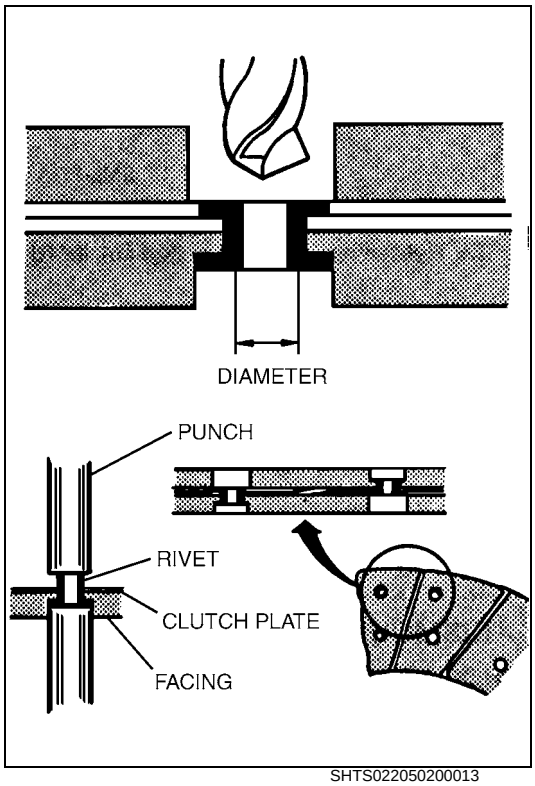
NOTICE
Before disassembling, make aligning marks on the clutch cover and pressure plate.



SHTS022050200012

2. DISASSEMBLE THE RELEASE LEVER ASSEMBLY.

(1) Remove the pin and the release lever.



SHTS022050200013

IMPORTANT POINTS - ASSEMBLY

1. REPLACE THE CLUTCH FACING.

(1) Drill off the rivets with a 5 mm {0.197 in.} diameter drill.

NOTICE

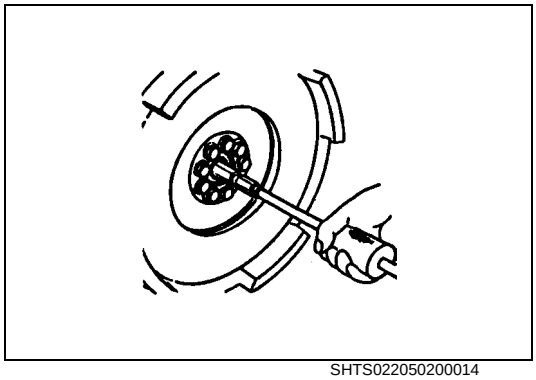
Do not remove the clutch facing with a tapping rod and a hammer or a press.

(2) Remove the old facing.

(3) Place the new facing on the clutch plate and insert the rivets into the holes so that the facing is held in position. (Secure the rivets with adhesive tape to prevent loosing them.)

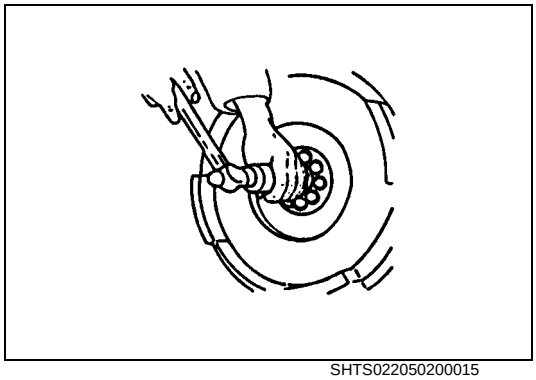
(4) Using a suitable riveter, rivet the new facing. In order to distribute pressure evenly, rivet in diagonal direction alternately.

(5) Using a dial gauge, check the misalignment of the clutch disc after riveting.


SHTS022050200014

2. REPLACE THE PILOT BEARING.

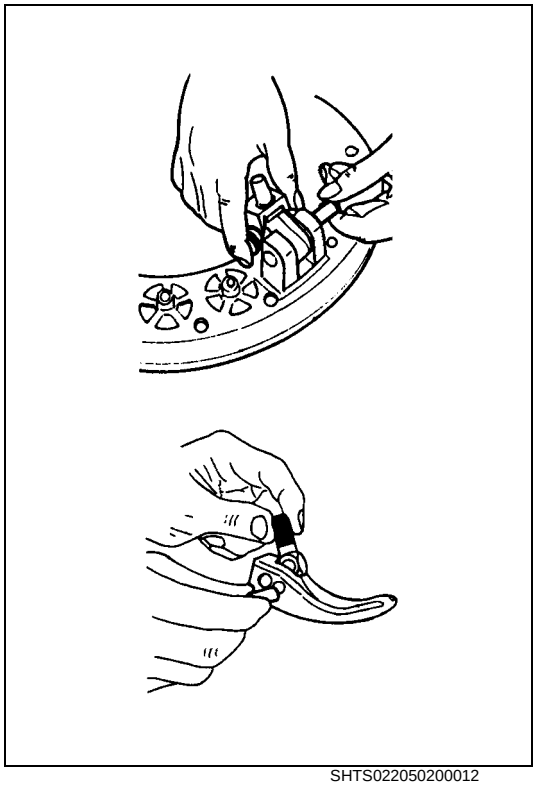
(1) Remove the pilot bearing.
SST:
Pilot Bearing Puller (S0965-01970)
Sliding Hammer (S0942-01442)


SHTS022050200015

(2) Using a suitable tapping rod, install the pilot bearing.

NOTICE

After installing the pilot bearing, ensure that it rotates smoothly.

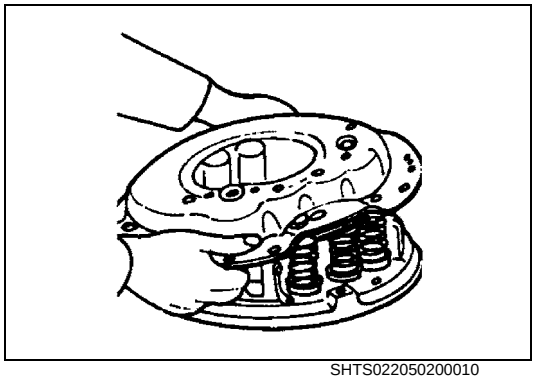

SHTS022050200012

3. INSTALL THE RELEASE LEVER.

(1) Assemble the release lever, release lever support and torsion spring, then install the release lever assembly on the pressure plate.

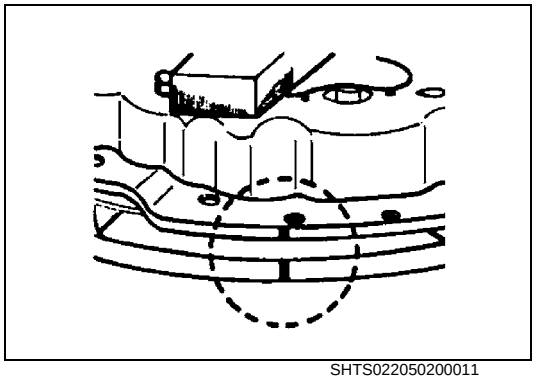
NOTICE

- **Do not coat any grease on the bushing.**
- **Coat lithium base grease to the sliding part between the clutch release lever and the pressure plate.**


SHTS022050200010

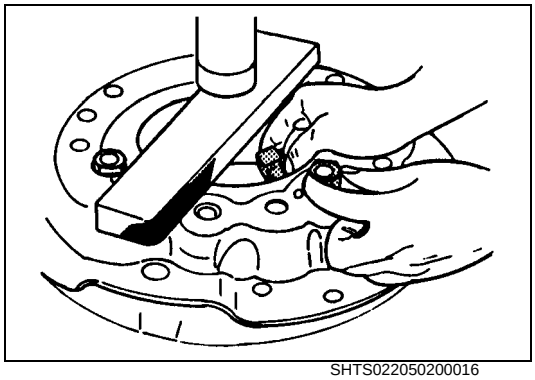
4. INSTALL THE CLUTCH COVER.

(1) Install the clutch cover in position according to the aligning marks. Compress the clutch cover to relieve the compression spring tension.


SHTS022050200011

NOTICE

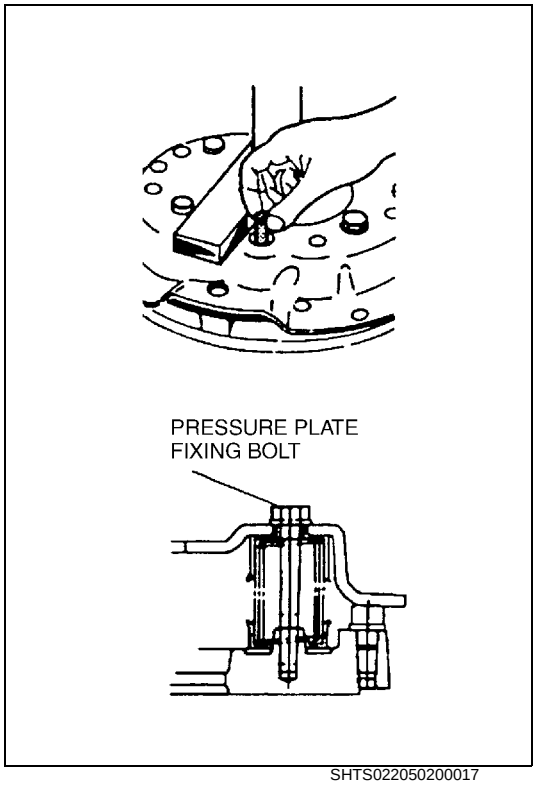
- **When compressing the clutch cover, be sure to hook up the torsion springs between clutch cover and release lever.**
- **When compressing the clutch cover, pull the release lever support up through the holes in the clutch cover.**
- **Be sure to insert the compression spring upper seats in the pressure cover.**


SHTS022050200016

(2) Temporarily tighten the release lever support nuts.

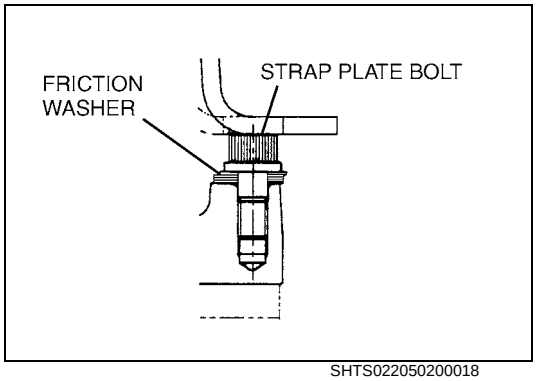
NOTICE

Coat the spherical seat of the clutch cover and threaded section of the release lever support with a small amount of anti-seizure agent.



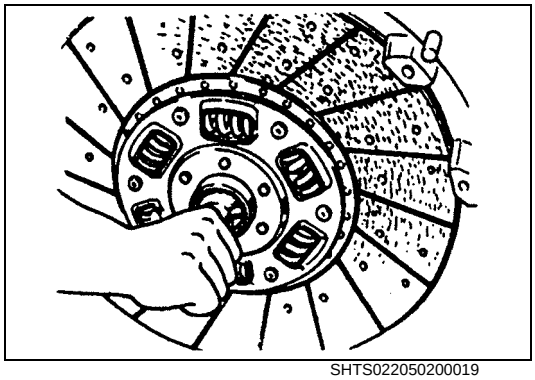
SHTS022050200017

(3) Install the four pressure plate fixing bolts with the plain washers through the clutch cover into the tapped holes in the pressure plate.
SST:
Pressure Plate Fixing Bolt (SH112-61070)
Plain Washer (SL611-01024)



SHTS022050200018

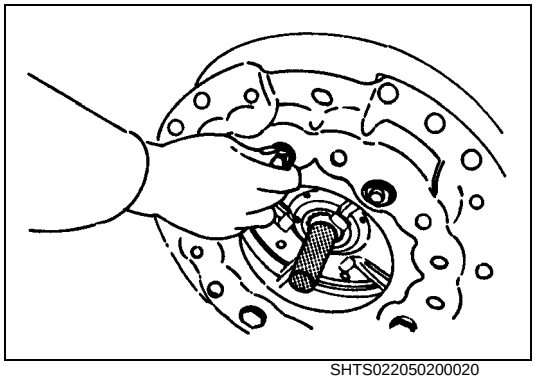
(4) Install the strap plate bolt with the friction washer and lock washer.


SHTS022050200019

IMPORTANT POINTS - MOUNTING

1. INSTALL THE CLUTCH DISC ON THE FLYWHEEL.

(1) Insert an aligning arbor or splined input shaft through the clutch disc hub and into the flywheel pilot bearing to position the clutch disc.
SST: Clutch Aligning Arbor (S0966-21200)

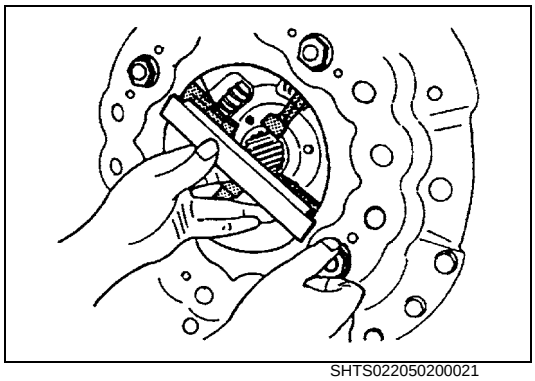

SHTS022050200020

2. INSTALL THE CLUTCH COVER ASSEMBLY.

(1) Insert the clutch cover aligning pins into each place of the clutch cover.

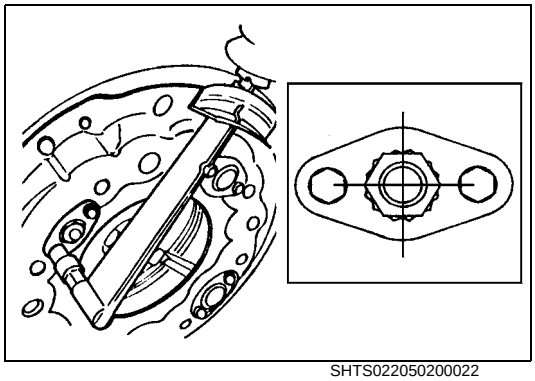
(2) Tighten the bolts evenly. Make several presses around the clutch cover until it is snug.
(3) Remove the pressure plate fixing bolts and plain washer.
(4) Remove the clutch aligning arbor.

NOTICE
When installing a new clutch cover assembly, do not forget to remove the four pressure plate fixing bolts from the clutch cover.


SHTS022050200021

3. ADJUST THE RELEASE LEVER HEIGHT WHEN INSTALLING A NEW CLUTCH DISC.

(1) Adjust the clearance of the contact surface between the special tool and the release lever by turning the release lever support nut.
Clearance: Zero
SST: Clutch Release Lever Height Gauge (S0966-11030)


SHTS022050200022

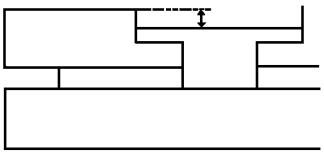
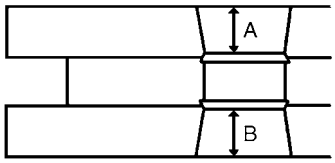
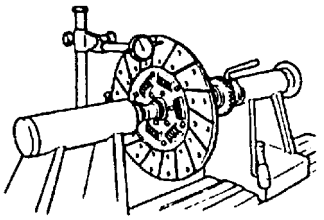
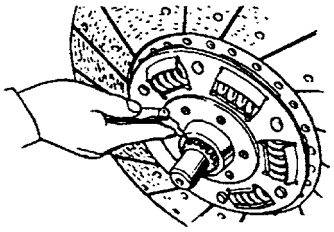
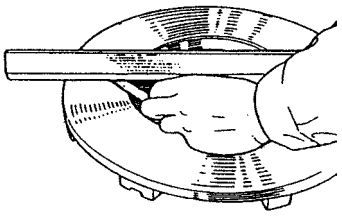
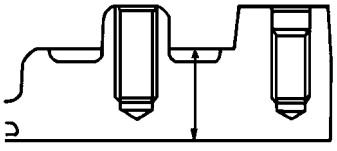
4. INSTALL THE LOCK PLATE.

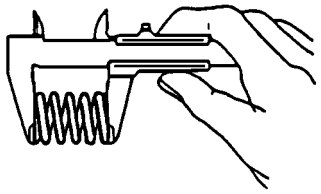
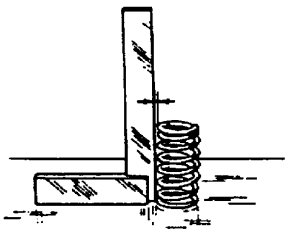
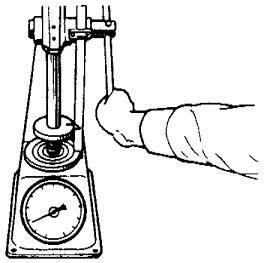
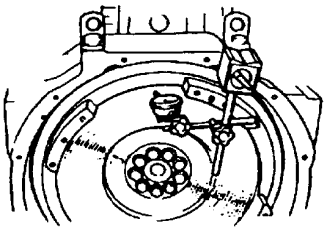
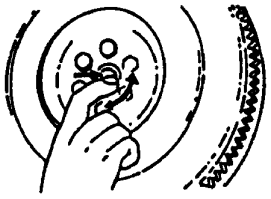
NOTICE
Be sure to lock the support nut with the lock plate.

INSPECTION AND REPAIR

EN0220502H300001

Unit: mm {in.}

Inspection item		Standard		Limit	Remedy	Inspection procedure
Rivet head depth	Molded Non-asbestos	2.2-2.8 {0.0866-0.1102}		0.1 {0.0039}	Replace disc assembly or facing.	Measure 
	Sintered metal (Ceramic metal)	Flywheel side "A"	1.2 {0.0472}	0.1 {0.0039}	Replace disc assembly or facing.	Measure 
		Flywheel side "B"	2.4 {0.0945}			
Clutch disc misalignment		0-0.7 {0-0.0275}		0.7 {0.0275}	Replace.	Measure 
Oily facings Loose rivets Broken or loose damper springs		—		—	Replace disc assembly, if necessary.	Visual check
Clearance between clutch disc hub and transmission input shaft spline		0.05-0.15 {0.0020-0.0059}		0.3 {0.0118}	Replace the clutch disc or the transmission input shaft.	Measure 
Pressure plate misalignment		Less than 0.1 {0.0039}		0.5 {0.0197}	Regrind the friction surface or replace.	Measure 
Pressure plate thickness		23 {0.906}		22 {0.866}	Replace.	Measure 
Pressure plate friction surface scoring or roughness		—		—	Regrind the friction surface or replace, if necessary.	Visual check

Inspection item	Standard	Limit	Remedy	Inspection procedure
Compression spring free length	**92.9 {3.657}**	**88.3 {3.476}**	**Replace.**	**Measure** 
Compression spring squareness	**—**	**5.0 {0.197}**	**Replace.**	**Measure** 
Compression spring setting load at the specified setting length	**1,285 N {131 kgf, 288.8 lbf} at 59.6 {2.346}**	**1,181.3 N {120.5 kgf, 266 lbf} at 54.8 {2.157}**	**Replace.**	**Measure** 
Flywheel misalignment	**0-0.1 {0-0.0039}**	**0.15 {0.059}**	**Regrind the friction surface or replace.**	**Measure** 
Flywheel friction surface scoring or roughness	**—**	**—**	**Regrind the friction surface or replace, if necessary.**	**Visual check**
Pilot bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

CLUTCH MAIN UNIT (CS430)

CL02-003

CLUTCH ASSEMBLY (CS430) CL02-2
DATA AND SPECIFICATIONS.....CL02-2
DESCRIPTION CL02-3
TROUBLESHOOTING.....CL02-4
SPECIAL TOOL.....CL02-5
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OVERHAUL CL02-7
INSPECTION AND REPAIR.....CL02-13

CLUTCH ASSEMBLY (CS430)

DATA AND SPECIFICATIONS

EN0220602I200001

CLUTCH FACING **Unit: mm {in.}**

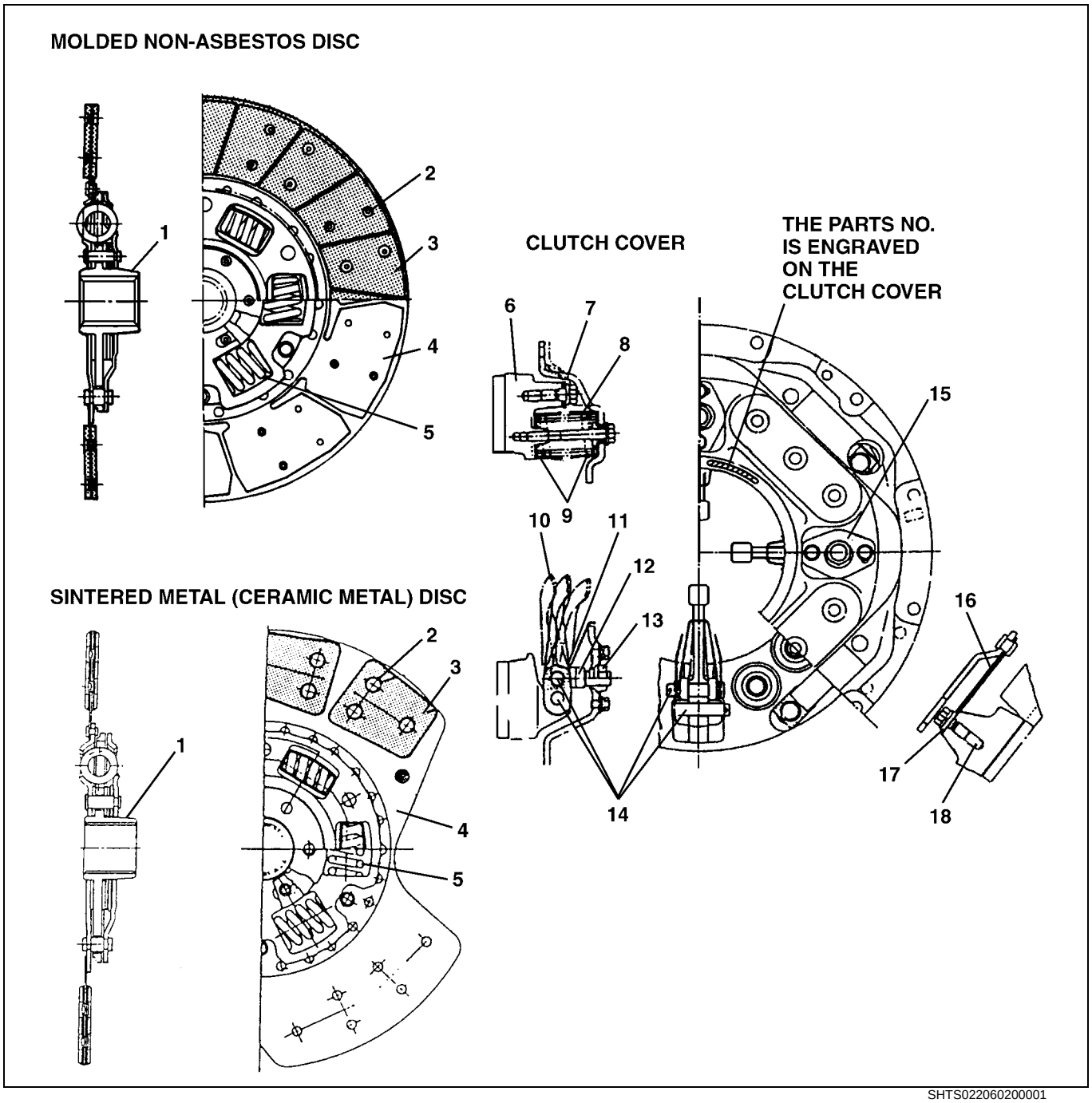
Material	**Molded non-asbestos**	**Sintered metal (Ceramic metal)**
Type	**Dry single plate with damper spring**	
Outside diameter	**430 {16.929}**	
Inside diameter	**250 {9.843}**	**—**
Thickness	**5.0 {0.197}**	**4.95 {0.195}**

COMPRESSION SPRING **Unit: mm {in.}**

Clutch cover parts No.	**31210-E0450**
Free length	**92.1 {3.626}**
Coil outside diameter	**36.5 {1.437}**
Diameter of wire	**6.5 {0.256}**
Quantity	**12**
Setting load	**1,496.5 N {152.6 kgf, 336.9 lbf}**
Setting length	**63 {2.346}**

DESCRIPTION

EN0220602C100001



SHTS022060200001

1	Clutch disc hub	10	Release lever
2	Rivet	11	Torsion spring
3	Clutch facing	12	Release lever support
4	Clutch plate	13	Release lever support nut
5	Damper spring	14	Release lever pin
6	Pressure plate	15	Lock plate
7	Clutch cover	16	Strap plate
8	Compression spring	17	Friction washer
9	Spring seat	18	Strap plate bolt

TROUBLESHOOTING

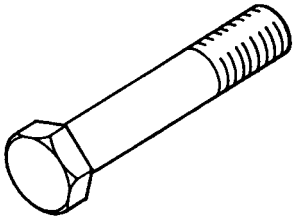
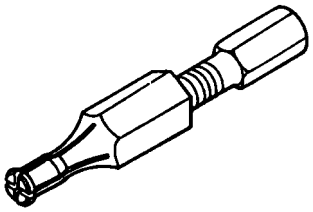
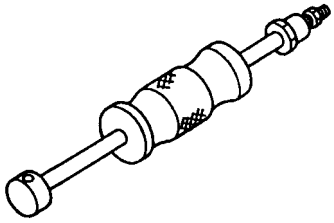
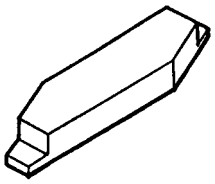
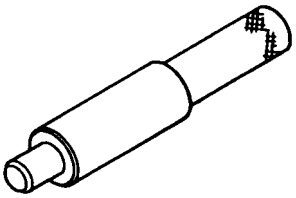
EN0220602F300001

Symptom	Possible cause	Remedy/Prevention
Clutch dragging	Clutch disc distorted or warped.	Replace clutch disc.
	Release lever incorrectly adjusted.	Adjust release lever.
	Transmission input shaft worn.	Replace input shaft and check clutch hub for excessive wear. If worn, replace disc. Check flywheel housing alignment.
Clutch slipping	Release lever and release bearing clearance incorrectly adjusted.	Adjust clearance.
	Clutch disc facing gummed with oil or grease.	Replace facing or disc assembly.
	Release bearing worn.	Replace bearing.
	Clutch pedal free-play incorrectly adjusted.	Adjust free-play.
	Compression spring weak.	Replace compression spring.
	Clutch facing worn.	Replace facing or disc assembly.
Vehicle vibrates when starting.	Improper engine idling.	Adjust idling.
	Clutch control incorrectly adjusted.	Adjust clutch control.
	Clutch disc facing gummed with oil or grease.	Replace facing or disc assembly.
	Glazed flywheel friction surface.	Unglazed flywheel surface with coarse emery cloth, stroking parallel to machining lines.
	Clutch disc distorted or warped.	Replace disc.
	Improper clutch cover tightening.	Tighten bolts.
	Flywheel housing misalignment.	Replace flywheel housing.
	Release lever incorrectly adjusted.	Adjust release lever.
Noisy clutch	Release bearing worn or dried.	Replace release bearing.
	Pilot bearing worn.	Replace pilot bearing.
	Clutch disc distorted or warped.	Replace clutch disc.
	Flywheel housing misalignment.	Replace flywheel housing.
	Transmission input shaft or clutch disc spline worn.	Clean and lubricate or replace.
	Release lever incorrectly adjusted.	Adjust release lever.
	Insufficient lubrication of pedal and its accessories.	Lubricate.
	Insufficient lubrication of release bearing hub.	Lubricate.
	Transmission input shaft retainer rusted or soiled.	Clean or replace if rusted.
	Clutch pedal free-play incorrectly adjusted.	Adjust free-play.
Clutch pedal can not be depressed.	Clutch control incorrectly adjusted.	Adjust clutch control.
	Insufficient lubricant release bearing hub.	Lubricate.
Change in clutch pedal give.	Air trapped in clutch fluid.	Bleed air.

SPECIAL TOOL

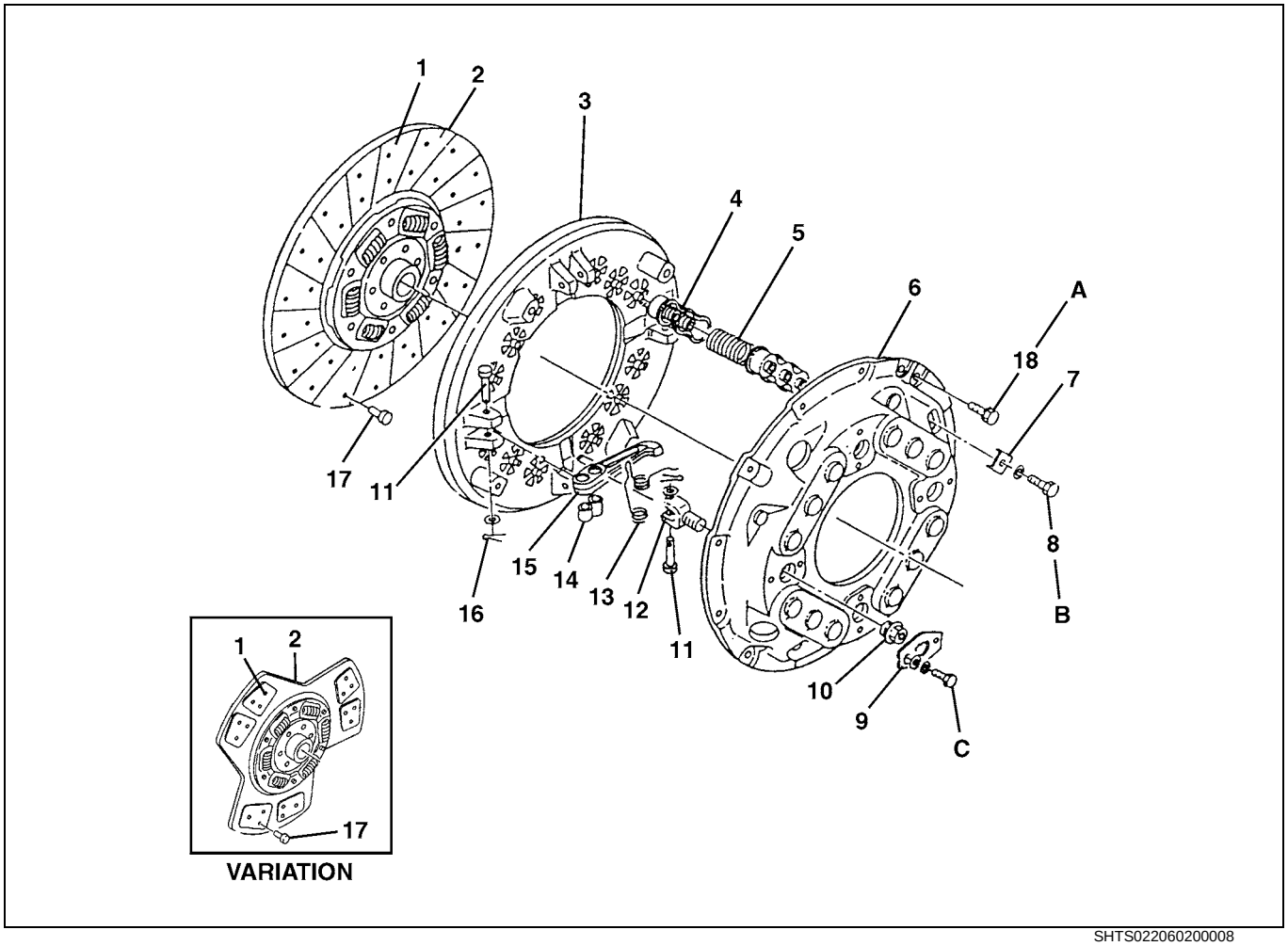
EN0220602K100001

Prior to starting a clutch main unit overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	SH112-61080	CLUTCH PRESSURE PLATE FIXING BOLT	
	SL611-01024	PLAIN WASHER	
	S0965-01020	CLUTCH PILOT BEARING PULLER	
	S0942-01442	SLIDING HAMMER	
	S0966-11020	CLUTCH RELEASE LEVER HEIGHT GAUGE	
	S0966-21080	CLUTCH ALIGNING ARBOR	

COMPONENT LOCATOR

EN0220602D100001



SHTS022060200008

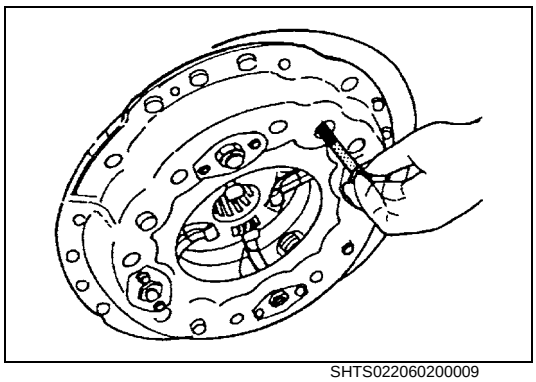
1	Clutch facing	10	Release lever support nut
2	Disc assembly	11	Release lever pin
3	Pressure plate	12	Release lever support
4	Spring seat	13	Torsion spring
5	Compression spring	14	Bushing
6	Clutch cover	15	Release lever
7	Friction washer	16	Cotter pin
8	Strap plate bolt	17	Rivet
9	Lock plate	18	Fitting bolt

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	64-84 {653-856, 48-61}	C	9.8-14.7 {100-150, 8-10}
B	39.2-49.0 {400-500, 29-36}		

OVERHAUL

EN0220602H200001


SHTS022060200009

IMPORTANT POINT - DISMOUNTING

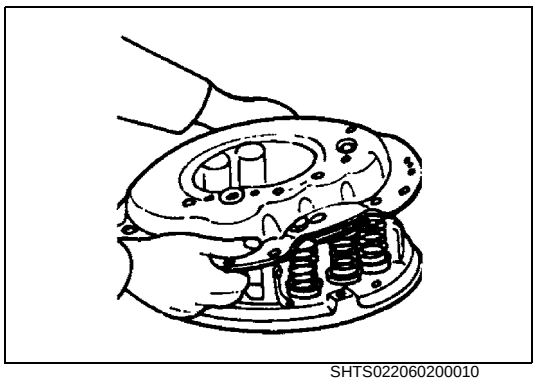
1. REMOVE THE CLUTCH COVER AND DISC.

(1) Install the four pressure plate fixing bolts and plain washers through the clutch cover into the tapped holes in the pressure plate.
SST:
Pressure Plate Fixing Bolt (SH112-61080)
Plain Washer (SL611-01024)

(2) Tighten the bolts in diagonal direction alternately and evenly to the compress the compression springs and release pressure plate tension.

(3) Loosen the fitting bolts.

⚠ CAUTION
When removing the clutch cover and clutch disc, be careful not to drop them on your foot.

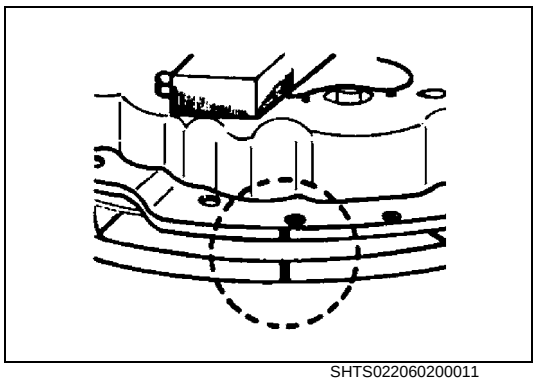

SHTS022060200010

IMPORTANT POINTS - DISASSEMBLY

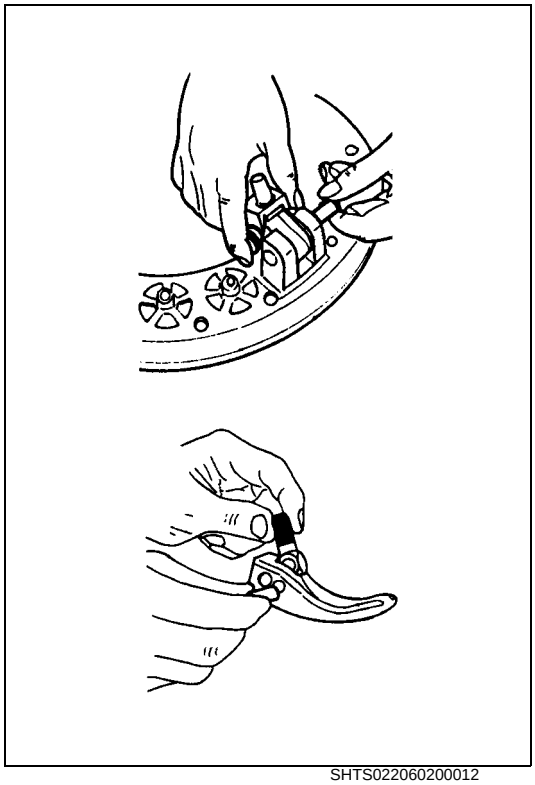
1. DISASSEMBLE THE CLUTCH COVER.

(1) Before removing the special tools and the strap plate bolt, compress the clutch cover to release the compression spring tension.

(2) Slowly release the press.


SHTS022060200011

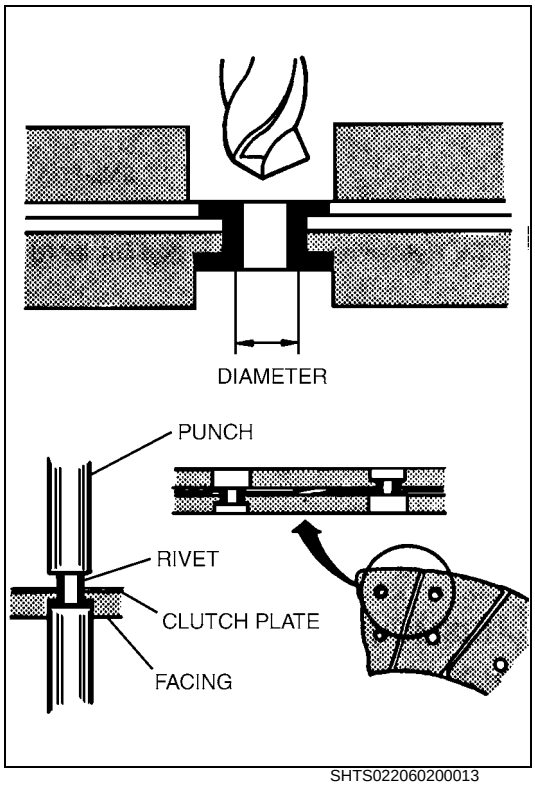
NOTICE
Before disassembling, make aligning marks on the clutch cover and pressure plate.



SHTS022060200012

2. DISASSEMBLE THE RELEASE LEVER ASSEMBLY.

(1) Remove the pin and the release lever.



SHTS022060200013

IMPORTANT POINTS - ASSEMBLY

1. REPLACE THE CLUTCH FACING.

(1) Drill off the rivets with a 5 mm {0.197 in.} diameter drill.

NOTICE

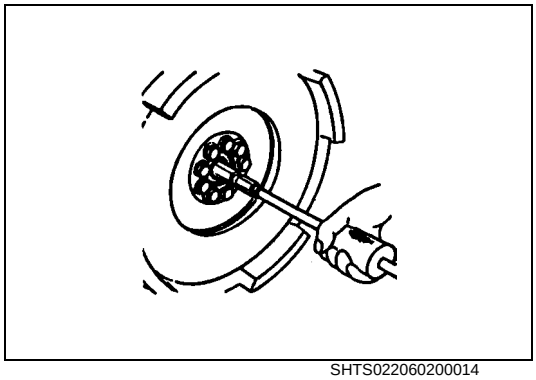
Do not remove the clutch facing with a tapping rod and a hammer or a press.

(2) Remove the old facing.

(3) Place the new facing on the clutch plate and insert the rivets into the holes so that the facing is held in position. (Secure the rivets with adhesive tape to prevent loosing them.)

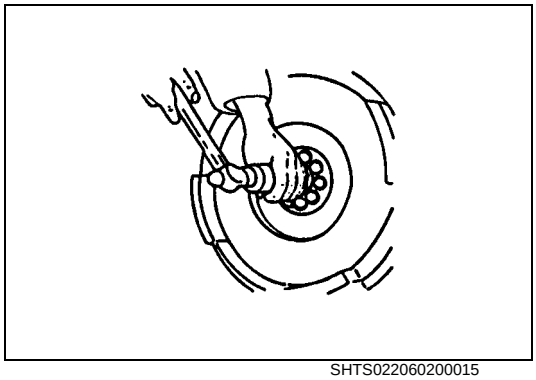
(4) Using a suitable riveter, rivet the new facing. In order to distribute pressure evenly, rivet in diagonal direction alternately.

(5) Using a dial gauge, check the misalignment of the clutch disc after riveting.


SHTS022060200014

2. REPLACE THE PILOT BEARING.

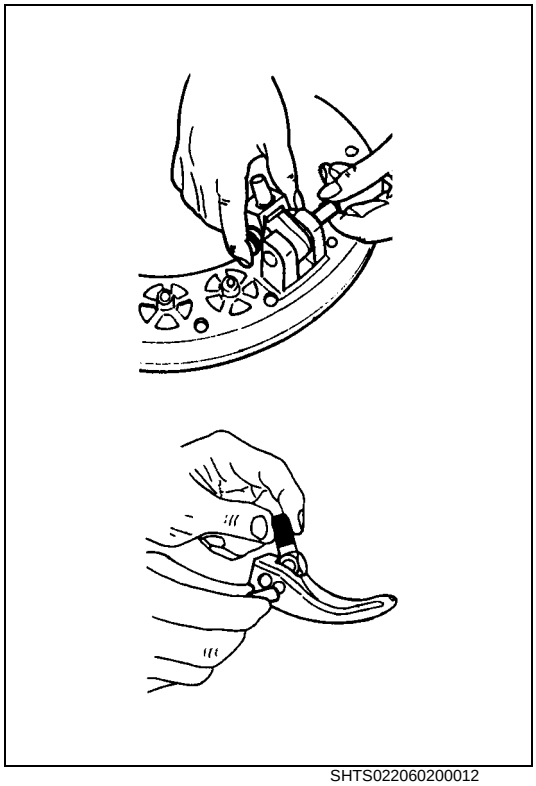
(1) Remove the pilot bearing.
SST:
Pilot Bearing Puller (S0965-01020)
Sliding Hammer (S0942-01442)


SHTS022060200015

(2) Using a suitable tapping rod, install the pilot bearing.

NOTICE

After installing the pilot bearing, ensure that it rotates smoothly.

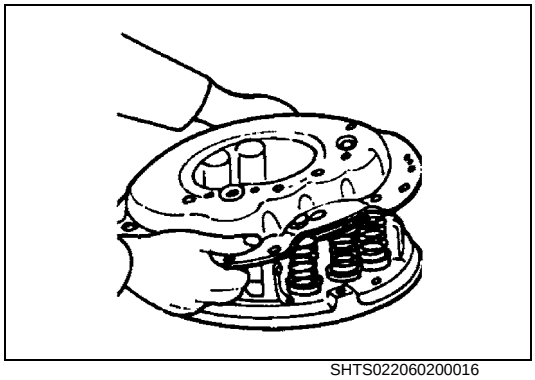

SHTS022060200012

3. INSTALL THE RELEASE LEVER.

(1) Assemble the release lever, release lever support and torsion spring, then install the release lever assembly on the pressure plate.

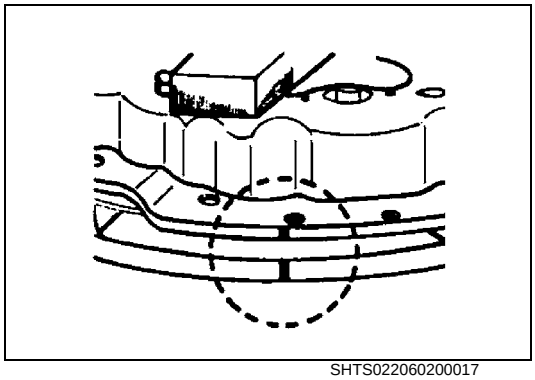
NOTICE

- **Do not coat any grease on the bushing.**
- **Coat lithium base grease to the sliding part between the clutch release lever and the pressure plate.**


SHTS022060200016

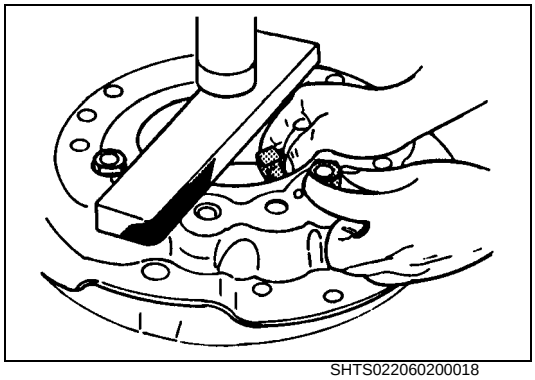
4. INSTALL THE CLUTCH COVER.

(1) Install the clutch cover in position according to the aligning marks. Compress the clutch cover to relieve the compression spring tension.


SHTS022060200017

NOTICE

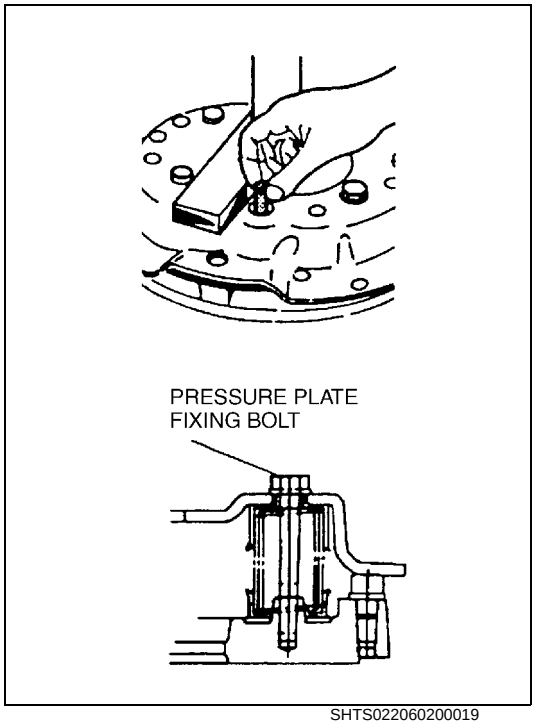
- **When compressing the clutch cover, be sure to hook up the torsion springs between clutch cover and release lever.**
- **When compressing the clutch cover, pull the release lever support up through the holes in the clutch cover.**
- **Be sure to insert the compression spring upper seats in the pressure cover.**


SHTS022060200018

(2) Temporarily tighten the release lever support nuts.

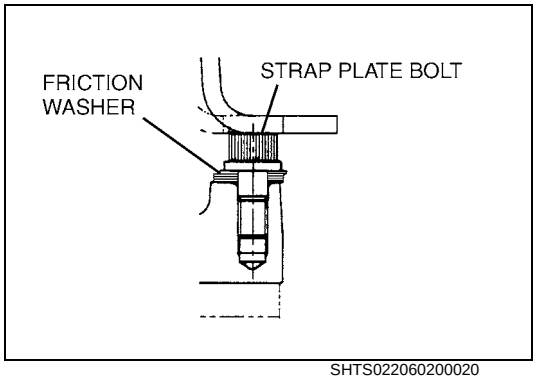
NOTICE

Coat the spherical seat of the clutch cover and threaded section of the release lever support with a small amount of anti-seizure agent.



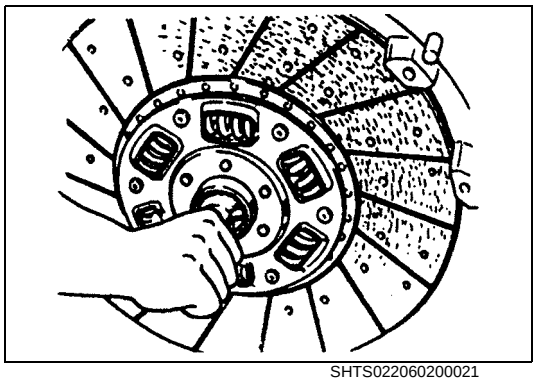
SHTS022060200019

(3) Install the four pressure plate fixing bolts with the plain washers through the clutch cover into the tapped holes in the pressure plate.
SST:
Pressure Plate Fixing Bolt (SH112-61080)
Plain Washer (SL611-01024)



SHTS022060200020

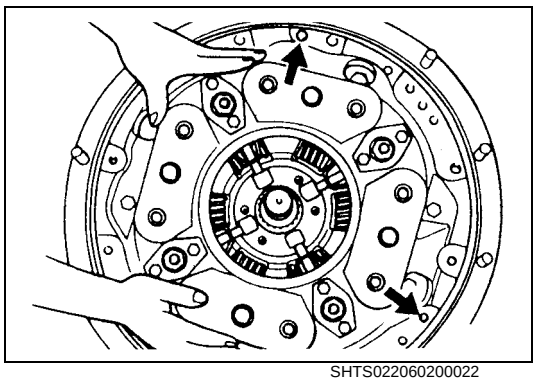
(4) Install the strap plate bolt with the friction washer and lock washer.


SHTS022060200021

IMPORTANT POINTS - MOUNTING

1. INSTALL THE CLUTCH DISC ON THE FLYWHEEL.

(1) Insert an aligning arbor or splined input shaft through the clutch disc hub and into the flywheel pilot bearing to position the clutch disc.
SST: Clutch Aligning Arbor (S0966-21080)

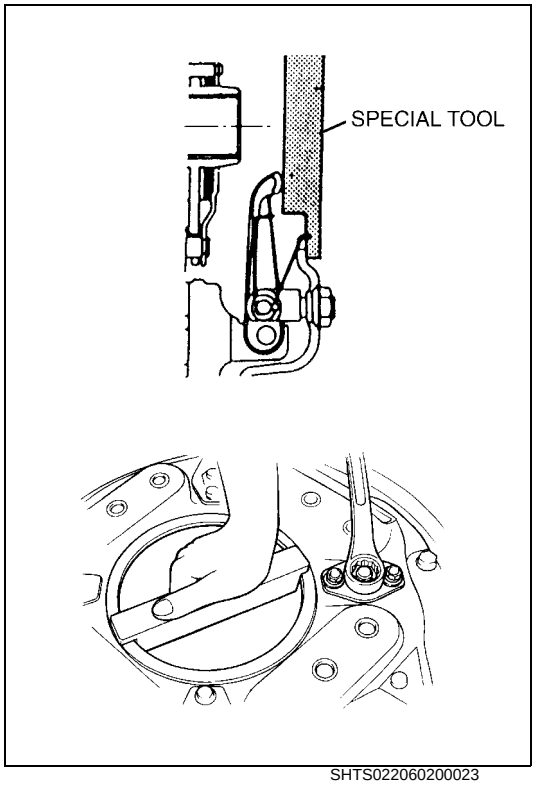

SHTS022060200022

2. INSTALL THE CLUTCH COVER ASSEMBLY.

(1) Insert the clutch cover aligning pins into each place of the clutch cover.

(2) Tighten the bolts evenly. Make several presses around the clutch cover until it is snug.
(3) Remove the pressure plate fixing bolts and plain washer.
(4) Remove the clutch aligning arbor.

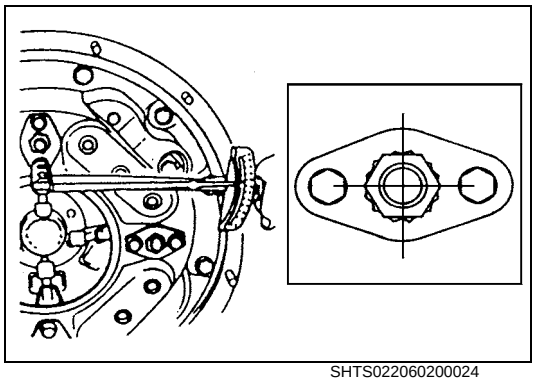
NOTICE
When installing a new clutch cover assembly, do not forget to remove the four pressure plate fixing bolts from the clutch cover.



SHTS022060200023

3. ADJUST THE RELEASE LEVER HEIGHT WHEN INSTALLING A NEW CLUTCH DISC.

(1) Adjust the clearance of the contact surface between the special tool and the release lever by turning the release lever support nut.
Clearance: Zero
SST: Clutch Release Lever Height Gauge (S0966-11020)


SHTS022060200024

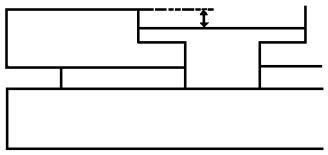
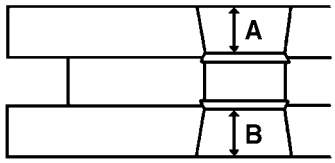
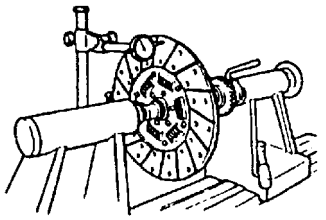
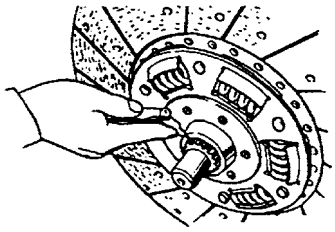
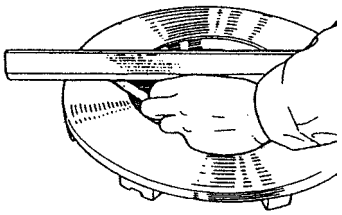
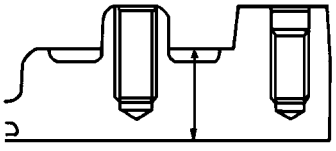
4. INSTALL THE LOCK PLATE.

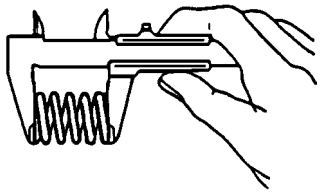
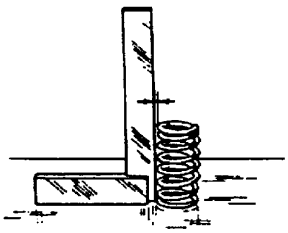
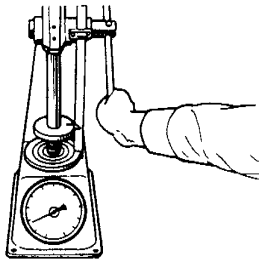
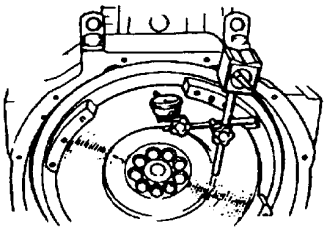
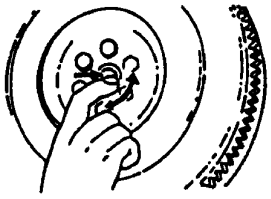
NOTICE
Be sure to lock the support nut with the lock plate.

INSPECTION AND REPAIR

EN0220602H300001

Unit: mm {in.}

Inspection item			Standard	Limit	Remedy	Inspection procedure
Rivet head depth	Molded non-asbestos		2.2-2.8 {0.0866-0.1102}	0.1 {0.0039}	Replace disc assembly or facing.	Measure 
	Sintered metal (Ceramic metal)	Flywheel side "A"	1.8 {0.0708}	0.1 {0.0039}	Replace disc assembly or facing.	Measure 
		Pressure plate side "B"	2.6 {0.1023}			
Clutch disc misalignment			0-1.3 {0-0.512}	1.3 {0.512}	Replace.	Measure 
Oily facings Loose rivets Broken or loose damper springs			—	—	Replace disc assembly, if necessary.	Visual check
Clearance between clutch disc hub and transmission input shaft spline			0.05-0.15 {0.0020-0.0059}	0.5 {0.0197}	Replace the clutch disc or the transmission input shaft.	Measure 
Pressure plate misalignment			Less than 0.1 {0.0039}	0.5 {0.0197}	Regrind the friction surface or replace.	Measure 
Pressure plate thickness			30 {1.181}	28 {1.102}	Replace.	Measure 
Pressure plate friction surface scoring or roughness			—	—	Regrind the friction surface or replace, if necessary.	Visual check

Inspection item	Standard	Limit	Remedy	Inspection procedure
Compression spring free length	**92.1 {3.626}**	**87.5 {3.445}**	**Replace.**	**Measure** 
Compression spring squareness	**—**	**5.0 {0.197}**	**Replace.**	**Measure** 
Compression spring setting load at the specified setting length	**1,496.5 N {152.6 kgf, 336.9 lbf} at 63 {2.346}**	**1,421.7 N {145 kgf, 319.604 lbf} at 63 {2.346}**	**Replace.**	**Measure** 
Flywheel misalignment	**—**	**0.2 {0.0079}**	**Regrind the friction surface or replace.**	**Measure** 
Flywheel friction surface scoring or roughness	**—**	**—**	**Regrind the friction surface or replace, if necessary.**	**Visual check**
Pilot bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

CLUTCH MAIN UNIT (SACHS MFZ430) CL02-004

CLUTCH ASSEMBLY
(SACHS MFZ430) CL02-2
DATA AND SPECIFICATIONS.....CL02-2
DESCRIPTION CL02-2
TROUBLESHOOTING.....CL02-3
SPECIAL TOOL.....CL02-4
COMPONENT LOCATOR CL02-5
OVERHAUL CL02-6
INSPECTION AND REPAIR.....CL02-8

CLUTCH ASSEMBLY (SACHS MFZ430)

DATA AND SPECIFICATIONS

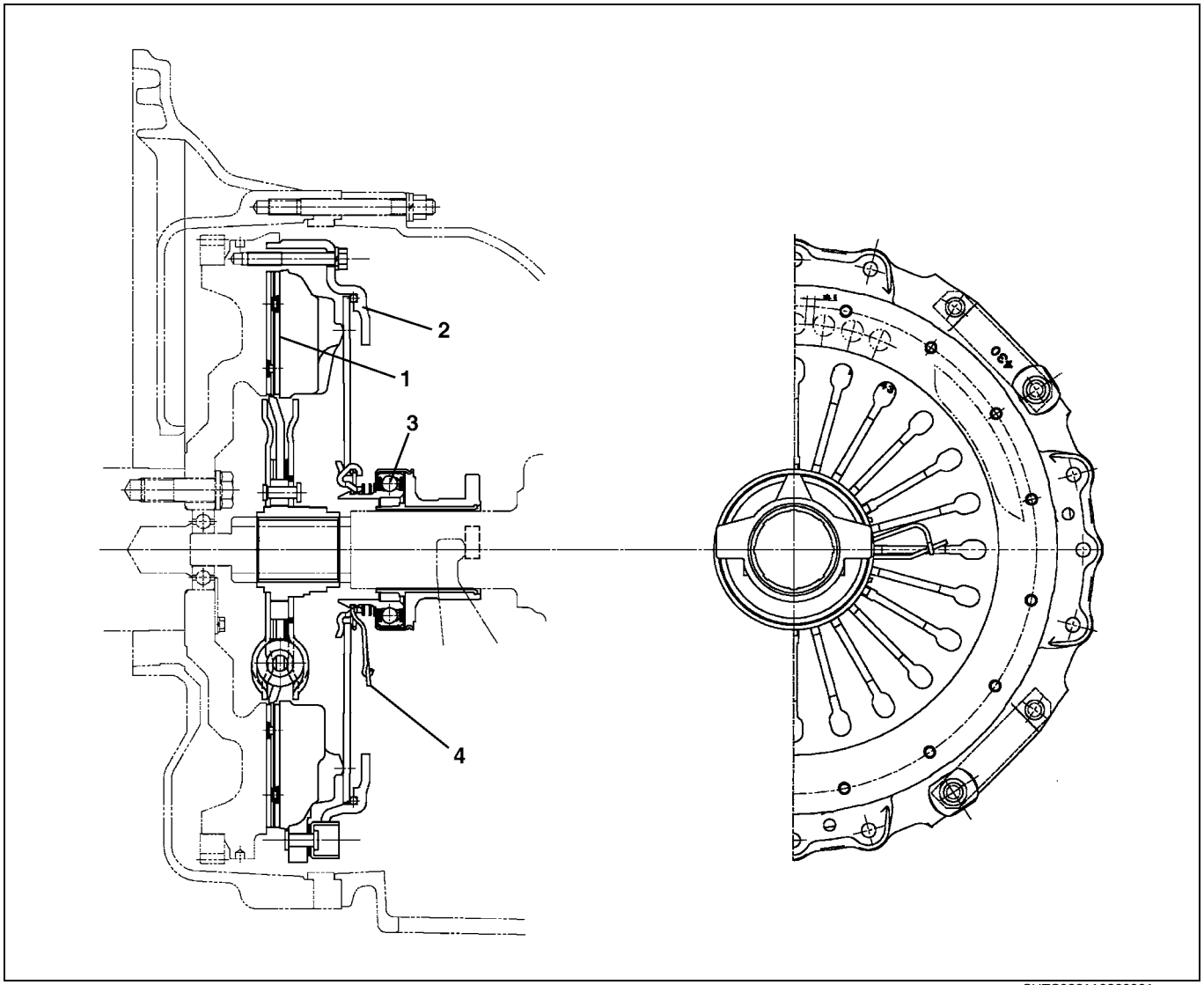
EN0221102I200001

CLUTCH FACING **Unit: mm {in.}**

Material	**Molded non-asbestos**
Type	**Dry single plate clutch MFZ430**
Outside diameter	**430 {16.929}**
Inside diameter	**240 {9.448}**

DESCRIPTION

EN0221102C100001



SHTS022110200001

1	**Clutch disc**	**3**	**Release bearing**
2	**Clutch cover assembly**	**4**	**Load ring**

TROUBLESHOOTING

EN0221102F300001

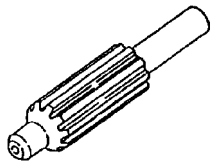
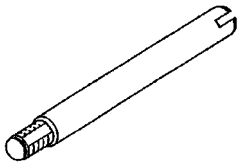
Symptom	Possible cause	Remedy/Prevention
Clutch dragging	Distortion or warp of clutch disc	Replace clutch disc.
	Wear of transmission input shaft	Replace input shaft and check clutch hub for excessive wear. If worn, replace disc. Check flywheel housing alignment.
	Excessive wear of clutch control parts	Replace control parts.
	Improper function of clutch control parts	Replace control parts.
	Incorrect adjustment of clutch control	Adjust clutch control.
	Excessive thick of clutch disc assembly	Replace clutch disc.
	Incorrect adjustment of clutch pedal free-play	Adjust free-play.
	Air in hydraulic system	Bleed air.
	Dirt or corrosion of hub or input shaft splines	Clean and lubricate.
Clutch slipping	Incorrect adjustment of release fork and release bearing clearance	Adjust clearance.
	Stickiness with oil or grease of clutch disc facing	Replace disc assembly.
	Wear of release bearing	Replace bearing.
	Incorrect adjustment of clutch pedal free-play	Adjust free-play.
	Weakness of diaphragm spring elasticity	Replace cover assembly.
	Wear of clutch facing	Replace facing or disc assembly.
	Failure of removing plate from the clutch cover assembly	Remove plate.
	Leaving of driver's foot on clutch pedal	Loose driver's foot on clutch pedal.
Vehicle vibrates when starting.	Improper engine idling speed	Adjust idling speed.
	Incorrect adjustment of clutch control	Adjust clutch control.
	Stickiness with oil or grease of clutch disc facing	Replace disc assembly.
	Glazed flywheel friction surface	Unglazed flywheel surface with coarse emery cloth, stroking parallel to machining lines.
	Distortion or warp of clutch disc	Replace disc.
	Improper tightness of clutch cover	Tighten bolts.
	Flywheel housing misalignment	Replace flywheel housing.
	Wear of engine and transmission mountings	Replace defective mountings.
Abnormal noise in transmission	Malfunction of engine	Tune up engine.
	Use of improper clutch disc	Replace proper clutch disc.
	Trouble in transmission	Check transmission.
	Low engine idling speed	Increase the idle speed.

Symptom	Possible cause	Remedy/Prevention
Noisy clutch	Wear or dry of release bearing	Replace release bearing.
	Wear of pilot bearing	Replace pilot bearing.
	Distortion or warp of clutch disc	Replace clutch disc.
	Flywheel housing misalignment	Replace flywheel housing.
	Wear of transmission input shaft or clutch disc spline	Clean and lubricate or replace.
	Insufficient lubrication of release shaft and release bearing hub	Lubricate.
	Rust or soil of transmission input shaft retainer	Clean or replace if rusted.
	Incorrect adjustment of clutch pedal free-play	Adjust free-play.
Clutch pedal can not be depressed.	Incorrect adjustment of clutch control	Adjust clutch control.
Change in clutch pedal give.	Air in clutch fluid	Bleed air.

SPECIAL TOOL

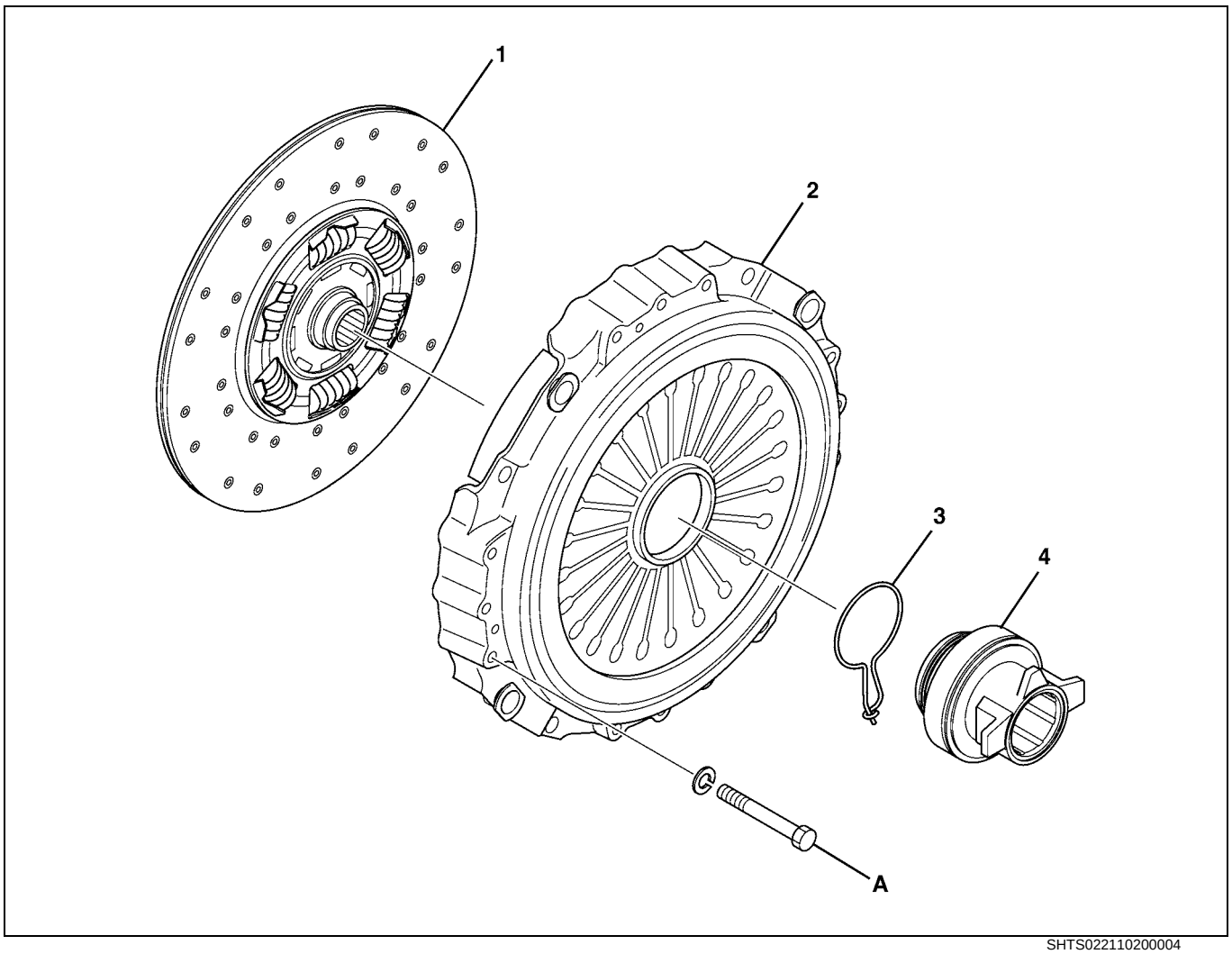
EN0221102K100001

Prior to starting a clutch main unit overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-21370	CLUTCH ALIGNING ARBOR	
	S0948-11510	GUIDE	

COMPONENT LOCATOR

EN0221102D100001



SHTS022110200004

1	Clutch disc assembly	3	Load ring
2	Clutch cover assembly	4	Releaser

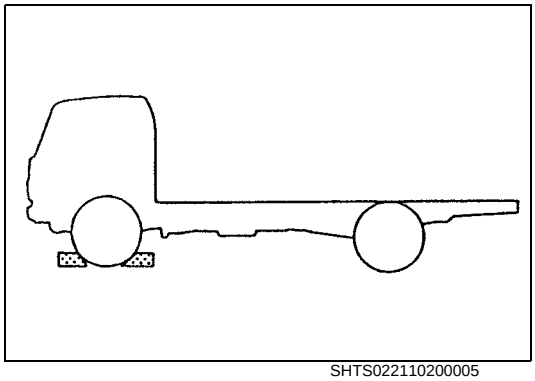
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	37.5-48.5 {382-495, 28-36}		

OVERHAUL

EN0221102H200001

IMPORTANT POINTS - DISMOUNTING


SHTS022110200005

1. BLOCK THE WHEELS.

(1) Park the vehicle on level ground.

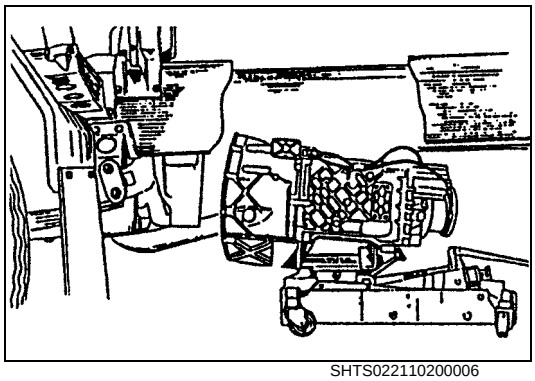
(2) Block the wheels.

NOTICE

Be sure to apply wheel stoppers in the front tires.

⚠ WARNING

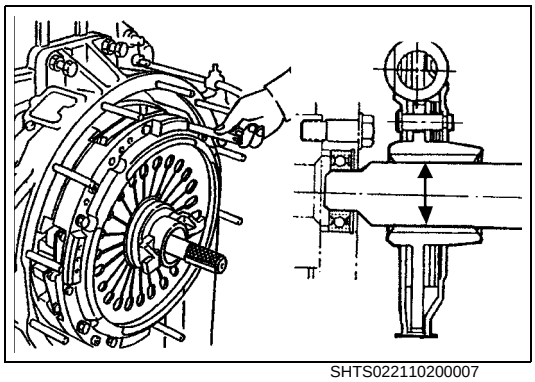
Do not work on the transmission while it is still hot. This can result in personal injury.


SHTS022110200006

2. REMOVE THE TRANSMISSION.

NOTICE

- **To remove the transmission from the vehicle refer to the chapter "TRANSMISSION MAIN UNIT".**
- **As the transmission is being removed, support the weight of the transmission and keep transmission in alignment with the engine until the main drive gear (input shaft) splines clear the clutch assembly. Failure to do so could cause distortion or hub breakage in the driven disc.**

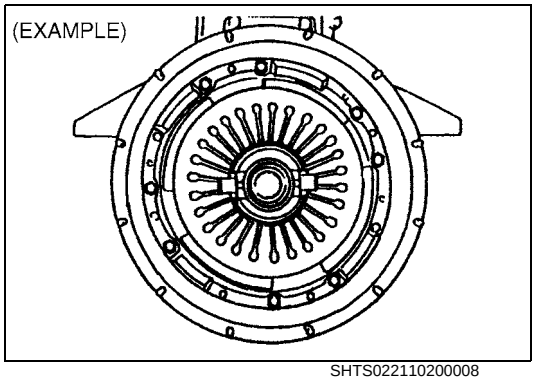

SHTS022110200007

3. REMOVE THE CLUTCH COVER ASSEMBLY AND CLUTCH DISC.

(1) Install an aligning arbor through the release bearing and the clutch discs, into the pilot bearing.
SST: Clutch Aligning Arbor (S0966-21370)

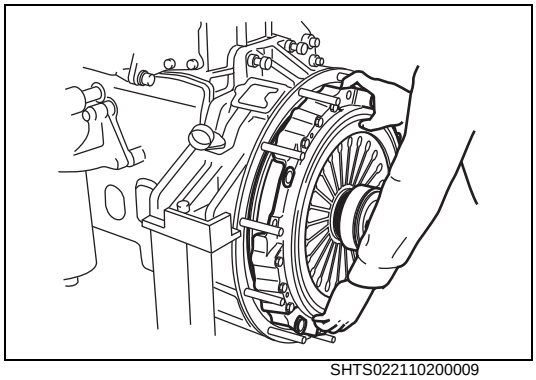
(2) Make aligning marks on the clutch cover, intermediate ring and flywheel.

(3) Install the two pieces of guides.
SST: Guide (S0948-11510)



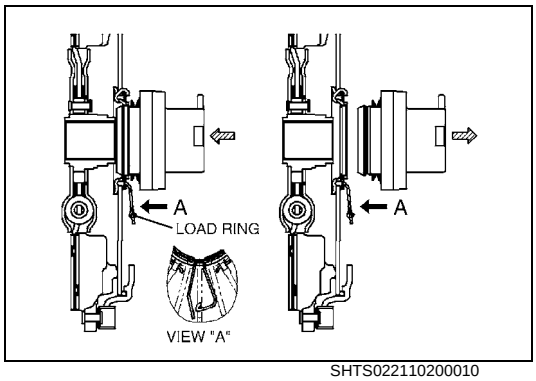
SHTS022110200008

(4) Remove the clutch cover fitting bolts.


SHTS022110200009

(5) Remove the clutch cover assembly and clutch disc assembly.

⚠ WARNING
The clutch cover assembly and clutch disc are heavy, be careful not to drop them.

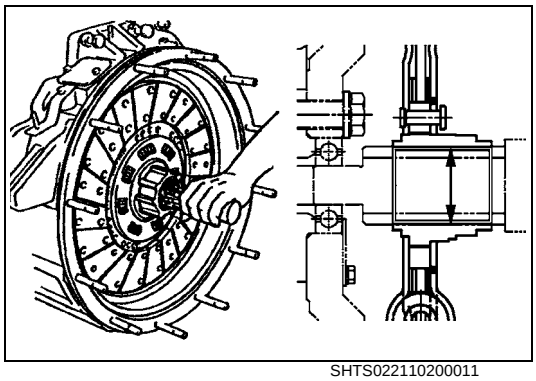


SHTS022110200010

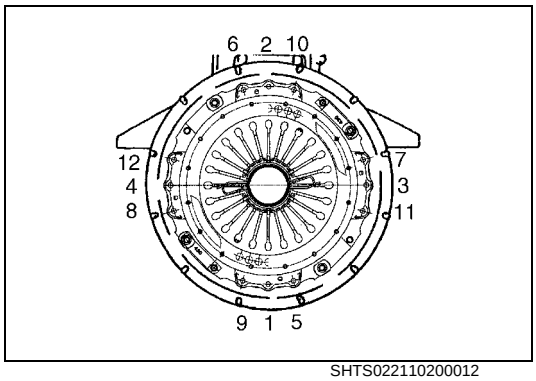
4. REMOVE THE RELEASER.
(1) Release the lock of the load ring installed on the clutch cover.
(2) Remove the load ring from the groove of the releaser with pushing the releaser toward the diaphragm spring side and then remove the releaser from the clutch cover.

IMPORTANT POINT - ASSEMBLY

1. INSTALL THE CLUTCH DISC AND COVER ON THE FLYWHEEL.
(1) Insert an aligning arbor or splined input shaft with the clutch disc into flywheel pilot bearing to position the clutch disc.
SST: Clutch Aligning Arbor (S0966-21370)


SHTS022110200011

NOTICE
- **Clutch disc discrimination mark (Flywheel side) for flywheel side.**
- **Apply a heat-resistant grease to the clutch disc spline inner face.**
- **Make sure that no grease is smeared onto the facing.**



SHTS022110200012

(2) Install the clutch cover assembly.
a. Tighten the clutch cover assembly fitting bolts in the order as shown.

NOTICE
Retighten them after about one minute with the same torque.

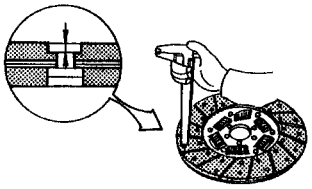
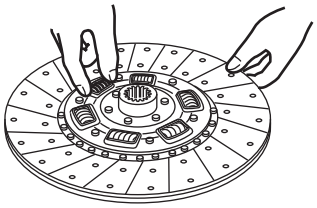
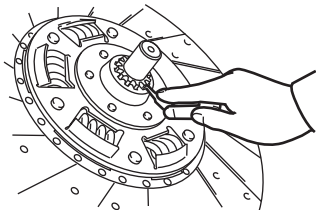
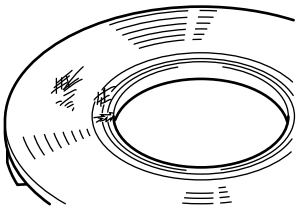
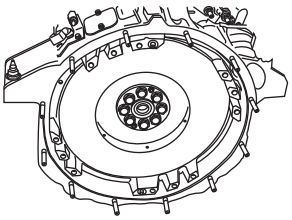
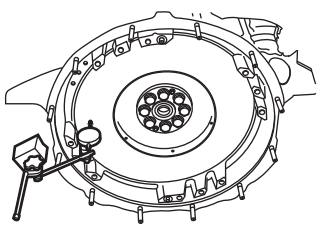
b. Remove the clutch aligning tool.

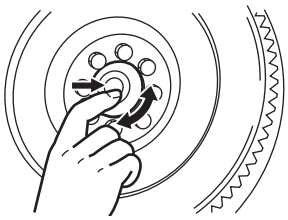
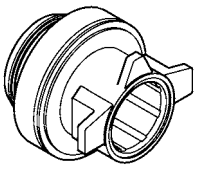
NOTICE
- **Apply a heat-resistant grease to the release fork contact point.**
- **Make sure that no grease is smeared the bushing in the releaser.**

INSPECTION AND REPAIR

EN0221102H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Facing thickness or rivet head depth	**1.4 {0.0551}**	**0.1 {0.004}**	**Replace disc assembly or facing.**	**Measure** 
Oily facings, Loose rivets and Broken or loose damper springs	**—**	**—**	**Replace disc assembly, if necessary.**	**Visual check** 
Clearance between clutch disc hub and transmission input shaft spline	**0.05-0.15 {0.0020-0.0059}**	**0.5 {0.0197}**	**Replace the clutch disc or the transmis-sion input shaft.**	**Measure** 
Pressure plate friction surface scoring or rough-ness	**—**	**—**	**Regrind the friction surface or replace, if necessary.**	**Visual check** 
Flywheel friction surface scoring or roughness	**—**	**—**	**Regrind the friction surface or replace, if necessary.**	**Visual check** 
Flywheel misalignment	**0-0.1 {0-0.0039}**	**0.2 {0.0078}**	**Regrind the friction surface or replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pilot bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Release bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

CLUTCH CONTROL (CS350, CS380, CS430)

CL03-001

CLUTCH CONTROL UNIT CL03-2
DATA AND SPECIFICATIONS.....CL03-2
DESCRIPTION CL03-2
SPECIAL TOOL.....CL03-4
INSPECTION AND ADJUSTMENT CL03-5

CLUTCH PEDAL AND RELEASE UNIT... CL03-9
COMPONENT LOCATOR CL03-9
OVERHAUL.....CL03-20
INSPECTION AND REPAIR.....CL03-23

CLUTCH MASTER CYLINDER CL03-24
COMPONENT LOCATOR CL03-24
OVERHAUL.....CL03-25
INSPECTION AND REPAIR.....CL03-25

CLUTCH BOOSTER CL03-26
COMPONENT LOCATOR CL03-26
OVERHAUL.....CL03-27
INSPECTION AND REPAIR.....CL03-32

CLUTCH CONTROL UNIT

DATA AND SPECIFICATIONS

EN02Z0203I200001

CLUTCH BOOSTER **Unit: mm {in.}**

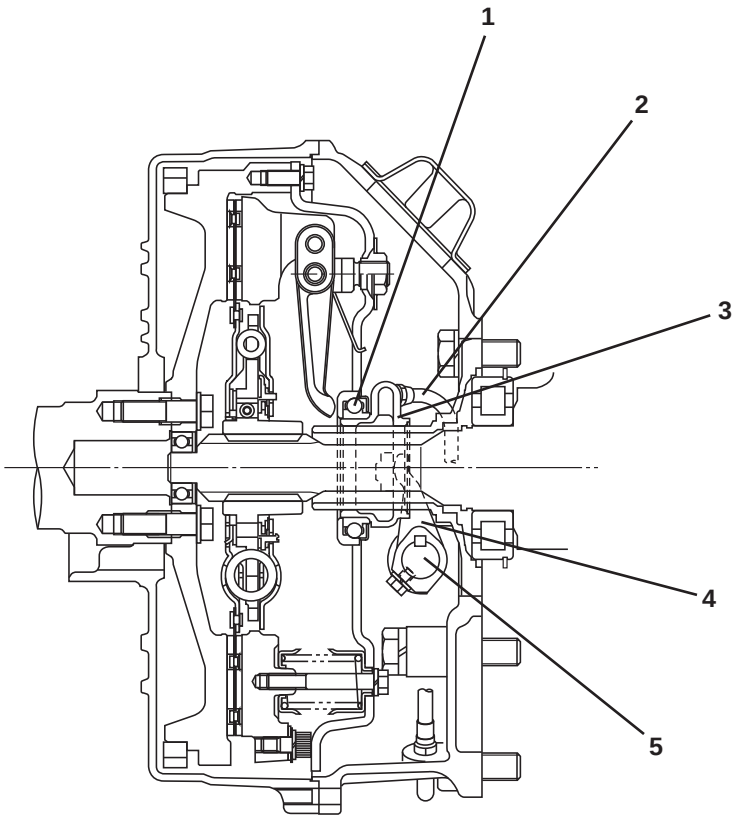
Engine series	J05D-TI, J05E-TI, J08E-TI	P11C
Power cylinder inside diameter	90 {3.543}	
Hydraulic cylinder inside diameter	19.8 {0.780}	
Relay valve piston outside diameter	14.3 {0.563}	12.7 {0.500}
Valve piston outside diameter	27.0 {1.063}	

DESCRIPTION

EN02Z0203C100001

CLUTCH RELEASE UNIT

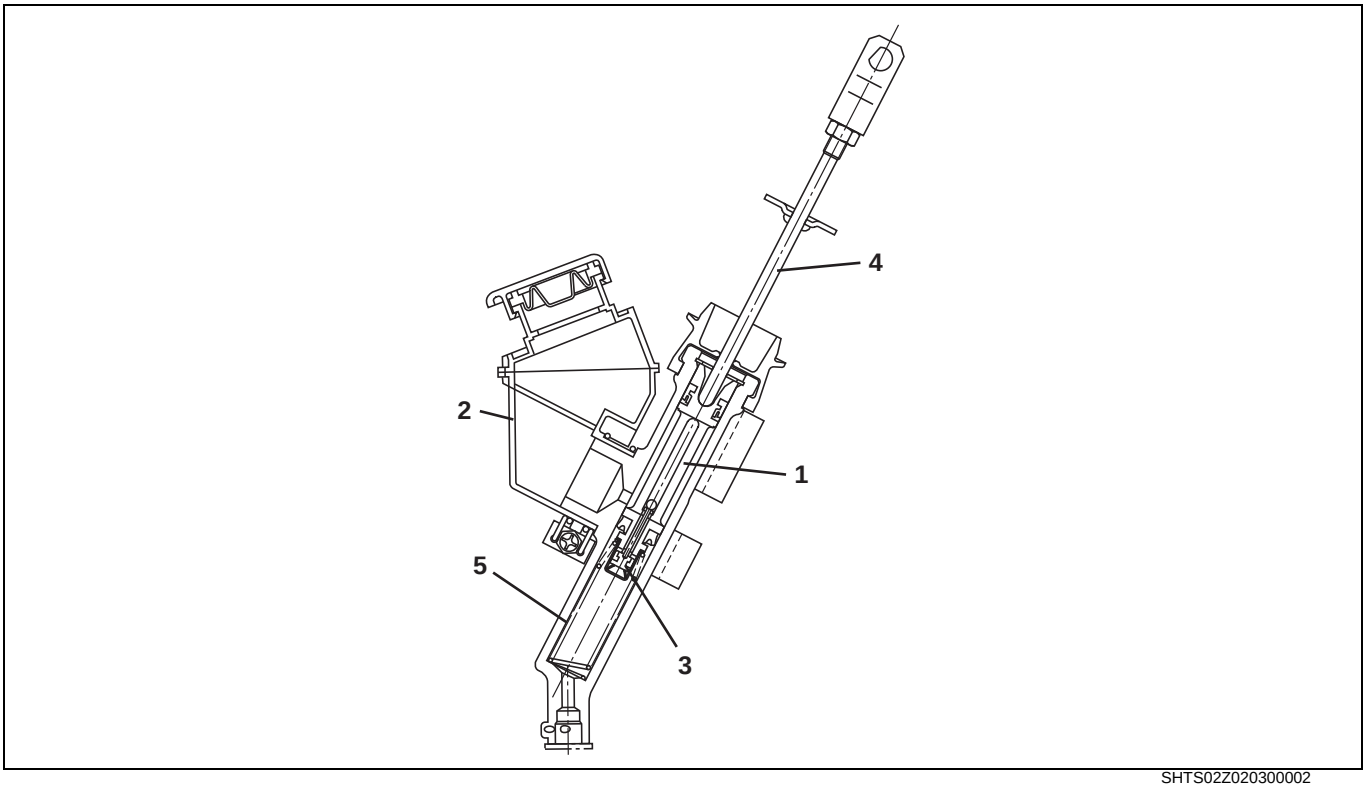
(REPRESENTATIVE TYPE)



SHTS02Z020300001

1	Release bearing	4	Release fork
2	Lubrication hose	5	Release fork shaft
3	Release bearing hub		

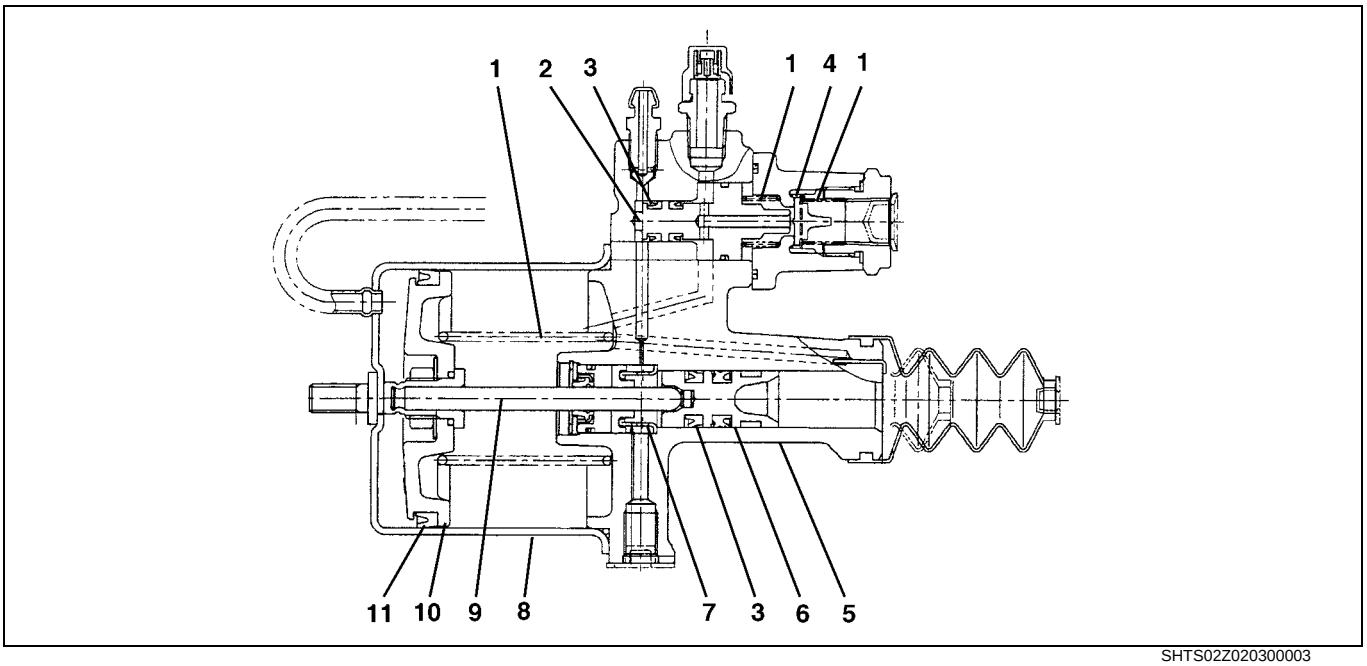
MASTER CYLINDER



SHTS02Z020300002

1	Piston	4	Push rod
2	Reservoir tank	5	Return spring
3	Valve		

CLUTCH BOOSTER



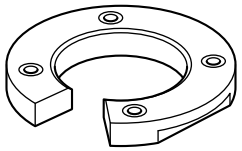
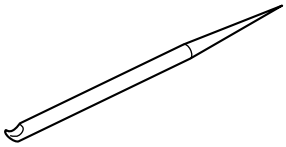
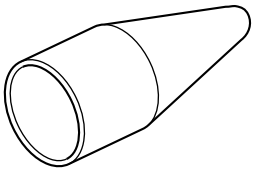
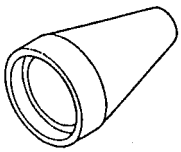
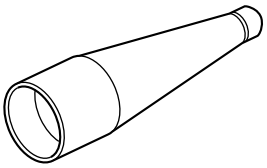
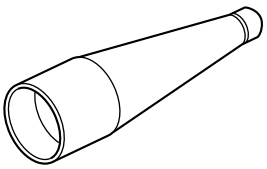
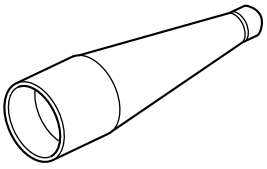
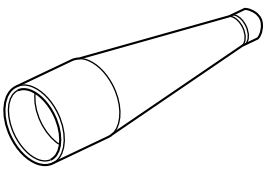
SHTS02Z020300003

1	Return spring	7	Retainer
2	Relay valve piston	8	Cylinder shell
3	Piston cup	9	Push rod
4	Poppet valve	10	Power piston
5	Hydraulic cylinder	11	Piston seal
6	Hydraulic piston		

SPECIAL TOOL

EN02Z0203K100001

Prior to starting a clutch booster overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0953-61020	STAND	
	S0965-31780	HOOK	
	S0965-72100	GUIDE	
	S0965-72090	GUIDE	
	S0965-72150	GUIDE	ENGINE SERIES: J05D-TI, J05E-TI, J08E-TI
	S0965-72160	GUIDE	ENGINE SERIES: J05D-TI, J05E-TI, J08E-TI
	S0965-71990	GUIDE	ENGINE SERIES: P11C
	S0965-72010	GUIDE	ENGINE SERIES: P11C

INSPECTION AND ADJUSTMENT

EN02Z0203H300001

AIR BLEEDING

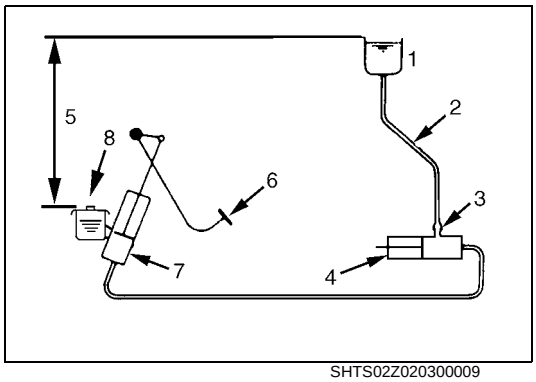
1. BLEED THE AIR FROM HYDRAULIC LINE.

NOTICE

- **Do not mix the clutch fluid with different types or brands.**
- **Be careful not to spill clutch fluid from the reservoir tank or from the air bleeder during air bleeding. Clutch fluid can damage the paint finish on the body or floor.**
- **There are two methods of bleeding, gravity bleeding and manual air bleeding.**

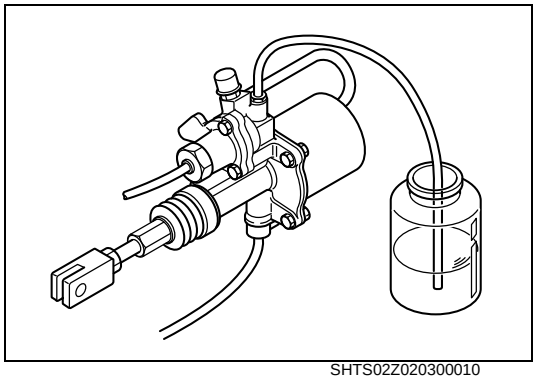
2. GRAVITY BLEEDING

(1) Connect a funnel to a vinyl tube.
(2) Connect the other end of the vinyl tube to the bleeder screw.
(3) Hold the funnel about 1.5 m {4.92 ft} higher than the reservoir tank.
(4) Loosen the bleeder screw and pour the clutch fluid into the funnel.
(5) Observe the flow of clutch fluid into the reservoir tank.
(6) When the air bubbles cease, close the bleeder screw.
(7) Check the fluid level. If necessary, add or remove clutch fluid in order to match the "MAX" level.



SHTS02Z020300009

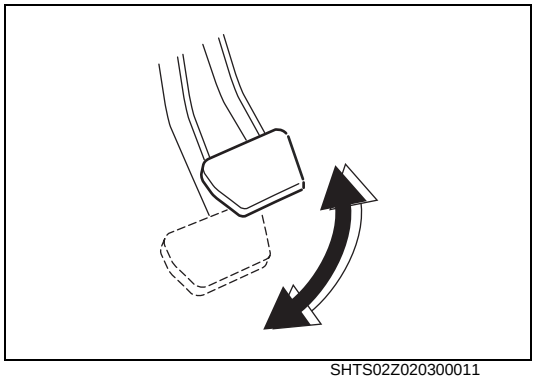
1. Funnel filled with clutch fluid
2. Vinyl tube (inside diameter: 6 mm {0.24 in.})
3. Bleeder
4. Clutch booster
5. About 1.5 m {4.92 ft}
6. Clutch pedal
7. Master cylinder
8. Reservoir tank



SHTS02Z020300010

3. MANUAL BLEEDING

(1) Fill the reservoir with clutch fluid.
(2) Connect the bleeder tube to the clutch booster screw. Place the other end of tube in a container half-filled with clutch fluid.

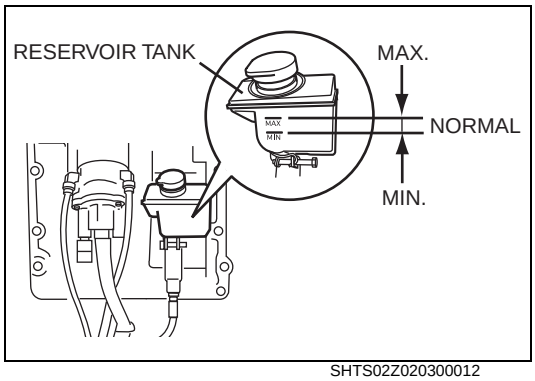


SHTS02Z020300011

(3) Slowly pump the clutch pedal several times. While pressing on the pedal, loosen the bleeder screw. Repeat this procedure until there are no more air bubbles in the fluid.

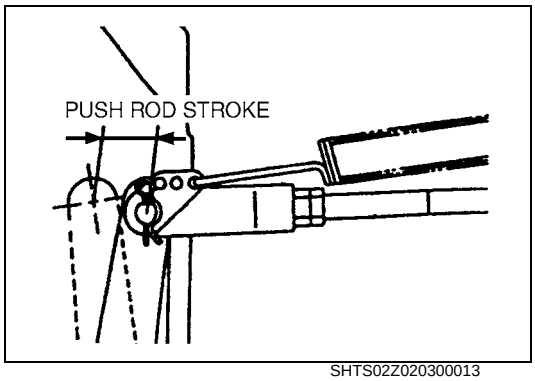
NOTICE

- **Do not return the clutch pedal before closing the bleeder screw.**
- **Keep the reservoir filled with clutch fluid.**
- **Re-bleeding will be necessary if the reservoir is emptied during bleeding operation.**



SHTS02Z020300012

(4) Check the fluid level. If necessary, add or remove clutch fluid in order to match the "MAX" level.



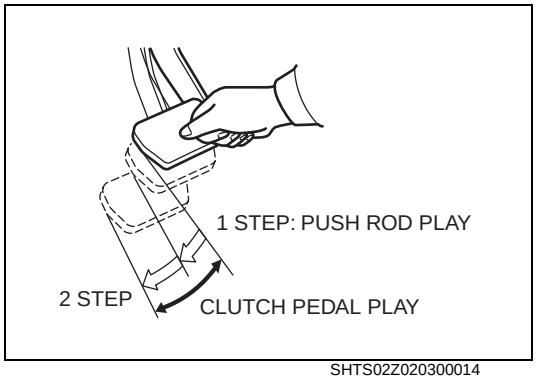
SHTS02Z020300013

4. AFTER BLEEDING, MAKE SURE THE PUSH ROD STROKE IS AS SPECIFIED.

(1) Depress the clutch pedal fully and measure the push rod stroke. If the stroke is less than standard, re-bleed the hydraulic system.

Transmission series	Standard
LX06S, LJ06S, MF06S, FS6109, FS8209, RT8908LL	More than 19.5 mm {0.768 in.}
HK06S	More than 23.0 mm {0.906 in.}
ZF9S109	More than 22.0 mm {0.866 in.}
ZF9S1110 ZF9S1310	More than 17.0 mm {0.669 in.}

CHECK AND ADJUSTMENT

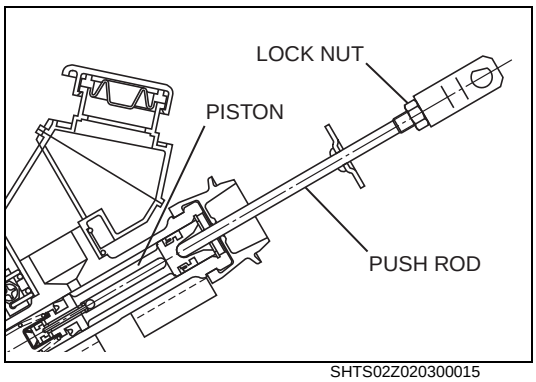


SHTS02Z020300014

1. CHECK AND ADJUST THE CLUTCH PEDAL PLAY.

(1) Check the push rod play.

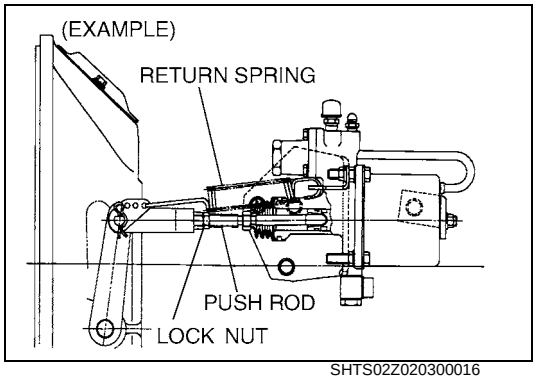
a. If necessary, adjust the push rod play.



SHTS02Z020300015

b. Loosen the lock nut and turn the master cylinder push rod until the push rod play is correct.
Standard:
Clearance between push rod and piston:
0.5 mm {0.0197 in.}
Push rod play at pedal top: 2-4 mm {0.079-0.157 in.}

c. Tighten the lock nut.



SHTS02Z020300016

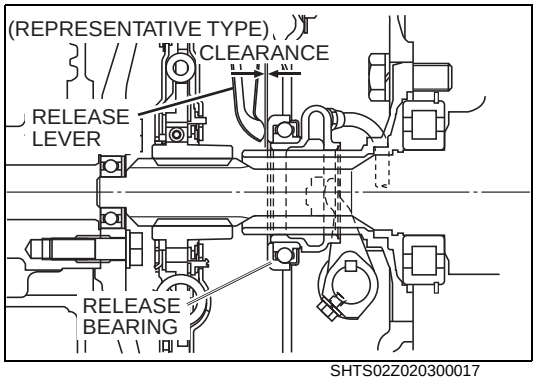
(2) Check the clutch pedal play.

a. Push the pedal until the beginning of clutch resistance is felt.

Engine series	Assembly standard
J05D-TI, J05E-TI, J08E-TI	52-65 mm {2.048-2.559 in.}
P11C	62-78 mm {2.441-3.070 in.}

b. If necessary, adjust the clutch pedal play by adjusting the clutch release bearing clearance.

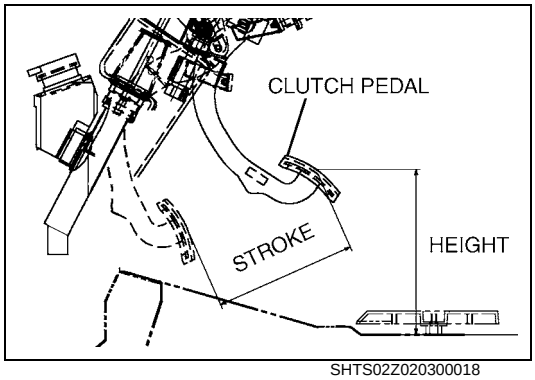
c. Loosen the lock nut and turn the push rod counterclockwise until the release bearing contacts the release lever.



SHTS02Z020300017

d. Turn the push rod clockwise about 2.5 turns.
Standard:
Clearance between release bearing and release lever:
2.0 mm {0.079 in.}

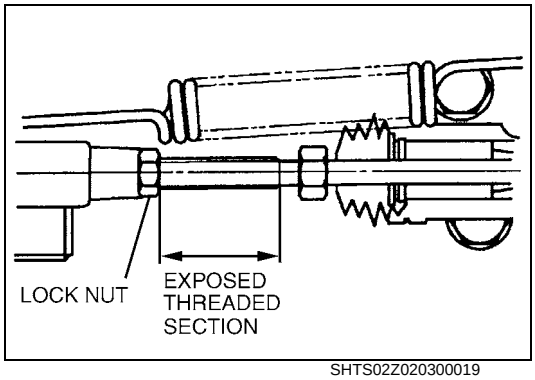
e. Tighten the lock nut.



SHTS02Z020300018

2. CHECK THE CLUTCH PEDAL HEIGHT AND STROKE.
Assembly Standard:

Engine series	J05D-TI, J05E-TI, J08E-TI	P11C
Pedal Height	169.2-179.2 mm {6.66-7.05 in.}	190.5-200.5 mm {7.50-7.89 in.}
Pedal Stroke	150-160 mm {5.91-6.29 in.}	180-190 mm {7.09-7.48 in.}



SHTS02Z020300019

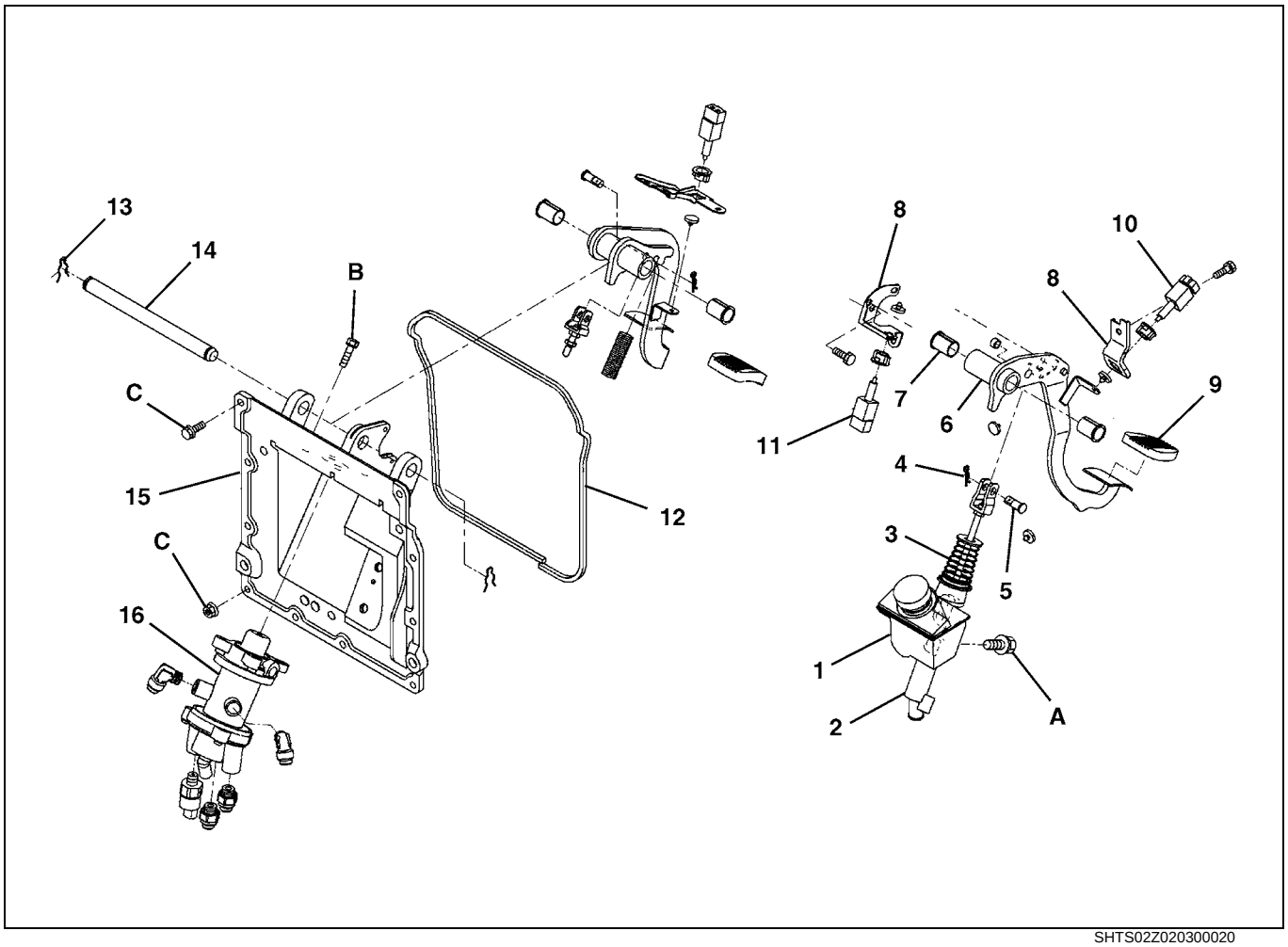
3. CHECK THE LENGTH OF THE EXPOSED THREADED SECTION OF THE PUSH ROD. IF ITS LENGTH IS LESS THAN THE SERVICE LIMIT, IT IS TIME TO REPLACE THE CLUTCH FACING.

Transmission series	Service limit
LX06S	18 mm {0.709 in.}
LJ06S	33 mm {1.299 in.}
MF06S, ZF9S109, ZF9S1110, ZF9S1310	20 mm {0.787 in.}
HK06S	7.5 mm {0.295 in.}
EATON FS6109/8209	11 mm {0.433 in.}
FULLER RT8908LL	2.5 mm {0.0984 in.}

CLUTCH PEDAL AND RELEASE UNIT

COMPONENT LOCATOR

EN02Z0203D100001



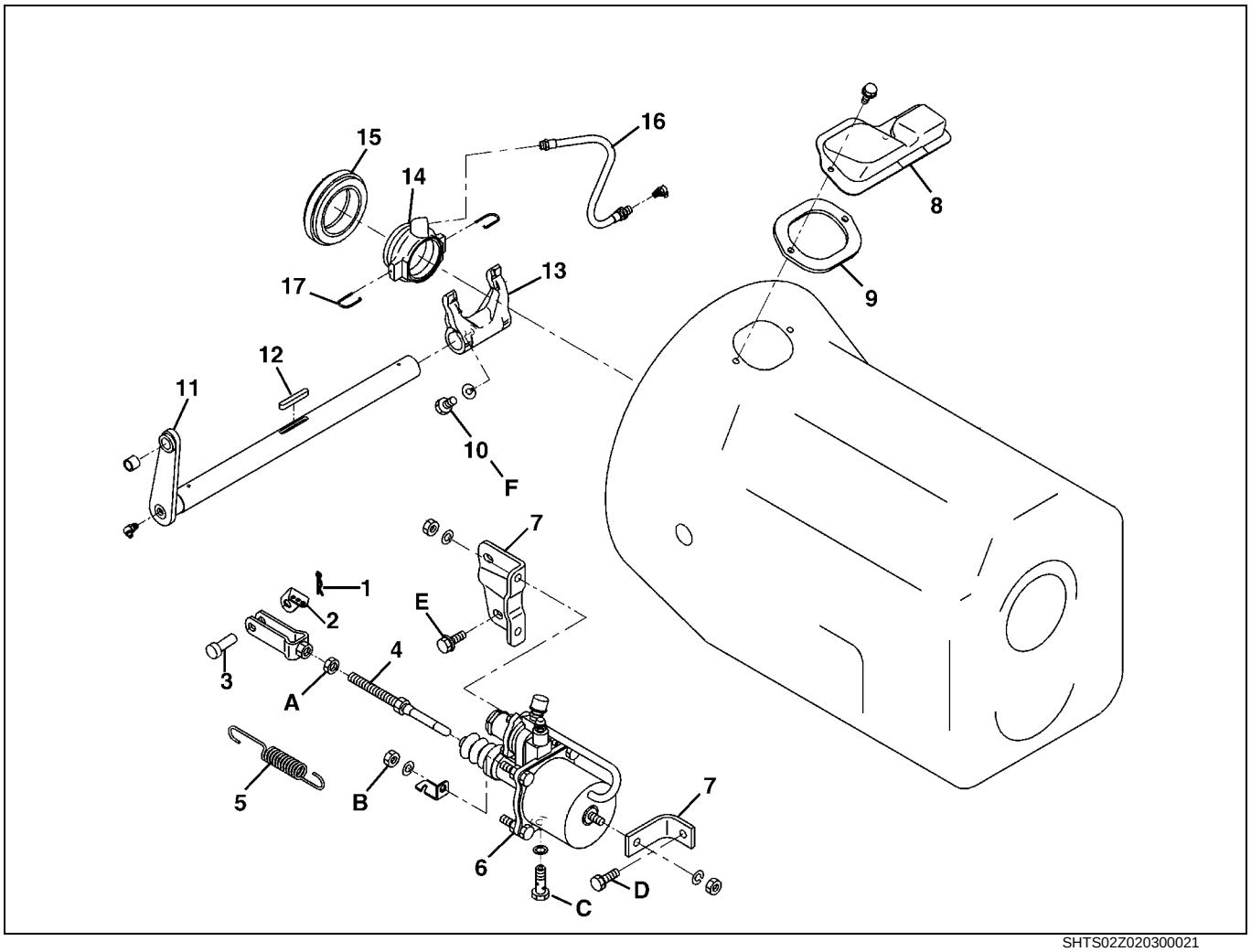
SHTS02Z020300020

1	Reservoir tank	10	Switch (For exhaust brake)
2	Master cylinder	11	Switch (For transmission P.T.O. control) (If so equipped)
3	Return spring	12	Seal
4	Cotter pin	13	Clip
5	Pin	14	Pedal shaft
6	Clutch pedal	15	Pedal bracket
7	Bushing	16	Brake valve
8	Bracket		
9	Pedal pad		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39-91 {398-927, 29-67}	C	18-31 {184-316, 14-22}
B	9.5-18.5 {97-188, 7.1-13.5}		

TRANSMISSION SERIES: LX06S



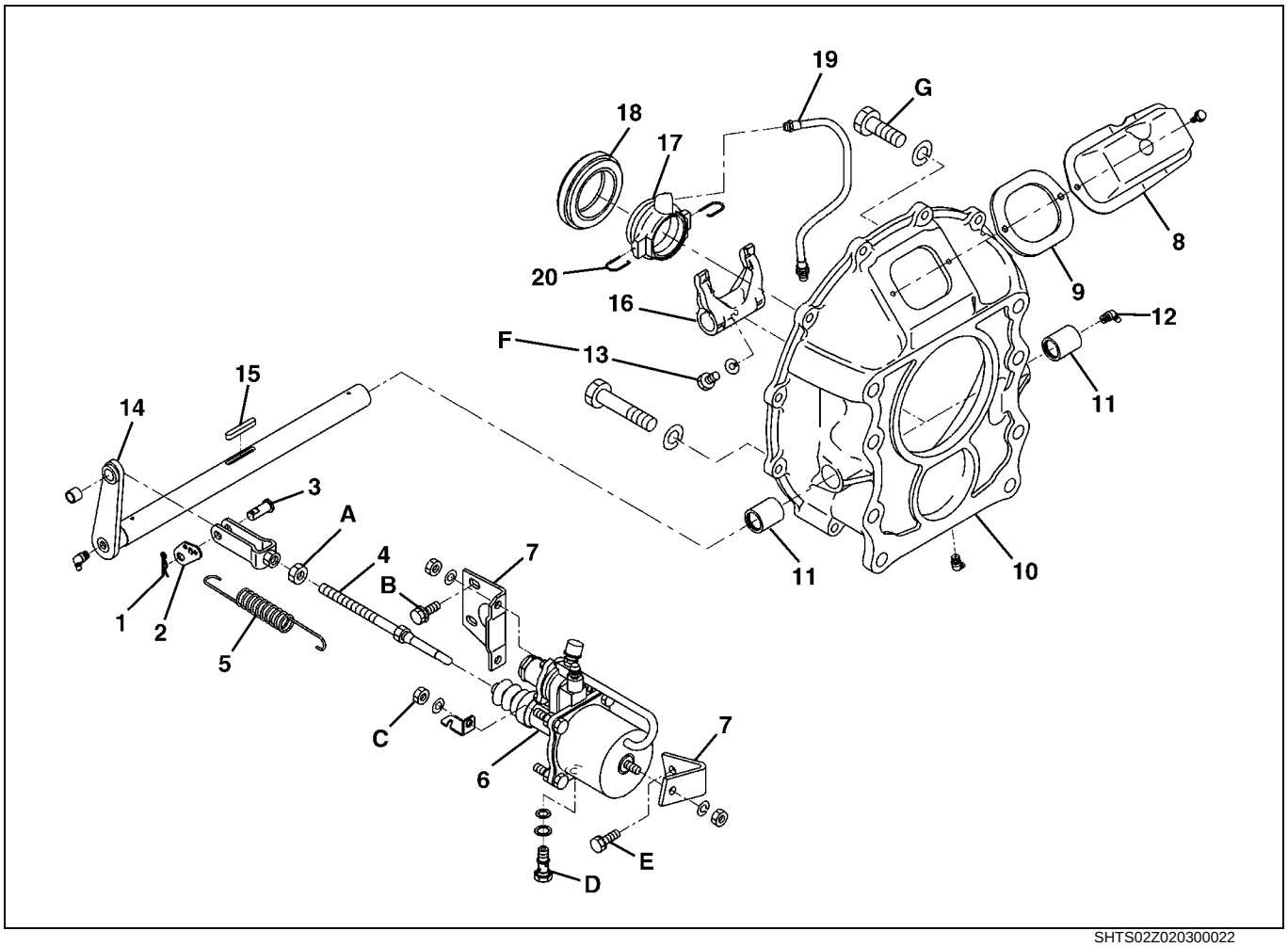
SHTS02Z020300021

1	Cotter pin	10	Set screw
2	Spring hanger	11	Release shaft
3	Pin	12	Key
4	Push rod	13	Release fork
5	Tension spring	14	Release bearing hub
6	Clutch booster	15	Release bearing
7	Bracket	16	Lubrication hose
8	Cover	17	Anti-rattle spring
9	Gasket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	37.5-48.5 {383-495, 28-35}
B	37.5-48.5 {383-495, 28-35}	E	37.5-48.5 {383-495, 28-35}
C	27.5-32.5 {281-331, 21-24}	F	14.5-17.5 {148-178, 11-12}

TRANSMISSION SERIES: LJ06S



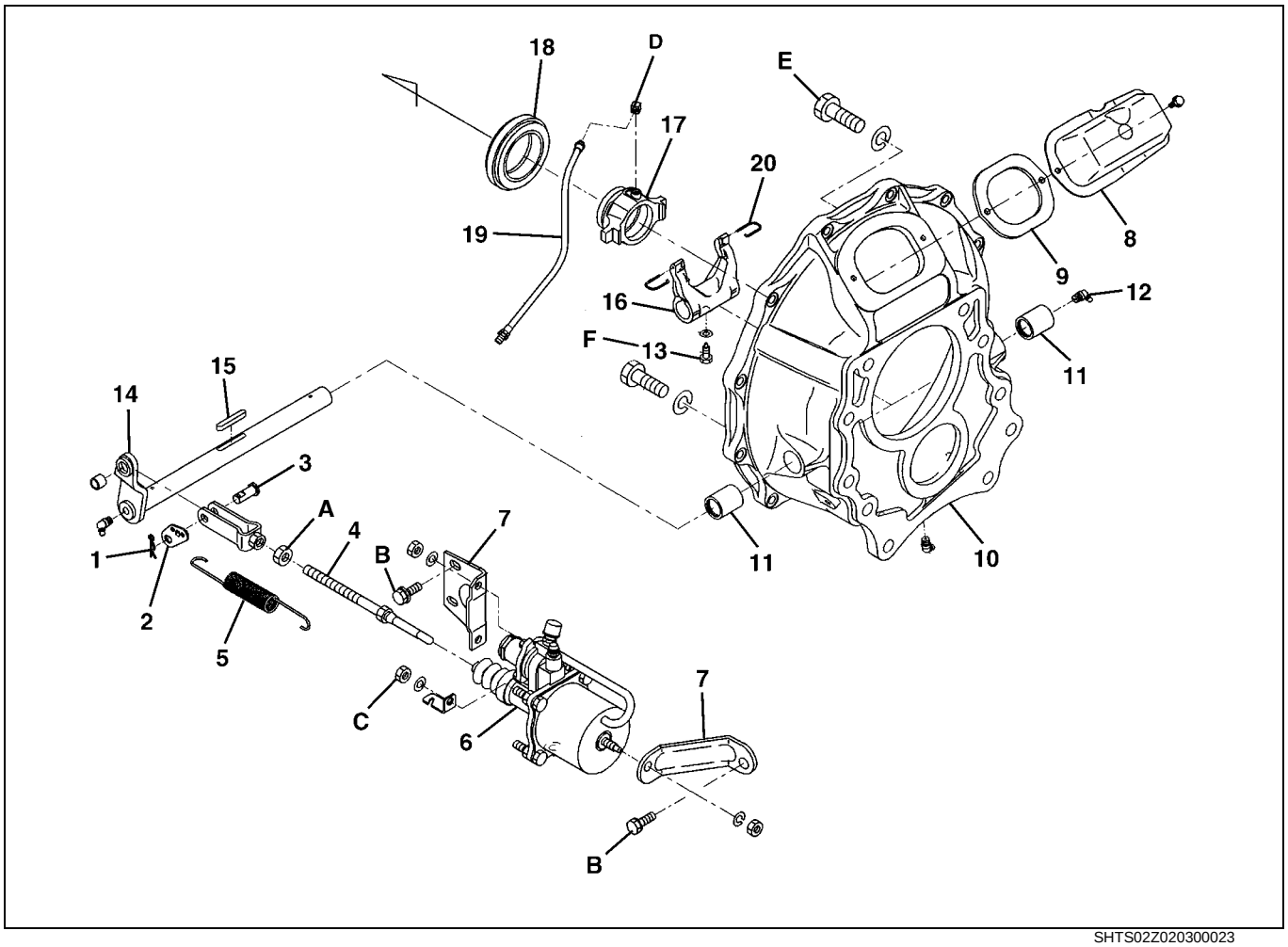
SHTS02Z020300022

1	Cotter pin	11	Release shaft bearing
2	Spring hanger	12	Lubrication fitting
3	Pin	13	Set screw
4	Push rod	14	Release shaft
5	Tension spring	15	Key
6	Clutch booster	16	Release fork
7	Bracket	17	Release bearing hub
8	Cover	18	Release bearing
9	Gasket	19	Lubrication hose
10	Clutch housing	20	Anti-rattle spring

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	E	37.5-48.5 {383-495, 28-35}
B	37.5-48.5 {383-495, 28-35}	F	14.5-17.5 {148-178, 11-12}
C	37.5-48.5 {383-495, 28-35}	G	246-322 {2,510-3,280, 182-237}
D	27.5-32.5 {280-330, 20-23}		

TRANSMISSION SERIES: MF06S



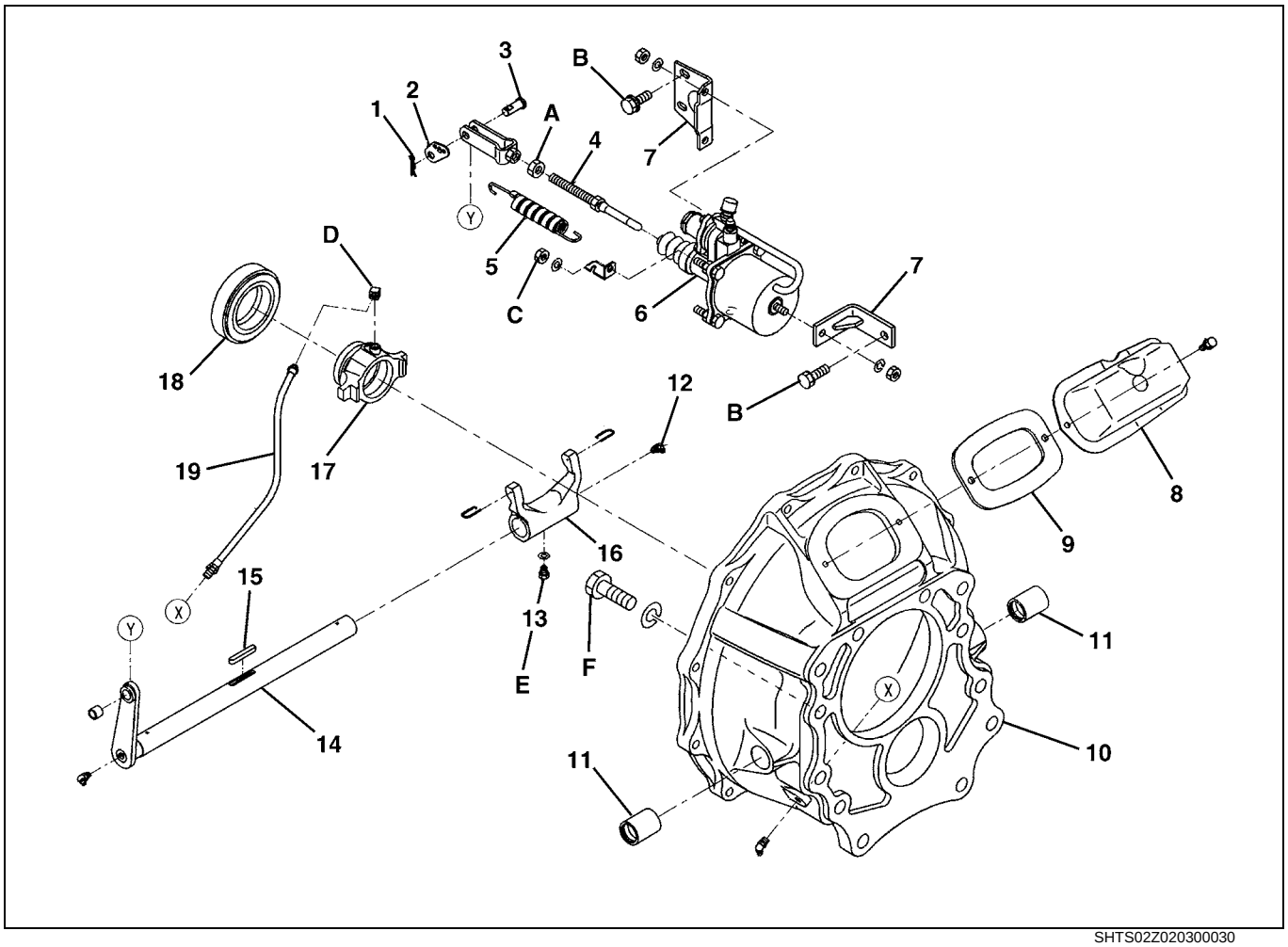
SHTS02Z020300023

1	Cotter pin	11	Release shaft bearing
2	Spring hanger	12	Lubrication fitting
3	Pin	13	Set screw
4	Push rod	14	Release shaft
5	Tension spring	15	Key
6	Clutch booster	16	Release fork
7	Bracket	17	Release bearing hub
8	Cover	18	Release bearing
9	Gasket	19	Lubrication hose
10	Clutch housing	20	Anti-rattle spring

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	44.5-57.5 {454-586, 33-42}
B	64-84 {653-856, 47-61}	E	344-460 {3,510-4,690, 254-339}
C	37.5-48.5 {383-495, 28-35}	F	14.5-17.5 {148-178, 11-12}

TRANSMISSION SERIES: HK06S



SHTS02Z020300030

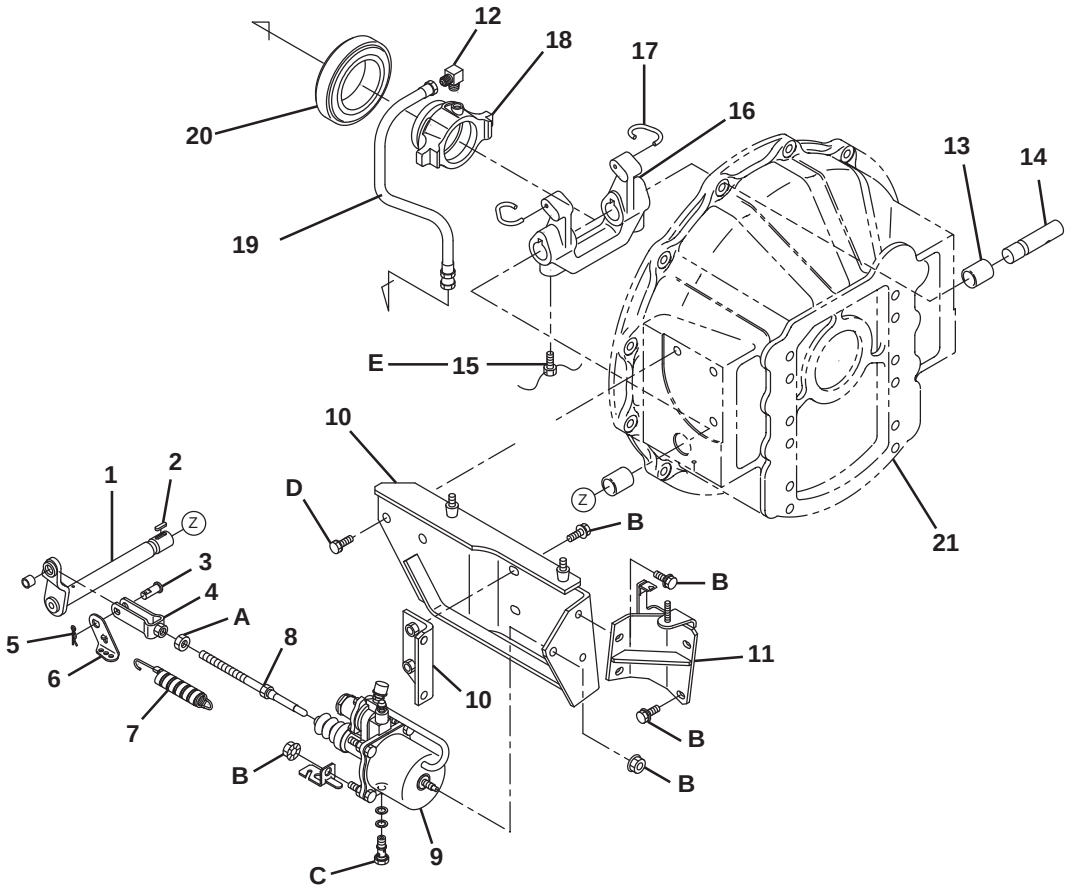
1	Cotter pin	11	Release shaft bearing
2	Spring hanger	12	Lubrication fitting
3	Pin	13	Set screw
4	Push rod	14	Release shaft
5	Tension spring	15	Key
6	Clutch booster	16	Release fork
7	Bracket	17	Release bearing hub
8	Cover	18	Release bearing
9	Gasket	19	Lubrication hose
10	Clutch housing		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	44.5-57.5 {454-586, 33-42}
B	64-84 {653-856, 47-61}	E	14.5-17.5 {148-178, 11-12}
C	37.5-48.5 {383-495, 28-35}	F	344-460 {3,510-4,690, 254-339}

TRANSMISSION SERIES: FS6109/8209

(MODELS FOR AUSTRALIA, CHILE, IRELAND, NEW ZEALAND AND TAIWAN)



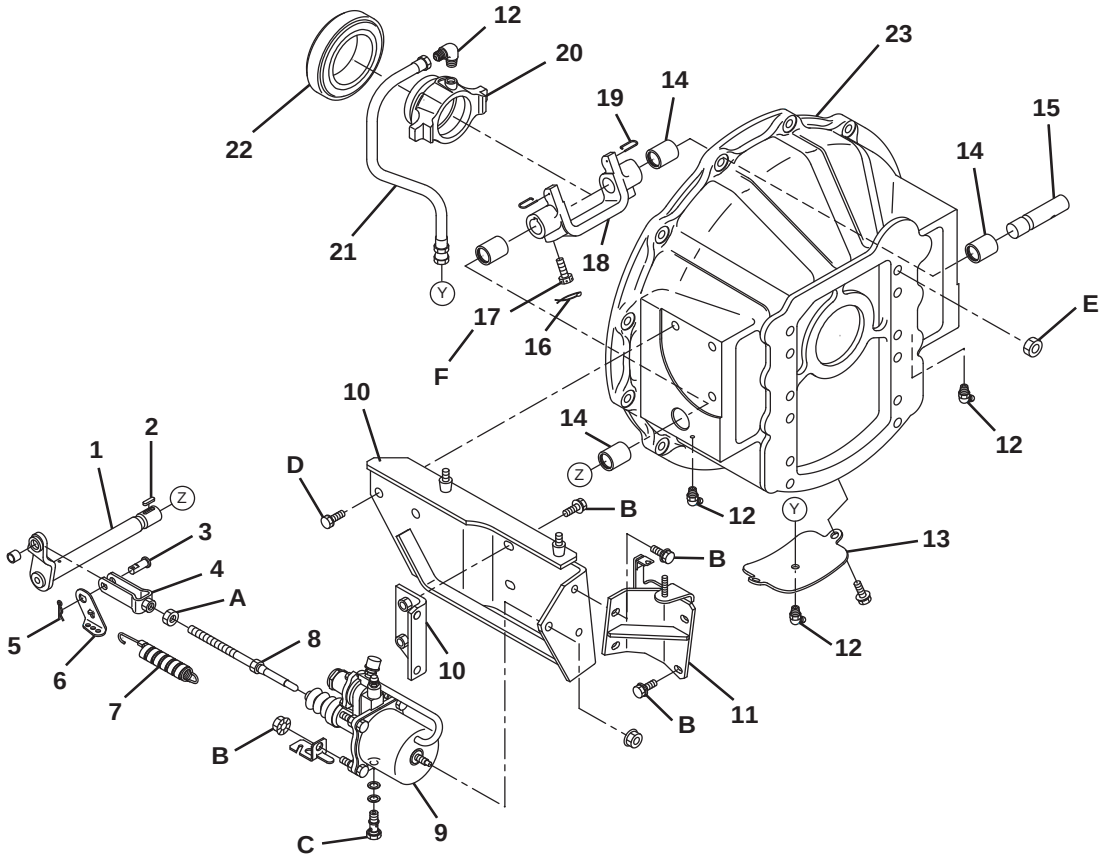
SHTS02Z020300024

1	Release lever	12	Lubrication fitting
2	Key	13	Bushing
3	Pin	14	Release shaft
4	Clevis	15	Set screw
5	Cotter pin	16	Release fork
6	Spring hanger	17	Anti-rattle spring
7	Tension spring	18	Release bearing hub
8	Push rod	19	Lubrication hose
9	Clutch booster	20	Release bearing
10	Bracket	21	Clutch housing
11	Support		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	64-84 {653-857, 48-61}
B	37.5-48.5 {383-495, 28-35}	E	48-62 {490-632, 35-45}
C	27.5-32.5 {280-330, 20-23}		

(MODELS FOR THAILAND, INDONESIA AND VIETNAM)



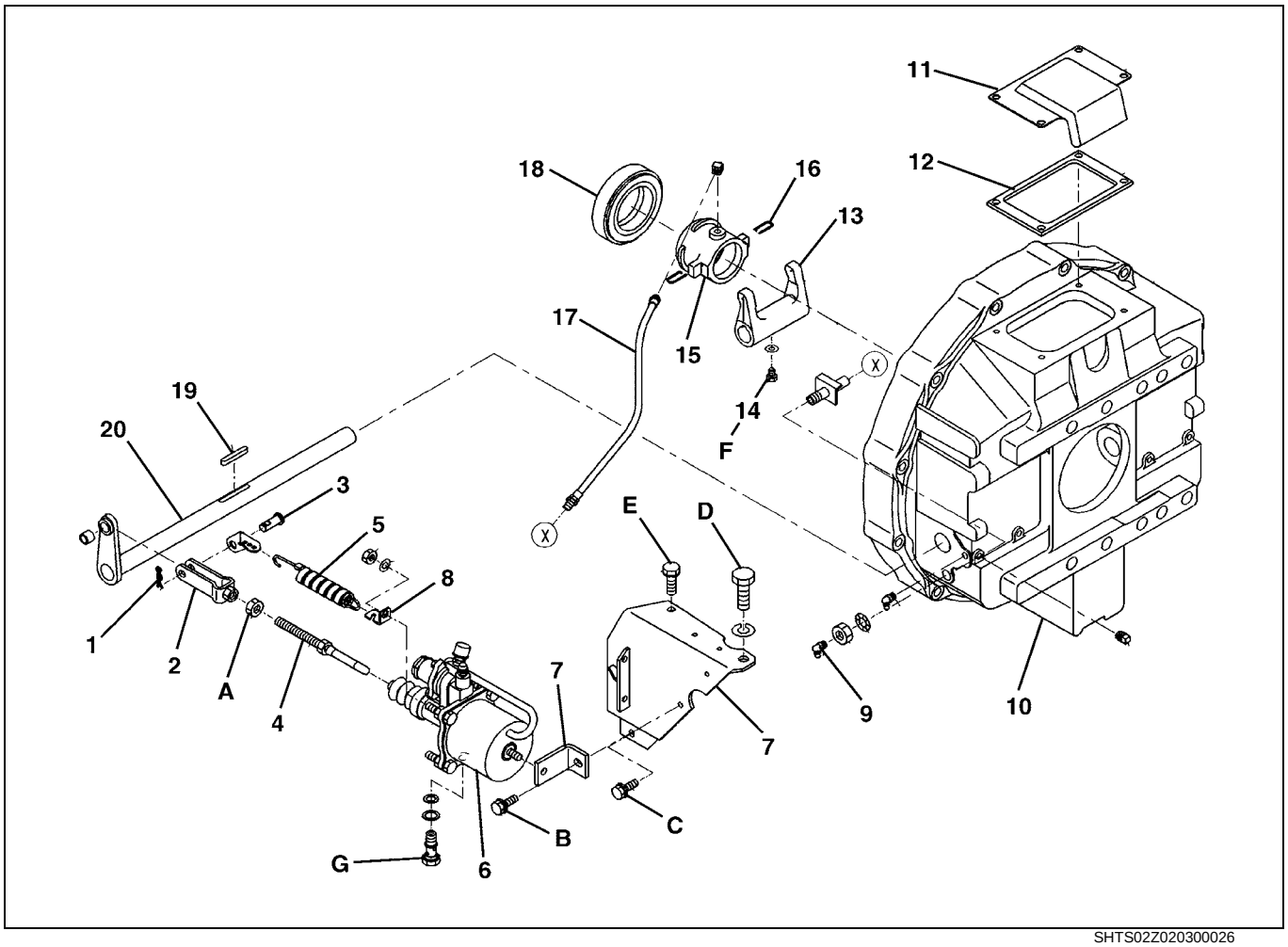
SHTS02Z020300025

1	Release lever	13	Cover
2	Key	14	Bushing
3	Pin	15	Release shaft
4	Clevis	16	Wire
5	Cotter pin	17	Set screw
6	Spring hanger	18	Release fork
7	Tension spring	19	Anti-rattle spring
8	Push rod	20	Release bearing hub
9	Clutch booster	21	Lubrication hose
10	Bracket	22	Release bearing
11	Support	23	Clutch housing
12	Lubrication fitting		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	64-84 {653-857, 48-61}
B	37.5-48.5 {383-495, 28-35}	E	70-78 {714-795, 52-57}
C	27.5-32.5 {280-330, 20-23}	F	48-62 {490-632, 35-45}

TRANSMISSION SERIES: ZF9S109



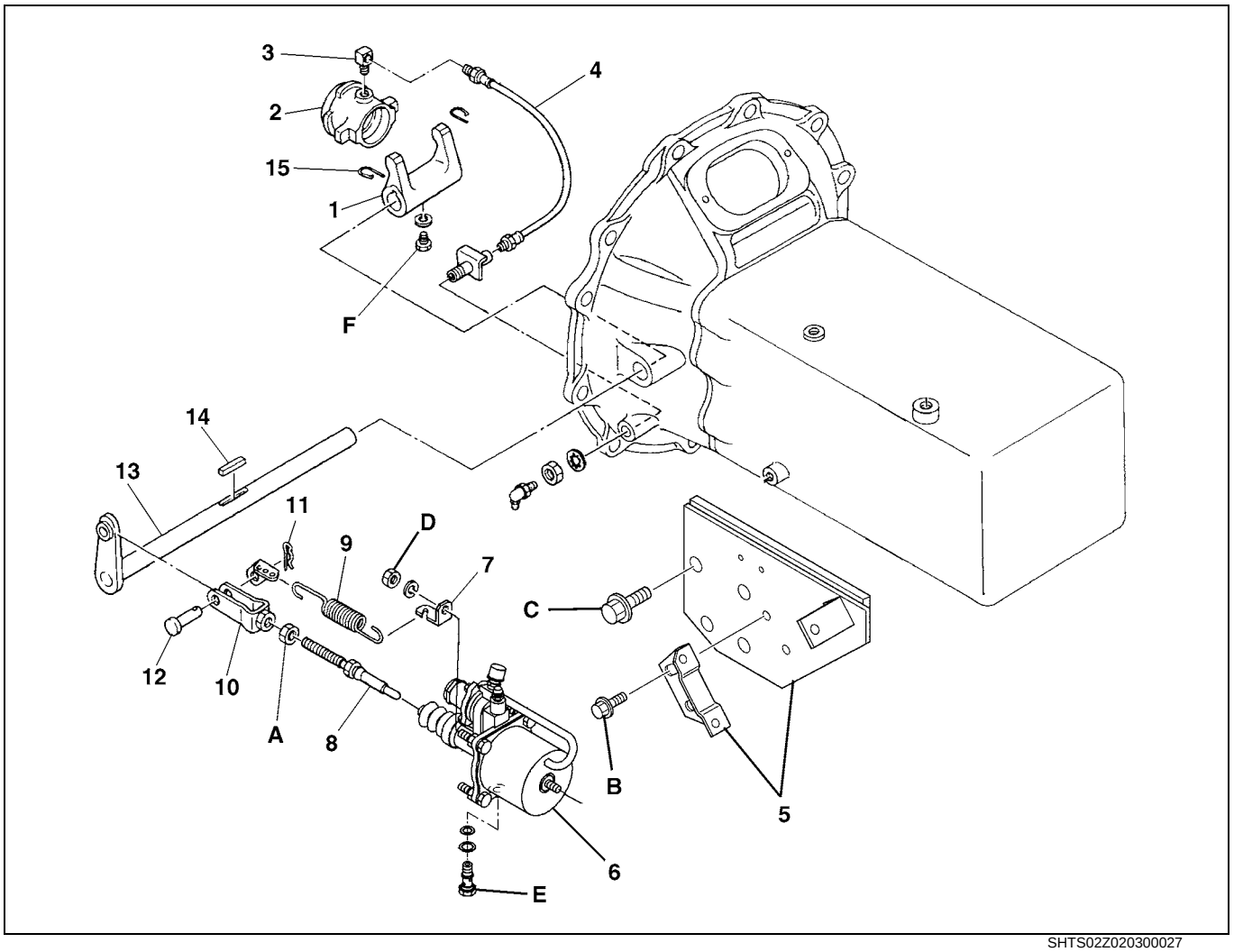
SHTS02Z020300026

1	Cotter pin	11	Cover
2	Clevis	12	Gasket
3	Pin	13	Release fork
4	Push rod	14	Set screw
5	Tension spring	15	Release bearing hub
6	Clutch booster	16	Anti-rattle spring
7	Bracket	17	Lubrication hose
8	Spring hanger	18	Release bearing
9	Lubrication fitting	19	Key
10	Clutch housing	20	Release shaft

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	E	64-84 {653-857, 48-61}
B	37.5-48.5 {383-495, 28-35}	F	14.5-17.5 {148-178, 11-12}
C	19-25 {193-255, 14-18}	G	27.5-32.5 {280-330, 20-23}
D	167-223 {1,704-2,276, 124-164}		

TRANSMISSION SERIES: RT8908LL



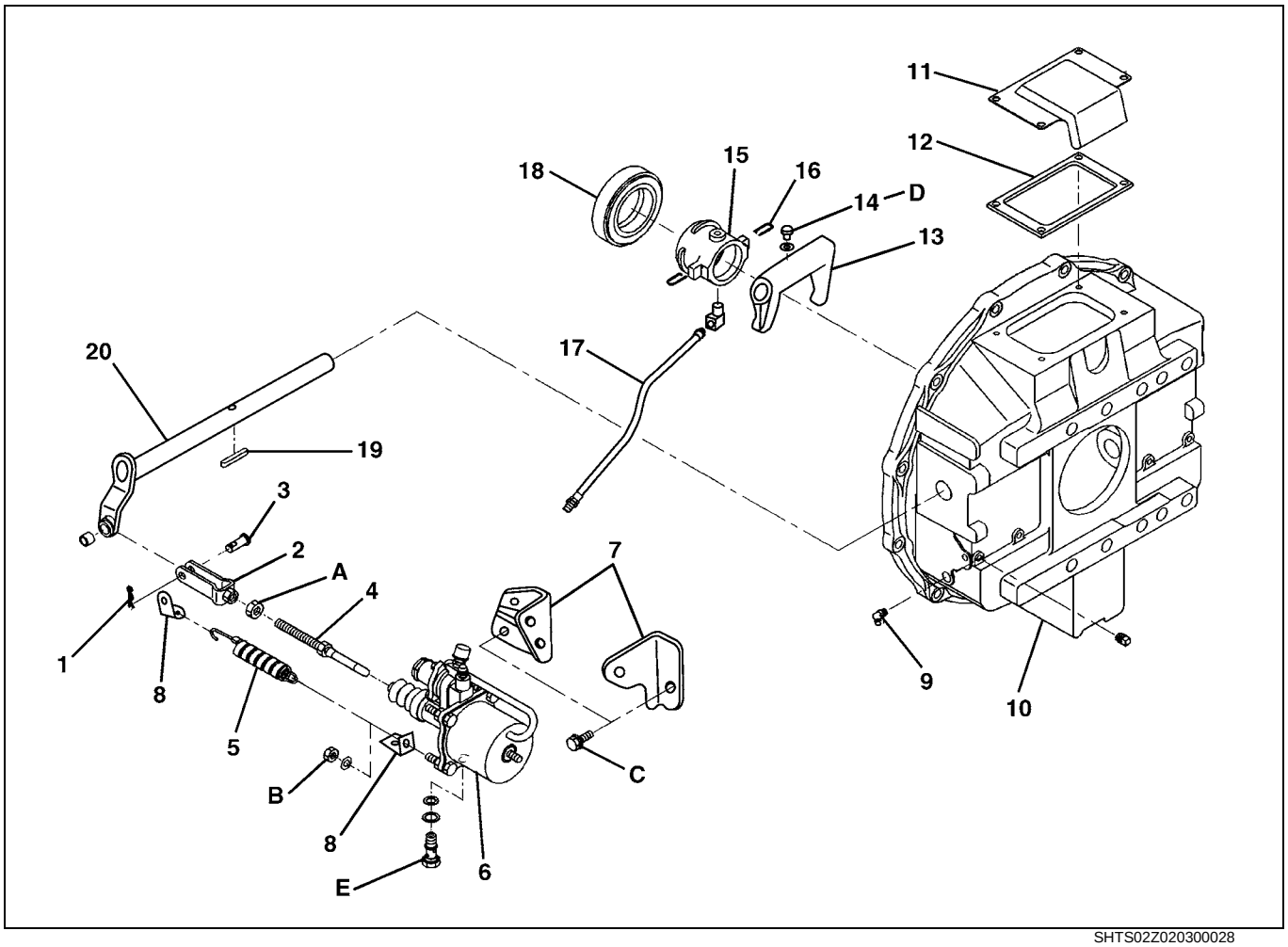
SHTS02Z020300027

1	Release fork	9	Tension spring
2	Release bearing hub	10	Clevis
3	Elbow	11	Cotter pin
4	Lubrication hose	12	Pin
5	Bracket	13	Release shaft
6	Clutch booster	14	Key
7	Spring hanger	15	Anti-rattle spring
8	Push rod		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	37.5-48.5 {383-485, 28-35}
B	64-84 {653-857, 48-61}	E	27.5-32.5 {280-330, 20-23}
C	344-460 {3,510-4,690, 254-339}	F	14.5-17.5 {148-178, 11-12}

TRANSMISSION SERIES: ZF9S1110



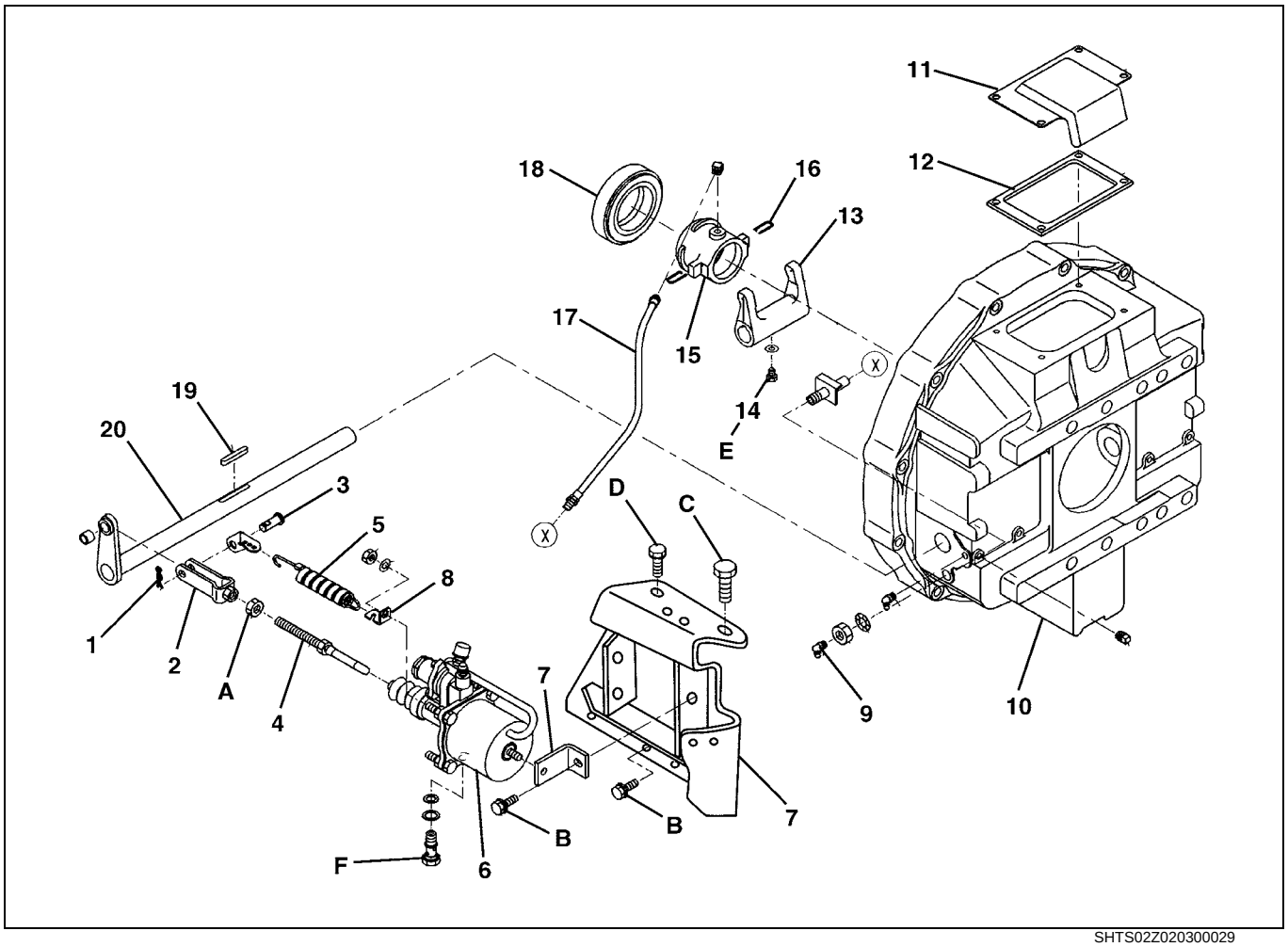
SHTS02Z020300028

1	Cotter pin	11	Cover
2	Clevis	12	Gasket
3	Pin	13	Release fork
4	Push rod	14	Set screw
5	Tension spring	15	Release bearing hub
6	Clutch booster	16	Anti-rattle spring
7	Bracket	17	Lubrication hose
8	Spring hanger	18	Release bearing
9	Lubrication fitting	19	Key
10	Clutch housing	20	Release shaft

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	14.5-17.5 {148-178, 11-12}
B	37.5-48.5 {383-495, 28-35}	E	27.5-32.5 {280-330, 20-23}
C	19.0-25.0 {193-255, 14-18}		

TRANSMISSION SERIES: ZF9S1310



SHTS02Z020300029

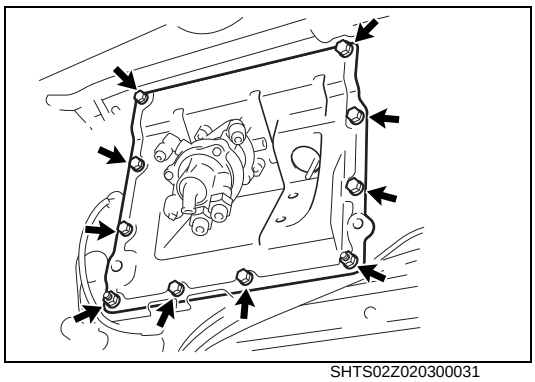
1	Cotter pin	11	Cover
2	Clevis	12	Gasket
3	Pin	13	Release fork
4	Push rod	14	Set screw
5	Tension spring	15	Release bearing hub
6	Clutch booster	16	Anti-rattle spring
7	Bracket	17	Lubrication hose
8	Spring hanger	18	Release bearing
9	Lubrication fitting	19	Key
10	Clutch housing	20	Release shaft

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45.5-58.5 {465-597, 34-43}	D	64-84 {653-857, 48-61}
B	37.5-48.5 {383-495, 28-35}	E	14.5-17.5 {148-178, 11-12}
C	167-223 {1,704-2,276, 124-164}	F	27.5-32.5 {280-330, 20-23}

OVERHAUL

EN02Z0203H200001

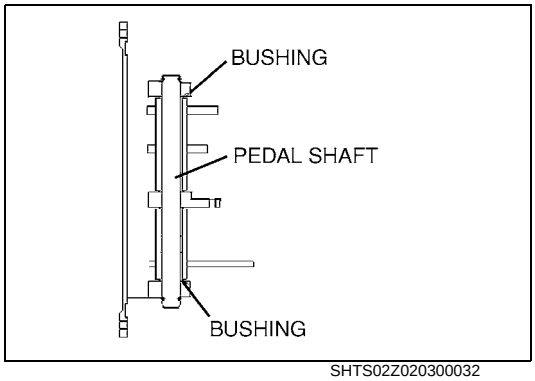

SHTS02Z020300031

IMPORTANT POINTS - DISMOUNTING

1. REMOVE THE PEDAL UNIT ASSEMBLY.

(1) Remove the 8 bolts and 2 nuts and dismount the pedal bracket assembly from the vehicle.

NOTICE
Be careful not to damage the vehicle.



SHTS02Z020300032

2. REMOVE THE CLUTCH PEDAL.

(1) Remove the stroke sensor from the clutch pedal.

(2) Remove the clip, and tap the pedal shaft lightly to remove the clutch pedal using a brass bar and a hammer.

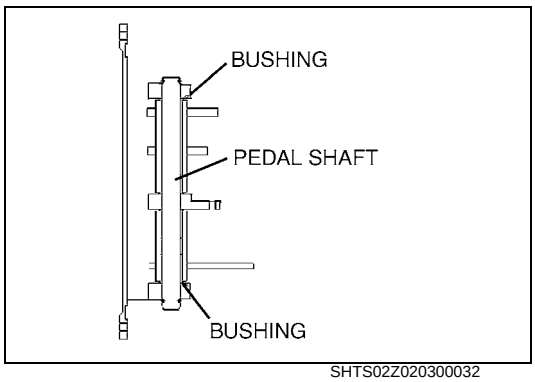
IMPORTANT POINTS - MOUNTING

1. INSTALL THE CLUTCH PEDAL.

(1) Apply lithium grease to the inner side and outer periphery of the bushing, and install the bushing to the inserting hole on the shaft part of the clutch pedal.

(2) Install the clutch pedal to the installing axle for pedal shaft and install the pedal shaft to the pedal bracket using a plastic hammer.

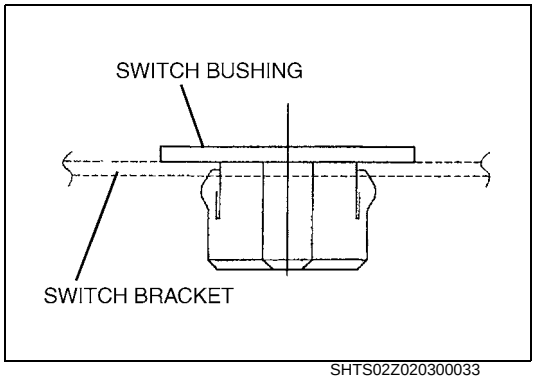
2. INSTALL THE PEDAL UNIT ASSEMBLY.



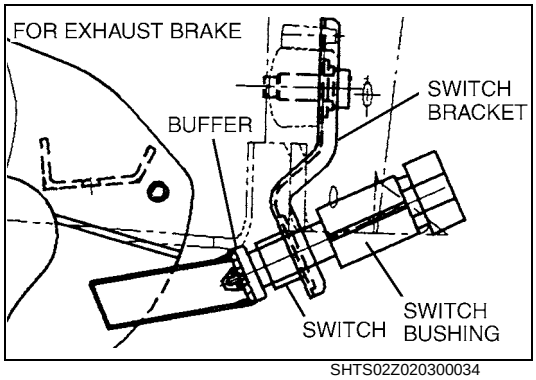
SHTS02Z020300032

3. INSTALL THE SWITCH FOR EXHAUST BRAKE AND TRANSMISSION P.T.O.

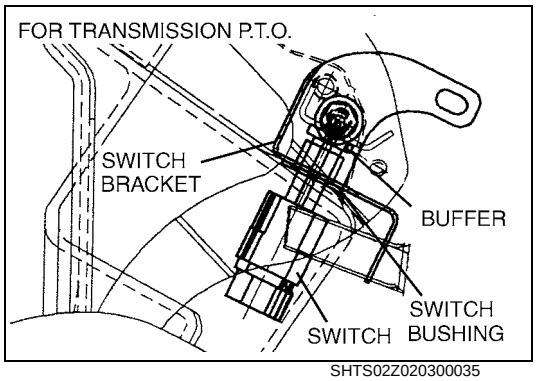
(1) Install the switch bushing into the switch bracket.



SHTS02Z020300033



SHTS02Z020300034

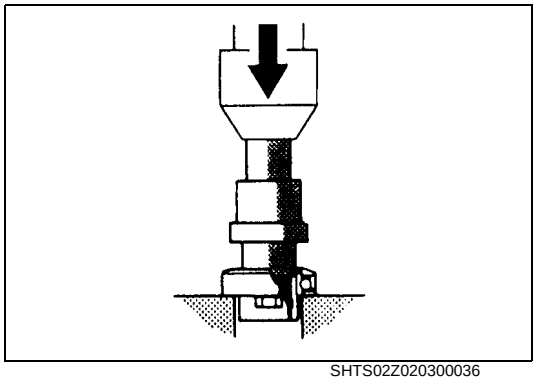


SHTS02Z020300035

(2) Push the switch into the switch bushing until the switch pounds the buffer, then fix the switch by turning if clockwise.

NOTICE

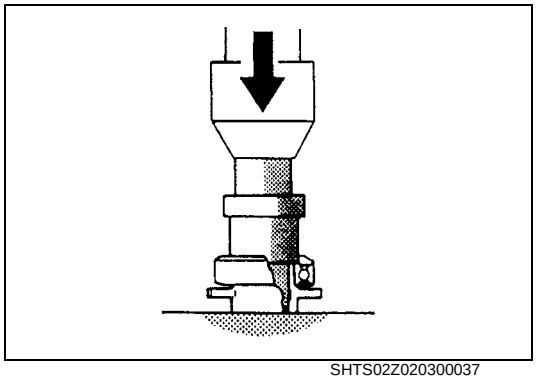
Check that the switch body does not contact the buffer and also that the switch rightly function.


SHTS02Z020300036

IMPORTANT POINTS - ASSEMBLY

1. REPLACE THE RELEASE BEARING.

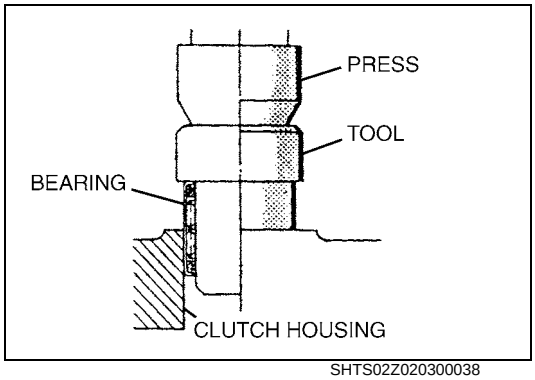
(1) Using a suitable tool and a press, remove the bearing from the release bearing hub.


SHTS02Z020300037

(2) Press the bearing into the hub.

NOTICE

- **After installing the bearing, ensure that it rotates smoothly.**
- **The bearing is permanently lubricated and require no cleaning or lubrication.**
- **In order to prevent damage to the race surface, press fit slowly by a press and do not apply impact loads.**

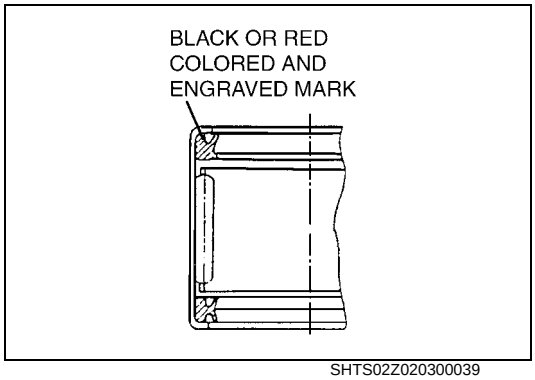


SHTS02Z020300038

2. REPLACE THE RELEASE SHAFT BEARING.

(1) Using a suitable tool and a press, remove the bearings from the clutch housing.

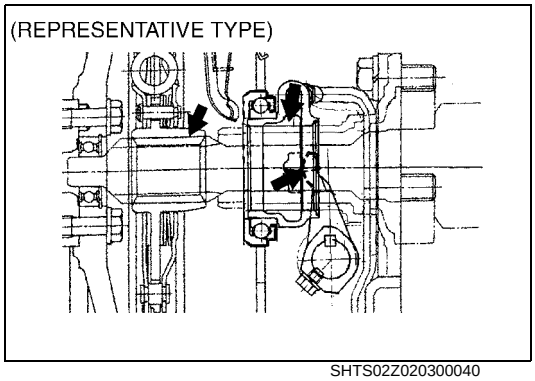
(2) Press the bearings into the housing.



SHTS02Z020300039

NOTICE

The bearing must be installed with red colored and engraved facing of the oil seal outward.



SHTS02Z020300040

3. APPLY BEARING GREASE OR HEAT RESISTANCE GREASE.

(1) Apply bearing grease to the following parts.
   a. The release fork and the release bearing hub contact point.
   b. The release bearing hub inner groove.

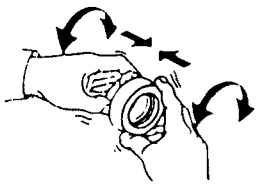
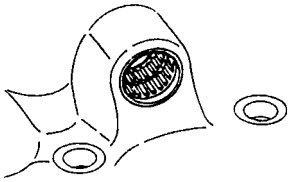
(2) Apply heat resistance grease to the transmission input shaft spline.

NOTICE

Apply a small amount of grease to the spline.

INSPECTION AND REPAIR

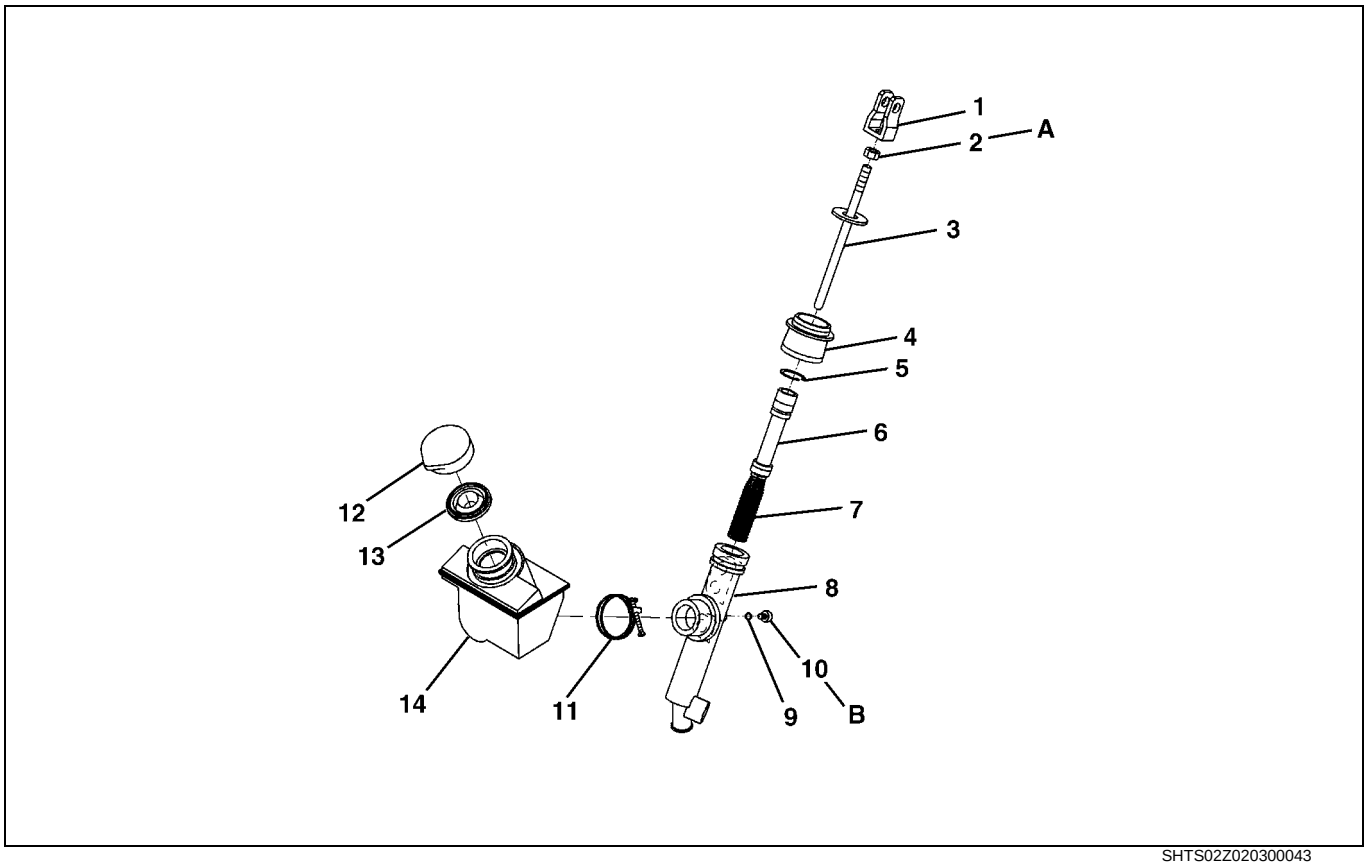
EN02Z0203H300002

Inspection item	Standard	Limit	Remedy	Inspection procedure
Release bearing improper rotation	**—**	**—**	**Replace release bearing, if necessary.**	**Visual check** 
Release fork and release hub: Wear and damage	**—**	**—**	**Replace the parts, if necessary.**	**Visual check**
Release shaft bearing: Wear and damage	**—**	**—**	**Replace the parts, if necessary.**	**Visual check** 

CLUTCH MASTER CYLINDER

COMPONENT LOCATOR

EN02Z0203D100002



SHTS02Z020300043

1	Clevis	8	Body
2	Lock nut	9	O-ring
3	Push rod	10	Stopper bolt
4	Boot	11	Clamp
5	Retainer ring	12	Reservoir cap
6	Piston	13	Gasket
7	Return spring	14	Reservoir tank

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	11.5-16.9 {118-172, 8.5-12.4}	B	2.4-4.4 {25-45, 1.9-3.2}

OVERHAUL

EN02Z0203H200002

IMPORTANT POINT - DISMOUNTING

1. REMOVE THE MASTER CYLINDER.

NOTICE

- **Before removing the master cylinder, drain the clutch fluid from the hydraulic line.**
- **Place a small drain pan under the master cylinder to catch the hydraulic fluid. Do not let the clutch fluid remain on a painted floor. Wash it off immediately.**

IMPORTANT POINT - ASSEMBLY

1. INSTALL THE RETURN SPRING AND PISTON TO THE CYLINDER.

NOTICE

Lubricate the cylinder bore and piston with clean clutch fluid.

INSPECTION AND REPAIR

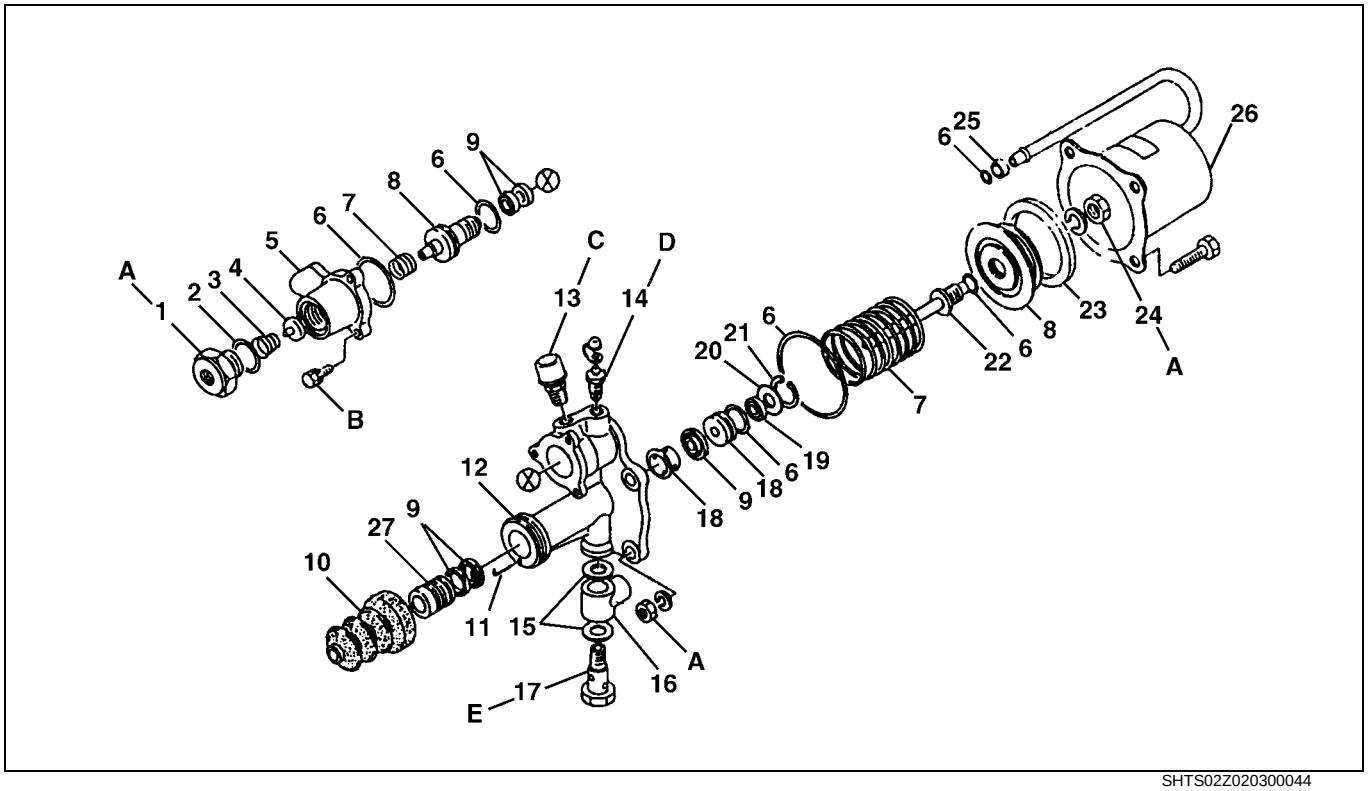
EN02Z0203H300003

Inspection item	Standard	Limit	Remedy	Inspection procedure
Piston seal and cup: Wear and damage Cylinder body bore: Scoring and corrosion	—	—	Replace the piston assembly and/or cylinder body, if necessary.	Visual check

CLUTCH BOOSTER

COMPONENT LOCATOR

EN02Z0203D100003



SHTS02Z020300044

1	Poppet valve adapter	15	Soft washer
2	Gasket	16	Oil pipe connector
3	Conical spring	17	Pipe joint bolt
4	Poppet valve	18	Cup and washer retainer
5	Poppet valve body	19	Oil seal
6	O-ring	20	Push rod washer
7	Return spring	21	Retainer ring
8	Piston	22	Push rod
9	Piston cup	23	Piston seal
10	Push rod boot	24	Lock nut
11	Pin	25	Collar
12	Cylinder	26	Cylinder shell
13	Exhaust port	27	Hydraulic piston
14	Air bleeder		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	19.6-29.4 {200-300, 15-21}	E	27.5-32.5 {280-330, 20-23}
B	3.9-5.9 {40-60, 2.9-4.3}		(Engine series: J05D-TI, J05E-TI, J08E-TI)
C	14.7-19.6 {150-200,11-14}		44.5-57.6 {454-587, 33-42}
D	6.9-12.7 {70-130, 6-9}		(Engine series: P11C)

OVERHAUL

EN02Z0203H200003

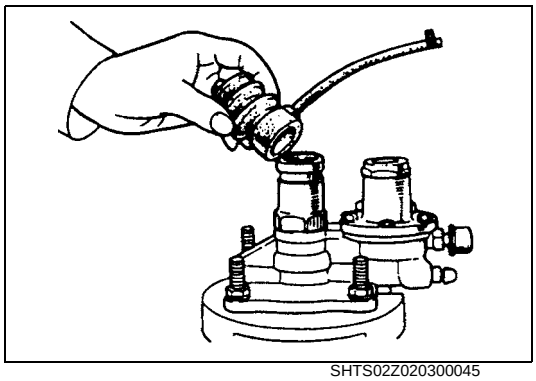
IMPORTANT POINT - DISMOUNTING

1. REMOVE THE CLUTCH BOOSTER.

NOTICE

- **Before removing the clutch booster, drain the clutch fluid from the hydraulic line.**
- **Apply the parking brake and bleed the pressure from the air brake system.**

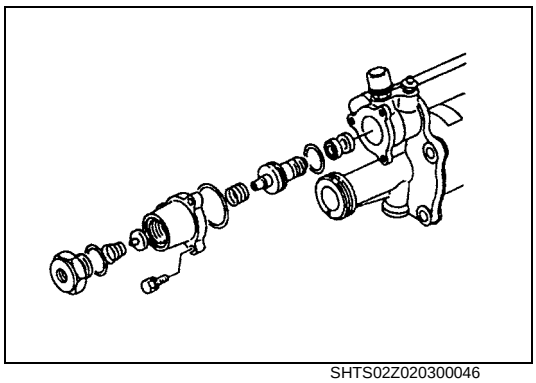
IMPORTANT POINTS - DISASSEMBLY



SHTS02Z020300045

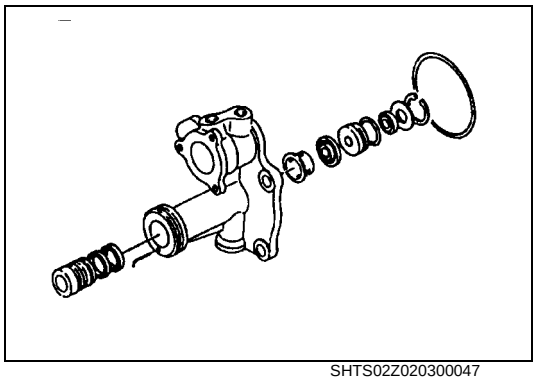
1. SET THE CLUTCH BOOSTER ON A STAND.
SST: Stand (S0953-61020)

NOTICE
Before disassembling the air booster, clean the outside of the booster.



SHTS02Z020300046

2. DISASSEMBLE THE CONTROL VALVE.
(1) Remove the poppet valve adapter and gasket.
(2) Remove the conical spring and poppet valve.
(3) Remove the poppet valve body, return spring and piston.

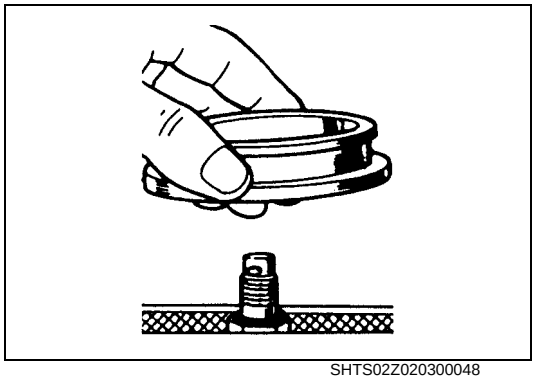


SHTS02Z020300047

3. DISASSEMBLE THE CYLINDER.
(1) Remove the pin and piston.
(2) Remove the retainer ring.
(3) Remove the push rod washers, the cup and washer retainer, piston cup and the oil seal.
(4) Using the special tool, remove the O-ring.
SST: Hook (S0965-31780)

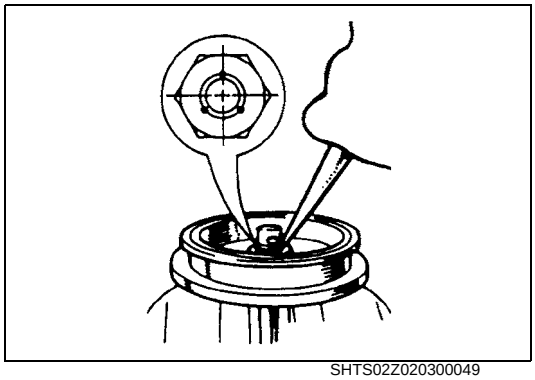
IMPORTANT POINTS - ASSEMBLY

- There is red colored and brown colored grease in the overhaul kit.
- The red colored grease should be used for the piston, the oil seals, the O-rings, the piston cups on the end plate, hydraulic cylinder and the relay valve.
- The brown colored grease should be used for the O-rings, the gasket, the piston seal and the inside of the cylinder shell.

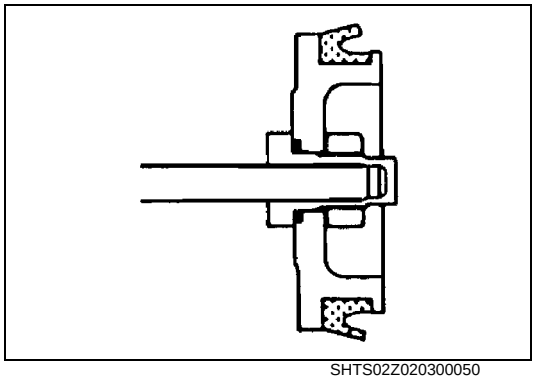

SHTS02Z020300048

1. ASSEMBLE THE POWER PISTON.

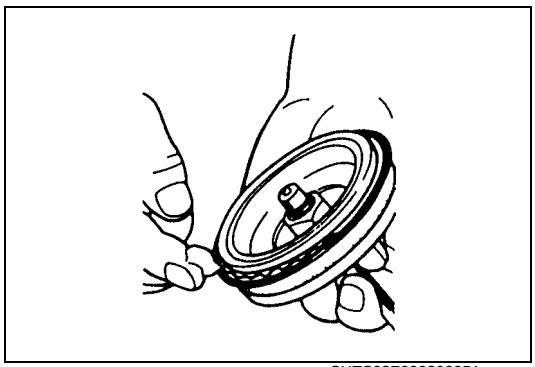
(1) Apply the brown colored grease to the O-ring and install the O-ring on the push rod.


SHTS02Z020300049

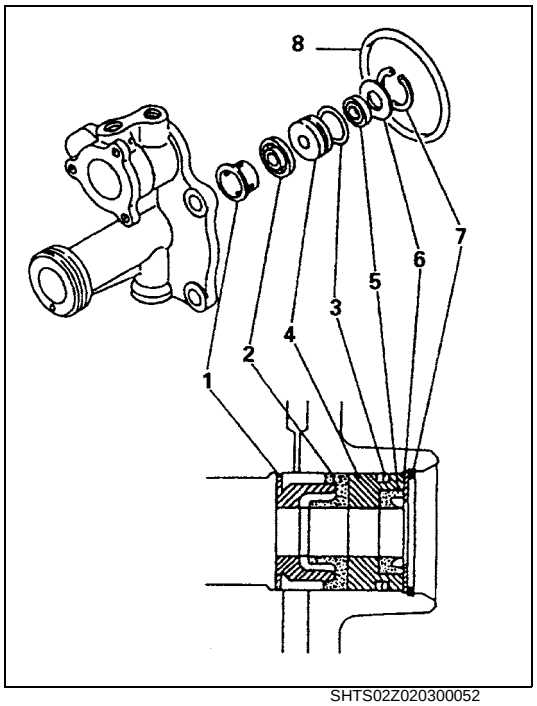
(2) After tightening the lock nut, secure the lock nut at three places with a punch to prevent loosening.


SHTS02Z020300050

(3) Install the piston seal on the piston.


SHTS02Z020300051

(4) Apply the brown colored grease on the piston seal and the inside of the cylinder shell.

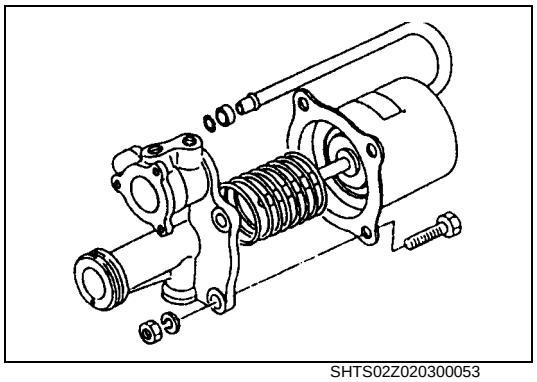


SHTS02Z020300052

2. ASSEMBLE THE CYLINDER.

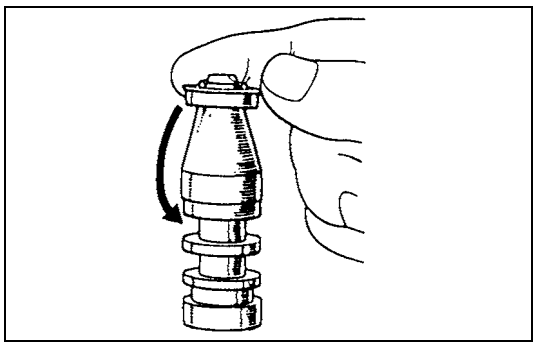
(1) Install the cup and washer retainer.
(2) Install the piston cup.
(3) Install the O-ring on the cup and washer retainer.
(4) Install the cup and washer retainer.
(5) Install the oil seal.
(6) Install the push rod washer.
(7) Install the retainer ring.
(8) Install the O-ring.

NOTICE
Coat the parts with red colored grease.


SHTS02Z020300053

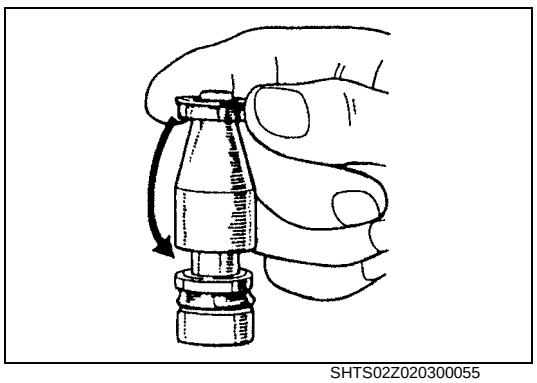
3. INSTALL THE CYLINDER ASSEMBLY ON THE POWER PISTON.

(1) Insert the control tube bushing and the seal on the control tube.


SHTS02Z020300054

4. ASSEMBLE THE HYDRAULIC CYLINDER.

(1) Using the special tools, install the piston cups on the piston.
SST:
Guide (S0965-72090)
Guide (S0965-72100)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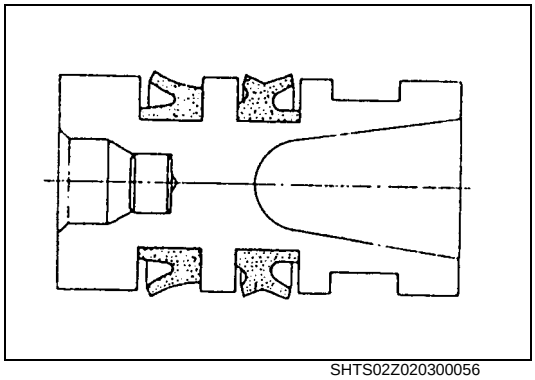
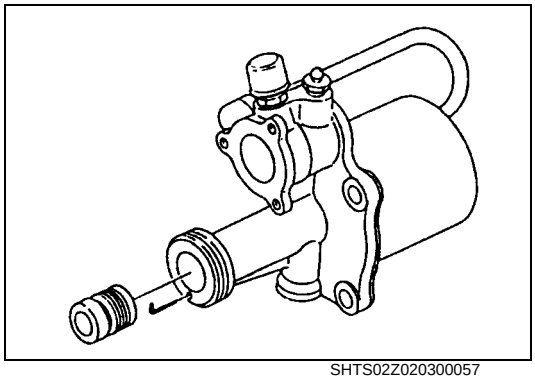
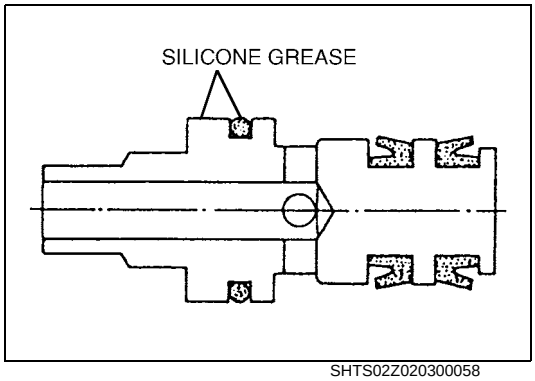

SHTS02Z020300056

(2) Apply the red colored grease on the piston cups, the piston and the inside of the hydraulic cylinder.


SHTS02Z020300057

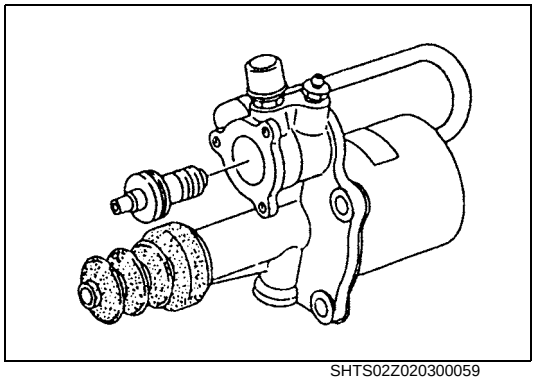
(3) Install the piston assembly in the hydraulic cylinder.
(4) Install the pin.



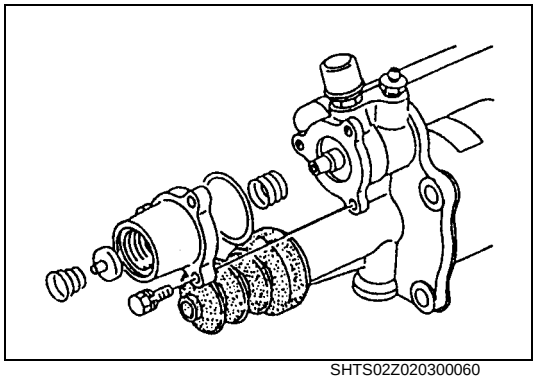
SHTS02Z020300058

5. ASSEMBLE THE PISTON.
(1) Install the piston cups and O-ring on the piston.
(2) Coat the cups with red colored grease.
SST:
Guide (Engine series: J05D-TI, J05E-TI, J08E-TI) (S0965-72150)
Guide (Engine series: P11C) (S0965-71990)
Guide (Engine series: J05D-TI, J05E-TI, J08E-TI) (S0965-72160)
Guide (Engine series: P11C) (S0965-72010)

NOTICE
- **Take care not to damage the piston cups when installing them on the piston.**
- **Coat the O-ring and sliding surfaces with silicone grease as shown in the figure.**


SHTS02Z020300059

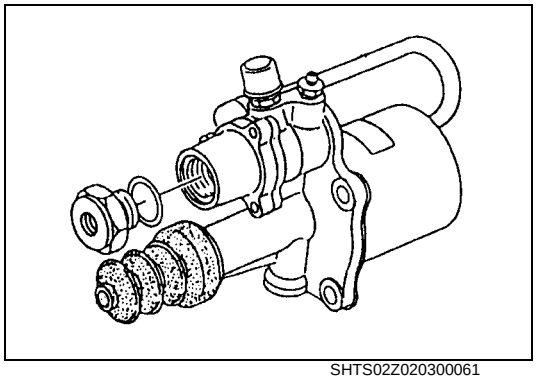
6. INSTALL THE PISTON ASSEMBLY TO THE CYLINDER.


SHTS02Z020300060

7. INSTALL THE RETURN SPRING, O-RING, POPPET VALVE BODY, POPPET VALVE AND CONICAL SPRING.

NOTICE

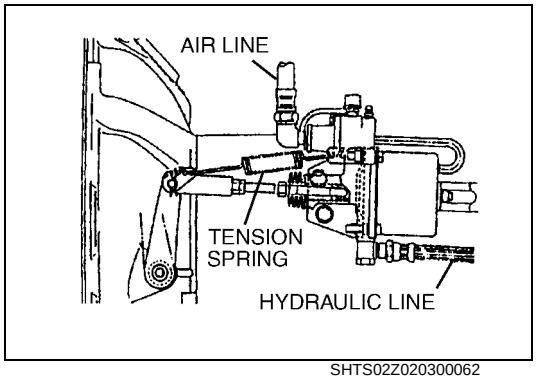
Coat the O-ring with brown colored grease.


SHTS02Z020300061

8. INSTALL THE ADAPTER.

(1) Coat the gasket with brown colored grease and install the gasket on the adapter.

(2) Install the adapter on the poppet valve body and tighten it.



SHTS02Z020300062

IMPORTANT POINT - MOUNTING

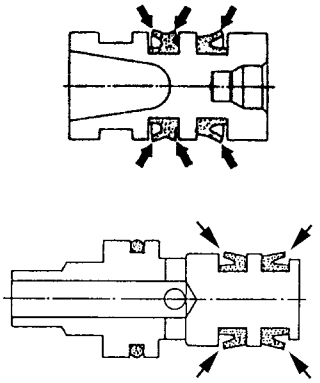
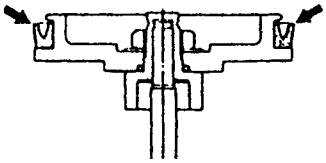
1. INSTALL THE CLUTCH BOOSTER.

(1) Connect the air and hydraulic lines to the clutch booster.

(2) Install the tension spring.

INSPECTION AND REPAIR

EN02Z0203H300004

Inspection item	Standard	Limit	Remedy	Inspection procedure
Piston cup: **Wear and damage** **Cylinder body bore:** **Scoring and corrosion**	**—**	**—**	**Replace the parts, if necessary.**	**Visual check** 
Piston seal: **Wear and damage** **Power cylinder bore:** **Scoring and corrosion**	**—**	**—**	**Replace the parts, if necessary.**	**Visual check** 

CLUTCH CONTROL (SACHS MFZ430) CL03-002

CLUTCH CONTROL UNIT CL03-2
DATA AND SPECIFICATIONS.....CL03-2
DESCRIPTION CL03-2
INSPECTION AND ADJUSTMENT CL03-4

CLUTCH PEDAL AND RELEASE UNIT... CL03-7
COMPONENT LOCATOR CL03-7
OVERHAUL CL03-8
INSPECTION AND REPAIR.....CL03-9

CLUTCH MASTER CYLINDER CL03-10
COMPONENT LOCATOR CL03-10
OVERHAUL CL03-11
INSPECTION AND REPAIR.....CL03-11

CLUTCH BOOSTER CL03-12
OVERHAUL CL03-12

CLUTCH CONTROL UNIT

DATA AND SPECIFICATIONS

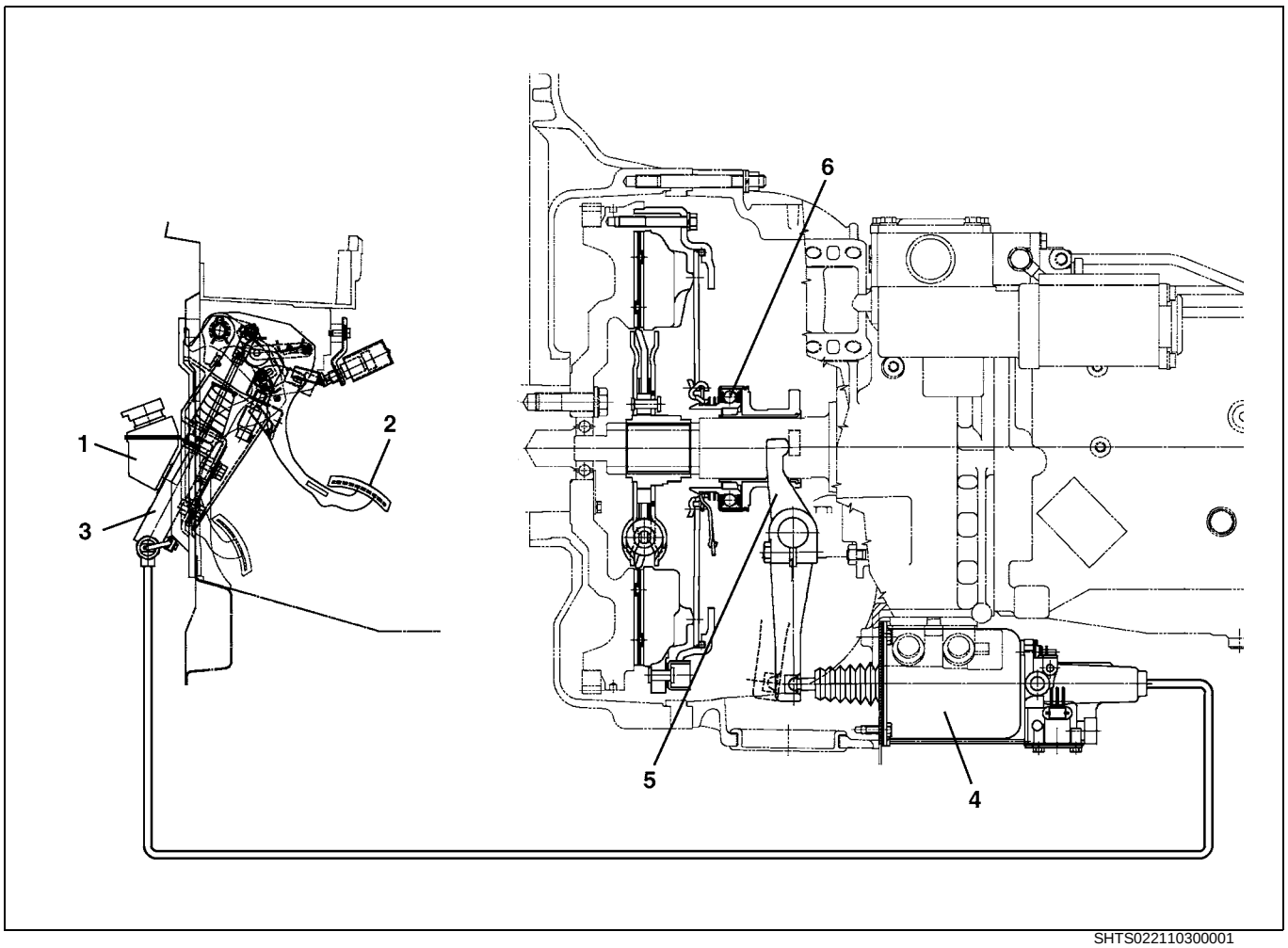
EN0221103I200001

Master cylinder inside diameter	**25.4 mm {1.000 in.}**
Clutch booster	**Product by ZF manufacture**

DESCRIPTION

EN0221103C100001

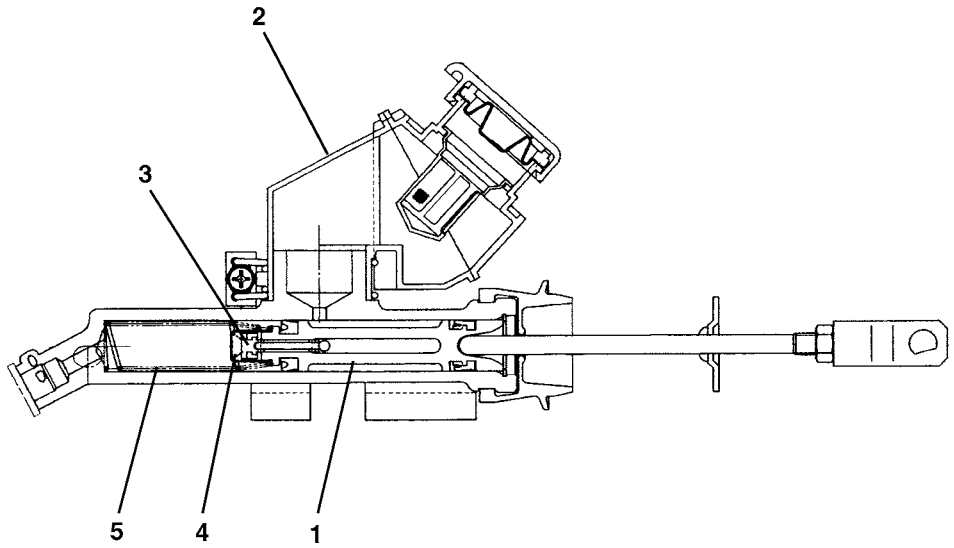
CLUTCH RELEASE UNIT



SHTS022110300001

1	**Reservoir tank**	**4**	**Clutch booster**
2	**Clutch pedal**	**5**	**Release fork**
3	**Master cylinder**	**6**	**Release bearing**

MASTER CYLINDER



SHTS022110300002

1	Piston	4	Conical spring
2	Reservoir tank	5	Return spring
3	Check valve		

INSPECTION AND ADJUSTMENT

EN0221103H300001

AIR BLEEDING

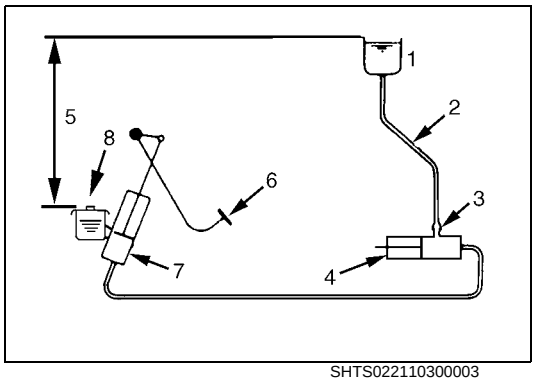
1. BLEED THE AIR FROM HYDRAULIC LINE.

NOTICE

- **Do not mix the clutch fluid with different types or brands.**
- **Be careful not to spill clutch fluid from the reservoir tank or from the air bleeder during air bleeding. Clutch fluid can damage the paint finish on the body or floor.**
- **There are two methods of bleeding, gravity bleeding and manual air bleeding.**

2. GRAVITY BLEEDING

(1) Connect a funnel to a vinyl tube.
(2) Connect the other end of the vinyl tube to the bleeder screw.
(3) Hold the funnel about 1.5 m {4.92 ft} higher than the reservoir tank.
(4) Loosen the bleeder screw and pour the clutch fluid into the funnel.
(5) Observe the flow of clutch fluid into the reservoir tank.
(6) When the air bubbles cease, close the bleeder screw.
(7) Check the fluid level. If necessary, add or remove clutch fluid in order to match the "MAX" level.

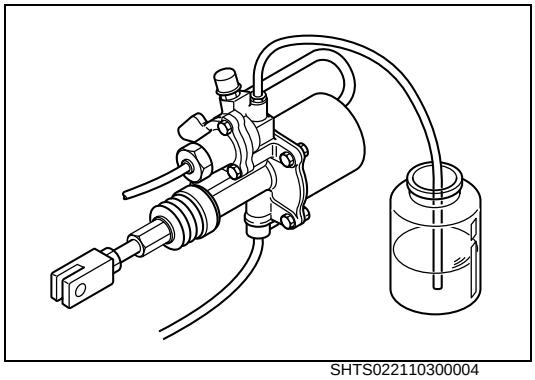


SHTS022110300003

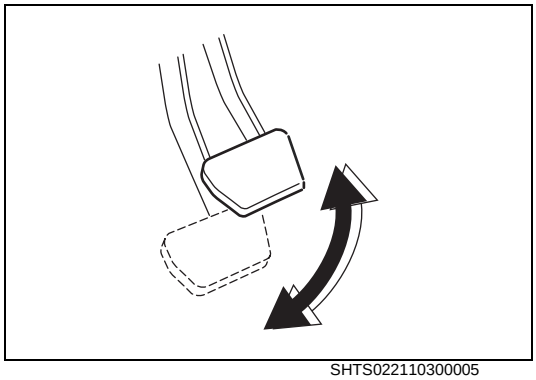
1. Funnel filled with clutch fluid
2. Vinyl tube (inside diameter: 6 mm {0.24 in.})
3. Bleeder
4. Clutch booster
5. About 1.5 m {4.92 ft}
6. Clutch pedal
7. Master cylinder
8. Reservoir tank

3. MANUAL BLEEDING

(1) Fill the reservoir with clutch fluid.
(2) Connect the bleeder tube to the clutch booster screw. Place the other end of tube in a container half-filled with clutch fluid.



SHTS022110300004

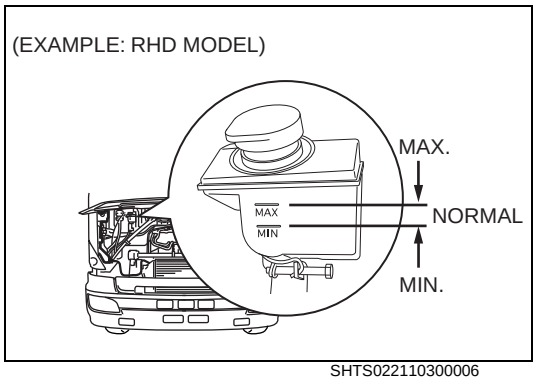


SHTS022110300005

(3) Slowly pump the clutch pedal several times. While pressing on the pedal, loosen the bleeder screw. Repeat this procedure until there are no more air bubbles in the fluid.

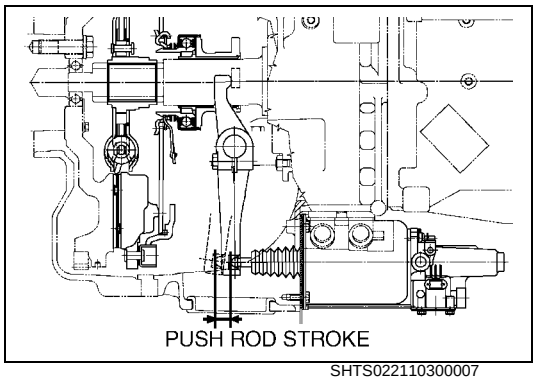
NOTICE

- **Do not return the clutch pedal before closing the bleeder screw.**
- **Keep the reservoir filled with clutch fluid.**
- **Re-bleeding will be necessary if the reservoir is emptied during bleeding operation.**



SHTS022110300006

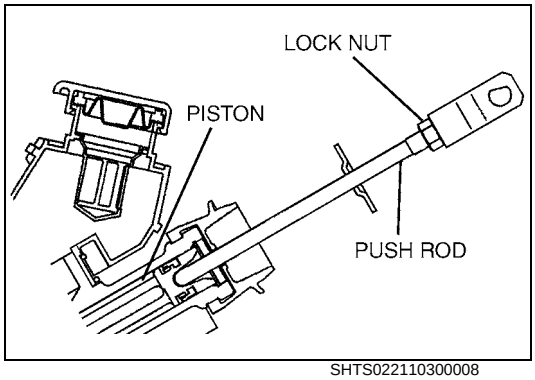
(4) Check the fluid level. If necessary, add or remove clutch fluid in order to match the "MAX" level.



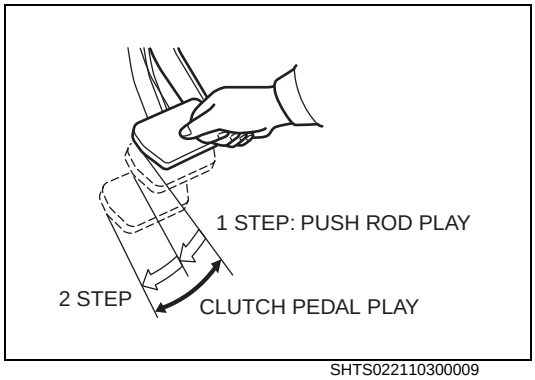
SHTS022110300007

4. AFTER BLEEDING, MAKE SURE THE PUSH ROD STROKE IS AS SPECIFIED.

(1) Depress the clutch pedal fully and measure the push rod stroke. If the stroke is less than standard, re-bleed the hydraulic system.
Standard: 22-26 mm {0.866-1.023 in.}



SHTS022110300008



SHTS022110300009

CHECK AND ADJUSTMENT

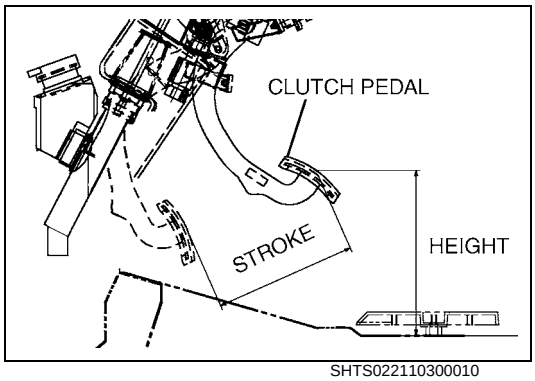
1. CHECK AND ADJUST THE CLUTCH PEDAL PLAY.

(1) Check the push rod play.
   a. If necessary, adjust the push rod play.
   b. Loosen the lock nut and turn the master cylinder push rod until the push rod play is correct.
      Standard:
      Clearance between push rod and piston:
      0.5 mm {0.0197 in.}
      Push rod play at pedal top: 2-4 mm {0.079-0.157 in.}
   c. Tighten the lock nut.

(2) Check the clutch pedal play.
   a. Push the pedal until the beginning of clutch resistance is felt.

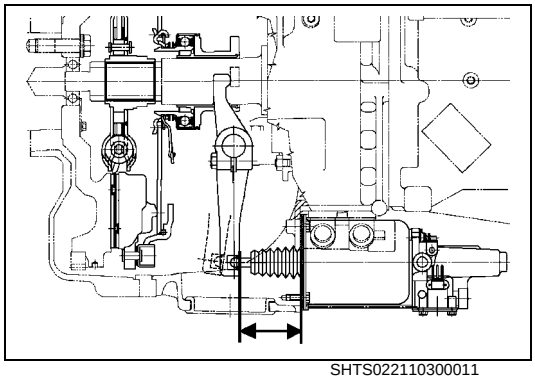
      Standard: 30-60 mm {1.192-2.362 in.}

NOTICE
Refer to the manual of ZF manufacture because the clutch booster is provided with auto-adjuster system.



SHTS022110300010

2. CHECK THE CLUTCH PEDAL HEIGHT AND STROKE.
Standard:
Pedal Height: 190 mm {7.480 in.}
Pedal Stroke: 174-186 mm {6.851-7.322 in.}

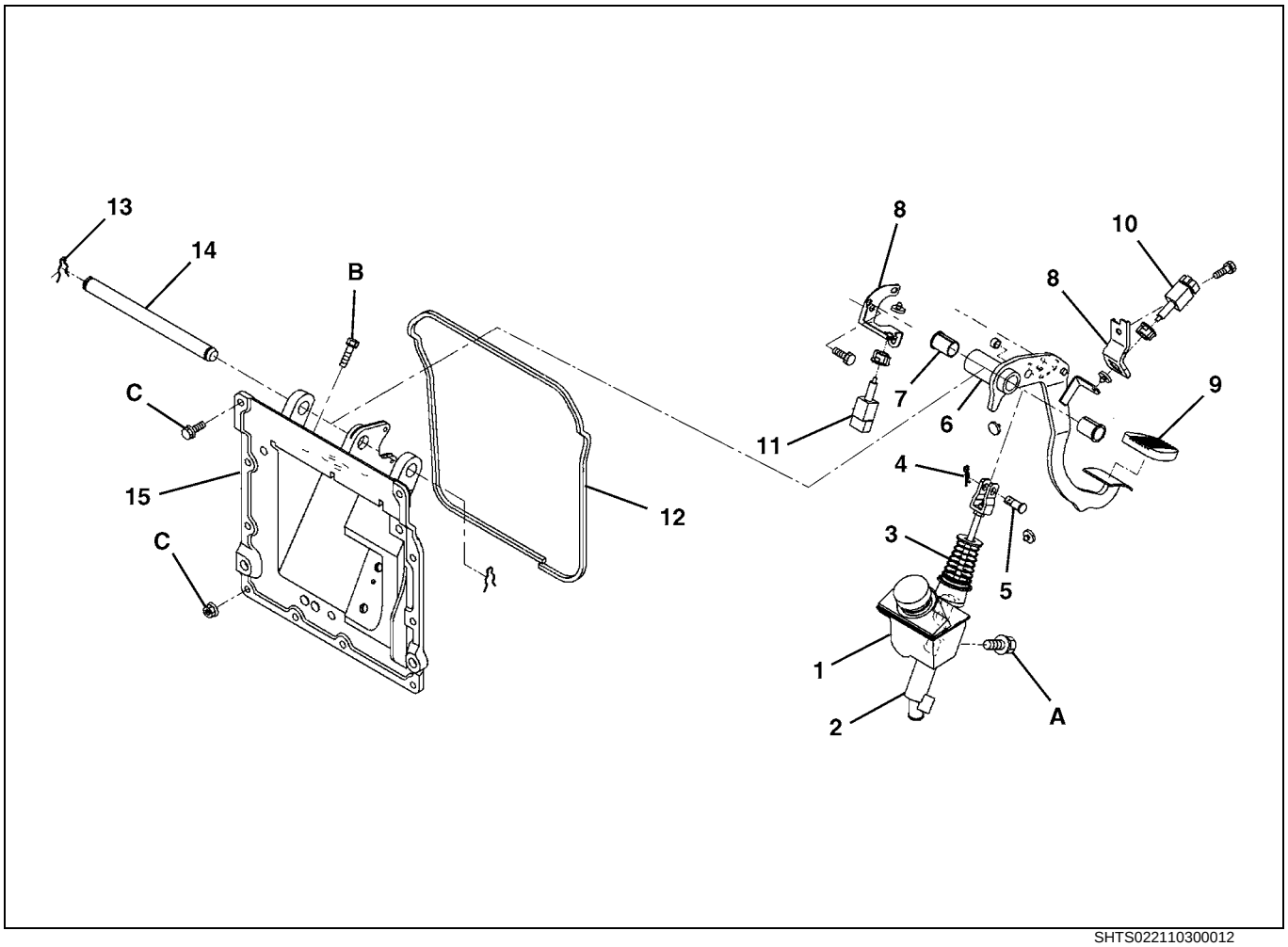

SHTS022110300011

3. CHECK THE LENGTH BETWEEN THE CLUTCH BOOSTER INSTALL SURFACE AND RELEASE FORK LOWER END. IF ITS LENGTH IS LESS THAN THE SERVICE LIMIT, IT IS TIME TO REPLACE THE CLUTCH FACING.
Service limit: 50 mm {1.969 in.}

CLUTCH PEDAL AND RELEASE UNIT

COMPONENT LOCATOR

EN0221103D100001



SHTS022110300012

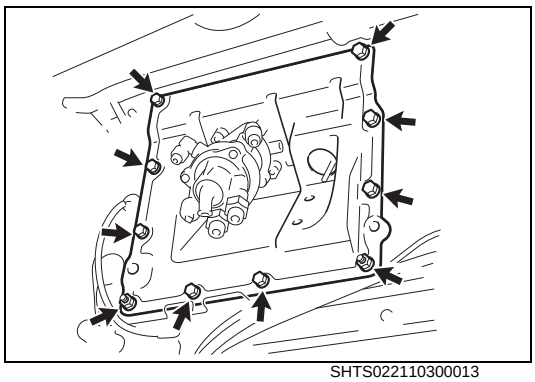
1	Reservoir tank	9	Pedal pad
2	Master cylinder	10	Switch (For retarder)
3	Return spring	11	Switch (For transmission P.T.O. control) (If so equipped)
4	Cotter pin	12	Seal
5	Pin	13	Clip
6	Clutch pedal	14	Pedal shaft
7	Bushing	15	Pedal bracket
8	Bracket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39-91 {398-927, 29-67}	C	18-31 {184-316, 14-22}
B	9.5-18.5 {97-188, 7.1-13.5}		

OVERHAUL

EN0221103H200001


SHTS022110300013

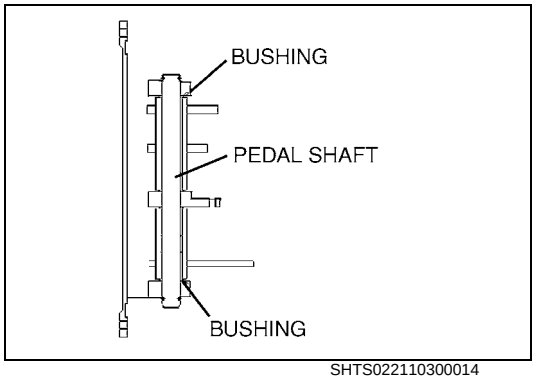
IMPORTANT POINTS - DISMOUNTING

1. REMOVING THE PEDAL UNIT ASSEMBLY

(1) Remove the 8 bolts and 2 nuts and dismount the pedal bracket assembly from the vehicle.

NOTICE

Be careful not to damage the vehicle.

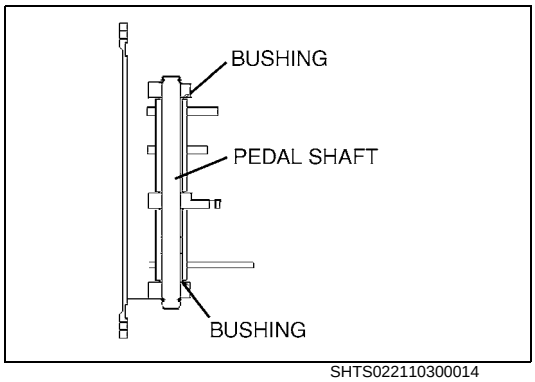


SHTS022110300014

2. REMOVING THE CLUTCH PEDAL

(1) Remove the stroke sensor from the clutch pedal.

(2) Remove the clip, and tap the pedal shaft lightly to remove the clutch pedal using a brass bar and a hammer.



SHTS022110300014

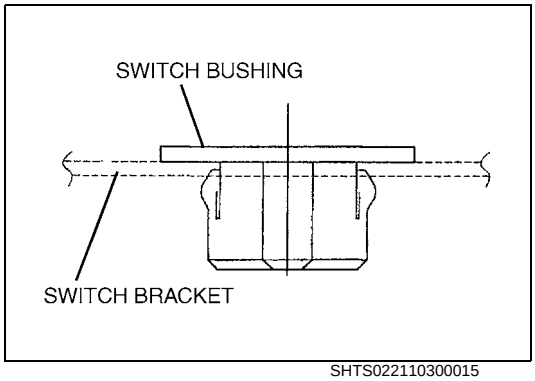
IMPORTANT POINTS - MOUNTING

1. INSTALLING THE CLUTCH PEDAL

(1) Apply lithium grease to the inner side and outer periphery of the bushing, and install the bushing to the inserting hole on the shaft part of the clutch pedal.

(2) Install the clutch pedal to the installing axle for pedal shaft and install the pedal shaft to the pedal bracket using a plastic hammer.

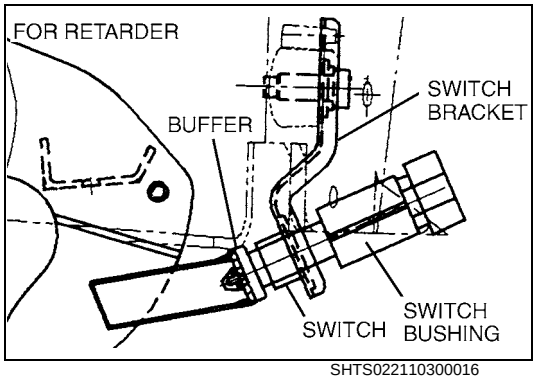
2. INSTALL THE PEDAL UNIT ASSEMBLY.



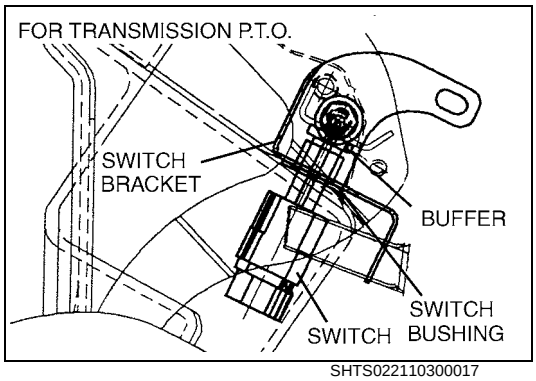
SHTS022110300015

3. INSTALL THE SWITCH FOR RETARDER AND TRANSMISSION P.T.O.

(1) Install the switch bushing into the switch bracket.



SHTS022110300016

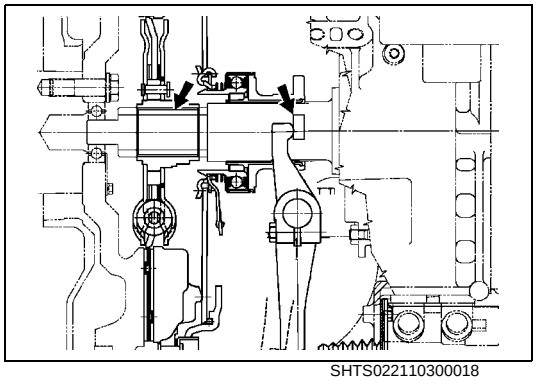


SHTS022110300017

(2) Push the switch into the switch bushing until the switch pounds the buffer, then fix the switch by turning if clockwise.

NOTICE

Check that the switch body does not contact the buffer and also that the switch rightly function.


SHTS022110300018

IMPORTANT POINT - ASSEMBLY

1. APPLY BEARING GREASE OR HEAT RESISTANCE GREASE.

(1) Apply bearing grease to the release fork and the releaser contact point.

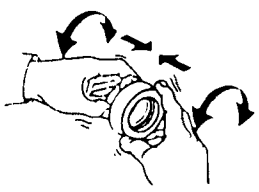
(2) Apply heat resistance grease to the transmission input shaft spline.

NOTICE

Apply a small amount of grease to the spline.

INSPECTION AND REPAIR

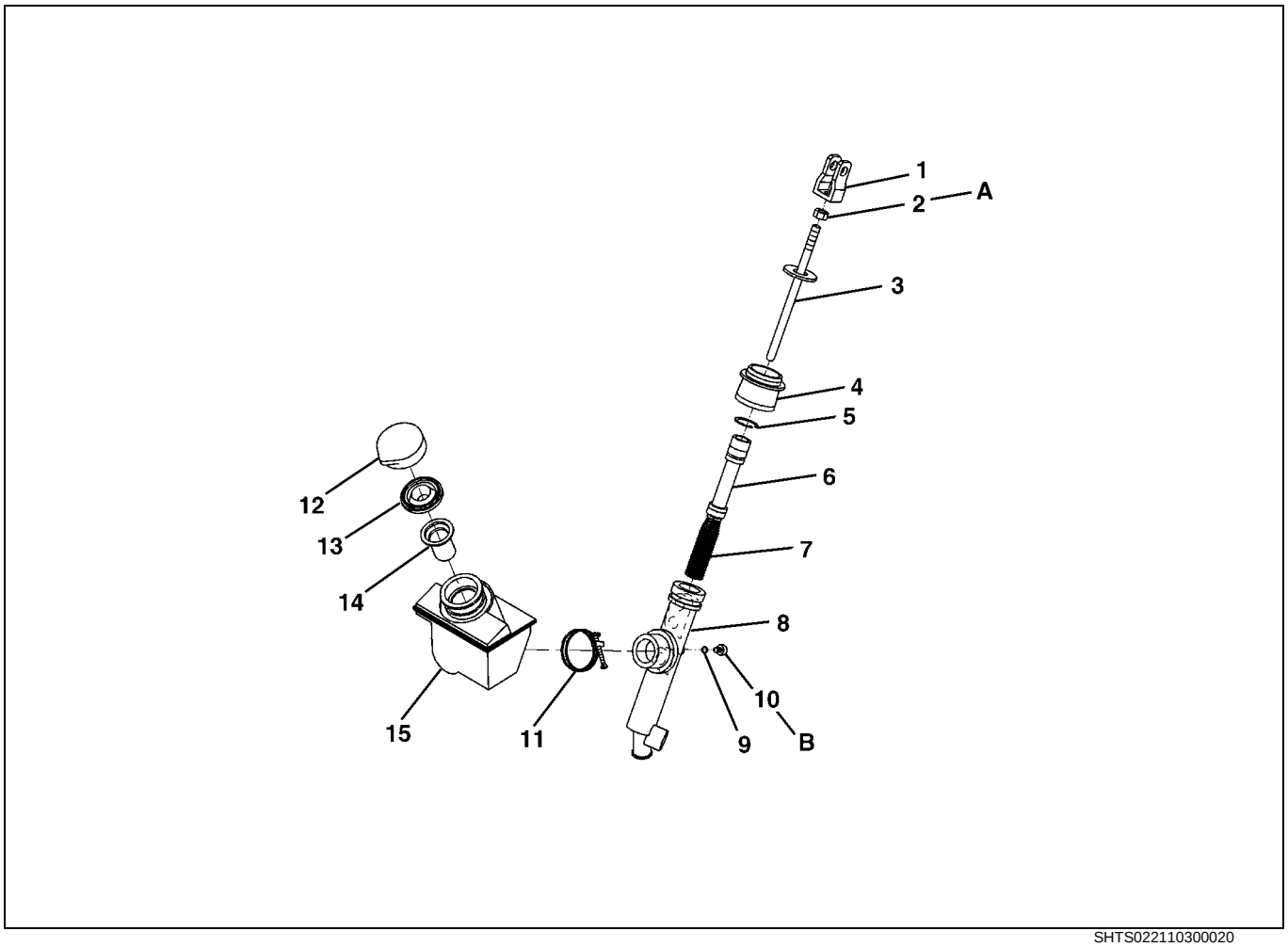
EN0221103H300002

Inspection item	Standard	Limit	Remedy	Inspection procedure
Release bearing improper rotation	**—**	**—**	**Replace release bearing, if necessary.**	**Visual check** 
Release fork and releaser: Wear and damage	**—**	**—**	**Replace the parts, if necessary.**	**Visual check**

CLUTCH MASTER CYLINDER

COMPONENT LOCATOR

EN0221103D100002



SHTS022110300020

1	Clevis	9	O-ring
2	Lock nut	10	Stopper bolt
3	Push rod	11	Clamp
4	Boot	12	Reservoir cap
5	Retainer ring	13	Gasket
6	Piston	14	Oil reservoir strainer
7	Return spring	15	Reservoir tank
8	Body		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	11.5-16.9 {118-172, 8.5-12.4}	B	2.4-4.4 {25-45, 1.9-3.2}

OVERHAUL

EN0221103H200002

IMPORTANT POINT - DISMOUNTING

1. REMOVE THE MASTER CYLINDER.

NOTICE

- **Before removing the master cylinder, drain the clutch fluid from the hydraulic line.**
- **Place a small drain pan under the master cylinder to catch the hydraulic fluid. Do not let the clutch fluid remain on a painted floor. Wash it off immediately.**

IMPORTANT POINT - ASSEMBLY

1. INSTALL THE RETURN SPRING AND PISTON TO THE CYLINDER.

NOTICE

Lubricate the cylinder bore and piston with clean clutch fluid.

INSPECTION AND REPAIR

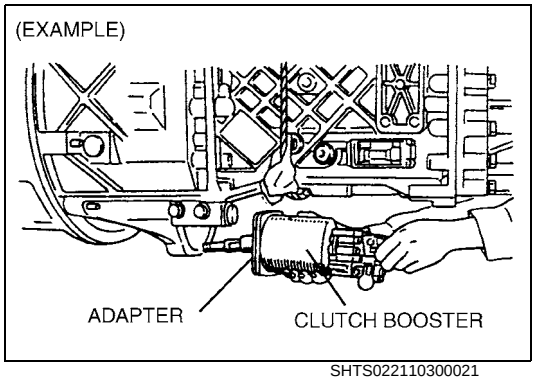
EN0221103H300003

Inspection item	Standard	Limit	Remedy	Inspection procedure
Piston seal and cup: Wear and damage Cylinder body bore: Scoring and corrosion	—	—	Replace the piston assembly and/or cylinder body, if necessary.	Visual check

CLUTCH BOOSTER

OVERHAUL

EN0221103H200003



SHTS022110300021

IMPORTANT POINT - DISMOUNTING

1. REMOVING THE CLUTCH BOOSTER.
(1) Drain the clutch fluid from the hydraulic line.
(2) Disconnect the oil hose and the air hose from the clutch booster.

NOTICE

- **When removing the oil hose, place a container under the clutch booster to catch fluid. Do not let the clutch fluid remain on a painted floor.**
- **Cover each port portion of hoses to prevent a foreign matter entering into removed hoses.**

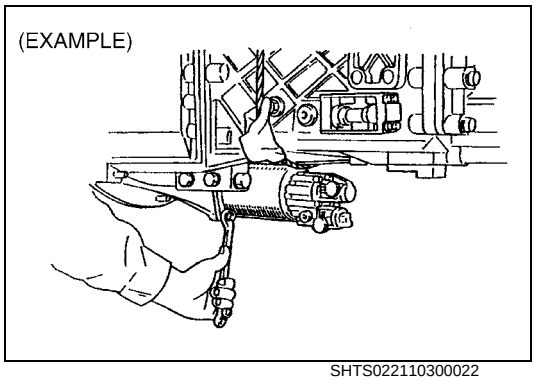
(3) Remove the return spring.
(4) Remove the clutch booster fitting bolts and remove the clutch booster and the adapter from the bracket.

INSPECTION AND REPLACEMENT OF CLUTCH BOOSTER

1. INSPECT AND REPLACE THE CLUTCH BOOSTER.

NOTICE

If necessary, replace the clutch booster assembly.



SHTS022110300022

IMPORTANT POINTS - MOUNTING

1. INSTALL THE CLUTCH BOOSTER WITH ADAPTER AND TIGHTEN THE FITTING BOLTS.
Tightening Torque:
19-25 N·m {193-255 kgf·cm, 14-18 lbf·ft}

2. CONNECT THE OIL HOSE AND THE AIR HOSE.
Tightening Torque:
Oil hose: 44-59 N·m {450-600 kgf·cm, 33-43 lbf·ft}
Air hose: 31-41 N·m {320-420 kgf·cm, 24-30 lbf·ft}

TRANSMISSION MAIN UNIT (LX06S)

TR02-001

TRANSMISSION ASSEMBLY..... TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DESCRIPTION TR02-3
TROUBLESHOOTING..... TR02-4
SPECIAL TOOL..... TR02-6
PROPOSAL TOOL
(TRANSMISSION CASE ASSEMBLY)..... TR02-7
DISMOUNTING AND MOUNTING TR02-8

GEAR SHIFT HOUSING TR02-10
COMPONENT LOCATOR TR02-10
OVERHAUL TR02-14

CASE AND MAIN UNIT TR02-19
COMPONENT LOCATOR TR02-19

TRANSMISSION CASE ASSEMBLY..... TR02-24
OVERHAUL TR02-24
INSPECTION AND REPAIR..... TR02-45

INPUT SHAFT ASSEMBLY TR02-46
OVERHAUL TR02-46
INSPECTION AND REPAIR..... TR02-50

OUTPUT SHAFT ASSEMBLY TR02-51
OVERHAUL TR02-51
INSPECTION AND REPAIR..... TR02-60

COUNTER SHAFT ASSEMBLY TR02-61
OVERHAUL TR02-61
INSPECTION AND REPAIR..... TR02-63

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

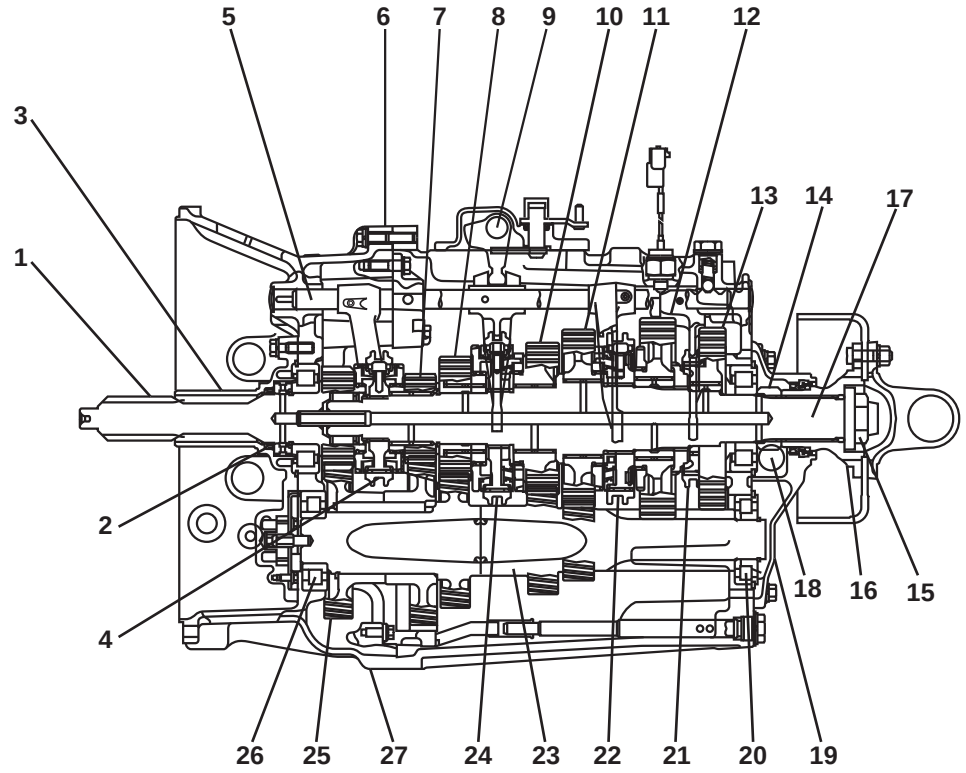
EN0332002I200001

Type		I	II	III	IV
Type		Six forward speeds, one reverse 2, 3, 4, 5, 6th Synchromesh, 1st and Reverse, Constant mesh			
Gear ratios:	1st	8.190	6.098	6.515	7.818
	2nd	5.073	3.858	4.122	4.957
	3rd	2.982	2.340	2.500	2.992
	4th	1.849	1.442	1.718	1.866
	5th	1.343	1.000	1.261	1.312
	6th	1.000	0.761	1.000	1.000
	Reverse	7.619	5.672	6.060	7.445
Number of teeth input shaft		21	25	24	21
Number of teeth counter shaft	Counter drive gear	44	39	40	43
	1st gear	11	11	11	11
	2nd gear	19	19	19	19
	3rd gear	26	26	26	26
	4th gear	34	34	32	34
	5th gear	39	39	37	39
	6th gear	—	—	—	—
	Reverse gear	11	11	11	11
Number of teeth output shaft	1st gear	43	43	43	42
	2nd gear	46	47	47	46
	3rd gear	37	39	39	38
	4th gear	30	31	33	31
	5th gear	25	25	28	25
	6th gear	—	—	—	—
	Reverse gear	40	40	40	40
Reverse idle gear		23/11	23/11	23/11	23/11
Power take-off opening		On left side of gear case			
Oil capacity, gear box		Approx. 5.0 liters {1.10 Imp.gal/1.32 US gal.}			
Oil capacity, gear box with power take-off		Approx. 7.4 liters {1.63 Imp.gal/1.95 US gal.}			
Lubricant, type		Gear oil (API GL-4)			
Viscosity, between -12 and 32°C {10 and 90°F}		SAE90			
Viscosity, above 32°C {90°F}		SAE140			

DESCRIPTION

EN0332002C100001

(REPRESENTATIVE TYPE)



SHTS033200200001

1	Input shaft	15	Lock nut
2	Oil seal	16	Flange
3	Front bearing retainer	17	Output shaft
4	5th-6th shift sleeve	18	Speedometer driven gear
5	Shift shaft	19	Rear bearing retainer
6	Case cover	20	Cylindrical bearing
7	5th (or 6th) gear	21	Reverse shift sleeve
8	4th gear	22	1st-2nd shift sleeve
9	Inner shift lever	23	Counter shaft
10	3rd gear	24	3rd-4th shift sleeve
11	2nd gear	25	Counter drive gear
12	1st gear	26	Counter shaft front bearing
13	Reverse gear	27	Transmission case
14	Speedometer drive gear		

TROUBLESHOOTING

EN0332002F300001

Symptom	Possible cause	Remedy/Prevention
Gear slip-off (Control system)	Joint worn and/or damaged	Replace joint.
	Bolts and nuts loose	Tighten bolts and nuts.
	Improper link rod adjustment	Adjust link rod.
Gear slip-off (Gear shift housing)	Lock ball and spring distorted and/or broken	Repair or replace as required.
	Groove for shift shaft worn	Replace shift fork.
Gear slip-off (Transmission gear)	Synchronizer hub and sleeve worn	Replace as required.
	Synchronizer sleeve and gear clutch teeth worn or damaged	Replace as required.
	Input shaft and/or output shaft bearing worn and/or broken	Replace bearing.
	Retainer ring and/or thrust washer worn and/or broken	Replace as required.
	Loosened transmission to engine mounting bolts	Tighten bolts.
Difficult gear engagement (Engine)	Engine idling speed too high	Adjust engine idling.
Difficult gear engagement (Clutch)	Improper disengagement of clutch	Adjust clutch.
	Clutch disc sticking	Repair or replace.
	Clutch shifter sleeve bent	Replace shifter sleeve.
Difficult gear engagement (Transmission)	Input shaft and/or output shaft bearing worn and/or damaged	Replace bearing.
	Engine crankshaft pilot bearing worn and/or damaged	Replace bearing.
	Synchronizer cone and ring worn	Replace as required.
Difficult gear engagement (Control system)	Looseness of control system and/or improper adjustment	Tighten and adjust control system.
	Improper motion of gear shift lever	Adjust shift lever.
Difficult gear engagement (Lubrication)	Improper lubrication of control lever	Lubricate as required.
	Shortage of gear oil and/or low oil viscosity	Add oil or change oil as required.
Noise (Transmission)	Grinding in transmission	Check screws, bolts or other foreign materials in transmission.
	Loose transmission-to-engine mounting bolts	Tighten bolts.
	Worn or damaged gear and bearing	Replace as required.
Noise (Lubrication)	Shortage of gear oil and/or low oil viscosity	Add oil or change oil as required.
Gear oil leaks (Transmission)	Leaks at the front and rear bearing retainer seal and gasket, case cover gasket, sand hole of case or shift shaft expansion plug	Repair and replace as required.
	Improper amount of gear oil and lack of oil viscosity	Check oil level and type.

Symptom	Possible cause	Remedy/Prevention
Gears are difficult to engage or cannot be engaged when engine is not operating.	Control cable damaged, bent, deteriorated or deformed due to heat	Replace control cable.
	Loose parts	Inspect and tighten.
	Damaged shift lever assembly	Replace shift lever.
	Damaged or bent parts on upper transmission cover section (lever, spring, etc.)	Replace.
	Faulty adjustment of control cable assembly and link rod	Adjust.
Excessive play in shift lever.	Worn bushing in joint or shift lever	Replace.
	Loose mounting bolts and nuts	Inspect and tighten.

SPECIAL TOOL

EN0332002K100001

Prior to starting a transmission overhaul, it is necessary to have these special tools.

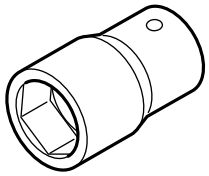
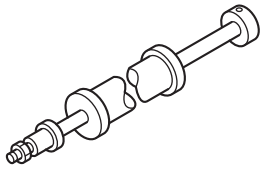
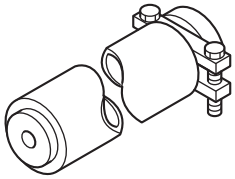
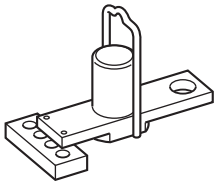
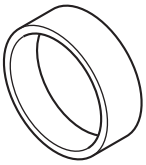
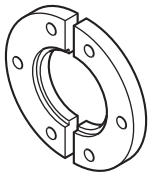
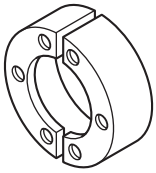
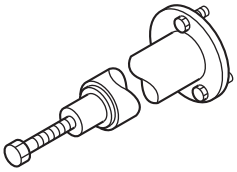
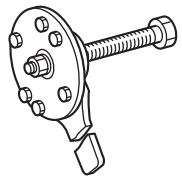
Illustration	Part number	Tool name	Remarks
	S0983-94601	SOCKET WRENCH	
	S0942-01442	SLIDING HAMMER	
	S0965-02070	INPUT SHAFT PULLER	
	S0963-02220	SHAFT HANGER	
	S0969-91370	SEAL RING GUIDE	
	S0965-31710	HOOK	
	S0965-31720 S0965-31730 S0965-31740	HOOK	
	S0965-01881	PULLER	

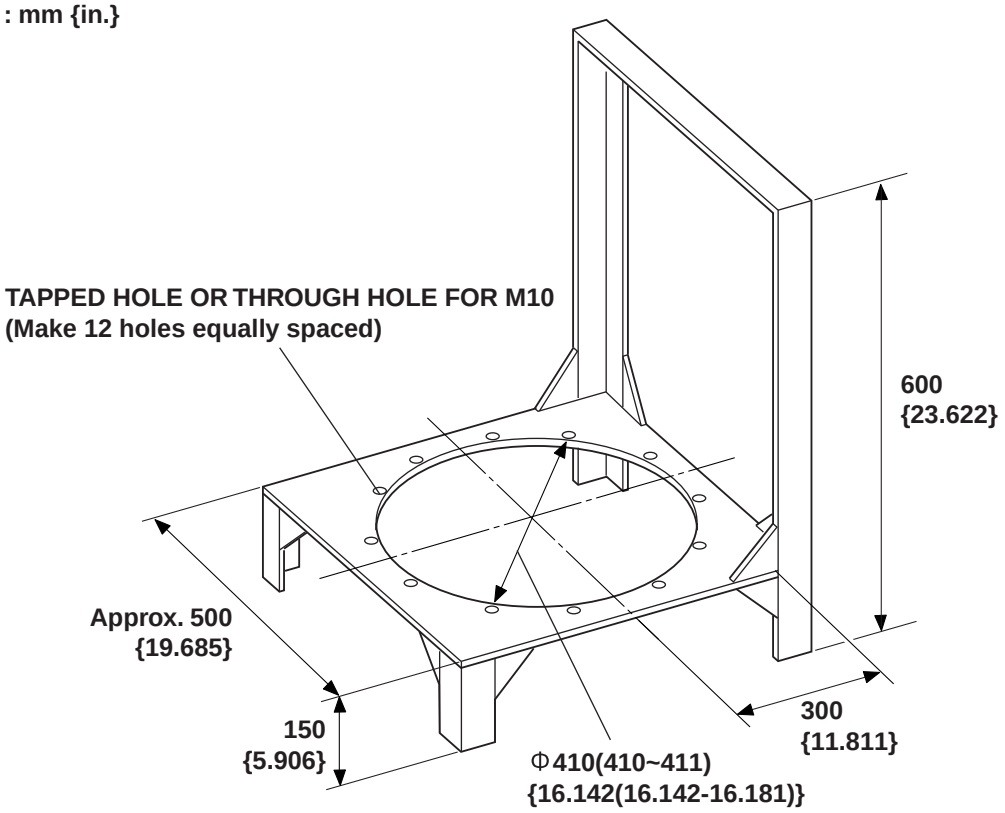
Illustration	Part number	Tool name	Remarks
	S0965-02080	PULLER	

PROPOSAL TOOL (TRANSMISSION CASE ASSEMBLY)

EN0332002K100002

TRANSMISSION WORKSTAND

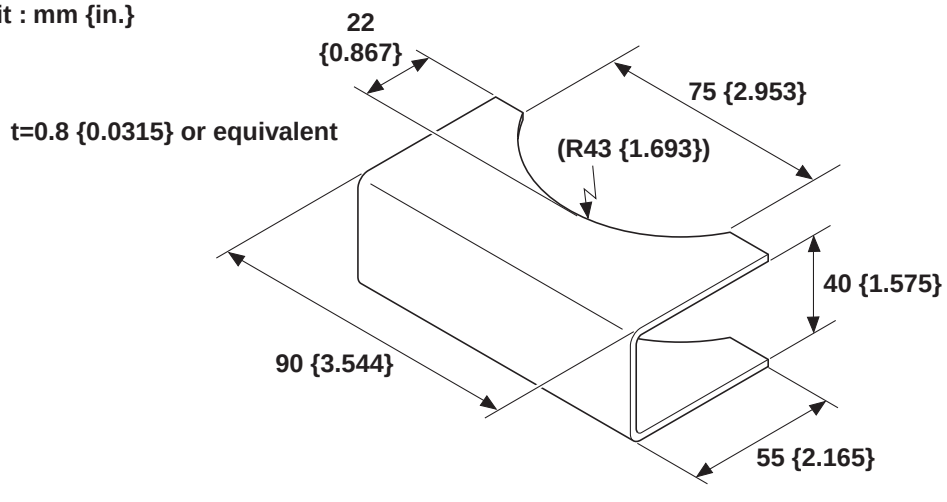
Unit : mm {in.}



SHTS033200200011

JIG FOR PREVENTING DETACHMENT

Unit : mm {in.}



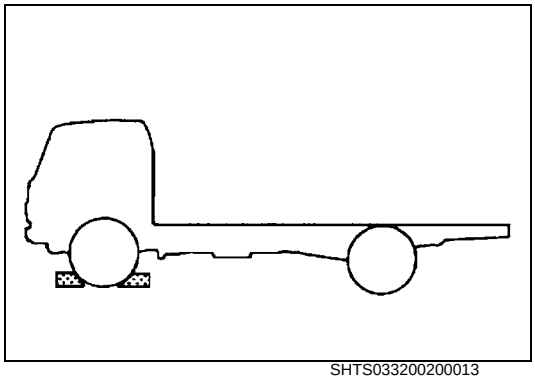
SHTS033200200012

DISMOUNTING AND MOUNTING

EN0332002H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033200200013

1. BLOCK THE WHEELS.

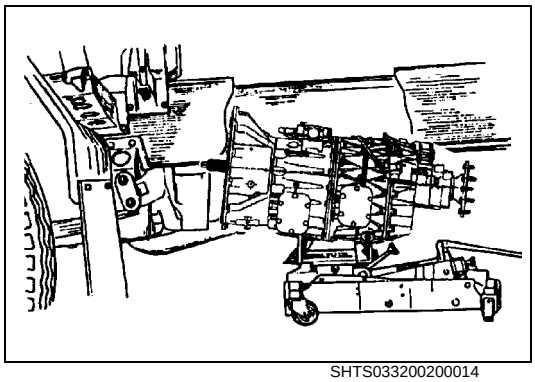
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

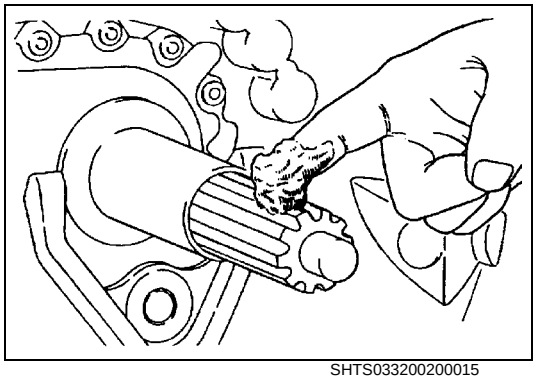
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



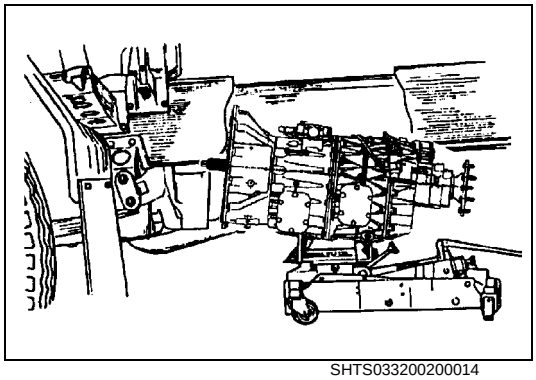
SHTS033200200014

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033200200015

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033200200014

2. INSTALL THE TRANSMISSION.

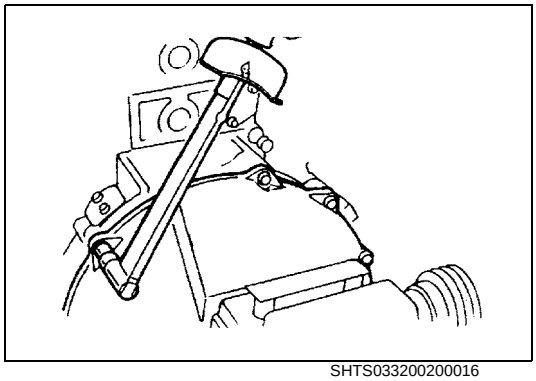
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033200200016

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL**".

9. CHECK THE GEAR SHIFT IN EACH POSITION.

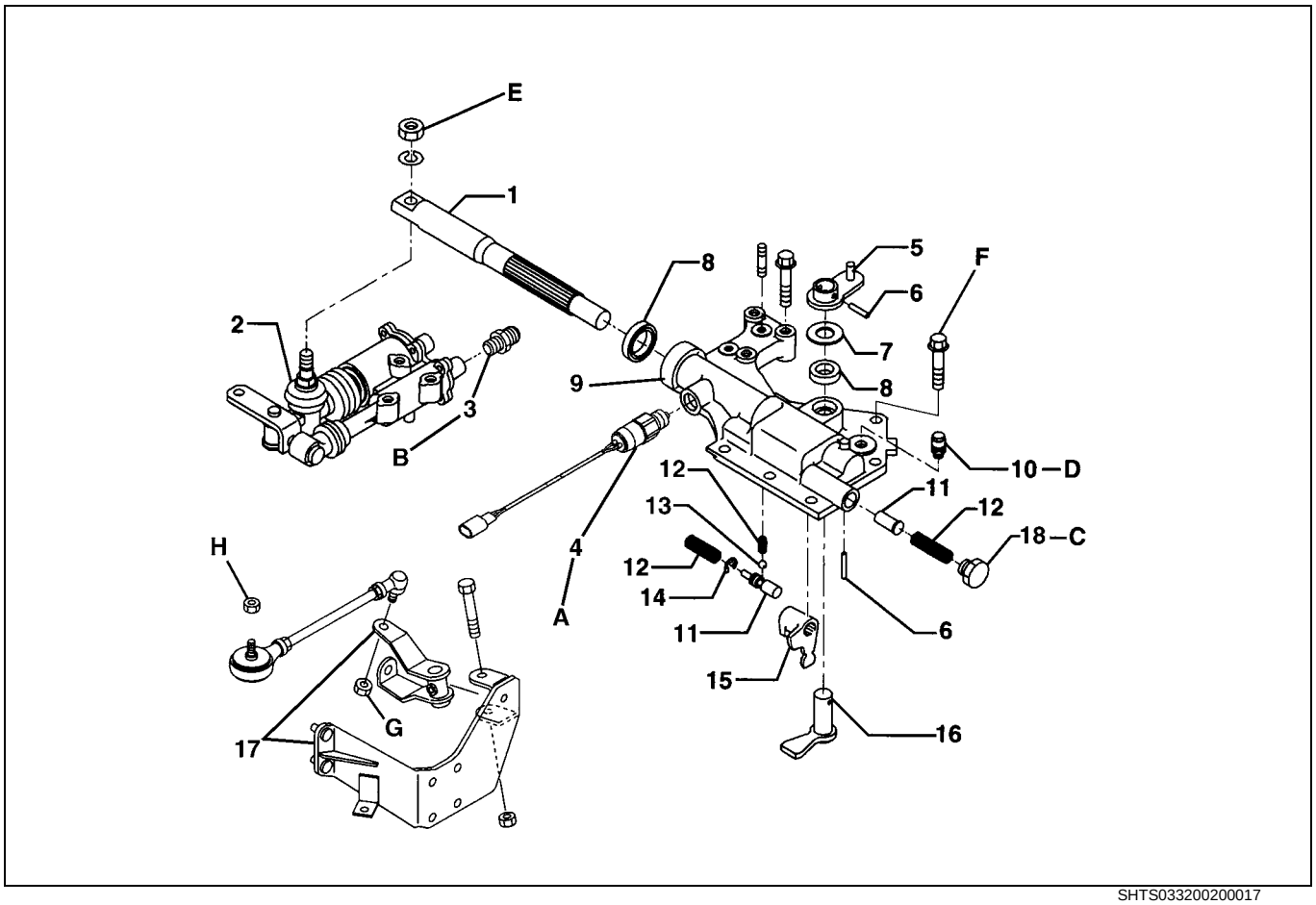
Refer to the chapter **"TRANSMISSION/ TRANSFER CONTROL"**.

GEAR SHIFT HOUSING

COMPONENT LOCATOR

EN0332002D100001

MODEL: FC (WITH POWER SHIFT)



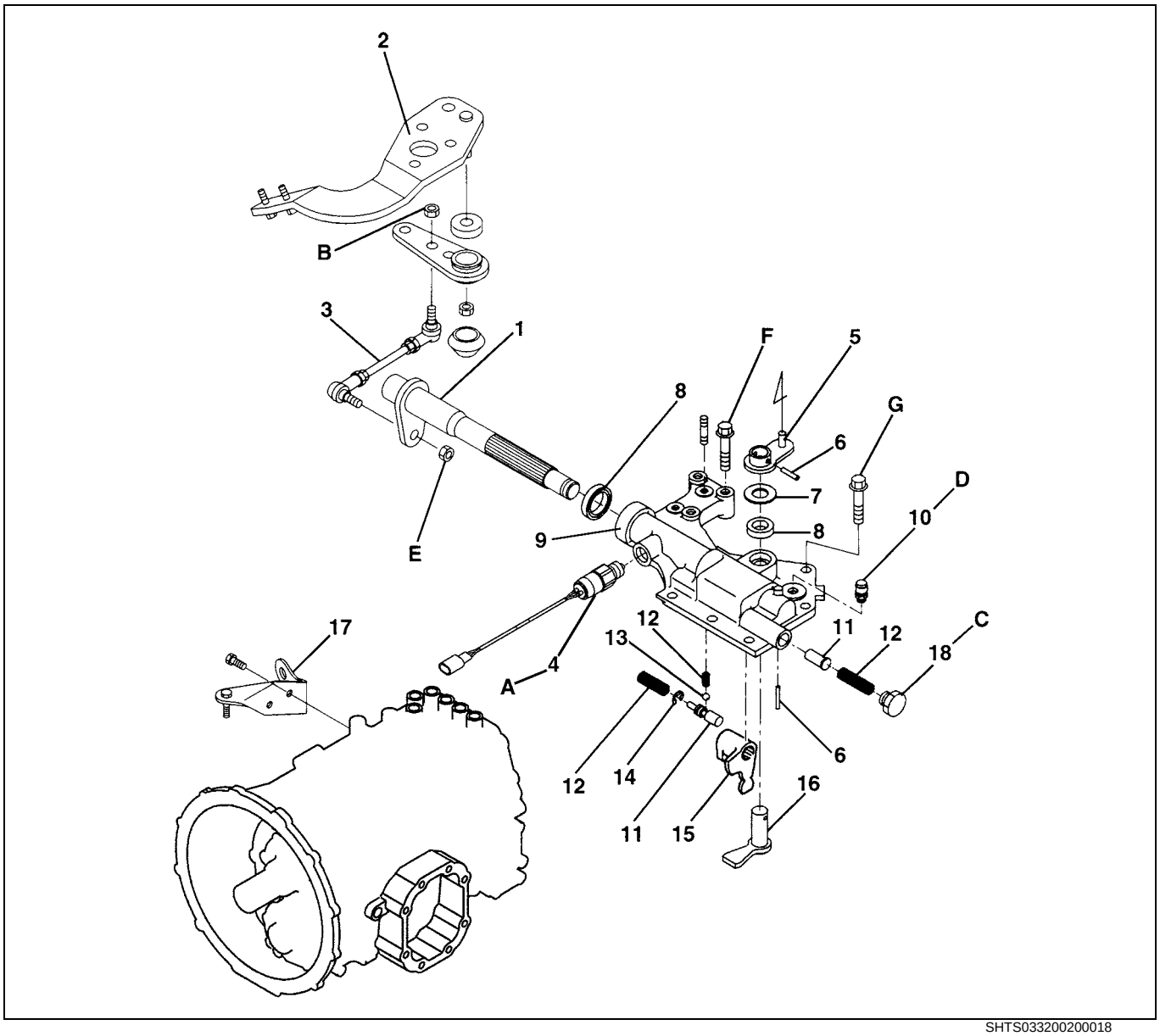
SHTS033200200017

1	Shift lever shaft	10	Air breather
2	Power shift assembly	11	Lockout plunger
3	Pipe joint	12	Compression spring
4	Neutral switch (If so equipped)	13	Steel ball
5	Outer select lever	14	E-ring
6	Spring pin	15	Inner shift lever
7	Plain washer	16	Select lever shaft
8	Oil seal	17	Gear control lever assembly
9	Shift lever shaft housing	18	Plug

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	34-38 {350-387, 25-28}	E	75.5-91.2 {770-929, 56-67}
B	20-30 {204-305, 15-22}	F	43.5-54.5 {444-555, 30-40}
C	25-30 {255-305, 19-22}	G	18-26 {184-265, 14-19}
D	9.8-11.8 {100-120, 7.3-8.6}	H	41.5-61.5 {423-627, 31-45}

MODEL: FC (WITHOUT POWER SHIFT)



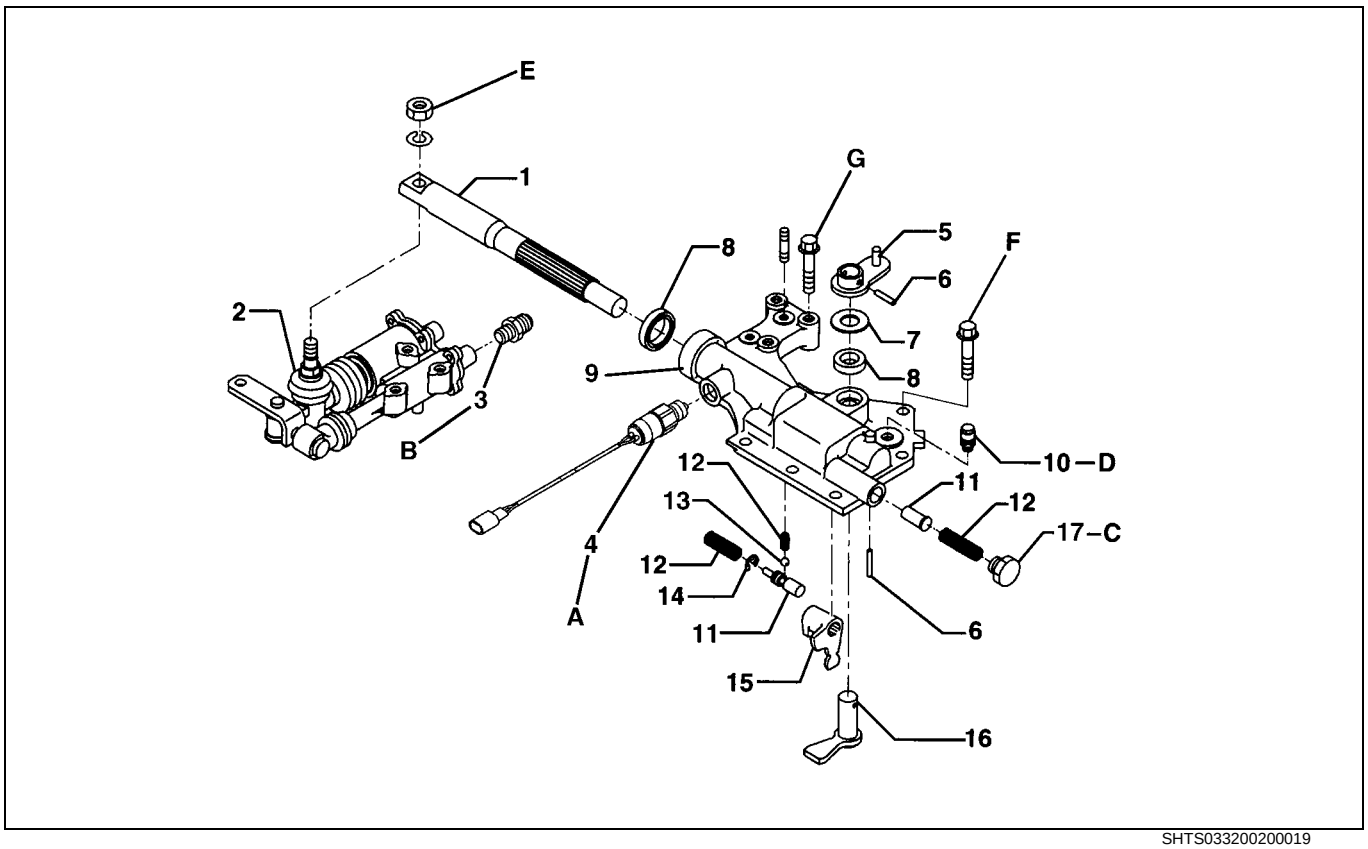
SHTS033200200018

1	Shift lever shaft	10	Air breather
2	Control rod support	11	Lockout plunger
3	Control rod end	12	Compression spring
4	Neutral switch (If so equipped)	13	Steel ball
5	Outer select lever	14	E-ring
6	Spring pin	15	Inner shift lever
7	Plain washer	16	Select lever shaft
8	Oil seal	17	Pipe joint bracket
9	Shift lever shaft housing	18	Plug

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	34-38 {350-387, 25-28}	E	18.6-28.4 {190-289, 14-20}
B	18-26 {184-265, 14-19}	F	24.5-37.3 {250-380, 19-27}
C	25-30 {255-305, 19-22}	G	43.5-54.5 {444-555, 33-40}
D	9.8-11.8 {100-120, 7.3-8.6}		

MODELS: FD, FT, GT (WITH POWER SHIFT)



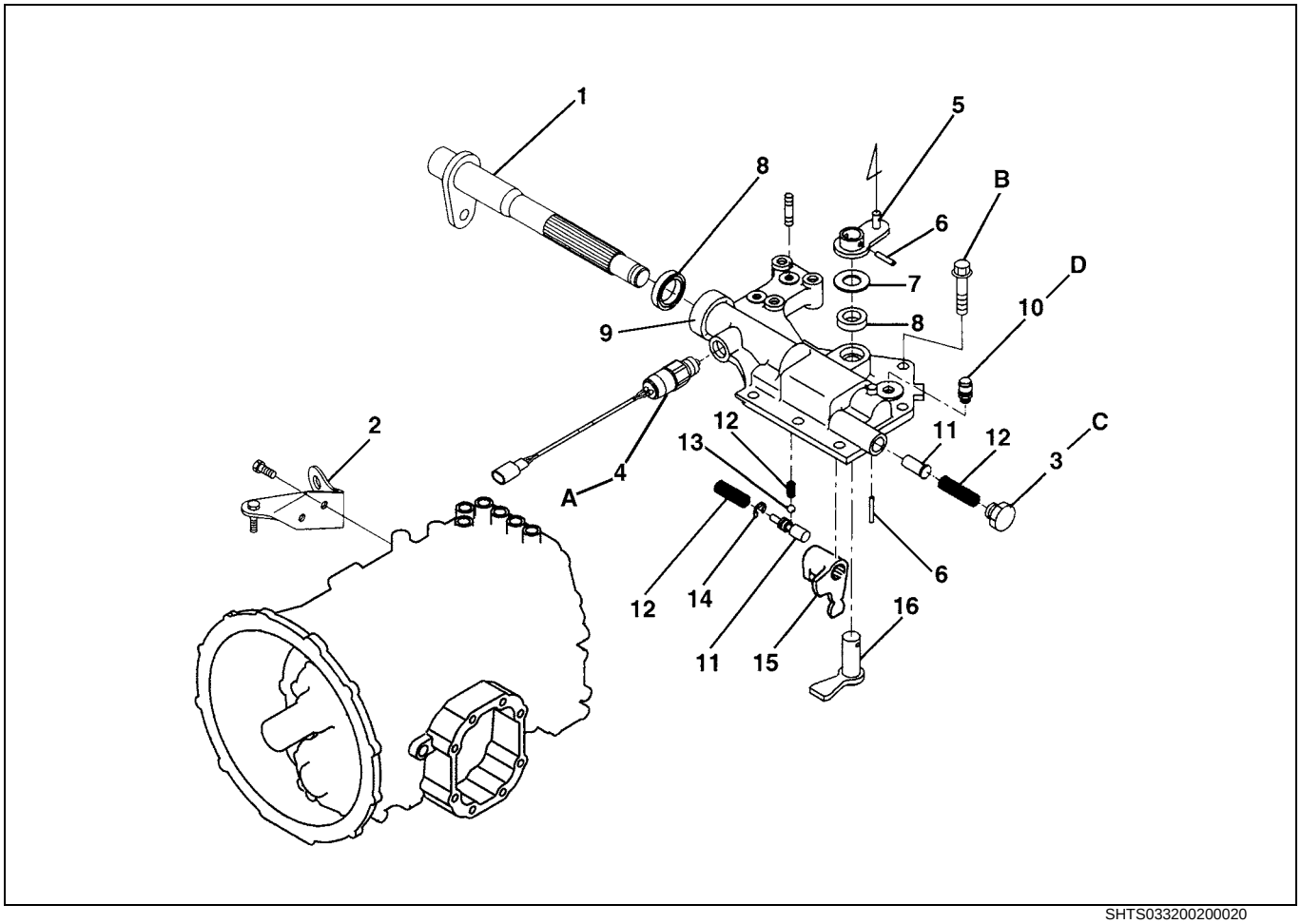
SHTS033200200019

1	Shift lever shaft	10	Air breather
2	Power shift assembly	11	Lockout plunger
3	Pipe joint	12	Compression spring
4	Neutral switch	13	Steel ball
5	Outer select lever	14	E-ring
6	Spring pin	15	Inner shift lever
7	Plain washer	16	Select lever shaft
8	Oil seal	17	Plug
9	Shift lever shaft housing		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	34-38 {350-387, 26-28}	E	75.5-91.2 {770-929, 56-67}
B	20-30 {204-305, 15-22}	F	43.5-54.5 {444-555, 33-40}
C	25-30 {255-305, 19-22}	G	40.2-46.1 {410-470, 30-33}
D	9.8-11.8 {100-120, 7.3-8.6}		

MODELS: FT, GT (WITHOUT POWER SHIFT)



SHTS033200200020

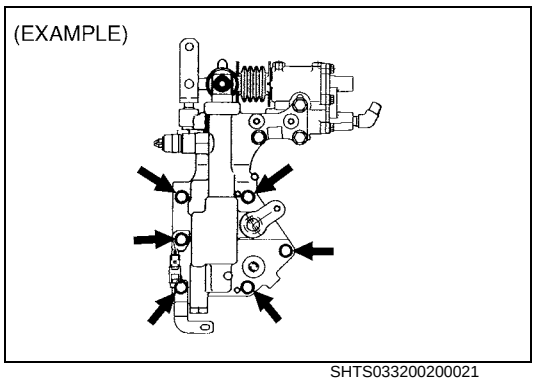
1	Shift lever shaft	9	Shift lever shaft housing
2	Pipe joint bracket	10	Air breather
3	Plug	11	Lockout plunger
4	Neutral switch	12	Compression spring
5	Outer select lever	13	Steel ball
6	Spring pin	14	E-ring
7	Plain washer	15	Inner shift lever
8	Oil seal	16	Select lever shaft

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	34-38 {350-387, 25-28}	C	25-30 {255-305, 19-22}
B	43.5-54.5 {444-555, 33-40}	D	9.8-11.8 {100-120, 7.3-8.6}

OVERHAUL

EN0332002H200001



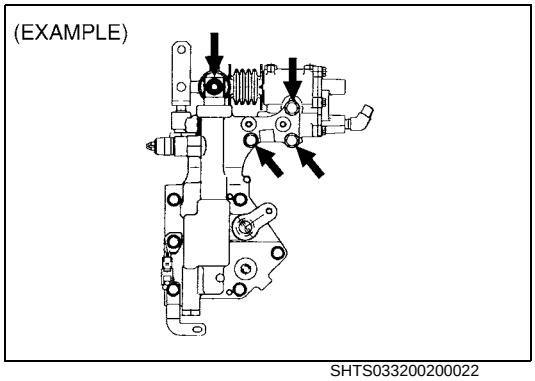
SHTS033200200021

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE SHIFT LEVER HOUSING.

(1) Take off the liquid gasket adhered to the contact surface using a scraper.

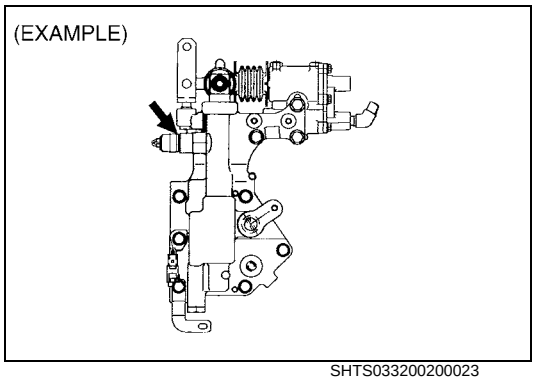
NOTICE
Be careful not to damage the contact surface.



SHTS033200200022

2. REMOVE THE POWER SHIFT.

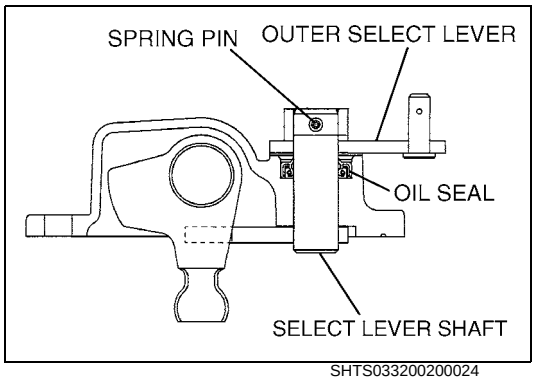
(1) Remove the power shift.



SHTS033200200023

3. REMOVE THE NEUTRAL SWITCH (IF SO EQUIPPED).

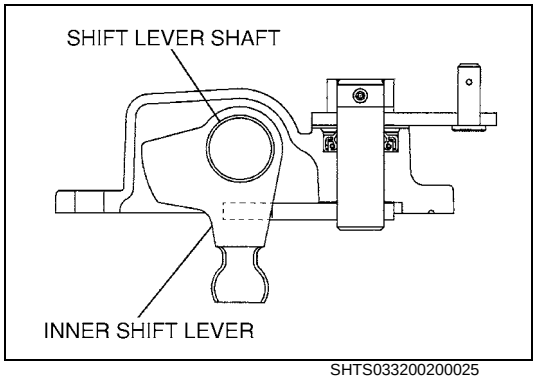
(1) Remove the neutral switch from the shift lever housing.



SHTS033200200024

4. REMOVE THE OUTER SELECT LEVER AND SELECT LEVER SHAFT.

(1) Using a copper hammer and tapping rod, remove the spring pin.
(2) Remove the outer select lever and select lever shaft.
(3) Remove the oil seal from the shift lever housing.

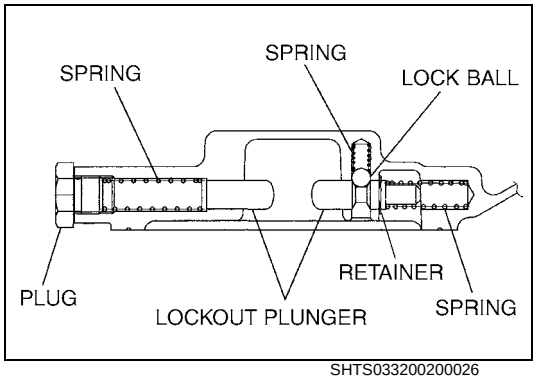


SHTS033200200025

5. REMOVE THE SHIFT LEVER SHAFT AND INNER SHIFT LEVER.

(1) Remove the shift lever shaft and inner shift lever from the shift lever housing.

(2) Remove the oil seal from the shift lever housing.



SHTS033200200026

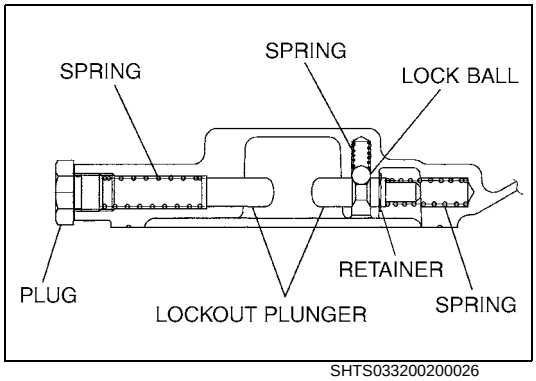
6. REMOVE THE LOCKOUT PLUNGER, LOCK BALL AND RETAINER.

(1) Loosen the plug to remove the spring, lock ball retainer and lock-out plunger.

NOTICE

The spring may fly out of the groove. So wear safety glasses while working.

IMPORTANT POINTS - ASSEMBLY



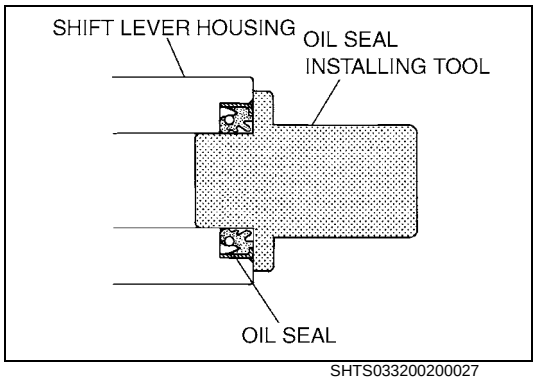
SHTS033200200026

1. INSTALL THE LOCKOUT PLUNGER, LOCK BALL AND SPRING.

(1) Apply bearing grease to the lockout plunger.

(2) Insert the spring, lock ball to the installing hole for lockout plunger in order, and insert the lockout plunger so that the lock ball does not fly out and install the retainer.

(3) After applying adhesive to the plug, install the lockout plunger, the spring and the plug.



SHTS033200200027

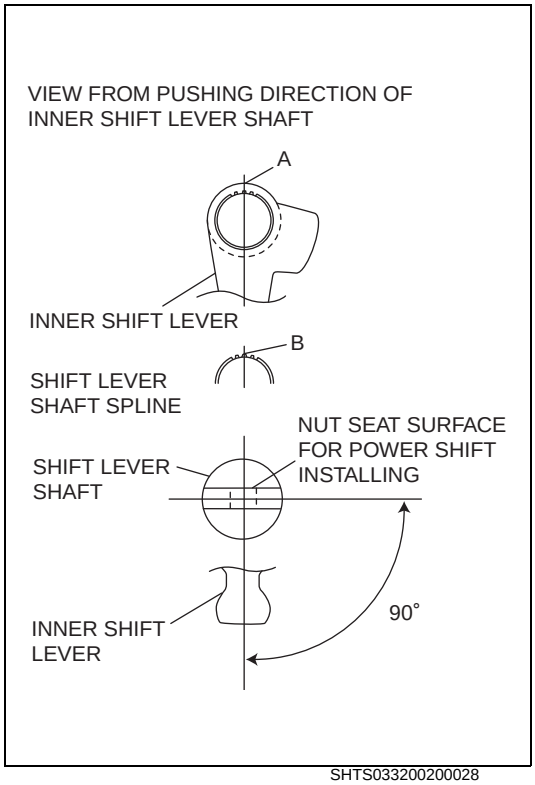
2. INSTALL THE SHIFT LEVER SHAFT AND INNER SHIFT LEVER.

(1) Using a receiving block and a hammer, drive a new oil seal into the shift lever housing.

NOTICE

Be careful not to damage the lip part of the oil seal.

(2) Apply bearing grease to the lip part of the oil seal and shaft part of the shift lever shaft.

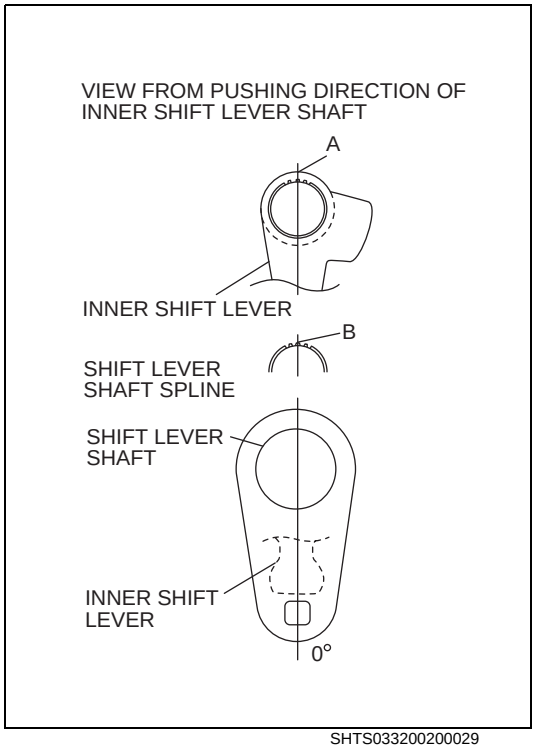


SHTS033200200028

(3) Match the shift lever shaft and inner shift lever as shown, and push the shift lever shaft into the inner shift lever.

Model: With power shift

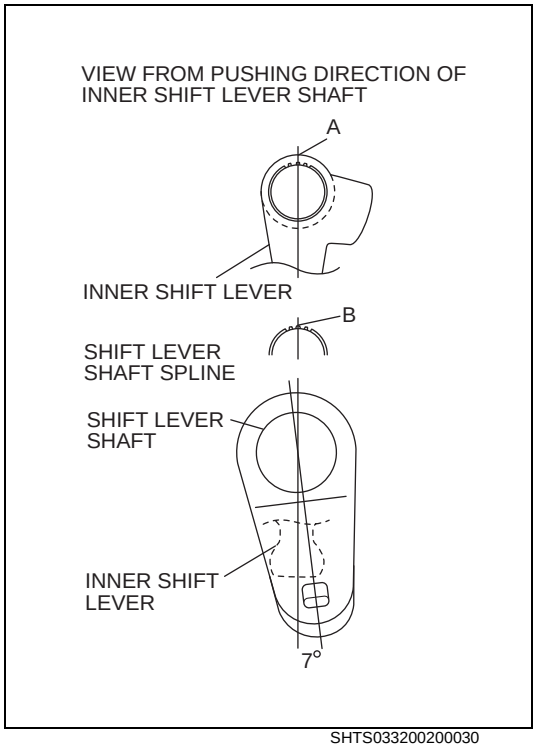
- **They should be installed so that the nut seat surface for power shift installing makes an angle of 90° with the inner shift lever.**



SHTS033200200029

Model: FC (Without power shift)

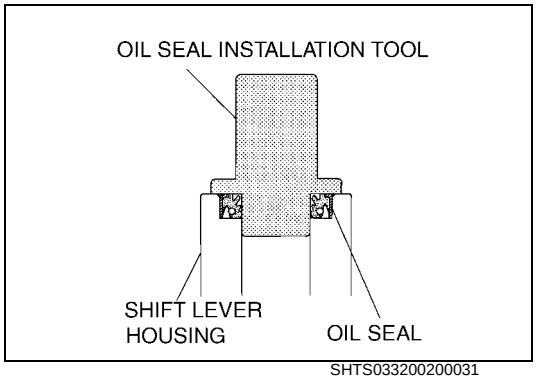
- **They should be installed so that the shift lever shaft and the inner shift lever are matched.**



SHTS033200200030

Models: FT, GT (Without power shift)

- **They should be installed so that the shift lever shaft installing makes an angle of counterclockwise 7° with the inner shift lever.**



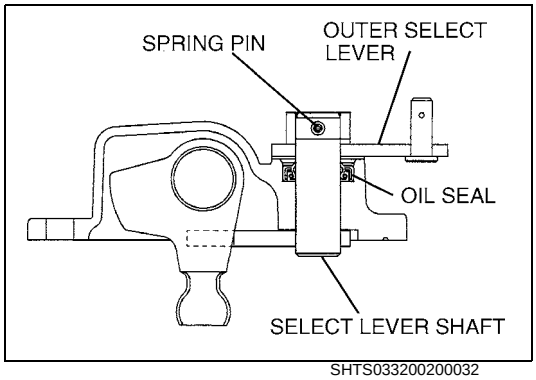
SHTS033200200031

3. INSTALL THE SELECT LEVER SHAFT AND OUTER SELECT LEVER.

(1) Using a receiving block and hammer, drive a new oil seal into the shift lever housing.

NOTICE
Be careful not to damage the lip part of the oil seal.

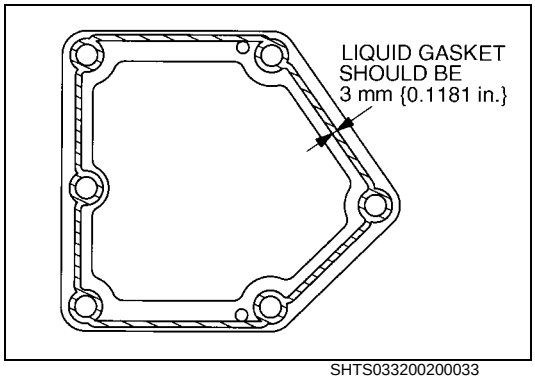
(2) Apply bearing grease to the lip part of the oil seal and shaft part of the select lever shaft.



SHTS033200200032

(3) Match the installing position of the select lever shaft and outer select lever and fix the spring pin.

NOTICE
Be sure to match the position of the select lever shaft, outer select lever and spring pin.



SHTS033200200033

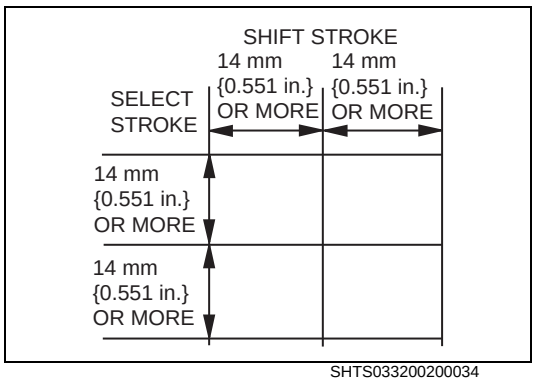
4. INSTALL THE SHIFT LEVER HOUSING

(1) Remove oil, dust etc. on the contact surface of the shift lever housing and transmission case.

(2) Coat the transmission case with liquid gasket (ThreeBond #1216 or equivalent) as shown in the figure.

NOTICE

- **The race of the liquid gasket must be continuous.**
- **Coating width of the liquid gasket should be 3 mm {0.1181 in.}**



SHTS033200200034

IMPORTANT POINT - INSPECTION

1. INSPECT THE STROKE OF THE INNER SHIFT LEVER.

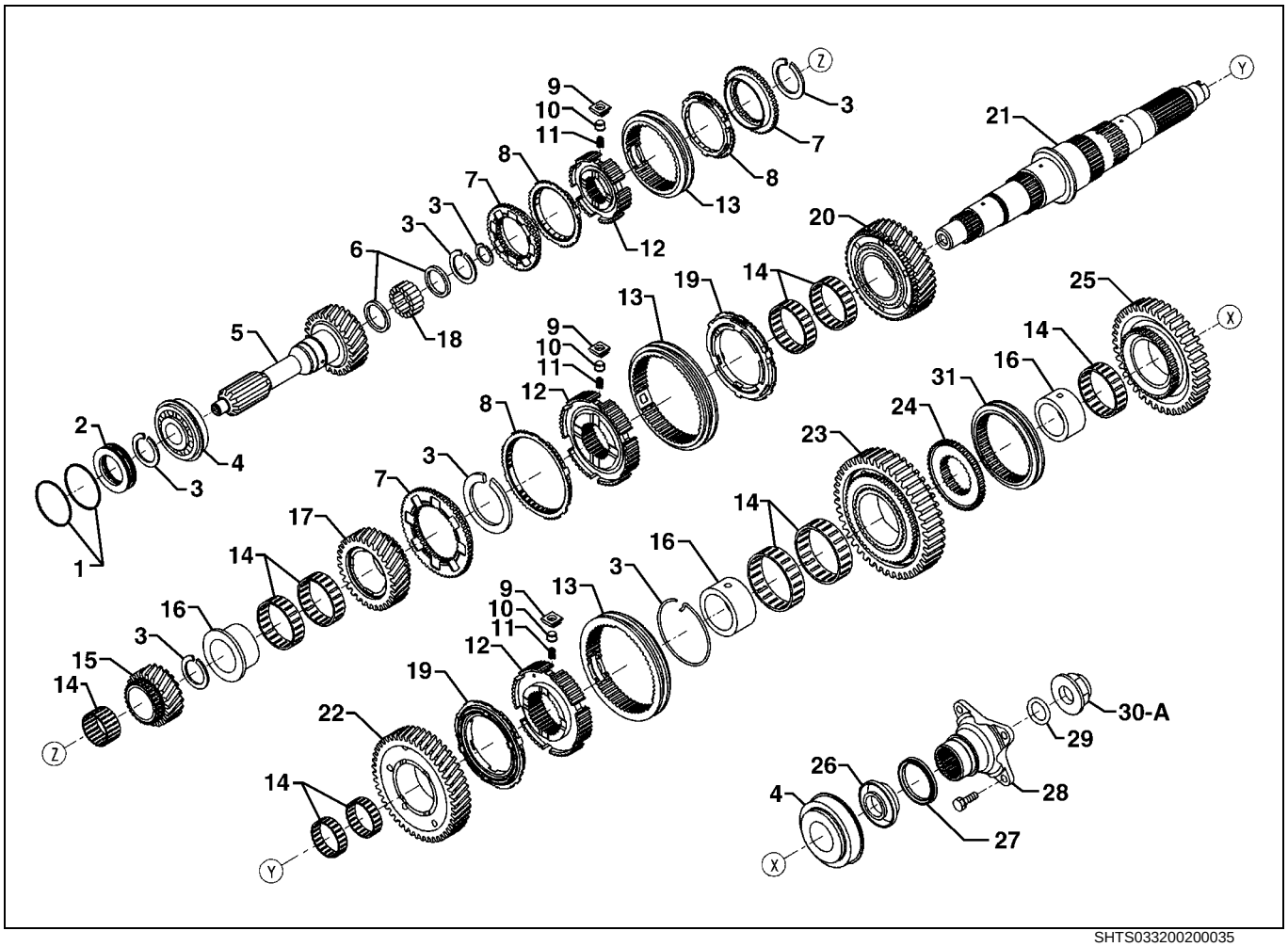
(1) Fit the scale to the inner shift lever and measure the shift stroke and select stroke of the inner shift lever.

	STANDARD
SHIFT STROKE	**14 mm {0.551 in.} or more**
SELECT STROKE	**14 mm {0.551 in.} or more**

CASE AND MAIN UNIT

COMPONENT LOCATOR

EN0332002D100002

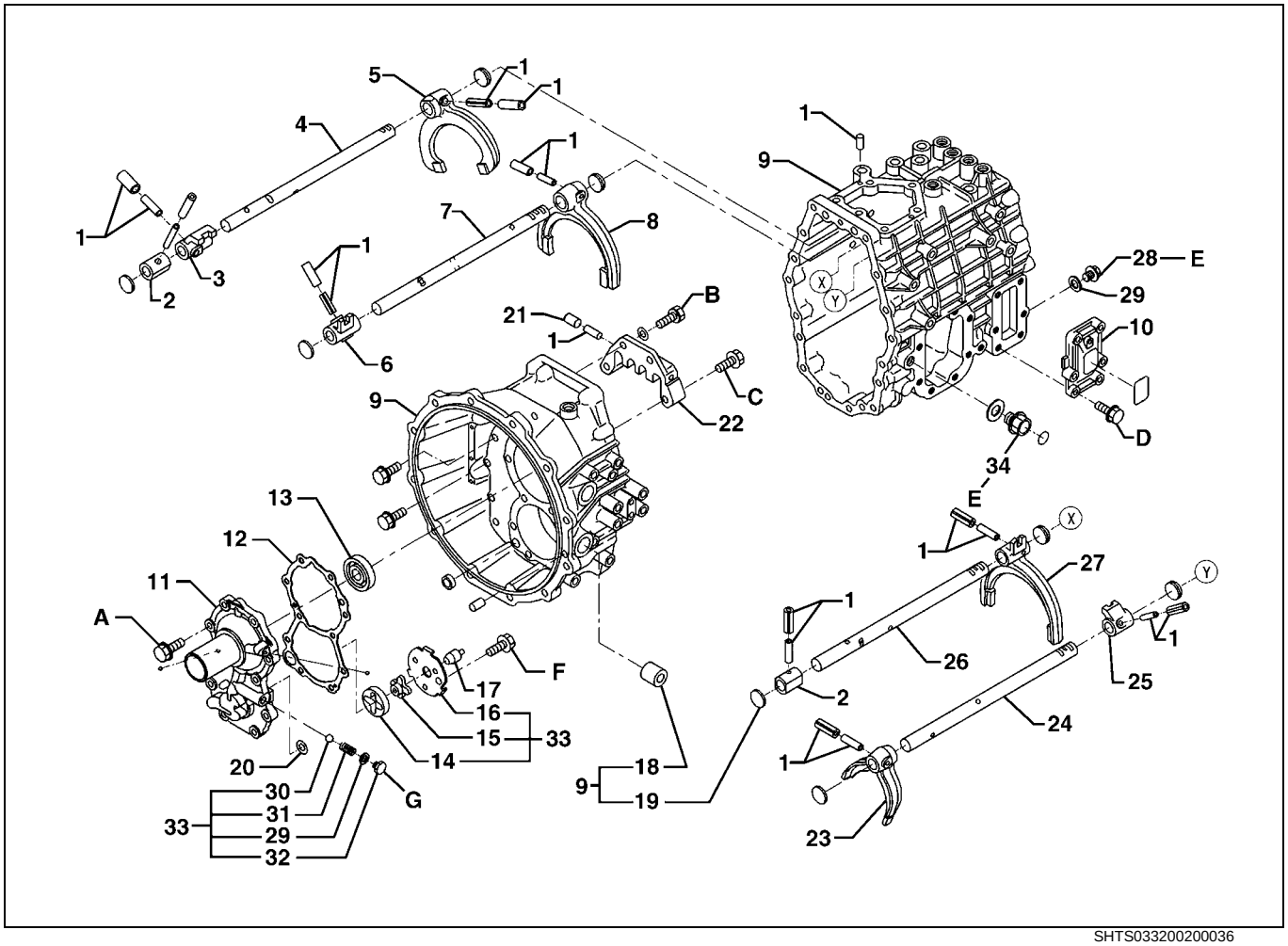


SHTS033200200035

1	Seal ring	12	Synchronizer hub	23	1st gear sub-assembly
2	Oil muffler	13	Synchronizer sleeve	24	Constant hub
3	Retainer ring	14	Needle roller bearing	25	Reverse gear
4	Cylindrical bearing	15	5th (or 6th) gear	26	Oil seal
5	Input shaft sub-assembly	16	Bushing	27	Dust reflector
6	Spacer	17	4th gear	28	Flange
7	Synchronizer cone	18	Roller bearing	29	O-ring
8	Synchronizer ring	19	Synchronizer ring sub-assembly	30	Lock nut
9	Synchronizer key	20	3rd gear sub-assembly	31	Constant sleeve
10	Synchronizer head	21	Output shaft		
11	Compression spring	22	2nd gear sub-assembly		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	587-783 {5,986-7,984, 433-577}	

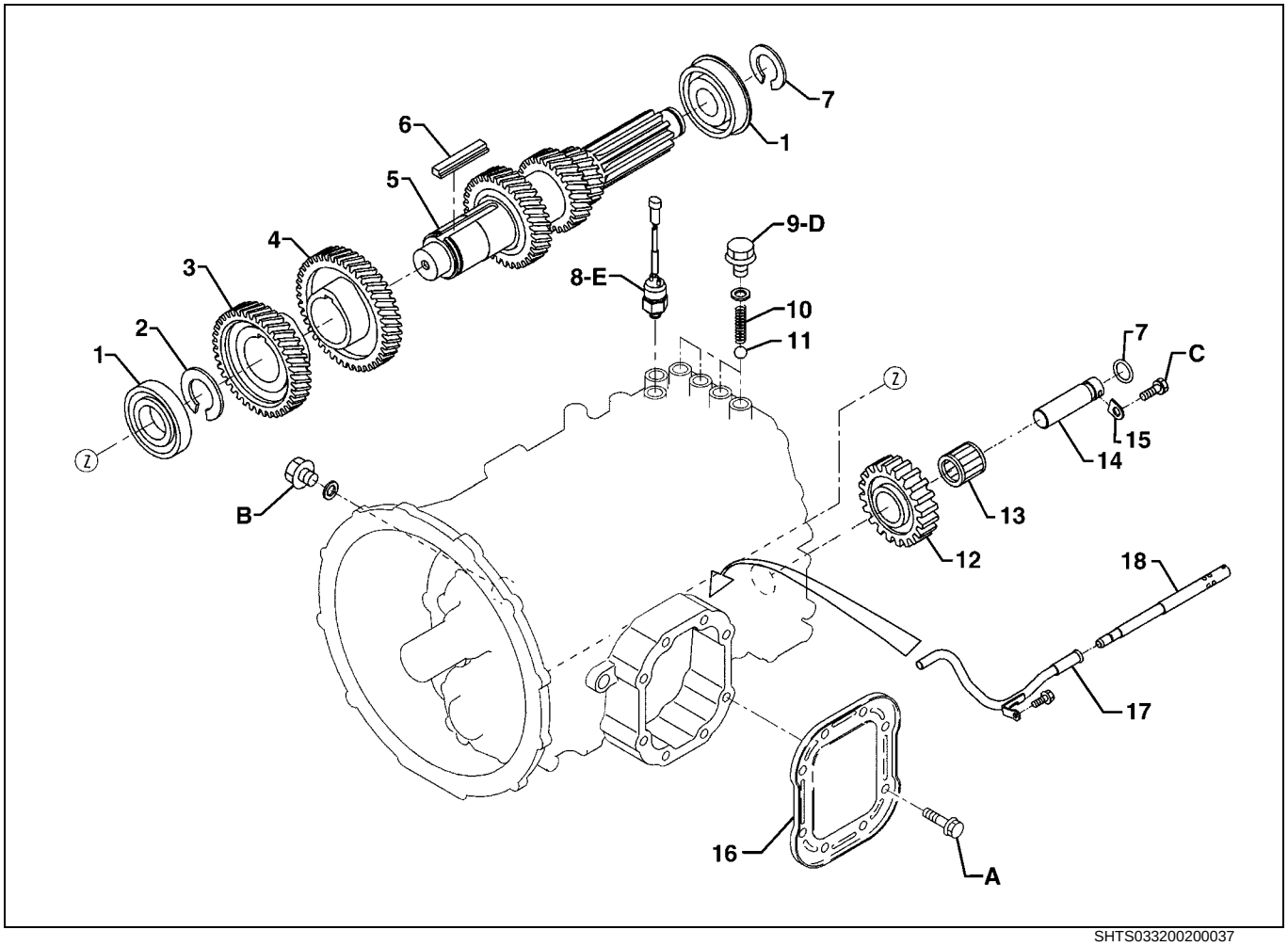


SHTS033200200036

1	Concentric pin	18	Release shaft bearing
2	Spacer	19	Expansion plug
3	Reverse shift head	20	O-ring (If so equipped)
4	Reverse shift shaft	21	Lockout plunger
5	Reverse shift fork	22	Control lever stopper
6	1st-reverse shift head	23	5th-6th shift fork
7	1st-reverse shift shaft	24	5th-6th shift shaft
8	1st-reverse shift fork	25	5th-6th shift head
9	Transmission case cover assembly	26	3rd-4th shift shaft
10	Idler gear cover	27	3rd-4th shift fork
11	Front bearing retainer	28	Drain plug
12	Gasket	29	Gasket
13	Oil seal	30	Steel ball
14	Outer rotor	31	Compression spring
15	Inner rotor	32	Plug
16	Oil pump cover	33	Front bearing retainer assembly
17	Oil pump drive shaft	34	Filler plug

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	54-68 {550-700, 40-50}	E	26-30 {266-305, 20-22}
B	44.5-53.5 {454-545, 33-39}	F	6-10 {62-101, 4.5-7.3}
C	44.5-53.5 {454-545, 33-39}	G	23.5-28.5 {240-290, 18-21}
D	23-29 {235-295, 17-21}		



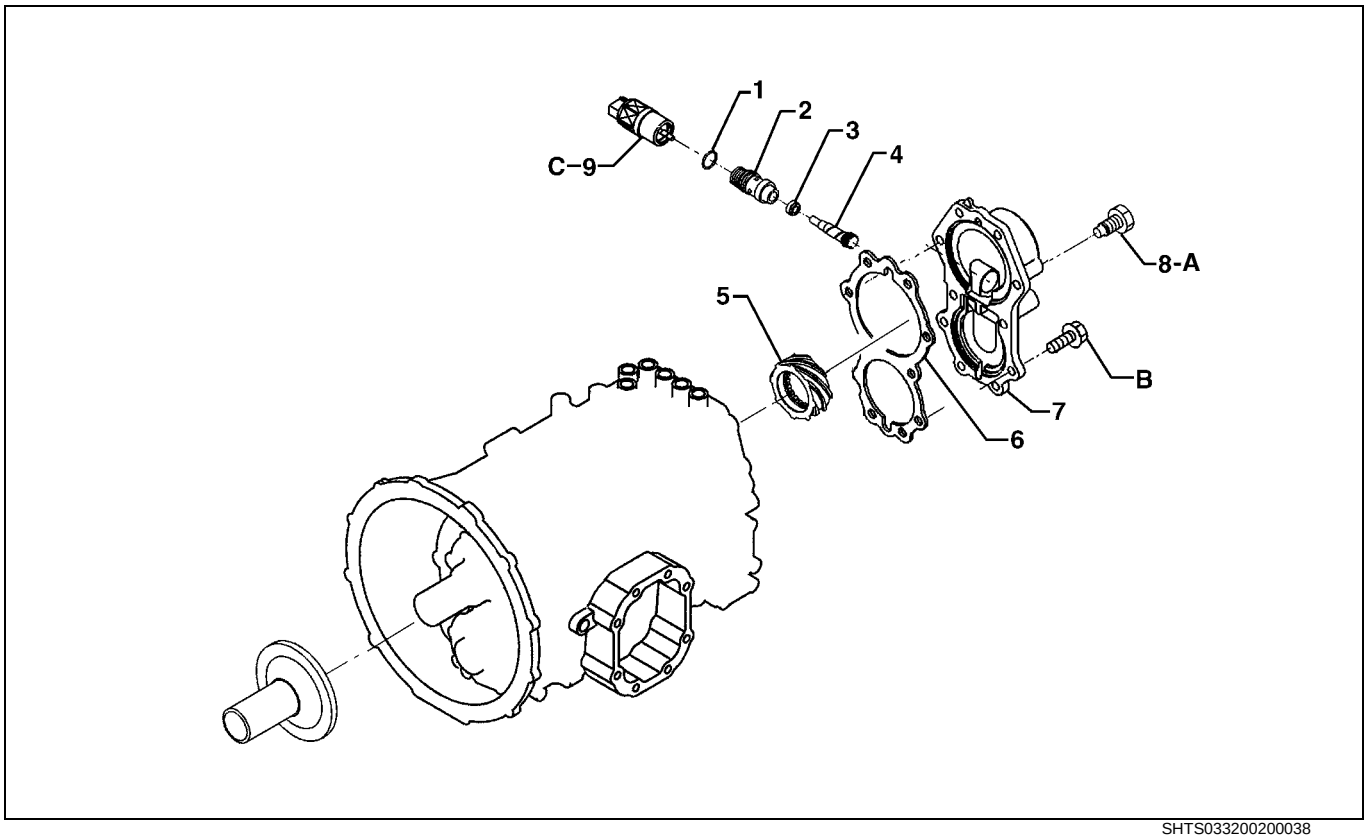
SHTS033200200037

1	Cylindrical roller bearing	10	Compression spring
2	Retainer ring	11	Lock ball
3	Counter drive gear	12	Reverse idler gear
4	Counter 5th gear	13	Needle roller bearing
5	Counter shaft	14	Reverse idler shaft
6	Key	15	Lock plate
7	Retainer ring	16	Power take-off cover
8	Back up light switch	17	Inlet oil pump pipe sub-assembly
9	Plug	18	Oil strainer

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	Without power shift: 19.5-30.5 {199-311, 15-22}	C	19-25 {194-254, 15-18}
	With power shift: 54-68 {551-693, 40-50}	D	49-63 {500-642, 37-46}
B	63.5-92.5 {648-943, 47-68}	E	26-30 {266-305, 20-22}

MODELS: FC, FD



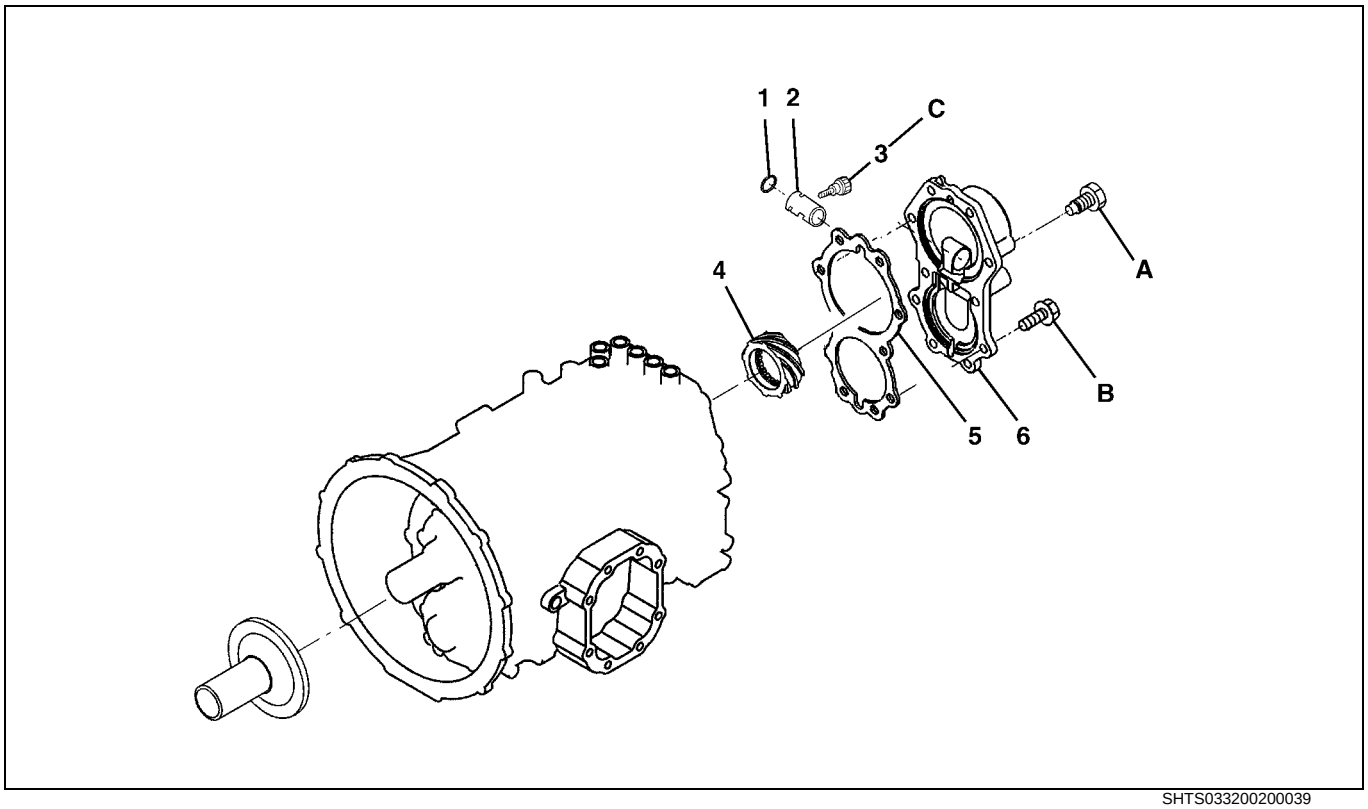
SHTS033200200038

1	O-ring	6	Gasket
2	Speedometer gear bushing	7	Rear bearing retainer assembly
3	Oil seal	8	Set screw
4	Speedometer driven gear	9	Speed sensor
5	Speedometer drive gear		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	8.5-10.5 {87-107, 6.3-7.7}	C	14.7-29.3 {150-298, 11-21}
B	54-68 {550-700, 40-50}		

MODELS: FT, GT



SHTS033200200039

1	O-ring	4	Speedometer drive gear
2	Speedometer gear bushing	5	Gasket
3	Set screw	6	Rear bearing retainer assembly

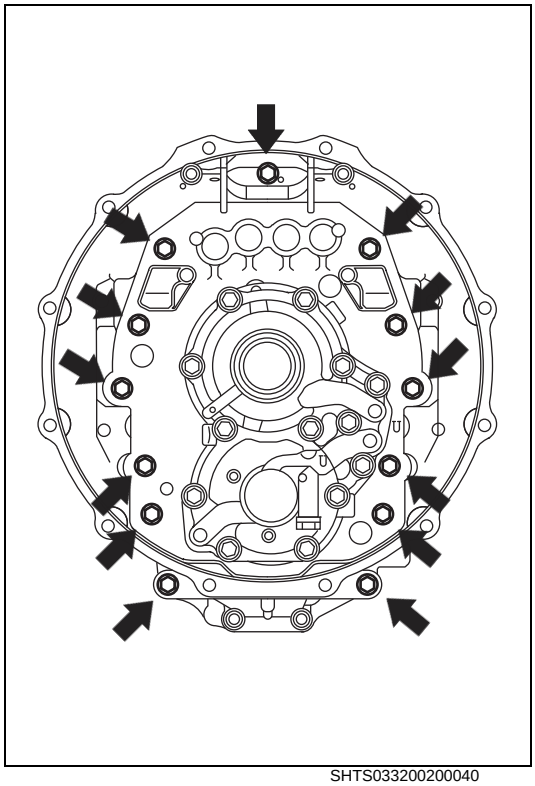
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	54-68 {550-700, 40-50}	C	8.5-10.5 {87-107, 6.3-7.7}
B	54-68 {550-700, 40-50}		

TRANSMISSION CASE ASSEMBLY

OVERHAUL

EN0332002H200002



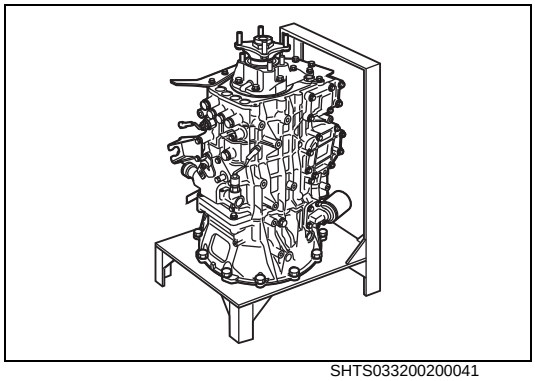
SHTS033200200040

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE TRANSMISSION CASE COVER FITTING BOLTS.

HINT

Disassembly and reassembly of the transmission is carried out basically by standing the transmission vertically. So, remove the bolts fixing the transmission case from the clutch housing side for better workability.



SHTS033200200041

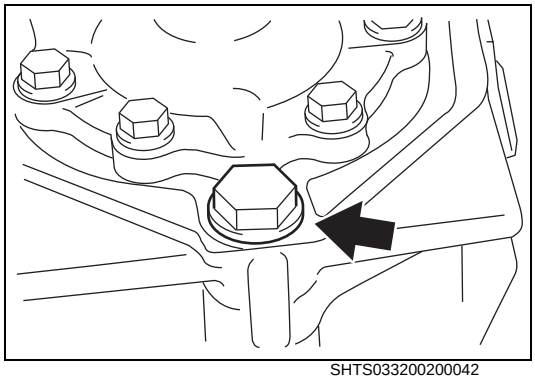
2. INSTALL THE TRANSMISSION ASSEMBLY INTO A TRANSMISSION WORKSTAND.

(1) Wire the transmission assembly rearward and lift it using a hoist.

NOTICE

As the transmission case is made of aluminum, be careful not to shock it.

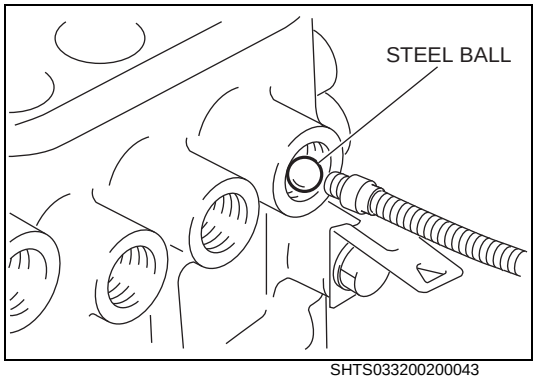
(2) Fix the transmission assembly to a workstand on the level ground with bolts and nuts.



SHTS033200200042

3. REMOVE THE PARKING BRAKE AND FLANGE COUPLING.

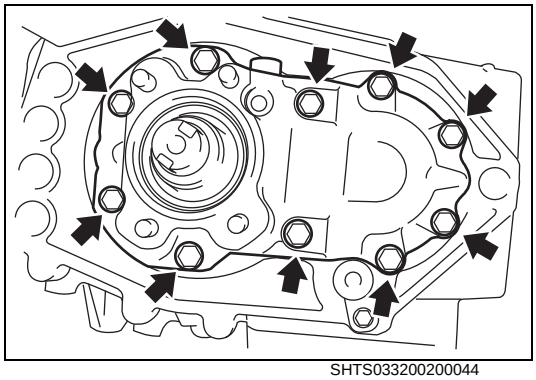
4. REMOVE THE OIL STRAINER.



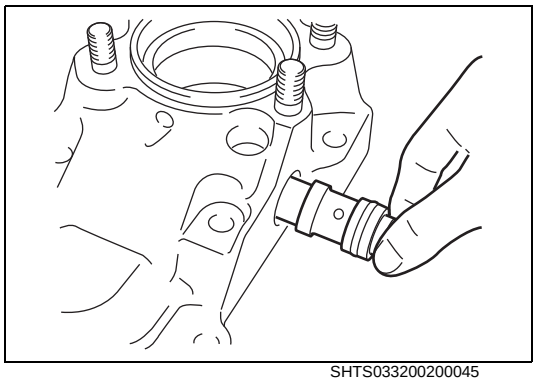
SHTS033200200043

5. REMOVE THE STEEL BALL.

(1) Remove the plug on the transmission case upper surface.
(2) Remove the spring and steel ball using a magnetic finger.


SHTS033200200044

6. REMOVE THE REAR BEARING RETAINER ASSEMBLY.


SHTS033200200045

7. DISASSEMBLE THE REAR BEARING RETAINER ASSEMBLY.

(1) Remove the speedometer gear bushing.

Models: FC, FD

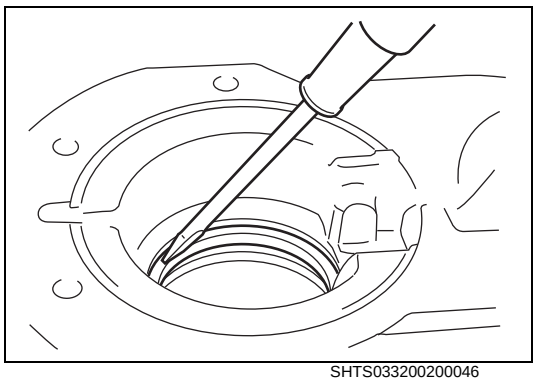
a. Remove the set screw of speedometer gear bushing and remove the driven gear and bushing.
b. Remove the O-ring and oil seal from the speedometer gear bushing.

NOTICE
Remember the position of aligning marks when removing the speedometer gear bushing.

Models: FT, GT

a. Remove the set screw and remove the speedometer gear bushing.
b. Remove the O-ring from the speedometer gear bushing.

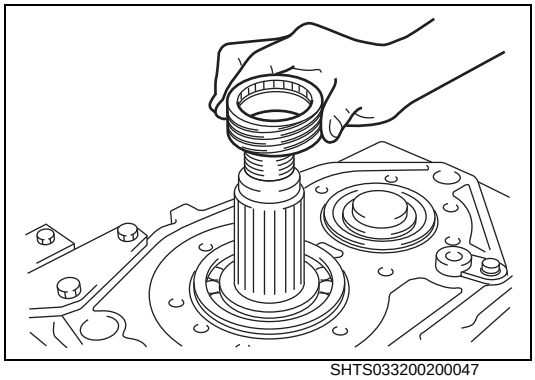
NOTICE
Remember the position of aligning marks when removing the speedometer gear bushing.


SHTS033200200046

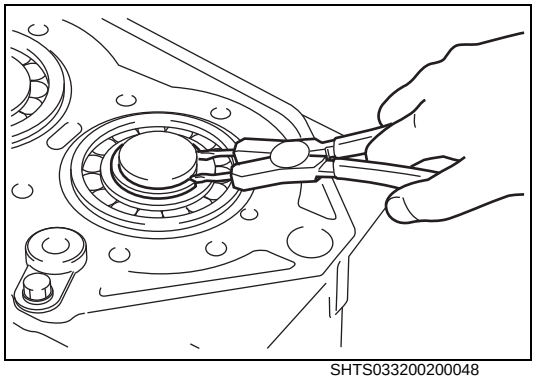
(2) Remove the oil seal.

a. Using a flat blade screwdriver, remove the oil seal from the rear bearing retainer.

NOTICE
Be careful not to damage the rear bearing retainer.


SHTS033200200047

8. REMOVE THE SPEEDOMETER DRIVE GEAR.


SHTS033200200048

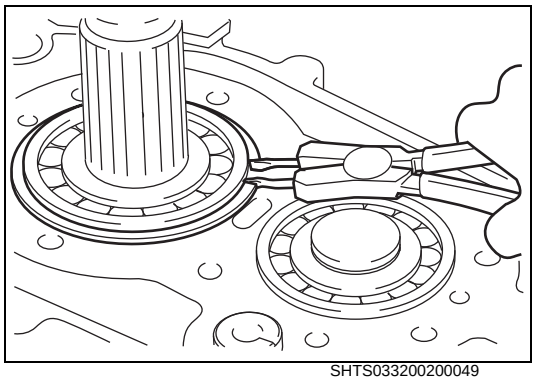
9. REMOVE THE TRANSMISSION CASE ASSEMBLY.

(1) Using a snap ring expander, remove the retainer ring from the counter shaft.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.

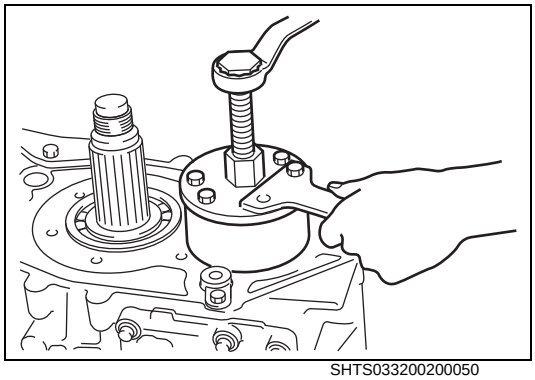
(2) Using a snap ring expander, remove the retainer ring from the rear bearing on the counter shaft side.

NOTICE
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200049

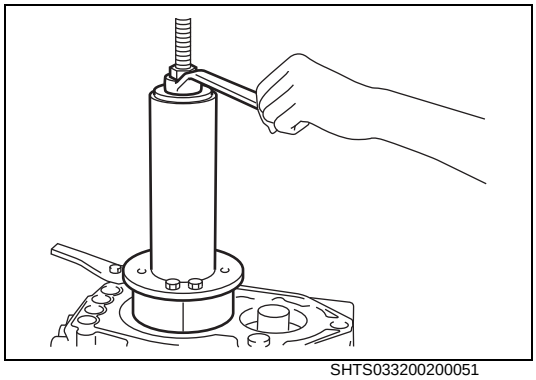
(3) Using a snap ring expander, remove the retainer ring from the rear bearing on the output shaft side.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200050

(4) Install the special tool to the groove of the rear bearing outer periphery on the counter shaft side.
SST:
Hook (S0965-31730)
Puller (S0965-02080)

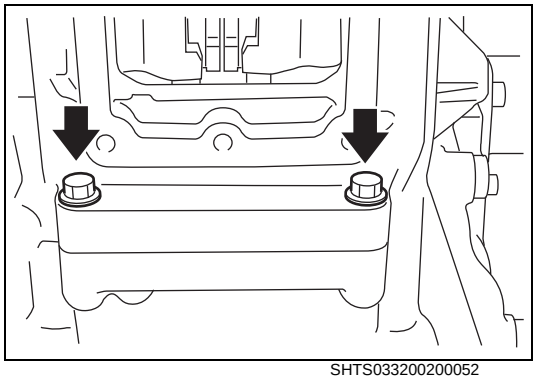
(5) Pull out the rear bearing by tightening the bolt of the special tool puller part.
(6) Remove the spacer.


SHTS033200200051

(7) Install the special tool to the groove of the rear bearing outer periphery on the output shaft side.
SST:
Hook (S0965-31720)
Puller (S0965-01881)

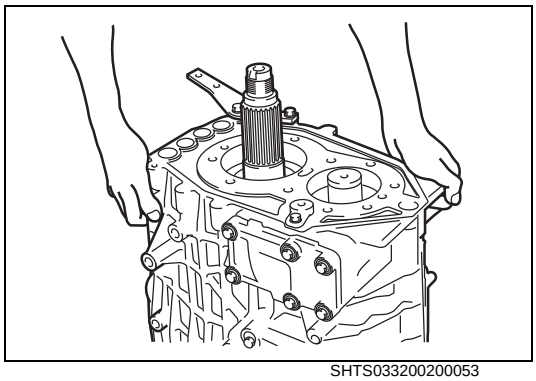
(8) Pull out the rear bearing by tightening the bolt of the special tool puller part.

(9) Remove the spacer.


SHTS033200200052

(10) Remove the 4 bolts connected to the clutch housing from the transmission case side.

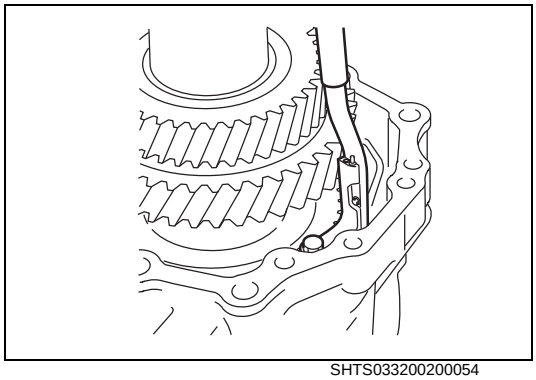
(11) Insert a chisel between lip parts of right and left side connected on the transmission case, and tap the chisel using a hammer to separate clutch housing and transmission case.


SHTS033200200053

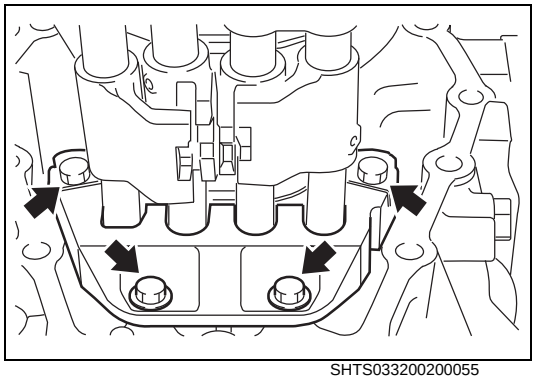
(12) Lift the transmission case assembly straight to remove it.

(13) Take off the liquid gasket adhered to the contact surface using a scraper.

NOTICE
Be careful not to damage the contact surface.


SHTS033200200054

10. REMOVE THE OIL PIPE.



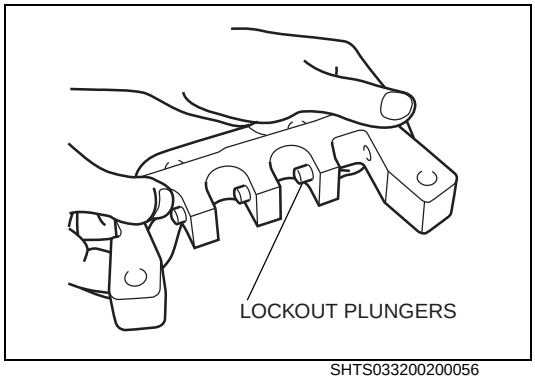
SHTS033200200055

11. REMOVE THE CONTROL LEVER STOPPER, LOCKOUT PLUNGER AND INTER LOCK PIN.

(1) Loosen the 4 bolts to remove the control lever stopper.

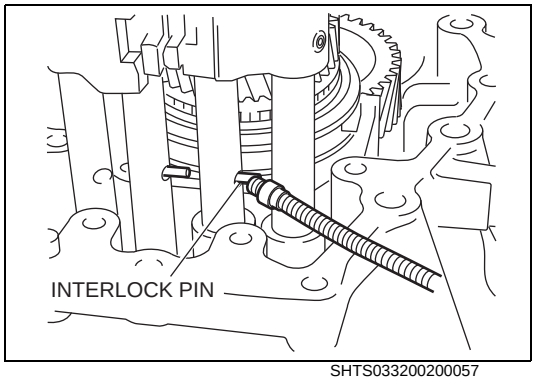
NOTICE

The inner 2 bolts of the control lever stopper fitting bolts are reamer bolt, so keep the inner 2 bolts separately.



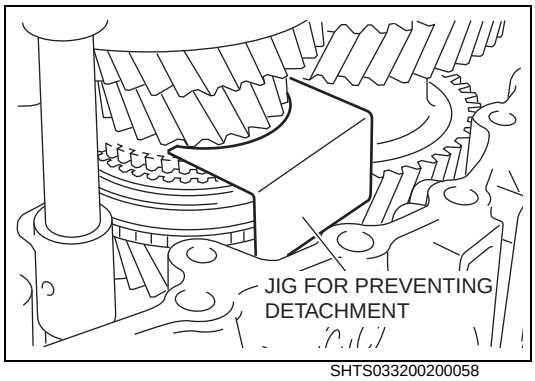
SHTS033200200056

(2) Remove the 3 lockout plungers from the control lever stopper.



SHTS033200200057

(3) Using a magnetic finger, remove the 2 interlock pins from the shift shaft.



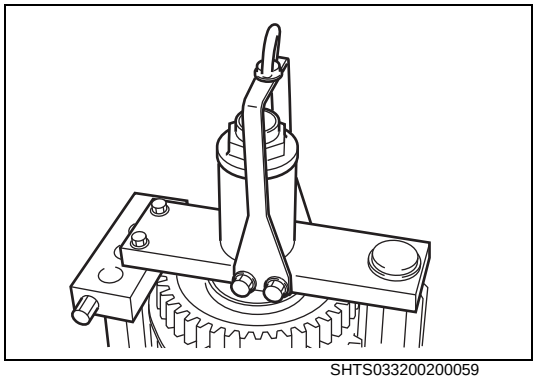
SHTS033200200058

12. REMOVE THE OUTPUT SHAFT ASSEMBLY, COUNTER SHAFT ASSEMBLY AND SHIFT SHAFT ASSEMBLY.

(1) Install the jig for preventing detachment into the 5th-6th synchronizer unit to prevent the 5th-6th synchronizer cone and ring from detaching.

HINT

In case of not using the jig for preventing detachment, support parts for the prevention of detachment by one of the worker.


SHTS033200200059

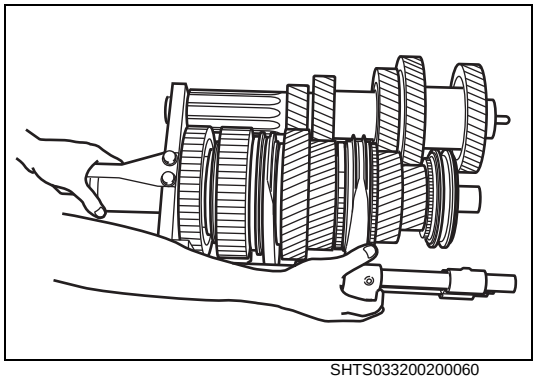
(2) Using the special tool, fix the output shaft assembly, counter shaft assembly and shift shaft assembly.
SST: Shaft hanger (S0963-02220)

HINT
The retainer ring and the lock nut removed previously should be reused.

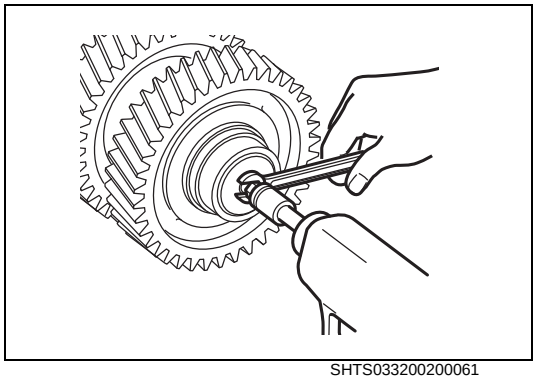
(3) Using a hoist, lift up the output shaft assembly, counter shaft assembly and shift shaft assembly together.

NOTICE

- **Lift them up little by little.**
- **Be careful not to make shift shaft be caught.**
- **Be careful not to damage the gear and bearing etc. when lifting up.**

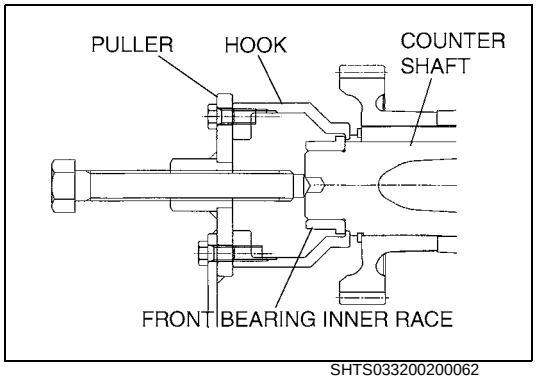

SHTS033200200060

(4) Remove the special tool and separate the output shaft assembly, counter shaft assembly and shift shaft assembly.


SHTS033200200061

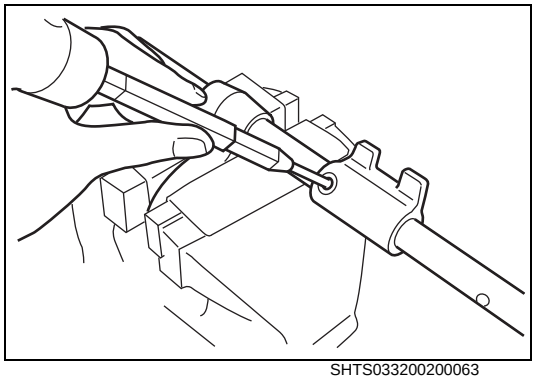
13. REMOVE THE COUNTER SHAFT FRONT BEARING INNER RACE.

(1) While holding the tapered portion of the oil pump drive pin by wrench, rotate (or vibrate) the oil pump drive pin by using impact wrench, and then pull it out.



SHTS033200200062

(2) Using the special tool, pull out the front bearing inner race from the counter shaft.
SST:
Hook (S0965-31740)
Puller (S0965-02080)

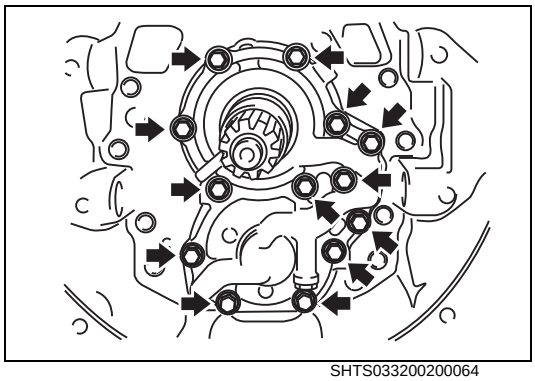

SHTS033200200063

14. DISASSEMBLE THE SHIFT SHAFT ASSEMBLY.

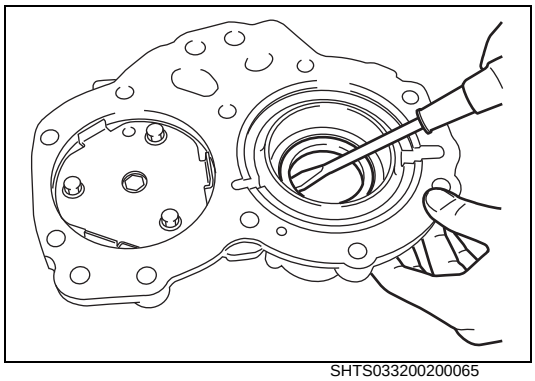
(1) Remove the shift fork and shift head.

a. Using a 5.0 mm {0.197 in.} diameter tapping rod and a hammer, drive out the inner pin and outer pin from the shift fork, shift head and spacer.

b. Remove the spacer, shift fork and shift head from the shift shaft.


SHTS033200200064

15. REMOVE THE FRONT BEARING RETAINER ASSEMBLY.

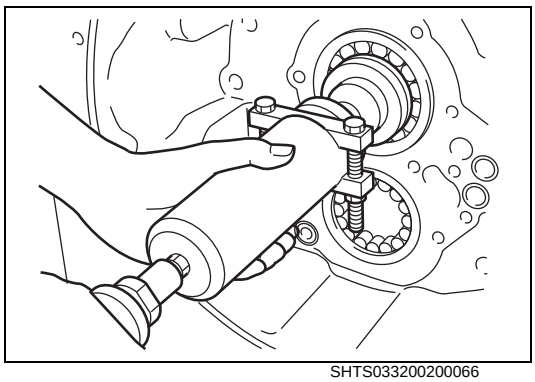

SHTS033200200065

16. DISASSEMBLE THE FRONT BEARING RETAINER ASSEMBLY.

(1) Remove the oil seal.

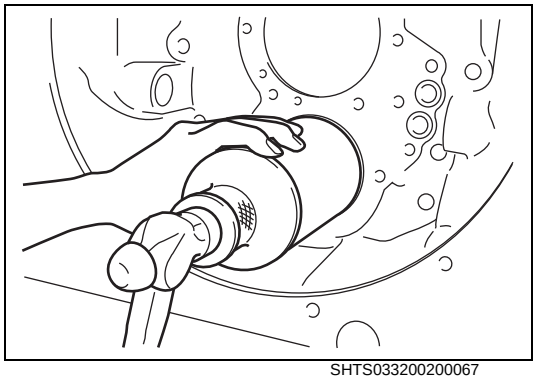
a. Using a flat blade screwdriver, remove the oil seal from the front bearing retainer.

NOTICE
Be careful not to damage the front bearing retainer.


SHTS033200200066

17. REMOVE THE INPUT SHAFT ASSEMBLY.

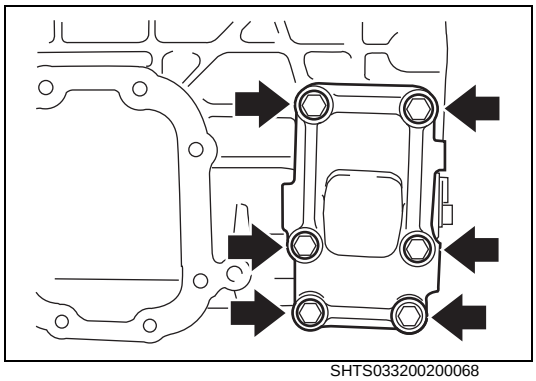
(1) Using the special tool, pull out the input shaft assembly from the clutch housing.
SST:
Sliding hammer (S0942-01442)
Input shaft puller (S0965-02070)


SHTS033200200067

18. REMOVE THE FRONT BEARING OUTER RACE ON THE COUNTER SHAFT SIDE.

(1) Using a receiving block and a hammer, tap the front bearing outer race equally to drive it out.

19. REMOVE THE OIL FILTER ASSEMBLY.


SHTS033200200068

20. DISASSEMBLE THE TRANSMISSION CASE ASSEMBLY.

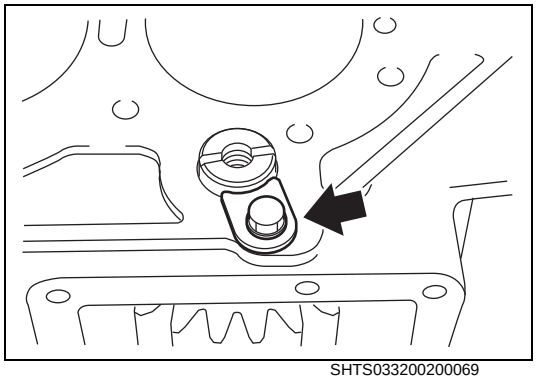
(1) Remove the idler cover.

a. Loosen the bolts to remove the idler cover.

b. Take off the liquid gasket adhered to the contact surface using a scraper.

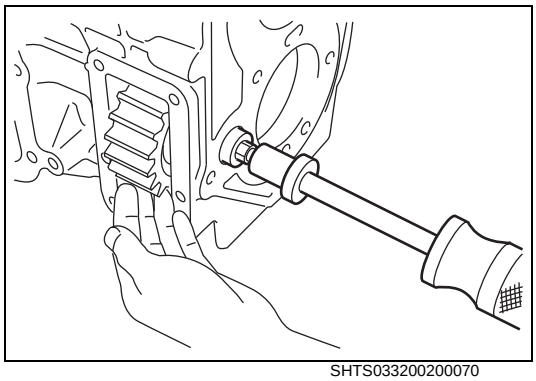
NOTICE

Be careful not to damage the contact surface.

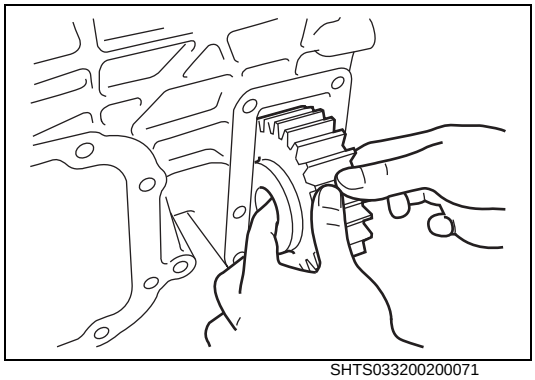

SHTS033200200069

(2) Remove the reverse idler gear.

a. Loosen the bolt to remove the lock plate.


SHTS033200200070

b. Using the special tool, pull out the reverse idler shaft.
SST: Sliding hammer (S0942-01442)


SHTS033200200071

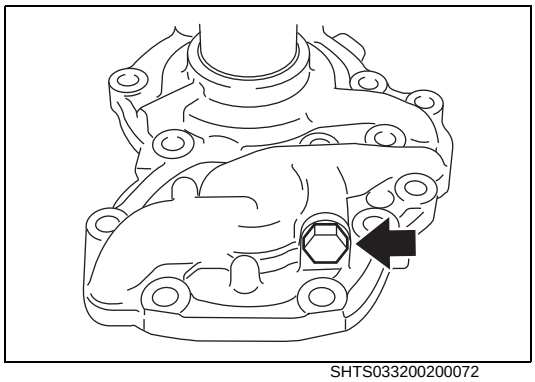
c. Remove the O-ring from the reverse idler shaft.
d. Remove the needle roller bearing.

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLE THE FRONT BEARING RETAINER ASSEMBLY.

(1) Assemble the relief valve.

a. Install the steel ball and compression spring in order to the front bearing retainer.
b. Install a new soft washer and the plug.

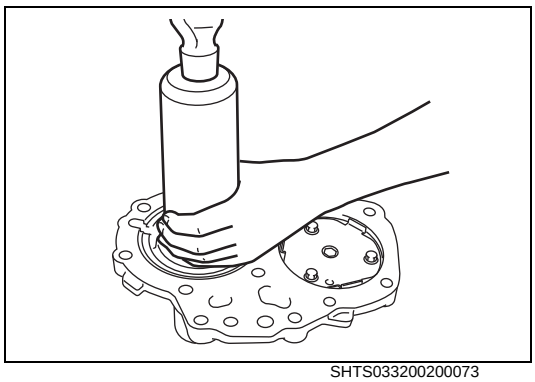

SHTS033200200072

(2) Install the oil seal.

a. Apply chassis grease to a new oil seal lip part.
b. Using a receiving block and a hammer, drive the oil seal into the front bearing retainer.

NOTICE

- **Be careful not to damage the lip part.**
- **Do not deform the oil seal.**


SHTS033200200073

2. ASSEMBLE THE REAR BEARING RETAINER ASSEMBLY.

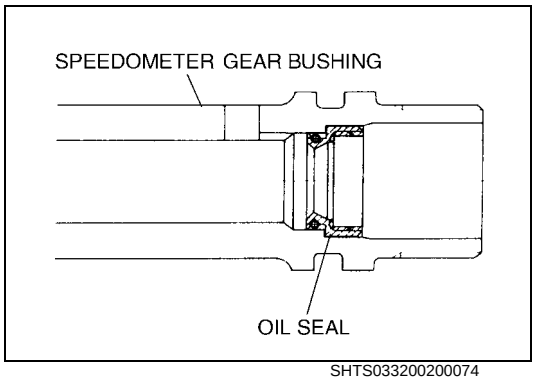
(1) Install the oil seal (Models: FC, FD) and O-ring.

Models: FC, FD

a. Apply chassis grease to a new O-ring and a new oil seal and install them to the speedometer gear bushing.

NOTICE

- **Be sure that the oil seal is installed in the proper direction.**
- **Be careful not to damage the O-ring and the oil seal.**



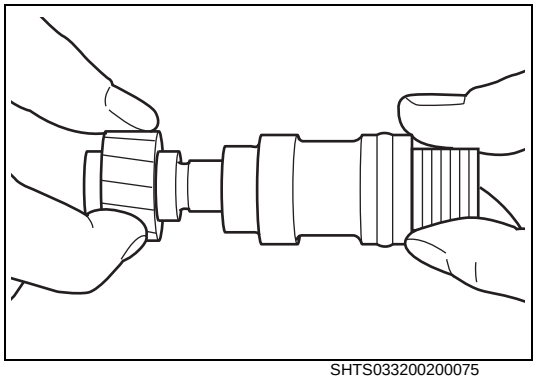
SHTS033200200074

Models: FT, GT

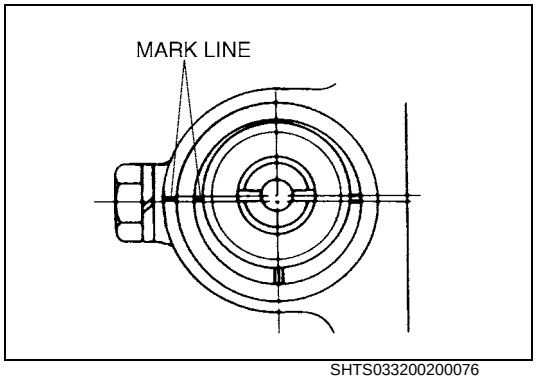
a. Apply chassis grease to a new O-ring and install it to the speedometer gear bushing.

NOTICE

Be careful not to damage the O-ring.


SHTS033200200075

(2) Apply chassis grease to the shaft part of the speedometer driven gear and insert it into the speedometer gear bushing (Models: FC, FD).

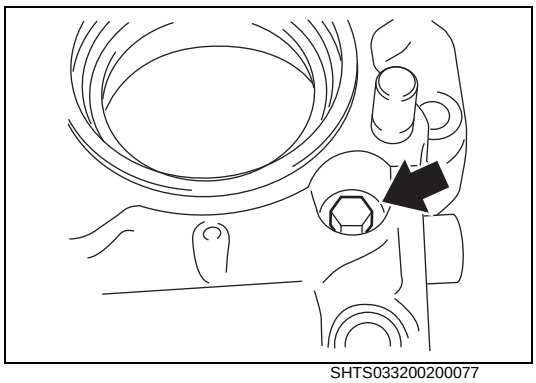


SHTS033200200076

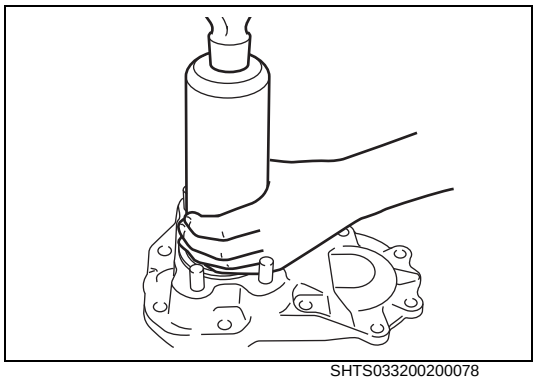
(3) Install the speedometer gear bushing.
   a. Align the mark line engraved on the speedometer gear bushing with the mark line engraved on the rear bearing retainer and insert it (Models: FC, FD).

Number of the drive gear teeth	Number of the driven gear teeth	Number of the mark lines
6	19	Three lines

NOTICE
To prevent the drive gear and driven gear from damaging, align the mark lines.

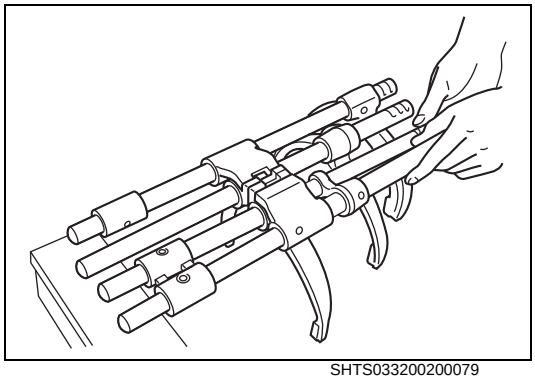

SHTS033200200077

(4) Fix the speedometer gear bushing with the set screw.


SHTS033200200078

3. INSTALL THE OIL SEAL.
(1) Apply chassis grease to the lip part of a new oil seal.
(2) Using a receiving block or a hammer, drive the oil seal into the rear bearing retainer.

NOTICE
- **Be careful not to damage the lip part of the oil seal.**
- **Do not deform the oil seal.**


SHTS033200200079

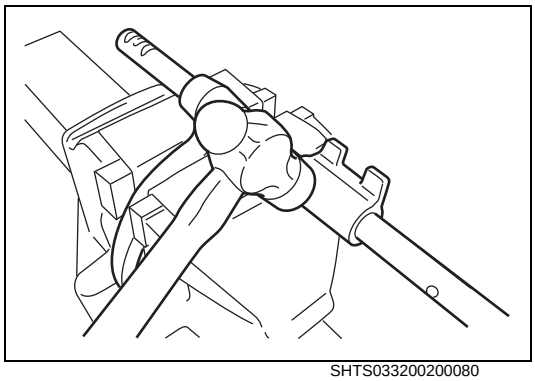
4. ASSEMBLE THE SHIFT SHAFT ASSEMBLY.

(1) Assemble the shift fork and shift head.

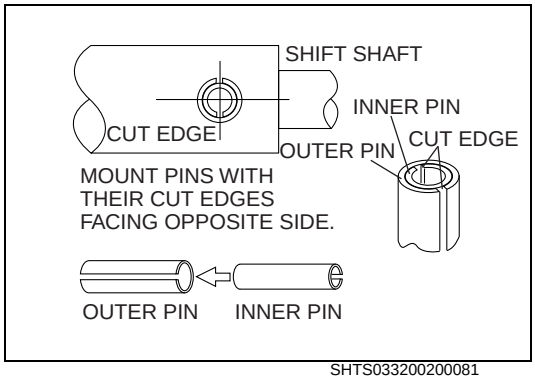
a. Match the spacer, shift fork and shift head with shift shaft installing position.

NOTICE

Be sure that the shift fork and shift head are installed in proper position and direction.


SHTS033200200080

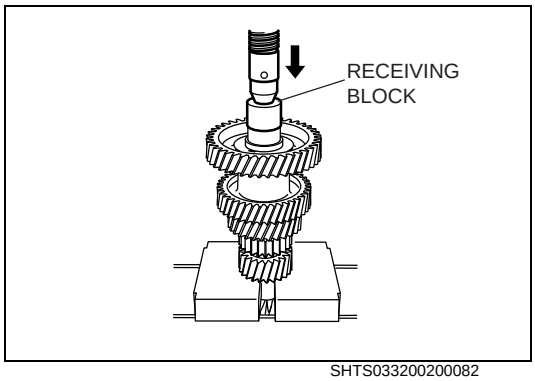
b. Using a hammer, drive a new inner pin and a new outer pin into the shift fork, shift head and spacer.



SHTS033200200081

NOTICE

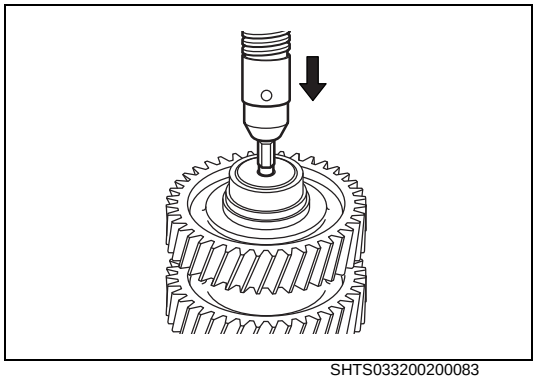
- **Mount the inner pin and outer pin with their cut edges facing opposite side to each other. Be sure that the cut edges of inner pin and outer pin are vertical to the shift shaft when knocking them into the shift fork and shift head.**
- **Knock home the inner pin and outer pin down to the knocking seat of the shift fork, shift head and spacer.**



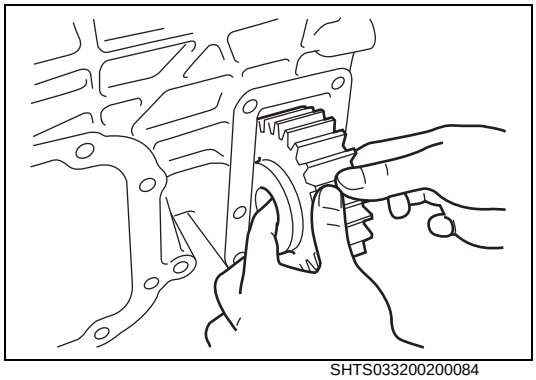
SHTS033200200082

5. INSTALL THE COUNTER SHAFT FRONT BEARING INNER RACE.

(1) Using a receiving block and a hammer, press the front bearing inner race into the counter shaft.


SHTS033200200083

(2) Using a press, press the oil pump drive pin into the counter shaft.


SHTS033200200084

6. ASSEMBLE THE TRANSMISSION CASE ASSEMBLY.

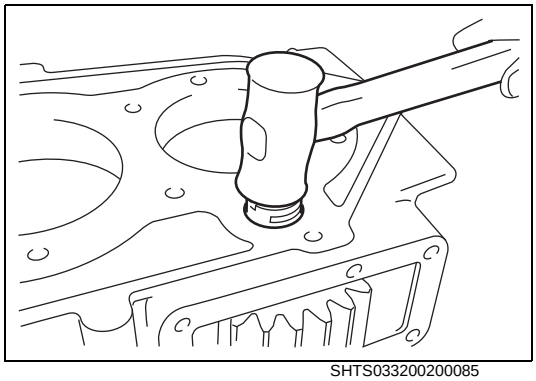
(1) Install the reverse idler gear.

a. Apply gear oil to the needle roller bearing.

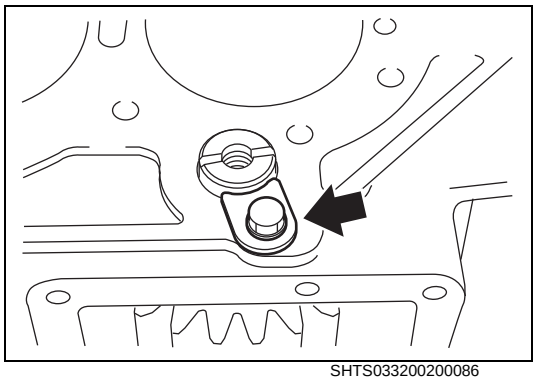
b. Assemble the reverse idler gear and needle roller bearing.

c. Apply bearing grease to the O-ring and install the O-ring to the groove of the reverse idler shaft.

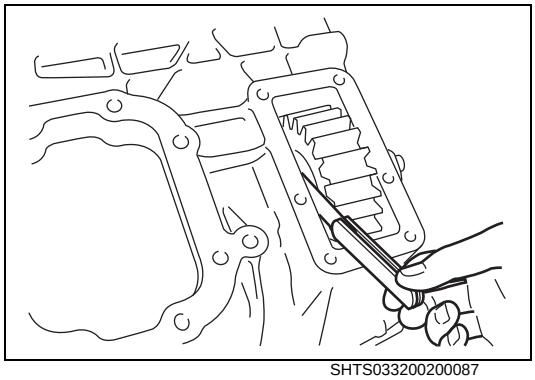
d. Match the reverse idler gear with the transmission case installing position.


SHTS033200200085

e. Using a copper hammer, drive the reverse idler shaft into the transmission case assembly.


SHTS033200200086

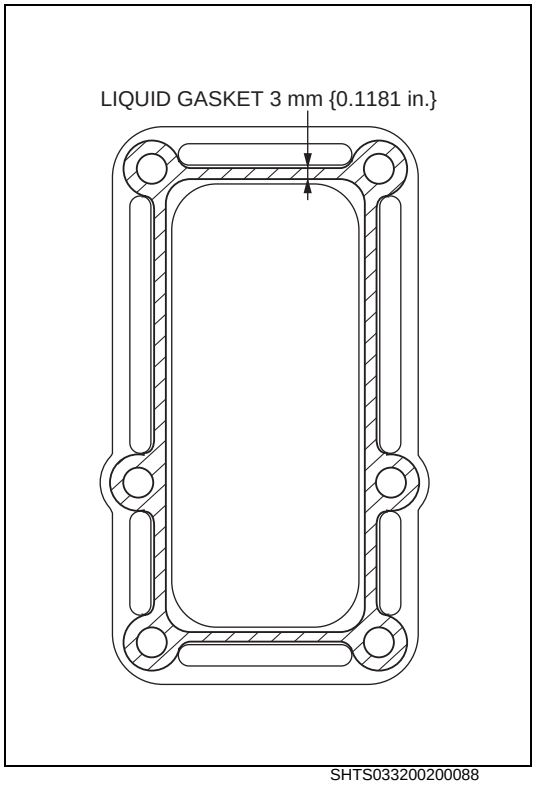
f. Match the lock plate with reverse idler shaft and install it with the bolt.



SHTS033200200087

(2) Measure the reverse idler gear end play.

Assembly Standard: 0.15-0.60 mm {0.0060-0.0236 in.}
Service Limit: 0.65 mm {0.0256 in.}



SHTS033200200088

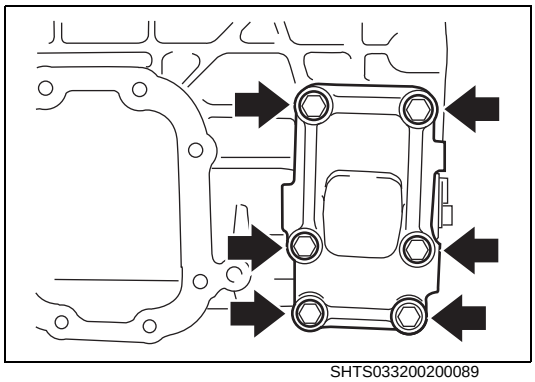
(3) Install the idler cover.

a. Remove oil, dust etc. on the contact surface of the idler cover and transmission case.

b. Coat the idler cover with liquid gasket (ThreeBond #1216 or equivalent) as shown in the figure.

NOTICE

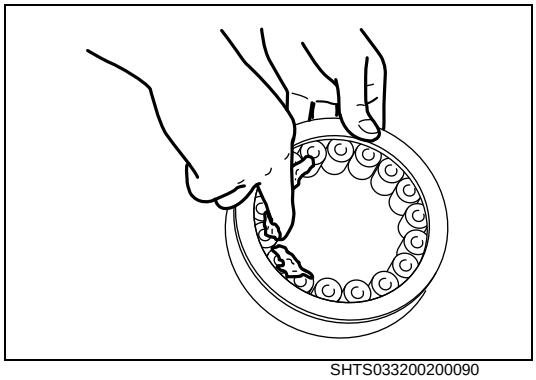
- **The trace of the liquid gasket must be continuous.**
- **Coating width of the liquid gasket should be 3 mm {0.1181 in.}.**



SHTS033200200089

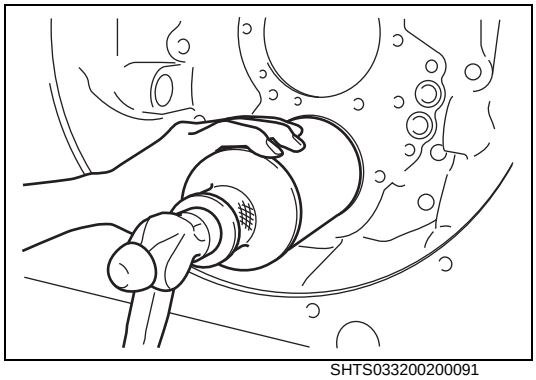
c. Install the idler cover to the transmission case with bolts.

NOTICE
Temporarily after tightening all bolts in equal, tighten them regularly.

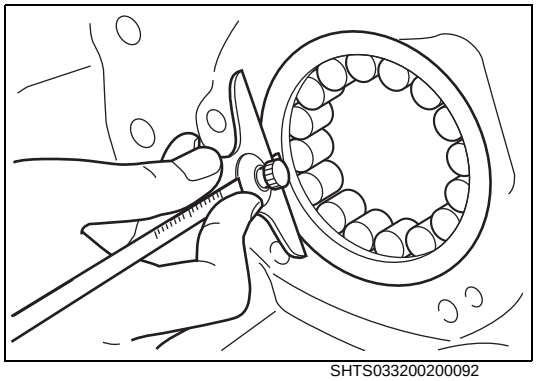

SHTS033200200090

7. INSTALL THE FRONT BEARING OUTER RACE OF THE COUNTER SHAFT SIDE.

(1) Apply gear oil to the front bearing outer race.

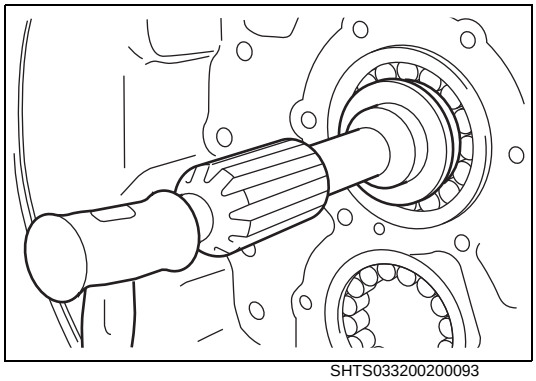

SHTS033200200091

(2) Using a receiving block and a hammer, drive the front bearing outer race into the clutch housing.


SHTS033200200092

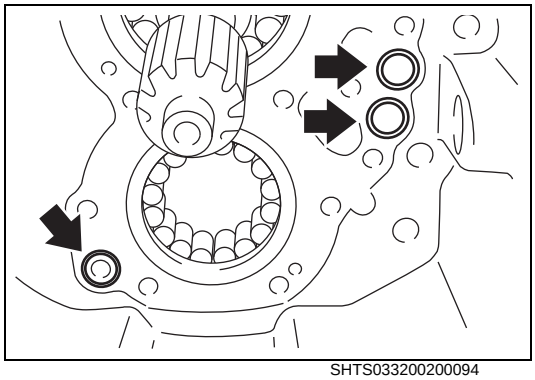
(3) Using a depth gauge, measure the dimension from the clutch housing front end surface to the front bearing outer race. If the dimension exceeds the standard value, adjust it to the standard value within the range.

Assembly Standard: 1.5-1.7 mm {0.0591-0.0669 in.}


SHTS033200200093

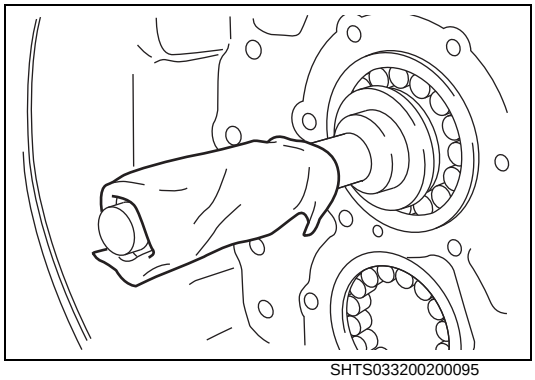
8. INSTALL THE INPUT SHAFT ASSEMBLY.

(1) Using a copper hammer, drive the input shaft assembly into the clutch housing.

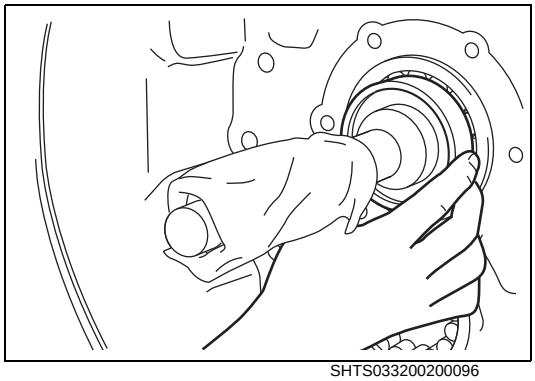

SHTS033200200094

9. INSTALL THE FRONT BEARING RETAINER ASSEMBLY.

(1) Apply gear oil to a new O-ring (3 pieces) and install the O-rings to the clutch housing.

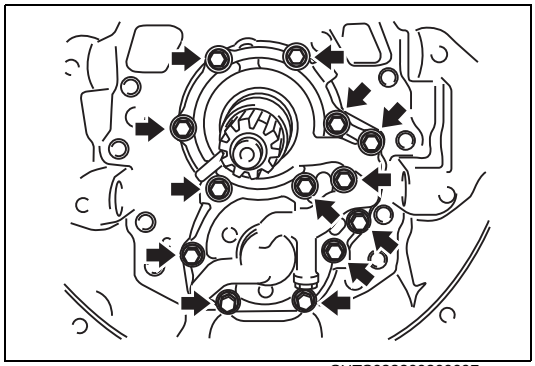

SHTS033200200095

(2) After applying gear oil to the input shaft, cover the input shaft spline part with cloth etc. to prevent oil seal of the front bearing retainer from damaging.


SHTS033200200096

(3) Using the special tool, make the seal ring of the oil muffler get to fit to the groove part.
SST: Seal ring guide (S0969-91370)

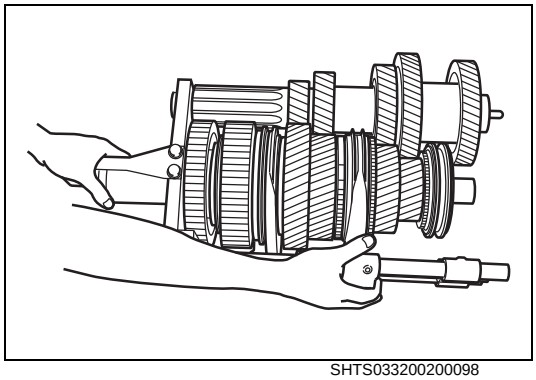
NOTICE
Make sure that the seal ring of the input shaft assembly does not protrude from the oil muffler.


SHTS033200200097

(4) Install the front bearing retainer assembly to the clutch housing with bolts through a new gasket.

NOTICE

- **Be sure that there is no curled-up of oil seal lip or no pinching of seal ring when mounting the front bearing retainer.**
- **Temporarily after tightening all bolts in equal, tighten them regularly.**
- **Be care not to damage the gasket.**


SHTS033200200098

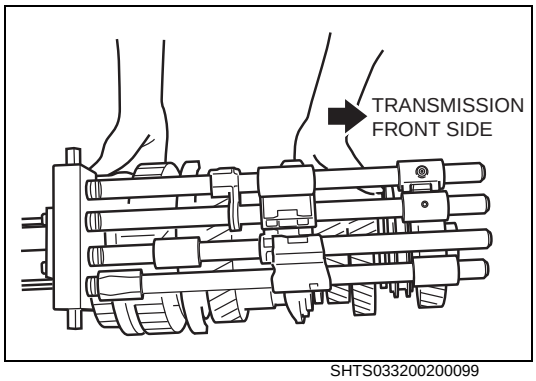
10. INSTALL THE OUTPUT SHAFT ASSEMBLY, COUNTER SHAFT ASSEMBLY AND SHIFT SHAFT ASSEMBLY.

(1) Apply gear oil to the sliding surface of the shift shaft.

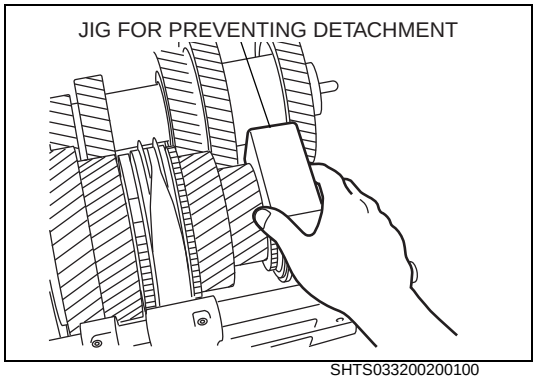
(2) Using the special tool, fix the output shaft assembly, counter shaft assembly and shift shaft assembly.
SST: Shaft hanger (S0963-02220)

HINT

- **After assembling the shift shaft assembly to the output shaft assembly and fixing them with special tool, assemble the counter shaft assembly for better workability.**
- **Place the shift shaft assembly as shown in the figure.**



SHTS033200200099

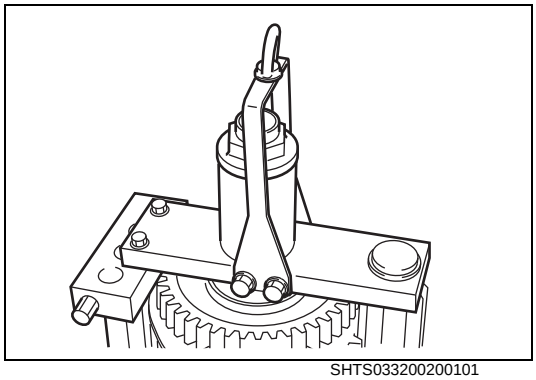


SHTS033200200100

(3) Install the jig for preventing detachment into the 5th-6th synchronizer unit to prevent the 5th-6th synchronizer cone and ring from detaching.

HINT

In case of not using the jig for preventing detachment, support parts for the prevention of detachment by one of the worker.

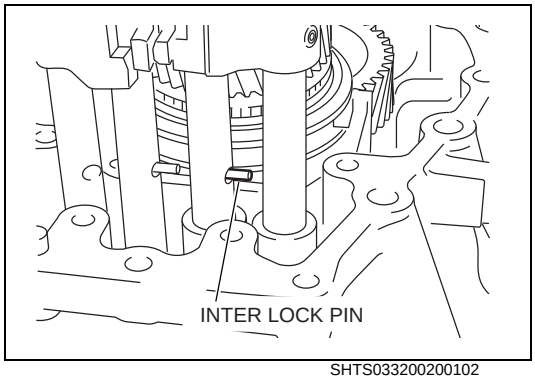

SHTS033200200101

(4) Using a hoist, lift up the output shaft assembly, counter shaft assembly and shift shaft assembly together and install them to the clutch housing.

NOTICE

- **Be sure to insert the shaft protruded from the input shaft into the hole of the output shaft point part.**
- **Be sure to insert the oil pump drive pin of counter shaft point part into the hole of the oil pump.**
- **Be careful not to damage the gear and bearing etc. when installing them.**

(5) Make sure that the gears of the output shaft and counter shaft rotate smoothly by rotating the input shaft.

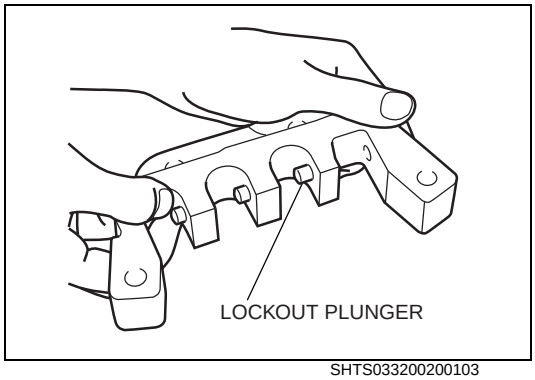


SHTS033200200102

11. INSTALL THE STOPPER, LOCKOUT PLUNGER AND INTER LOCK PIN.

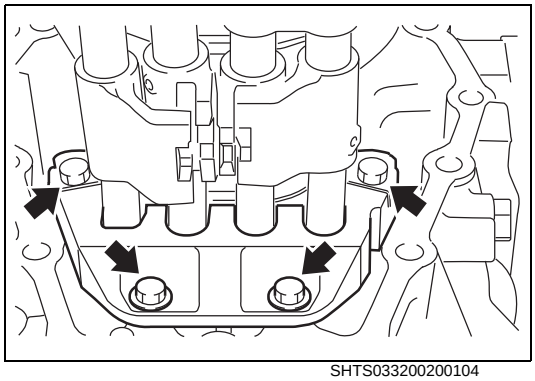
(1) Apply chassis grease to the lockout plunger and inter lock pin.

(2) Install the inter lock pin to the shift shaft.



SHTS033200200103

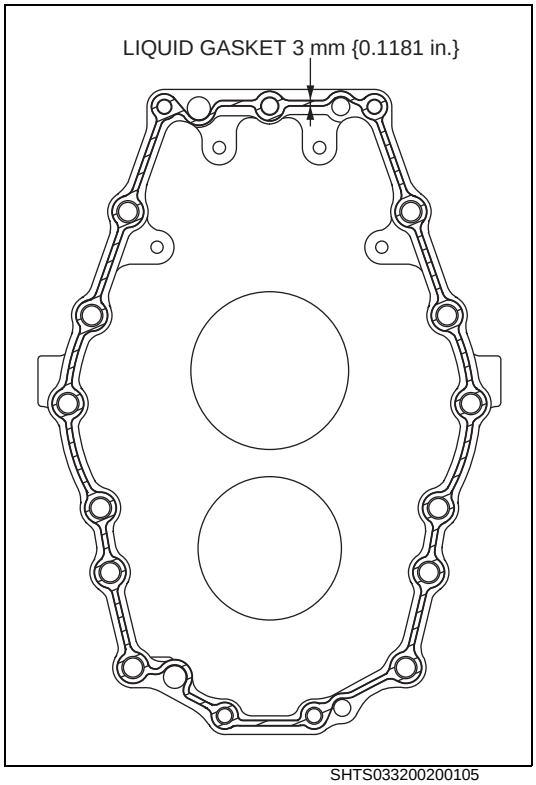
(3) Install the lockout plunger to the stopper.


SHTS033200200104

(4) Install the stopper with bolts.

NOTICE

- **Be careful that lockout plunger does not fall out.**
- **Reamer bolt should be used as the inner 2 bolts of the control lever stopper fitting bolts.**



SHTS033200200105

12. INSTALL THE OIL PIPE.

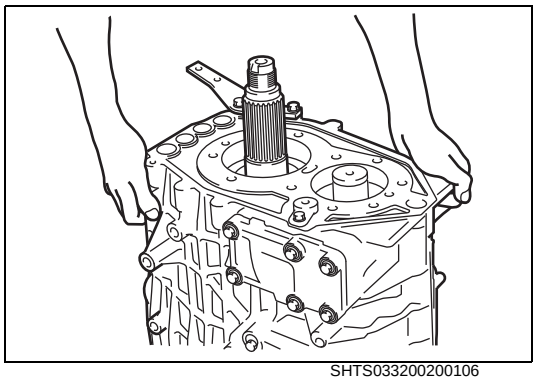
13. INSTALL THE TRANSMISSION CASE ASSEMBLY.

(1) Remove oil, dust etc. on the contact surface of the clutch housing and transmission case.

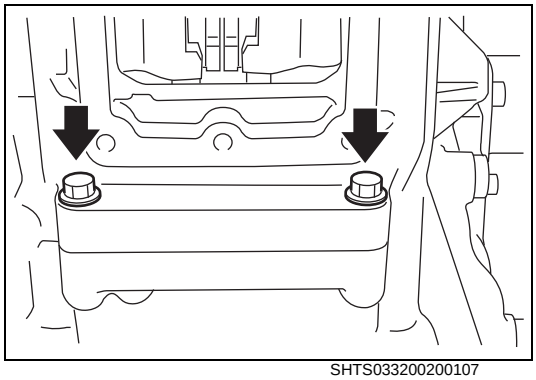
(2) Apply liquid gasket (ThreeBond #1216 or equivalent) to the clutch housing as shown in the figure.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **Coating width of the liquid gasket should be 3 mm {0.1181 in.}.**


SHTS033200200106

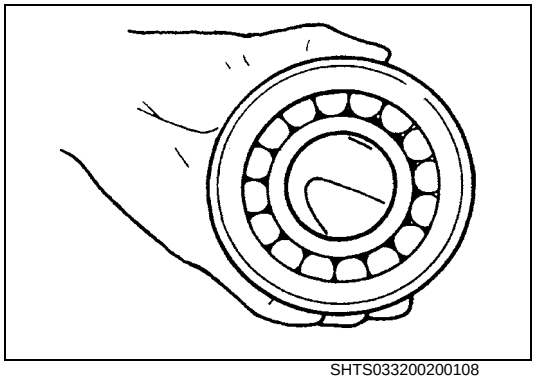
(3) Install the transmission case assembly from right above.


SHTS033200200107

(4) Fix the transmission case assembly with 4 bolts.

NOTICE

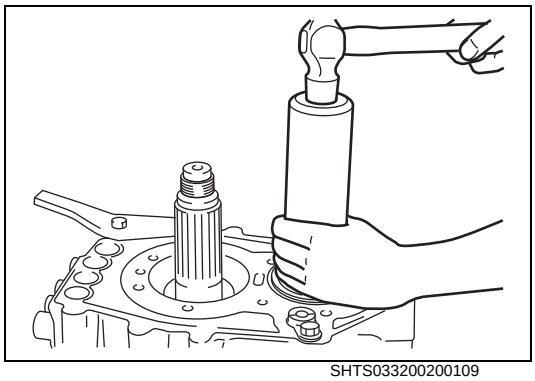
Temporarily after tightening all bolts in equal, tighten them regularly.


SHTS033200200108

(5) Apply gear oil to the rear bearings of the output shaft and counter shaft.

(6) Using a snap ring expander, install the retainer ring to the rear bearing of the output shaft side and counter shaft side.

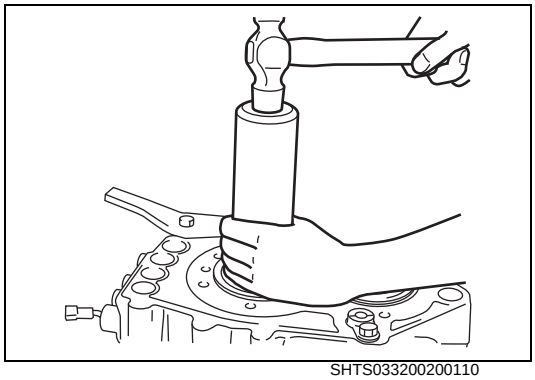
⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200109

(7) Install the spacer to the counter shaft.

NOTICE
The spacer should be installed with its chamfered side facing downward.

(8) Using a receiving block and a hammer, drive the rear bearing of counter shaft side into the transmission case.

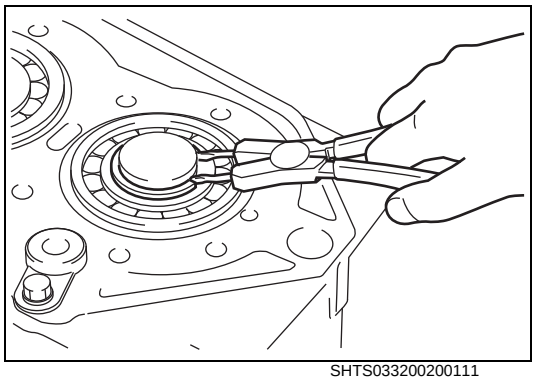

SHTS033200200110

(9) Install the spacer to the output shaft.

NOTICE
The spacer should be installed with its flange side facing downward.

(10) Using a receiving block and a hammer, drive the rear bearing of output shaft side into the transmission case.

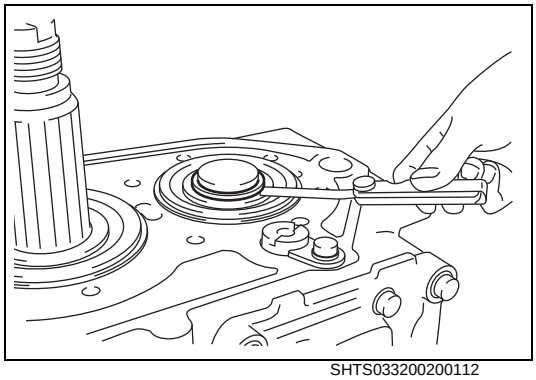
(11) Make sure that the gears of the output shaft and counter shaft rotate smoothly by rotating the input shaft.


SHTS033200200111

(12) Using a snap ring expander, install a new retainer ring to the counter shaft.

NOTICE

- **The retainer ring may fly out of the groove. So wear safety glasses while working.**
- **Make sure that the retainer ring fits in the groove surely.**

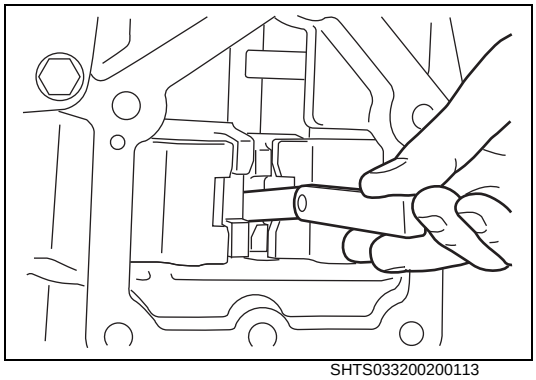

SHTS033200200112

(13) Using a thickness gauge, measure the clearance (play in axial direction) between the rear bearing and the retainer ring. If the clearance exceeds standard value, select a suitable retainer ring and install it again.

Assembly Standard: 0.1 mm {0.0039 in.} or less

A kind of retainer ring

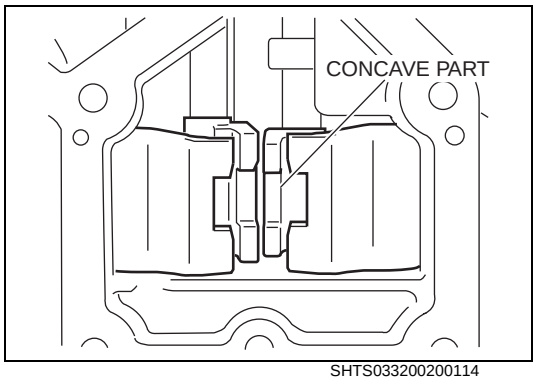
Thickness	Color code
2.4 mm {0.0945 in.}	None
2.5 mm {0.0984 in.}	White
2.6 mm {0.1024 in.}	Green
2.7 mm {0.1063 in.}	Brown


SHTS033200200113

14. INSPECT THE SHIFT HEAD.

(1) Using a thickness gauge, measure the clearance between each shift head, and make sure it does not exceed the standard value.

Assembly Standard: 1.1-3.1 mm {0.0434-0.1220 in.}



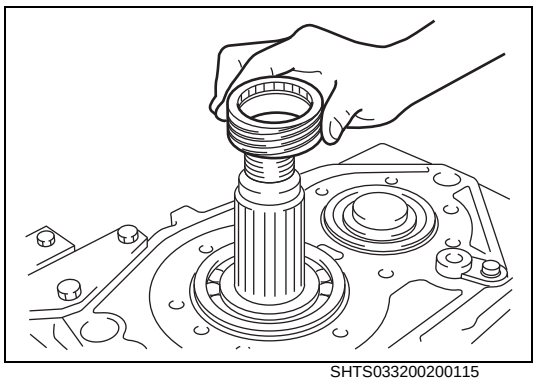
SHTS033200200114

(2) Make sure that a inspection jig inserts in the concave part of the shift head smoothly.

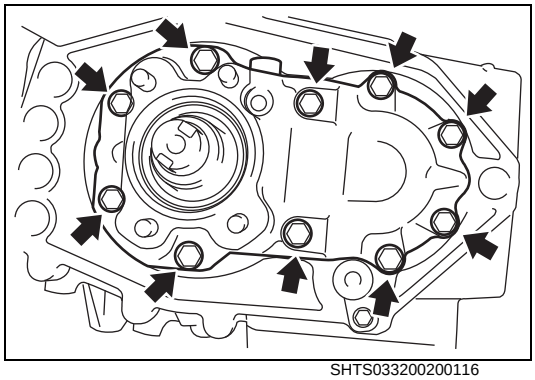
(3) Make sure that two shift shafts (shift heads) do not move at a time.

NOTICE

If two shift shafts (shift heads) move at a time, it fails to install the lockout plunger.


SHTS033200200115

15. INSTALL THE SPEEDOMETER DRIVE GEAR.



SHTS033200200116

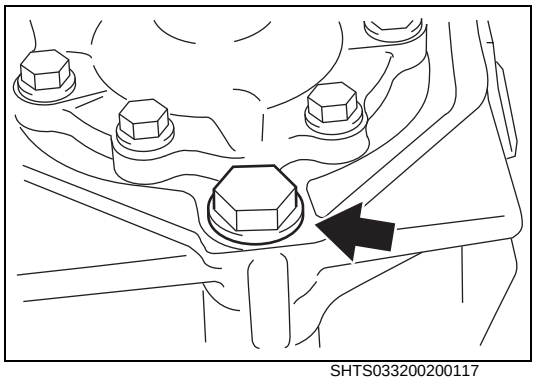
16. INSTALL THE REAR BEARING RETAINER.

(1) Install the rear bearing retainer assembly to the transmission case with bolts through a new gasket.

NOTICE

- **Temporarily after tightening all bolts in equal, tighten them regularly.**
- **Be care not to damage the gasket.**

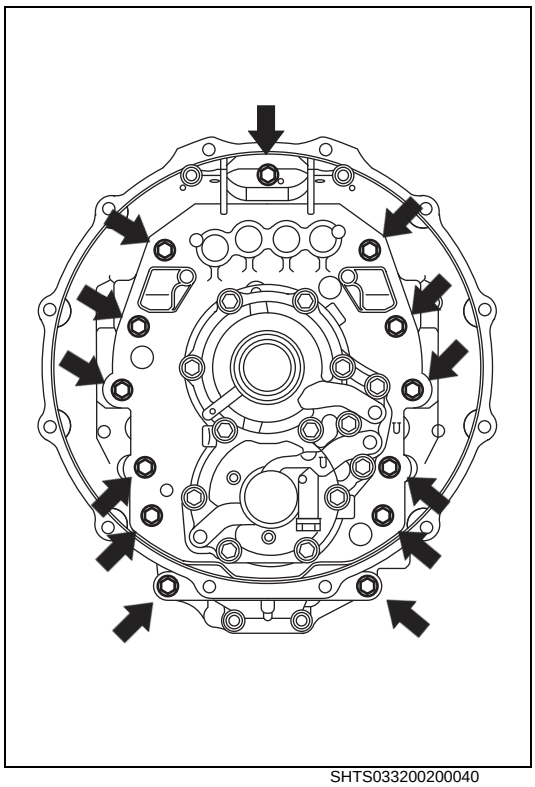
17. INSTALL THE LOCK BALL.



SHTS033200200117

18. INSTALL THE OIL STRAINER.

19. INSTALL THE PARKING BRAKE AND FLANGE COUPLING.



SHTS033200200040

20. REMOVE THE TRANSMISSION WORKSTAND.

(1) Install the transmission case cover fitting bolts.

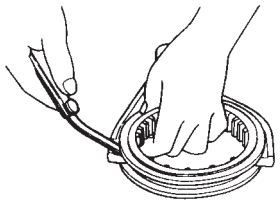
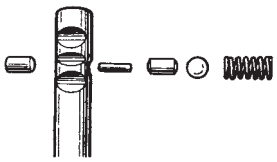
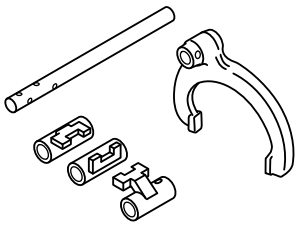
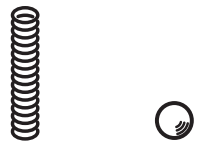
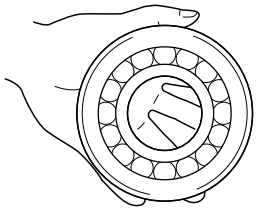
NOTICE

Temporarily after tightening all bolts in equal, tighten them regularly.

INSPECTION AND REPAIR

EN0332002H300001

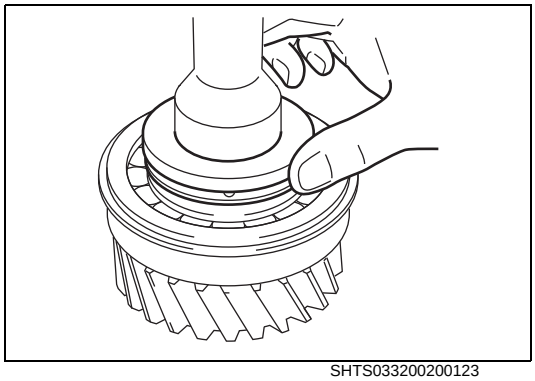
Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Clearance between shift fork and sleeve	**0.02-0.45 {0.0008-0.0177}**	**1.5 {0.0591}**	**Replace.**	**Measure** 
Interlock pin, interlock plunger, compression spring and steel ball: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift head, shift fork and shift shaft: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Inner rotor and outer rotor in oil pump: Wear and damage	**—**	**—**	**Replace the parts as a set, if necessary.**	**Visual check**
Front bearing retainer: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**
Ball and spring in relief valve: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing: Wear, damage and rotation condition	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Reverse idler gear and reverse idler shaft: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**
Needle roller bearing: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**

INPUT SHAFT ASSEMBLY

OVERHAUL

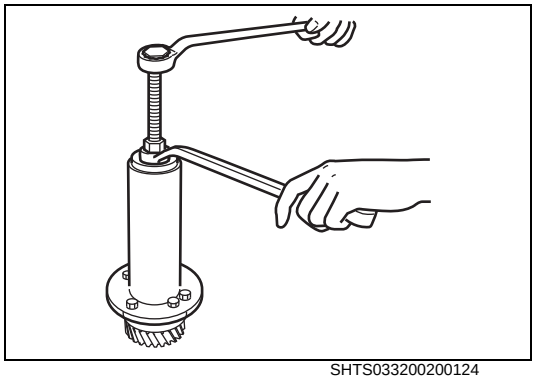
EN0332002H200003


SHTS033200200123

IMPORTANT POINTS - DISASSEMBLY

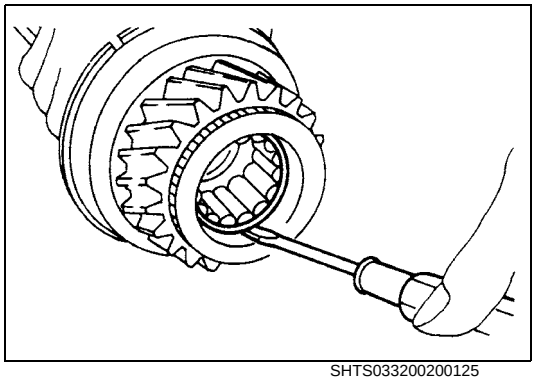
1. REMOVE THE OIL MUFFLER.

(1) Remove the seal ring from the oil muffler.


SHTS033200200124

(2) Install the special tool to the groove of the oil muffler outer periphery.
SST:
Puller (S0965-01881)
Hook (S0965-31710)

(3) Pull out the oil muffler by tightening the bolt of the special tool puller part.

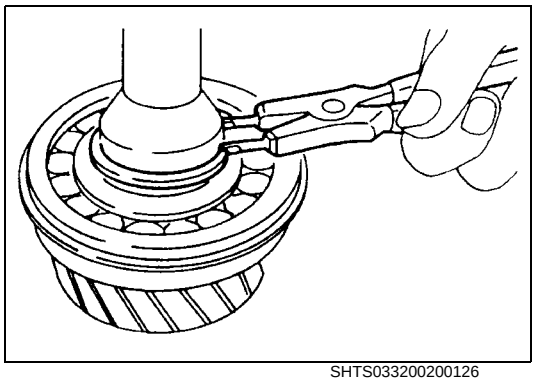

SHTS033200200125

2. REMOVE THE PILOT ROLLER BEARING.

(1) Using a flat blade screwdriver, remove the retainer ring on the input shaft groove.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.

(2) Remove the spacer and pilot roller bearing.


SHTS033200200126

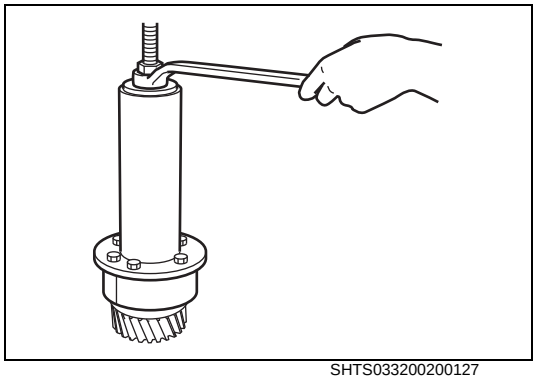
3. REMOVE THE FRONT BEARING.

(1) Using a snap ring expander, remove the retainer ring from the input shaft.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.

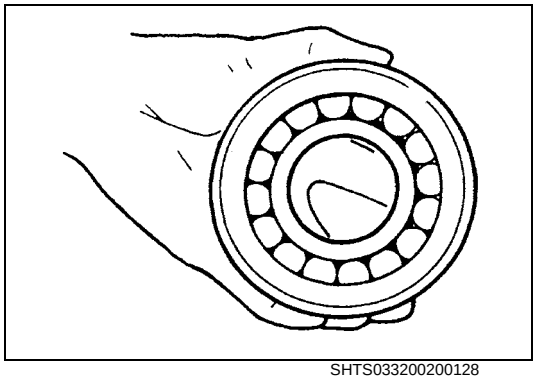
(2) Using a snap ring expander, remove the retainer ring from the front bearing.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200127

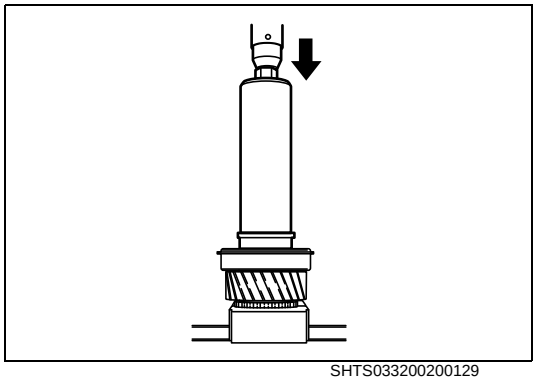
(3) Install the special tool to the groove of the front bearing outer periphery.
SST:
Hook (S0965-31720)
Puller (S0965-01881)

(4) Pull out the front bearing by tightening the bolt of the special tool puller part.


SHTS033200200128

IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE FRONT BEARING.
(1) Apply gear oil to the front bearing.


SHTS033200200129

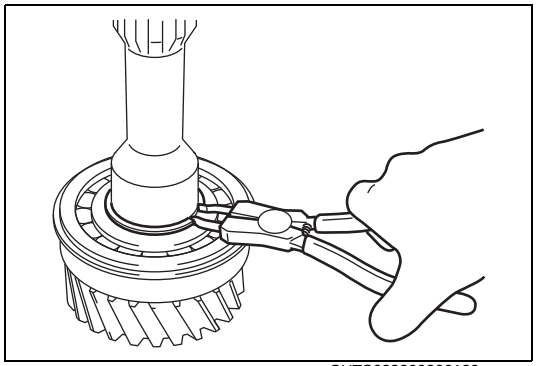
(2) Using a receiving block and a press, press the front bearing into the input shaft.

NOTICE
A receiving block should be attached to the bearing inner race.

(3) Using a snap ring expander, install the retainer ring to the front bearing.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.

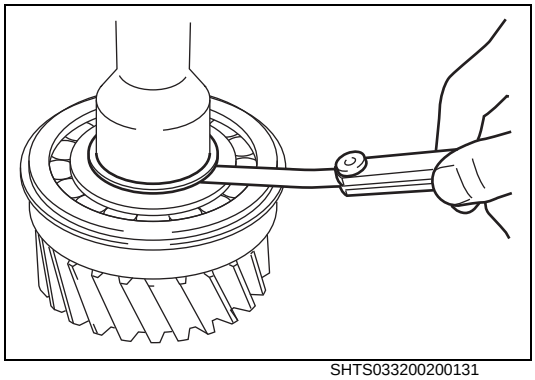
NOTICE
Make sure that the retainer ring fits in the groove surely.


SHTS033200200130

(4) Using a snap ring expander, install a new retainer ring to the input shaft.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.

NOTICE
Make sure that the retainer ring fits in the groove surely.

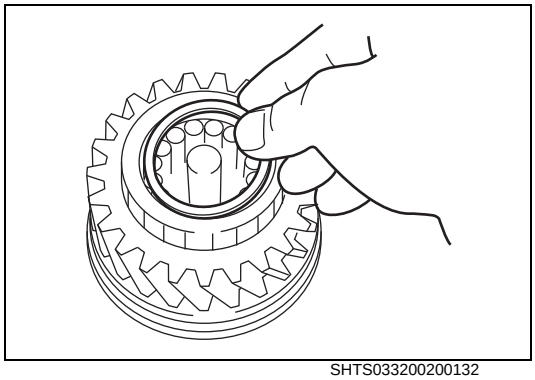

SHTS033200200131

(5) Using a thickness gauge, measure the clearance (play in axial direction) between the front bearing and the retainer ring. If the clearance exceeds standard value, select a suitable retainer ring and install it again.

Assembly Standard: 0.1 mm {0.0039 in.} or less

A kind of retainer ring

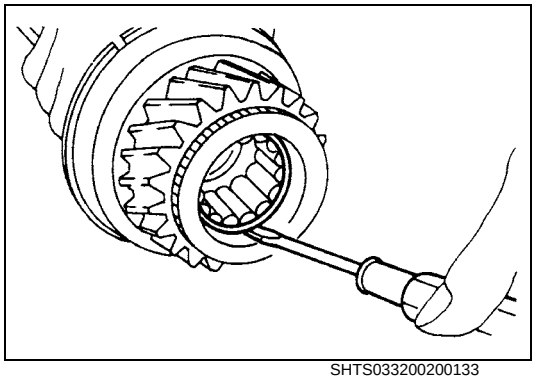
Thickness	Color code
2.4 mm {0.0945 in.}	None
2.5 mm {0.0984 in.}	White
2.6 mm {0.1024 in.}	Green
2.7 mm {0.1063 in.}	Brown


SHTS033200200132

2. INSTALL THE PILOT ROLLER BEARING.

(1) Apply gear oil to the input shaft inner surface and pilot roller bearing.

(2) Install the spacer, pilot roller bearing, spacer into the input shaft inner surface in order.


SHTS033200200133

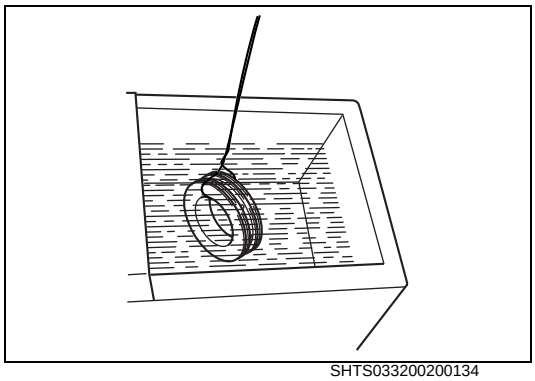
(3) Using a flat blade screwdriver, install a new retainer ring to the input shaft.

⚠ CAUTION

The retainer ring may fly out of the groove. Wear safety glasses while working.

NOTICE

Make sure that the retainer ring fits in the groove surely.


SHTS033200200134

3. INSTALL THE OIL MUFFLER.

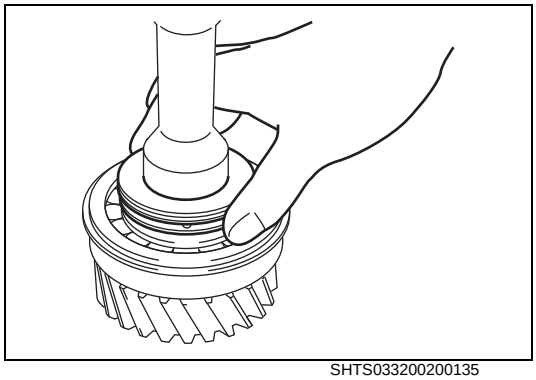
(1) Heat the oil muffler in hot water or oil to 90°C-120°C {194°F-248°F}.

⚠ CAUTION

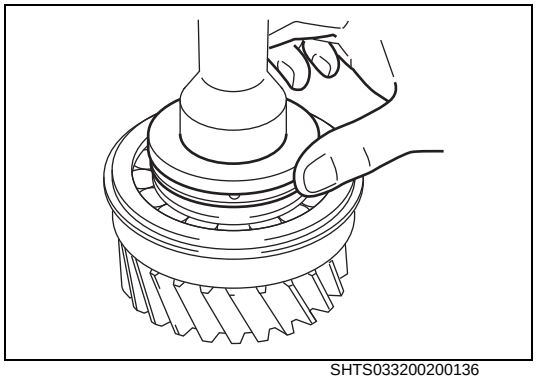
Hot water or oil and parts are high temperature, so never touch hot water or oil and parts with your bare hands.

NOTICE

- **In case of using oil, do not heat the oil muffler in excess of 120°C {248°F}.**
- **In case of using hot water, remove moisture before installation.**


SHTS033200200135

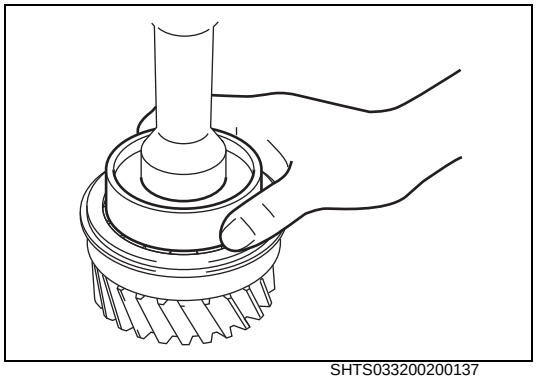
(2) Install the oil muffler to the input shaft.


SHTS033200200136

(3) Install a new seal ring to the oil muffler.

NOTICE

- **The oil muffler should be installed after its cooling down completely.**
- **Because the seal ring is easy to be deformed, extend it at minimum when mounting it.**
- **Make sure that the seal ring does not protrude from the oil muffler when installing seal ring.**

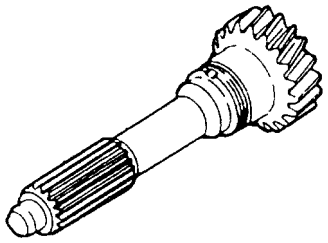
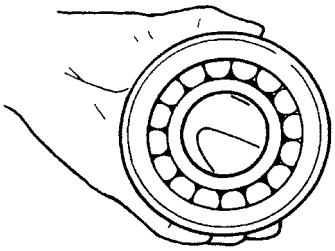

SHTS033200200137

(4) Using the special tool, make the seal ring of the oil muffler get to fit to the groove part.
SST: Seal ring guide (S0969-91370)

(5) Apply gear oil to the sliding surface of the oil muffler.

INSPECTION AND REPAIR

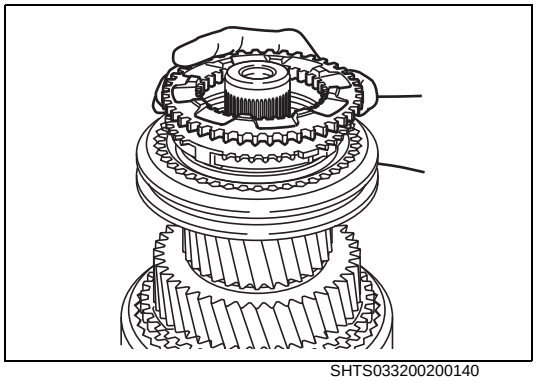
EN0332002H300002

Inspection item	Standard	Limit	Remedy	Inspection procedure
Input shaft: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing: Wear, damage and rotate condition	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Oil muffler (Seal ring groove): Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**

OUTPUT SHAFT ASSEMBLY

OVERHAUL

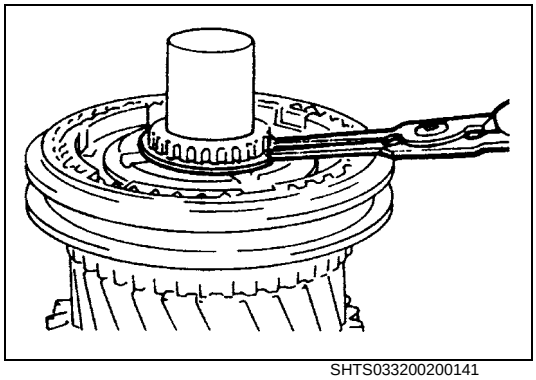
EN0332002H200004



SHTS033200200140

IMPORTANT POINTS - DISASSEMBLY

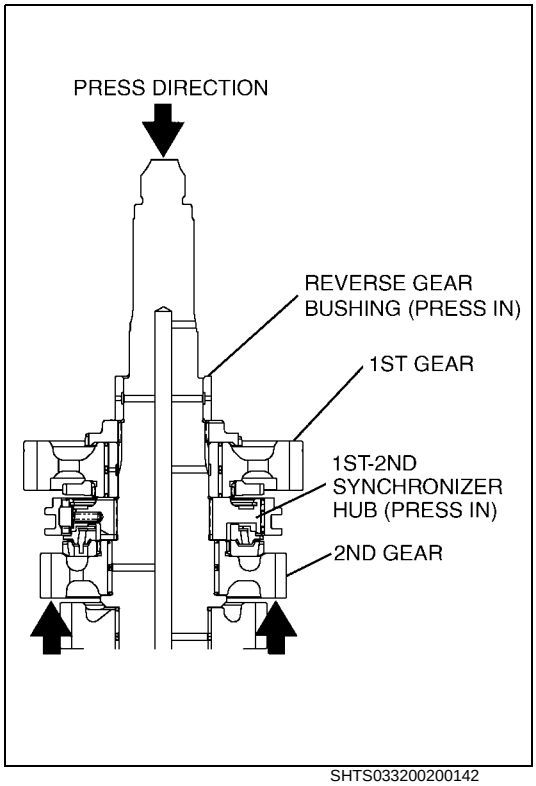
1. REMOVE THE 5TH-6TH SYNCHRONIZER UNIT.



SHTS033200200141

(1) Put the output shaft front end part upward and remove the retainer ring from the output shaft using a snap ring expander.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.



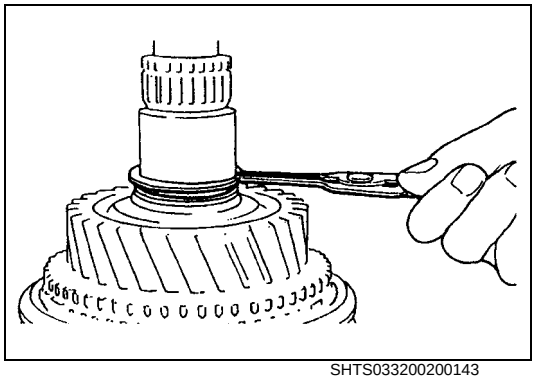
SHTS033200200142

2. REMOVE THE 1ST GEAR ASSEMBLY, 1ST-2ND SYNCHRONIZER UNIT AND 2ND GEAR ASSEMBLY.

(1) Use the front side of 2nd gear as the support for pressing. Press the rear end of the output shaft to pull out the gears.

NOTICE

- **When pressing the output shaft, put a wood block on the lower part of the shaft.**
- **Because the output shaft is heavy, support it securely.**



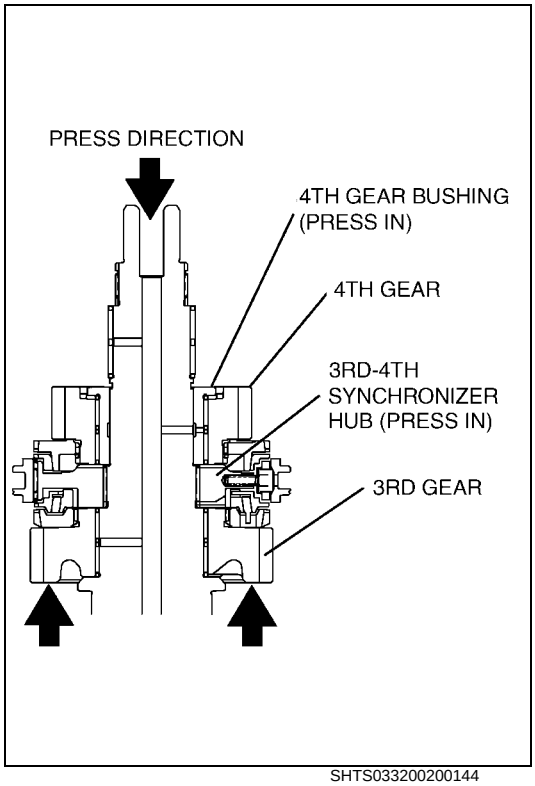
SHTS033200200143

3. REMOVE THE 4TH GEAR ASSEMBLY, 3RD-4TH SYNCHRONIZER UNIT AND 3RD GEAR ASSEMBLY.

(1) Using a snap ring expander, remove the retainer ring from the output shaft.

⚠ CAUTION

The retainer ring may fly out of the groove. Wear safety glasses while working.

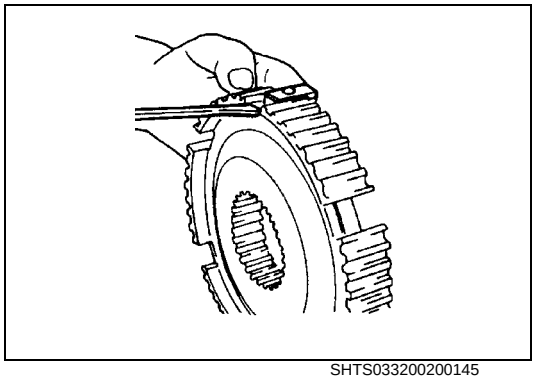


SHTS033200200144

(2) Use the front side of 2nd gear as the support for pressing. Press the rear end of the output shaft to pull out the gears.

NOTICE

- **When pressing the output shaft, put a wood block on the lower part of the shaft.**
- **Because the output shaft is heavy, support it securely.**



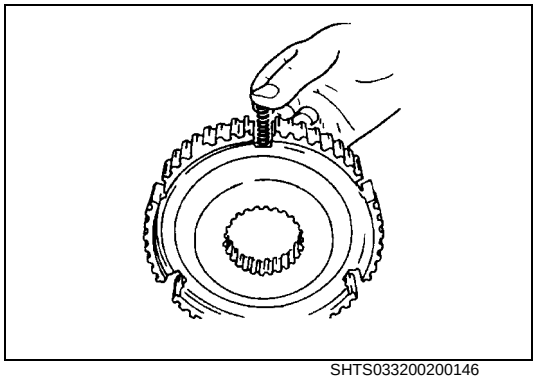
SHTS033200200145

4. DISASSEMBLE THE SYNCHRONIZER UNIT. (1ST-2ND, 3RD-4TH, 5TH-6TH; 3 pieces)

(1) Using a snap ring expander, remove the retainer ring from the output shaft.

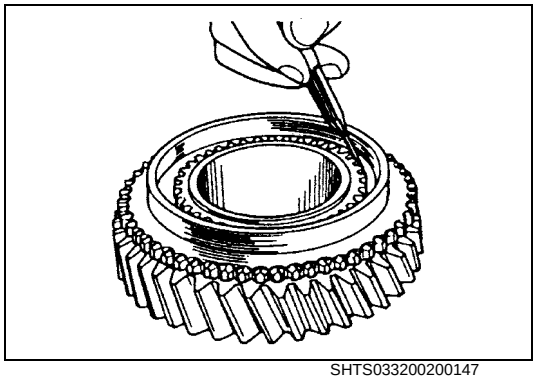
⚠ CAUTION

The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200146

(2) Remove the synchronizer key, synchronizer head and compression spring from the synchronizer hub.

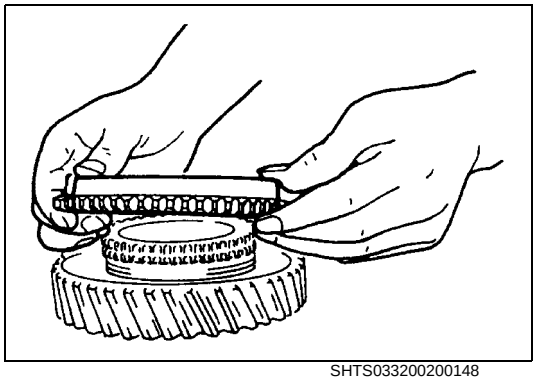
⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200147

5. DISASSEMBLE THE GEAR [4TH GEAR, 5TH (OR 6TH) GEAR; 2 pieces]

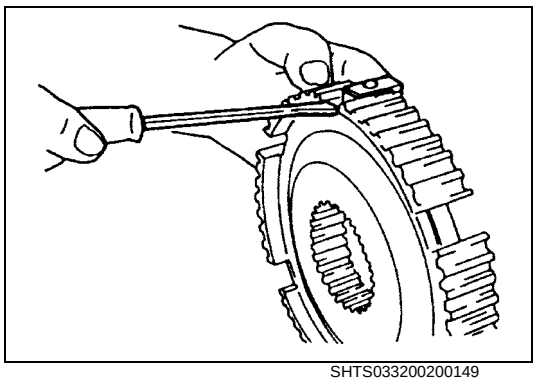
(1) Using a snap ring expander, remove 4th and 5th (or 6th) gear.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200148

(2) Remove the synchronizer cone from 4th and 5th (or 6th) gear.

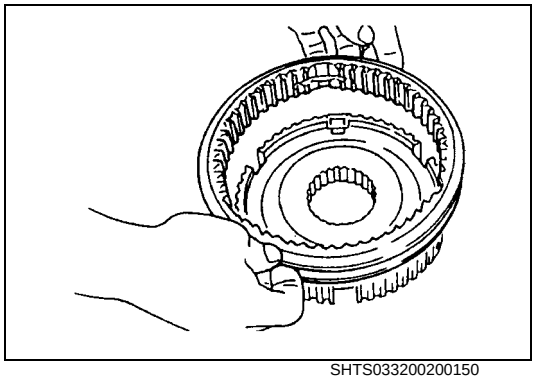
IMPORTANT POINTS - ASSEMBLY


SHTS033200200149

1. ASSEMBLE THE SYNCHRONIZER UNIT. (1ST-2ND, 3RD-4TH, 5TH-6TH; 3 pieces)

(1) Only for 1st and 2nd synchronizer unit, remove the retainer ring of 1st side.

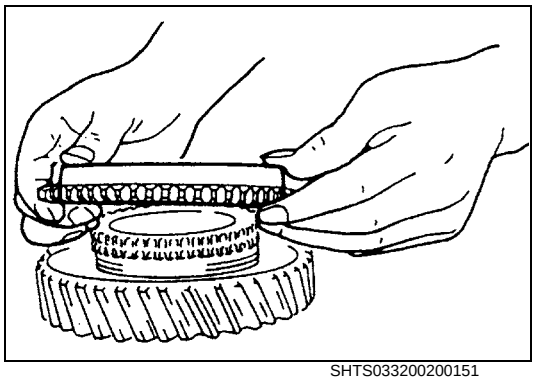
⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200150

(2) Install the synchronizer sleeve.

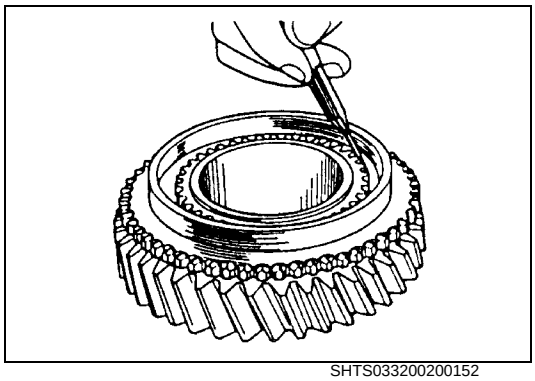
(3) Install the retainer ring to the 1st side of 1st-2nd synchronizer unit.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.


SHTS033200200151

2. ASSEMBLE THE GEAR ASSEMBLY. [4TH GEAR, 5TH (OR 6TH) GEAR; 2 pieces]

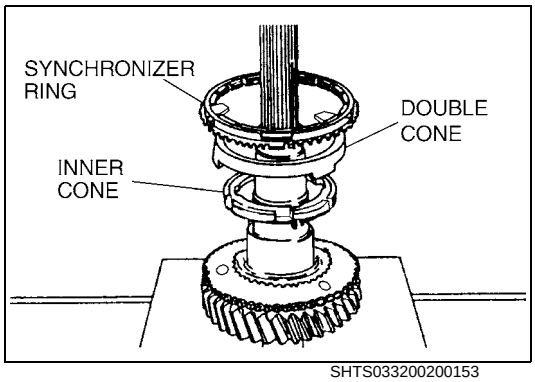
(1) Install the synchronizer cone to the 4th and 5th (or 6th) gear.


SHTS033200200152

(2) Using a snap ring expander, install a new retainer ring to the groove of the synchronizer installing surface of 4th and 5th (or 6th) gear.

⚠ CAUTION
The retainer ring may fly out of the groove. Wear safety glasses while working.

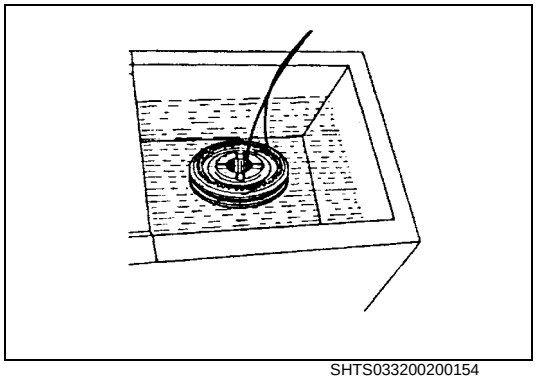
NOTICE
Make sure that the retainer ring fits in the groove surely.



SHTS033200200153

3. INSTALL THE 1ST-2ND SYNCHRONIZER UNIT.

(1) Install the inner cone, double cone, synchronizer ring to the output shaft in order.

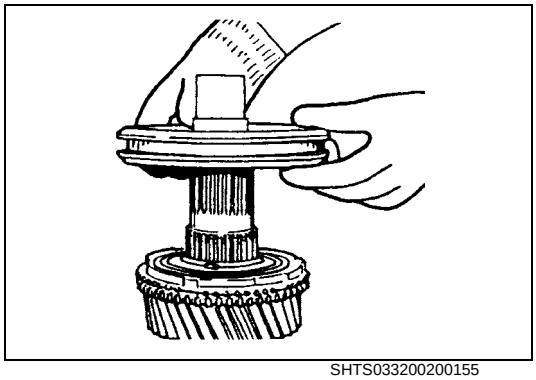

SHTS033200200154

(2) Using a heater, (piston heater etc.) heat the synchronizer unit in hot water or oil to 90°C-120°C {194°F-248°F}.

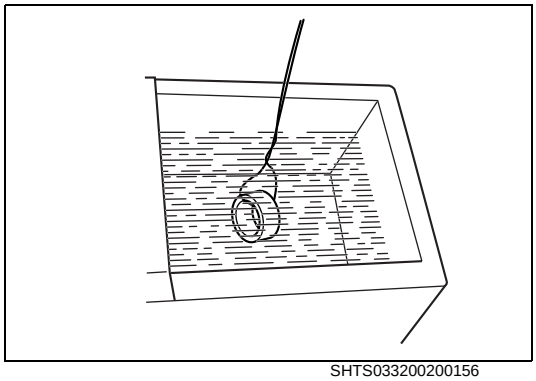
⚠ CAUTION
Hot water or oil and parts are high temperature, so never touch hot water or oil and parts with your bare hands.

NOTICE

- **In case of using oil, do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **In case of using hot water, remove moisture before installation.**


SHTS033200200155

(3) Install the synchronizer unit to the output shaft.


SHTS033200200156

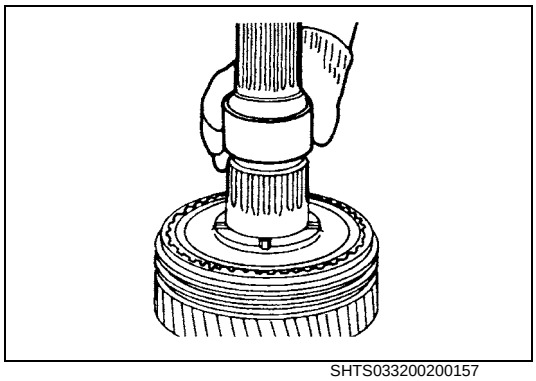
4. INSTALL THE 1ST GEAR ASSEMBLY.

(1) Install the synchronizer bushing of the 2nd gear to the output shaft.

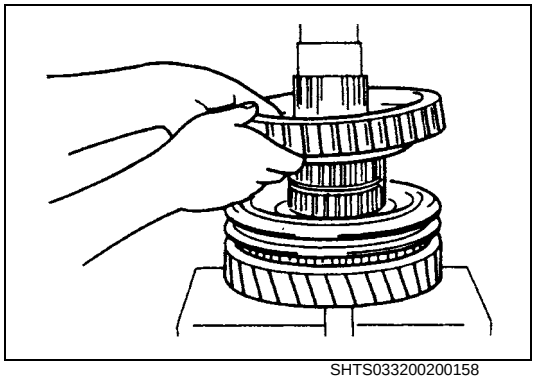
⚠ CAUTION
Hot water or oil and parts are high temperature, so never touch hot water or oil and parts with your bare hands.

NOTICE

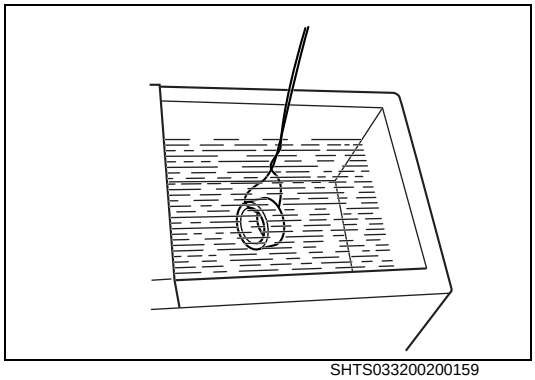
- **In case of using oil, do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **In case of using hot water, remove moisture before installation.**


SHTS033200200157

(2) Install the synchronizer bushing of the 1st gear to the output shaft.


SHTS033200200158

(3) Apply sulfide molybdenum grease to the both ends surface of the 1st gear boss part and install the 1st gear assembly.


SHTS033200200159

5. INSTALL THE REVERSE GEAR.

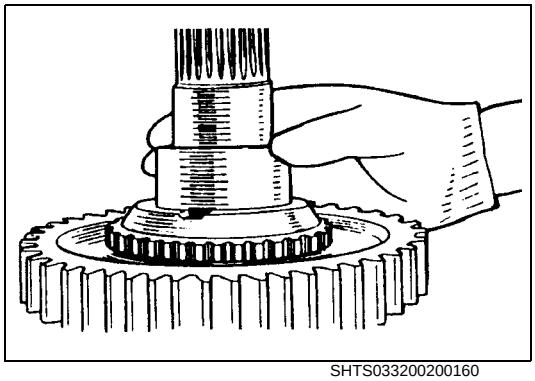
(1) Using a heater, (piston heater etc.) heat the bushing of reverse gear in hot water or oil to 90°C-120°C {194°F-248°F}.

⚠ CAUTION

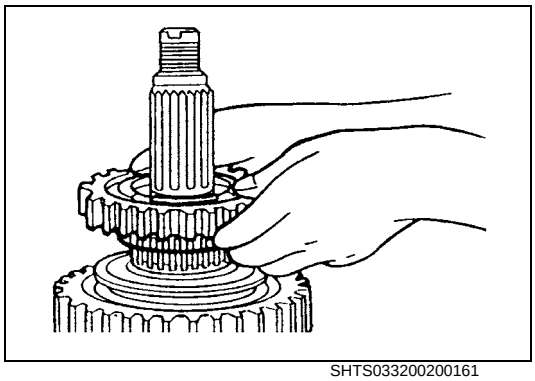
Hot water or oil and parts are high temperature, so never touch hot water or oil and parts with your bare hands.

NOTICE

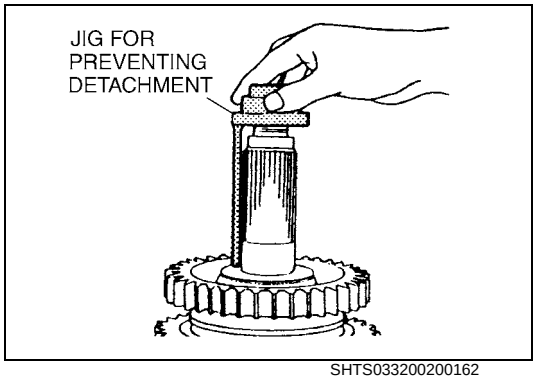
- **In case of using oil, do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **In case of using hot water, remove moisture before installation.**


SHTS033200200160

(2) Install the bushing of the reverse gear to the output shaft.


SHTS033200200161

(3) Apply sulfide molybdenum grease to the both ends surface of the reverse gear boss part and install the reverse gear.



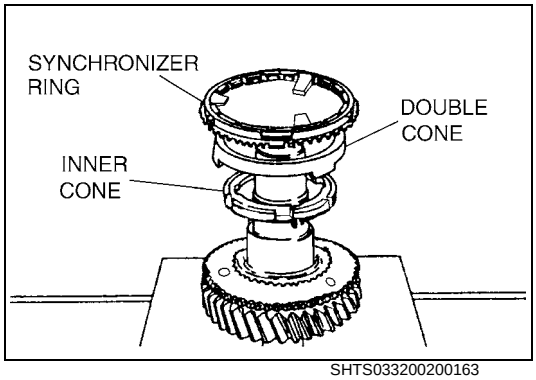
SHTS033200200162

6. INSTALL THE 3RD GEAR ASSEMBLY.

(1) Install the jig for preventing detachment to the output shaft.

NOTICE

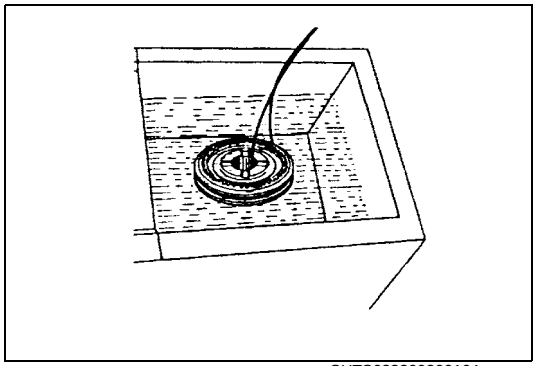
The jig should be used to prevent assembled gear and bearing from falling off.



SHTS033200200163

7. INSTALL THE 3RD-4TH SYNCHRONIZER UNIT.

(1) Install the inner cone, double cone and synchronizer ring to the output shaft in order.


SHTS033200200164

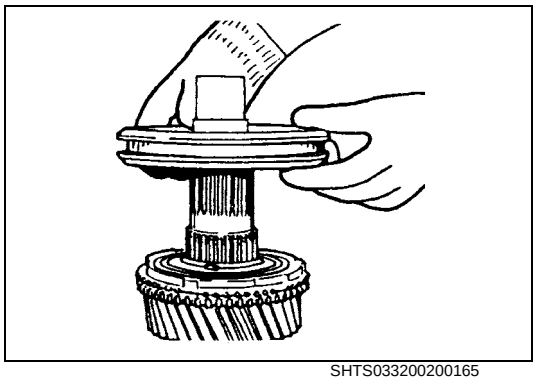
(2) Heat the synchronizer unit in hot water or oil to 90°C-120°C {194°F-248°F}.

⚠ CAUTION

Hot water or oil and parts are high temperature, so never touch hot water or oil and parts with your bare hands.

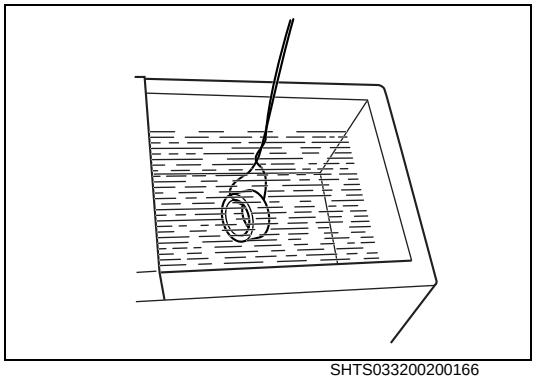
NOTICE

- **In case of using oil, do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **In case of using hot water, remove moisture before installation.**


SHTS033200200165

(3) Install the synchronizer unit to the output shaft.

(4) Install the synchronizer ring.


SHTS033200200166

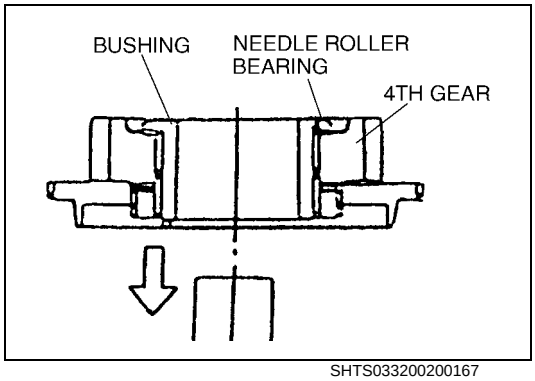
8. INSTALL THE 4TH GEAR ASSEMBLY.

(1) Heat the bushing of 4th gear in hot water or oil to 90°C-120°C {194°F-248°F}.

⚠ CAUTION
Hot water or oil and parts are high temperature, so never touch hot water or oil and parts with your bare hands.

NOTICE

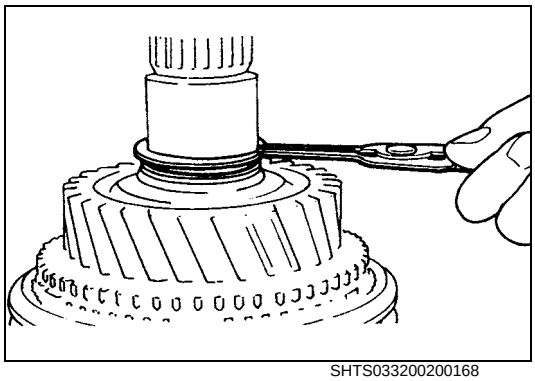
- **In case of using oil, do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **In case of using hot water, remove moisture before installation.**



SHTS033200200167

(2) Apply gear oil to the needle roller bearing of the 4th gear and insert it into the 4th gear inner side.

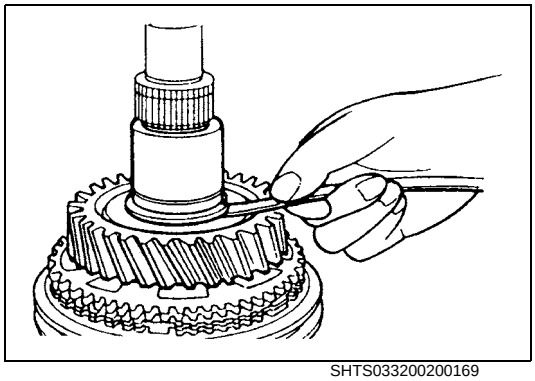
(3) Install the 4th gear assembly and bushing to the output shaft.


SHTS033200200168

(4) Using a snap ring expander, install a new retainer ring to the output shaft.

⚠ CAUTION
The retainer ring may fly out of the groove. So wear safety glasses while working.

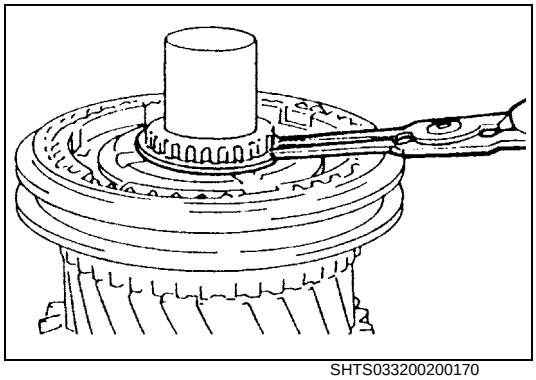
NOTICE
Make sure that the retainer ring fits in the groove surely.


SHTS033200200169

(5) Using a thickness gauge, measure the clearance (play in axial direction) between the gear bushing and the retainer ring. If the clearance exceeds standard value, select a suitable retainer ring and install it again.
Assembly Standard: 0.1 mm {0.0039 in.} or less

A kind of retainer ring

Thickness	Color code
2.35 mm {0.0925 in.}	None
2.45 mm {0.0965 in.}	White
2.55 mm {0.1004 in.}	Green
2.65 mm {0.1043 in.}	Brown


SHTS033200200170

9. INSTALL THE 5TH-6TH SYNCHRONIZER UNIT.

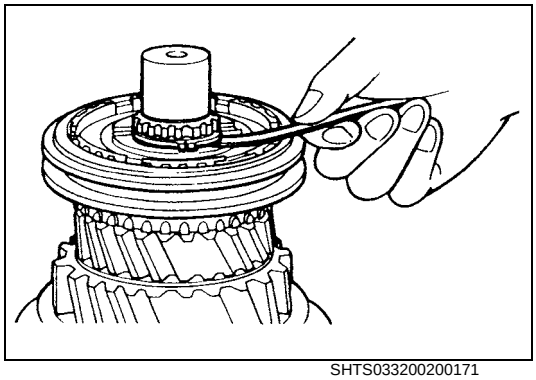
(1) Using a snap ring expander, install a new retainer ring to the output shaft.

⚠ CAUTION

The retainer ring may fly out of the groove. So wear safety glasses while working.

NOTICE

Make sure that the retainer ring fits in the groove surely.


SHTS033200200171

(2) Using a thickness gauge, measure the clearance (play in axial direction) between the synchronizer hub and the retainer ring. If the clearance exceeds standard value, select a suitable retainer ring and install it again.

Assembly Standard: 0.1 mm {0.0039 in.} or less

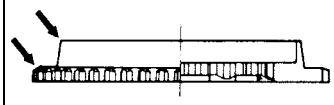
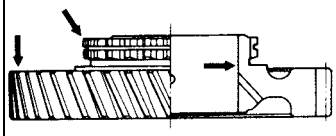
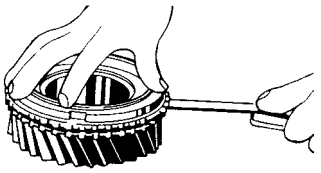
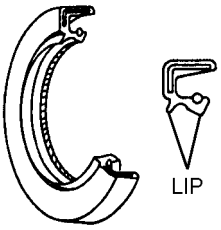
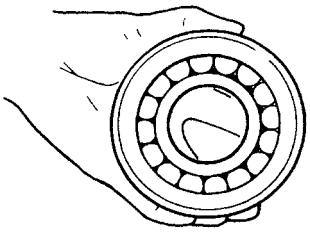
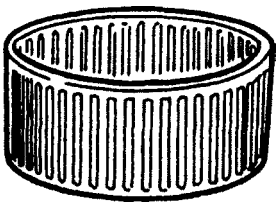
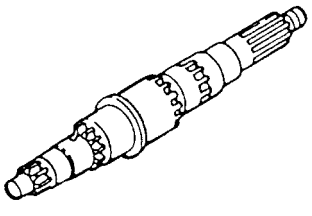
A kind of retainer ring

Thickness	Color code
1.9 mm {0.0784 in.}	None
2.0 mm {0.0787 in.}	White

INSPECTION AND REPAIR

EN0332002H300003

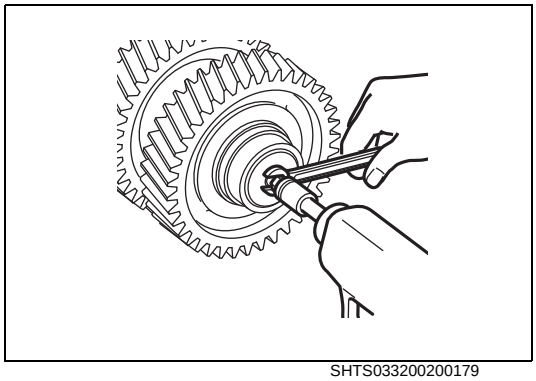
Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Synchronizer ring: Deformity, crack and excessive damage	—	—	Replace, if necessary.	Visual check 
Gear excessive: Wear, chips and cracks	—	—	Replace, if necessary.	Visual check 
Clearance between synchronizer ring and synchronizer cone and gear sub-assembly	2nd, 3rd and 4th gear 1.0-1.8 {0.0394-0.0708} 5th and input gear 1.2-2.0 {0.0473-0.0787}	0.2 {0.0079}	Replace the synchronizer ring and/or gear sub-assembly.	Measure 
Oil seal lip: Wear and damage	—	—	Replace, if necessary.	Visual check 
Cylindrical bearing, and ball bearing: Improper rotation	—	—	Replace, if necessary.	Visual check 
Needle roller bearing in deformed shape	—	—	Replace, if necessary.	Visual check 
Output shaft: Wear and damage	—	—	Replace, if necessary.	Visual check 

COUNTER SHAFT ASSEMBLY

OVERHAUL

EN0332002H200005

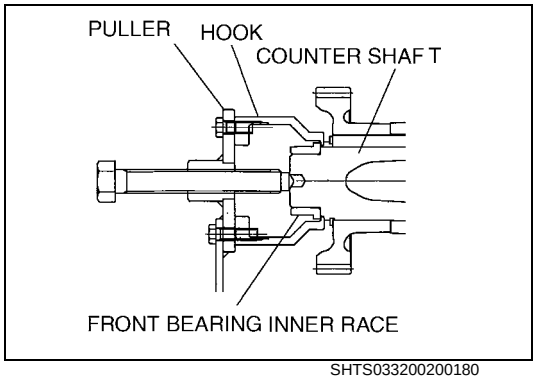


SHTS033200200179

IMPORTANT POINTS - DISASSEMBLY

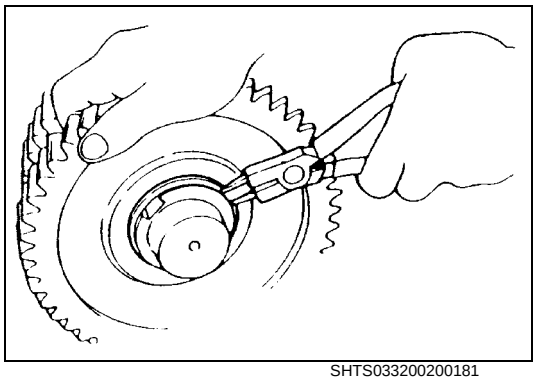
1. REMOVE THE FRONT BEARING INNER RACE.

(1) While holding the tapered portion of the oil pump drive pin by wrench, rotate (or vibrate) the oil pump drive pin by using impact wrench, and then pull it out.



SHTS033200200180

(2) Using the special tool, pull out the front bearing inner race from the counter shaft.
SST:
Hook (S0965-31740)
Puller (S0965-02080)

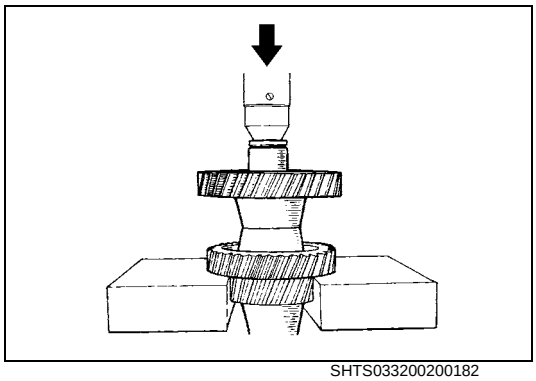


SHTS033200200181

2. DISASSEMBLE THE COUNTER SHAFT ASSEMBLY.

(1) Using a snap ring expander, remove the retainer ring from the counter shaft.

⚠ CAUTION
The retainer ring may fly out of the groove. So wear safety glasses while working.

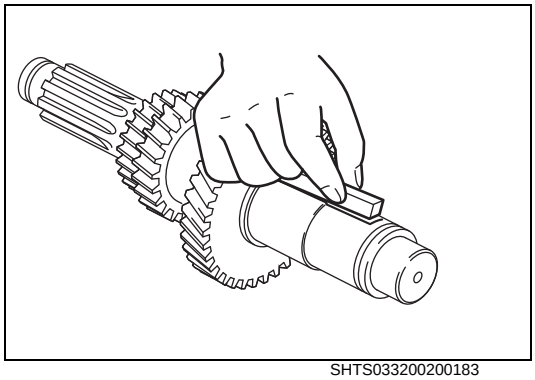


SHTS033200200182

(2) Use the counter shaft 5th gear as the support for pressing. Press the counter shaft to pull out the counter drive gear and counter 5th gear.

NOTICE

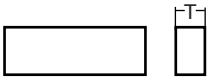
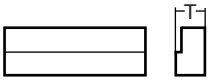
- **When pressing the output shaft, put a wood block on the lower part of the shaft.**
- **Because the output shaft is heavy, support it securely.**

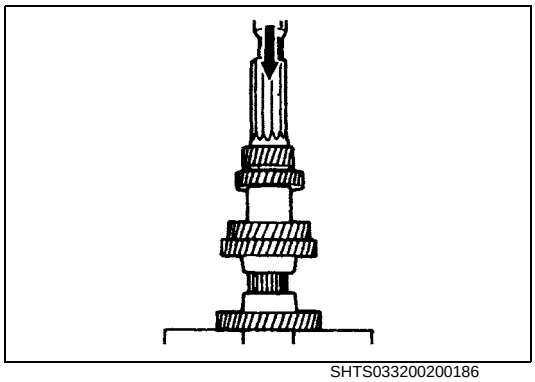

SHTS033200200183

IMPORTANT POINT - ASSEMBLY

1. ASSEMBLE THE COUNTER SHAFT ASSEMBLY.

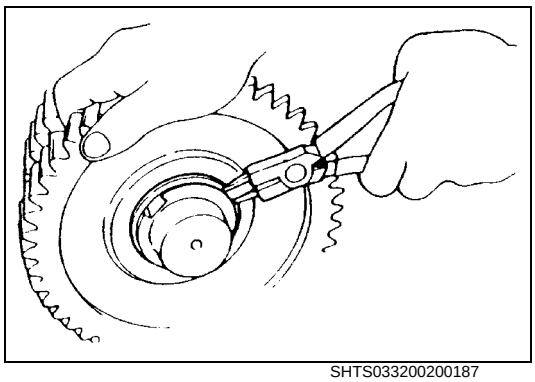
(1) Select the proper size key according to the size of the key groove and install it.

Thickness (T)	Shape
14.018-14.029 mm {0.5519-0.5523 in.}	
14.070-14.085 mm {0.5540-0.5545 in.}	


SHTS033200200186

(2) Press the counter shaft into the gears making certain that counter shaft key and idler gear key groove are aligned.

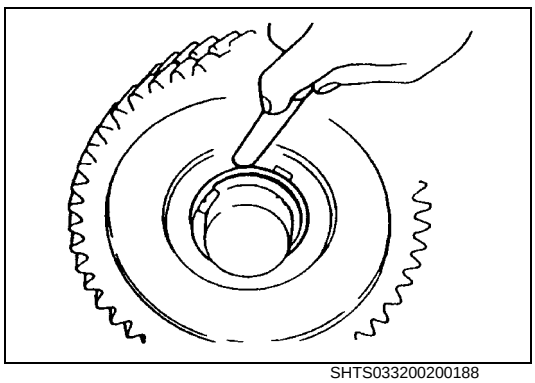
(3) Press the counter shaft into the gears making certain that counter shaft key and counter drive gear key groove are aligned.


SHTS033200200187

(4) Using a snap ring expander, install a new retainer ring to the counter shaft.

⚠ CAUTION
The retainer ring may fly out of the groove. So wear safety glasses while working.

NOTICE
Make sure that the retainer ring fits in the groove surely.

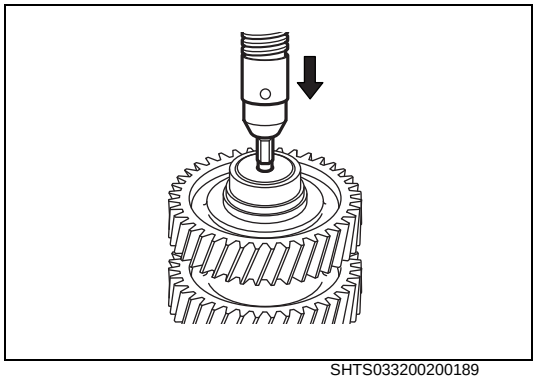

SHTS033200200188

(5) Using a thickness gauge, measure the clearance (play in axial direction) between the counter drive gear and the retainer ring. If the clearance exceeds standard value, select a suitable retainer ring and install it again.

Assembly Standard: 0.1 mm {0.0039 in.} or less

A kind of retainer ring

Thickness	Color code
2.45 mm {0.0965 in.}	**White**
2.55 mm {0.1004 in.}	**Red**
2.65 mm {0.1043 in.}	**Yellow**
2.75 mm {0.1083 in.}	**Blue**

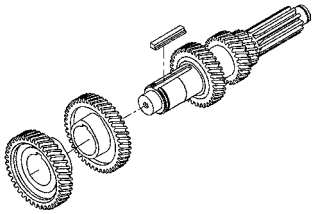
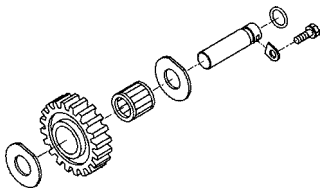
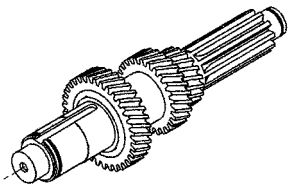
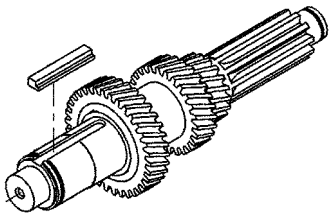


SHTS033200200189

(6) Press the oil pump drive pin into the counter shaft.

INSPECTION AND REPAIR

EN0332002H300004

Inspection item	Standard	Limit	Remedy	Inspection procedure
All gears: Cracks and defects	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Idle gear, shaft and needle roller bearing: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Counter shaft: Wear, chips and cracks	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Counter shaft key and key groove: Damage and looseness	**—**	**—**	**Replace the counter shaft and/or key, if necessary.**	**Visual check** 

TRANSMISSION MAIN UNIT (LJ06S)

TR02-002

TRANSMISSION ASSEMBLY TR02-2
DATA AND SPECIFICATIONS TR02-2
DESCRIPTION TR02-3
TROUBLESHOOTING TR02-4
SPECIAL TOOL TR02-6
DISMOUNTING AND MOUNTING TR02-7

GEAR SHIFT HOUSING TR02-9
COMPONENT LOCATOR TR02-9
OVERHAUL TR02-12
INSPECTION AND REPAIR TR02-17

INPUT SHAFT, OUTPUT SHAFT, GEARS AND RELATED PARTS TR02-18
COMPONENT LOCATOR TR02-18
OVERHAUL TR02-20
INSPECTION AND REPAIR TR02-30

COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS TR02-31
COMPONENT LOCATOR TR02-31
OVERHAUL TR02-32
INSPECTION AND REPAIR TR02-37

TRANSMISSION ASSEMBLY

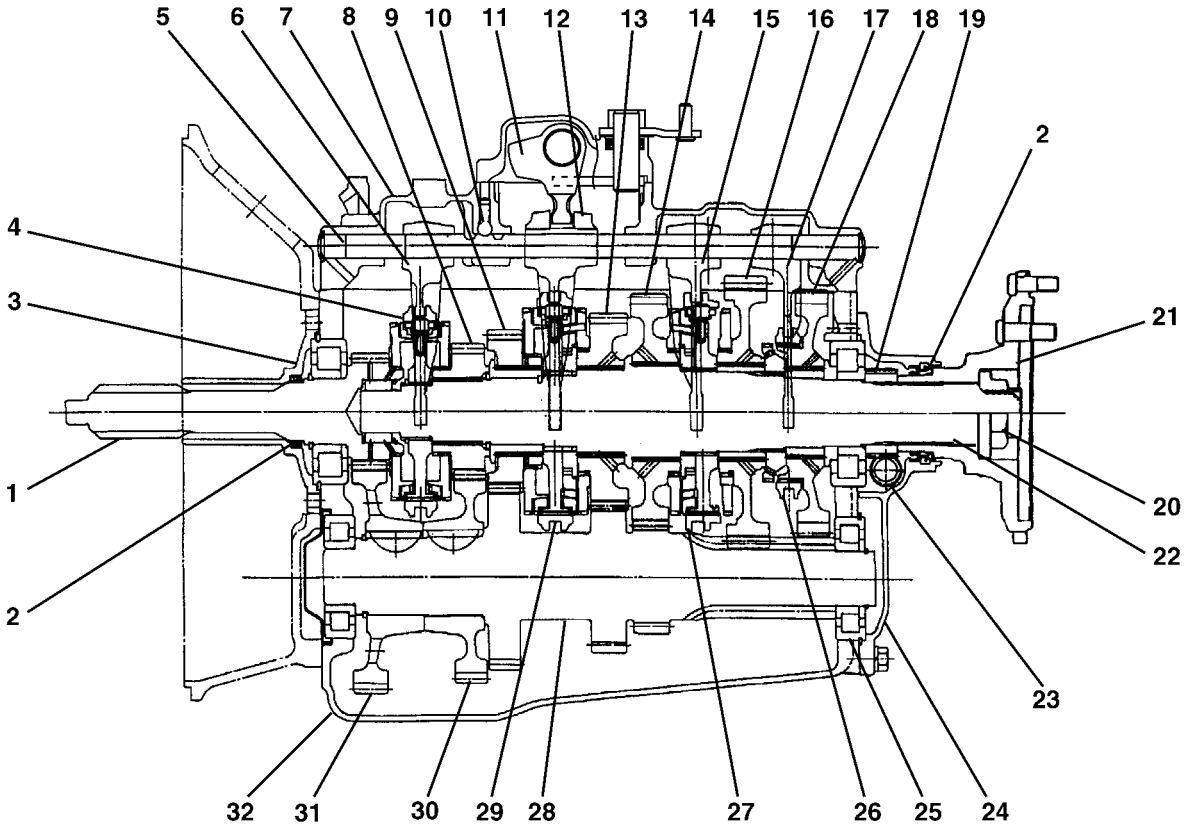
DATA AND SPECIFICATIONS

EN0332202I200001

Type		I	II	III
Type		Six forward speeds, one reverse 2, 3, 4, 5, 6th, Synchromesh, 1st and Reverse, Constant mesh		
Gear ratios:	1st	6.893	6.746	6.477
	2nd	4.274	4.190	4.016
	3rd	2.607	2.451	2.450
	4th	1.564	1.474	1.470
	5th	1.000	1.000	1.000
	6th	0.770	0.823	0.723
	Reverse	6.453	6.453	6.064
Number of teeth input shaft		25		26
Number of teeth counter shaft	Counter drive gear	44	44	43
	1st gear	12	12	12
	2nd gear	21	21	21
	3rd gear	27	28	27
	4th gear	36	37	36
	5th gear	—	—	—
	6th gear	48	47	48
	Reverse gear	12	12	12
Number of teeth output shaft	1st gear	47	46	47
	2nd gear	51	50	51
	3rd gear	40	39	40
	4th gear	32	31	32
	5th gear	—	—	—
	6th gear	21	22	21
	Reverse gear	44	44	44
Reverse idler gear		23		
Power take-off opening		On left side of gear case		
Oil capacity, gear box		Approx. 8.0 liters {1.76 Imp.gal, 2.11 US gal.}		
Oil capacity, gear box with power take-off		Approx. 8.5 liters {1.87 Imp.gal, 2.25 US gal.}		
Lubricant, type		Gear oil (API GL-4)		
Viscosity, between -12 and 32°C {10 and 90°F}		SAE90		
Viscosity, above 32°C {90°F}		SAE140		

DESCRIPTION

EN0332202C100001



SHTS033220200001

1	Input shaft	17	Reverse shift fork
2	Oil seal	18	Reverse gear
3	Front bearing retainer	19	Speedometer drive gear
4	5th-6th synchronizer unit	20	Nut
5	Shift shaft	21	Flange
6	5th-6th shift fork	22	Output shaft
7	Case cover	23	Speedometer driven gear
8	6th gear	24	Rear bearing retainer
9	4th gear	25	Cylindrical roller bearing
10	Steel ball	26	Reverse shift sleeve
11	Inner shift lever	27	1st-2nd synchronizer unit
12	3rd-4th shift fork	28	Counter shaft
13	3rd gear	29	3rd-4th synchronizer unit
14	2nd gear	30	Counter 6th gear
15	1st-2nd shift fork	31	Counter drive gear
16	1st gear	32	Transmission case

TROUBLESHOOTING

EN0332202F300001

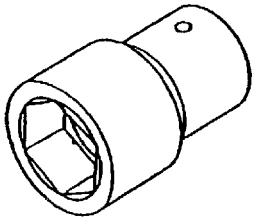
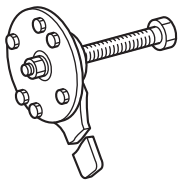
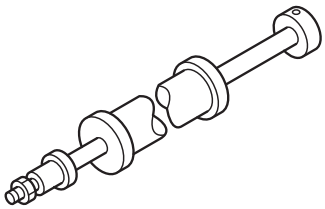
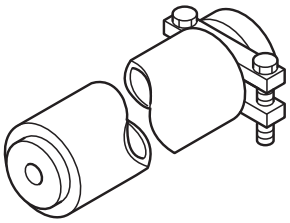
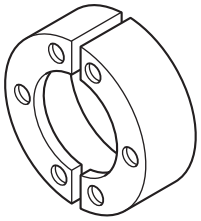
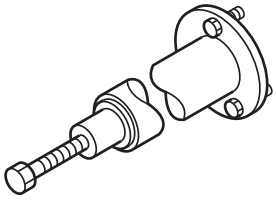
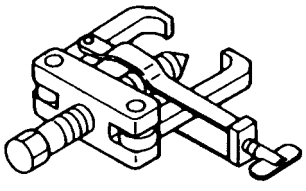
Symptom	Possible cause	Remedy/Prevention
Gear slip-off (Control system)	Joint worn and/or damaged	Replace joint.
	Bolts and nuts loose	Tighten bolts and nuts.
	Improper link rod adjustment	Adjust link rod.
Gear slip-off (Gear shift housing)	Lock ball and spring distorted and/or broken	Replace as required.
	Groove for shift shaft worn	Replace shift fork.
Gear slip-off (Transmission gear)	Synchronizer hub and sleeve worn	Replace as required.
	Synchronizer sleeve and gear clutch teeth worn or damaged	Replace as required.
	Input shaft and/or output shaft bearing worn and/or broken	Replace bearing.
	Retainer ring and/or thrust washer worn and/or broken	Replace as required.
	Loosened transmission to engine mounting bolts	Tighten bolts.
Difficult gear engagement (Engine)	Engine idling speed too high	Adjust engine idling.
Difficult gear engagement (Clutch)	Improper disengagement of clutch	Adjust clutch.
	Clutch disc sticking	Repair or replace.
	Clutch shifter sleeve bent	Replace shifter sleeve.
Difficult gear engagement (Transmission)	Input shaft and/or output shaft bearing worn and/or damaged	Replace bearing.
	Engine crankshaft pilot bearing worn and/or damaged	Replace bearing.
	Synchronizer cone and ring worn	Replace as required.
Difficult gear engagement (Control system)	Looseness of control system and/or improper adjustment	Tighten and adjust control system.
	Improper motion of gear shift lever	Adjust shift lever.
Difficult gear engagement (Lubrication)	Improper lubrication of control lever	Lubricate as required.
	Shortage gear oil and/or low oil viscosity	Add oil or change oil as required.
Noise (Transmission)	Grinding in transmission	Check for screws, bolts or other foreign materials in transmission.
	Loose transmission-to-engine mounting bolts	Tighten bolts.
	Worn or damaged gear and bearing	Replace as required.
Noise (Lubrication)	Shortage of gear oil and/or low oil viscosity	Add oil or change oil as required.
Gear oil leaks (Transmission)	Leaks at the front and rear bearing retainer seal and gasket, case cover gasket, sand hole of case or shift shaft expansion plug	Repair and replace as required.
	Improper amount of gear oil and lack of oil viscosity	Check oil level and type.

Symptom	Possible cause	Remedy/Prevention
Gears are difficult to engage or cannot be engaged when engine is not operating.	Control cable damaged, bent, deteriorated or deformed due to heat	Replace control cable.
	Loose parts	Inspect and tighten.
	Damaged shift lever assembly	Replace shift lever.
	Damaged or bent parts on upper transmission cover section (lever, spring, etc.)	Replace.
	Faulty adjustment of control cable assembly and link rod	Adjust.
The play of the lever is excessive.	A joint is seriously worn.	Replace the joint.
	Looseness of tightening bolt and nut	Inspect and tighten each the bolts and the nuts.

SPECIAL TOOL

EN0332202K100001

Prior to starting a transmission overhaul, it is necessary to have these special tools.

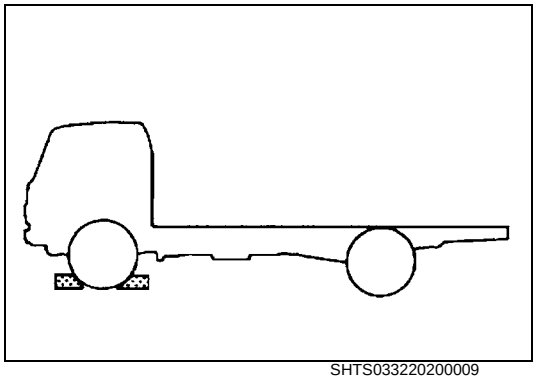
Illustration	Part number	Tool name	Remarks
	S0983-95005	SOCKET WRENCH	
	S0965-01900	PULLER	
	S0942-01442	SLIDING HAMMER	
	S0965-02070	INPUT SHAFT PULLER	
	S0965-31180 S0965-31200	HOOK	
	S0965-01881	PULLER	
	S0965-01101	PULLER	

DISMOUNTING AND MOUNTING

EN0332202H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033220200009

1. BLOCK THE WHEELS.

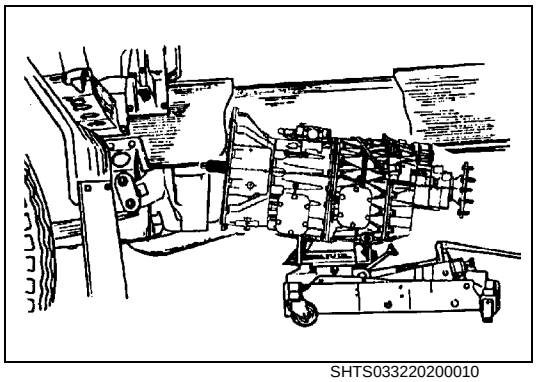
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

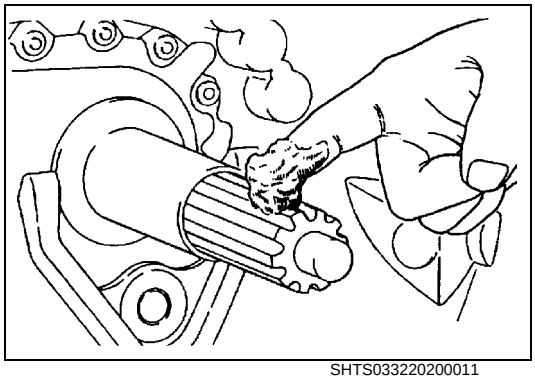
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



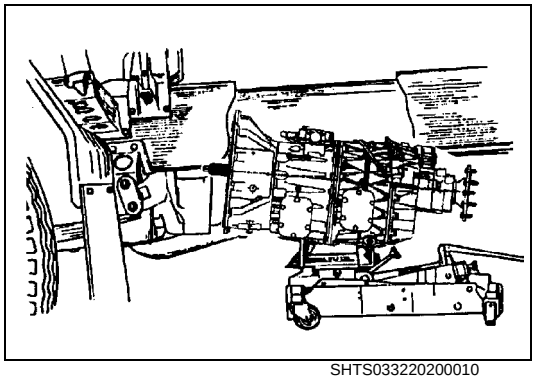
SHTS033220200010

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033220200011

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033220200010

2. INSTALL THE TRANSMISSION.

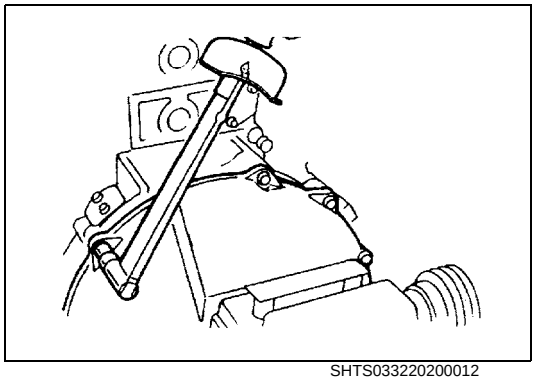
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033220200012

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

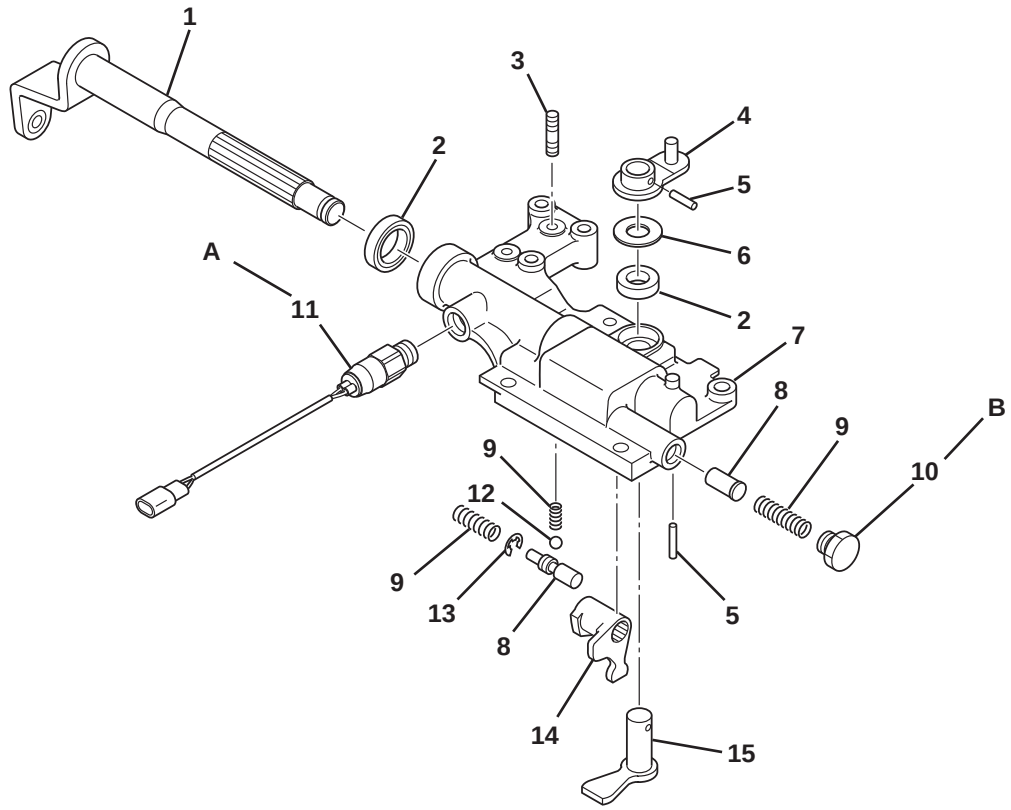
Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

GEAR SHIFT HOUSING

COMPONENT LOCATOR

EN0332202D100001

WITHOUT POWER SHIFT



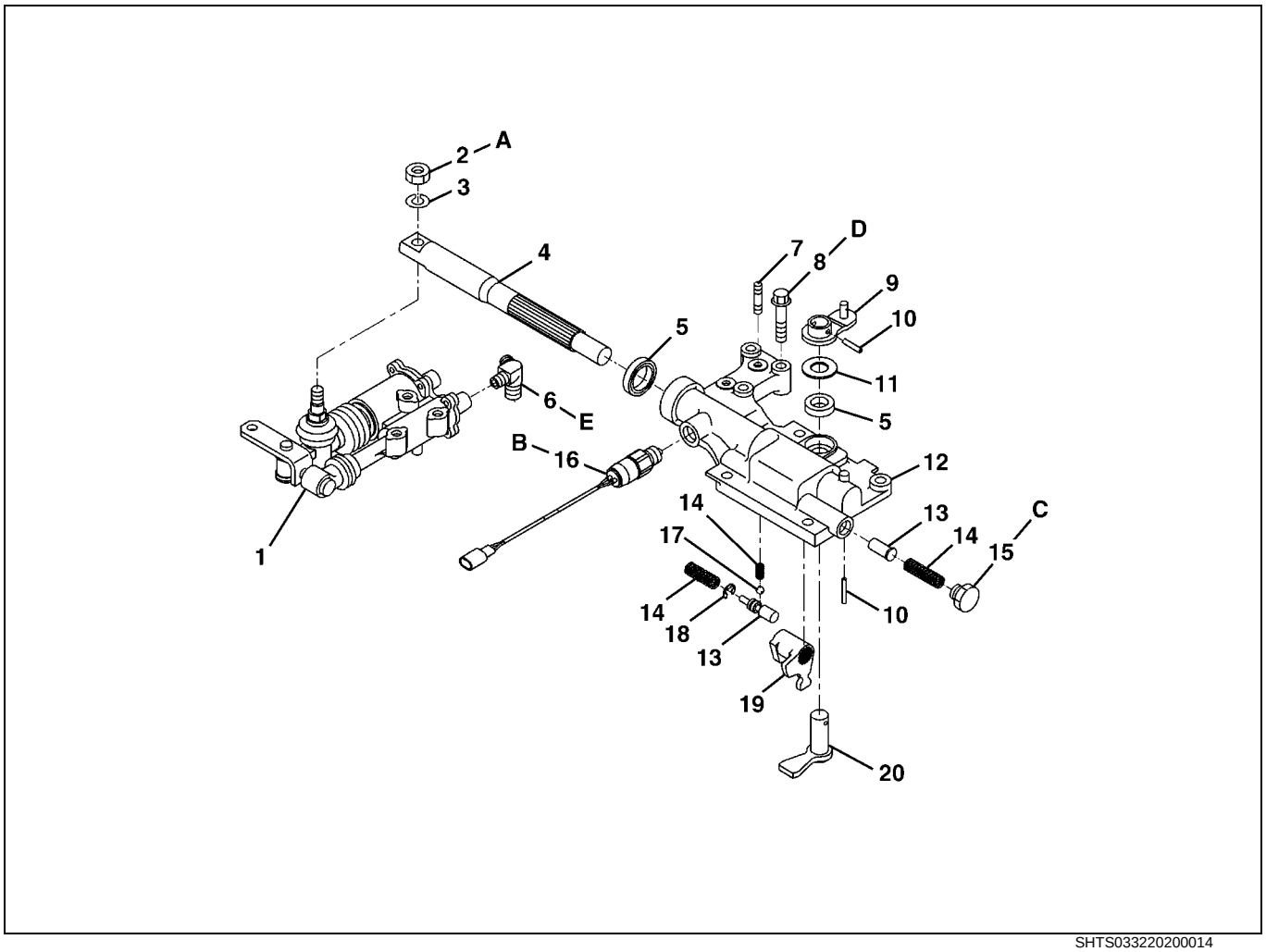
SHTS033220200013

1	Shift lever shaft	9	Compression spring
2	Oil seal	10	Plug
3	Stud	11	Neutral switch
4	Outer select lever	12	Steel ball
5	Pin	13	Retainer
6	Plain washer	14	Inner shift lever
7	Shift lever shaft housing	15	Select lever shaft
8	Lockout plunger		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	34-38 {350-390, 25-27}	B	25-30 {255-306, 19-22}

WITH POWER SHIFT



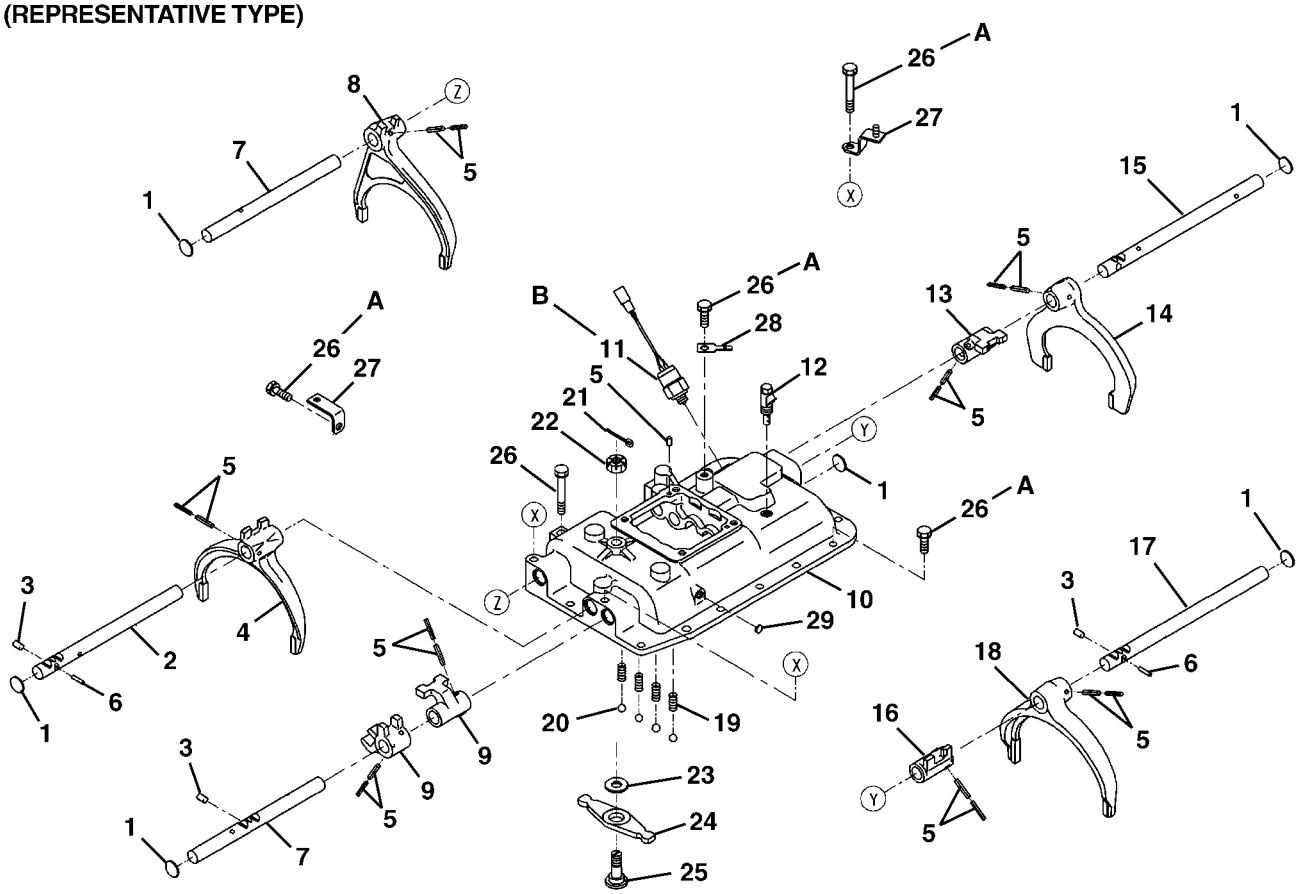
SHTS033220200014

1	Power shift unit assembly	11	Plain washer
2	Nut	12	Shift lever shaft housing
3	Spring washer	13	Lockout plunger
4	Shift lever shaft	14	Compression spring
5	Oil seal	15	Plug
6	Pipe joint	16	Neutral switch
7	Stud	17	Steel ball
8	Bolt	18	Retainer
9	Outer select lever	19	Inner shift lever
10	Pin	20	Select lever shaft

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	75.5-91.2 {770-930, 56-67}	D	40.2-46.1 {410-470, 30-33}
B	34-38 {350-390, 25-27}	E	20-30 {204-305, 15-22}
C	25-30 {255-306, 19-22}		

(REPRESENTATIVE TYPE)



SHTS033220200015

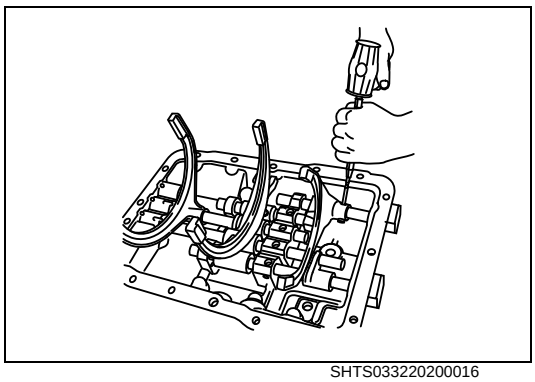
1	Expansion plug	16	1st-2nd shift head
2	3rd-4th shift shaft	17	1st-2nd shift shaft
3	Interlock plunger	18	1st-2nd shift fork
4	3rd-4th shift fork	19	Compression spring
5	Pins	20	Steel ball
6	Interlock pin	21	Cotter pin
7	5th-6th shift shaft	22	Slotted nut
8	5th-6th shift fork	23	Plain washer
9	5th-6th shift head	24	Inversion lever
10	Transmission case cover	25	Inversion pin
11	Back-up light switch	26	Bolt
12	Air breather	27	Clip holder
13	Reverse shift head	28	Bracket
14	Reverse shift fork	29	Expansion plug
15	Reverse shift shaft		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	37.5-48.5 {385-490, 28-35}	B	26-30 {265-300, 19-22}

OVERHAUL

EN0332202H200001



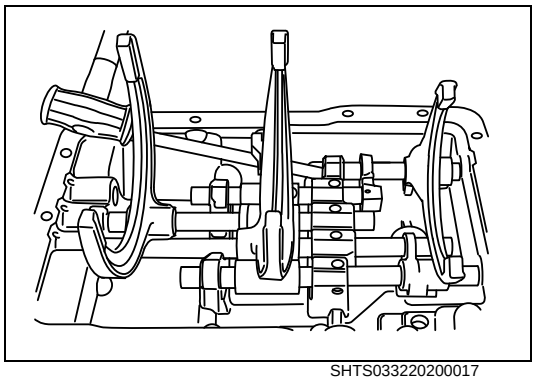
SHTS033220200016

IMPORTANT POINT - DISASSEMBLY

1. REMOVE THE GEAR SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.

(1) Set each shaft in the neutral position.

(2) Tap the shift head and shift fork fitting pins lightly with a 5 mm {0.197 in.} diameter tapping rod.



SHTS033220200017

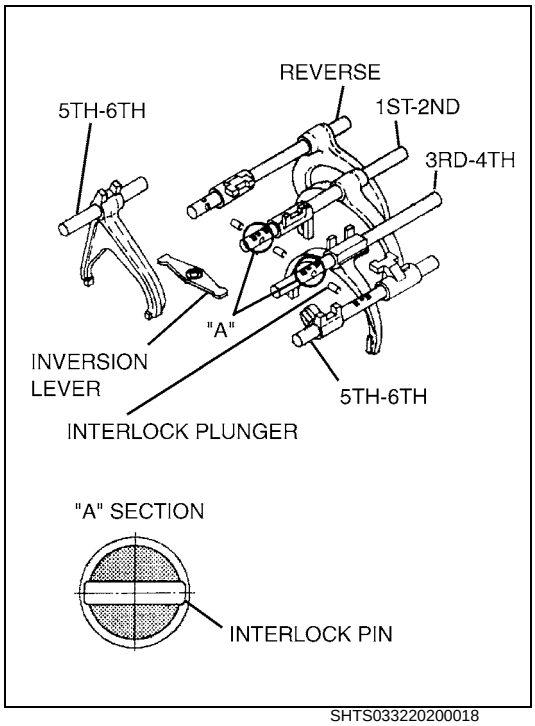
(3) Drive out the shift shafts and its expansion plugs one at a time. When removing the shift shaft, remove the shift fork and the shift head.

NOTICE

Take care not to damage the sliding bore.

⚠ CAUTION

The steel ball may fly out of the hole when removing the shift shaft. Wear safety glasses during removal.



SHTS033220200018

IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE STEEL BALL, COMPRESSION SPRING, SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.

(1) Install the inversion lever and the pin.

(2) Place the ball and spring in the hole.

(3) Depress the ball and spring with a suitable tool.

⚠ CAUTION

The steel ball may fly out of the hole when installing the shift shaft. Wear safety glasses during installation.

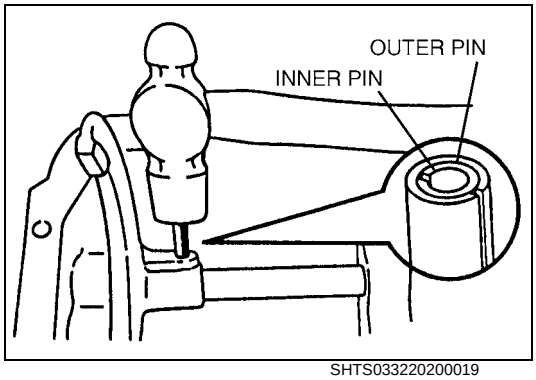
(4) Coat the shift shaft with gear oil.

(5) Align the shift fork and head and put the shift shaft through, and then slide the shift shaft over the ball.

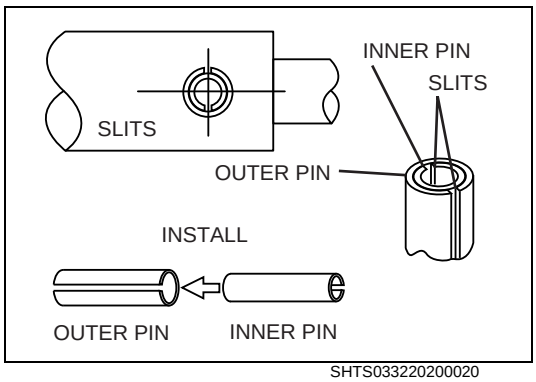
(6) Place the shift shaft in neutral position.

NOTICE

- **Pay special attention to the position and direction of the shift fork and shift head.**
- **For 1st-2nd and 3rd-4th shift shafts, insert the interlock pin. Coat the interlock pin with bearing grease.**



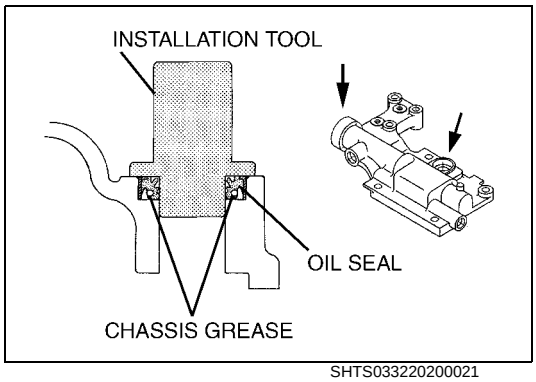
SHTS033220200019



SHTS033220200020

2. SECURE THE SHIFT HEAD AND FORK WITH CONCENTRIC PINS.

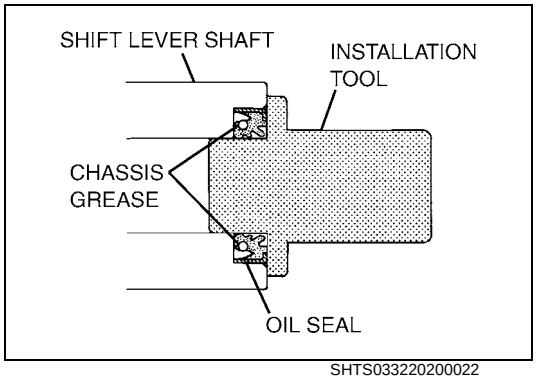
(1) Drive the concentric pins into the fork and the head. Make sure that the slits of the concentric pins are on opposite sides as shown.



SHTS033220200021

3. INSTALL THE OIL SEAL.

(1) Drive a new oil seal into the shift lever shaft housing with the installation tool.



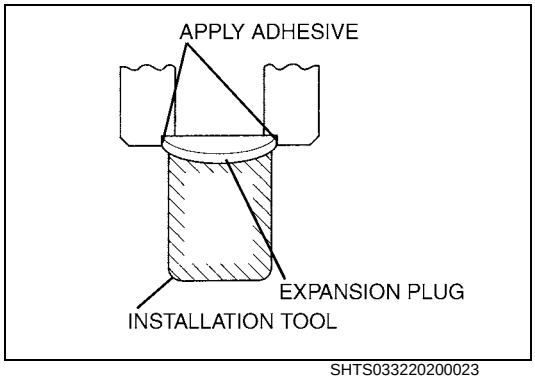
SHTS033220200022

(2) Drive a new oil seal into the shift lever shaft with the installation tool.

(3) Coat the sealing surface between the seal lips with bearing grease.

NOTICE

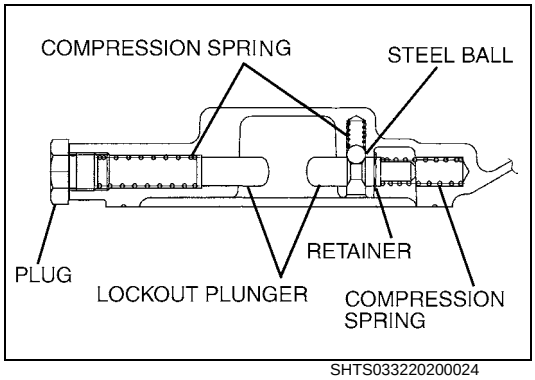
- **Always use a new oil seal.**
- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**



SHTS033220200023

4. INSTALL THE EXPANSION PLUG.

(1) Apply adhesive all around to the expansion plug.



SHTS033220200024

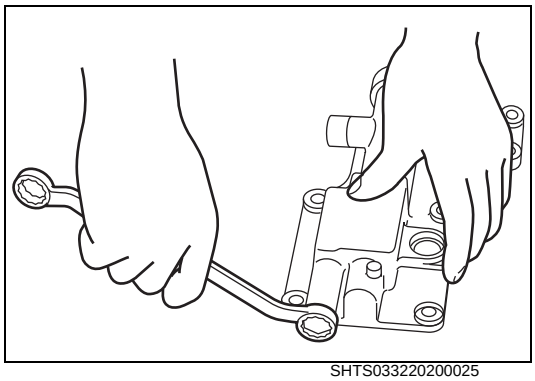
5. INSTALL THE LOCKOUT PLUNGER, THE STEEL BALL AND THE COMPRESSION SPRING.

(1) Coat the lockout plunger with bearing grease.

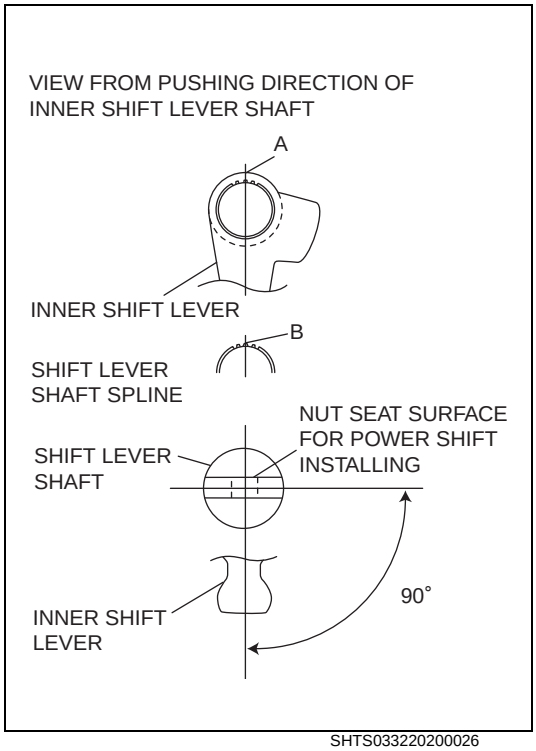
(2) Put the compression spring and the steel ball, then install the lockout plunger as shown in the figure.

NOTICE

When installing the lockout plunger, be careful not to spring out the steel ball.


SHTS033220200025

(3) After applying lock agent (LOCTITE#575) to the plug, put the compression spring and install the plug.



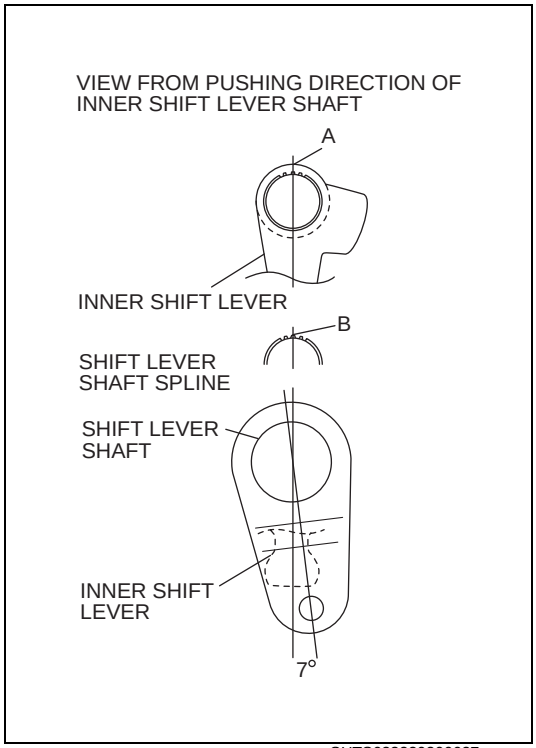
SHTS033220200026

6. INSTALL THE SHIFT LEVER SHAFT AND INNER SHIFT LEVER.

(1) Match the shift lever shaft and inner shift lever as shown, and push the shift lever shaft into the inner shift lever.

Model: With power shift

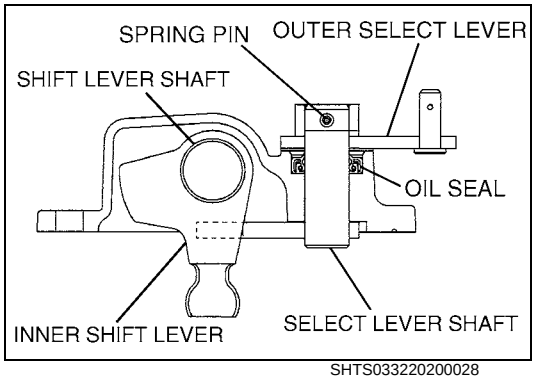
- **They should be installed so that the nut seat surface for power shift installing makes an angle of 90° with inner shift lever.**



SHTS033220200027

Model: Without power shift

- **They should be installed so that the shift lever shaft installing makes an angle of counterclockwise 7° with the inner shift lever.**



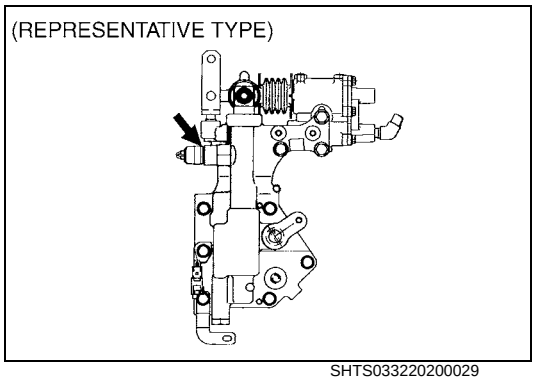
SHTS033220200028

7. INSTALL THE SELECT LEVER SHAFT AND OUTER SELECT LEVER.

(1) Align the hole of the outer select lever with the hole of the select lever shaft to fix them with spring pin.

NOTICE

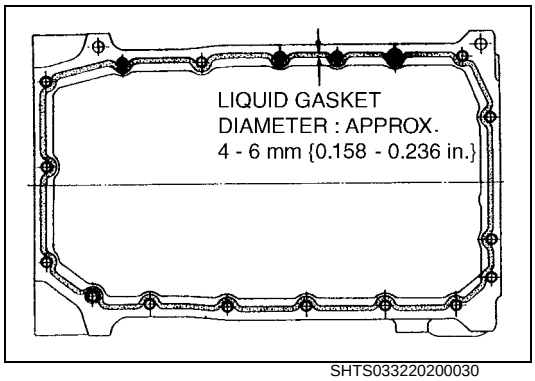
When installing the select lever shaft, be sure to align the holes of select lever shaft and outer select lever with the spring pin.



SHTS033220200029

8. INSTALL THE NEUTRAL SWITCH

(1) Apply lock agent (LOCTITE#575) to the neutral switch and install it to the shift lever housing.



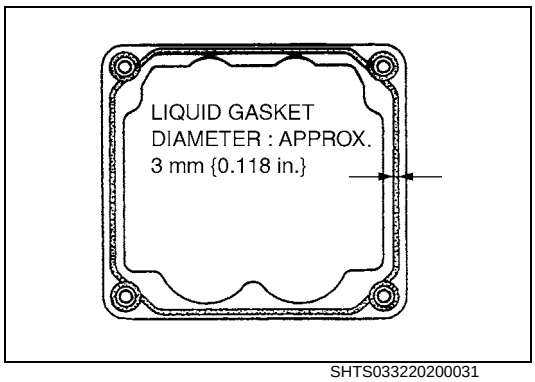
SHTS033220200030

9. INSTALL THE TRANSMISSION CASE COVER.

(1) Coat the face of the transmission case with liquid gasket.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



SHTS033220200031

10. INSTALL THE SHIFT LEVER SHAFT HOUSING.

(1) Coat the face of the transmission case cover with liquid gasket.

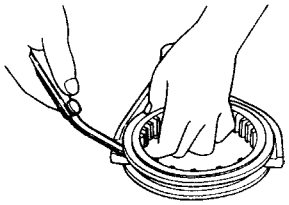
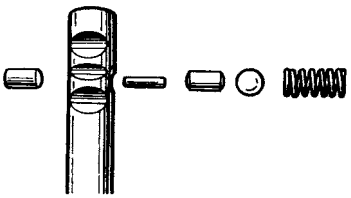
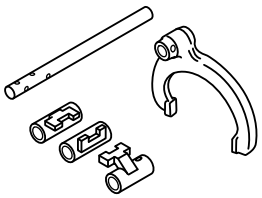
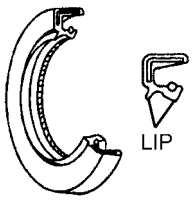
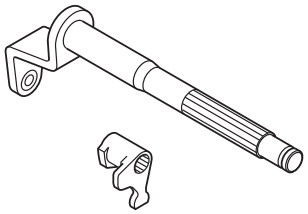
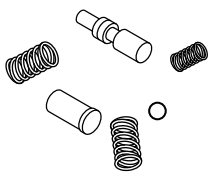
NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

INSPECTION AND REPAIR

EN0332202H300001

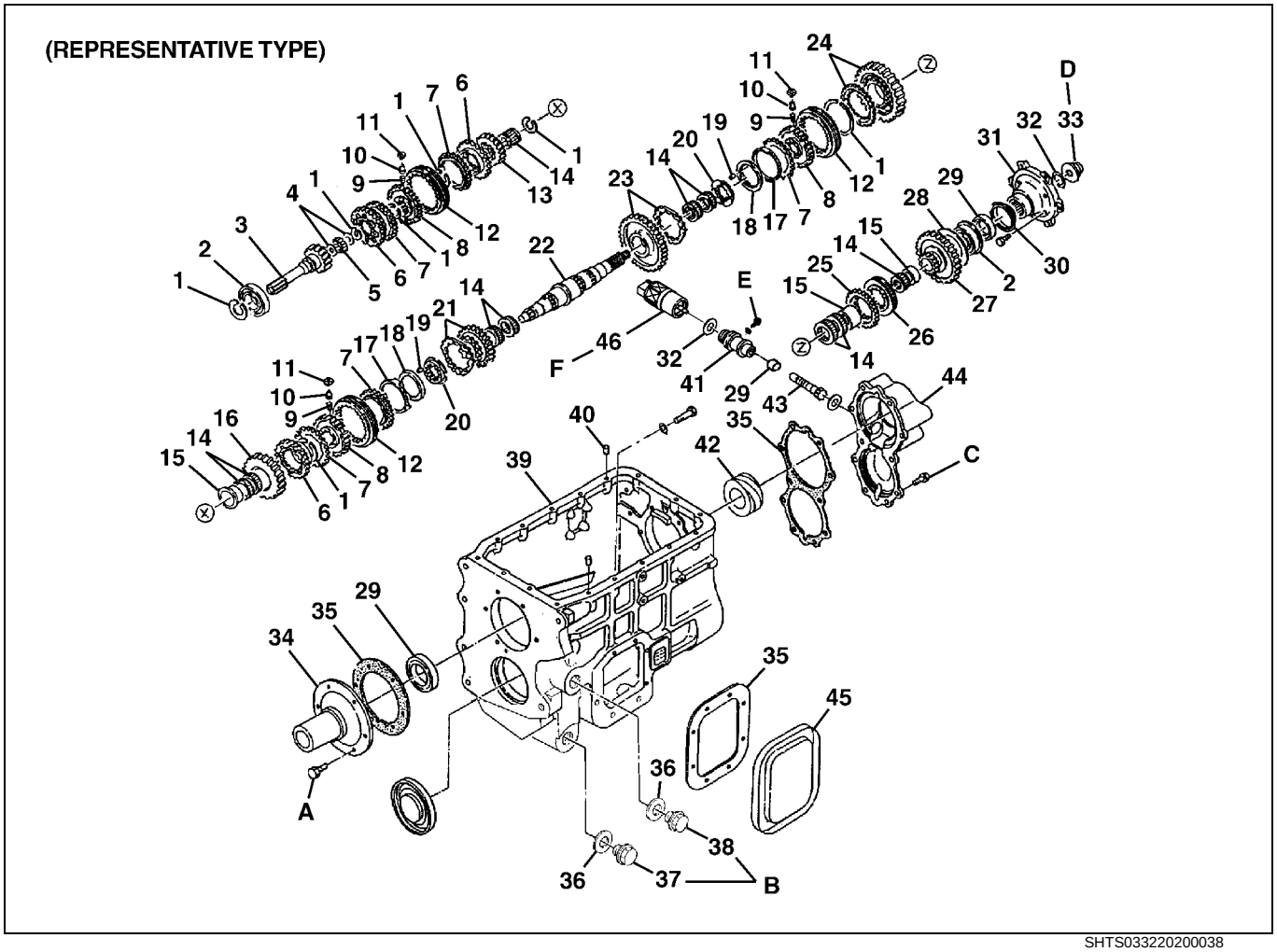
Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Clearance between shift fork and sleeve	**0.2-0.45 {0.0079-0.0177}**	**1.0 {0.039}**	**Replace.**	**Measure** 
Interlock pin, interlock plunger, compression spring and steel ball wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift head, shift fork and shift shaft wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Oil seal lip wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift lever shaft and inner shift lever wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Compression spring and lockout plunger and steel ball wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

INPUT SHAFT, OUTPUT SHAFT, GEARS AND RELATED PARTS

COMPONENT LOCATOR

EN0332202D100002



SHTS033220200038

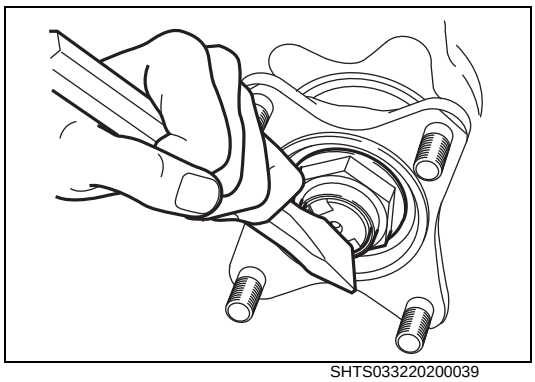
1	Retainer ring	24	1st gear sub-assembly
2	Cylindrical roller bearing	25	Constant hub
3	Input shaft	26	Constant sleeve
4	Spacer	27	Reverse gear
5	Roller bearing	28	Thrust washer
6	Synchronizer cone	29	Oil seal
7	Synchronizer ring	30	Dust deflector
8	Synchronizer hub	31	Universal joint flange
9	Compression spring	32	O-ring
10	Synchronizer head	33	Nut
11	Synchronizer key	34	Front bearing retainer
12	Synchronizer sleeve	35	Gasket
13	6th gear	36	Soft washer
14	Needle roller bearing	37	Drain plug
15	Bushing	38	Filler plug
16	4th gear	39	Transmission case
17	Synchronizer double cone	40	Straight pin
18	Synchronizer inner cone	41	Speedometer driven gear bushing
19	Pin	42	Speedometer drive gear
20	Synchronizer bushing	43	Speedometer driven gear
21	3rd gear sub-assembly	44	Rear bearing retainer
22	Output shaft	45	Power take-off cover
23	2nd gear sub-assembly	46	Speed sensor

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	54-68 {550-700, 40-50}	D	587-783 {6,000-8,000, 434-578}
B	79-117 {806-1,193, 59-86}	E	8.5-10.5 {87-107, 6.3-7.7}
C	63.5-84.5 {650-870, 47-62}	F	14.7-29.3 {150-300, 11-23}

OVERHAUL

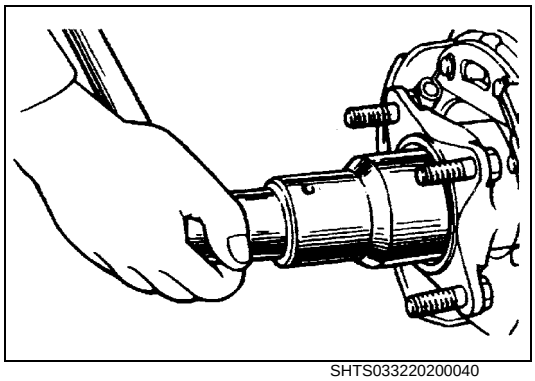
EN0332202H200002


SHTS033220200039

IMPORTANT POINTS - DISASSENMBLY

1. REMOVE THE OUTPUT SHAFT LOCK NUT.

(1) The lock nut has been caulked, so before loosening it, lift the caulked part completely out of the shaft groove.

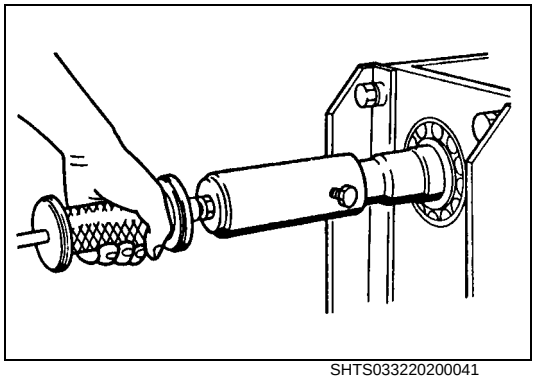

SHTS033220200040

(2) Using the special tool or the commercial tool, remove the lock nut.

NOTICE

Before loosening the lock nut, engage two gears so that the output shaft can not be turned around.

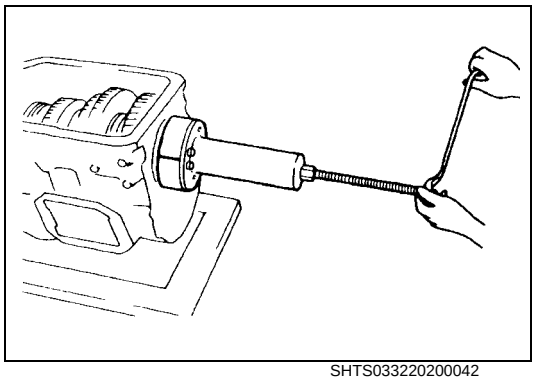
SST: Socket Wrench (S0983-95005)


SHTS033220200041

2. REMOVE THE INPUT SHAFT.

(1) Using the special tools, pull out input shaft with the accompanying bearings.

SST:
Input Shaft Puller (S0965-02070)
Sliding Hammer (S0942-01442)


SHTS033220200042

3. REMOVE THE OUTPUT SHAFT REAR BEARING.

(1) Remove the retainer ring.

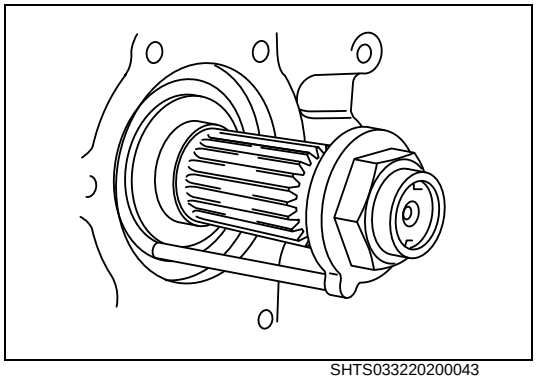
⚠ CAUTION

The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.

(2) Using the special tools, remove the output shaft rear bearing.
SST:
Hook (S0965-31200)
Puller (S0965-01881)

NOTICE

Insert the hook's click into the groove for the retainer ring, then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.

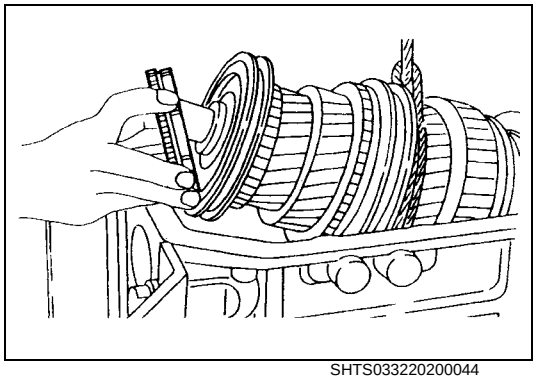

SHTS033220200043

4. REMOVE THE OUTPUT SHAFT ASSEMBLY FROM THE TRANSMISSION CASE.

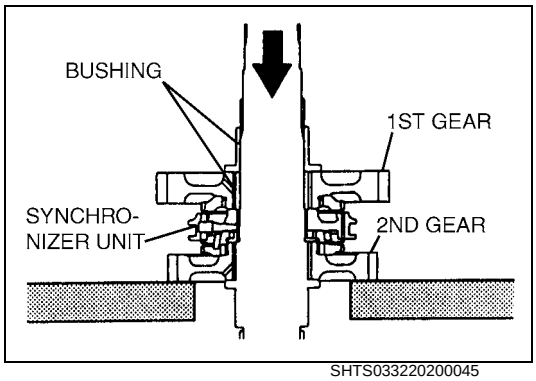
(1) Attach a jig to the end of the output shaft.

⚠ CAUTION
If the output shaft assembly is removed from the transmission without a jig, the reverse gear will drop from the shaft, which can result in the personal injury.

(2) Attach a suitable hook or other lifting device around the 3rd-4th speed synchronizer sleeve and carefully lift the output shaft assembly from the transmission case.


SHTS033220200044

(3) When removing the output shaft assembly, remove the synchronizer ring and the cone of the input shaft gear.



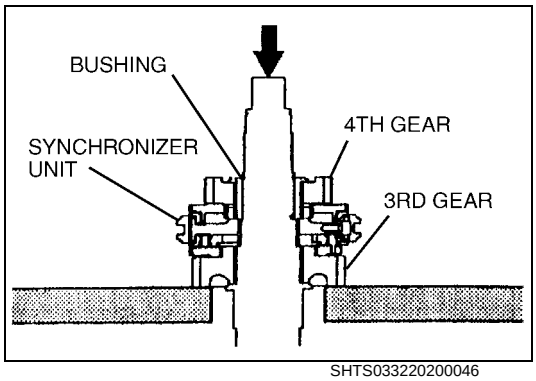
SHTS033220200045

5. REMOVE THE BUSHINGS FROM THE OUTPUT SHAFT.

(1) Support the 2nd gear and press the output shaft rear end through the bushings, 1st gear, synchronizer unit, 2nd gear and needle roller bearings.

NOTICE
When removing the output shaft, do not allow the shaft to drop on a hard surface.

⚠ CAUTION
Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.

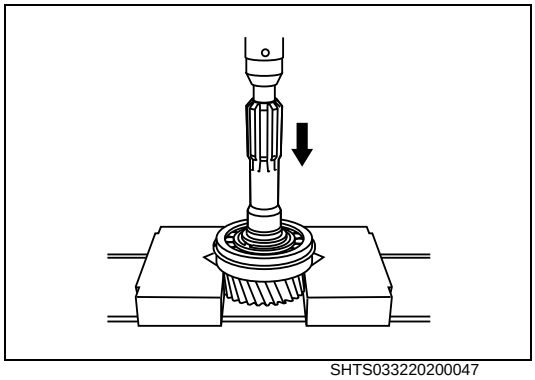


SHTS033220200046

(2) Support the 3rd gear and press the output shaft rear end through the bushing, the 4th gear, the synchronizer unit and the needle roller bearings.

NOTICE
When removing the output shaft, do not allow the shaft to drop on a hard surface.

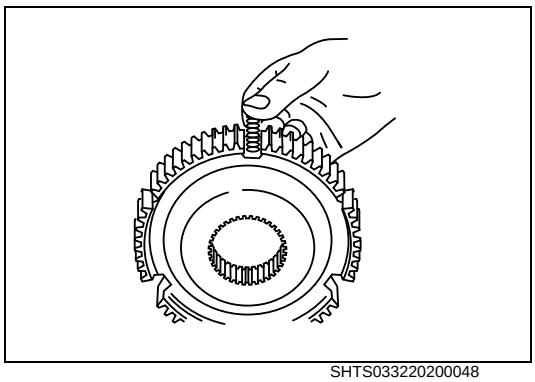
⚠ CAUTION
Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.


SHTS033220200047

6. DISASSEMBLE THE INPUT SHAFT.
(1) Remove retainer ring.
(2) Using a press, remove the cylindrical roller bearing.

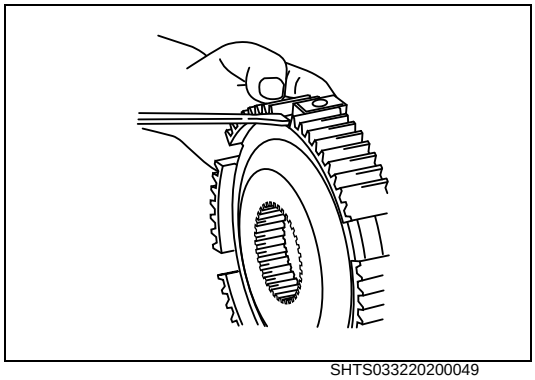
⚠ CAUTION
- **The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**
- **Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**

IMPORTANT POINTS - ASSEMBLY

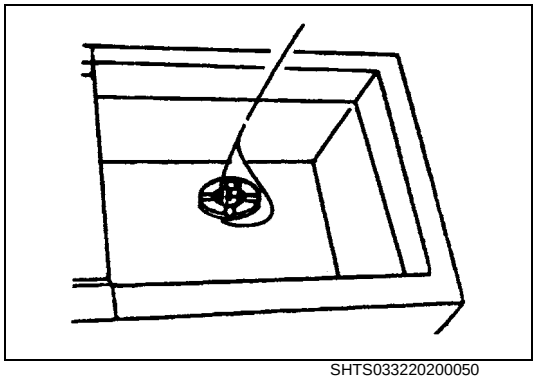

SHTS033220200048

1. ASSEMBLE THE SYNCHRONIZER UNIT.
(1) Install the compression spring.

⚠ CAUTION
The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.


SHTS033220200049

(2) Install the synchronizer key and head.


SHTS033220200050

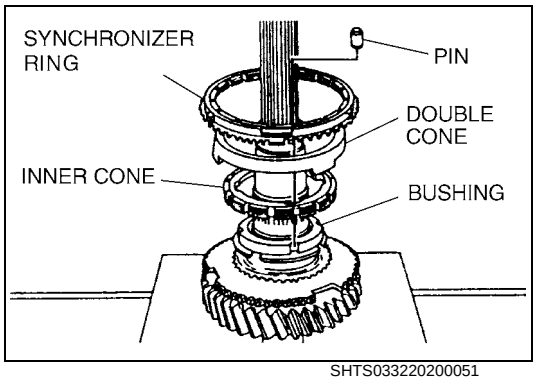
2. INSTALL THE 2ND GEAR, SYNCHRONIZER UNIT, 1ST GEAR, 1ST GEAR BUSHING AND REVERSE GEAR BUSHING.

(1) Install the 2nd gear.

(2) Heat the 2nd synchronizer bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer bushing on the shaft.

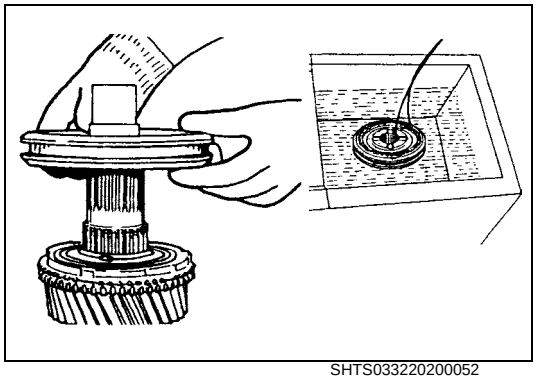
NOTICE
Do not heat the synchronizer bushing in excess of 150°C {302°F}.

⚠ CAUTION
Never touch hot oil and heated synchronizer bushing with your bare hand. This can result in personal injury.



SHTS033220200051

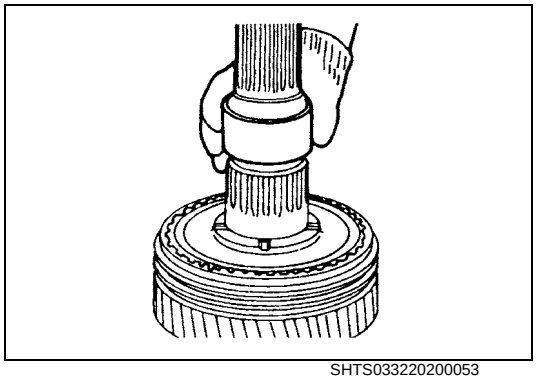
(3) Install the synchronizer bushing, synchronizer inner cone, synchronizer double cone, synchronizer ring and pins.


SHTS033220200052

(4) Heat the 2nd synchronizer unit for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer unit on the shaft.

NOTICE
Do not heat the synchronizer unit in excess of 150°C {302°F}.

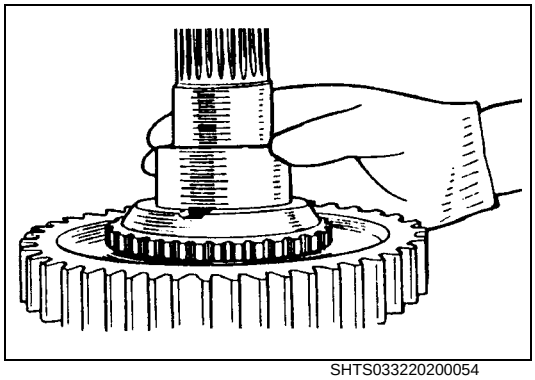
⚠ CAUTION
Never touch hot oil and heated synchronizer unit with your bare hand. This can result in personal injury.


SHTS033220200053

(5) Heat the 1st gear bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the bushing on the shaft.

NOTICE
Do not heat the bushing in excess of 150°C {302°F}.

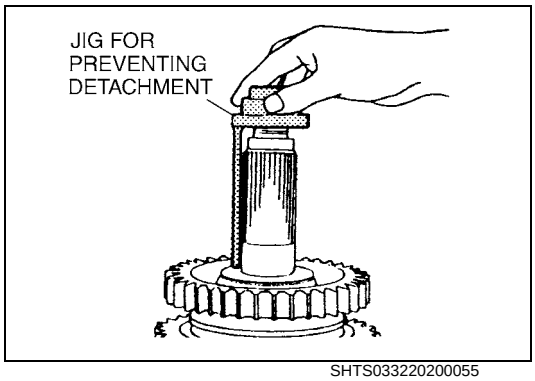
⚠ CAUTION
Never touch hot oil and heated bushing with your bare hand. This can result in personal injury.


SHTS033220200054

(6) Heat the reverse gear bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the bushing on the shaft.

NOTICE
Do not heat the bushing in excess of 150°C {302°F}.

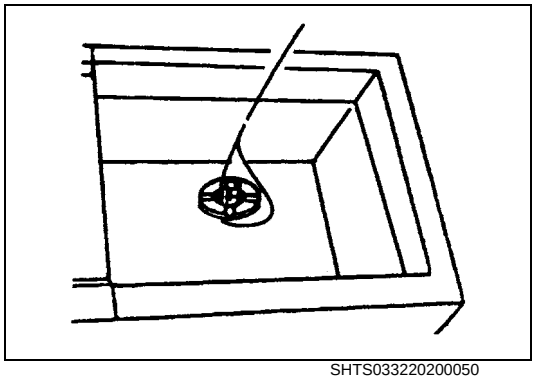
⚠ CAUTION
Never touch hot oil and heated bushing with your bare hand. This can result in personal injury.



SHTS033220200055

(7) Hold the thrust washer with a jig.

⚠ CAUTION
If the output shaft assembly is installed to the transmission without a jig, the reverse gear will drop from the shaft, which can possibly result in personal injury.


SHTS033220200050

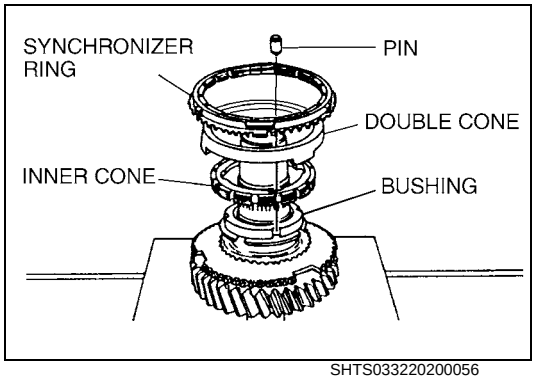
3. INSTALL THE 3RD GEAR, SYNCHRONIZER UNIT, 4TH GEAR AND BUSHING ON THE SHAFT.

(1) Install the 3rd gear.

(2) Heat the 3rd synchronizer bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer bushing on the shaft.

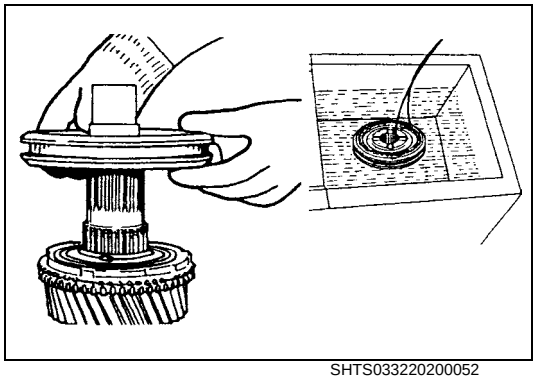
NOTICE
Do not heat the synchronizer bushing in excess of 150°C {302°F}.

⚠ CAUTION
Never touch hot oil and heated synchronizer bushing with your bare hand. This can result in personal injury.



SHTS033220200056

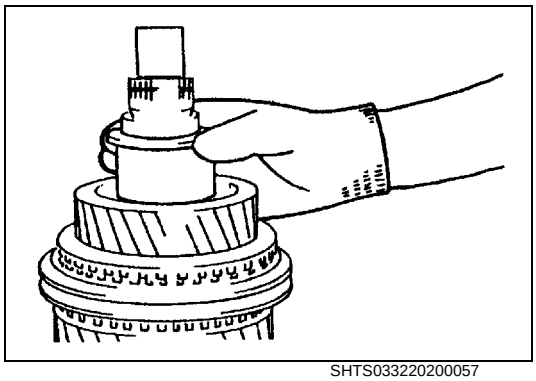
(3) Install the synchronizer bushing, synchronizer inner cone, synchronizer double cone, synchronizer ring and pin.


SHTS033220200052

(4) Heat the 3rd-4th synchronizer unit for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer unit on the shaft.

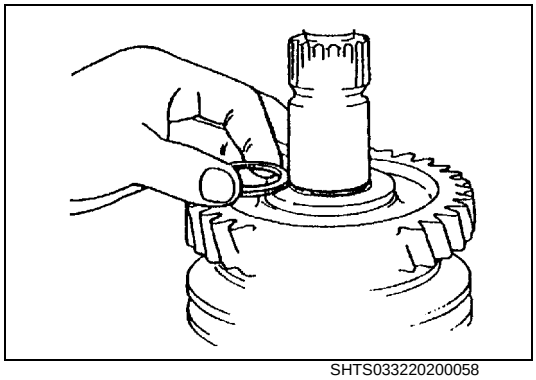
NOTICE
Do not heat the synchronizer unit in excess of 150°C {302°F}.

⚠ CAUTION
Never touch hot oil and heated synchronizer unit with your bare hand. This can result in personal injury.


SHTS033220200057

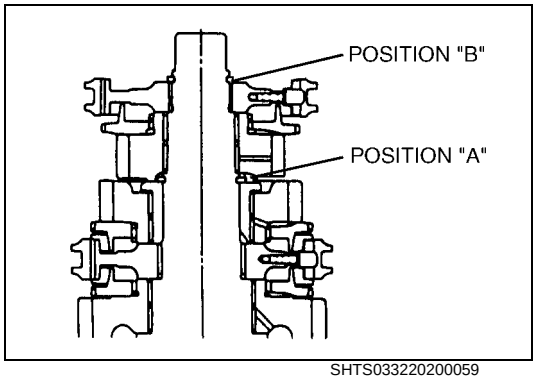
(5) Install the 4th gear and needle roller bearing.
(6) Install the 4th gear bushing.
Heat the bushing to approximately 120°C to 130°C {248°F to 266°F} in a heater and place on output shaft against the end stop.

⚠ CAUTION
Never touch hot oil and heated bushing with your bare hand. This can result in personal injury.


SHTS033220200058

4. INSTALL THE GEARS, BUSHINGS, NEEDLE ROLLER BEARING, SYNCHRONIZER UNITS AND OTHER PARTS ON THE OUTPUT SHAFT.
(1) Select a retainer ring that will provide a tight fit.
Clearance: Less than 0.1 mm {0.0039 in.}

NOTICE
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**



SHTS033220200059

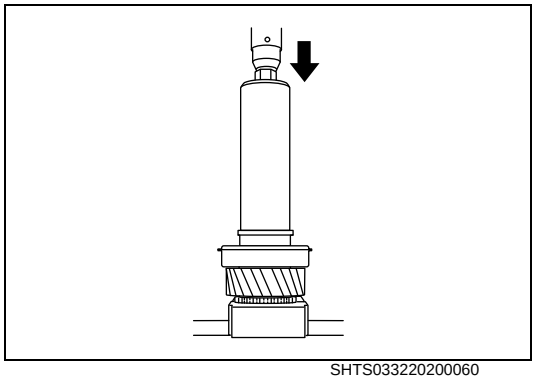
Retainer rings are available in the following sizes: Position "A"

Thickness	Color code
2.4 mm {0.0945 in.}	None
2.5 mm {0.0984 in.}	Blue
2.6 mm {0.1024 in.}	Green
2.7 mm {0.1063 in.}	Yellow
2.8 mm {0.1102 in.}	Red

Retainer rings are available in the following sizes: Position "B"

Thickness	Color code
2.45 mm {0.0965 in.}	None
2.55 mm {0.1004 in.}	Blue

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.

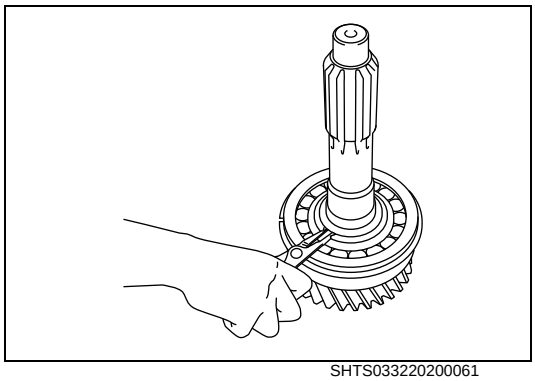

SHTS033220200060

5. ASSEMBLE THE INPUT SHAFT.

(1) Using a press, install the cylindrical roller bearing to the input shaft.

NOTICE

- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


SHTS033220200061

(2) Select a retainer ring, that will provide a tight fit.
Clearance: Less than 0.1 mm {0.0039 in.}

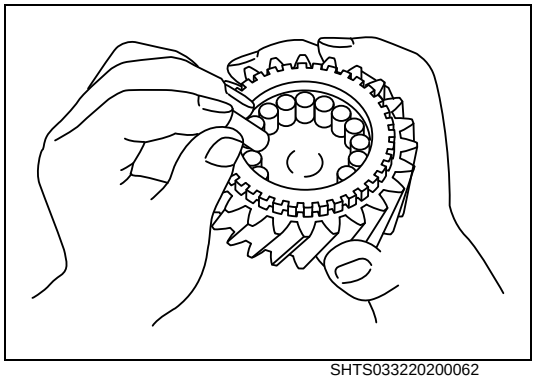
NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

Retainer rings are available in the following sizes

Thickness	Color code
2.4 mm {0.0945 in.}	None
2.5 mm {0.0984 in.}	Blue
2.6 mm {0.1024 in.}	Green
2.7 mm {0.1063 in.}	Yellow

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.

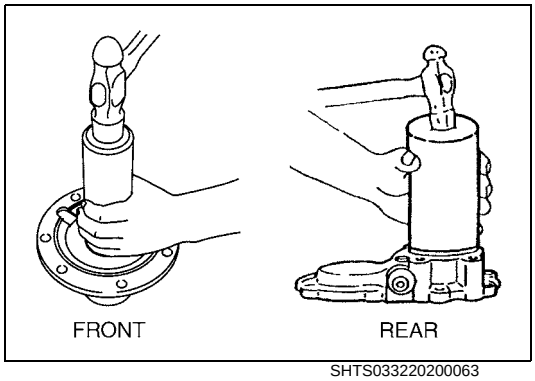

SHTS033220200062

6. INSTALL THE ROLLER BEARING IN THE COUNTERBORE OF THE INPUT SHAFT.

(1) Apply gear oil to the bearings.
(2) Place spacers at both ends of the bearings.
(3) Install the retainer ring.

NOTICE
Always use roller bearings of uniform diameter (16 pieces per set). There are 3 types of roller bearings in different diameters. There are distinguished by the colors red, blue, and white.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.



SHTS033220200063

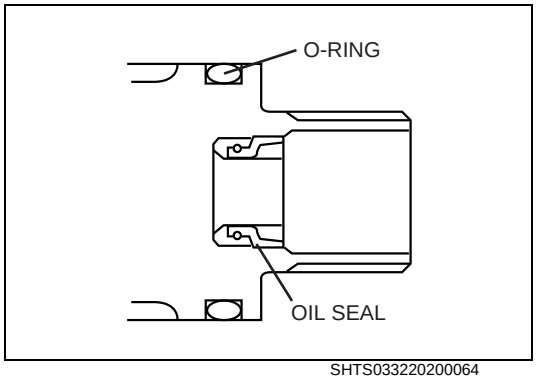
7. REPLACE THE OIL SEAL OF THE FRONT AND REAR BEARING RETAINER.

(1) Using a screwdriver, remove the oil seal from the bearing retainer.
(2) Using a press and a suitable installing tool, press the oil seal into the bearing retainer.

NOTICE

- **Coat gear oil to oil seal surface.**
- **Be sure the oil seal is installed in the proper direction.**

(3) Coat bearing grease to the sealing surface between the seal lips.



SHTS033220200064

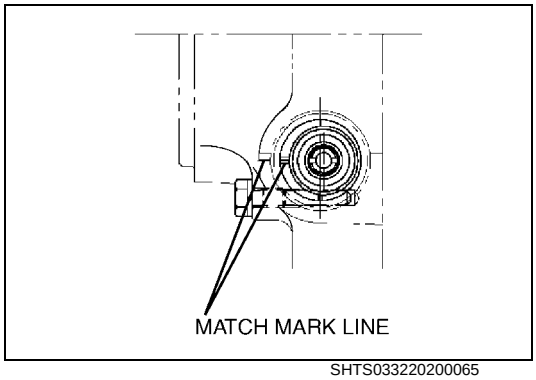
8. INSTALL THE SPEEDOMETER DRIVEN GEAR BUSHING.

(1) Install the O-ring and oil seal to the bushing.

NOTICE

- **Coat the O-ring, oil seal and driven gear with bearing grease.**
- **Make sure that the oil seal is installed in the correct direction when replacing it.**

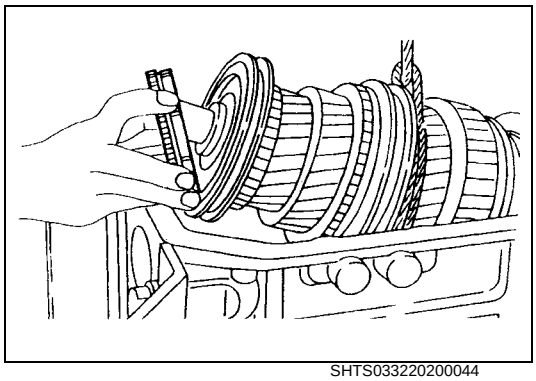
(2) Match the mark line on the bushing with the mark line on the rear bearing retainer.



SHTS033220200065

(3) Align the speedometer driven gear bushing hole with the hole of the rear bearing retainer.

Number of the drive gear teeth	Number of the driven gear teeth	The mark should be matched to the mark on retainer
7	18	One line


SHTS033220200044

9. INSTALL THE OUTPUT SHAFT ASSEMBLY IN THE TRANSMISSION CASE.

(1) Using ropes or some other lifting device, carefully lower the output shaft assembly into the case. When installing the output shaft, install the synchronizer ring and cone of the input shaft gear.

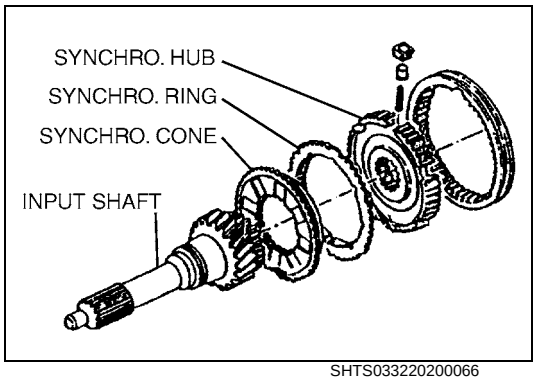
(2) Place the output shaft assembly in position.

NOTICE

Attach a jig to the end of output shaft.

⚠ CAUTION

If the output shaft assembly is installed to the transmission without a jig, the reverse gear will drop from the shaft, which can possibly result in the personal injury.

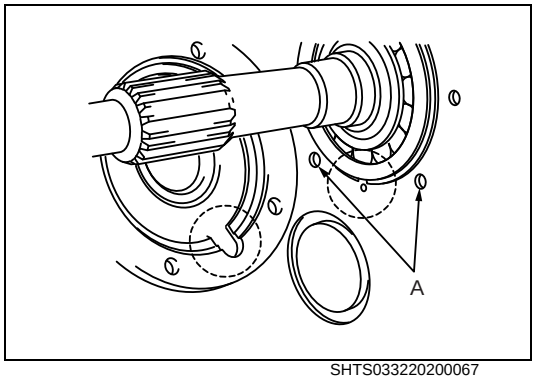


SHTS033220200066

10. INSTALL THE INPUT SHAFT INTO THE TRANSMISSION CASE.

(1) Mesh the synchronizer cone to the input shaft.

(2) Align the synchronizer hub slot with synchronizer ring.



SHTS033220200067

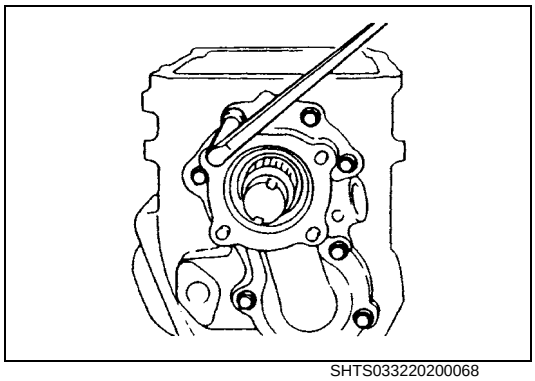
11. INSTALL THE FRONT BEARING RETAINER.

(1) Coat both sides of the gasket with liquid gasket.

(2) Apply liquid gasket or sealing tape to the bolt "A".

NOTICE

- **When installing the bearing retainer, the gasket must be installed in such a way that the gasket notch matches the oil drain hole on the case so as not to block the hole.**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #HP-17 or equivalent.**


SHTS033220200068

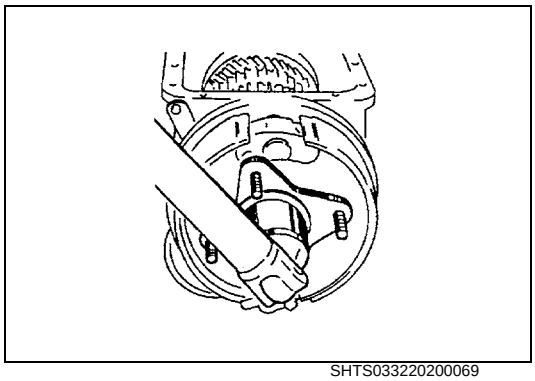
12. INSTALL THE REAR BEARING RETAINER.

(1) Coat both sides of the gasket with liquid gasket.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #HP-17 or equivalent.**

(2) Apply liquid gasket or sealing tape to the bolt.

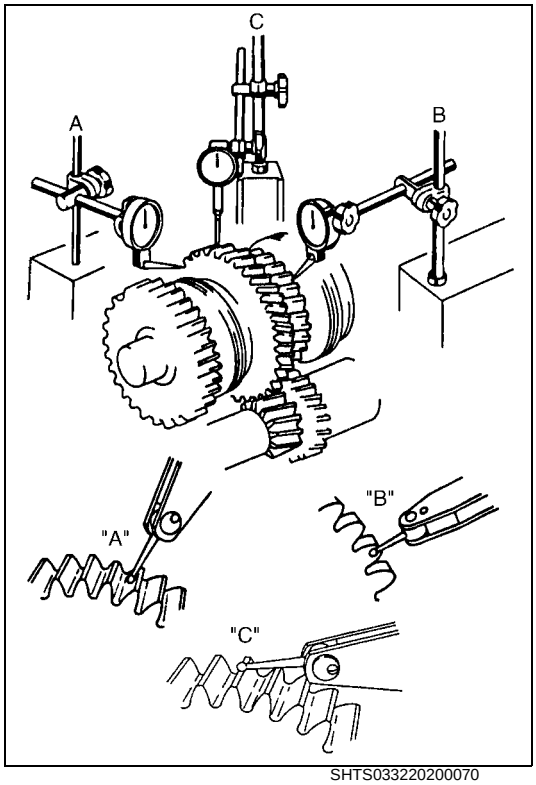

SHTS033220200069

13. INSTALL THE OUTPUT SHAFT LOCK NUT.

(1) Before tightening the lock nut engage two gears so that the shaft can not be turned around.

(2) Install the lock nut to the output shaft and tighten it.
SST: Socket Wrench (S0983-95005)

NOTICE
Do not damage the O-ring.



SHTS033220200070

14. MEASURE THE GEAR BACKLASH, END PLAY AND RADIAL PLAY.

(1) Block the counter shaft with a pry bar when measuring.

<BACKLASH "A"> **Unit: mm {in.}**

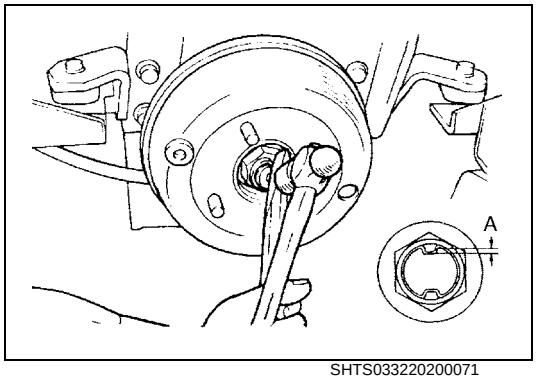
	Assembly Standard	Service Limit
Reverse gear	0.08-0.16 {0.0032-0.0062}	0.4 {0.0157}
1st gear	0.08-0.18 {0.0032-0.0070}	
2nd gear	0.08-0.16 {0.0032-0.0062}	
3rd gear		
4th gear	0.04-0.12 {0.0016-0.0047}	
6th gear		
Input shaft gear		

<END PLAY "B"> **Unit: mm {in.}**

	Assembly Standard	Service Limit
Reverse gear	0.20-0.35 {0.0079-0.0137}	0.5 {0.0197}
1st gear	0.15-0.30 {0.0060-0.0118}	
2nd gear		
3rd gear		
4th gear		
6th gear	0.15-0.50 {0.0060-0.0196}	

<RADIAL PLAY "C"> **Unit: mm {in.}**

	Assembly Standard
Reverse gear	0.033-0.111 {0.0013-0.0043}
1st gear	
2nd gear	0.022-0.071 {0.0009-0.0027}
3rd gear	0.020-0.068 {0.0008-0.0026}
4th gear	0.021-0.095 {0.0009-0.0037}
6th gear	0.021-0.062 {0.0009-0.0024}



SHTS033220200071

15. CAULK THE OUTSIDE RIM OF THE OUTPUT SHAFT LOCK NUT.

(1) Using a hammer and a chisel, caulk the outside rim of the lock nut into the groove on the output shaft.
A: More than 1.5 mm {0.0591 in.}

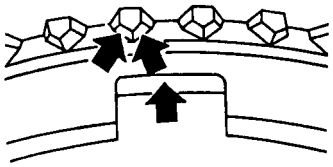
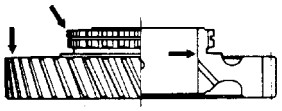
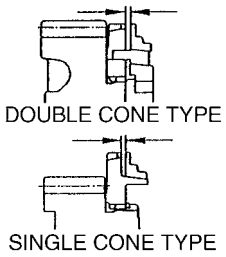
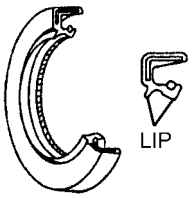
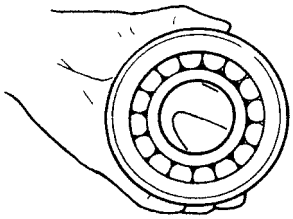
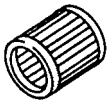
NOTICE

- **The caulking should fit the groove thoroughly.**
- **The caulking should be done without rift.**

INSPECTION AND REPAIR

EN0332202H300002

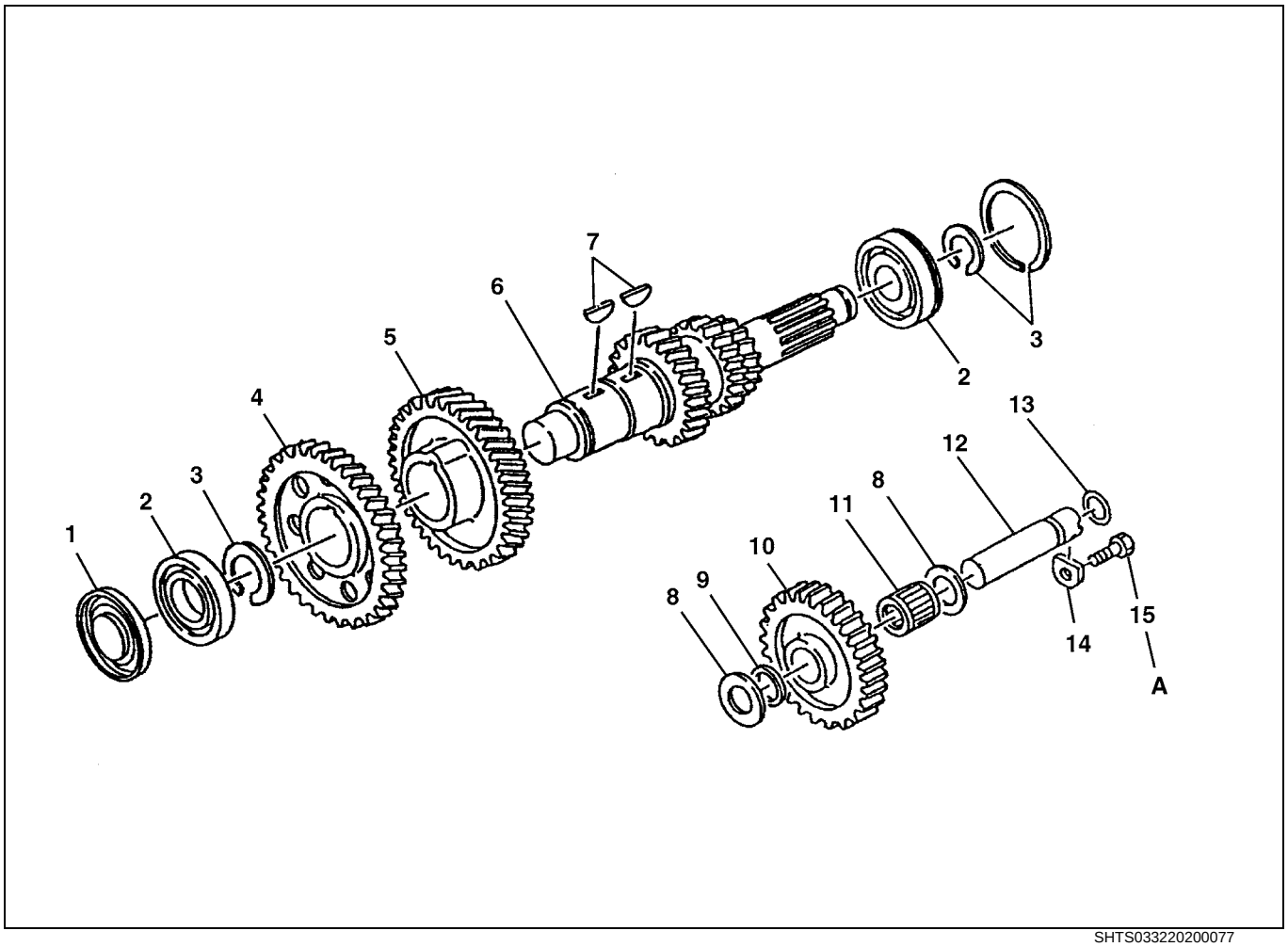
Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Synchronizer ring, deformity, crack and excessive damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Gear excessive wear, chips and cracks	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Clearance between synchronizer ring and synchronizer cone or gear sub assembly	**2nd, 3rd and 4th gear 1.0-1.8 {0.0394-0.0708}** **6th and Input gear 1.2-2.0 {0.0473-0.0787}**	**0.2 {0.0079}**	**Replace the synchronizer ring and/or gear sub assembly.**	**Measure** 
Oil seal lip wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Cylindrical roller bearing and ball bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Needle roller bearing in deformed shape	**—**	**—**	**Replace, if necessary.**	**Visual check** 

COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS

COMPONENT LOCATOR

EN0332202D100003



SHTS033220200077

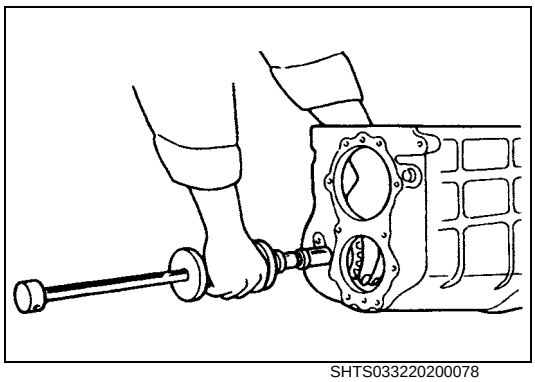
1	Seal cover	9	Spacer
2	Cylindrical roller bearing	10	Reverse idler gear
3	Retainer ring	11	Needle roller bearing
4	Counter drive gear	12	Reverse idler shaft
5	Counter 6th gear	13	O-ring
6	Counter shaft	14	Lock plate
7	Woodruff key	15	Bolt
8	Thrust washer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	19-25 {190-260, 14-18}		

OVERHAUL

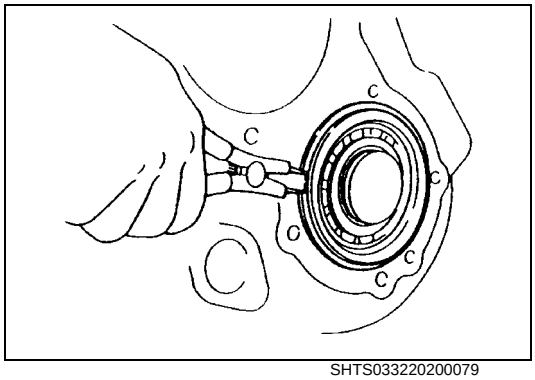
EN0332202H200003


SHTS033220200078

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE IDLER SHAFT AND IDLER GEAR.

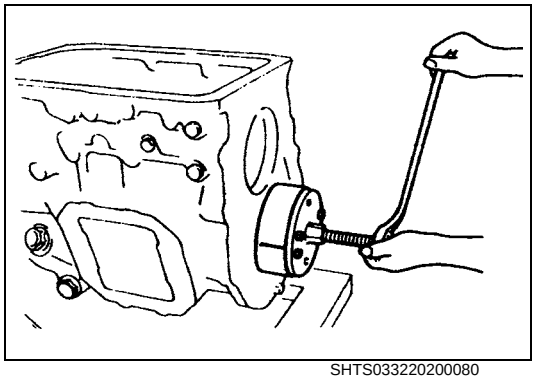
(1) Using a special tool, pull out the reverse idler shaft while holding the reverse idler gear thrust washers and bearing inside the case.
SST: Sliding Hammer (S0942-01442)


SHTS033220200079

2. REMOVE THE COUNTER SHAFT REAR BEARING.

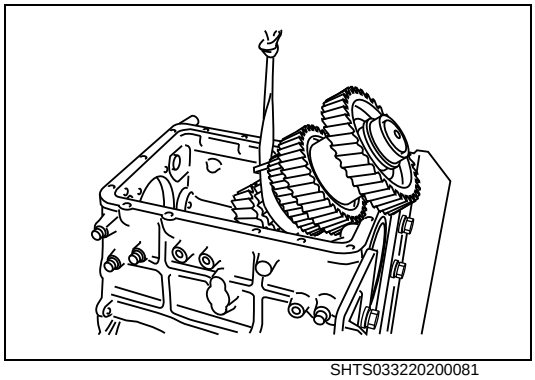
(1) Remove the retainer rings from the counter shaft and the cylindrical roller bearing.

⚠ CAUTION
The retainer ring is spring steel and may fly out of groove during removal. Wear safety glasses during removal.


SHTS033220200080

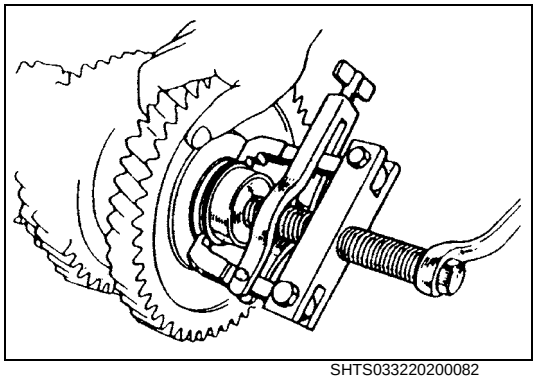
(2) Install the special tools on the rear cylindrical roller bearing and remove it.
SST:
Hook (S0965-31180)
Puller (S0965-01900)

NOTICE
Insert the hook's click into the groove for the retainer ring then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.


SHTS033220200081

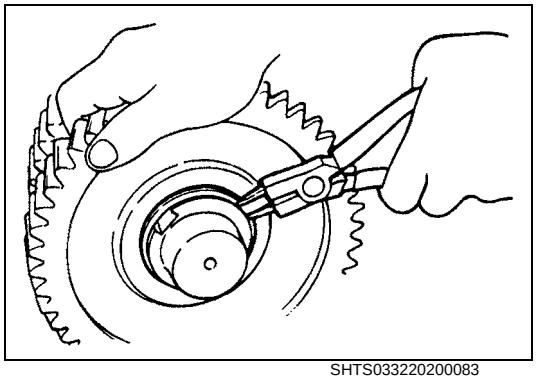
3. REMOVE THE COUNTER SHAFT FROM THE TRANSMISSION CASE.

(1) Tie a rope or hook around the counter shaft and carefully pry the counter shaft assembly rearward until the front end of the shaft is cleared out of the front cylindrical roller bearing.
(2) Carefully lift the counter shaft assembly from the case.


SHTS033220200082

4. REMOVE THE CYLINDRICAL ROLLER BEARING INNER RACE.

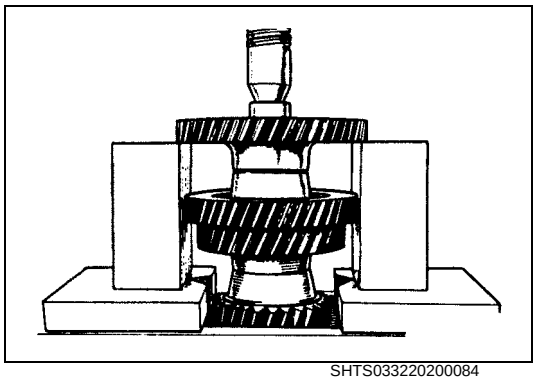
(1) Using a special tool on the inner race, pull out the front cylindrical roller bearing inner race from the counter shaft.
SST: Puller (S0965-01101)


SHTS033220200083

5. REMOVE THE COUNTER SHAFT GEARS.

(1) Remove the retainer ring.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.

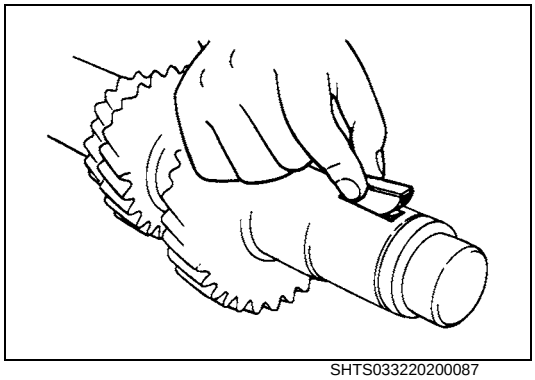

SHTS033220200084

(2) Support the counter shaft drive gear as close as possible to the gear hub and press the counter shaft front end until it is free of the drive gear.

(3) Support the counter 6th gear under the gear teeth and press the counter shaft out of the gear.

NOTICE
When removing the counter shaft gears, do not allow the shaft to drop to on a hard surface.

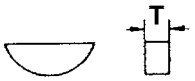
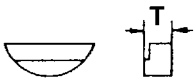
⚠ CAUTION
Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.

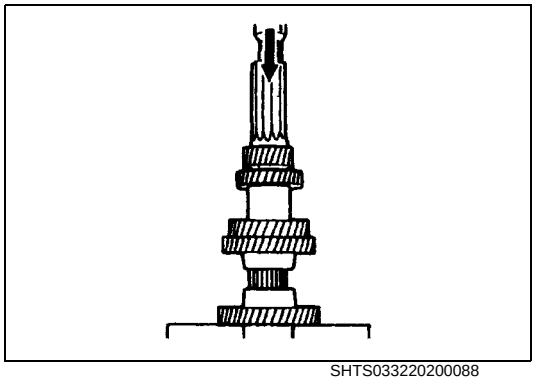

SHTS033220200087

IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE COUNTER DRIVE GEAR AND COUNTER 6TH GEAR.

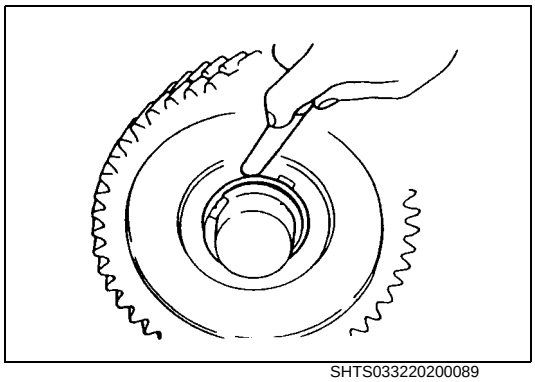
(1) Select the proper size key according to the size of the key groove.

Thickness "T"	Shape
10.015-10.024 mm {0.3943-0.3946 in.}	
10.080-10.090 mm {0.3969-0.3972 in.}	


SHTS033220200088

(2) Press the counter shaft into the gears making certain that the key and keyway are aligned.

NOTICE
Ensure that the gears are installed in the proper direction.


SHTS033220200089

(3) Select a retainer ring that will provide a tight fit and install it on the shaft.

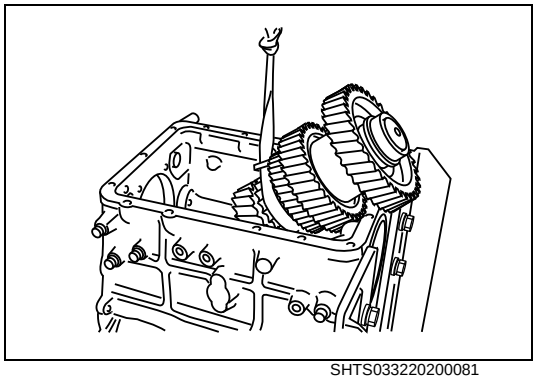
NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

Clearance: Less than 0.1 mm {0.0039 in.}
Retainer rings are available in the following sizes.

Thickness	Color code
2.4 mm {0.0945 in.}	**Brown**
2.5 mm {0.0984 in.}	**Blue**
2.6 mm {0.1024 in.}	**Green**
2.7 mm {0.1063 in.}	**Yellow**
2.8 mm {0.1102 in.}	**Red**

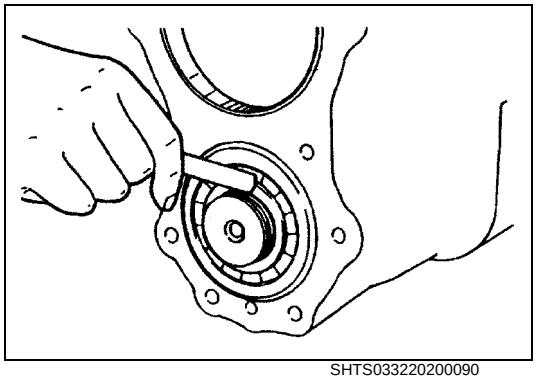
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS033220200081

2. INSTALL THE COUNTER SHAFT IN THE TRANSMISSION CASE.

NOTICE

- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


SHTS033220200090

(1) Select a retainer ring that will provide a tight fit and install it on the shaft.

NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

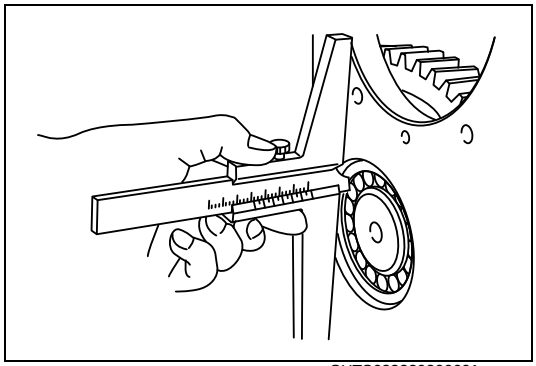
Clearance: Less than 0.1 mm {0.0039 in.}

Retainer rings are available in the following sizes.

Thickness	Color code
2.4 mm {0.0945 in.}	Green
2.5 mm {0.0984 in.}	Brown
2.6 mm {0.1024 in.}	Sky-blue
2.7 mm {0.1063 in.}	Black

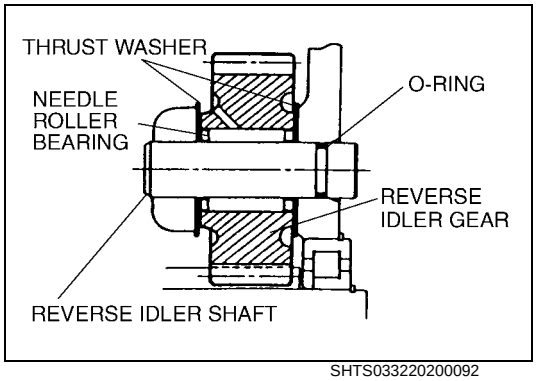
⚠ CAUTION

The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS033220200091

3. DISTANCE BETWEEN THE GEAR CASE OUTER SURFACE AND THE FRONT BEARING OUTER RACE.
Assembly Standard: 1.7-2.2 mm {0.0670-0.0866 in.}

4. PRESS IN THE SEAL COVER AND MAKE IT FLUSH WITH THE CASE FRONT.

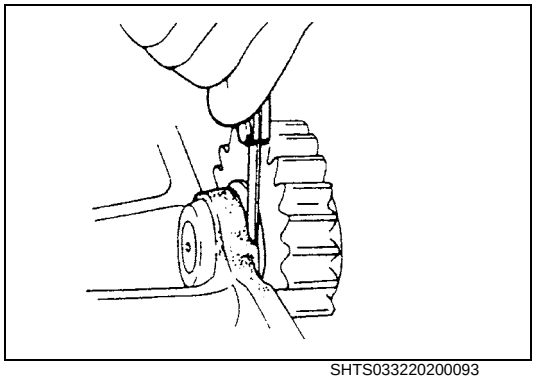


SHTS033220200092

5. INSTALL THE REVERSE IDLER GEAR.

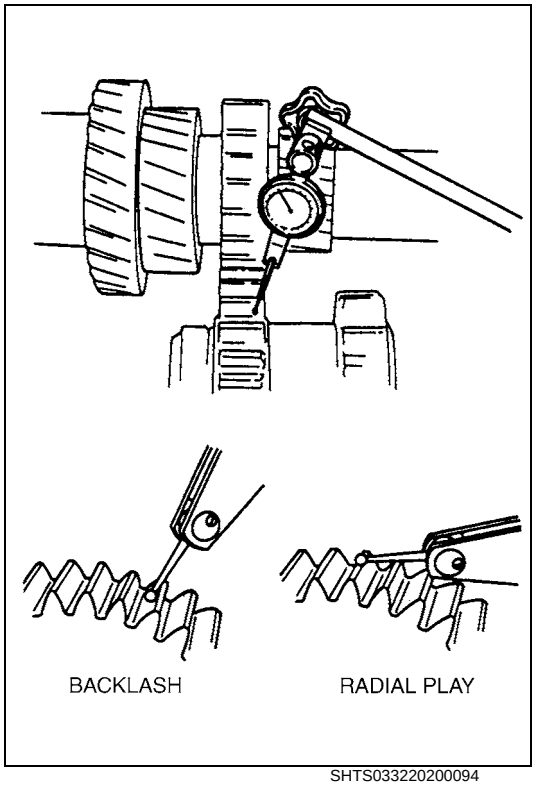
NOTICE

- **Apply a light coat of gear oil to the needle roller bearing, spacer and thrust washers before assembling them.**
- **Be sure the gear is installed in the proper direction.**
- **Make sure that O-ring is in the shaft groove.**



SHTS033220200093

6. **MEASURE THE REVERSE IDLER GEAR END PLAY.**
   Assembly Standard: 0.15-0.70 mm {0.0060-0.0275 in.}
   Service Limit: 0.7 mm {0.0276 in.}



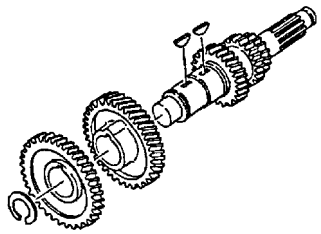
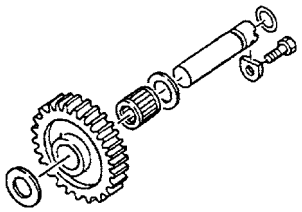
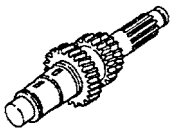
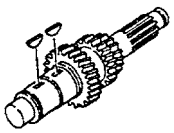
SHTS033220200094

7. **MEASURE THE BACKLASH BETWEEN THE REVERSE IDLER GEAR AND THE COUNTER SHAFT REVERSE GEAR.**
   Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}
   Service Limit: 0.4 mm {0.0157 in.}

8. **MEASURE THE REVERSE IDLER GEAR RADIAL PLAY.**
   Assembly Standard: 0.016-0.055 mm {0.0007-0.0021 in.}

INSPECTION AND REPAIR

EN0332202H300003

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
All gears for cracks and defects	—	—	Replace, if necessary.	Visual check 
Idler gear, shaft and needle roller bearing wear and damage	—	—	Replace, if necessary.	Visual check 
Counter shaft wear, chips and cracks	—	—	Replace, if necessary.	Visual check 
Counter shaft key way damage and looseness	—	—	Replace the counter shaft and/or key, if necessary.	Visual check 

TRANSMISSION MAIN UNIT (MF06S)

TR02-003

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INSPECTION AND REPAIR TR02-26

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COMPONENT LOCATOR TR02-27
OVERHAUL TR02-28
INSPECTION AND REPAIR TR02-33

TRANSMISSION ASSEMBLY

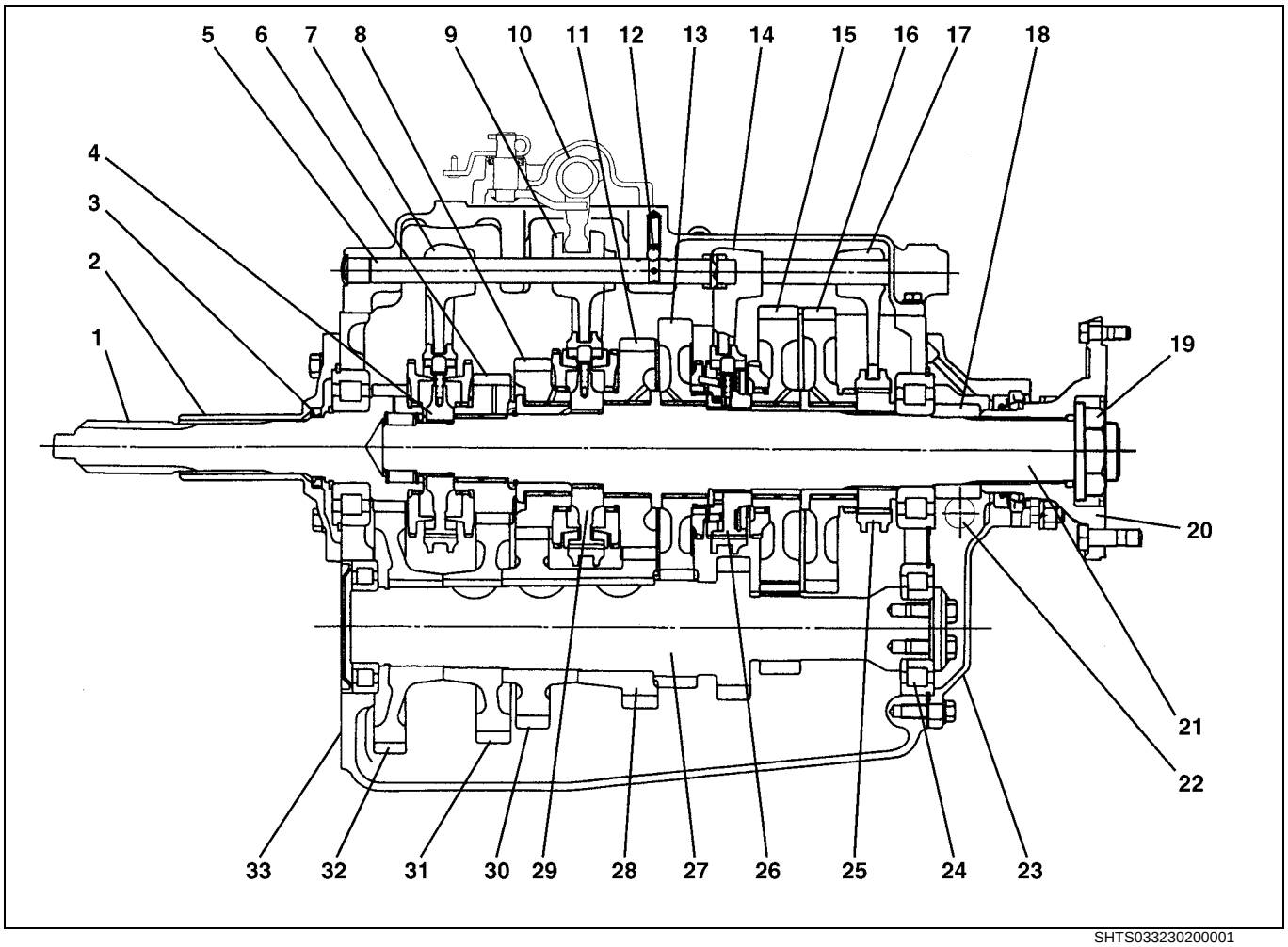
DATA AND SPECIFICATIONS

EN0332302I200001

Type		I	II
Type		Six forward speeds, one reverse 2, 3, 4, 5, 6th, Synchromesh, 1st and Reverse, Constant mesh	
Gear ratios:	1st	8.189	7.395
	2nd	5.340	4.758
	3rd	3.076	3.076
	4th	1.936	1.936
	5th	1.341	1.341
	6th	1.000	1.000
	Reverse	7.142	7.142
Number of teeth input shaft		22	
Number of teeth counter shaft	Counter drive gear	47	47
	1st gear	12	13
	2nd gear	20	22
	3rd gear	25	25
	4th gear	32	32
	5th gear	43	43
	6th gear	—	—
	Reverse gear	21	21
Number of teeth output shaft	1st gear	46	45
	2nd gear	50	49
	3rd gear	36	36
	4th gear	29	29
	5th gear	27	27
	6th gear	—	—
	Reverse gear	46	46
Reverse idler gear		29/19	
Power take-off opening		On left side of gear case	
Oil capacity, gear box		Approx. 11.5 liters {2.53 Imp.gal, 3.04 US gal.}	
Oil capacity, gear box with power take-off		Approx. 11.8 liters {2.6 Imp.gal, 3.1 US gal.}	
Lubricant, type		Gear oil (API GL-4, MIL-L-2105)	
Viscosity, between -12 and 32°C {10 and 90°F}		SAE90	
Viscosity, above 32°C {90°F}		SAE140	

DESCRIPTION

EN0332302C100001



SHTS033230200001

1	Input shaft	18	Speedometer drive gear
2	Front bearing retainer	19	Lock nut
3	Oil seal	20	Flange
4	5th-6th synchronizer unit	21	Output shaft
5	Shift shaft	22	Speedometer driven gear
6	5th gear	23	Rear bearing retainer
7	5th-6th shift fork	24	Cylindrical roller bearing
8	4th gear	25	Reverse shift sleeve
9	3rd-4th shift fork	26	1st-2nd synchronizer unit
10	Inner shift lever	27	Counter shaft
11	3rd gear	28	Counter 3rd gear
12	Steel ball	29	3rd-4th synchronizer unit
13	2nd gear	30	Counter 4th gear
14	1st-2nd shift fork	31	Counter 5th gear
15	1st gear	32	Counter drive gear
16	Reverse gear	33	Transmission case
17	Reverse shift fork		

TROUBLESHOOTING

EN0332302F300001

Symptom	Possible cause	Remedy/Prevention
Gear slip-off (Control system)	Joint worn and/or damaged	Replace joint.
	Bolts and nuts loose	Tighten bolts and nuts.
	Improper link rod adjustment	Adjust link rod.
Gear slip-off (Gear shift housing)	Lock ball and spring distorted and/or broken	Replace or replace as required.
	Groove for shift shaft worn	Replace shift fork.
Gear slip-off (Transmission gear)	Synchronizer hub and sleeve worn	Replace as required.
	Synchronizer sleeve and gear clutch teeth worn or damaged	Replace as required.
	Input shaft and/or output shaft bearing worn and/or broken	Replace bearing.
	Retainer ring and/or thrust washer worn and/or broken	Replace as required.
	Loosened transmission to engine mounting bolts	Tighten bolts.
Difficult gear engagement (Engine)	Engine idling speed too high	Adjust engine idling.
Difficult gear engagement (Clutch)	Improper disengagement of clutch	Adjust clutch.
	Clutch disc sticking	Repair or replace.
	Clutch shifter sleeve bent	Replace shifter sleeve.
Difficult gear engagement (Transmission)	Input shaft and/or output shaft bearing worn and/or damaged	Replace bearing.
	Engine crankshaft pilot bearing worn and/or damaged	Replace bearing.
	Synchronizer cone and ring worn	Replace as required.
Difficult gear engagement (Control system)	Looseness of control system and/or improper adjustment	Tighten and adjust control system.
	Improper motion of gear shift lever	Adjust shift lever.
Difficult gear engagement (Lubrication)	Improper lubrication of control lever	Lubricate as required.
	Shortage gear oil and/or low oil viscosity	Add oil or change oil as required.
Noise (Transmission)	Grinding in transmission	Check for screws, bolts or other foreign materials in transmission.
	Loose transmission-to-engine mounting bolts	Tighten bolts.
	Worn or damaged gear and bearing	Replace as required.
Noise (Lubrication)	Shortage of gear oil and/or low oil viscosity	Add oil or change oil as required.
Gear oil leaks (Transmission)	Leaks at the front and rear bearing retainer seal and gasket, case cover gasket, sand hole of case or shift shaft expansion plug	Repair and replace as required.
	Improper amount of gear oil and lack of oil viscosity	Check oil level and type.

Symptom	Possible cause	Remedy/Prevention
Gears are difficult to engage or cannot be engaged when engine is not operating.	Control cable damaged, bent, deteriorated or deformed due to heat	Replace control cable.
	Loose parts	Inspect and tighten.
	Damaged shift lever assembly	Replace shift lever.
	Damaged or bent parts on upper transmission cover section (lever, spring, etc.)	Replace.
	Faulty adjustment of control cable assembly and link rod	Adjust.
The play of the lever is excessive.	A joint is seriously worn.	Replace the joint.
	Looseness of tightening bolt and nut	Inspect and tighten each the bolts and the nuts.

SPECIAL TOOL

EN0332302K100001

Prior to starting a transmission overhaul, it is necessary to have these special tools.

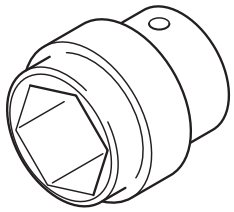
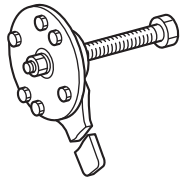
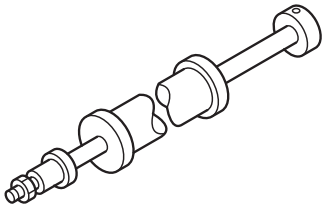
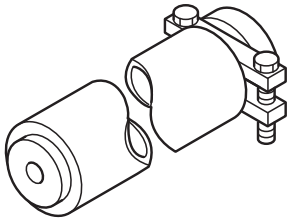
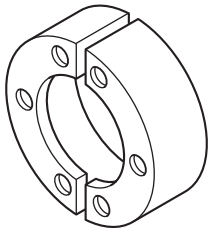
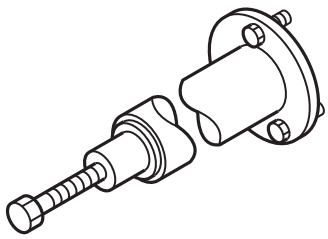
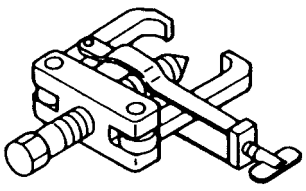
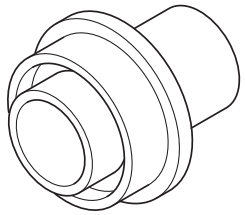
Illustration	Part number	Tool name	Remarks
	S0983-96504	SOCKET WRENCH	
	S0965-01900	PULLER	
	S0942-01442	SLIDING HAMMER	
	S0965-02070	INPUT SHAFT PULLER	
	S0965-31190 S0965-31210	HOOK	
	S0965-01881	PULLER	
	S0965-01101	PULLER	

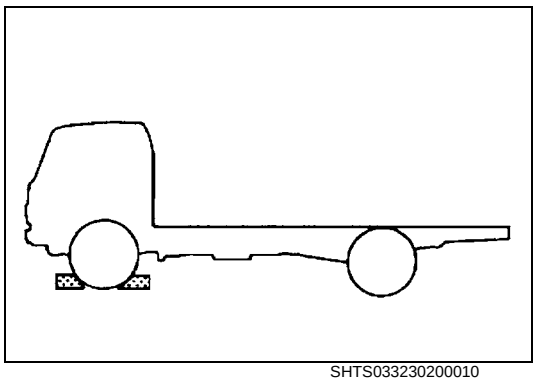
Illustration	Part number	Tool name	Remarks
	S0965-91250	ADAPTER	

DISMOUNTING AND MOUNTING

EN0332302H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033230200010

1. BLOCK THE WHEELS.

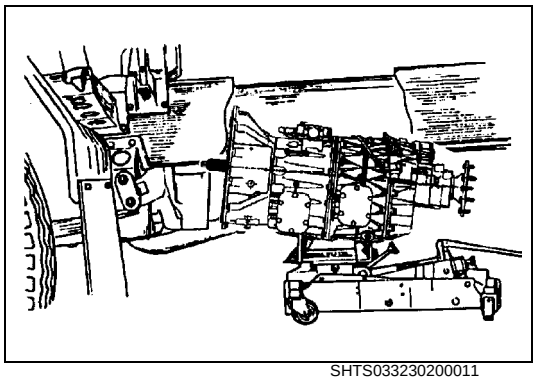
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

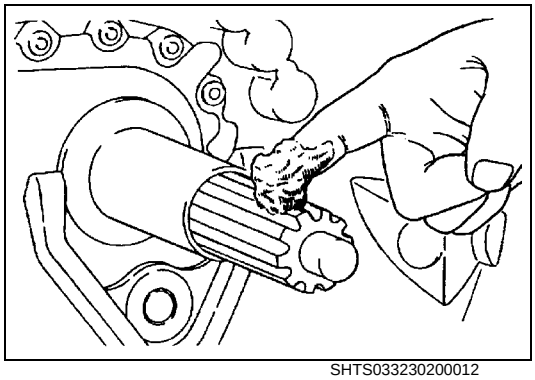
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



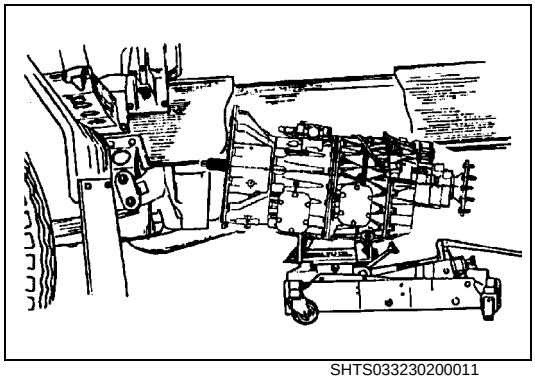
SHTS033230200011

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033230200012

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033230200011

2. INSTALL THE TRANSMISSION.

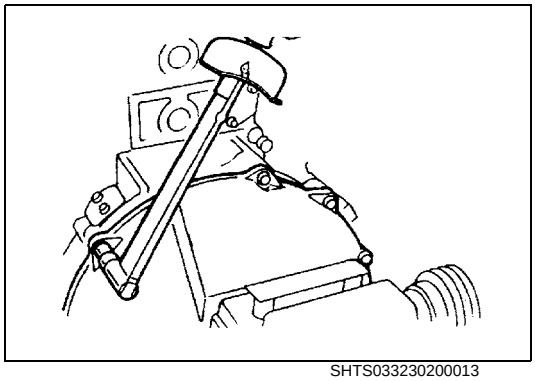
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033230200013

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

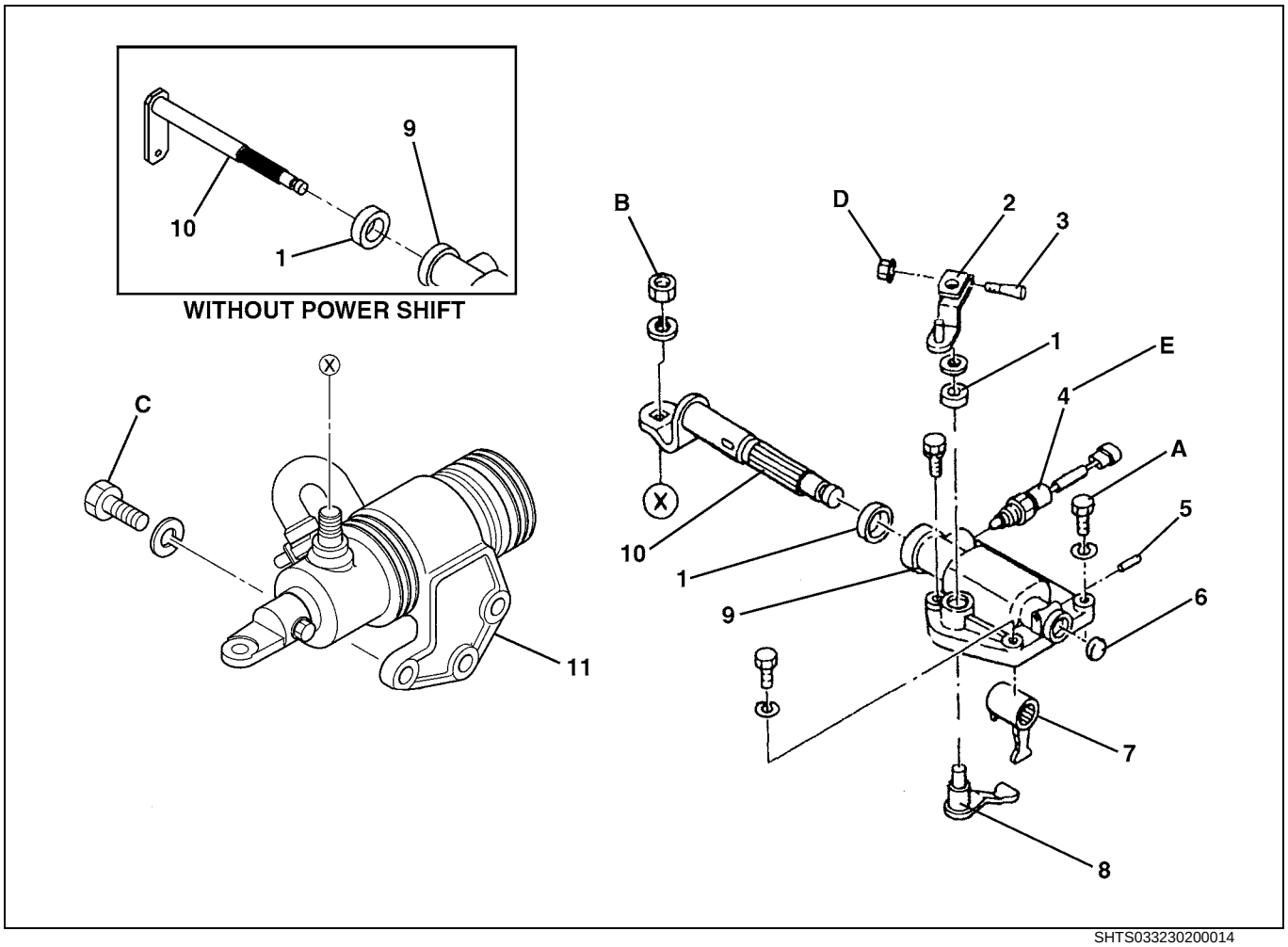
9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

GEAR SHIFT HOUSING

COMPONENT LOCATOR

EN0332302D100001

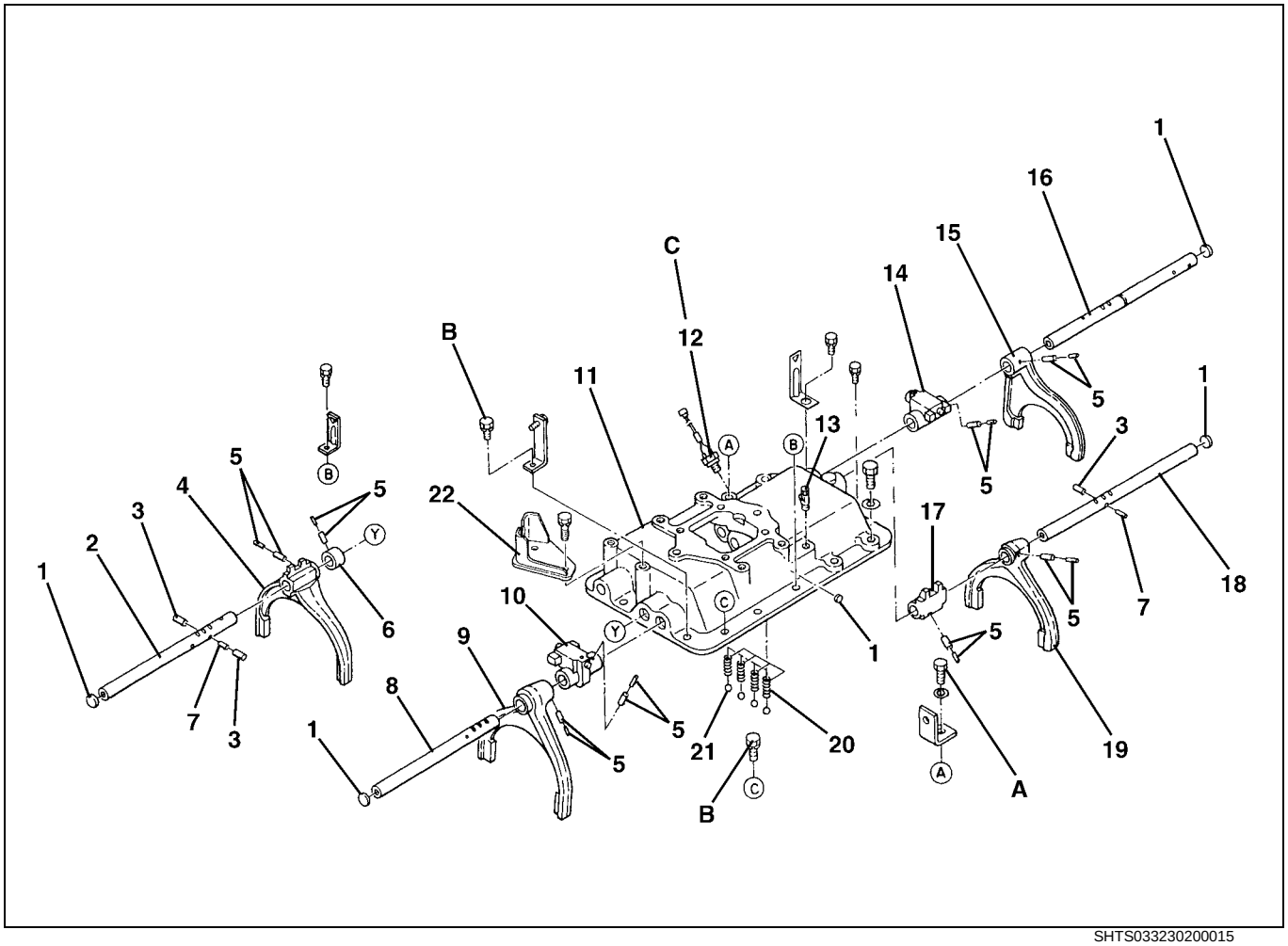


SHTS033230200014

1	Oil seal	7	Inner shift lever
2	Outer select lever	8	Select lever shaft
3	Select lever pin	9	Shift lever shaft housing
4	Neutral switch	10	Shift lever shaft
5	Lock pin	11	Power shift unit (If so equipped)
6	Expansion plug		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	37.5-48.5 {383-494, 28-35}	D	9.8-11.8 {100-120, 7.3-8.6}
B	101-147 {1,030-1,498, 75-108}	E	34-38 {347-387, 26-28}
C	64-86 {653-876, 48-63}		



SHTS033230200015

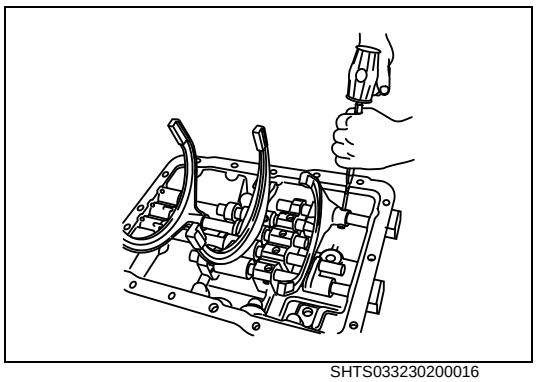
1	Expansion plug	12	Back-up light switch
2	3rd-4th shift shaft	13	Air breather
3	Interlock plunger	14	Reverse shift head
4	3rd-4th shift fork	15	Reverse shift fork
5	Concentric pins	16	Reverse shift shaft
6	Collar	17	1st-2nd shift head
7	Interlock pin	18	1st-2nd shift shaft
8	5th-6th shift shaft	19	1st-2nd shift fork
9	5th-6th shift fork	20	Compression spring
10	5th-6th shift head	21	Steel ball
11	Transmission case cover	22	Link rod support lower bracket

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	93-117 {950-1,200, 69-86}	C	26-30 {266-305, 20-22}
B	37.5-48.5 {383-494, 28-35}		

OVERHAUL

EN0332302H200001



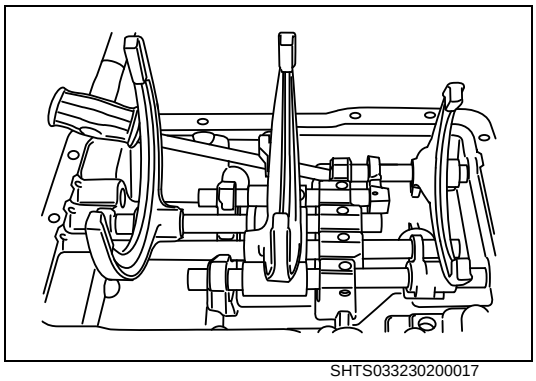
SHTS033230200016

IMPORTANT POINT - DISASSEMBLY

1. REMOVE THE GEAR SHIFT SHAFT, SHIFT FORK, SHIFT HEAD AND COLLAR.

(1) Set each shaft in the neutral position.

(2) Tap the shift head and shift fork fitting pins lightly with a 3.5 mm {0.138 in.} diameter tapping rod.



SHTS033230200017

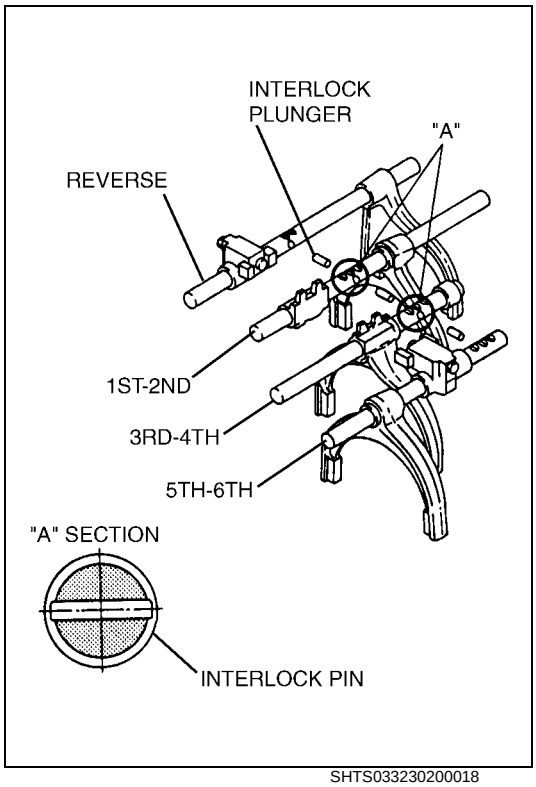
(3) Drive out the shift shafts and its expansion plugs one at a time. When removing the shift shaft, remove the shift fork and the shift head.

NOTICE

Take care not to damage the sliding bore.

⚠ CAUTION

The steel ball may fly out of the hole when removing the shift shaft. Wear safety glasses during removal.



SHTS033230200018

IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE STEEL BALL, COMPRESSION SPRING, SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.

(1) Place the ball and spring in the hole.

(2) Depress the ball and spring with a suitable tool.

⚠ CAUTION

The steel ball may fly out of the hole when installing the shift shaft. Wear safety glasses during installation.

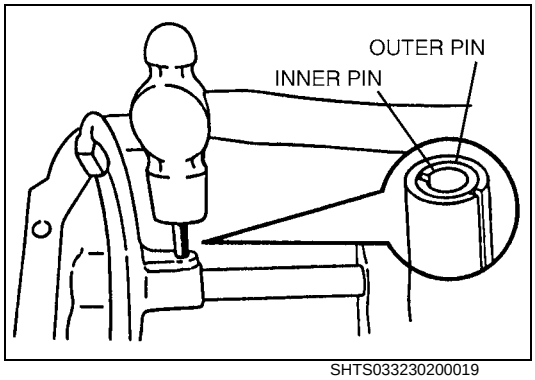
(3) Coat the shift shaft with gear oil.

(4) Align the shift fork and head and put the shift shaft through, and then slide the shift shaft over the ball.

(5) Place the shift shaft in neutral position.

NOTICE

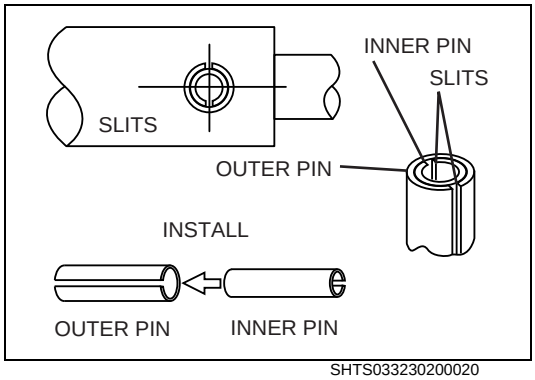
- **Pay special attention to the position and direction of the shift fork and shift head.**
- **For 1st-2nd and 3rd-4th shift shafts, insert the interlock pin. Coat the interlock pin with bearing grease.**



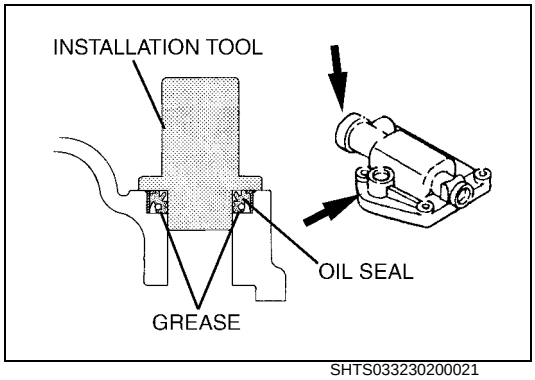
SHTS033230200019

2. SECURE THE SHIFT HEAD AND FORK WITH CONCENTRIC PINS.

(1) Drive the concentric pins into the fork and the head. Make sure that the slits of the concentric pins are on opposite sides as shown.



SHTS033230200020



SHTS033230200021

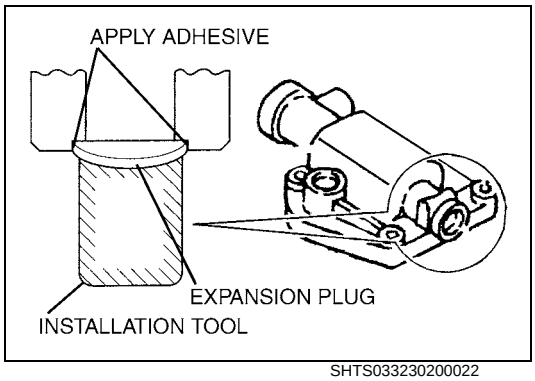
3. INSTALL THE OIL SEAL.

(1) Drive the new oil seal into the shift lever shaft housing with the installation tool.

(2) Coat the sealing surface between the seal lips with bearing grease.

NOTICE

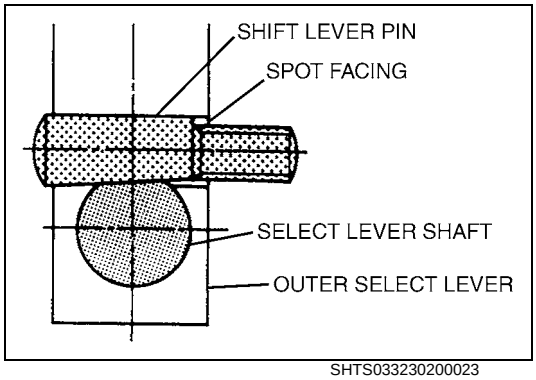
- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**



SHTS033230200022

4. INSTALL THE EXPANSION PLUG.

(1) Apply adhesive all around to the expansion plug.

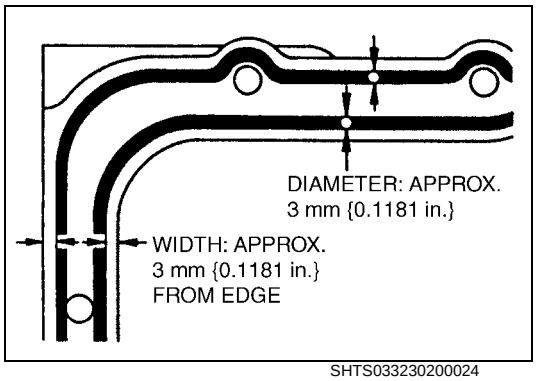


SHTS033230200023

5. INSERT THE SHIFT LEVER PIN INTO THE OUTER SELECT LEVER.

NOTICE

Pay attention to the position of the shift and the direction of the shift lever pin.



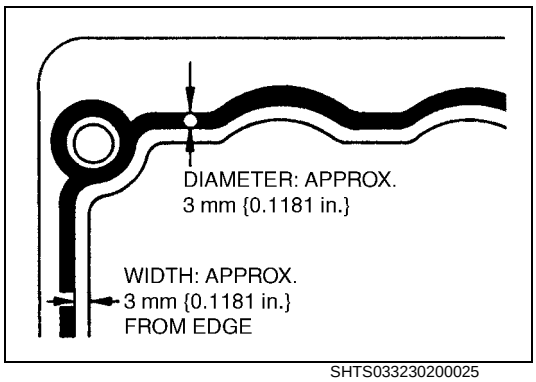
SHTS033230200024

6. INSTALL THE TRANSMISSION CASE COVER.

(1) Coat the face of the transmission case with liquid gasket.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



SHTS033230200025

7. INSTALL THE SHIFT LEVER SHAFT HOUSING.

(1) Coat the face of the transmission case cover with liquid gasket.

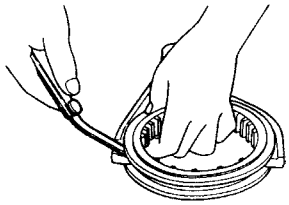
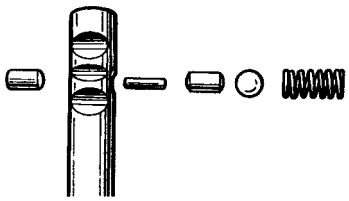
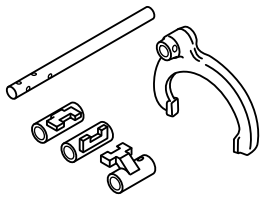
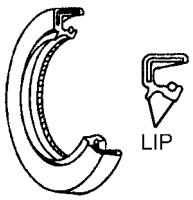
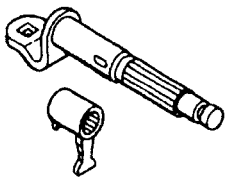
NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

INSPECTION AND REPAIR

EN0332302H300001

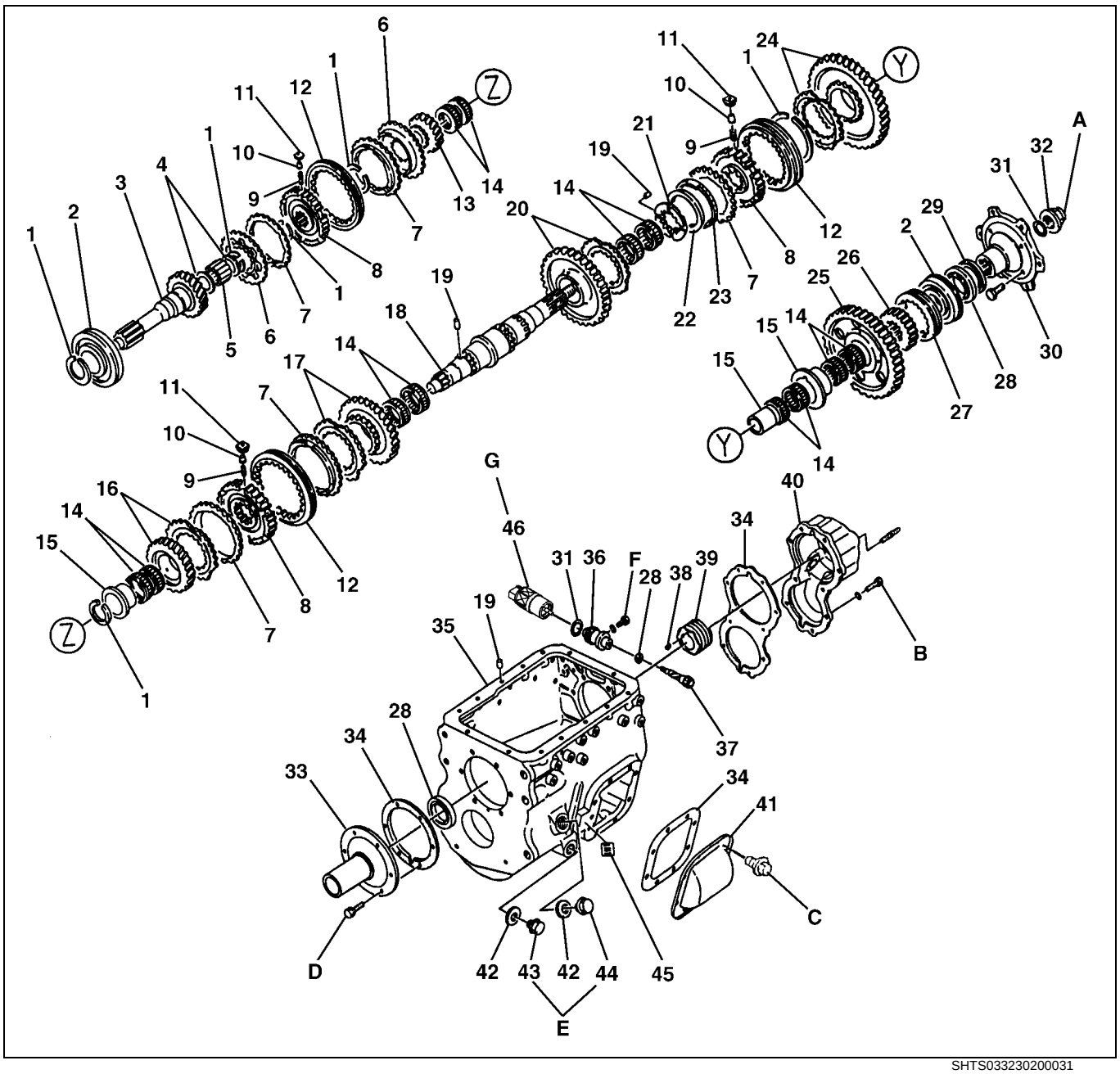
Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Clearance between shift fork and sleeve	0.20-0.45 {0.0079-0.0177}	1.0 {0.0394}	Replace.	Measure 
Interlock pin, interlock plunger, compression spring and steel ball wear and damage	—	—	Replace, if necessary.	Visual check 
Shift head, shift fork and shift shaft wear and damage	—	—	Replace, if necessary.	Visual check 
Oil seal lip wear and damage	—	—	Replace, if necessary.	Visual check 
Shift lever shaft and inner shift lever wear and damage	—	—	Replace, if necessary.	Visual check 

INPUT SHAFT, OUTPUT SHAFT, GEARS AND RELATED PARTS

COMPONENT LOCATOR

EN0332302D100002



SHTS033230200031

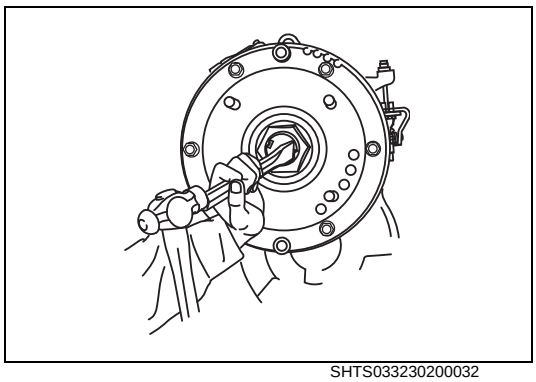
1	Retainer ring	24	1st gear sub-assembly
2	Cylindrical roller bearing	25	Reverse gear
3	Input shaft	26	Constant hub
4	Spacer	27	Constant sleeve
5	Roller bearing	28	Oil seal
6	Synchronizer cone	29	Dust deflector
7	Synchronizer ring	30	Universal joint flange
8	Synchronizer hub	31	O-ring
9	Compression spring	32	Lock nut
10	Synchronizer head	33	Front bearing retainer
11	Synchronizer key	34	Gasket
12	Synchronizer sleeve	35	Transmission case
13	5th gear	36	Speedometer driven gear bushing
14	Needle roller bearing	37	Speedometer driven gear
15	Bushing	38	Key
16	4th gear sub-assembly	39	Speedometer drive gear
17	3rd gear sub-assembly	40	Rear bearing retainer
18	Output shaft	41	Power take-off cover
19	Pin	42	Soft washer
20	2nd gear sub-assembly	43	Drain plug
21	Synchronizer bushing	44	Filler plug
22	Synchronizer inner cone	45	Transmission speedometer gear and gear ratio plate
23	Synchronizer double cone	46	Speed sensor

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	587-783 {6,000-8,000, 434-578}	E	79-117 {800-1,200, 58-86}
B	73-93 {750-950, 55-68}	F	19-25 {190-260, 14-18}
C	19.5-24.5 {200-250, 15-18}	G	14.7-29.3 {150-300, 11-23}
D	64-86 {650-870, 47-62}		

OVERHAUL

EN0332302H200002

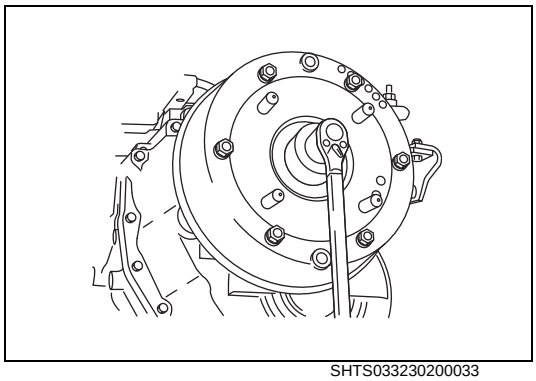


SHTS033230200032

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE OUTPUT SHAFT LOCK NUT.

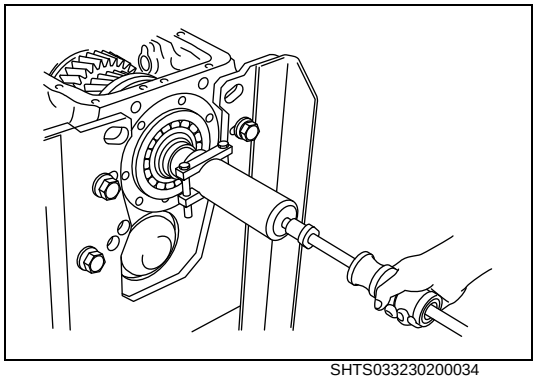
(1) The lock nut has been caulked, so before loosening it, lift the caulked part completely out of the shaft groove.



SHTS033230200033

(2) Using the special tool or the commercial tool, remove the lock nut.
SST: Socket Wrench (S0983-96504)

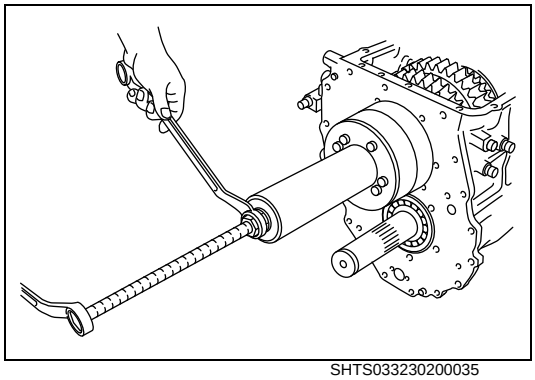
NOTICE
Before loosening the lock nut, engage two gears so that the output shaft can not be turned around.



SHTS033230200034

2. REMOVE THE INPUT SHAFT.

(1) Using the special tools, pull out input shaft with the accompanying bearings.
SST:
Input Shaft Puller (S0965-02070)
Sliding Hammer (S0942-01442)


SHTS033230200035

3. REMOVE THE OUTPUT SHAFT REAR BEARING.

(1) Remove the retainer ring.

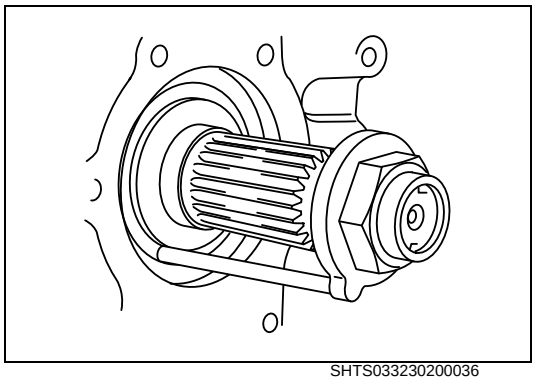
⚠ CAUTION

The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.

(2) Using the special tools, remove the output shaft rear bearing.
SST:
Hook (S0965-31210)
Puller (S0965-01881)

NOTICE

Insert the hook's click into the groove for the retainer ring, then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.

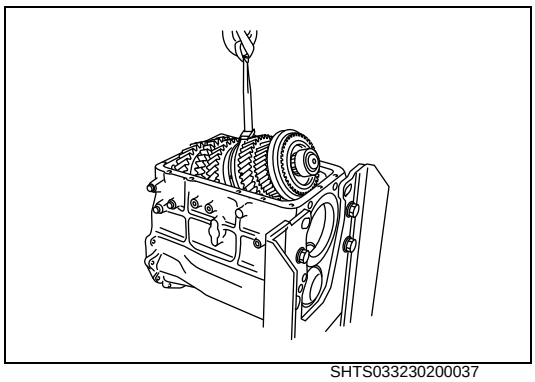

SHTS033230200036

4. REMOVE THE OUTPUT SHAFT ASSEMBLY FROM THE TRANSMISSION CASE.

(1) Attach a jig to the end of the output shaft.

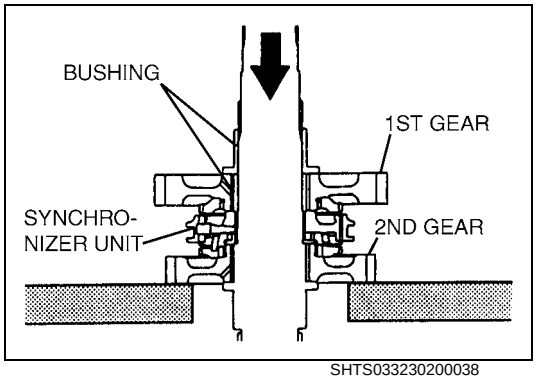
⚠ CAUTION

If the output shaft assembly is removed from the transmission without a jig, the reverse gear will drop from the shaft, which can possibly result in the personal injury.


SHTS033230200037

(2) Attach a suitable hook or other lifting device around the 3rd-4th speed synchronizer sleeve and carefully lift the output shaft assembly from the transmission case.

(3) When removing the output shaft assembly, remove the synchronizer ring and the cone of the input shaft gear.



SHTS033230200038

5. REMOVE THE BUSHINGS FROM THE OUTPUT SHAFT.

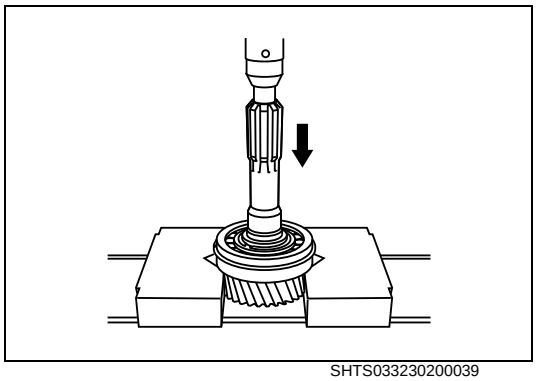
(1) Support the 2nd gear and press the output shaft front end through the bushings, 1st gear, synchronizer unit, 2nd gear and needle roller bearings.

NOTICE

When removing the output shaft, do not allow the shaft to drop on a hard surface.

⚠ CAUTION

Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.


SHTS033230200039

6. DISASSEMBLE THE INPUT SHAFT.

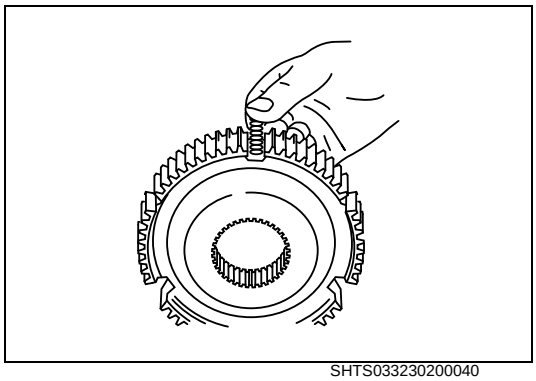
(1) Remove retainer ring.

(2) Using a press, remove the cylindrical roller bearing.

⚠ CAUTION

- **The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**
- **Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**

IMPORTANT POINTS - ASSEMBLY

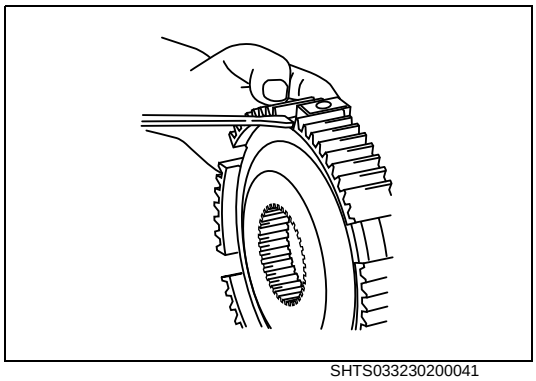

SHTS033230200040

1. ASSEMBLE THE SYNCHRONIZER UNIT.

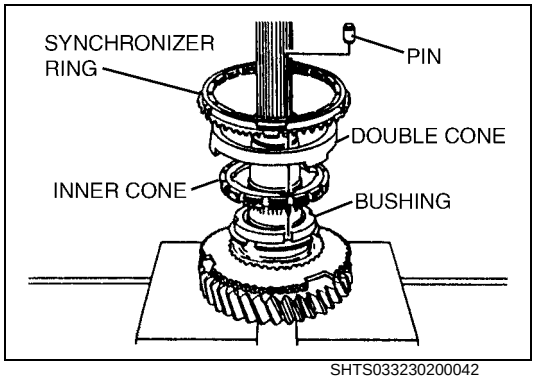
(1) Install the compression spring.

⚠ CAUTION

The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.


SHTS033230200041

(2) Install the synchronizer key and head.



SHTS033230200042

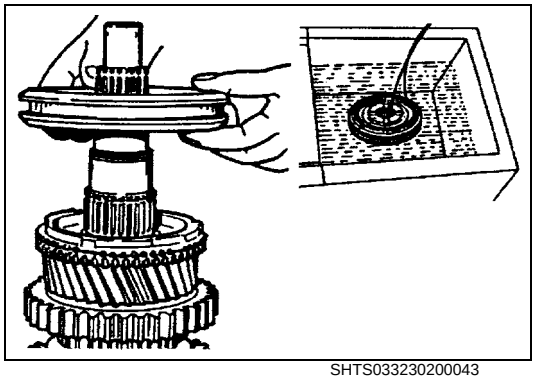
2. INSTALL THE 2ND GEAR, SYNCHRONIZER UNIT, 1ST GEAR, 1ST GEAR BUSHING AND REVERSE GEAR BUSHING.

(1) Install the needle roller bearing and 2nd gear.

NOTICE

Coat the needle roller bearing with gear oil during installation to provide initial lubrication.

(2) Install the synchronizer bushing, synchronizer inner cone, synchronizer double cone, synchronizer ring and pins on the 2nd gear.


SHTS033230200043

(3) Heat the synchronizer unit and bushing for about 5 minutes in water or oil heated to 80-100°C {176-212°F}.

(4) Install the synchronizer unit and other parts on the output shaft.

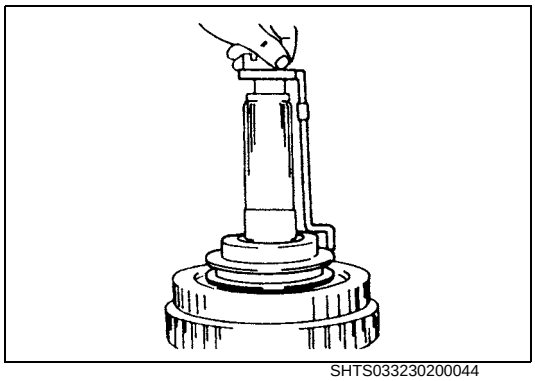
(5) Place the bushing on the output shaft against the end stop.

NOTICE

- **Do not heat the synchronizer unit and bushing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION

Never touch hot water or hot oil and heated synchronizer unit and bushing with your bare hand. This can result in personal injury.


SHTS033230200044

3. INSTALL THE REVERSE GEAR.

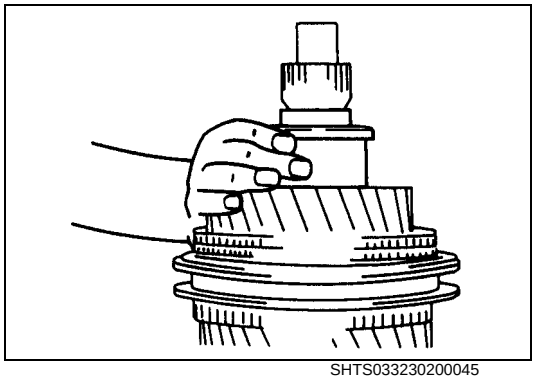
(1) Install the needle roller bearing and reverse gear.

(2) Install the constant hub and constant sleeve.

(3) Hold the constant hub with jig.

⚠ CAUTION

When installing the output shaft assembly in the transmission case, be careful not to drop the reverse gear from the shaft.

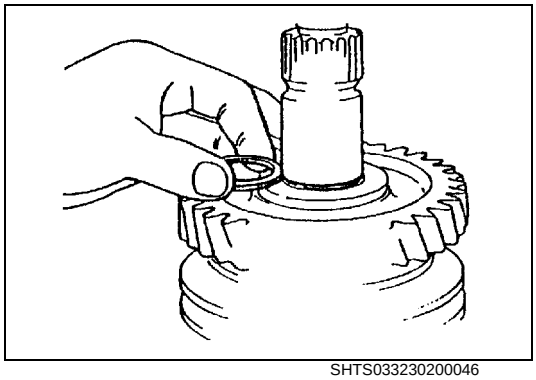

SHTS033230200045

4. INSTALL THE 3RD AND 4TH GEAR.

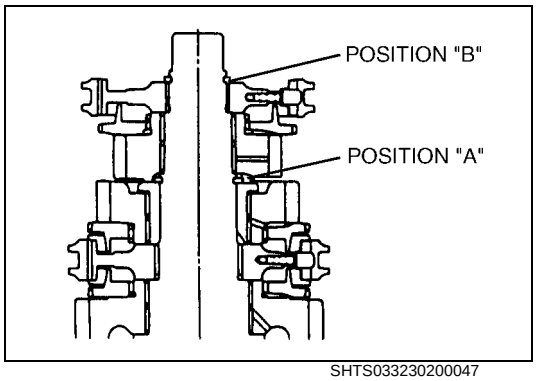
(1) Install the needle roller bearing and 3rd gear.

(2) Install the 3rd-4th gear synchronizer unit.

(3) Install the pin, 4th gear, needle roller bearing and bushing.



SHTS033230200046



SHTS033230200047

5. INSTALL THE GEARS, BUSHINGS, NEEDLE ROLLER BEARING, SYNCHRONIZER UNITS AND OTHER PARTS ON THE OUTPUT SHAFT.

NOTICE

Coat the needle roller bearings with gear oil during installation to provided initial lubrication.

(1) Select a retainer ring that will provide a tight fit.
Clearance: Less than 0.1 mm {0.0039 in.}

NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

Retainer rings are available in the following sizes: Position "A"

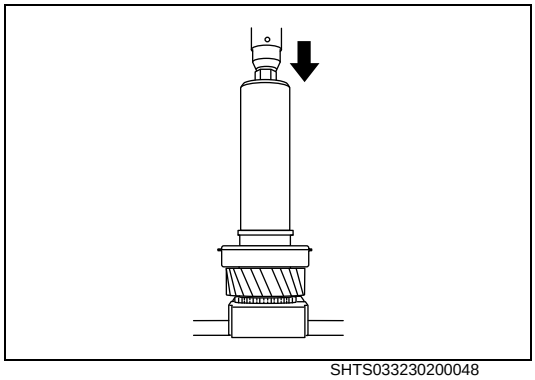
Thickness	Color code
2.4 mm {0.0945 in.}	None
2.5 mm {0.0984 in.}	White
2.6 mm {0.1024 in.}	Green
2.7 mm {0.1063 in.}	Brown
2.8 mm {0.1102 in.}	Blue

Retainer rings are available in the following sizes: Position "B"

Thickness	Color code
2.35 mm {0.0925 in.}	White
2.45 mm {0.0965 in.}	None
2.55 mm {0.1004 in.}	Blue

⚠ CAUTION

The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.

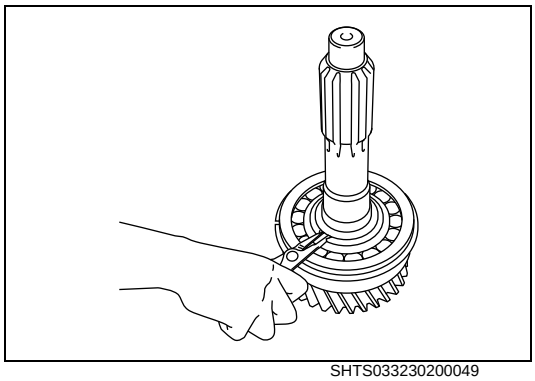

SHTS033230200048

6. ASSEMBLE THE INPUT SHAFT.

(1) Using a press, install the cylindrical roller bearing to the input shaft.

NOTICE

- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race**


SHTS033230200049

(2) Select a retainer ring.
Clearance: Less than 0.1 mm {0.0039 in.}

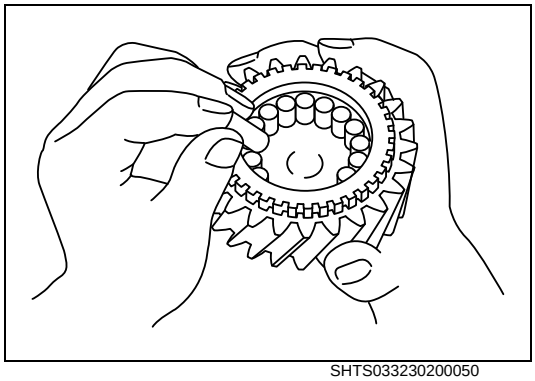
NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

Retainer rings are available in the following sizes.

Thickness	Color code
2.8 mm {0.1102 in.}	None
2.9 mm {0.1141 in.}	Blue
3.0 mm {0.1181 in.}	Green
3.1 mm {0.1220 in.}	Yellow
3.2 mm {0.1260 in.}	Red

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.

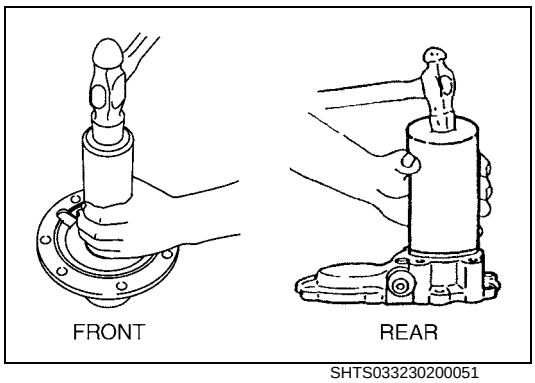

SHTS033230200050

7. INSTALL THE ROLLER BEARING IN THE COUNTERBORE OF THE INPUT SHAFT.

(1) Apply gear oil to the bearings.
(2) Place spacers at both ends of the bearings.
(3) Install the retainer ring.

NOTICE
Always use roller bearings of uniform diameter (15 pieces per set). There are 3 types of roller bearings in different diameters. There are distinguished by the colors red, blue, and white.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.



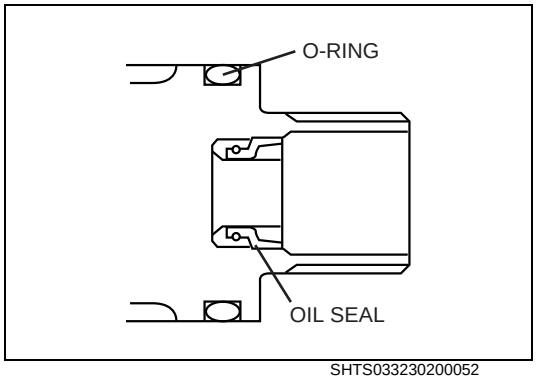
SHTS033230200051

8. REPLACE THE OIL SEAL OF THE FRONT AND REAR BEARING RETAINER.

(1) Using a screwdriver, remove the oil seal from the bearing retainer.
(2) Using a press and a suitable installing tool, press the oil seal into the front bearing retainer.
(3) Using a press and a special tool, press the oil seal into the rear bearing retainer.
SST: Adapter (S0965-91250)

NOTICE
Be sure the oil seal is installed in the proper direction.

(4) Coat bearing grease to the sealing surface between the seal lips.



SHTS033230200052

9. INSTALL THE SPEEDOMETER DRIVEN GEAR BUSHING.

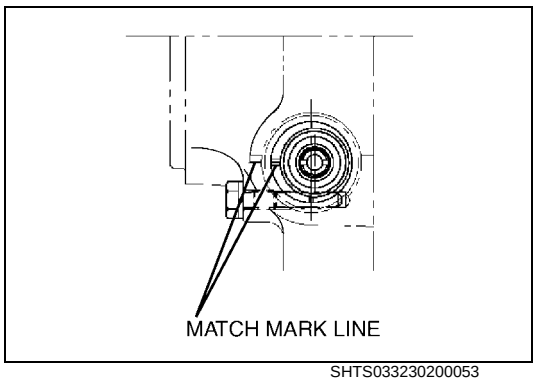
(1) Install the O-ring and oil seal to the bushing.

NOTICE

- **Coat the O-ring, oil seal and driven gear with bearing grease.**
- **Make sure that the oil seal is installed in the correct direction when replacing it.**

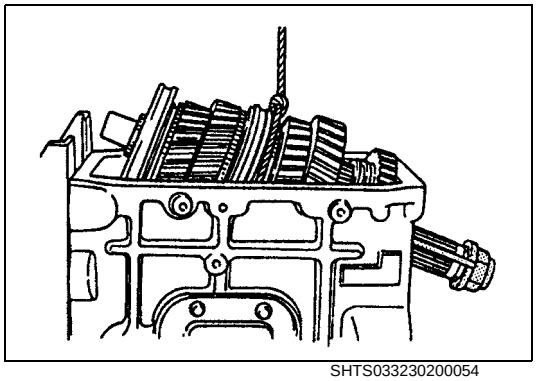
(2) Match the mark line on the bushing with the mark line on the rear bearing retainer.

(3) Align the speedometer driven gear bushing hole with the hole of the rear bearing retainer.



SHTS033230200053

Number of the drive gear teeth	Number of the driven gear teeth	The mark should be matched to the mark on retainer
7	18	18

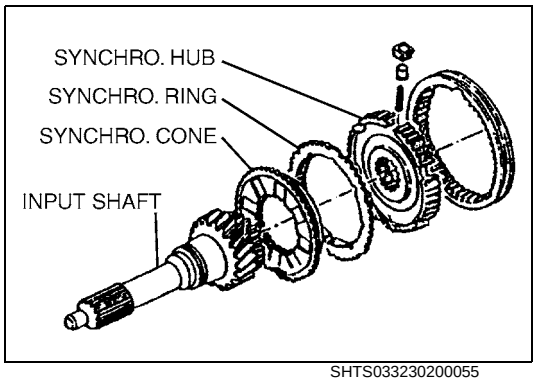

SHTS033230200054

10. INSTALL THE OUTPUT SHAFT ASSEMBLY IN THE TRANSMISSION CASE.

(1) Using ropes or some other lifting device, carefully lower the output shaft assembly into the case.

(2) When installing the output shaft assembly, install the synchronizer ring and cone of the input shaft gear.

(3) Place the output shaft assembly in position.

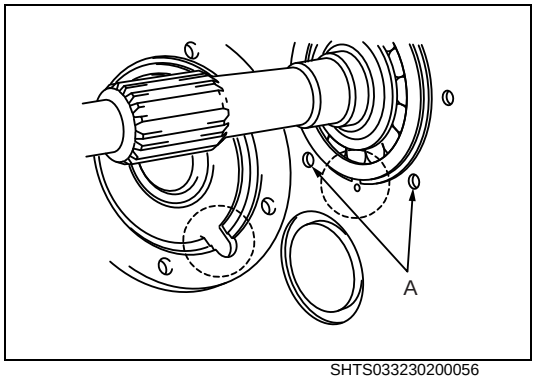


SHTS033230200055

11. INSTALL THE INPUT SHAFT INTO THE TRANSMISSION CASE.

(1) Mesh the synchronizer cone to the input shaft.

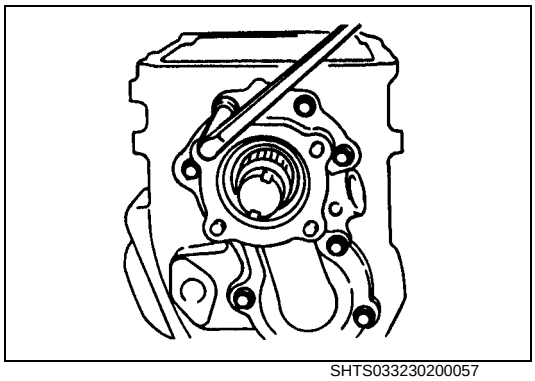
(2) Align the synchronizer hub slot with synchronizer ring.



SHTS033230200056

12. INSTALL THE FRONT BEARING RETAINER.
(1) Coat both sides of the gasket with liquid gasket.
(2) Apply liquid gasket or sealing tape to the bolt "A".

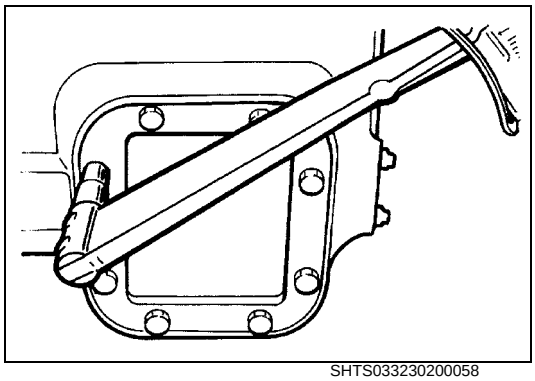
NOTICE
- **When installing the bearing retainer, the gasket must be installed in such a way that the gasket notch matches the oil drain hole on the case so as not to block the hole.**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**


SHTS033230200057

13. INSTALL THE REAR BEARING RETAINER.
(1) Coat both sides of the gasket with liquid gasket.

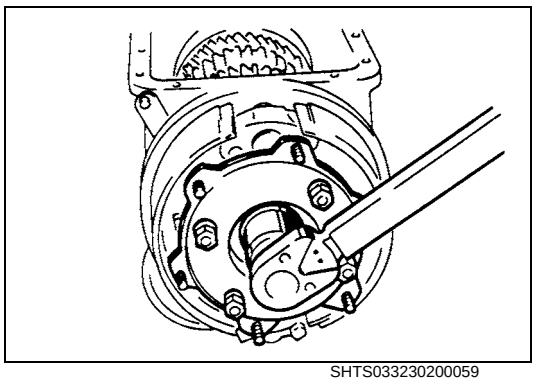
NOTICE
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

(2) Apply liquid gasket or sealing tape to the bolt.


SHTS033230200058

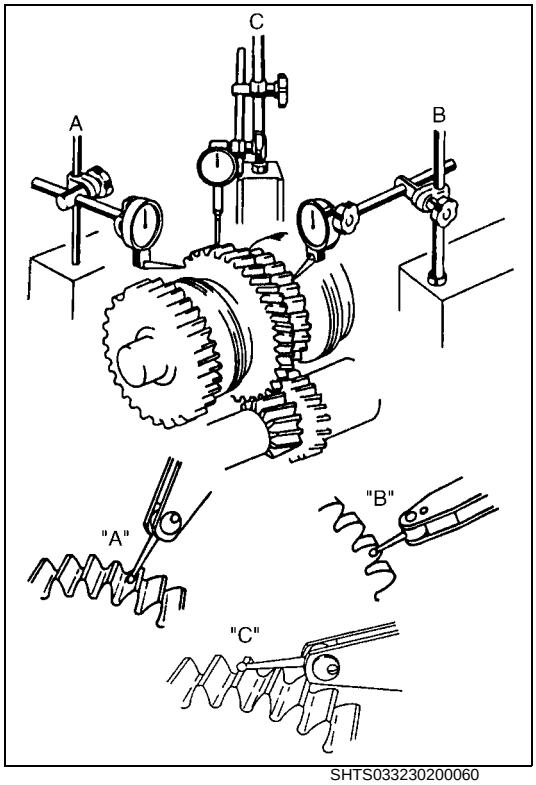
14. INSTALL THE POWER TAKE-OFF COVER.
(1) Coat both sides of the gasket with liquid gasket.

NOTICE
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**


SHTS033230200059

15. INSTALL THE OUTPUT SHAFT LOCK NUT.
(1) Before tightening the lock nut engage two gears so that the shaft can not be turned around.
(2) Install the lock nut to the output shaft and tighten it.
SST: Socket Wrench (S0983-96504)

NOTICE
Do not damage the O-ring.



SHTS033230200060

16. MEASURE THE GEAR BACKLASH, END PLAY AND RADIAL PLAY.

(1) Block the counter shaft with a pry bar when measuring.

(2) Measure the gear backlash, end play and radial play at four points of each gear.

<BACKLASH "A"> **Unit: mm {in.}**

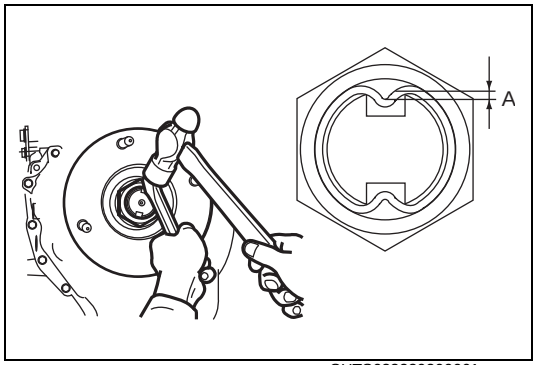
	Assembly Standard	Service Limit
Reverse gear	0.08-0.16 {0.0032-0.0062}	0.4 {0.0157}
1st gear		
2nd gear	0.05-0.13 {0.0020-0.0051}	
3rd gear		
4th gear		
5th gear	0.08-0.16 {0.0032-0.0062}	
Input shaft gear		

<END PLAY "B"> **Unit: mm {in.}**

	Assembly Standard	Service Limit
Reverse gear	0.15-0.30 {0.0060-0.0118}	0.5 {0.0197}
1st gear		
2nd gear		
3rd gear		
4th gear		
5th gear	0.15-0.50 {0.0049-0.0162}	

<RADIAL PLAY "C"> **Unit: mm {in.}**

	Assembly Standard
Reverse gear	0.015-0.085 {0.0006-0.0033}
1st gear	0.012-0.061 {0.0005-0.0024}
2nd gear	0.012-0.061 {0.0005-0.0024}
3rd gear	0.013-0.083 {0.0006-0.0032}
4th gear	0.015-0.078 {0.0006-0.0030}
5th gear	0.110-0.155 {0.0044-0.0061}



SHTS033230200061

17. CAULK THE OUTSIDE RIM OF THE OUTPUT SHAFT LOCK NUT.

(1) Using a hammer and a chisel, caulk the outside rim of the lock nut into the groove on the output shaft.
A: More than 1.5 mm {0.0591 in.}

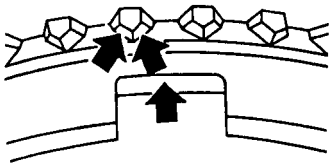
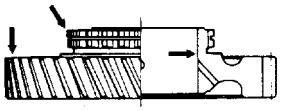
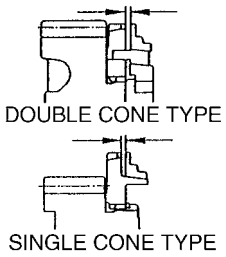
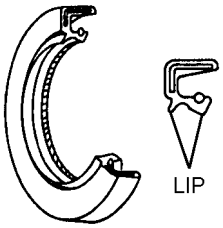
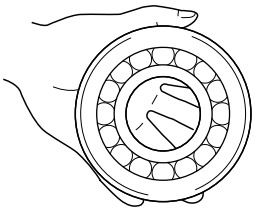
NOTICE

- **The caulking should fit the groove thoroughly.**
- **The caulking should be done without rift.**

INSPECTION AND REPAIR

EN0332302H300002

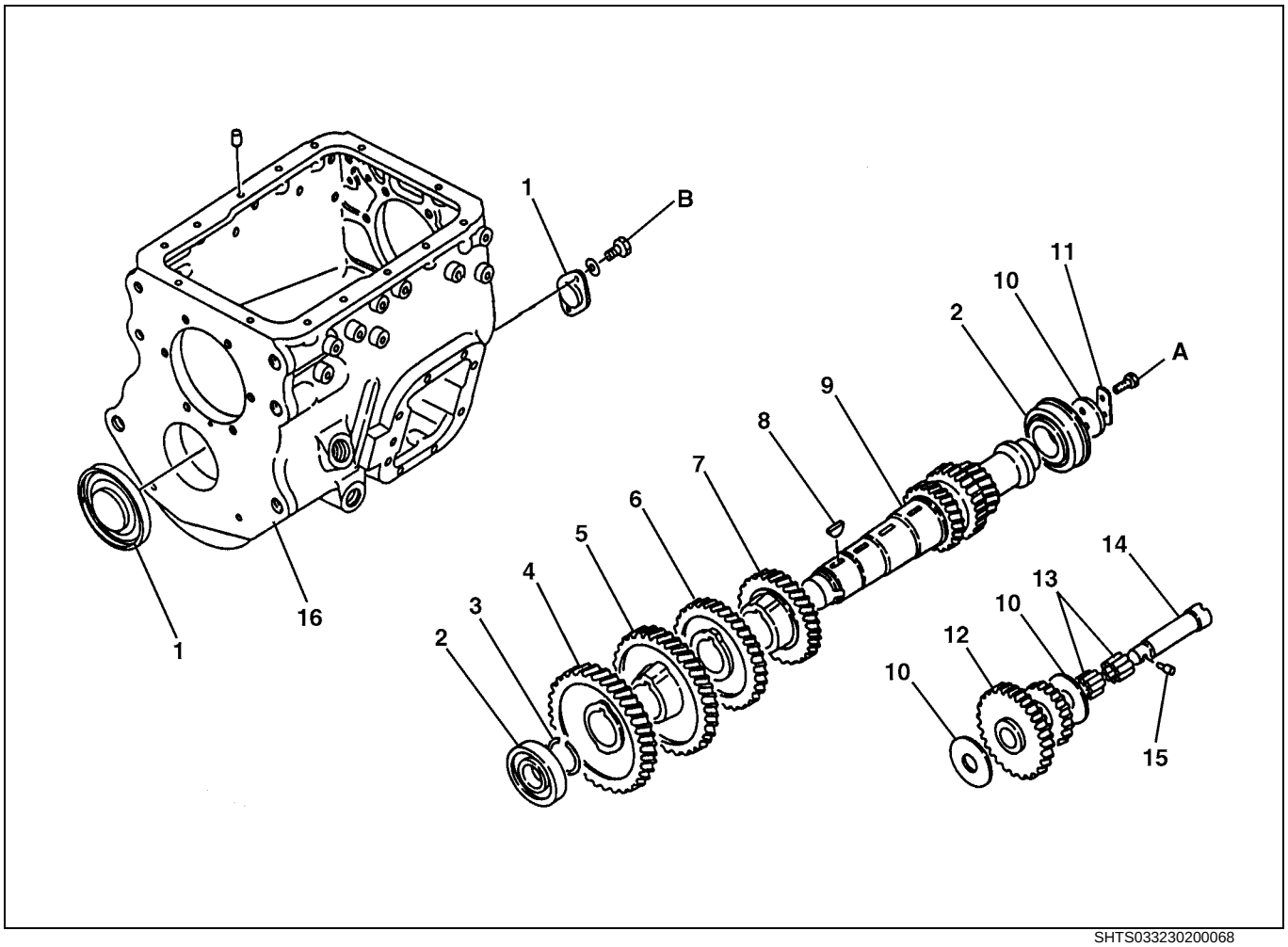
Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Synchronizer ring, deformity, crack and excessive damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Gear excessive wear, chips and cracks	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Clearance between synchronizer ring and synchronizer cone or gear sub assembly	**2nd gear 1.1-2.55 {0.044-0.101}** **3rd, 4th gear 1.15-1.8 {0.046-0.070}** **5th, Input gear 1.1-1.9 {0.044-0.074}**	**0.2 {0.0079}**	**Replace the synchronizer ring and/or gear sub assembly.**	**Measure** 
Oil seal lip wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Cylindrical roller bearing and ball bearing improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Needle roller bearing in deformed shape	**—**	**—**	**Replace, if necessary.**	**Visual check**

COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS

COMPONENT LOCATOR

EN0332302D100003



SHTS033230200068

1	Seal cover	9	Counter shaft
2	Cylindrical roller bearing	10	Thrust washer
3	Retainer ring	11	Lock plate
4	Counter drive gear	12	Reverse idler gear
5	Counter 5th gear	13	Needle roller bearing
6	Counter 4th gear	14	Reverse idler shaft
7	Counter 3rd gear	15	Set screw
8	Woodruff key	16	Transmission case

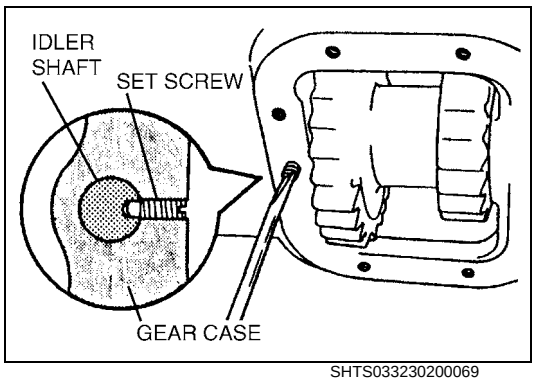
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	64-86 {653-876, 48-63}	B	37.5-48.5 {383-494, 28-36}

OVERHAUL

EN0332302H200003

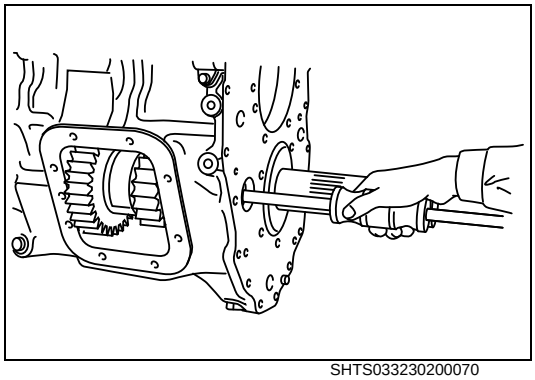
IMPORTANT POINTS - DISASSEMBLY



SHTS033230200069

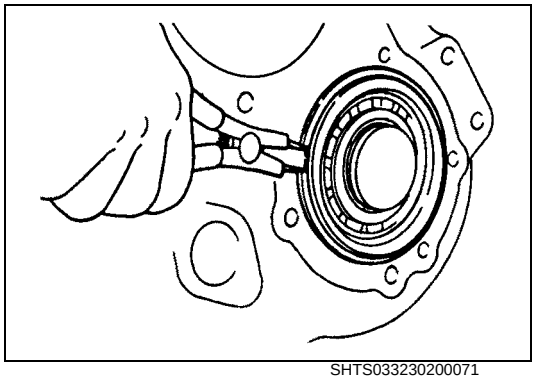
1. REMOVE THE IDLER SHAFT SET SCREW.

(1) Using a screwdriver, remove the reverse idler shaft set screw.


SHTS033230200070

2. REMOVE THE IDLER SHAFT AND IDLER GEAR.

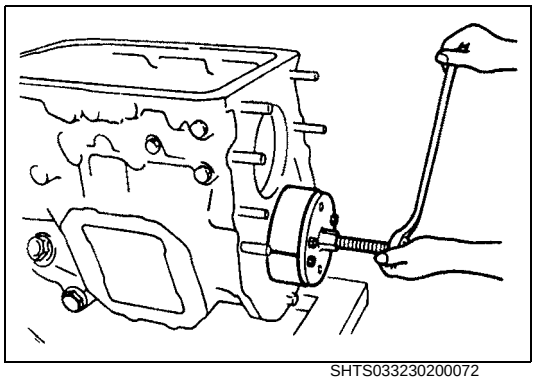
(1) Using the special tool, pull out the reverse idler shaft while holding the reverse idler gear thrust washers and bearing inside the case.
SST: Sliding Hammer (S0942-01442)


SHTS033230200071

3. REMOVE THE COUNTER SHAFT REAR BEARING.

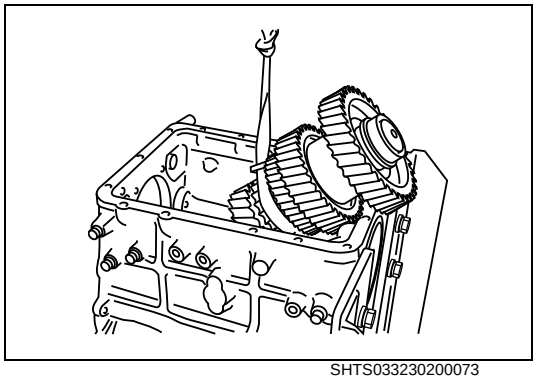
(1) Remove the retainer ring.

⚠ CAUTION
The retainer ring is spring steel and may fly out of groove during removal. Wear safety glasses during removal.


SHTS033230200072

(2) Install the special tools on the rear cylindrical roller bearing and remove it.
SST:
Hook (S0965-31190)
Puller (S0965-01900)

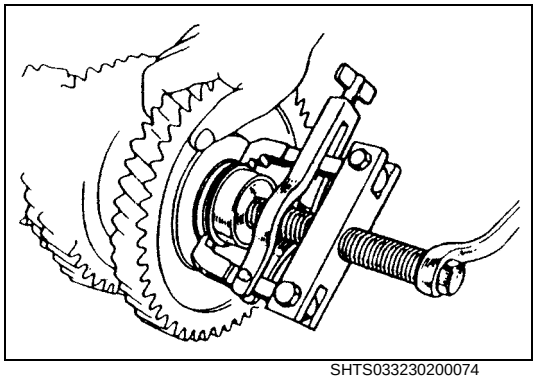
NOTICE
Insert the hook's click into the groove for the retainer ring then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.


SHTS033230200073

4. REMOVE THE COUNTER SHAFT FROM THE TRANSMISSION CASE.

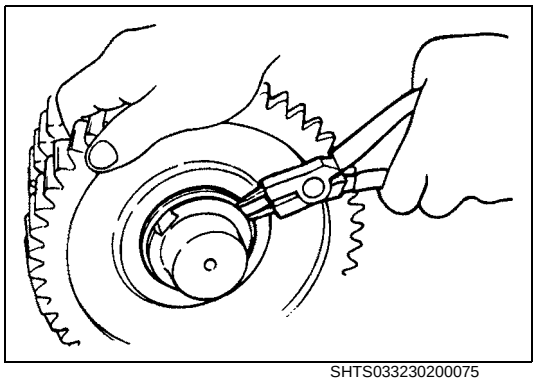
(1) Tie a rope or hook around the counter shaft and carefully pry the counter shaft assembly rearward until the front end of the shaft is cleared out of the front cylindrical roller bearing.

(2) Carefully lift the counter shaft assembly from the case.


SHTS033230200074

5. REMOVE THE CYLINDRICAL ROLLER BEARING INNER RACE.

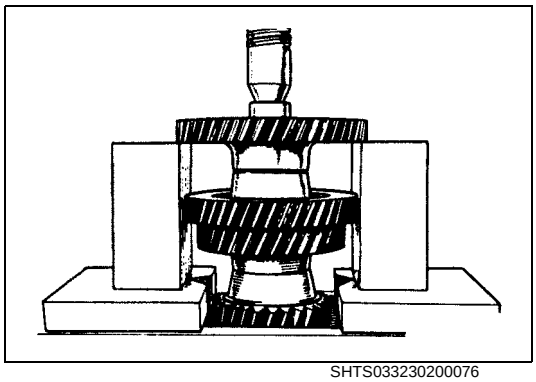
(1) Using the special tool on the inner race, pull out the front cylindrical roller bearing inner race from the counter shaft.
SST: Puller (S0965-01101)


SHTS033230200075

6. REMOVE THE COUNTER SHAFT GEARS.

(1) Remove the retainer ring.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.


SHTS033230200076

(2) Support the counter shaft drive gear as close as possible to the gear hub and press the counter shaft front end until it is free of the drive gear.

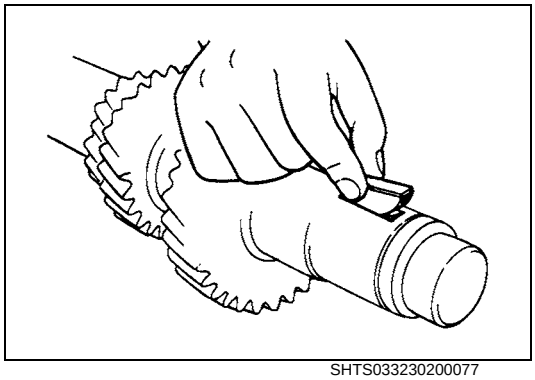
(3) Support the counter 5th gear under the gear teeth and press the counter shaft out of the gear.

(4) Support the counter 4th gear under the gear teeth and press the counter shaft out of the gear.

(5) Support the counter 3rd gear under the gear teeth and press the counter shaft out of the gear.

NOTICE
When removing the counter shaft gears, do not allow the shaft to drop to on a hard surface.

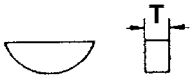
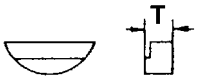
⚠ CAUTION
Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.

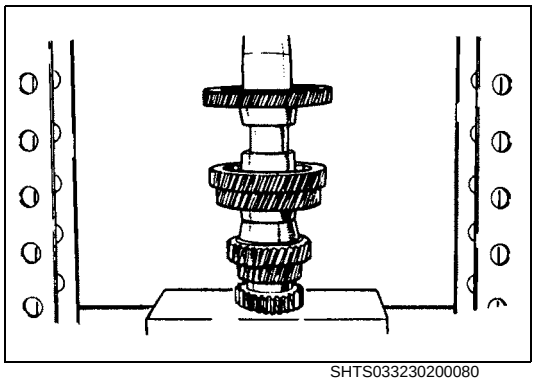

SHTS033230200077

IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE COUNTER DRIVE GEAR, COUNTER 3RD, 4TH AND 5TH GEAR.

(1) Select the proper size key according to the size of the key groove.

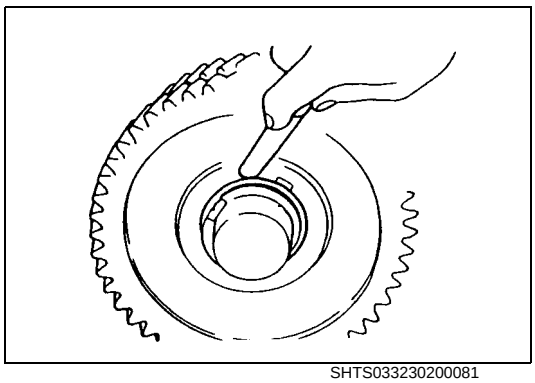
Thickness "T"	Shape
12.018-12.029 mm {0.4732-0.4735 in.}	
12.070-12.085 mm {0.4752-0.4757 in.}	


SHTS033230200080

(2) Press the counter shaft into the gears making certain that the key and keyway are aligned.

NOTICE

Be sure that the gears are installed in the proper direction.


SHTS033230200081

(3) Select a retainer ring that will provide a tight fit and install it on the shaft.

NOTICE

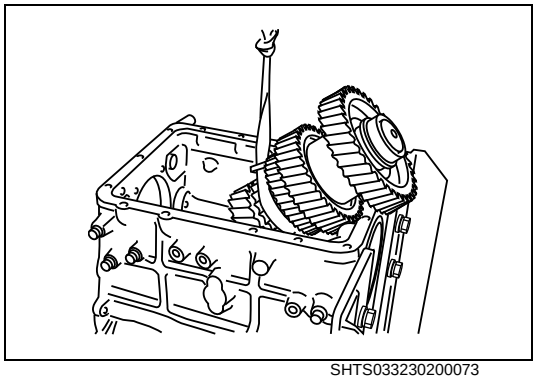
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

Retainer rings are available in the following sizes.

Thickness	Color code
2.45 mm {0.0965 in.}	**White**
2.55 mm {0.1004 in.}	**Red**
2.65 mm {0.1043 in.}	**Yellow**
2.75 mm {0.1083 in.}	**Blue**
2.85 mm {0.1122 in.}	**Green**
2.95 mm {0.1161 in.}	**Brown**

⚠ CAUTION

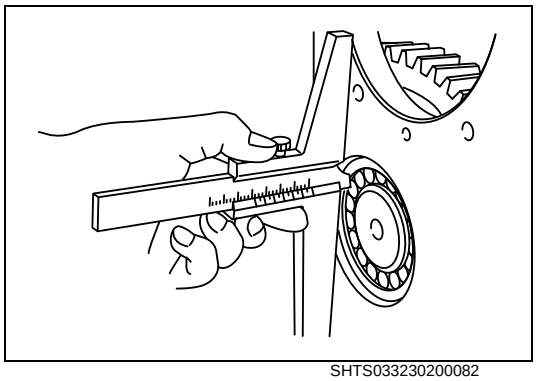
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS033230200073

2. INSTALL THE COUNTER SHAFT IN THE TRANSMISSION CASE.

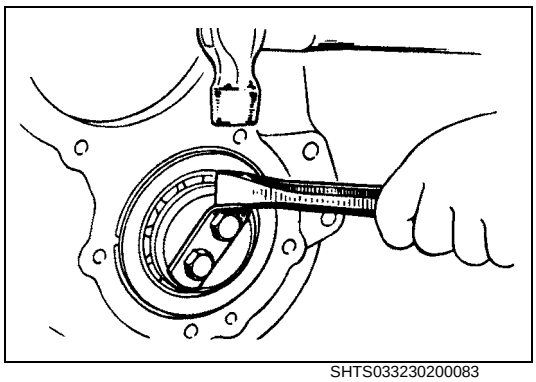
NOTICE

- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


SHTS033230200082

3. DISTANCE BETWEEN THE GEAR CASE OUTER SURFACE AND THE FRONT BEARING OUTER RACE.
Assembly Standard: 6.5-7.0 mm {0.26-0.28 in.}

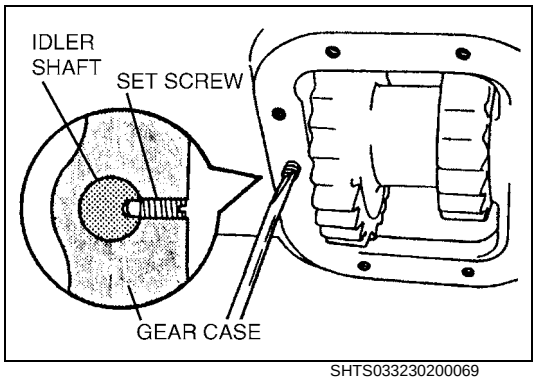
4. PRESS IN THE SEAL COVER NOT TO HAVE MISMATCH WITH THE CASE FRONT.


SHTS033230200083

5. INSTALL THE THRUST WASHER AND LOCK PLATE.
(1) Install the thrust washer and lock plate on the rear end of counter shaft.
(2) Secure the bolts by staking the lock plate.

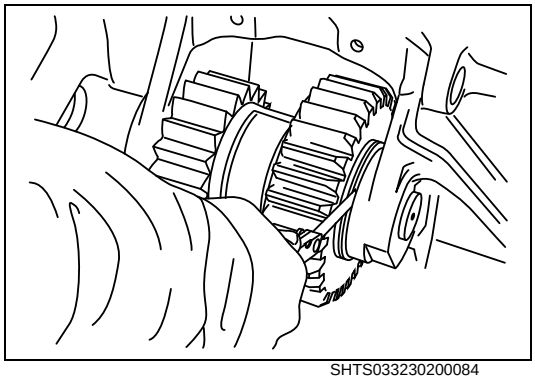
NOTICE

- **Caulk the lock plate to the flat surface of the bolt.**
- **For the lock plate contacting the protruding portion of the bolt, caulk only the half on the tightening side.**



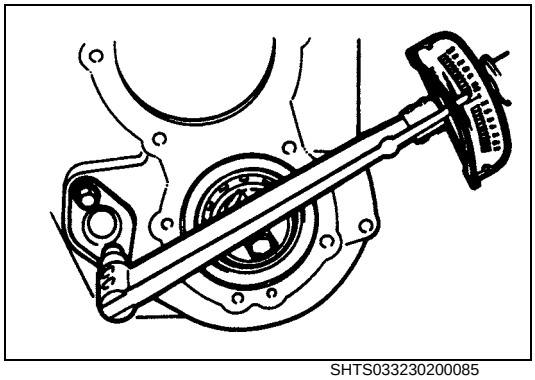
SHTS033230200069

6. INSTALL THE REVERSE IDLER GEAR.
(1) Coat the two thrust washers with disulfide molybdenum grease to hold the washers in place against each side of the idler gear.
(2) Insert the idler shaft until the thread hole of the set screw in the shaft is aligned correctly with the thread hole in the case rib, so that the screw can be installed.
(3) Tighten the set screw until the screw head is completely below the transmission case surface.



SHTS033230200084

7. MEASURE THE REVERSE IDLER GEAR END PLAY.
Assembly Standard: 0.30-0.75 mm {0.0119-0.0295 in.}
Service Limit: 1.2 mm {0.0472 in.}

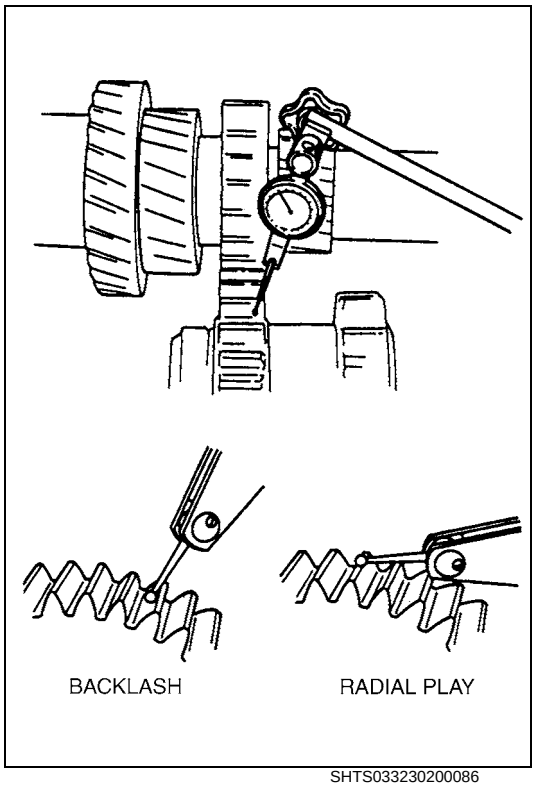


SHTS033230200085

8. INSTALL THE SEAL COVER.
(1) Coat seal cover with liquid gasket.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



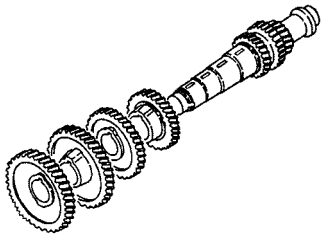
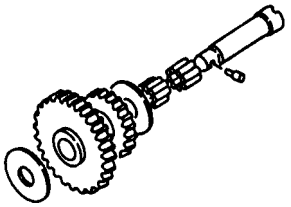
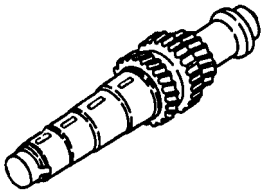
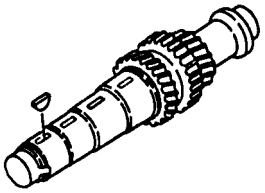
SHTS033230200086

9. MEASURE THE BACKLASH BETWEEN THE REVERSE IDLER GEAR AND THE COUNTER SHAFT REVERSE GEAR.
Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}
Service Limit: 0.4 mm {0.0157 in.}

10. MEASURE THE REVERSE IDLER GEAR RADIAL PLAY.
Assembly Standard: 0.008-0.240 mm {0.0004-0.0094 in.}

INSPECTION AND REPAIR

EN0332302H300003

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
All gears for cracks and defects	—	—	Replace, if necessary.	Visual check 
Idler gear, shaft and needle roller bearing wear and damage	—	—	Replace, if necessary.	Visual check 
Counter shaft wear, chips and cracks	—	—	Replace, if necessary.	Visual check 
Counter shaft key way damage and looseness	—	—	Replace the counter shaft and/or key, if necessary.	Visual check 

TRANSMISSION MAIN UNIT (HK06S)

TR02-004

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TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

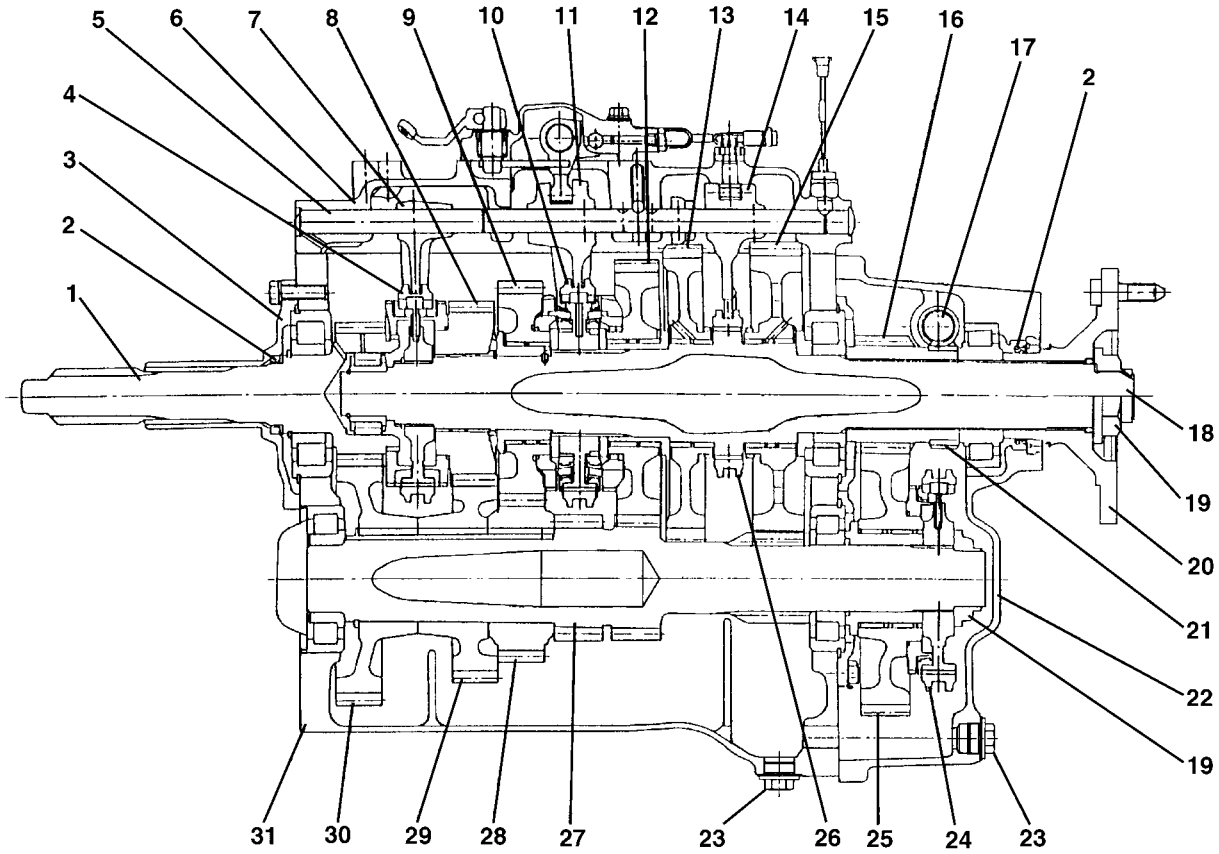
EN0332402I200001

Type		**Six forward speeds, one reverse 2, 3, 4, 5, 6th Synchromesh, 1st and Reverse, Constant-mesh.**
Gear ratios:	**1st**	**7.028**
	2nd	**4.389**
	3rd	**2.495**
	4th	**1.592**
	5th	**1.000**
	6th	**0.743**
	Reverse	**6.987**
Number of teeth input shaft		**24**
Number of teeth counter shaft	**Counter drive gear**	**43**
	1st gear	**13**
	2nd gear	**20**
	3rd gear	**28**
	4th gear	**36**
	5th gear	**—**
	6th gear	**53**
	Reverse gear	**20**
Number of teeth output shaft	**1st gear**	**51**
	2nd gear	**49**
	3rd gear	**39**
	4th gear	**32**
	5th gear	**—**
	6th gear	**22**
	Reverse gear	**52**
Reverse idler gear		**30/20**
Power take-off opening		**On left side of gear case**
Oil capacity, gear box		**Approx. 13.5 liters {2.97 Imp.gal, 3.57 US gal.}**
Lubricant, type		**Gear oil (API GL-3)**
Viscosity, between -12 and 32°C {10 and 90°F}		**SAE90 or SAE80W-90**
Viscosity, above 32°C {90°F}		**SAE90**

DESCRIPTION

EN0332402C100001

(EXAMPLE)



SHTS033240200001

1	Input shaft	17	Speedometer driven gear
2	Oil seal	18	Output shaft
3	Front bearing retainer	19	Lock nut
4	4th-5th synchronizer unit	20	Flange
5	Shift shaft	21	Speedometer drive gear
6	Case cover	22	Rear bearing retainer
7	4th-5th shift fork	23	Drain plug
8	4th gear	24	6th synchronizer unit
9	3rd gear	25	Counter 6th gear
10	2nd-3rd synchronizer unit	26	Reverse-1st shift sleeve
11	2nd-3rd shift fork	27	Counter shaft
12	2nd gear	28	Counter 3rd gear
13	Reverse gear	29	Counter 4th gear
14	Reverse-1st shift fork	30	Counter drive gear
15	1st gear	31	Transmission case
16	6th gear		

TROUBLESHOOTING

EN0332402F300001

Symptom	Possible cause	Remedy/Prevention
Gear slip-off (Control system)	Joint worn and/or damaged	Replace joint.
	Bolts and nuts loose	Tighten bolts and nuts.
	Improper link rod adjustment	Adjust link rod.
Gear slip-off (Gear shift housing)	Lock ball and spring distorted and/or broken	Replace or replace as required.
	Groove for shift shaft worn	Replace shift fork.
Gear slip-off (Transmission gear)	Synchronizer hub and sleeve worn	Replace as required.
	Synchronizer sleeve and gear clutch teeth worn or damaged	Replace as required.
	Input shaft and/or output shaft bearing worn and/or broken	Replace bearing.
	Retainer ring and/or thrust washer worn and/or broken	Replace as required.
	Loosened transmission to engine mounting bolts	Tighten bolts.
Difficult gear engagement (Engine)	Engine idling speed too high	Adjust engine idling.
Difficult gear engagement (Clutch)	Improper disengagement of clutch	Adjust clutch.
	Clutch disc sticking	Repair or replace.
	Clutch shifter sleeve bent	Replace shifter sleeve.
Difficult gear engagement (Transmission)	Input shaft and/or output shaft bearing worn and/or damaged	Replace bearing.
	Engine crankshaft pilot bearing worn and/or damaged	Replace bearing.
	Synchronizer cone and ring worn	Replace as required.
Difficult gear engagement (Control system)	Looseness of control system and/or improper adjustment	Tighten and adjust control system.
	Improper motion of gear shift lever	Adjust shift lever.
Difficult gear engagement (Lubrication)	Improper lubrication of control lever	Lubricate as required.
	Shortage gear oil and/or low oil viscosity	Add oil or change oil as required.
Noise (Transmission)	Grinding in transmission	Check for screws, bolts or other foreign materials in transmission.
	Loose transmission-to-engine mounting bolts	Tighten bolts.
	Worn or damaged gear and bearing	Replace as required.
Noise (Lubrication)	Shortage of gear oil and/or low oil viscosity	Add oil or change oil as required.
Gear oil leaks (Transmission)	Leaks at the front and rear bearing retainer seal and gasket, case cover gasket, sand hole of case or shift shaft expansion plug	Repair and replace as required.
	Improper amount of gear oil and lack of oil viscosity	Check oil level and type.

Symptom	Possible cause	Remedy/Prevention
Gears are difficult to engage or cannot be engaged when engine is not operating.	Control cable damaged, bent, deteriorated or deformed due to heat	Replace control cable.
	Loose parts	Inspect and tighten.
	Damaged shift lever assembly	Replace shift lever.
	Damaged or bent parts on upper transmission cover section (lever, spring, etc.)	Replace.
	Faulty adjustment of control cable assembly and link rod	Adjust.
The play of the lever is excessive.	A joint is seriously worn.	Replace the joint.
	Looseness of tightening bolt and nut	Inspect and tighten each the bolts and the nuts.

SPECIAL TOOL

EN0332402K100001

Prior to starting a transmission overhaul, it is necessary to have these special tools.

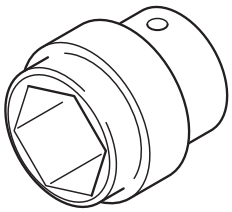
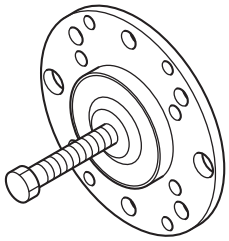
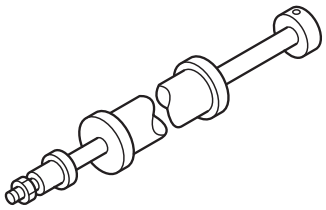
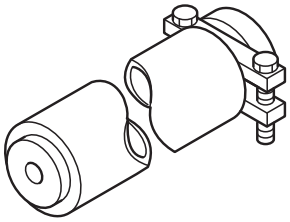
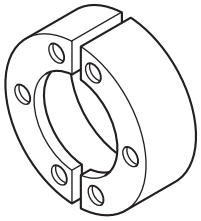
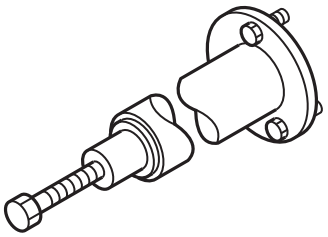
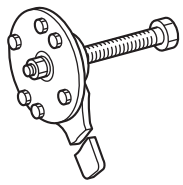
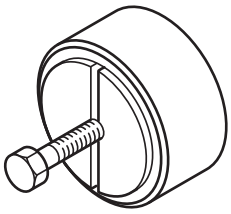
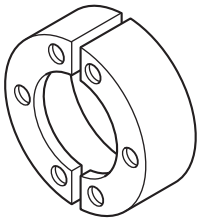
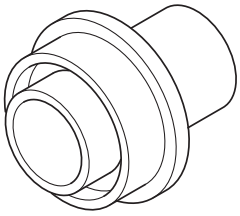
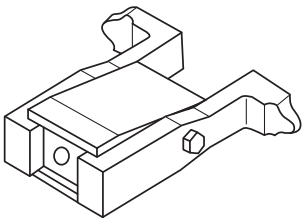
Illustration	Part number	Tool name	Remarks
	S0983-96504	SOCKET WRENCH	
	S0965-02232	PULLER	
	S0942-01442	SLIDING HAMMER	
	S0965-02070	INPUT SHAFT PULLER	
	S0965-31540 S0965-31550 S0965-31570 S0965-31580	HOOK	

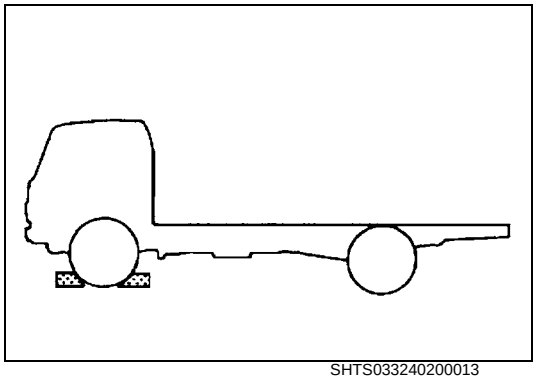
Illustration	Part number	Tool name	Remarks
	S0965-01882	PULLER	
	S0965-01900	PULLER	
	S0965-02170	PULLER	
	S0965-31210 S0965-31230 S0965-31430	HOOK	
	S0965-91240	ADAPTER	
	S0965-02270	PULLER	

DISMOUNTING AND MOUNTING

EN0332402H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033240200013

1. BLOCK THE WHEELS.

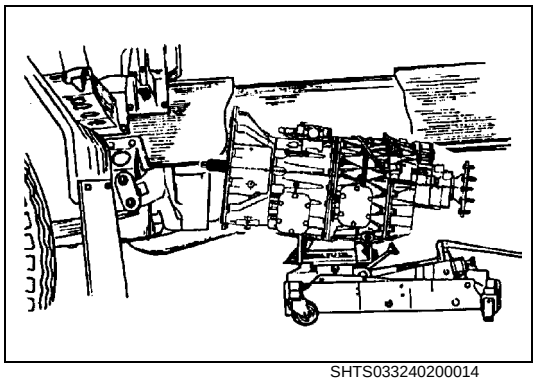
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

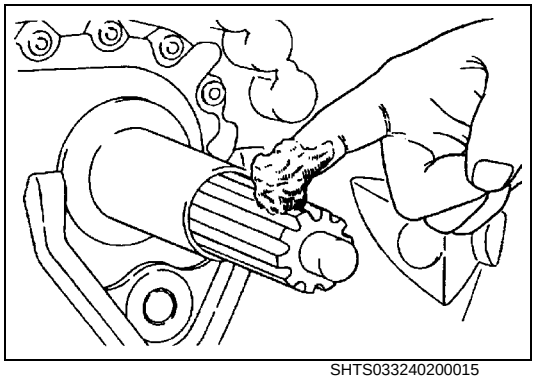
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



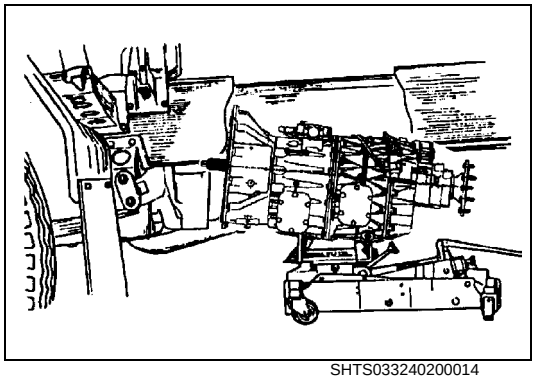
SHTS033240200014

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033240200015

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033240200014

2. INSTALL THE TRANSMISSION.

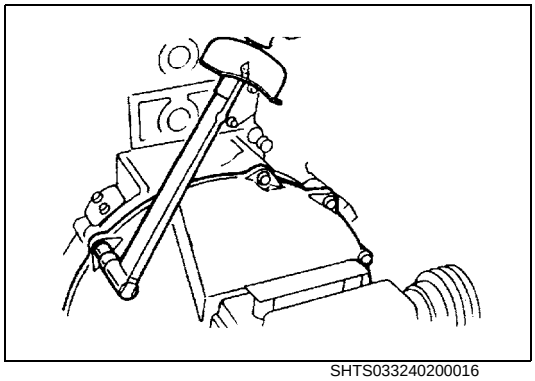
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033240200016

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

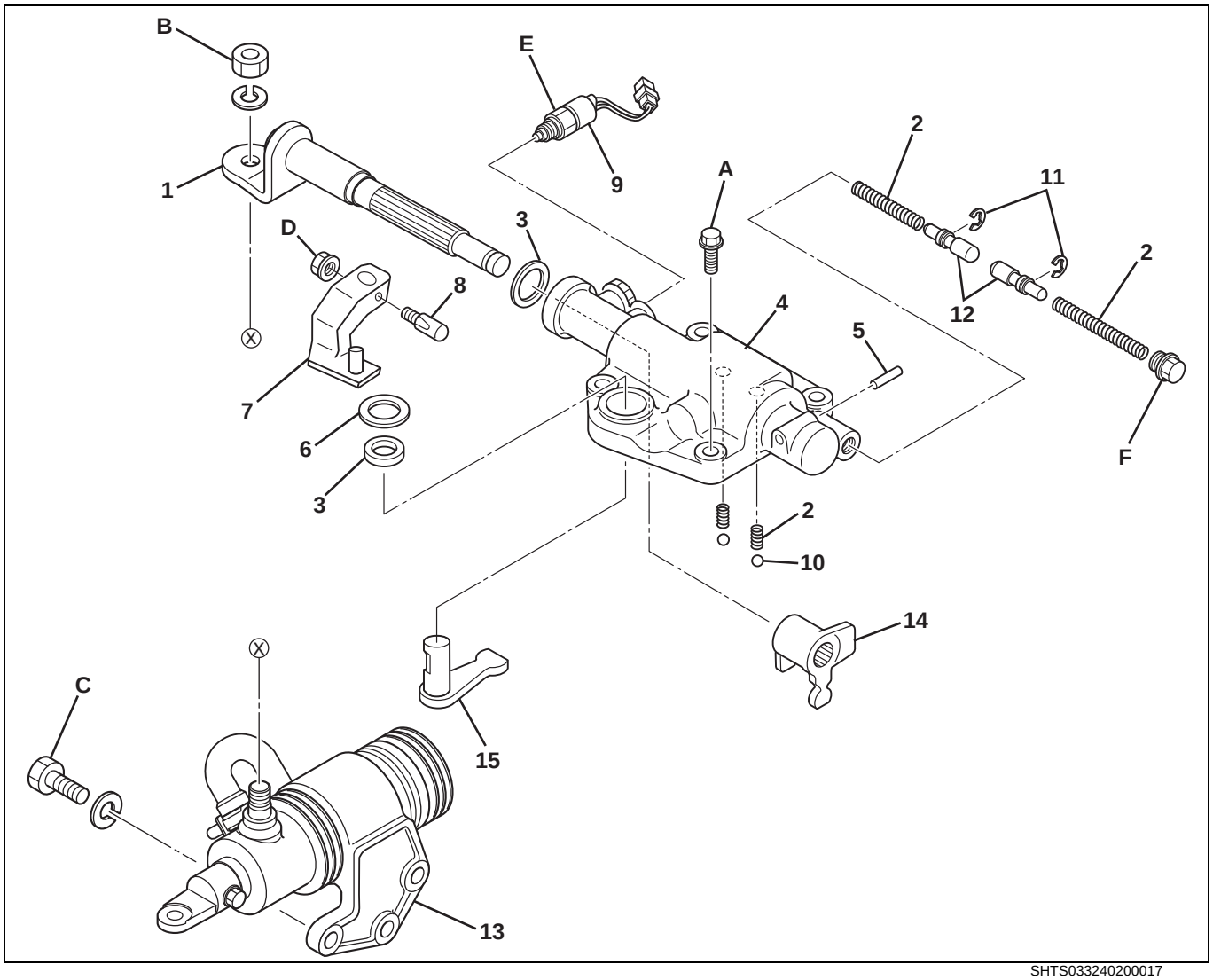
9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

GEAR SHIFT HOUSING

COMPONENT LOCATOR

EN0332402D100001

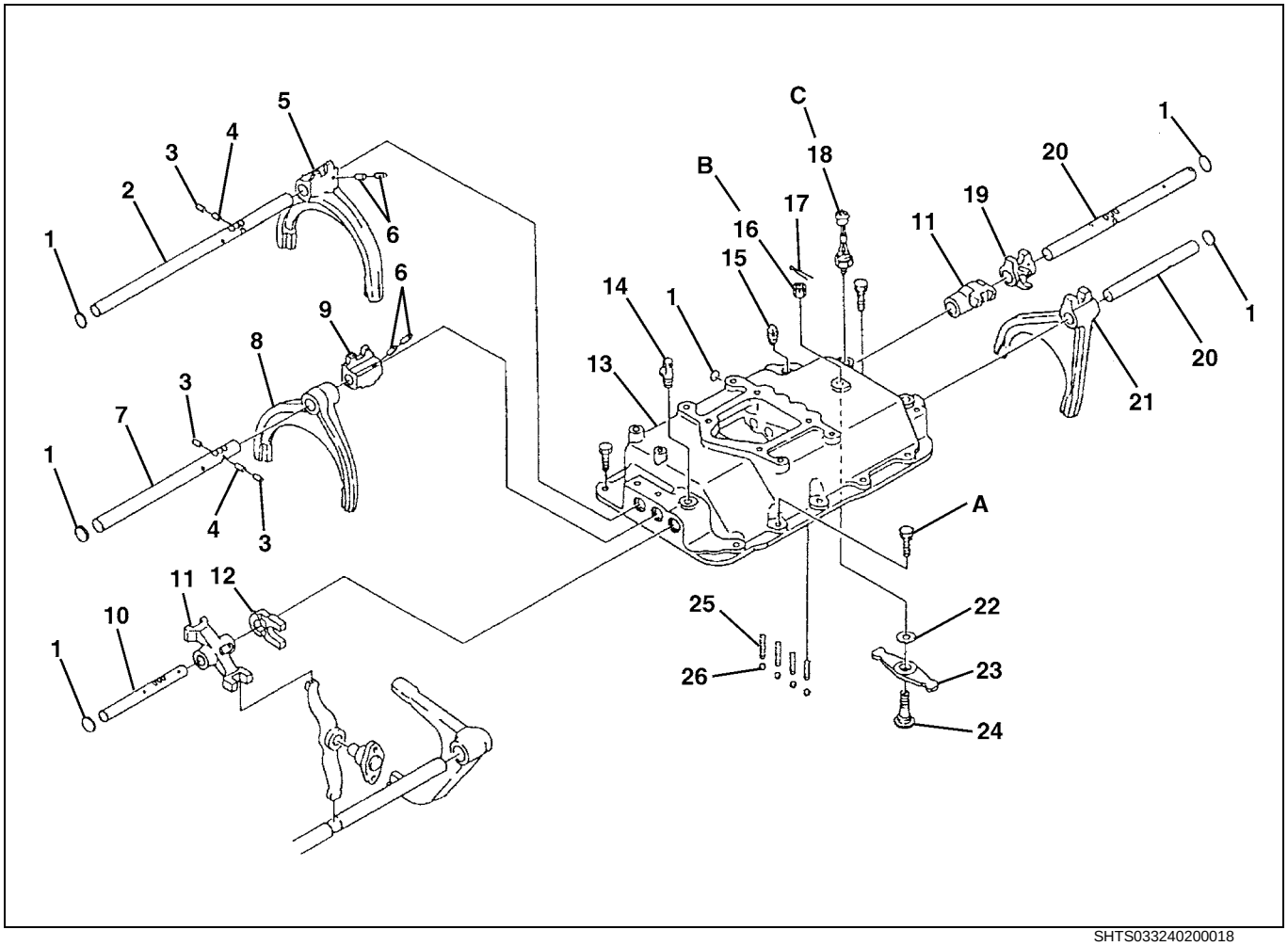


SHTS033240200017

1	Shift lever shaft	9	Neutral switch
2	Compression spring	10	Steel ball
3	Oil seal	11	Retainer ring
4	Shift lever shaft housing	12	Plunger
5	Pin	13	Power shift unit assembly
6	Plain washer	14	Inner shift lever
7	Outer select lever	15	Inner select lever
8	Shift lever pin		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	37-49 {380-500, 28-36}	D	9.8-11.8 {100-120, 7-9}
B	101-147 {1,030-1,498, 75-108}	E	34-40 {347-407, 26-29}
C	64-86 {650-870, 47-62}	F	31.2-47.2 {320-480, 23-35}



SHTS033240200018

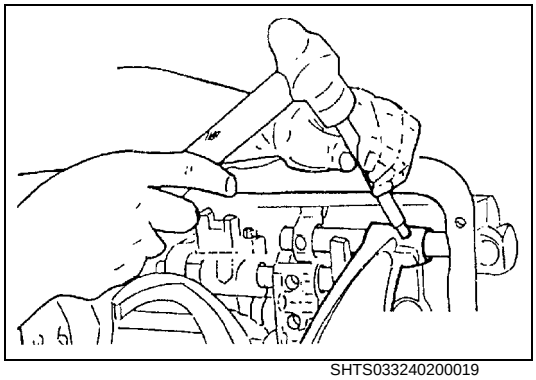
1	Expansion plug	14	Air breather
2	2nd-3rd shift shaft	15	Plug
3	Interlock plunger	16	Slotted nut
4	Interlock pin	17	Cotter pin
5	2nd-3rd shift fork	18	Back-up light switch
6	Concentric pins	19	1st-Reverse shift head
7	4th-5th shift shaft	20	1st-Reverse shift shaft
8	4th-5th shift fork	21	1st-Reverse shift fork
9	4th-5th shift head	22	Plain washer
10	6th shift shaft	23	Inversion lever
11	Head sub assembly	24	Inversion lever pin
12	6th shift head	25	Compression spring
13	Case cover	26	Steel ball

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	45-53 {460-540, 34-39}	C	34-39 {350-400, 26-28}
B	76-108 {775-1,100, 56-79}		

OVERHAUL

EN0332402H200001



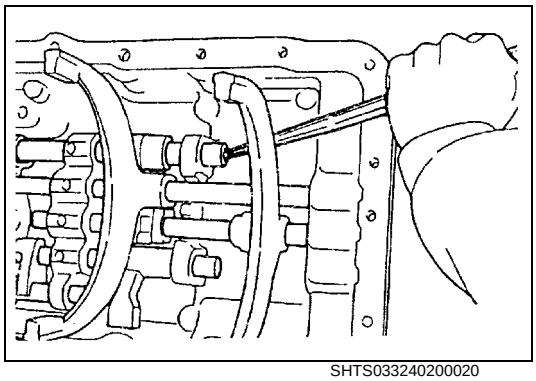
SHTS033240200019

IMPORTANT POINT - DISASSEMBLY

1. REMOVE THE GEAR SHIFT SHAFT, SHIFT FORK, SHIFT HEAD AND COLLAR.

(1) Set each shaft in the neutral position.

(2) Tap the shift head and shift fork fitting pins lightly with a 3.5 mm {0.138 in.} diameter tapping rod.



SHTS033240200020

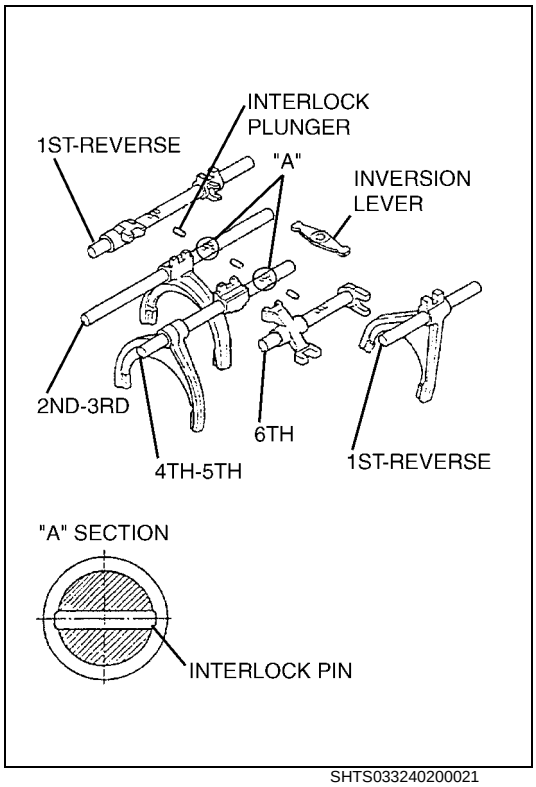
(3) Drive out the shift shafts and its expansion plugs one at a time. When removing the shift shaft, remove the shift fork and the shift head.

NOTICE

Take care not to damage the sliding bore.

⚠ CAUTION

The steel ball may fly out of the hole when removing the shift shaft. Wear safety glasses during removal.



SHTS033240200021

IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE STEEL BALL, COMPRESSION SPRING, SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.

(1) Install the inversion lever and the pin.

(2) Place the ball and spring in the hole.

(3) Depress the ball and spring with a suitable tool.

⚠ CAUTION

The steel ball may fly out of the hole when installing the shift shaft. Wear safety glasses during installation.

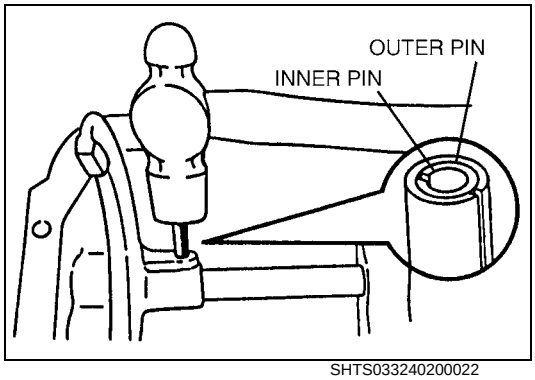
(4) Coat the shift shaft with gear oil.

(5) Align the shift fork and head and put the shift shaft through, and then slide the shift shaft over the ball.

(6) Place the shift shaft in neutral position.

NOTICE

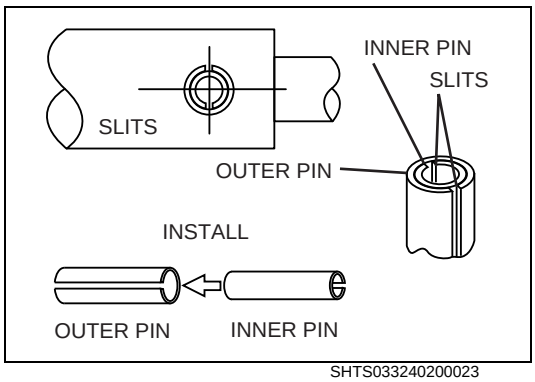
- **Pay special attention to the position and direction of the shift fork and shift head.**
- **For 2nd-3rd and 4th-5th shift shafts, insert the interlock pin. Coat the interlock pin with bearing grease.**



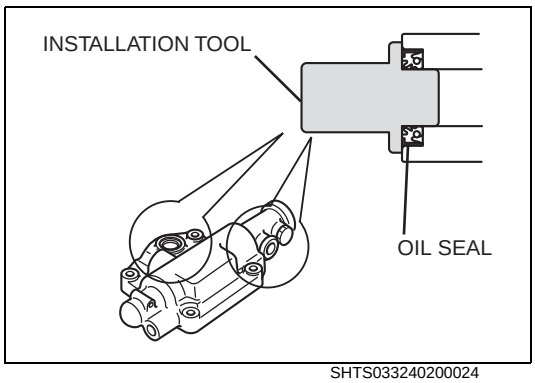
SHTS033240200022

2. SECURE THE SHIFT HEAD AND FORK WITH CONCENTRIC PINS.

(1) Drive the concentric pins into the fork and the head. Make sure that the slits of the concentric pins are on opposite sides as shown.



SHTS033240200023



SHTS033240200024

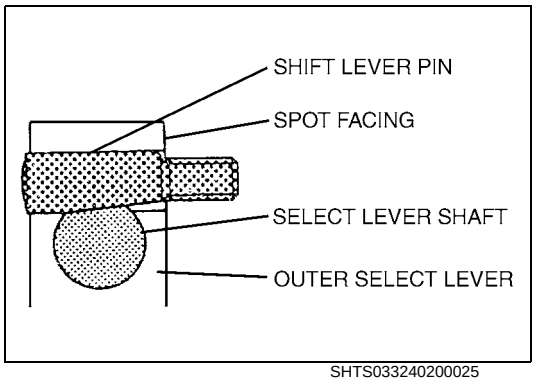
3. INSTALL THE OIL SEALS.

(1) Drive the new oil seals into the shift lever shaft housing with the installation tool.

(2) Coat the sealing surfaces between the seal lips with bearing grease.

NOTICE

- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**

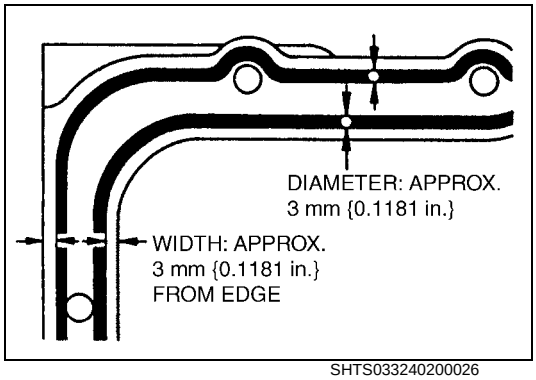


SHTS033240200025

4. INSERT THE SHIFT LEVER PIN INTO THE OUTER SELECT LEVER.

NOTICE

Pay attention to the position of the shift and the direction of the shift lever pin.



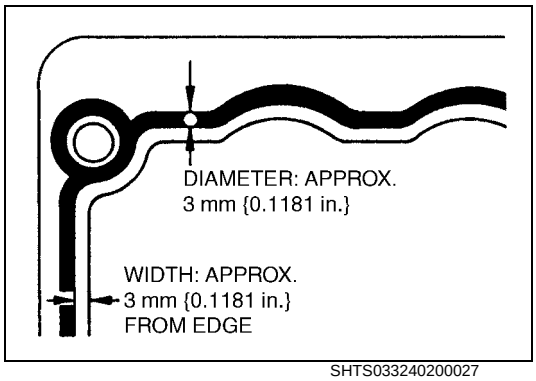
SHTS033240200026

5. INSTALL THE TRANSMISSION CASE COVER.

(1) Coat the face of the transmission case with liquid gasket.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



SHTS033240200027

6. INSTALL THE SHIFT LEVER SHAFT HOUSING.

(1) Coat the face of the transmission case cover with liquid gasket.

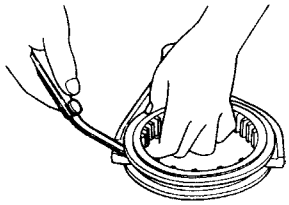
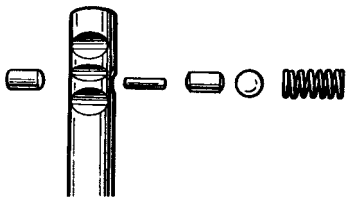
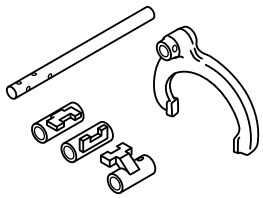
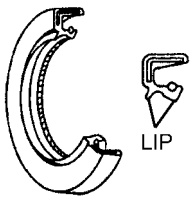
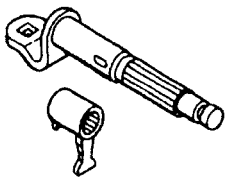
NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

INSPECTION AND REPAIR

EN0332402H300001

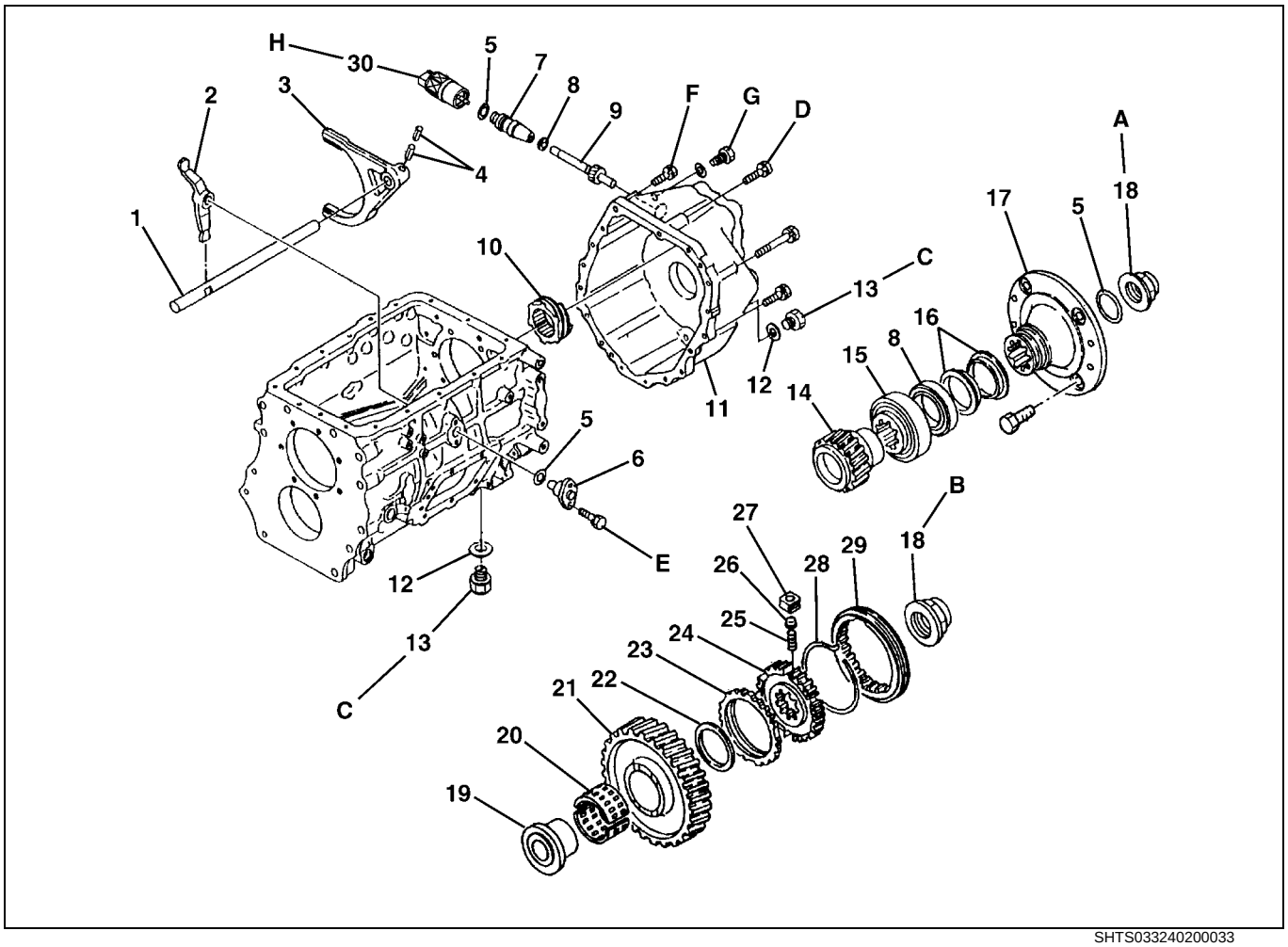
Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Clearance between shift fork and sleeve	0.20-0.45 {0.0079-0.0177}	1.0 {0.0394}	Replace.	Measure 
Interlock pin, interlock plunger, compression spring and steel ball wear and damage	—	—	Replace, if necessary.	Visual check 
Shift head, shift fork and shift shaft wear and damage	—	—	Replace, if necessary.	Visual check 
Oil seal lip wear and damage	—	—	Replace, if necessary.	Visual check 
Shift lever shaft and inner shift lever wear and damage	—	—	Replace, if necessary.	Visual check 

AUXILIARY CASE, GEARS AND RELATED PARTS

COMPONENT LOCATOR

EN0332402D100002



SHTS033240200033

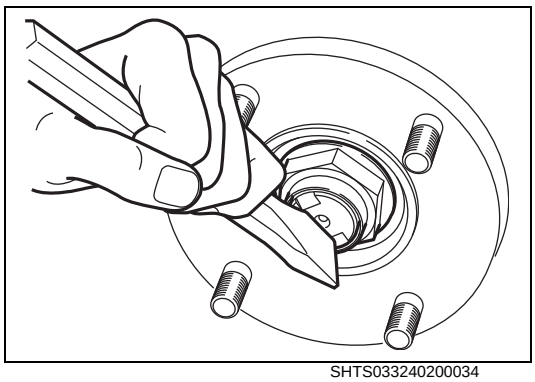
1	6th shift shaft	16	Dust deflector
2	Inversion lever	17	Flange
3	6th shift fork	18	Nut
4	Lock pin	19	Bushing
5	O-ring	20	Needle roller bearing
6	Inversion lever pin	21	Counter 6th gear
7	Speedometer driven gear bushing	22	Spacer
8	Oil seal	23	Synchronizer ring
9	Speedometer driven gear	24	Synchronizer hub
10	Speedometer drive gear	25	Compression spring
11	Auxiliary case	26	Synchronizer head
12	Soft washer	27	Synchronizer key
13	Drain plug	28	Retainer ring
14	6th gear	29	Synchronizer sleeve
15	Cylindrical roller bearing	30	Speedosensor

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	588-784 {6,000-8,000, 434-578}	E	37-49 {380-500, 28-36}
B	343-461 {3,500-4,700, 254-339}	F	109-147 {1,100-1,500, 80-108}
C	79-117 {800-1,200, 58-86}	G	19-25 {190-260, 14-18}
D	44-54 {450-550, 33-39}	H	14.7-29.3 {150-300, 11-23}

OVERHAUL

EN0332402H200002


SHTS033240200034

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE OUTPUT SHAFT LOCK NUT.

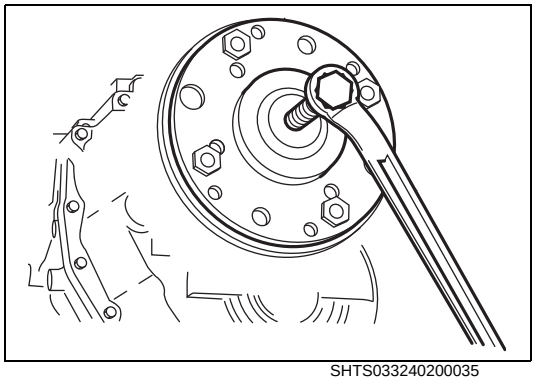
(1) The lock nut has been caulked, so before loosening it, lift the caulked part completely out of the shaft groove.

(2) Using the special tool or the commercial tool, remove the lock nut.

NOTICE

Before loosening the lock nut, engage two gears so that the output shaft can not be turned around.

SST: Socket Wrench (S0983-96504)

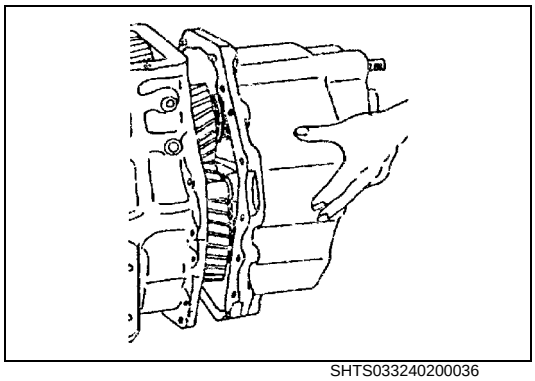

SHTS033240200035

2. REMOVE THE FLANGE COUPLING.

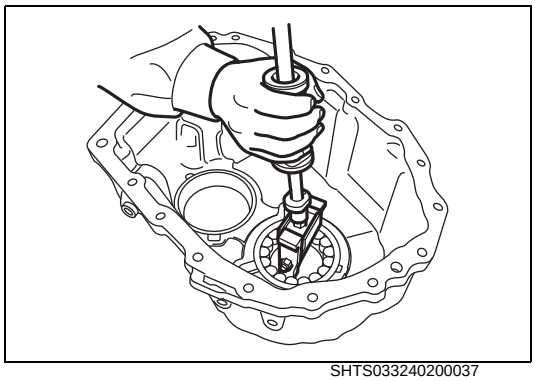
(1) Remove the brake drum.

(2) Using the special tool, remove the flange coupling.
SST: Puller (S0965-02232)

(3) Remove the speedometer driven gear bushing.


SHTS033240200036

3. REMOVE THE AUXILIARY CASE.

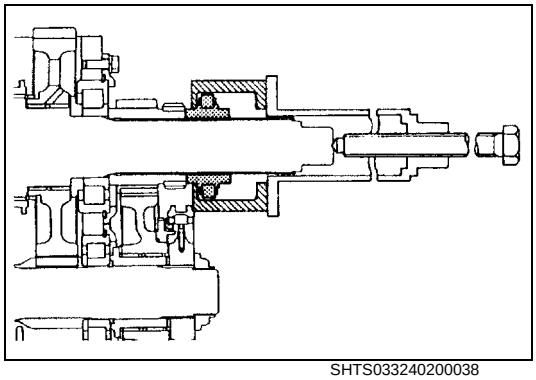

SHTS033240200037

4. REMOVE THE CYLINDRICAL ROLLER BEARING OUTER RACE.

(1) Using the special tools, remove the cylindrical roller bearing outer race from the auxiliary case.
SST:
Puller (S0965-02270)
Sliding Hammer (S0942-01442)

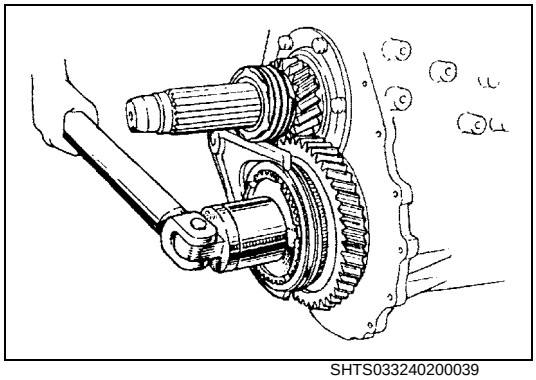
5. REMOVE THE OIL SEAL.

(1) Using a brass bar and hammer, drive out the oil seal from the auxiliary case.


SHTS033240200038

6. REMOVE THE CYLINDRICAL ROLLER BEARING INNER RACE.

(1) Using the special tools, remove the cylindrical roller bearing inner race from the output shaft.
SST:
Puller (S0965-01882)
Hook (S0965-31540)


SHTS033240200039

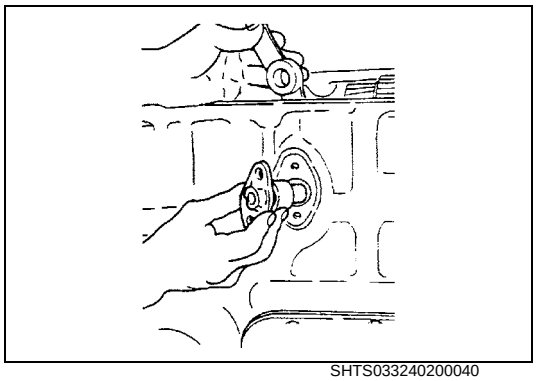
7. REMOVE THE 6TH SHIFT FORK AND SHAFT.

(1) The lock nut has been caulked, so before loosening it, lift the caulked part completely out of the shaft groove.

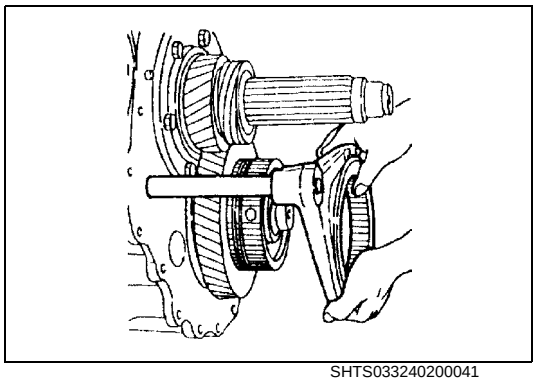
(2) Using the special tool or the commercial tool, remove the lock nut.

NOTICE
Before loosening the lock nut, engage two gears so that the output shaft can not be turned.

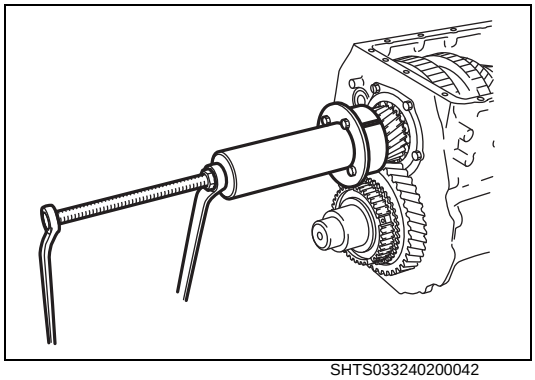
SST: Socket Wrench (S0983-96504)


SHTS033240200040

(3) Remove the inversion lever and lever pin.

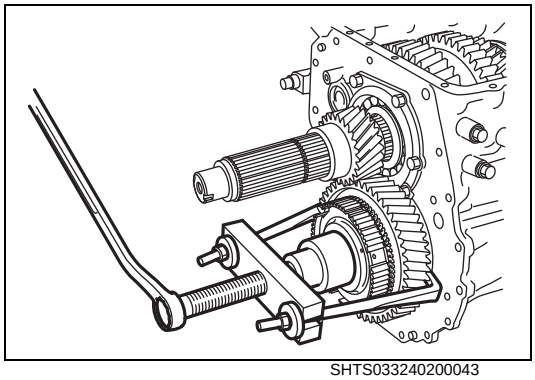

SHTS033240200041

(4) Remove the 6th shift fork with synchronizer sleeve.


SHTS033240200042

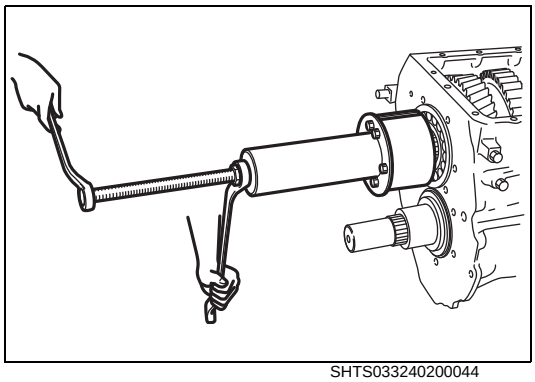
8. REMOVE THE SPEEDOMETER DRIVE GEAR.

(1) Using the special tools, remove the speedometer drive gear.
SST:
Puller (S0965-01882)
Hook (S0965-31570)


SHTS033240200043

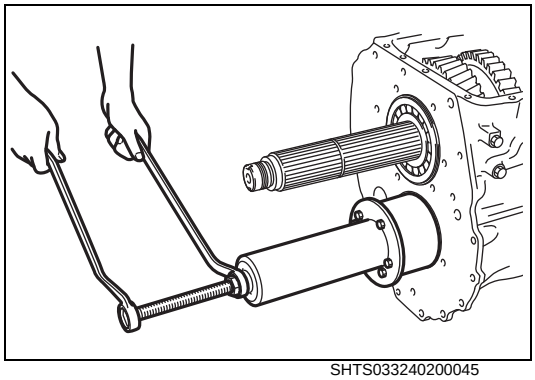
9. REMOVE THE SYNCHRONIZER HUB AND COUNTER 6TH GEAR.

(1) Using a commercial tool, remove the synchronizer hub and counter 6th gear.
(2) Remove the spacer and needle roller bearing.


SHTS033240200044

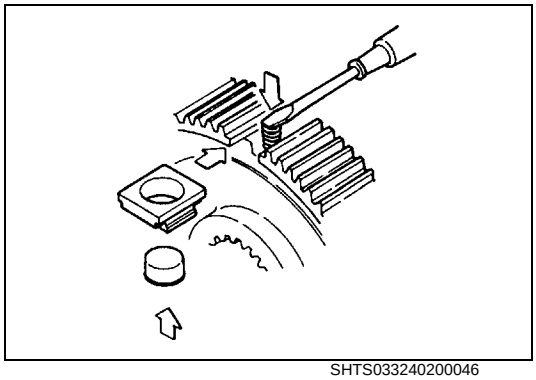
10. REMOVE THE 6TH GEAR.

(1) Using the special tools, remove the 6th gear.
SST:
Puller (S0965-01882)
Hook (S0965-31550)


SHTS033240200045

11. REMOVE THE COUNTER 6TH GEAR BUSHING.

(1) Using the special tools, remove the 6th gear bushing.
SST:
Puller (S0965-01882)
Hook (S0965-31580)

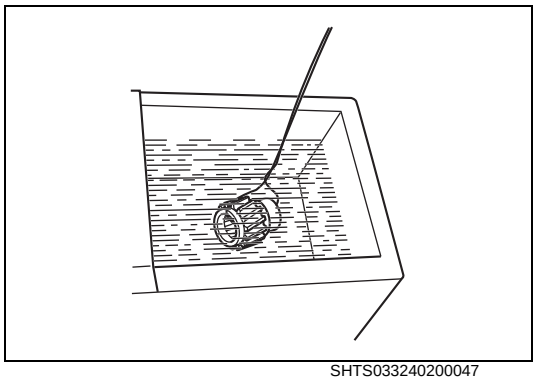

SHTS033240200046

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLE THE 6TH GEAR SYNCHRONIZER UNIT.

(1) Install the compression spring.
(2) Install the synchronizer key and head.

⚠ CAUTION
The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.


SHTS033240200047

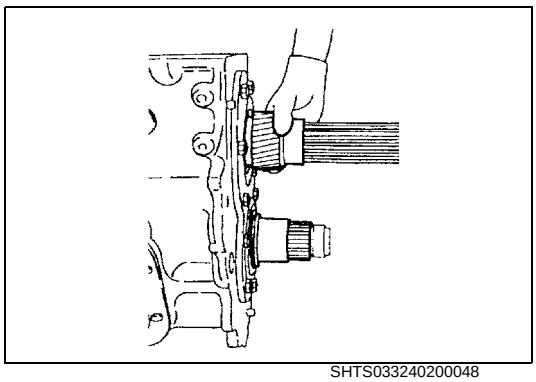
2. INSTALL THE OUTPUT AND COUNTER SHAFT 6TH GEAR.

(1) Heat the output 6th gear and bushing for about 5 minutes in water or oil heated to 80°C-100°C {176°F-212°F}.
Then install the 6th gear and bushing on the shaft.

NOTICE

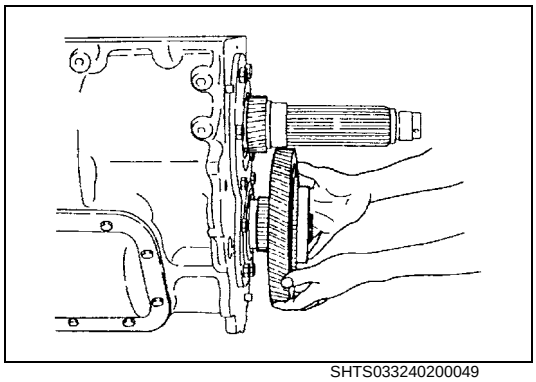
- **Do not heat the 6th gear and bushing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

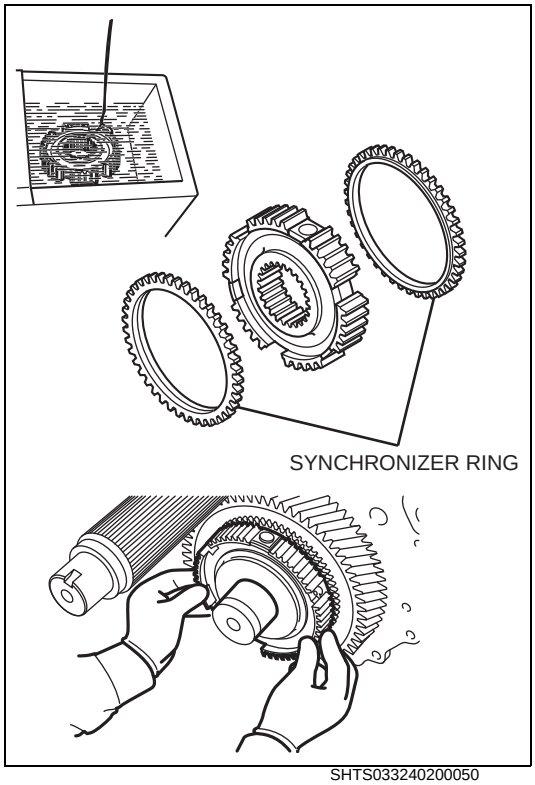
⚠ CAUTION
Never touch hot water or oil and heated 6th gear and bushing with your bare hand. This can result in personal injury.


SHTS033240200048

(2) Install the needle roller bearing, spacer and counter 6th gear.

NOTICE
Coat the needle roller bearing with gear oil.


SHTS033240200049



SHTS033240200050

3. INSTALL THE 6TH GEAR SYNCHRONIZER UNIT.

(1) Heat the synchronizer unit for about 5 minutes in water or oil heated to 80°C-100°C {176°F-212°F}.

NOTICE

- **Do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

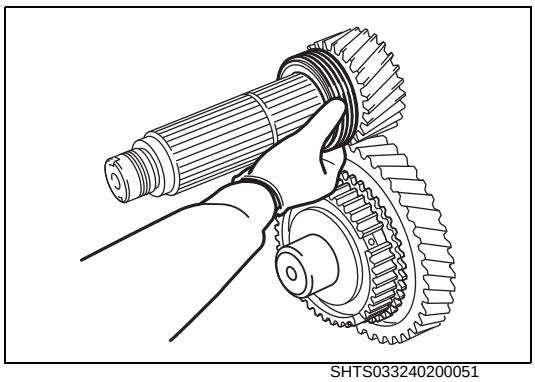
⚠ CAUTION

Never touch hot water or oil and heated synchronizer unit with your bare hand. This can result in personal injury.

(2) Install the synchronizer unit on the counter shaft.

NOTICE

Apply disulfide molybdenium grease to the synchronizer ring inner surface.


SHTS033240200051

4. INSTALL THE SPEEDOMETER DRIVE GEAR.

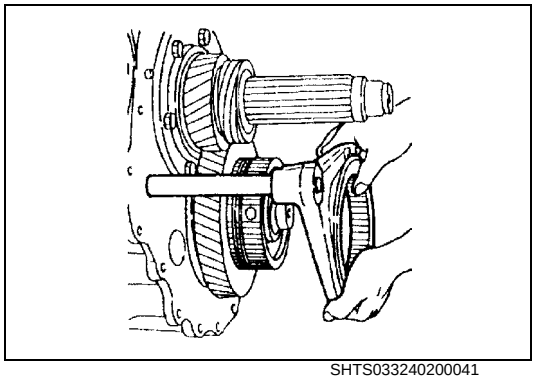
(1) Heat the speedometer drive gear for about 5 minutes in water or oil heated to 80°C-100°C {176°F-212°F}.
Then install the speedometer drive gear on the output shaft.

NOTICE

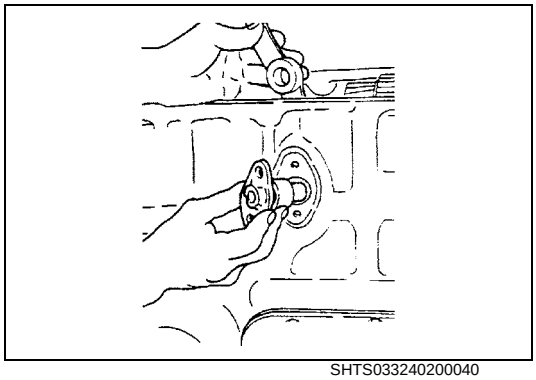
- **Do not heat the speedometer drive gear in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION

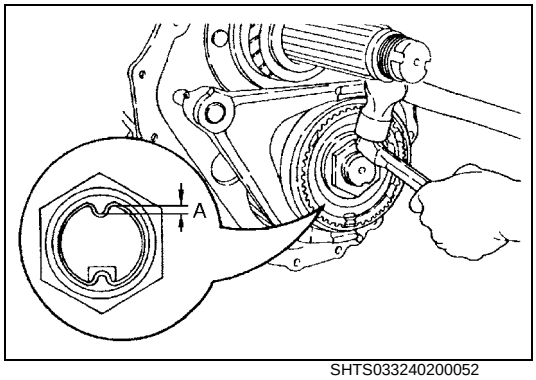
Never touch hot water or oil and heated speedometer drive gear with your bare hand. This can result in personal injury.


SHTS033240200041

5. INSTALL THE SHIFT FORK WITH SYNCHRONIZER SLEEVE.


SHTS033240200040

6. INSTALL THE INVERSION LEVER AND LEVER PIN.

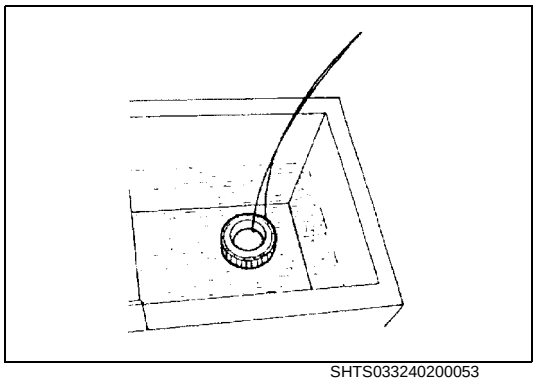


SHTS033240200052

7. INSTALL THE LOCK NUT.

(1) Using the special tool or the commercial tool, tighten the lock nut.
SST: Socket Wrench (S0983-96504)

(2) Using a hammer and chisel, caulk the outside rim of the lock nut into the groove on the shaft.
"A": 1.5 mm {0.0590 in.} or more


SHTS033240200053

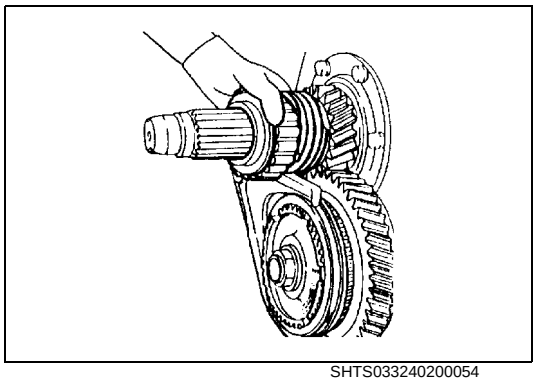
8. INSTALL THE CYLINDRICAL ROLLER BEARING INNER RACE.

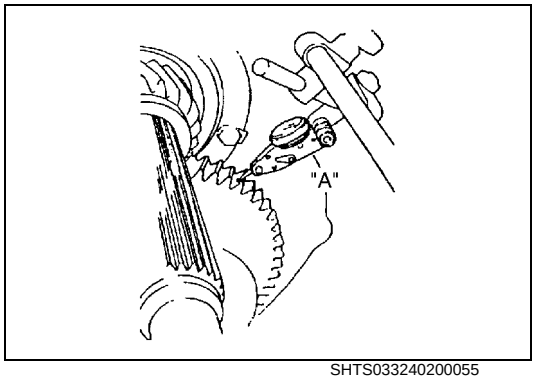
(1) Heat the cylindrical roller bearing inner race for about 5 minutes in oil heated to 80°C-100°C {176°F-212°F}, then install the cylindrical roller bearing inner race on the output shaft.

NOTICE

- **Do not heat the cylindrical roller bearing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

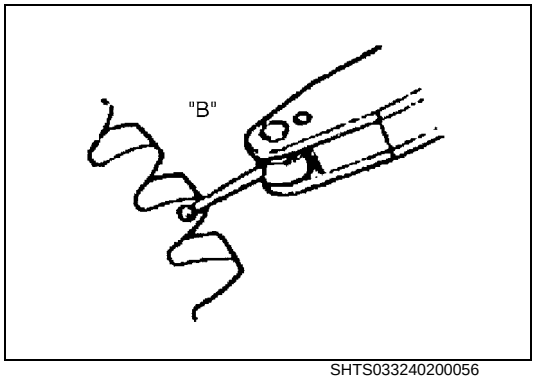
⚠ CAUTION
Never touch hot oil and heated cylindrical roller bearing with your bare hand. This can result in personal injury.


SHTS033240200054



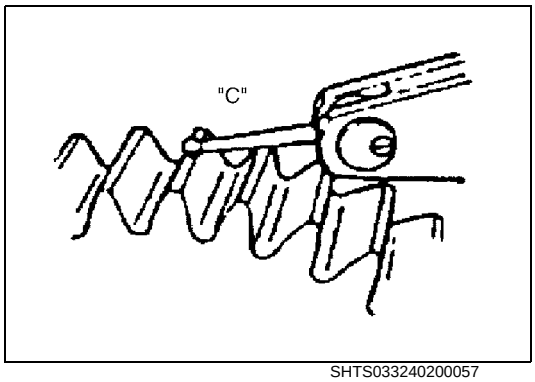
SHTS033240200055

9. MEASURE THE 6TH GEAR BACKLASH "A".
Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}
Service Limit: 0.4 mm {0.0157 in.}



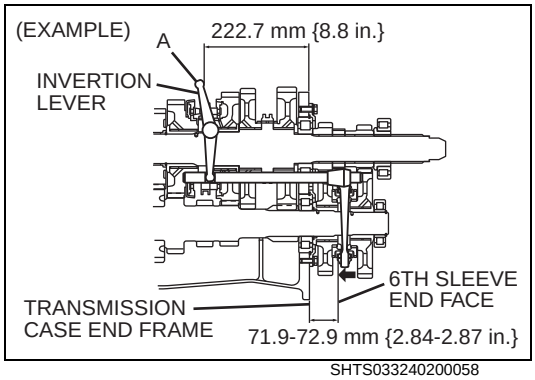
SHTS033240200056

10. MEASURE THE 6TH GEAR END PLAY "B".
Assembly Standard: 0.15-0.30 mm {0.0060-0.0118 in.}
Service Limit: 0.5 mm {0.0197 in.}



SHTS033240200057

11. MEASURE THE 6TH GEAR RADIAL PLAY "C".
Assembly Standard: 0.022-0.079 mm {0.0009-0.0031 in.}



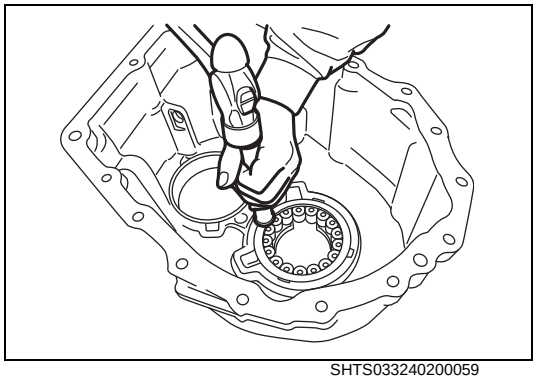
SHTS033240200058

12. INSPECT THE FITTING PLACE OF THE SYNCHRONIZER SLEEVE.

(1) Fix the inversion lever "A" at the position of 222.7 mm {8.8 in.} away from the rear and of the transmission case as shown in the figure.

(2) Remove the gaps between the inversion lever, the shift shaft, the shift fork, and the synchronizer sleeve by pushing the synchronizer sleeve slightly ahead (to the arrow pointed direction).

(3) After performing 1 and 2, adjust the dimension between the transmission case and the 6th sleeve and face to the dimension shown in the figure.
Assembly Standard: 71.9-72.9 mm {2.84-2.87 in.}



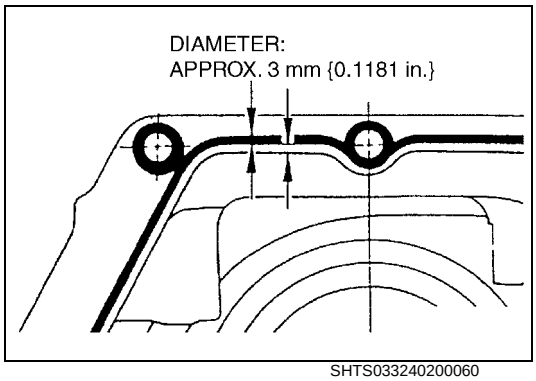
SHTS033240200059

13. INSTALL THE CYLINDRICAL ROLLER BEARING OUTER RACE.

(1) Using a brass bar and hammer, install the cylindrical roller bearing outer race into the auxiliary case.

NOTICE

Coat the cylindrical roller bearing outer race with gear oil during installation to provide initial lubrication.



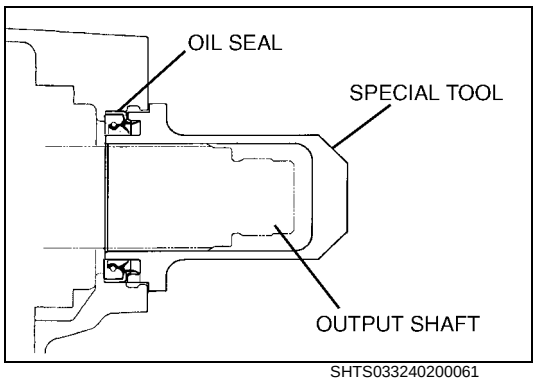
SHTS033240200060

14. INSTALL THE AUXILIARY CASE.

(1) Coat the face of the auxiliary case with liquid gasket.

NOTICE

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1216 or equivalent.**



SHTS033240200061

15. INSTALL THE OIL SEAL.

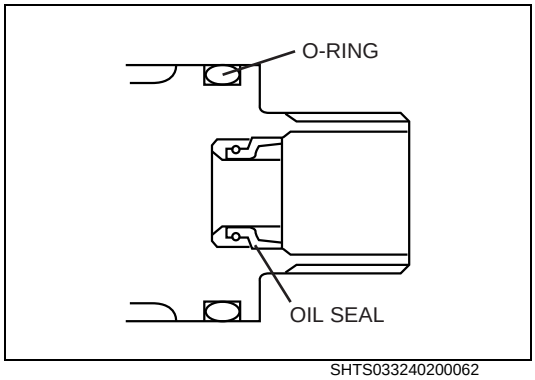
(1) Coat the sealing surface between the seal lips with bearing grease.

(2) Using the special tool, press the oil seal into the auxiliary case.
SST: Adapter (S0965-91240)

NOTICE

- **Take care not to damage the seal lips.**
- **Ensure the oil seal is installed in the correct direction.**

(3) Coat bearing grease to the sealing surface between the seal lips.



SHTS033240200062

16. INSTALL THE SPEEDOMETER DRIVEN GEAR BUSHING.

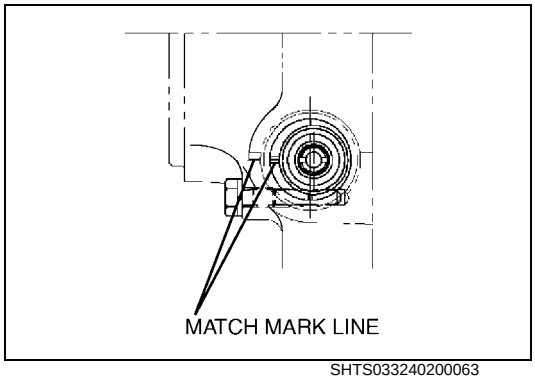
(1) Install the O-ring and oil seal to the bushing.

NOTICE

- **Coat the O-ring, oil seal and driven gear with bearing grease.**
- **Make sure that the oil seal is installed in the correct direction when replacing it.**

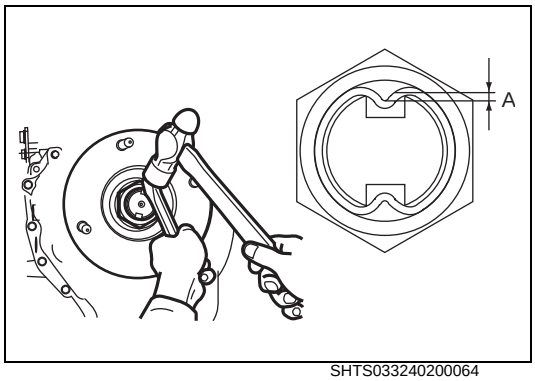
(2) Match the mark line on the bushing with the mark line on the rear bearing retainer.

(3) Align the speedometer driven gear bushing hole with the hole of the rear bearing retainer.



SHTS033240200063

Number of the drive gear teeth	Number of the driven gear teeth	The mark should be matched to the mark on retainer
7	18	18



SHTS033240200064

17. INSTALL THE OUTPUT SHAFT LOCK NUT.

(1) Before tightening the lock nut, engage two gears so that the shaft can not be turned around.

(2) Install the lock nut to the output shaft and tighten it.
SST: Socket Wrench (S0983-96504)

NOTICE
Do not damage the O-ring.

(3) Using a hammer and a chisel, caulk the outside rim of the lock nut into the groove on the shaft.

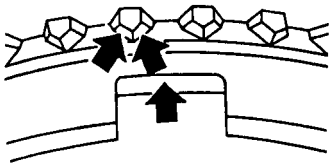
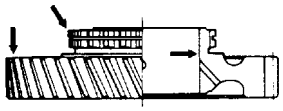
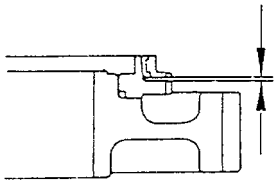
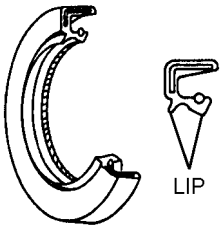
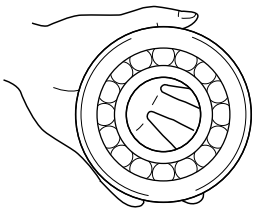
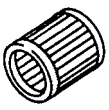
"A": 1.5 mm {0.0590 in.} or more

NOTICE
Staking should be done with out rift.

INSPECTION AND REPAIR

EN0332402H300002

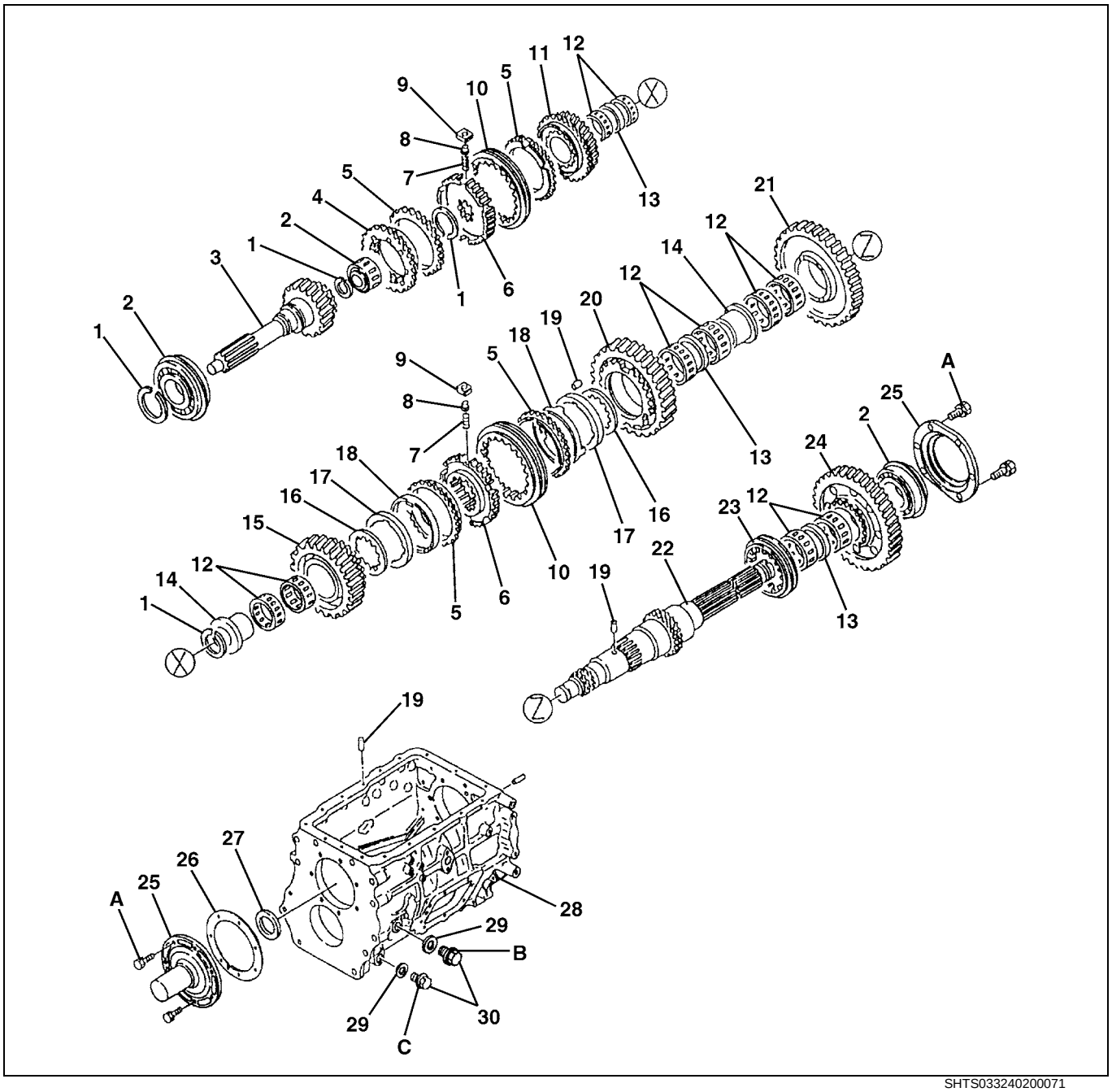
Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Synchronizer ring deformity, crack and excessive damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Gear excessive wear, chips and cracks	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Clearance between synchronizer ring and synchronizer cone or gear sub assembly.	**0.85-1.90 {0.0335-0.0748}**	**0.20 {0.0079}**	**Replace the synchronizer ring and/or gear sub assembly.**	**Measure** 
Oil seal lip wear and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Cylindrical roller bearing and ball bearing improper rotation.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Needle roller bearing in deformed shape	**—**	**—**	**Replace, if necessary.**	**Visual check** 

INPUT SHAFT AND OUTPUT SHAFT

COMPONENT LOCATOR

EN0332402D100003



SHTS033240200071

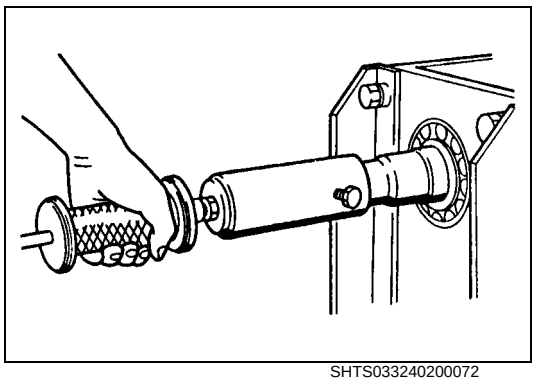
1	Retainer ring	16	Synchronizer bushing
2	Cylindrical roller bearing	17	Synchronizer inner cone
3	Input shaft	18	Synchronizer double cone
4	Synchronizer cone	19	Pin
5	Synchronizer ring	20	2nd gear sub-assembly
6	Synchronizer hub	21	Reverse gear
7	Compression spring	22	Output shaft
8	Synchronizer head	23	Constant sleeve
9	Synchronizer key	24	1st gear sub-assembly
10	Synchronizer sleeve	25	Bearing retainer
11	4th gear sub-assembly	26	Gasket
12	Needle roller bearing	27	Oil seal
13	Spacer	28	Transmission case
14	Bushing	29	Soft washer
15	3rd gear sub-assembly	30	Plug

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	64-86 {650-870, 47-62}	C	50-78 {500-800, 37-57}
B	79-117 {800-1,200, 58-86}		

OVERHAUL

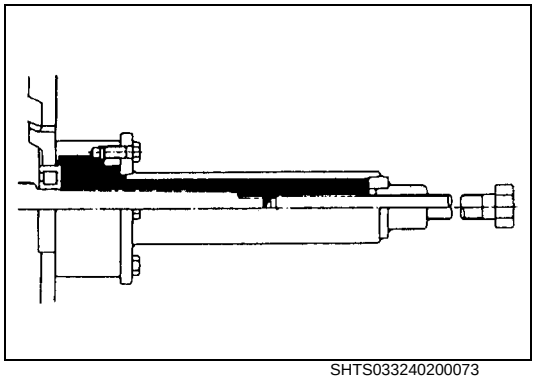
EN0332402H200003


SHTS033240200072

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE INPUT SHAFT.

(1) Using the special tools, pull out the input shaft with the accompanying bearings.
SST:
Input Shaft Puller (S0965-02070)
Sliding Hammer (S0942-01442)

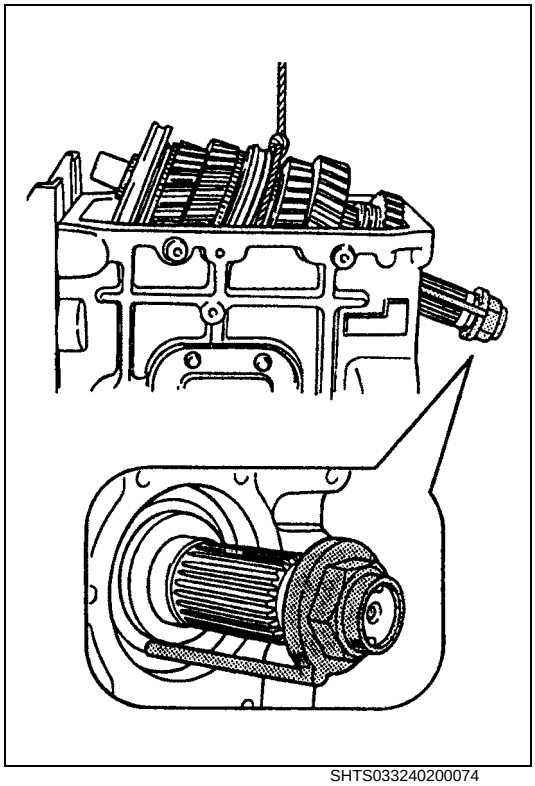

SHTS033240200073

2. REMOVE THE OUTPUT SHAFT REAR BEARING.

(1) Remove the retainer ring from the cylindrical roller bearing.
(2) Attach the special tools to the bearing, remove the cylindrical roller bearing.
SST:
Hook (S0965-31230)
Puller (S0965-01882)

NOTICE
Insert the hook's click into the groove for the retainer ring, then secure the puller to the hook with bolts. Secure the puller so that it does not turn around, and then rotate the bolt to pull the bearing out.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.

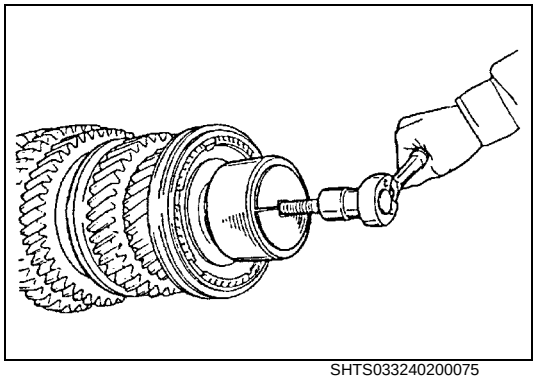

SHTS033240200074

3. REMOVE THE OUTPUT SHAFT ASSEMBLY FROM THE TRANSMISSION CASE.

(1) Attach a jig to the end of the output shaft.

⚠ CAUTION
If the output shaft assembly is removed from the transmission without a jig, the 1st gear will drop from the shaft, which can possibly result in the personal injury.

(2) Attach a suitable hook or other lifting device around the 2nd-3rd speed synchronizer sleeve and carefully lift the output shaft assembly from the transmission case.
(3) When removing the output shaft assembly, remove the synchronizer ring and the cone of the input shaft gear.

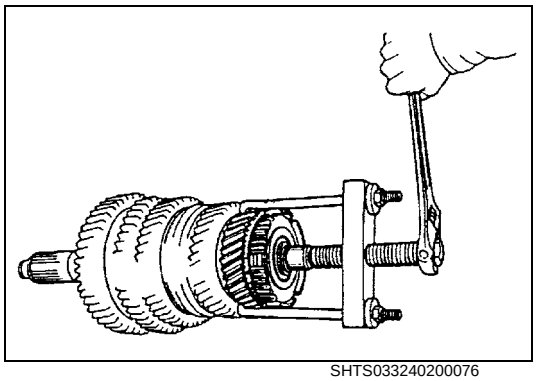

SHTS033240200075

4. REMOVE THE CYLINDRICAL ROLLER BEARING.

(1) Remove the retainer ring.

(2) Attach the special tool to the bearing, remove the cylindrical roller bearing.
SST: Puller (S0965-02170)

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.

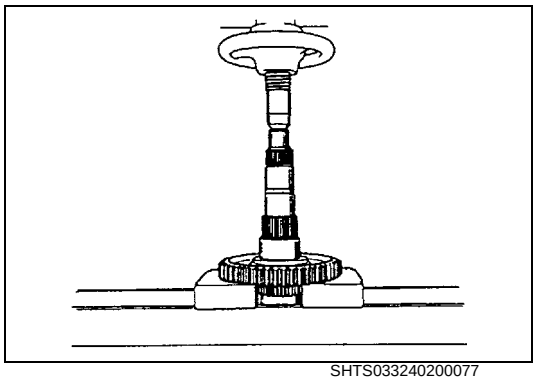

SHTS033240200076

5. REMOVE THE SYNCHRONIZER UNIT AND 4TH GEAR.

(1) Remove the retainer ring.

(2) Using a commercial tool, remove the synchronizer unit and 4th gear.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.

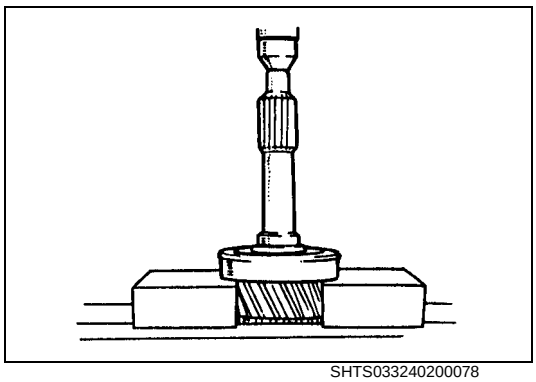

SHTS033240200077

6. REMOVE THE BUSHINGS FROM THE OUTPUT SHAFT.

(1) Support the reverse gear and press the output shaft front end through the bushing and needle roller bearings.

NOTICE
When removing the output shaft, do not allow the shaft to drop on a hard surface.

⚠ CAUTION
Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.


SHTS033240200078

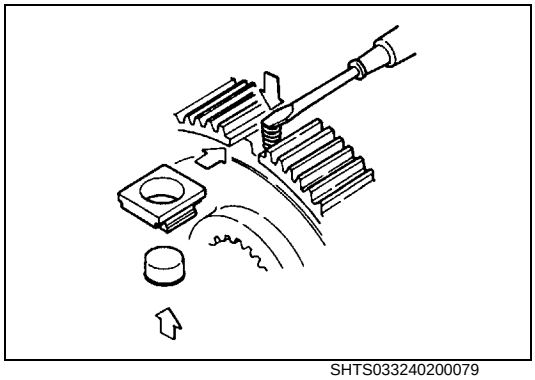
7. DISASSEMBLE THE INPUT SHAFT.

(1) Remove the retainer ring from the input shaft.

(2) Using a press, remove the cylindrical roller bearing.

⚠ CAUTION

- **The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**
- **Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**



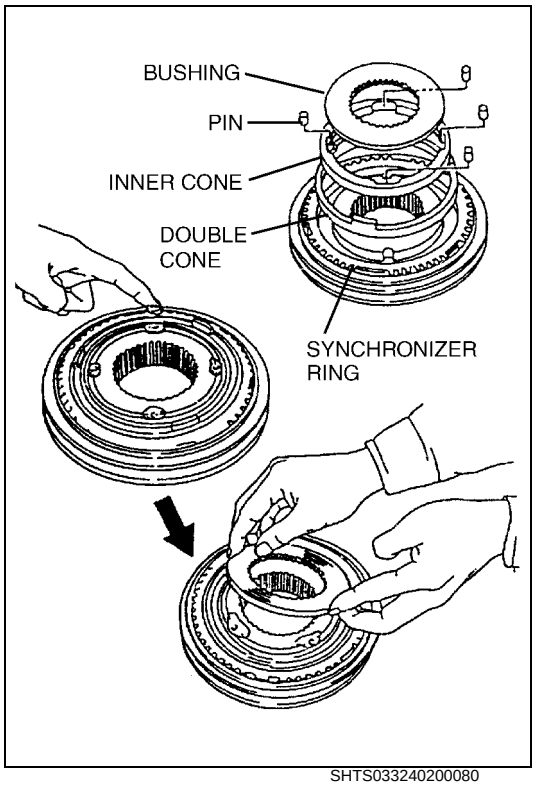
SHTS033240200079

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLE THE 2ND-3RD SYNCHRONIZER UNIT.

(1) Install the compression spring.
(2) Install the synchronizer key and head.

⚠ CAUTION
The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.



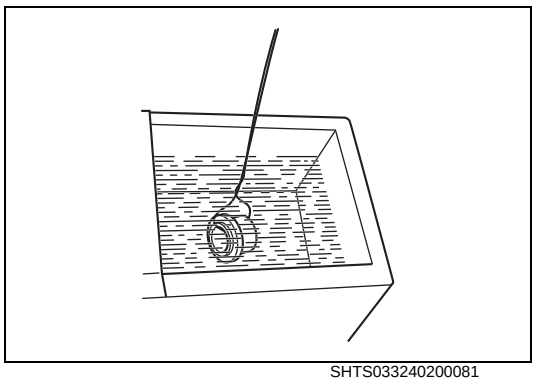
SHTS033240200080

(3) Install the synchronizer ring, double cone, inner cone, pins and sleeve on the synchronizer unit.

NOTICE

- **Apply disulfide molybdenium grease to the synchronizer ring inner surface and the inner cone outer surface.**
- **Apply grease to the pins to prevent the pins from falling down and installing into the bushing.**

(4) Set the bushing on the original position.



SHTS033240200081

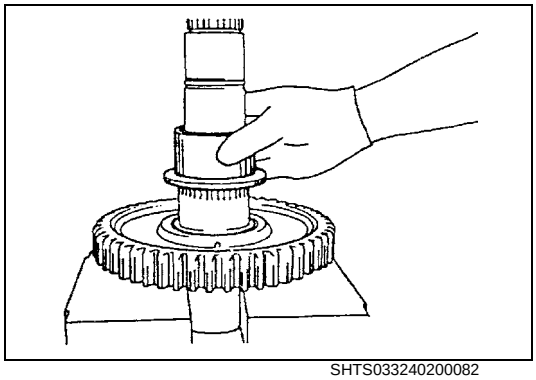
2. INSTALL THE 2ND GEAR BUSHING AND 2ND GEAR.

(1) Heat the bushing for about 5 minutes in water or oil heated to 80°C-100°C {176°F-212°F}.

NOTICE

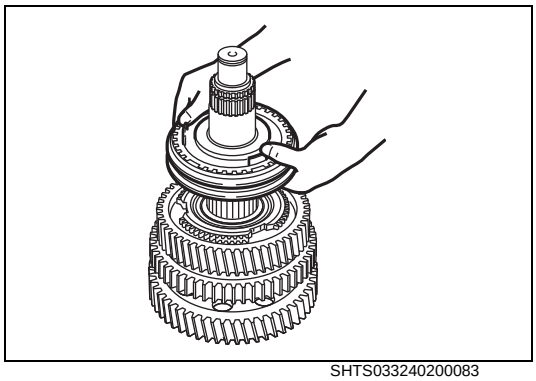
- **Do not heat the bushing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION
Never touch hot water or oil and heated bushing with your bare hand. This can result in personal injury.

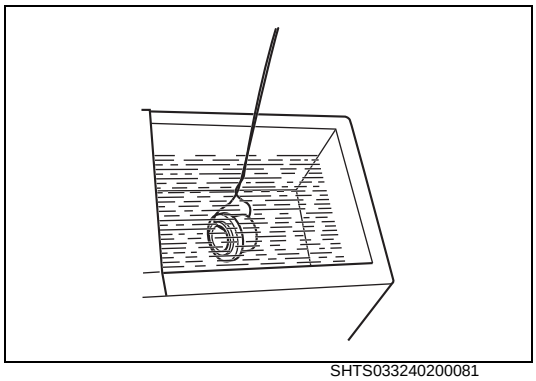

SHTS033240200082

(2) Place the bushing on the output shaft against the end stop.
(3) Install the 2nd gear and needle roller bearing.

NOTICE
Coat the needle roller bearing with gear oil during installation to provide initial lubrication.


SHTS033240200083

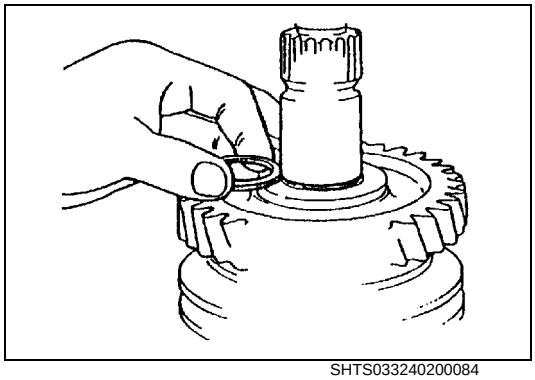
3. INSTALL THE 2ND-3RD SYNCHRONIZER UNIT.


SHTS033240200081

4. INSTALL THE 3RD GEAR, NEEDLE ROLLER BEARING, BUSHING AND 4TH GEAR.
(1) Install the 3rd gear and needle roller bearing on the shaft.
(2) Heat the bushing for about 5 minutes in water or oil heated to 80°C-100°C {176°F-212°F}, then install the bushing on the shaft.

NOTICE
- **Coat the needle roller bearing with gear oil during installation to provide initial lubrication.**
- **Do not heat the bushing and the needle roller bearing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION
Never touch hot water or oil and heated bushing with your bare hand. This can result in personal injury.


SHTS033240200084

(3) Select a retainer ring.

Clearance: 0-0.1 mm {0-0.0039 in.}

NOTICE

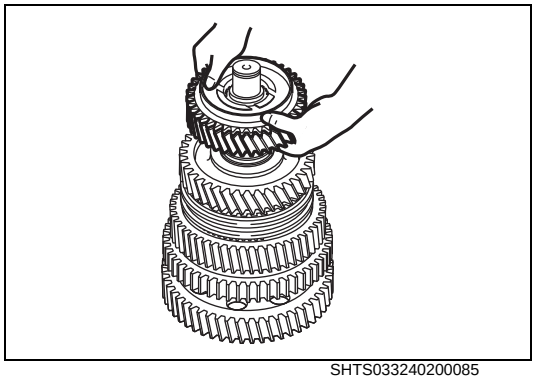
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

Retainer rings are available in the following sizes.

Thickness	Color code
2.5 mm {0.0984 in.}	Brown
2.6 mm {0.1024 in.}	Blue
2.7 mm {0.1063 in.}	Green
2.8 mm {0.1102 in.}	Yellow
2.9 mm {0.1142 in.}	Red

⚠ CAUTION

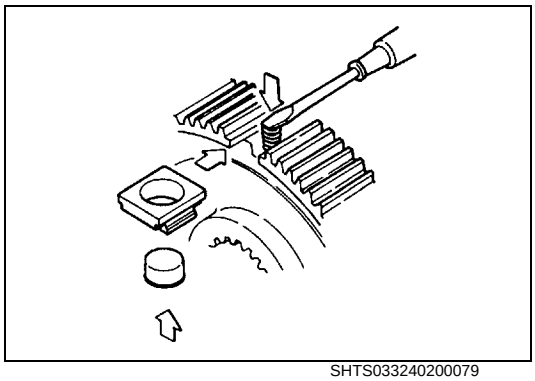
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS033240200085

(4) Install the 4th gear and needle roller bearing on the shaft.

NOTICE

Coat the needle roller bearing with gear oil during installation to provide initial lubrication.


SHTS033240200079

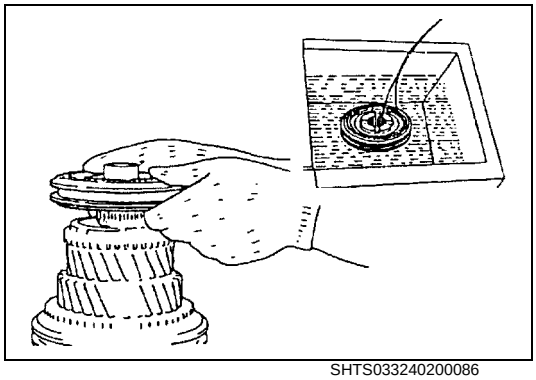
5. ASSEMBLE THE 4TH-5TH SYNCHRONIZER UNIT.

(1) Install the compression spring.

(2) Install the synchronizer key and head.

⚠ CAUTION

The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.


SHTS033240200086

6. INSTALL THE 4TH-5TH SYNCHRONIZER UNIT.

(1) Heat the synchronizer unit for about 5 minutes in water or oil heated to 80°C-100°C {176°F-212°F}.

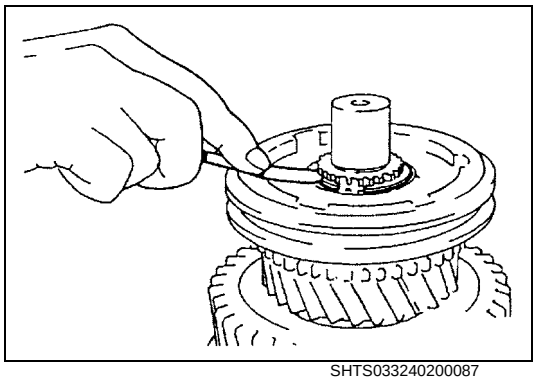
(2) Install the synchronizer unit on the output shaft.

NOTICE

- **Do not heat the synchronizer unit in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**
- **Apply disulfide molybdenium grease to the synchronizer ring inner surface.**

⚠ CAUTION

Never touch hot water or oil and heated synchronizer unit with your bare hand. This can result in personal injury.


SHTS033240200087

7. INSTALL THE RETAINER RING.

(1) Select a retainer ring.
Clearance: 0-0.1 mm {0-0.0039 in.}

NOTICE

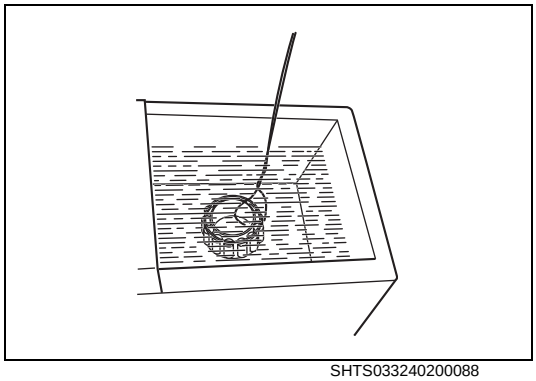
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

Retainer rings are available in the following sizes.

Thickness	Color code
2.4 mm {0.0945 in.}	None
2.5 mm {0.0984 in.}	Blue
2.6 mm {0.1024 in.}	Green
2.7 mm {0.1063 in.}	Yellow
2.8 mm {0.1102 in.}	Red

⚠ CAUTION

The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS033240200088

8. INSTALL THE CYLINDRICAL ROLLER BEARING

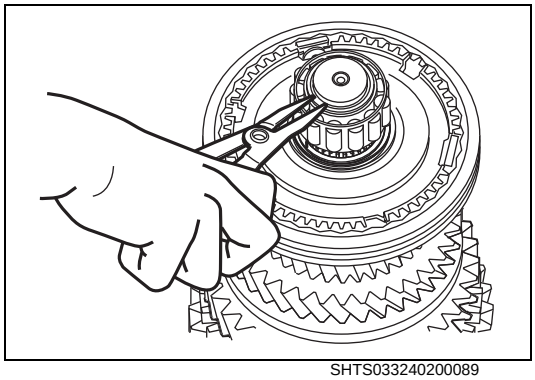
(1) Heat the cylindrical roller bearing for about 5 minutes in oil heated to 80°C-100°C {176°F-212°F}.

NOTICE

- **Do not heat the cylindrical roller bearing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION

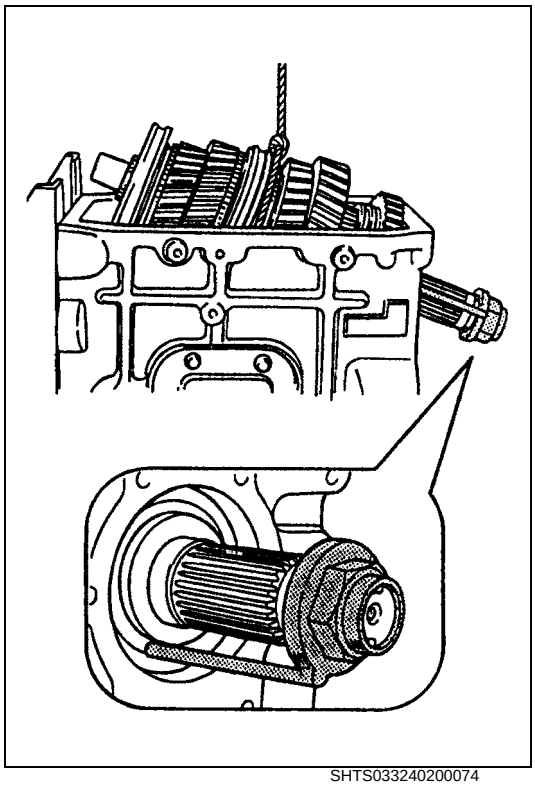
Never touch hot water or oil and heated synchronizer unit with your bare hand. This can result in personal injury.


SHTS033240200089

(2) Install the cylindrical roller bearing on the output shaft.
(3) Install the retainer ring.

NOTICE
Coat the needle roller bearing with gear oil during installation to provide initial lubrication.

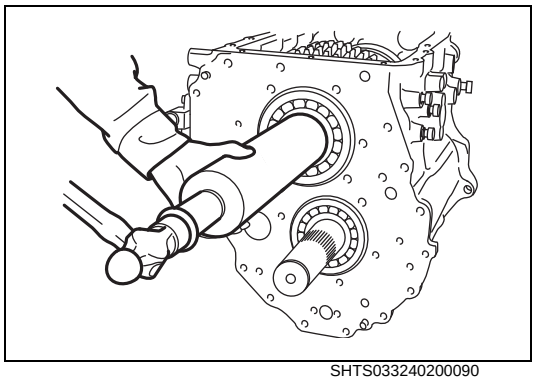
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS033240200074

9. INSTALL THE OUTPUT SHAFT ASSEMBLY IN THE TRANSMISSION CASE.
(1) Attach a suitable hook around the 2nd-3rd synchronizer sleeve and carefully lower the output shaft assembly into the case.
(2) Position the output shaft gears so that they mesh with mating counter shaft gears.
(3) When installing the output shaft assembly, install the synchronizer ring and cone of the input shaft gear.

NOTICE
If the output shaft assembly is installed into the transmission case without jig, the 1st gear will drop from the shaft.

⚠ CAUTION
When installing the output shaft assembly in the transmission case, be careful not to drop the 1st gear from the shaft.

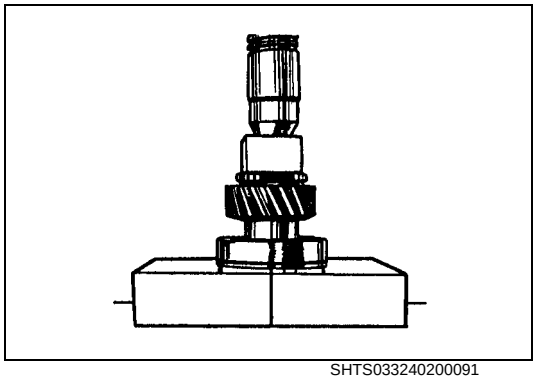

SHTS033240200090

10. INSTALL THE OUTPUT SHAFT REAR BEARING
(1) Install the retainer ring to the cylindrical roller bearing.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.

(2) Using a suitable installing tool, press the cylindrical roller bearing into the transmission case.

NOTICE
Coat the cylindrical roller bearing with gear oil during installation to provide initial lubrication.

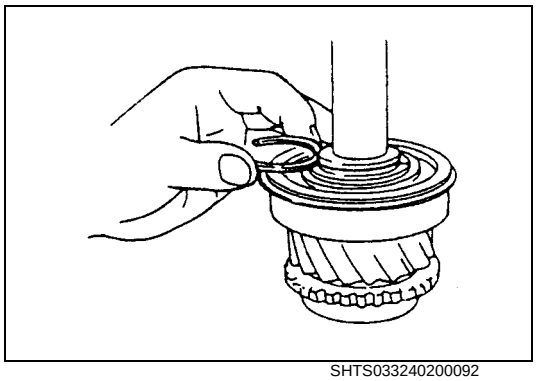

SHTS033240200091

11. ASSEMBLE THE INPUT SHAFT.

(1) Using a press, install the cylindrical roller bearing to the input shaft.

NOTICE

- **When installing the bearing side ring, place the larger chamfering side to gear side.**
- **Coat the cylindrical roller bearing with gear oil during installation to provide initial lubrication.**
- **Do not put any pressure on the outer race.**


SHTS033240200092

(2) Select a retainer ring.
Clearance: 0-0.1 mm {0-0.0039 in.}

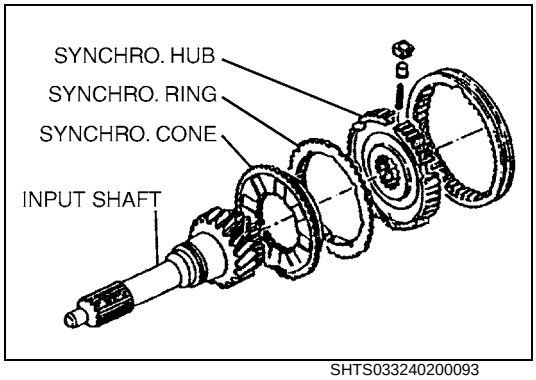
NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

Retainer rings are available in the following sizes.

Thickness	Color code
3.0 mm {0.1181 in.}	Blue
3.1 mm {0.1220 in.}	Green
3.2 mm {0.1260 in.}	Yellow
3.3 mm {0.1299 in.}	Red

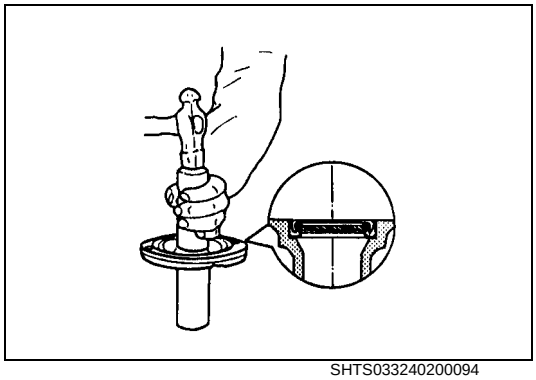
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.



SHTS033240200093

12. INSTALL THE INPUT SHAFT INTO THE TRANSMISSION CASE.

(1) Mesh the synchronizer cone to the input shaft.
(2) Align the synchronizer hub slot with synchronizer ring.


SHTS033240200094

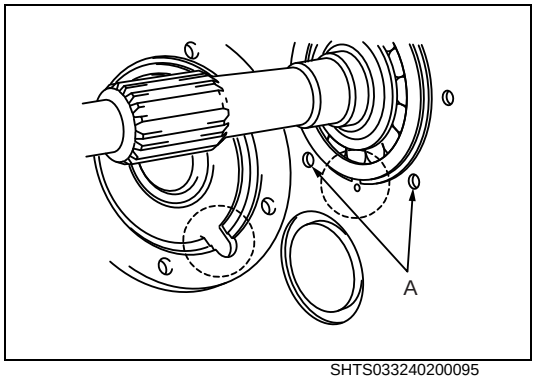
13. REPLACE THE OIL SEAL OF THE FRONT BEARING RETAINER.

(1) Using a screw driver, remove the oil seal from the bearing retainer.
(2) Using a press and a suitable installing tool, press the oil seal into the bearing retainer.

NOTICE

- **Coat gear oil to oil seal surface.**
- **Be sure the oil seal is installed in the proper direction.**

(3) Coat the sealing surface between the seal lips with bearing grease.



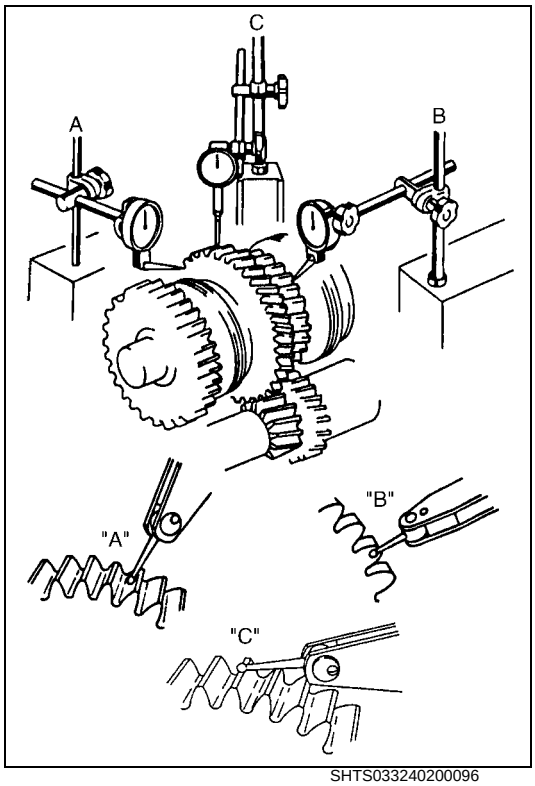
SHTS033240200095

14. INSTALL THE FRONT BEARING RETAINER.

(1) Coat both sides of the gasket with liquid gasket.
(2) Apply liquid gasket or sealing tape to the "A" bolt threads.

NOTICE

- **When installing the bearing retainer, the gasket must be installed in such a way that the gasket notch matches the oil drain hole on the case so as not to block the hole.**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **Take care not to damage the seal lips.**



SHTS033240200096

15. MEASURE THE GEAR BACKLASH, END PLAY AND RADIAL PLAY.

(1) Block the counter shaft with a pry bar when measuring.
(2) Measure the gear backlash, end play and radial play at four points of each gear.

BACKLASH: "A" **Unit: mm {in.}**

	Standard	Limit
Input shaft gear	0.08-0.16 {0.0032-0.0062}	0.4 {0.0157}
Reverse gear		
1st gear		
2nd gear		
3rd gear		
4th gear		

END PLAY: "B" **Unit: mm {in.}**

	Standard	Limit
Reverse gear	0.15-0.30 {0.0060-0.0118}	0.5 {0.0197}
1st gear	0.25-0.40 {0.0099-0.0157}	
2nd gear	0.15-0.30 {0.0060-0.0118}	
3rd gear		
4th gear	0.125-0.555 {0.0050-0.0218}	0.7 {0.0276}

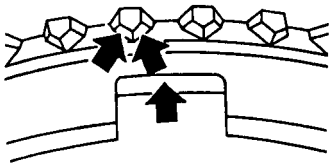
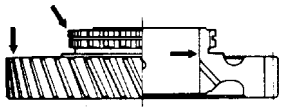
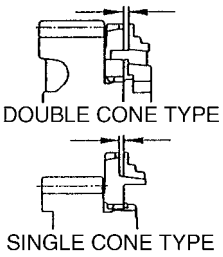
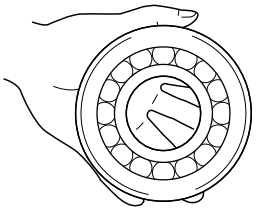
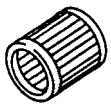
RADIAL PLAY: "C" **Unit: mm {in.}**

	Assembly Standard
Reverse gear	0.032-0.080 {0.0013-0.0031}
1st gear	
2nd gear	0.028-0.082 {0.0012-0.0032}
3rd gear	0.024-0.122 {0.0010-0.0048}
4th gear	0.020-0.070 {0.0008-0.0027}

INSPECTION AND REPAIR

EN0332402H300003

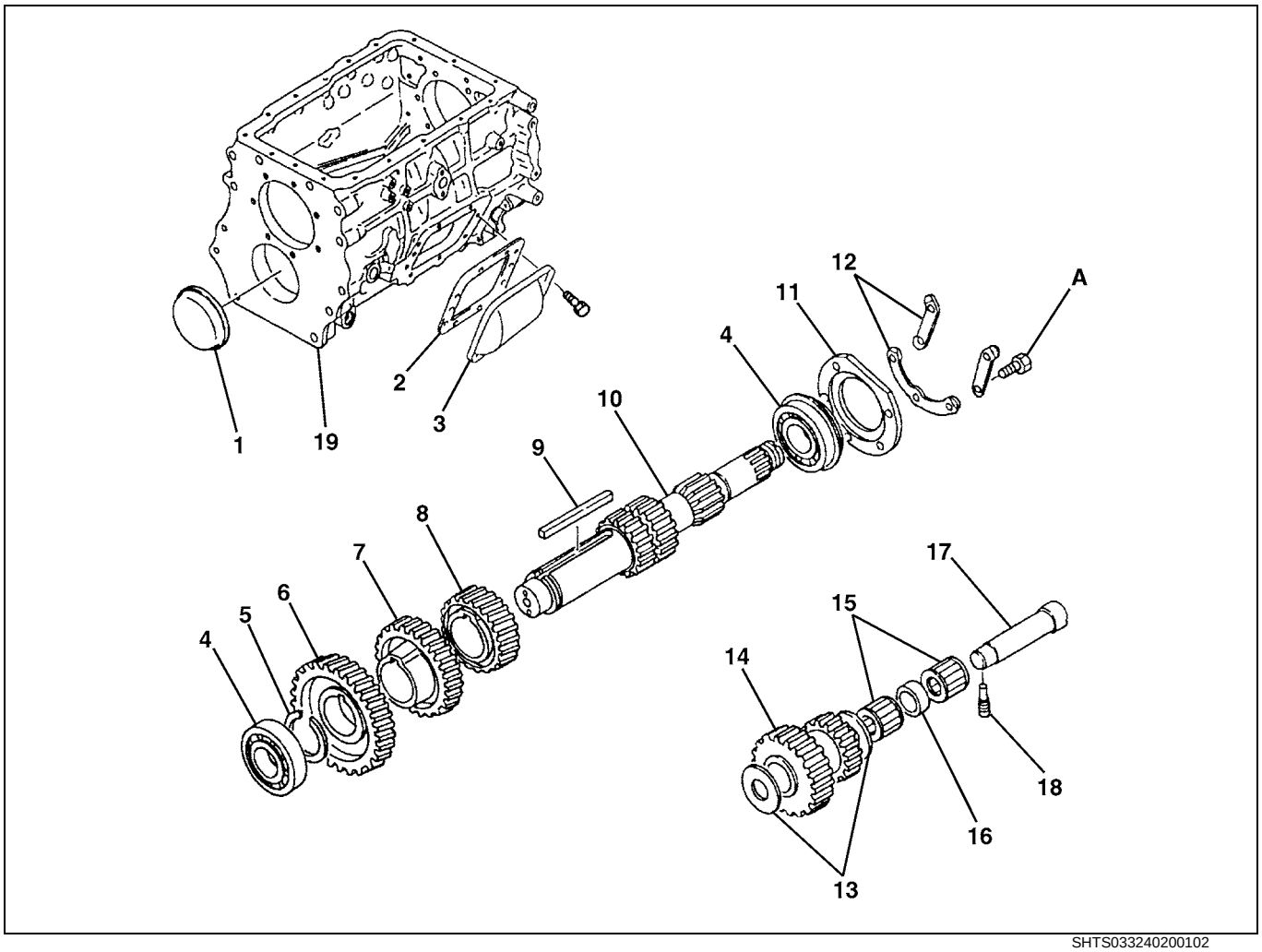
Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Synchronizer ring deformity, crack and excessive damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Gear excessive wear, chips and cracks	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Clearance between synchronizer ring and synchronizer cone or gear sub assembly.	**2nd and 3rd gear 1.05-2.30 {0.0413-0.0906}** **4th gear and Input gear 0.80-1.60 {0.0315-0.0629}**	**0.2 {0.0079}**	**Replace the synchronizer ring and/or gear sub assembly.**	**Measure** 
Cylindrical roller bearing improper rotation.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Needle roller bearing in deformed shape.	**—**	**—**	**Replace, if necessary.**	**Visual check** 

COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS

COMPONENT LOCATOR

EN0332402D100004



SHTS033240200102

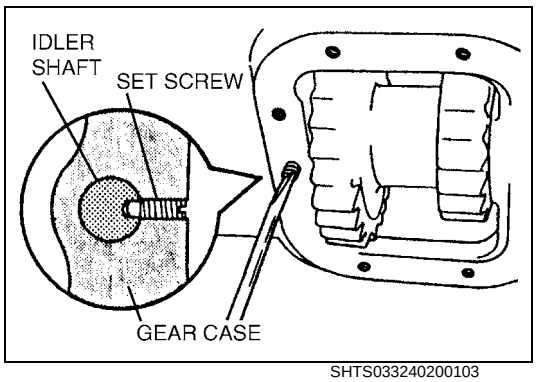
1	Seal cover	11	Bearing retainer
2	Gasket	12	Lock plate
3	Power take-off cover	13	Thrust washer
4	Cylindrical roller bearing	14	Reverse idler gear
5	Retainer ring	15	Needle roller bearing
6	Counter shaft drive gear	16	Spacer
7	Counter 4th gear	17	Reverse idler shaft
8	Counter 3rd gear	18	Set screw
9	Key	19	Transmission case
10	Counter shaft		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	64-86 {650-870, 47-62}		

OVERHAUL

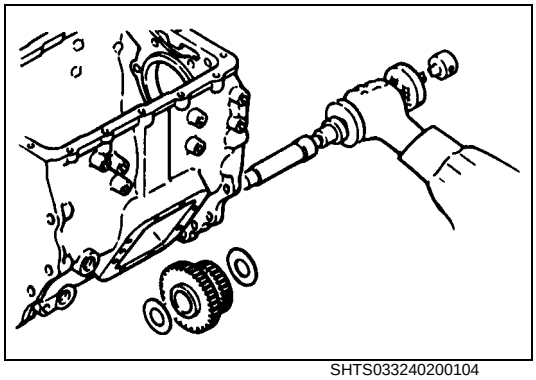
EN0332402H200004



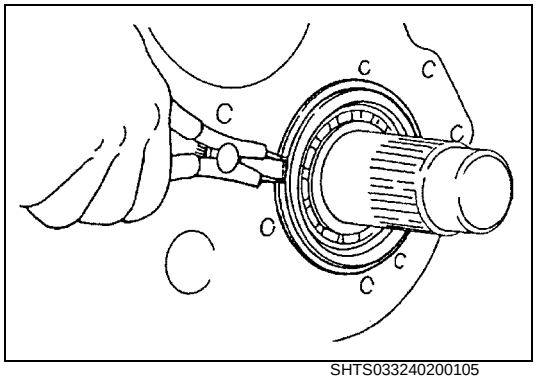
SHTS033240200103

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE IDLER SHAFT SET SCREW.
(1) Using a screwdriver, remove the reverse idler shaft set screw.

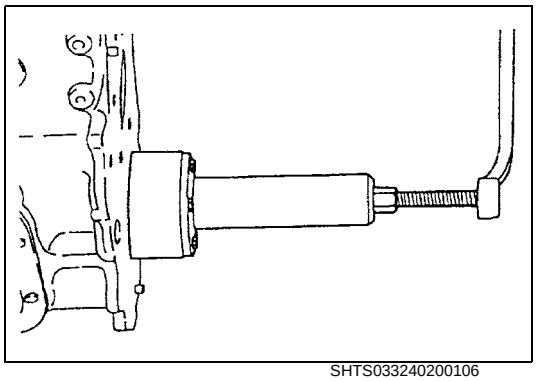

SHTS033240200104

2. REMOVE THE IDLER SHAFT AND IDLER GEAR.
(1) Using the special tool, pull out the reverse idler shaft while holding the reverse idler gear thrust washers and bearing inside the case.
SST: Sliding Hammer (S0942-01442)


SHTS033240200105

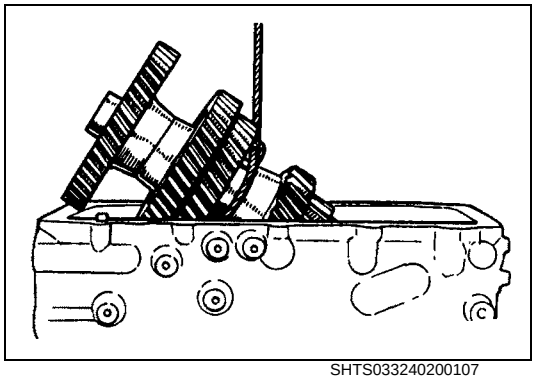
3. REMOVE THE COUNTER SHAFT REAR BEARING.
(1) Remove the bearing retainer.
(2) Remove the retainer ring.

⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.


SHTS033240200106

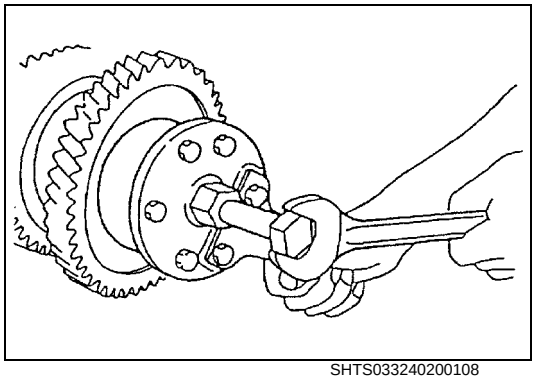
(3) Using the special tools, remove the cylindrical roller bearing.
SST:
Hook (S0965-31210)
Puller (S0965-01882)

NOTICE
Insert the hook's click into the groove for the retainer ring then secure the puller to the hook with bolts. Secure the puller so that it does not turn around, then rotate the bolt to pull the bearing out.


SHTS033240200107

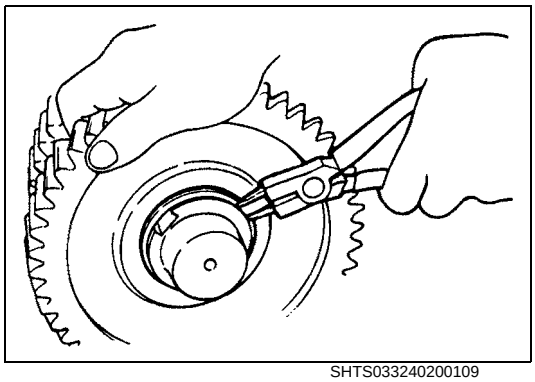
4. REMOVE THE COUNTER SHAFT FROM THE TRANSMISSION CASE.

(1) Tie a rope or hook around the counter shaft and carefully pry the counter shaft assembly rearward until the front end of the shaft is cleared out of the front cylindrical roller bearing.
(2) Carefully lift the counter shaft assembly from the case.


SHTS033240200108

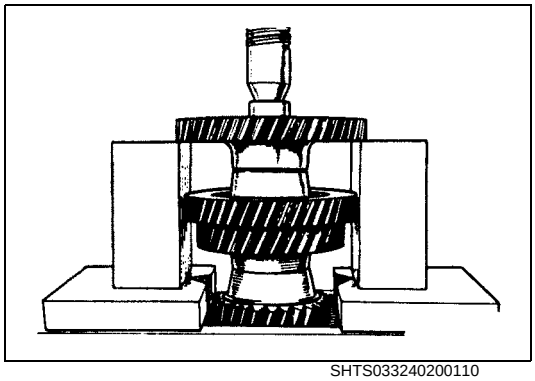
5. REMOVE THE CYLINDRICAL ROLLER BEARING INNER RACE.

(1) Using the special tools on the inner race, pull out the front cylindrical roller bearing inner race from the counter shaft.
SST:
Puller (S0965-01900)
Hook (S0965-31430)


SHTS033240200109

6. REMOVE THE RETAINER RING.

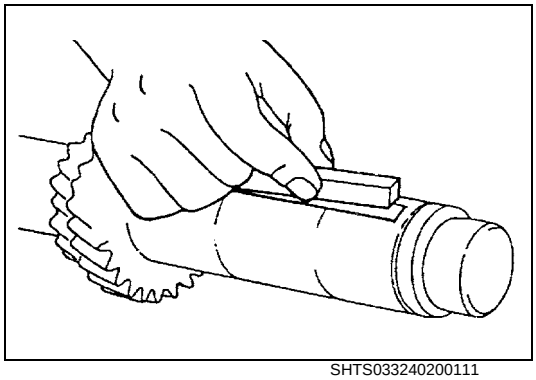
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.


SHTS033240200110

7. REMOVE THE COUNTER SHAFT GEARS.

(1) Support the counter shaft drive gear as close as possible to the gear hub and press the counter shaft front end until it is freed out of the drive gear.
(2) Support the counter 4th gear under the gear teeth and press the counter shaft out of the gear.
(3) Support the counter 3rd gear under the gear teeth and press the counter shaft out of the gear.

⚠ CAUTION
Stay out from under the shaft during removal.
The shaft could drop suddenly, which can result in personal injury.

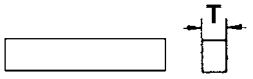
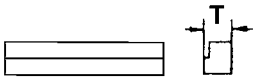

SHTS033240200111

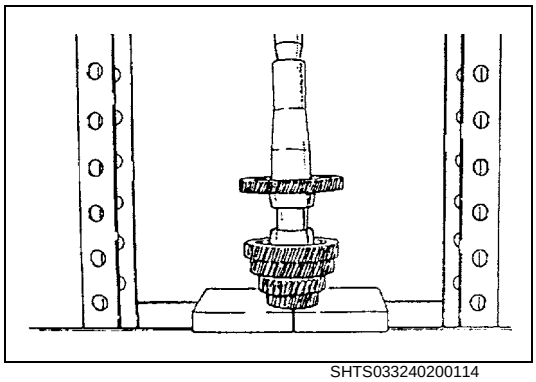
IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE COUNTER DRIVE GEAR, COUNTER 4TH GEAR AND 3RD GEAR.

(1) Select the proper size key according to the size of the key groove.

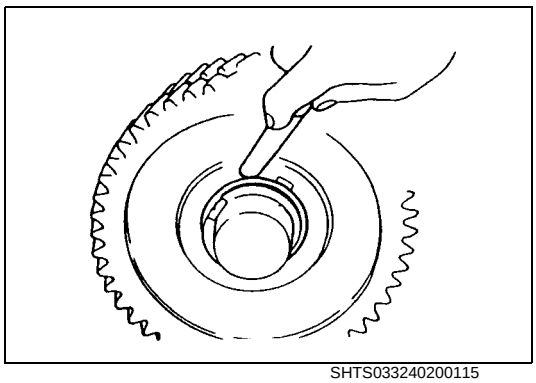
Unit: mm {in.}

Thickness "T"	Color code	Shape
14.018-14.029 {0.5519-0.5523}	None	
14.070-14.085 {0.5540-0.5545}	White	


SHTS033240200114

(2) Press in the gears into the counter shaft making certain that the key and keyway are aligned.

NOTICE
Be sure that the gears are installed in the proper direction.


SHTS033240200115

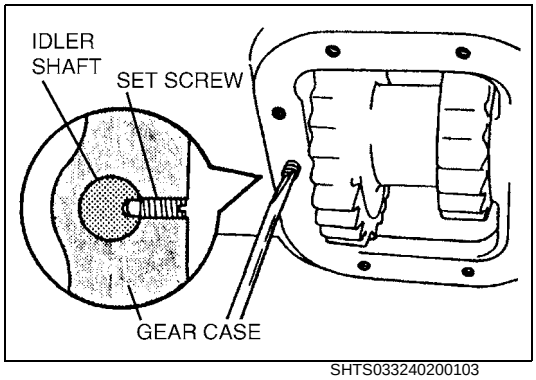
(3) Select a retainer ring that will provide a tight fit and install it on the shaft.

NOTICE

- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

Clearance: 0-0.1 mm {0-0.0039 in.}
Retainer rings are available in the following sizes.

Thickness	Color code
2.45 mm {0.0965 in.}	Red
2.55 mm {0.1004 in.}	None
2.65 mm {0.1043 in.}	Yellow
2.75 mm {0.1083 in.}	Blue
2.85 mm {0.1122 in.}	White
2.95 mm {0.1161 in.}	Green



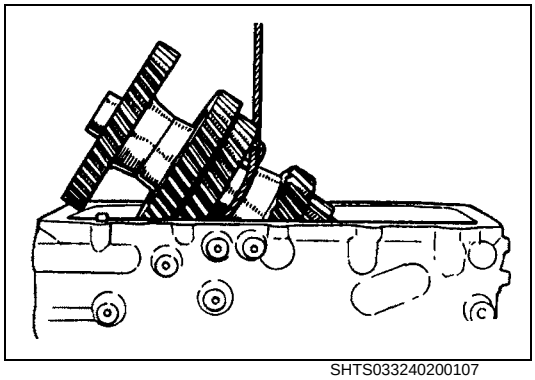
SHTS033240200103

2. INSTALL THE REVERSE IDLER GEAR.

(1) Coat the two thrust washers with disulfide molybdenium grease to hold the washers in place against each side of the idler gear.

(2) Insert the idler shaft until the thread hole of the set screw in the shaft is aligned correctly with the thread hole in the case rib, so that the set screw can be installed.

(3) Tighten the set screw until the screw head is completely below the gear case surface.

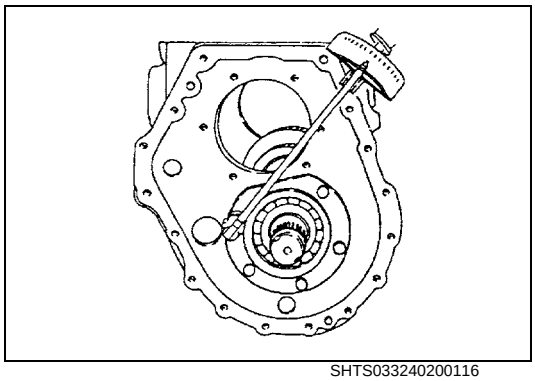


SHTS033240200107

3. INSTALL THE COUNTER SHAFT IN THE TRANSMISSION CASE.

NOTICE

- **When installing the bearing side ring, place the larger chamfering side to gear side.**
- **Do not put any pressure on the outer race.**

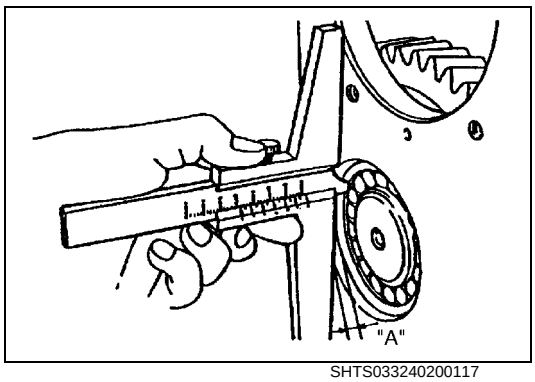


SHTS033240200116

4. INSTALL THE BEARING RETAINER AND LOCK PLATE.

NOTICE

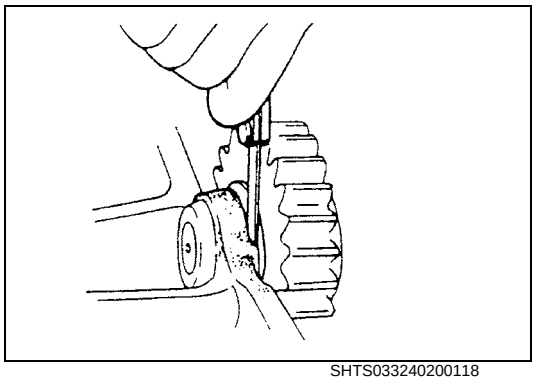
- **Caulk the lock plate to the flat surface of the bolt.**
- **For the lock plate contacting the protruding portion of the bolt, caulk only the half on the tightening side.**



SHTS033240200117

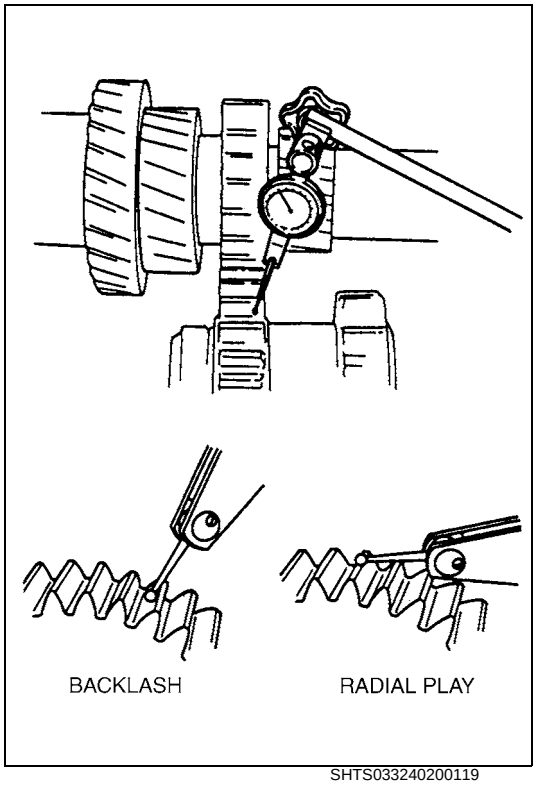
5. MEASURE THE DISTANCE "A" BETWEEN THE GEAR CASE OUTER SURFACE AND THE FRONT BEARING OUTER RACE.
Assembly Standard: 6.7-7.2 mm {0.2638-0.2834 in.}

6. PRESS IN THE SEAL COVER NOT TO HAVE SURFACE MISMATCH WITH THE CASE FRONT.



SHTS033240200118

7. MEASURE THE REVERSE IDLER GEAR END PLAY.
Assembly Standard: 0.30-0.75 mm {0.0119-0.0295 in.}
Service Limit: 0.9 mm {0.0354 in.}



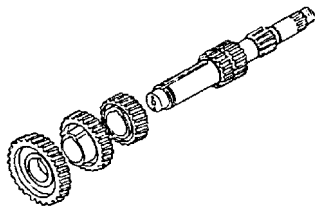
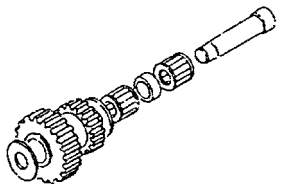
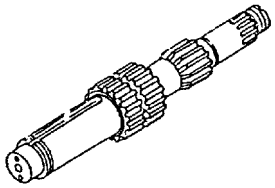
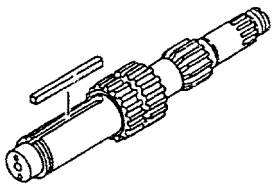
SHTS033240200119

8. MEASURE THE BACKLASH BETWEEN THE REVERSE IDLER GEAR AND THE COUNTER SHAFT REVERSE GEAR.
Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}
Service Limit: 0.4 mm {0.0157 in.}

9. MEASURE THE REVERSE IDLER GEAR RADIAL PLAY.
Assembly Standard: 0.020-0.080 mm {0.0008-0.0031 in.}

INSPECTION AND REPAIR

EN0332402H300004

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
All gears for cracks and defects	—	—	Replace, if necessary.	Visual check 
Idler gear, shaft and needle roller bearing wear and damage	—	—	Replace, if necessary.	Visual check 
Counter shaft wear, chips and cracks	—	—	Replace, if necessary.	Visual check 
Counter shaft key way damage and looseness	—	—	Replace the counter shaft and/or key, if necessary.	Visual check 

TRANSMISSION MAIN UNIT (EATON FS6109)

TR02-005

TRANSMISSION ASSEMBLY TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0332502I200001

Manufacture	**EATON**	
Transmission model	**FS6109**	
Gear ratios	**Crawler**	**12.637**
	1st	**8.806**
	2nd	**6.550**
	3rd	**4.768**
	4th	**3.548**
	5th	**2.481**
	6th	**1.845**
	7th	**1.343**
	8th	**1.000**
	Reverse	**13.210**
Oil capacity, gear box	**Without power take-off**	**Approx. 8.5 litters {1.87 lmp.gal., 2.25 US.gal.}**
	With power take-off	**Approx. 9 litters {1.98 lmp.gal., 2.38 US.gal.}**
Lubricant type		**Mild EP gear oil (API GL-4, MIL-L-2105)**
Viscosities	**At -26°C to 21°C (-14.8°F to 68.0°F)**	**SAE 80W**
	At -12°C to 37°C (10.4°F to 98.6°F)	**SAE 90**
	At -26°C to 38°C (-14.8°F to 100.4°F)	**SAE 80W-90**

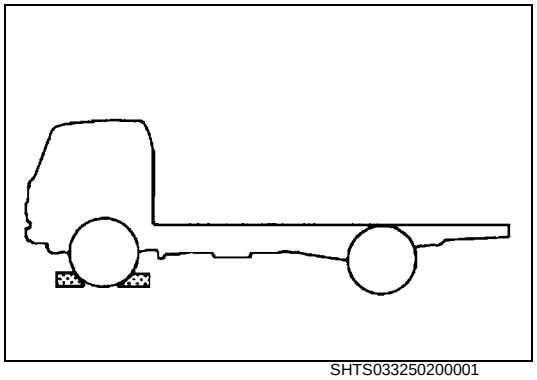
NOTICE
For other details, refer to EATON manuals.

DISMOUNTING AND MOUNTING

EN0332502H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033250200001

1. BLOCK THE WHEELS.

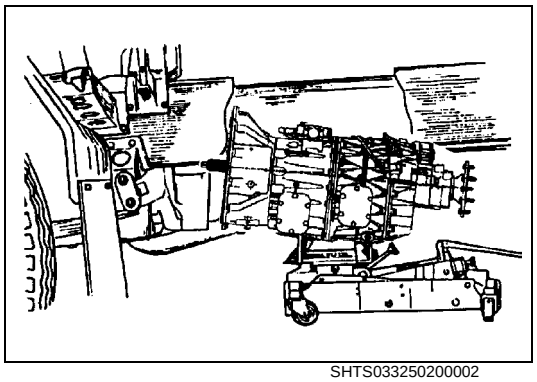
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

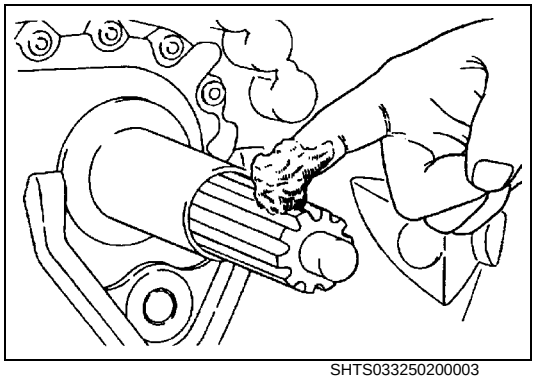
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



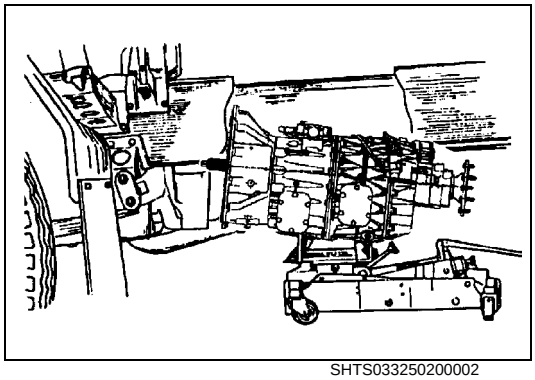
SHTS033250200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033250200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033250200002

2. INSTALL THE TRANSMISSION.

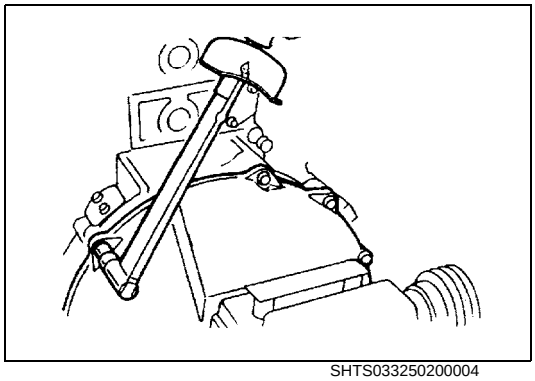
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033250200004

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.

TRANSMISSION MAIN UNIT (EATON FS8209)

TR02-006

TRANSMISSION ASSEMBLY TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0332602I200001

Manufacture	**EATON**	
Transmission model	**FS8209**	
Gear ratios	**Crawler**	**12.637**
	1st	**8.806**
	2nd	**6.550**
	3rd	**4.768**
	4th	**3.548**
	5th	**2.481**
	6th	**1.845**
	7th	**1.343**
	8th	**1.000**
	Reverse	**13.210**
Oil capacity, gear box	**Without power take-off**	**Approx. 8.5 litters {1.87 lmp.gal., 2.25 US.gal.}**
	With power take-off	**Approx. 9 litters {1.98 lmp.gal., 2.38 US.gal.}**
Lubricant type		**Mild EP gear oil (API GL-4, MIL-L-2105)**
Viscosities	**At -26°C to 21°C (-14.8°F to 68.0°F)**	**SAE 80W**
	At -12°C to 37°C (10.4°F to 98.6°F)	**SAE 90**
	At -26°C to 38°C (-14.8°F to 100.4°F)	**SAE 80W-90**

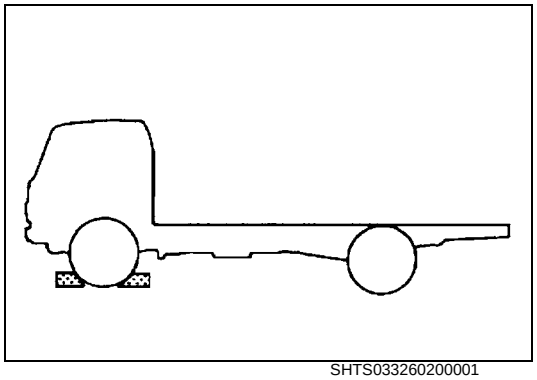
NOTICE
For other details, refer to EATON manuals.

DISMOUNTING AND MOUNTING

EN0332602H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033260200001

1. BLOCK THE WHEELS.

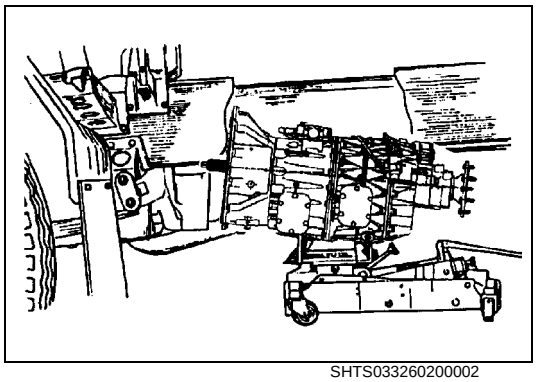
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

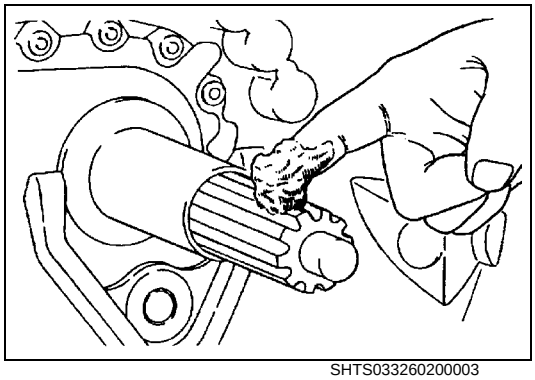
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



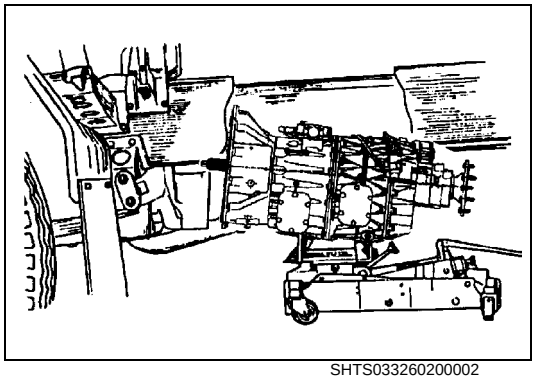
SHTS033260200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033260200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033260200002

2. INSTALL THE TRANSMISSION.

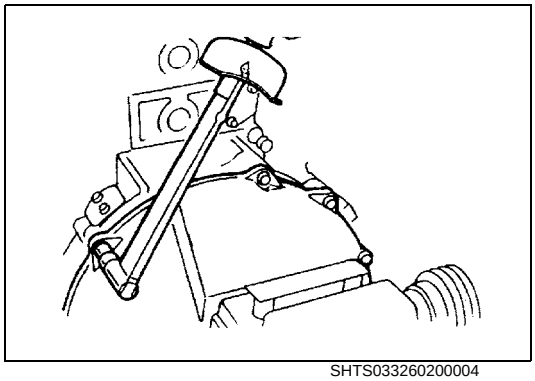
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033260200004

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.

TRANSMISSION MAIN UNIT (ZF 9S109)

TR02-007

TRANSMISSION ASSEMBLY..... TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0332702I200001

Manufacture	**ZF**	
Transmission model	**9S109**	
Gear ratios	**Crawler**	**10.245**
	1st	**6.573**
	2nd	**4.775**
	3rd	**3.529**
	4th	**2.610**
	5th	**1.862**
	6th	**1.353**
	7th	**1.000**
	8th	**0.739**
	Reverse	**9.436**
Oil capacity, gear box	**Without power take-off**	**Approx. 8.0 litters {1.76 lmp.gal., 2.11 US.gal.}**
	With power take-off	**Approx. 8.5 litters {1.87 lmp.gal., 2.25 US.gal.}**
Lubricant type		**Mild EP gear oil (API GL-4, TE-ML02)**
Viscosities	**At -26°C to 21°C (-14.8°F to 68.0°F)**	**SAE 80W**
	At -12°C to 37°C (10.4°F to 98.6°F)	**SAE 90**
	At -26°C to 38°C (-14.8°F to 100.4°F)	**SAE 80W-90**

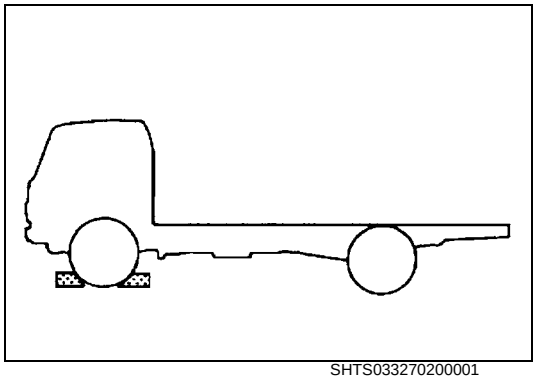
NOTICE
For other details, refer to ZF manuals.

DISMOUNTING AND MOUNTING

EN0332702H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033270200001

1. BLOCK THE WHEELS.

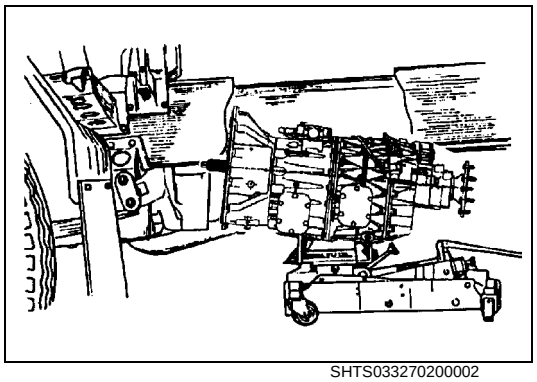
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

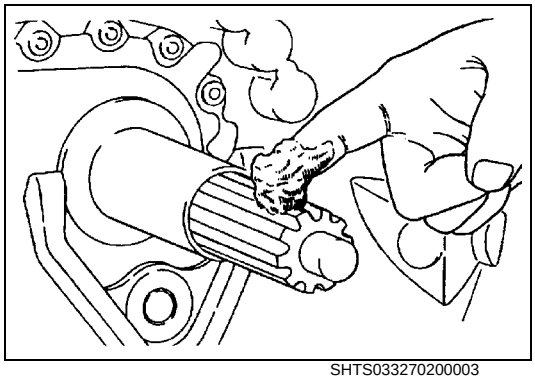
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



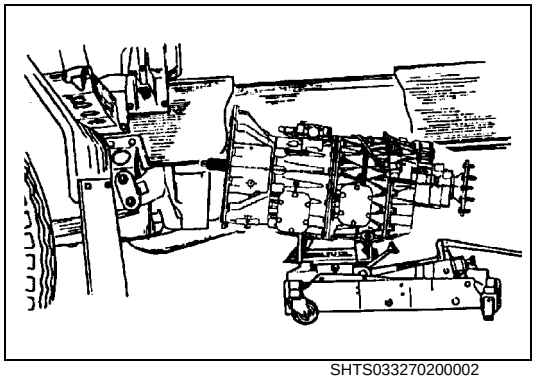
SHTS033270200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033270200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033270200002

2. INSTALL THE TRANSMISSION.

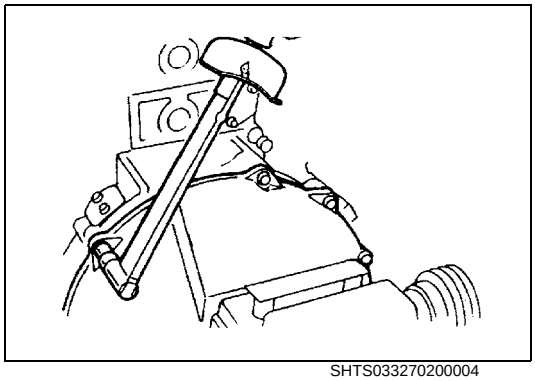
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033270200004

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
64-84 N·m {653-857 kgf·cm, 48-61 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter **"CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter **"TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURER'S ORIGINAL MANUAL.

TRANSMISSION MAIN UNIT (FULLER RT8908LL)

TR02-008

TRANSMISSION ASSEMBLY TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0333002I200001

Manufacture		**EATON**		
Transmission model		**FULLER RT8908LL**		
Gear ratios		**1st**	**19.577**	
		2nd	**12.658**	
		3rd	**8.390**	
		4th	**6.229**	
		5th	**4.578**	
		6th	**3.404**	
		7th	**2.464**	
		8th	**1.829**	
		9th	**1.344**	
		10th	**1.000**	
		Reverse (Low)	**20.467**	
		Reverse (Middle)	**13.243**	
		Reverse (High)	**3.889**	
Lubricants type			**Eaton roadranger CD50 transmission fluid (API CD)**	**Mineral gear oil with rust and oxidation inhibitor (API GL-1)**
Oil capacity, gear box			**Approx. 13.0 litters {3.43 lmp.gal., 2.86 US.gal.}**	
Viscosities	**Below -12°C {10.4°F}**		**SAE 50**	**SAE 80W**
	Above -12°C {10.4°F}			**SAE 90**

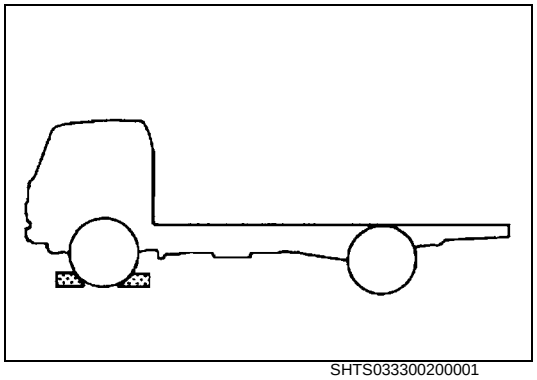
NOTICE
For other details, refer to EATON manuals.

DISMOUNTING AND MOUNTING

EN0333002H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033300200001

1. BLOCK THE WHEELS.

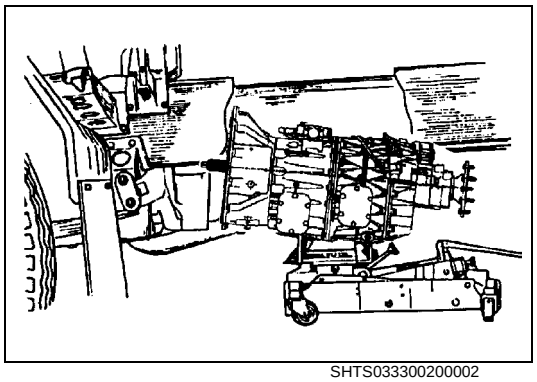
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

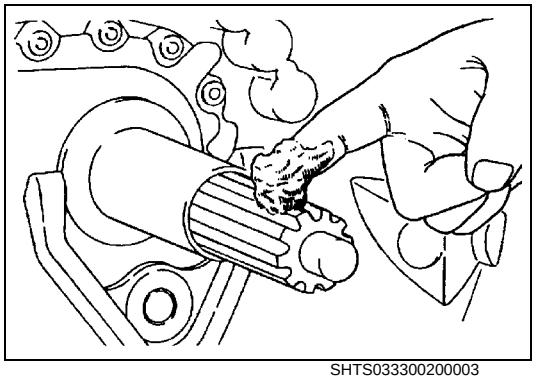
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



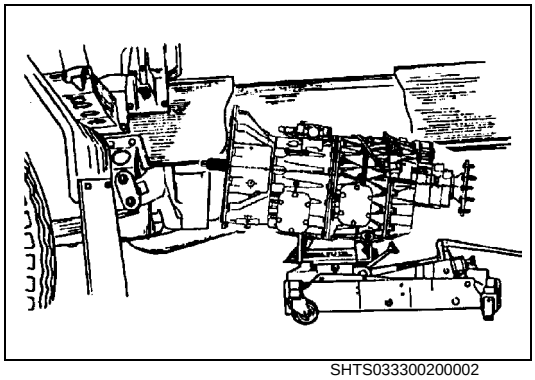
SHTS033300200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033300200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033300200002

2. INSTALL THE TRANSMISSION.

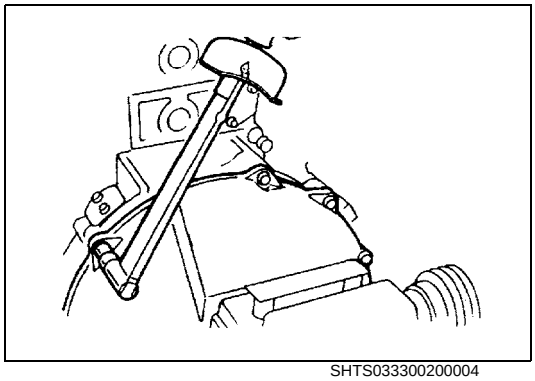
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033300200004

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.

TRANSMISSION MAIN UNIT (ZF 9S1110)

TR02-009

TRANSMISSION ASSEMBLY TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0334002I200001

Manufacture	**ZF**	
Transmission model	**9S1110**	
Gear ratios	**Crawler**	**12.728**
	1st	**8.829**
	2nd	**6.281**
	3rd	**4.644**
	4th	**3.478**
	5th	**2.538**
	6th	**1.806**
	7th	**1.335**
	8th	**1.000**
	Reverse	**12.040**
Oil capacity, gear box	**Without power take-off**	**Approx. 8.8 litters {1.94 lmp.gal., 2.32 US.gal.}**
	With power take-off	**Approx. 9.3 litters {2.05 lmp.gal., 2.46 US.gal.}**
Lubricant type		**Mild EP gear oil (API GL-4, MIL-L-2105)**
Viscosities	**At -26°C to 21°C (-14.8°F to 68.0°F)**	**SAE 80W**
	At -12°C to 37°C (10.4°F to 98.6°F)	**SAE 90**
	At -26°C to 38°C (-14.8°F to 100.4°F)	**SAE 80W-90**

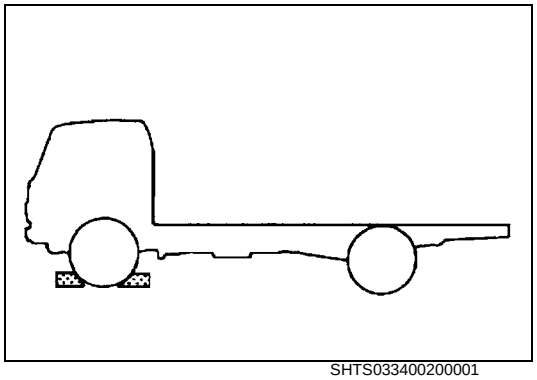
NOTICE
For other details, refer to ZF manuals.

DISMOUNTING AND MOUNTING

EN0334002H100001

IMPORTANT POINTS - DISMOUNTING

⚠ CAUTION
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033400200001

1. BLOCK THE WHEELS.

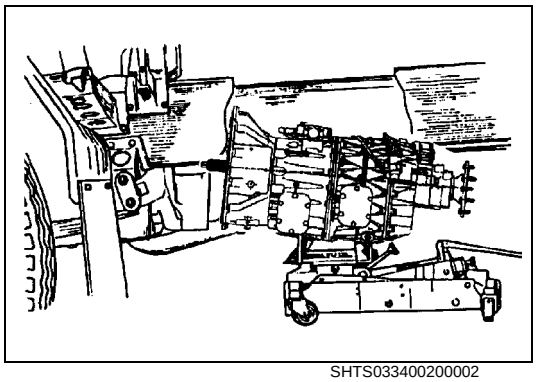
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

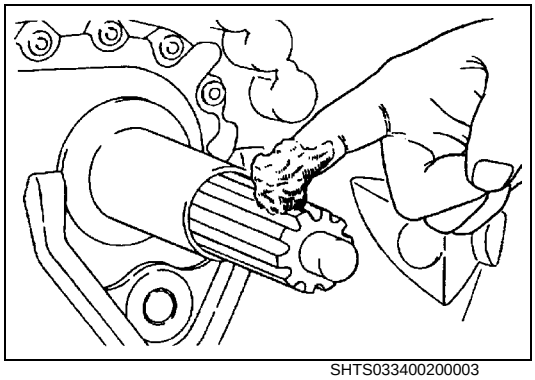
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



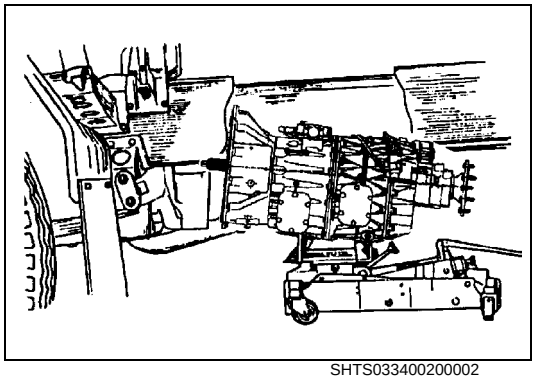
SHTS033400200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033400200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033400200002

2. INSTALL THE TRANSMISSION.

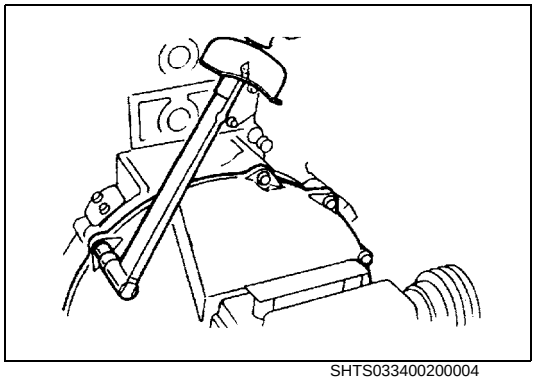
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033400200004

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURER'S ORIGINAL MANUAL.

TRANSMISSION MAIN UNIT (ZF 9S1310)

TR02-010

TRANSMISSION ASSEMBLY..... TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0334102I200001

Manufacture	**ZF**	
Transmission model	**9S1310**	
Gear ratios	**Crawler**	**9.479**
	1st	**6.576**
	2nd	**4.678**
	3rd	**3.478**
	4th	**2.617**
	5th	**1.890**
	6th	**1.345**
	7th	**1.000**
	8th	**0.752**
	Reverse	**8.967**
Oil capacity, gear box	**Without power take-off**	**Approx. 8.8 litters {1.94 lmp.gal., 2.32 US.gal.}**
	With power take-off	**Approx. 9.3 litters {2.05 lmp.gal., 2.46 US.gal.}**
Lubricant type		**Mild EP gear oil (API GL-4, TE-ML02)**
Viscosities	**At -26°C to 21°C (-14.8°F to 68.0°F)**	**SAE 80W**
	At -12°C to 37°C (10.4°F to 98.6°F)	**SAE 90**
	At -26°C to 38°C (-14.8°F to 100.4°F)	**SAE 80W-90**

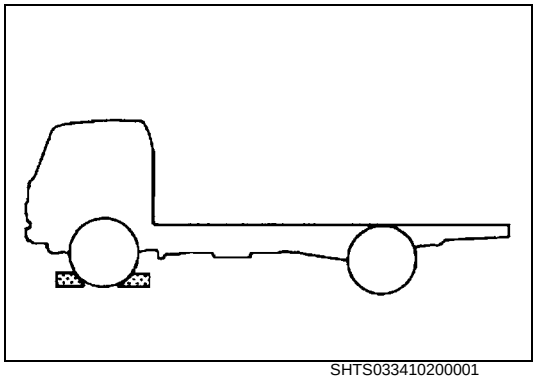
NOTICE
For other details, refer to ZF manuals.

DISMOUNTING AND MOUNTING

EN0334102H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033410200001

1. BLOCK THE WHEELS.

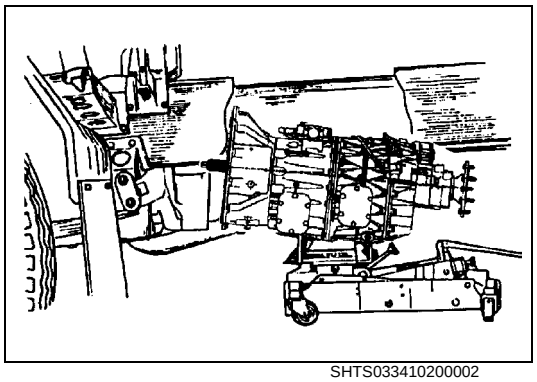
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

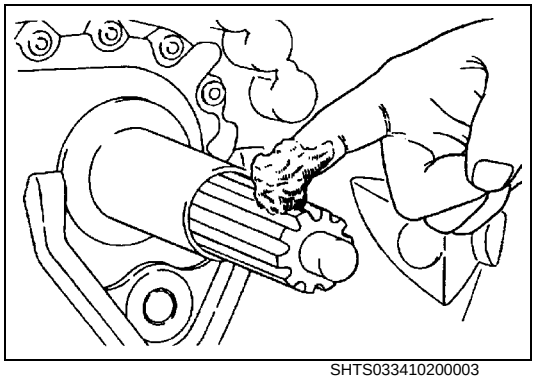
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



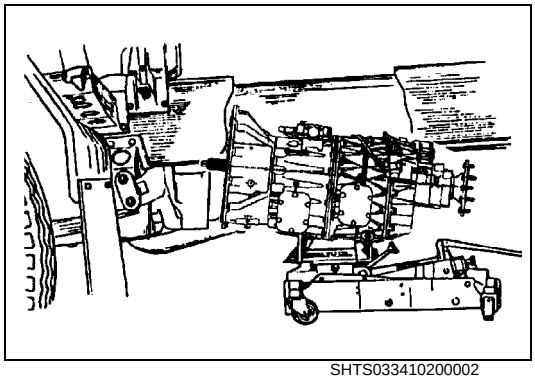
SHTS033410200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033410200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033410200002

2. INSTALL THE TRANSMISSION.

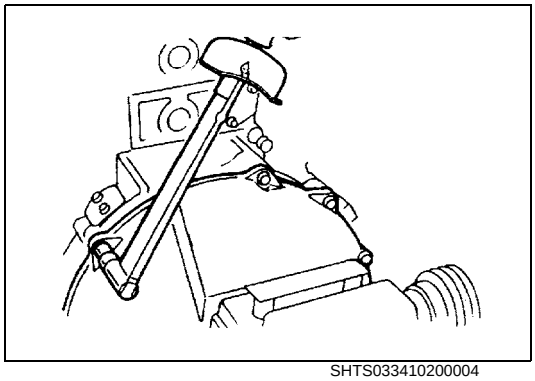
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033410200004

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
64-84 N·m {653-857 kgf·cm, 48-61 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter **"CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter **"TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURER'S ORIGINAL MANUAL.

TRANSMISSION MAIN UNIT (FULLER RTO11909ALL)

TR02-011

TRANSMISSION ASSEMBLY TR02-2
DATA AND SPECIFICATIONS..... TR02-2
DISMOUNTING AND MOUNTING TR02-3

TRANSMISSION ASSEMBLY

DATA AND SPECIFICATIONS

EN0334302I200001

Manufacture		**EATON**		
Transmission model		**FULLER RTO11909ALL**		
Gear ratios	**Lo**	**26.078**		
	LL1	**16.299**		
	LL2	**11.853**		
	1st	**7.408**		
	2nd	**5.234**		
	3rd	**3.794**		
	4th	**2.770**		
	5th	**1.952**		
	6th	**1.379**		
	7th	**1.000**		
	8th	**0.730**		
	Reverse (Low)	**20.848**		
	Reverse (Middle)	**13.030**		
	Reverse (High)	**3.434**		
Lubricants type		**Eaton roadranger CD50 transmission fluid (API CD)**	**Mineral gear oil with rust and oxidation inhibitor (API GL-1)**	
Oil capacity, gear box		**Approx. 13.0 litters {3.43 lmp.gal., 2.86 US.gal.}**		
Viscosities	**Below -12°C {10.4°F}**	**SAE 50**	**SAE 80W**	
	Above -12°C {10.4°F}		**SAE 90**	

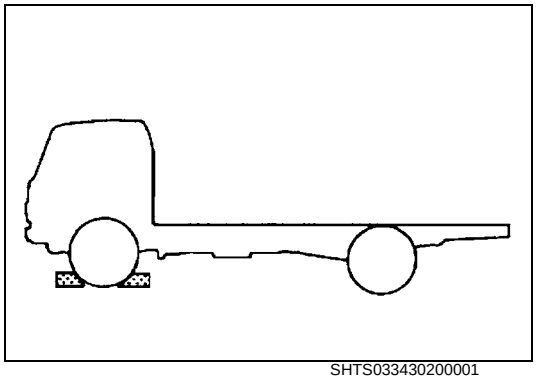
NOTICE
For other details, refer to EATON manuals.

DISMOUNTING AND MOUNTING

EN0334302H100001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot. This can result in personal injury.



SHTS033430200001

1. BLOCK THE WHEELS.

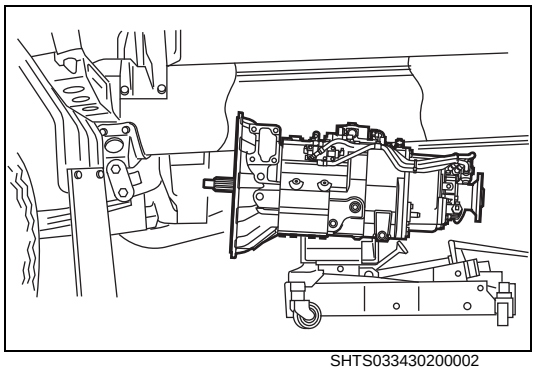
2. DRAIN THE TRANSMISSION OIL.

3. DISCONNECT THE PROPELLER SHAFT.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

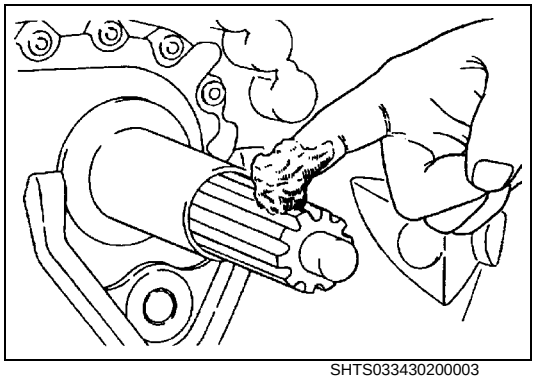
5. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.

6. REMOVE THE CLUTCH BOOSTER.



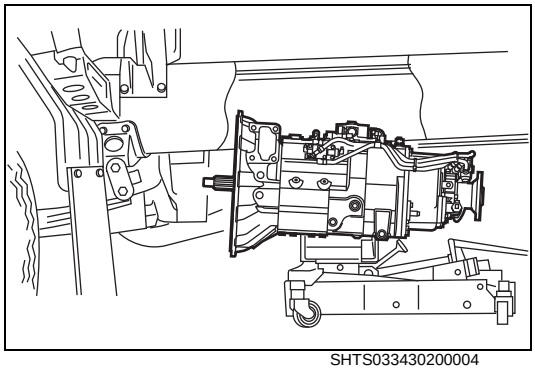
SHTS033430200002

7. REMOVE THE TRANSMISSION.
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


SHTS033430200003

IMPORTANT POINTS - MOUNTING

1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.


SHTS033430200004

2. INSTALL THE TRANSMISSION.

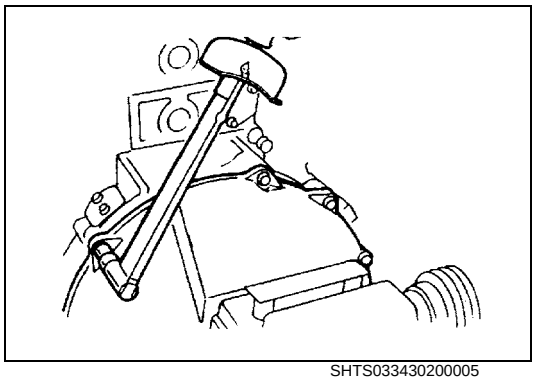
(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

NOTICE

Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.

(2) Install the upper nuts or bolts around the clutch housing.

(3) Lower the transmission jack and pull the jack out from under the vehicle.


SHTS033430200005

(4) Install the remaining nuts or bolts around the clutch housing.
Tightening Torque:
37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}

3. INSTALL THE CLUTCH BOOSTER.

4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.

5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

6. CONNECT THE PROPELLER SHAFT.

7. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.

8. CHECK THE CLUTCH PEDAL PLAY.

Refer to the chapter "**CLUTCH CONTROL"**.

9. CHECK THE GEAR SHIFT IN EACH POSITION.

Refer to the chapter "**TRANSMISSION/ TRANSFER CONTROL"**.

DISASSEMBLY AND ASSEMBLY

NOTICE

When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.

TRANSFER MAIN UNIT (MA12C)

TR03-001

TRANSFER ASSEMBLY TR03-2
DATA AND SPECIFICATIONS..... TR03-2
DESCRIPTION TR03-3
TROUBLESHOOTING..... TR03-5
PROPOSAL TOOL TR03-6
COMPONENT LOCATOR TR03-7
OVERHAUL TR03-10
INSPECTION AND REPAIR..... TR03-22

TRANSFER ASSEMBLY

DATA AND SPECIFICATIONS

EN0333103I200001

TRANSFER

Type		**Two speed, constantmesh with helical gear**
Transfer series		**MA12C**
Reduction ratio:	**Low gear**	**2.224**
	High gear	**1.000**
Oil capacity		**Approx. 3.4 L {0.75 lmp·gal./ 0.90 US·gal.}**
Lubricant grade		**Gear oil (API GL-4)**
Oil viscosity:	**Between -12 and 32°C {10 and 90°F}**	**SAE 90**
	Above 32°C {90°F}	**SAE 140**

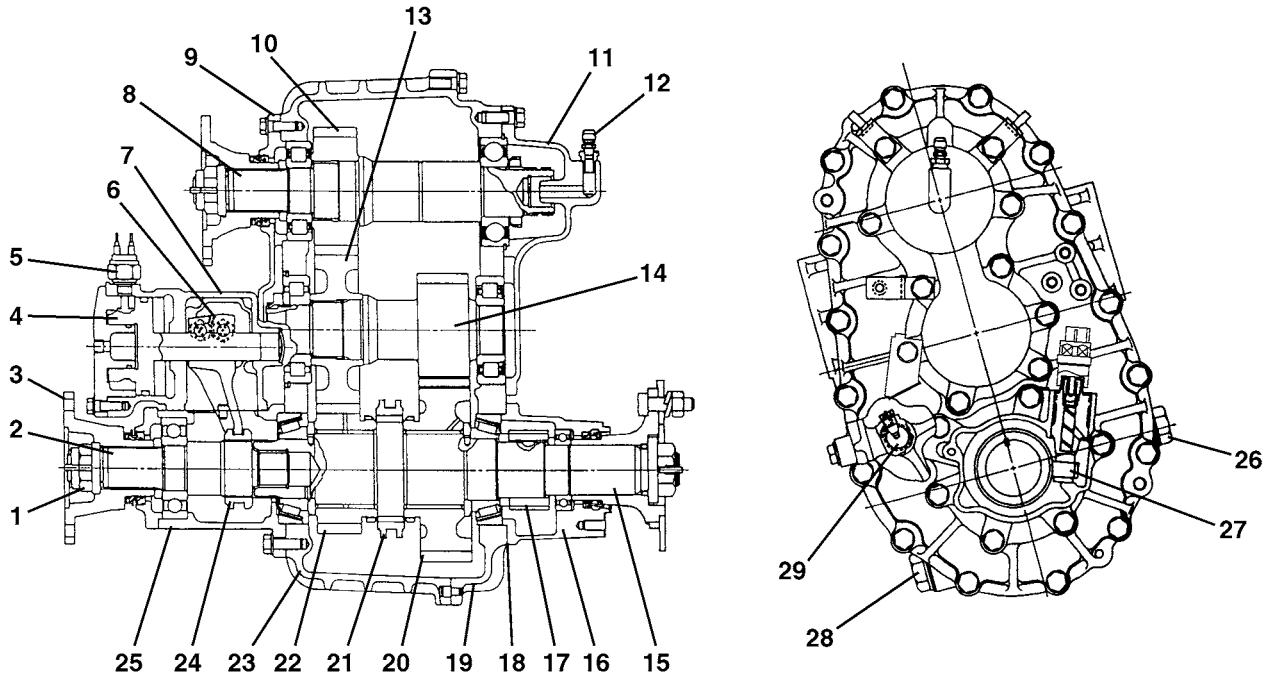
SHIFT CONTROL

High-Low speed	**Electric and pneumatic control**
Four wheel drive	

DESCRIPTION

EN0333103C100001

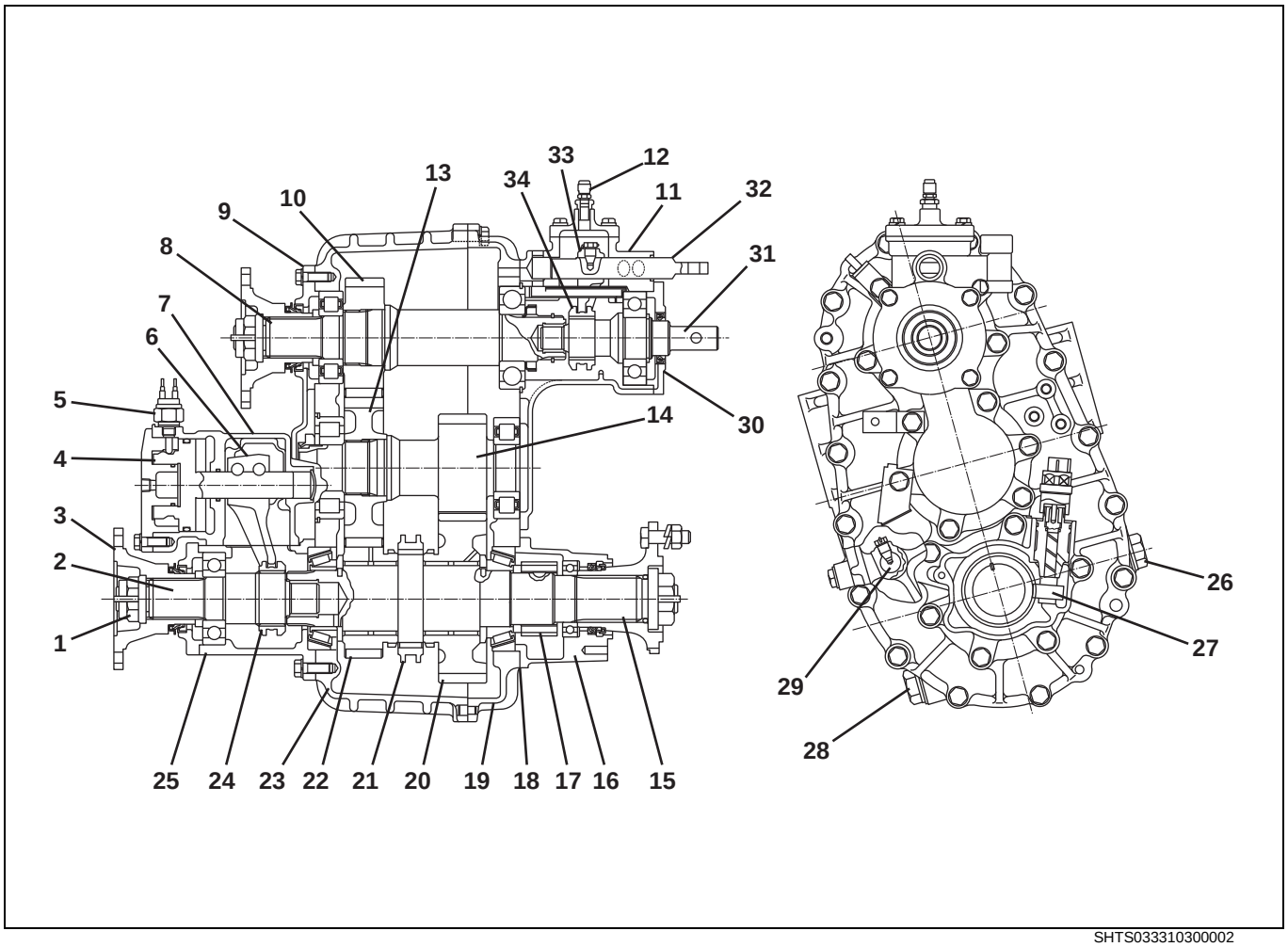
MODEL: WITHOUT POWER TAKE-OFF



SHTS033310300001

1	Lock nut	11	Rear bearing retainer	21	High-Low constant sleeve
2	Front output shaft	12	Breather plug	22	Output shaft high gear
3	Universal joint flange	13	Idler shaft high gear	23	Transfer case
4	Power piston and shift shaft	14	Idler shaft low gear	24	4WD constant sleeve
5	4WD selector warning switch	15	Rear output shaft	25	Front output shaft bearing retainer
6	Shift fork	16	Rear output shaft bearing retainer	26	Filler plug
7	4WD shift unit	17	Speedometer drive gear	27	Speedometer driven gear
8	Input shaft	18	Shim	28	Drain plug
9	Front bearing retainer	19	Transfer case cover	29	Shift shaft
10	Input shaft gear	20	Output shaft low gear		

MODEL: WITH POWER TAKE-OFF



SHTS033310300002

1	Lock nut	13	Idler shaft high gear	25	Front output shaft bearing retainer
2	Front output shaft	14	Idler shaft low gear	26	Filler plug
3	Universal joint flange	15	Rear output shaft	27	Speedometer driven gear
4	Power piston and shift shaft	16	Rear output shaft bearing retainer	28	Drain plug
5	4WD selector warning switch	17	Speedometer drive gear	29	Shift shaft
6	4WD shift fork	18	Shim	30	Power take-off bearing retainer
7	4WD shift unit	19	Transfer case cover	31	Power take-off output shaft
8	Input shaft	20	Output shaft low gear	32	Power take-off shift shaft
9	Front bearing retainer	21	High-Low constant sleeve	33	Power take-off shift fork
10	Input shaft gear	22	Output shaft high gear	34	Power take-off sleeve
11	Transfer power take-off case	23	Transfer case		
12	Breather plug	24	4WD constant sleeve		

TROUBLESHOOTING

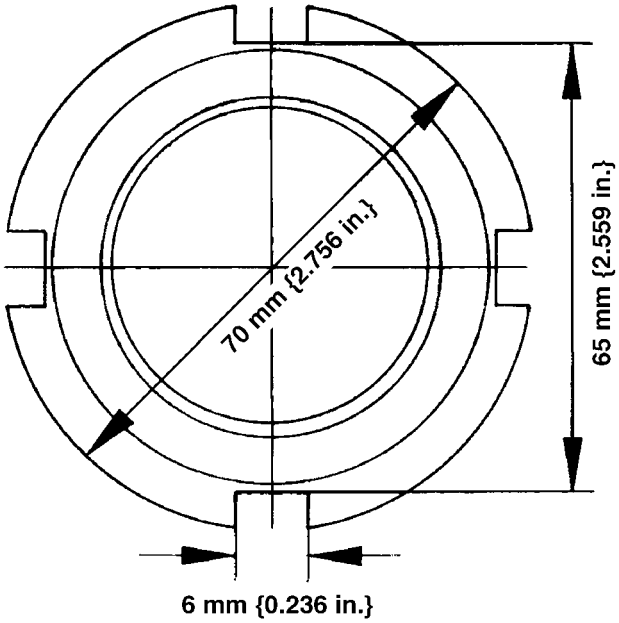
EN0333103F300001

Symptom	Possible cause	Remedy/Prevention
Noise (Lubrication)	Insufficient oil	Add oil to correct level.
	Lack of oil viscosity	Change oil as required.
Noise (Transfer)	Gear teeth or spline worn or damaged	Replace.
	Bearing damaged	Replace.
Noise (Clutch)	Damper spring defective	Replace clutch disc assembly.
Gear jump-out (Transfer)	Shift fork bent	Replace.
	Shift shaft steel ball and steel ball bore worn.	Replace or repair.
	Compression spring broken or fatigued.	Replace.
	Shift sleeve teeth worn or damaged	Replace.
	Bearing worn	Replace.
Gear jump-out (Control)	Transfer control switch or solenoid valve defective	Replace or repair.
Gear jump-out (Mounting)	Engine or transfer vibrated	Replace mounting cushion rubber or tighten cushion rubber fitting bolt or nut.
Difficult gear engagement (Lubrication)	Oil viscosity too high	Change oil as required.
Difficult gear engagement (Transfer)	Shift sleeve teeth worn or damaged	Replace.
	Shift fork bent	Replace.
Difficult gear engagement (Control)	Transfer control switch or solenoid valve defective	Replace or repair.
Difficult gear engagement (Clutch)	Improper disengagement	Adjust.

PROPOSAL TOOL

EN0333103K100001

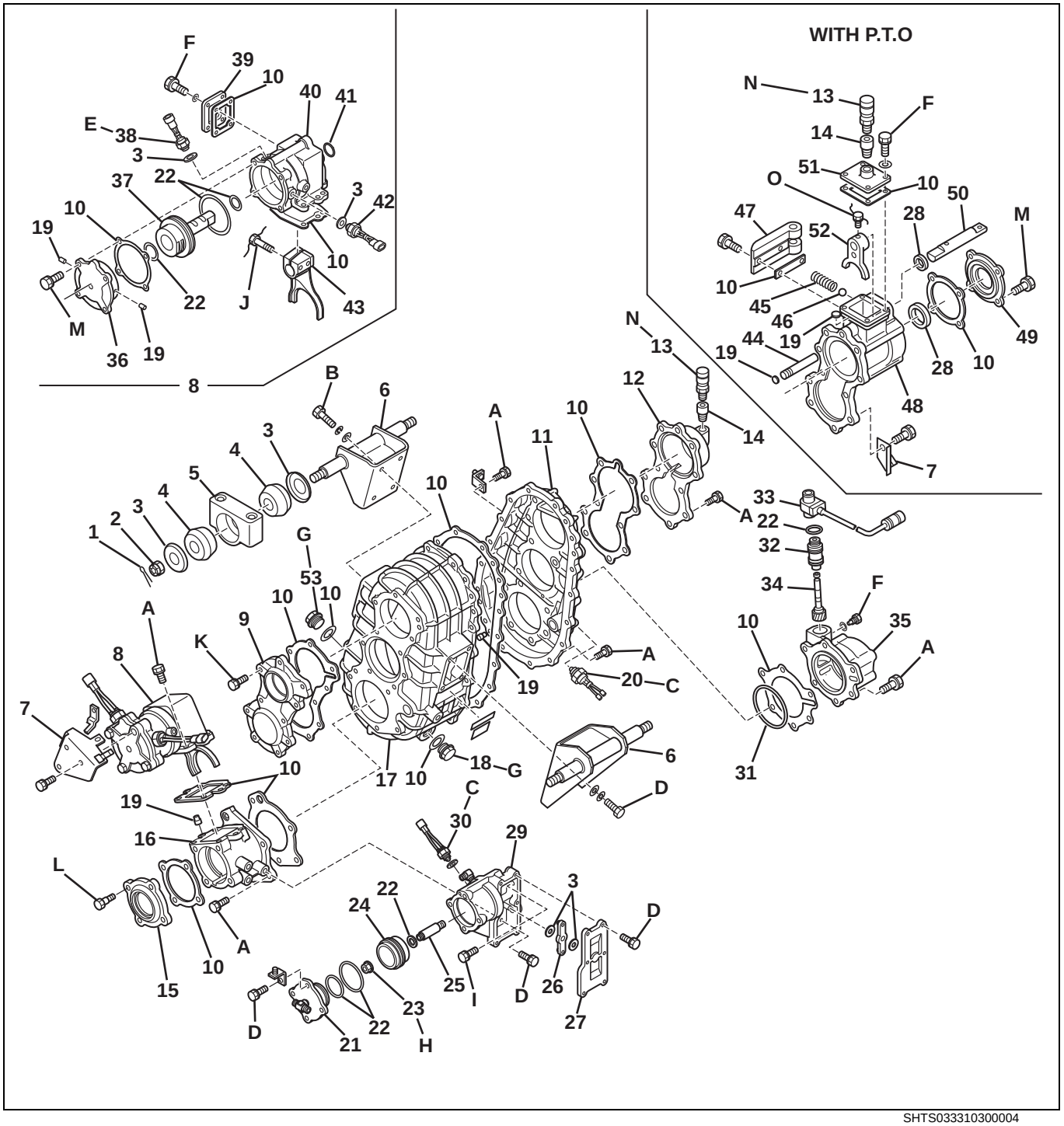
SOCKET WRENCH



SHTS033310300003

COMPONENT LOCATOR

EN0333103D100001

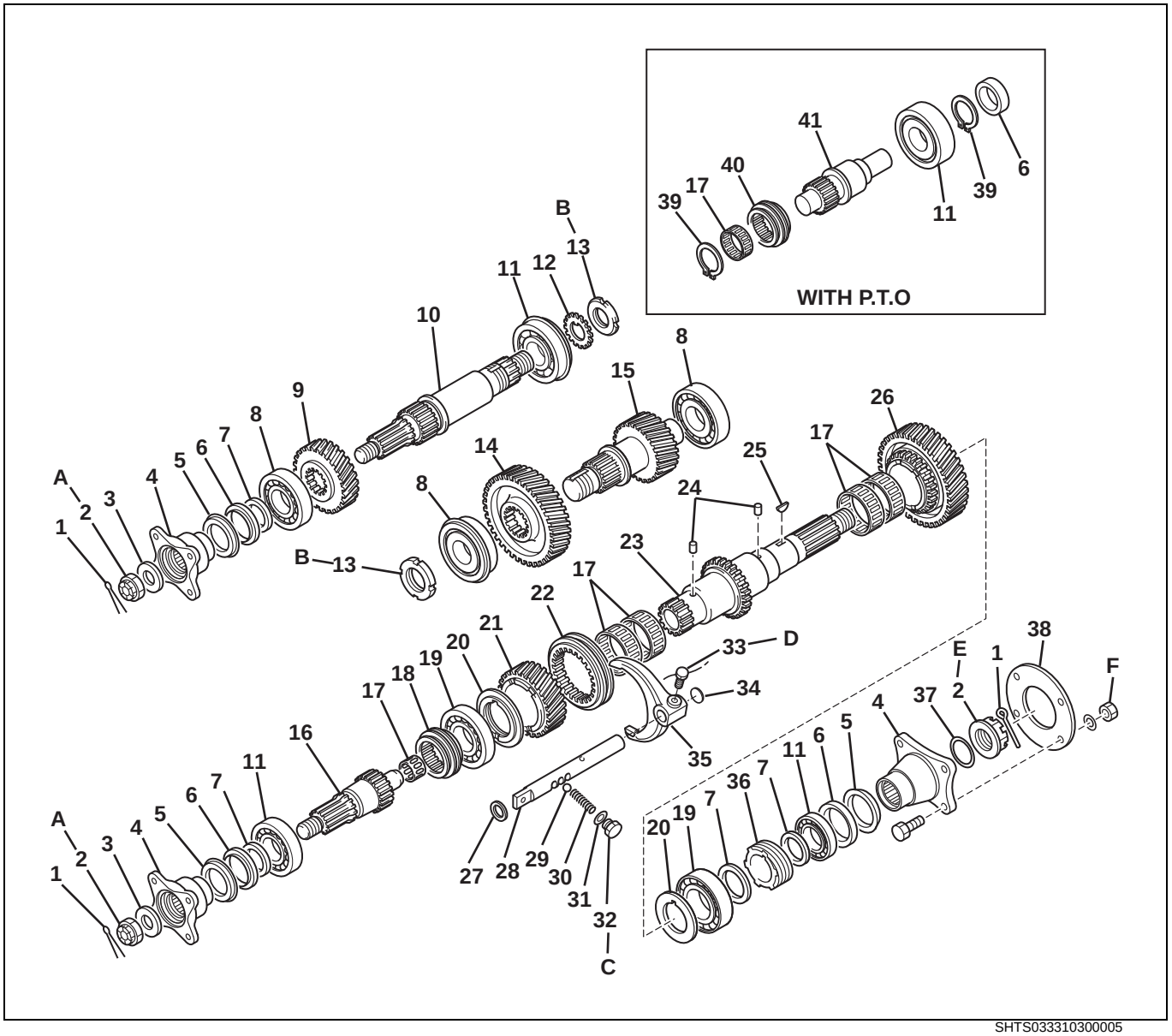


SHTS033310300004

1	Cotter pin	19	Pin	37	Power piston and shift shaft
2	Slotted nut	20	Low detection switch	38	4WD selector warning switch
3	Washer	21	High-Low shift unit case cover	39	4WD shift unit cover
4	Cushion rubber	22	O-ring	40	4WD shift unit case
5	Holder	23	Lock nut	41	Expansion plug
6	Transfer case bracket	24	Piston	42	4WD detection switch
7	Bracket	25	Rod	43	4WD shift fork
8	4WD shift unit	26	Lever	44	Oil pipe
9	Front bearing retainer	27	High-Low shift unit cover	45	Compression spring
10	Gasket	28	Oil seal	46	Steel ball
11	Transfer case cover	29	High-Low shift unit	47	Power take-off shift support
12	Rear bearing retainer	30	High detection switch	48	Transfer power take-off case
13	Breather plug	31	Shim	49	Power take-off bearing retainer
14	Plug connection	32	Speedometer driven gear bushing	50	Power take-off shift shaft
15	Dust seal retainer	33	Revolution sensor	51	Power take-off case cover
16	Front output shaft bearing retainer	34	Speedometer driven gear	52	Power take-off shift fork
17	Transfer case	35	Rear output shaft bearing retainer	53	Filler plug
18	Drain plug	36	4WD shift unit case cover		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	64-85 {650-870, 47-62}	I	56-83 {571-846, 42-61}
B	64.5-85.5 {658-871, 48-63}	J	59-78 {602-795, 44-57}
C	35-39 {357-397, 26-28}	K	37-49 {378-499, 28-36}
D	42-62 {429-632, 31-45}	L	38-49 {388-499, 28-36}
E	34-39 {347-397, 26-28}	M	37-44 {378-448, 28-32}
F	15-21 {153-214, 11-15}	N	3-6 {31-61, 2.3-4.4}
G	27-48 {274-489, 20-35}	O	25-29 {255-295, 19-21}
H	20-29 {204-295, 15-21}		



SHTS033310300005

1	Cotter pin	15	Idler shaft and low gear	29	Steel ball
2	Slotted nut	16	Front output shaft	30	Compression spring
3	Plain washer	17	Needle roller bearing	31	Copper washer
4	Universal joint flange	18	4WD constant sleeve	32	Plug
5	Dust deflector	19	Tapered roller bearing	33	Set screw
6	Oil seal	20	Thrust washer	34	Expansion plug
7	Collar	21	Output shaft high gear	35	High-Low shift fork
8	Cylindrical roller bearing	22	High-Low constant sleeve	36	Speedometer drive gear
9	Input shaft gear	23	Rear output shaft	37	O-ring
10	Input shaft	24	Straight pin	38	Spacer
11	Ball bearing	25	Woodruff key	39	Retainer ring
12	Lock washer	26	Output shaft low gear	40	Power take-off sleeve
13	Lock nut	27	Oil seal	41	Power take-off output shaft
14	Idler shaft high gear	28	High-Low shift shaft		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	245-294 {2,500-3,000, 181-216}	D	25-29 {250-300, 19-21}
B	196-294 {2,000-3,000, 145-216}	E	344-470 {3,500-4,800, 254-346}
C	35-39 {357-397, 26-28}	F	108-147 {1,100-1,500, 80-108}

OVERHAUL

EN0333103H200001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transfer while it is still hot. This can result in personal injury.

1. BLOCK THE WHEELS.

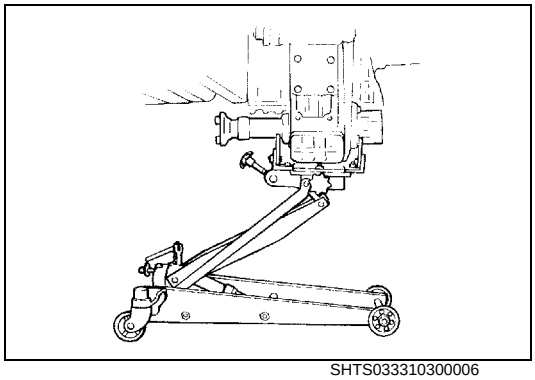
2. DRAIN THE TRANSFER OIL.

3. EXHAUST THE COMPRESSED AIR FROM THE AIR TANK.

4. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

5. DISCONNECT THE AIR PIPE AND HOSE.

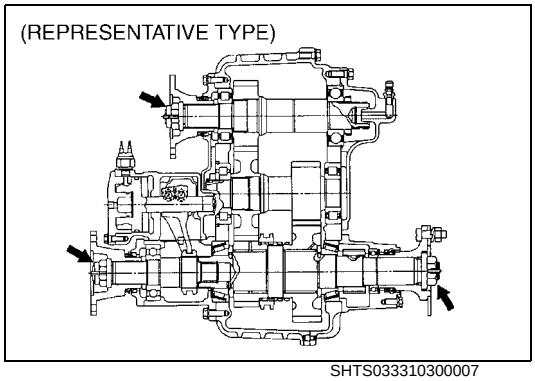
6. DISCONNECT THE PROPELLER SHAFT.


SHTS033310300006

7. REMOVE THE TRANSER.
(1) Crane the transfer with chain block or place the transmission jack under the transfer.
(2) Remove the fitting bolts and nuts.
(3) Dismount the transfer from the chassis.

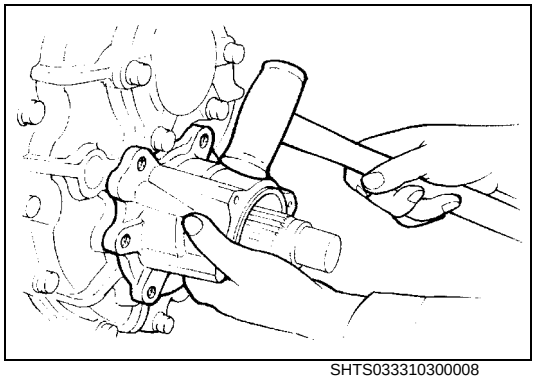
NOTICE
In using the transmission jack, take care to mount or dismount the transfer so as to prevent dropping the jack because the transfer is vertically long and instable.

IMPORTANT POINTS - DISASSEMBLY

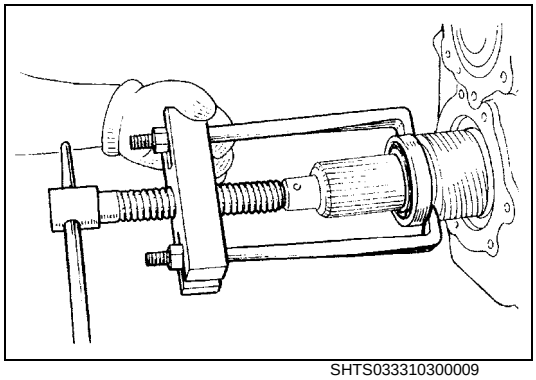


SHTS033310300007

1. REMOVE THE UNIVERSAL JOINT FLANGE LOCK NUT.
(1) Remove the cotter pin.
(2) Using a socket wrench, remove the lock nut.


SHTS033310300008

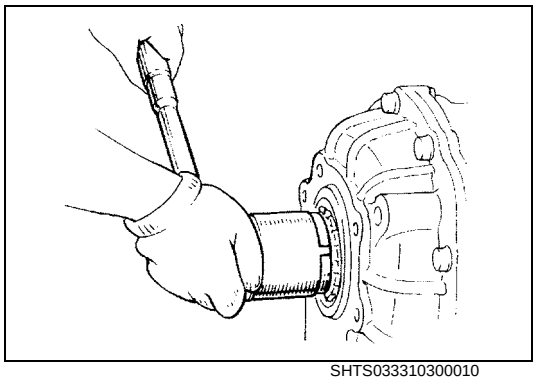
2. REMOVE THE REAR OUTPUT SHAFT BEARING RETAINER.
(1) Remove the bearing retainer by tapping it lightly.


SHTS033310300009

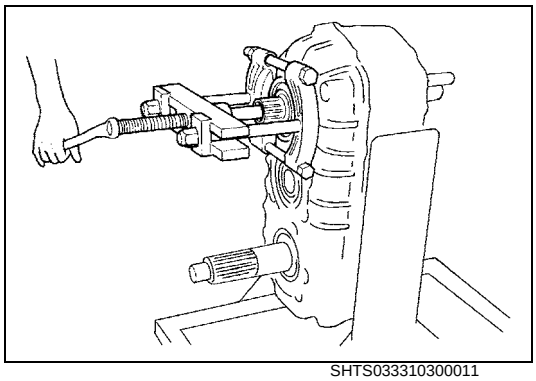
3. REMOVE THE REAR OUTPUT SHAFT BALL BEARING.
(1) Using a suitable commercial puller, remove the ball bearing from the rear output shaft.

4. REMOVE THE SPEEDOMETER DRIVE GEAR.
(1) Remove the speedometer drive gear and collar.
(2) Remove the woodruff key.
(3) Remove the collar.

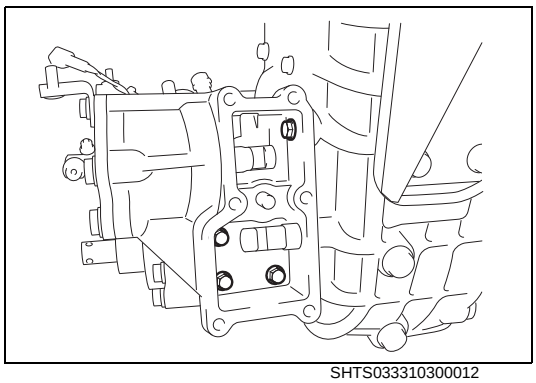
5. REMOVE THE REAR BEARING RETAINER OR POWER TAKE-OFF UNIT (MODEL: WITH POWER TAKE-OFF).


SHTS033310300010

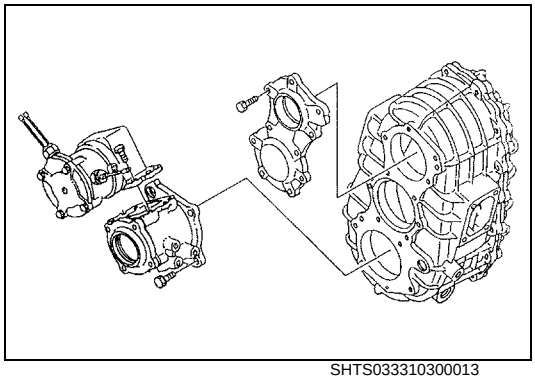
6. REMOVE THE INPUT SHAFT REAR LOCK NUT.
(1) Lift the caulked part completely out of nut groove.
(2) Using a proposal tool remove the lock nut.
Proposal tool: Socket Wrench


SHTS033310300011

7. REMOVE THE INPUT SHAFT REAR BALL BEARING.
(1) Using a copper hammer, drive out the input shaft to the rearward about 5 mm {0.1969 in.}.
(2) Using a suitable commercial puller, remove the ball bearing from the input shaft.


SHTS033310300012

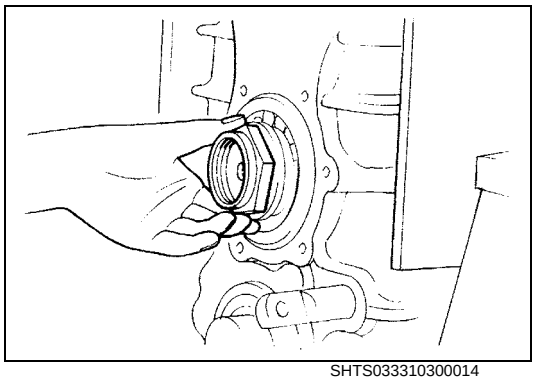
8. REMOVE THE HIGH-LOW SHIFT UNIT.
(1) Remove the bolts, remove the High-Low shift unit.


SHTS033310300013

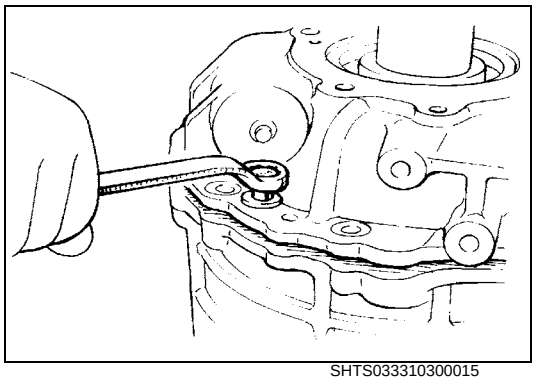
9. REMOVE THE 4WD SHIFT UNIT.

10. REMOVE THE FRONT OUTPUT SHAFT BEARING RETAINER.
(1) Remove the bearing retainer by tapping it lightly.

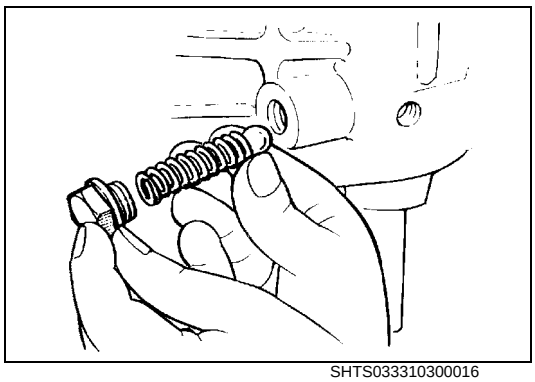
11. REMOVE THE FRONT BEARING RETAINER.


SHTS033310300014

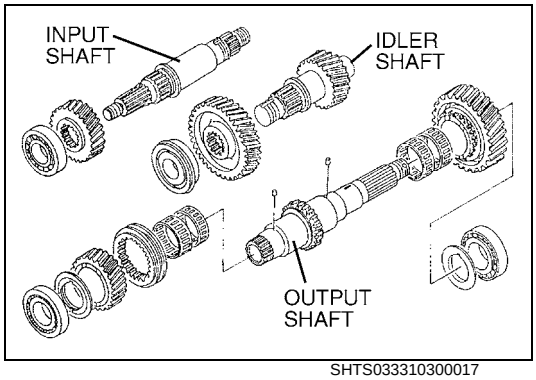
12. REMOVE THE IDLER SHAFT LOCK NUT.


SHTS033310300015

13. REMOVE THE TRANSFER CASE COVER.
(1) Using puller bolts, separate the case cover from the transfer case.
(2) Remove the case cover.


SHTS033310300016

14. REMOVE THE SHAFT ASSEMBLY FROM THE TRANSFER CASE.
(1) Remove the steel ball and compression spring.
(2) Remove the output shaft assembly.
(3) Remove the idler shaft assembly.
(4) Remove the input shaft assembly.



SHTS033310300017

15. DISASSEMBLE THE INPUT SHAFT ASSEMBLY, IDLER SHAFT ASSEMBLY AND OUTPUT SHAFT ASSEMBLY.

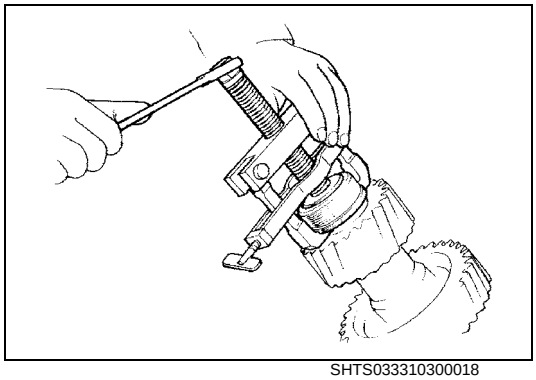
(1) Using a press, remove the bearing and gears from the shaft.

⚠ CAUTION

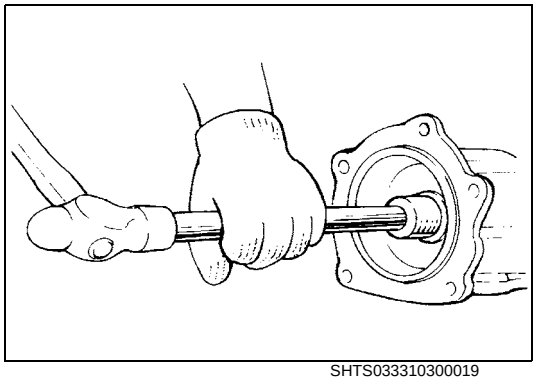
Stay out from under the shaft during removal. The shaft could drop suddenly resulting in personal injury.

NOTICE

When removing the shaft, do not drop on a hard surface.


SHTS033310300018

(2) Using a suitable puller, remove the idler shaft rear bearing inner race.

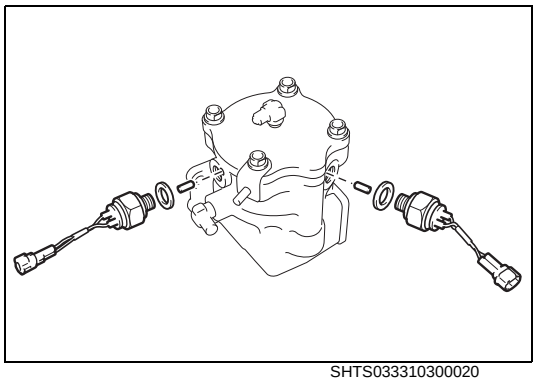

SHTS033310300019

16. DISASSEMBLE THE FRONT OUTPUT SHAFT BEARING RETAINER.

(1) Remove the dust seal retainer.

(2) Using a brass bar and a hammer, drive out the front output shaft with ball bearing.

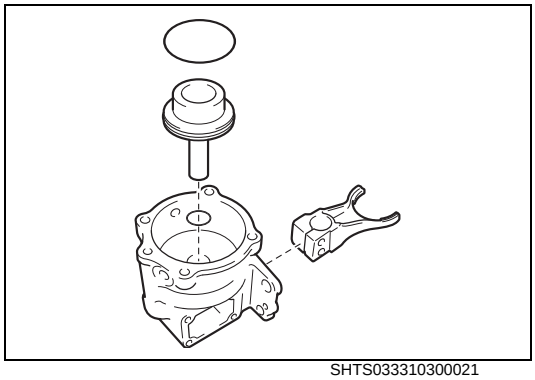
(3) Using a press, press the shaft front end until it is free of ball bearing.


SHTS033310300020

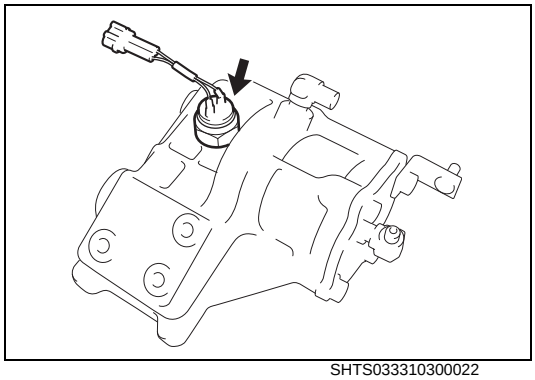
17. DISASSEMBLE THE 4WD SHIFT UNIT.

(1) Remove the 4WD selector warning switch, 4WD detection switch and pins.

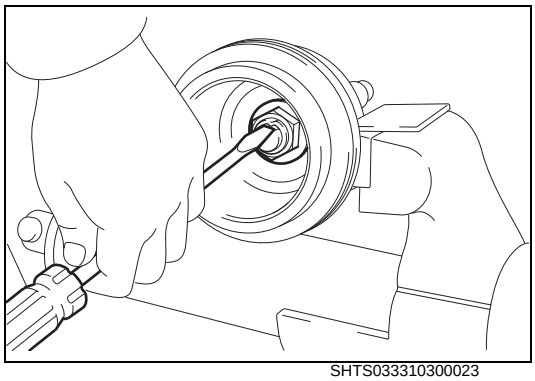
(2) Remove the case cover and cover.


SHTS033310300021

(3) Remove the reamer bolts.
(4) Remove the shift shaft, shift fork and O-rings.

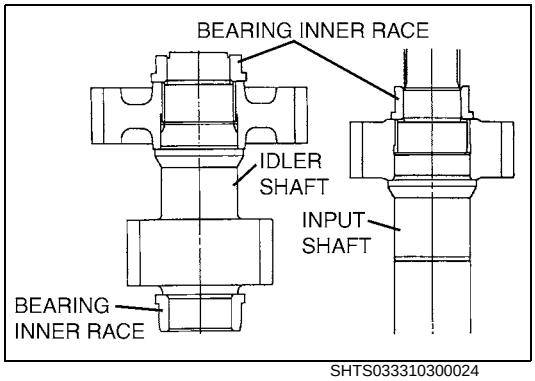

SHTS033310300022

18. DISASSEMBLE THE HIGH-LOW SHIFT UNIT.
(1) Remove the high detection switch and gasket.
(2) Remove the case cover.
(3) Remove the piston from the case.


SHTS033310300023

(4) Uncaulk the caulked part of the lock nut and remove the nut.
(5) Remove the O-ring and rod from the piston.
(6) Remove the O-rings.

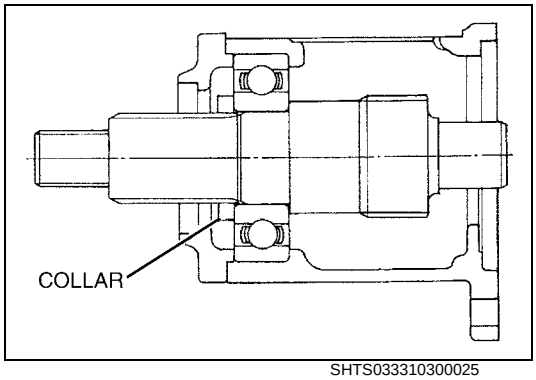
IMPORTANT POINTS - ASSEMBLY



SHTS033310300024

1. ASSEMBLE THE IDLER SHAFT.
(1) Install the idler shaft high gear on the shaft and press the bearing inner race on the shaft.
(2) Press the bearing inner race on the shaft.

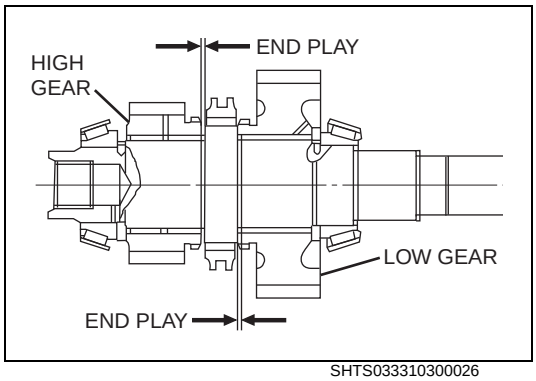
2. ASSEMBLE THE INPUT SHAFT.
(1) Install the input shaft gear and press the bearing inner race on the shaft.



SHTS033310300025

3. ASSEMBLE THE FRONT OUTPUT SHAFT BEARING RETAINER.

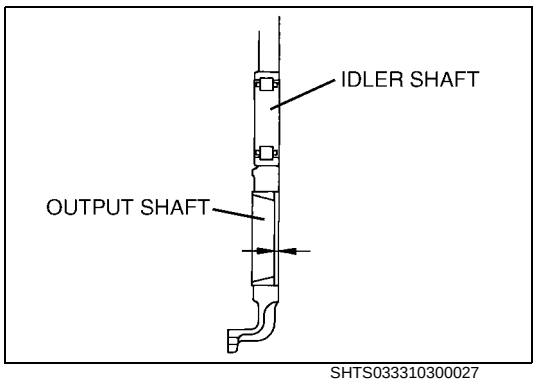
(1) Drive the ball bearing and constant sleeve on the front output shaft.
(2) Install the shaft into the bearing retainer.
(3) Install the collar.
(4) Install the dust seal retainer.



SHTS033310300026

4. ASSEMBLE THE REAR OUTPUT SHAFT.

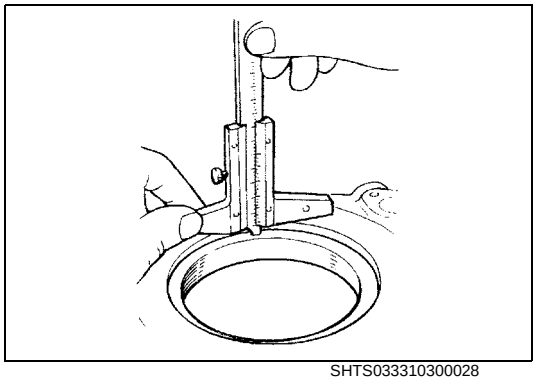
(1) Install the needle roller bearing, high gear, pin and thrust washer on the shaft.
(2) Press the bearing inner race on the shaft.
(3) Check the high gear end play.
Assembly Standard: 0.2-0.4 mm {0.0079-0.0157 in.}
Service Limit: 0.6 mm {0.0236 in.}
(4) Install the constant sleeve, needle roller bearing, low gear, pin and thrust washer on the shaft.
(5) Press the inner bearing on the shaft.
(6) Check the low gear end play.
Assembly Standard: 0.2-0.4 mm {0.0079-0.0157 in.}
Service Limit: 0.6 mm {0.0236 in.}

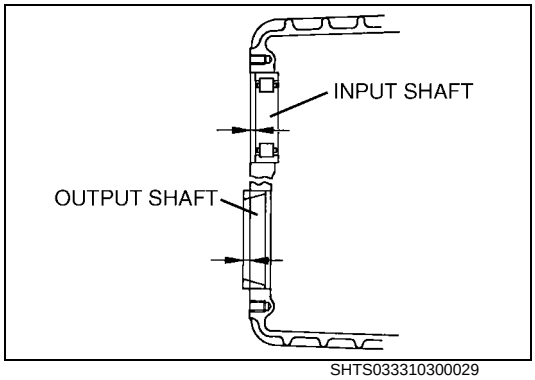


SHTS033310300027

5. INSTALL THE BEARING OUTER RACE AND CYLINDRICAL ROLLER BEARING IN THE CASE COVER.

(1) Tap the outer race in the cover bore as specified position.
Assembly Standard: 3.5-4.0 mm {0.1378-0.1574 in.}
(2) Tap the cylindrical bearing in the cover bore as specified position.
Assembly Standard: 0.2-1.2 mm {0.0079-0.0472 in.}


SHTS033310300028

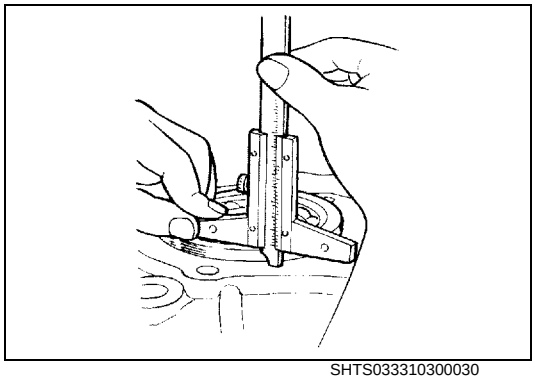


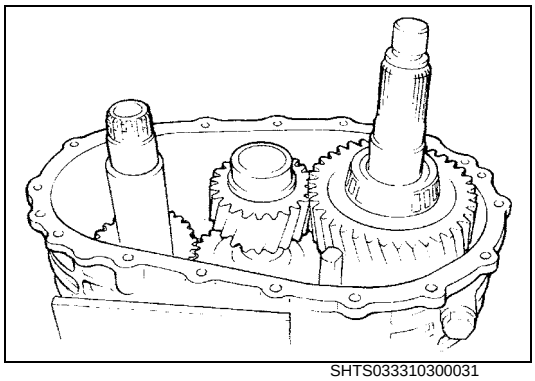
SHTS033310300029

6. INSTALL THE BEARING OUTER RACE AND CYLINDRICAL ROLLER BEARING IN THE CASE.

(1) Tap the outer race in the case bore as specified position.
Assembly Standard: 6.8-7.3 mm {0.2678-0.2874 in.}

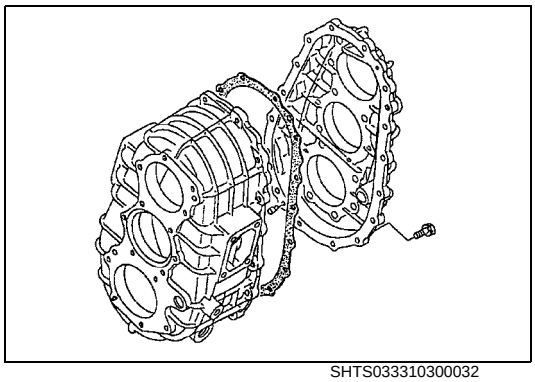
(2) Tap the cylindrical bearing in the case bore as specified position.
Assembly Standard: 4.0-5.0 mm {0.1575-0.1968 in.}


SHTS033310300030


SHTS033310300031

7. PLACE THE INPUT SHAFT ASSEMBLY, IDLER SHAFT ASSEMBLY AND OUTPUT SHAFT ASSEMBLY IN THE CASE.

(1) Install the input shaft assembly.
(2) Install the idler shaft assembly.
(3) Install the output shaft assembly with shift fork and shift shaft.
(4) Install the steel ball, compression spring and plug in the case.


SHTS033310300032

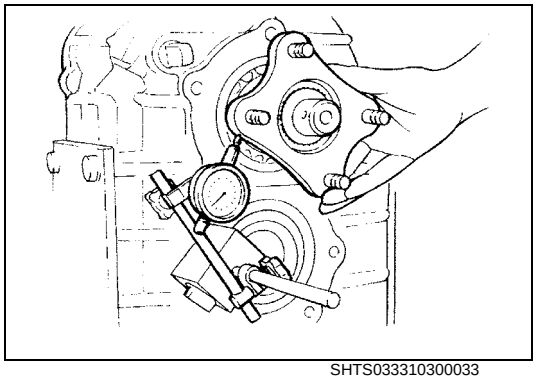
8. INSTALL THE CASE COVER ON THE CASE.

(1) Coat both sides of the gasket with liquid gasket.

NOTICE

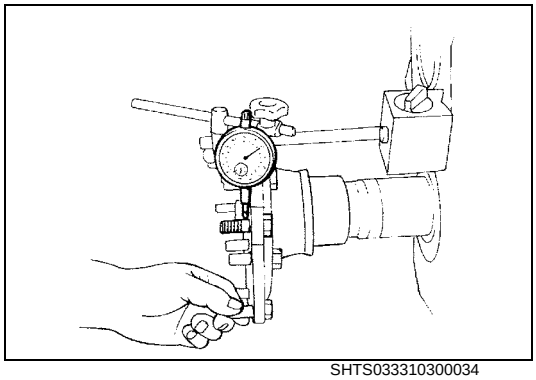
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be the ThreeBond #1215 or equivalent.**

(2) Install the low detection switch.


SHTS033310300033

9. MEASURE THE BACKLASH BETWEEN INPUT SHAFT GEAR AND IDLER SHAFT HIGH GEAR.

(1) Install the universal joint flange on the input shaft.
(2) Measure the backlash at flange bolt.
Assembly Standard: 0.10-0.28 mm {0.0040-0.0110 in.}
Service Limit: 0.5 mm {0.0197 in.}

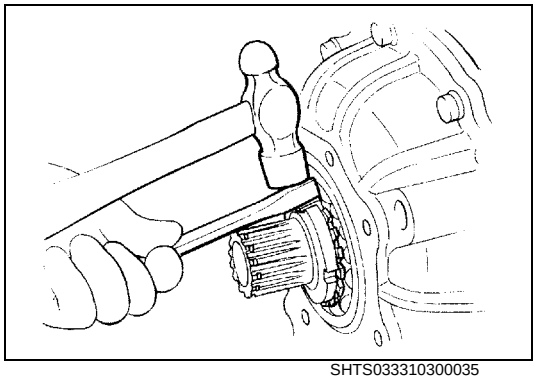

SHTS033310300034

10. MEASURE THE BACKLASH BETWEEN OUTPUT SHAFT GEAR AND IDLER SHAFT GEAR.

(1) Install the universal joint flange on the rear output shaft.
(2) Shift the transfer in the low position and measure the backlash at flange bolt.
Assembly Standard: 0.10-0.28 mm {0.0040-0.0110 in.}
Service Limit: 0.5 mm {0.0197 in.}
(3) Shift the transfer in the high position and measure the backlash at flange bolt.
Assembly Standard: 0.10-0.28 mm {0.0040-0.0110 in.}
Service Limit: 0.5 mm {0.0197 in.}

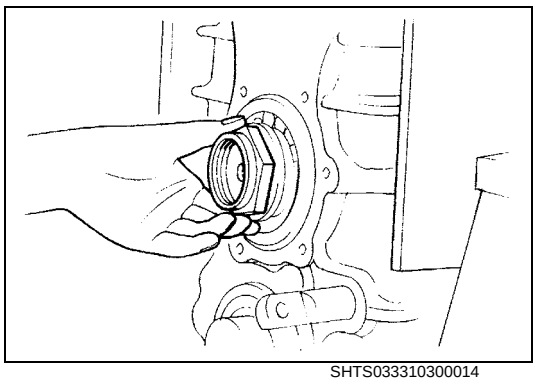
NOTICE

- **Before measuring the gear backlash, check the tapered roller bearings on both ends of output shaft that there is no play. If there is play, tap outer race in until the play is eliminated.**
- **Measure the backlashes of the low gear and high gear on the output shaft to the constant sleeve, and subtract the measured values from the measured value specified in Item 2 above. The resultant values are the backlashes of the individual gears on the output shaft.**


SHTS033310300035

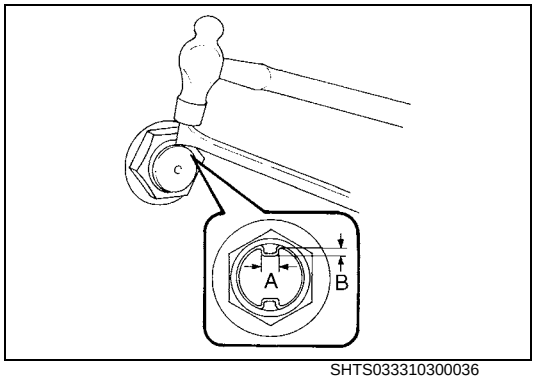
11. INSTALL THE INPUT SHAFT REAR BEARING.

(1) Install the ball bearing in the case cover.
(2) Install the retainer ring.
(3) Using a suitable socket wrench, tighten the lock nut.
(4) Secure the lock nut by bending the lock washer teeth in the slot in the nut.


SHTS033310300014

12. INSTALL THE IDLER SHAFT FRONT BEARING LOCK NUT.

(1) Install the bearing side ring and lock nut on the shaft.
(2) Using a suitable socket wrench, tighten the lock nut.



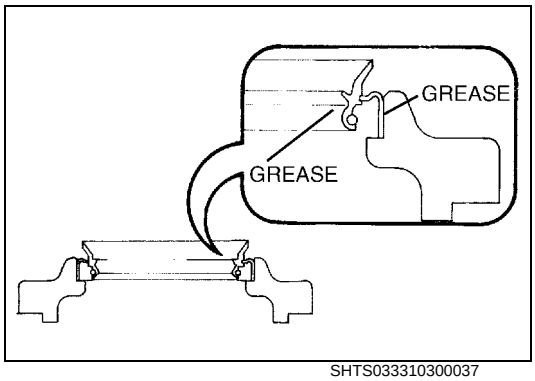
SHTS033310300036

(3) Caulk the outside rim of the nut into the groove on the shaft.

A: 10 mm {0.394 in.}
B: More than 1.5 mm {0.0591 in.}

NOTICE

- **The caulking should fit the groove thoroughly.**
- **The caulking should be done without rift.**



SHTS033310300037

13. REPLACE THE OIL SEAL.

(1) Coat the outer surface of the oil seal with liquid gasket.

NOTICE

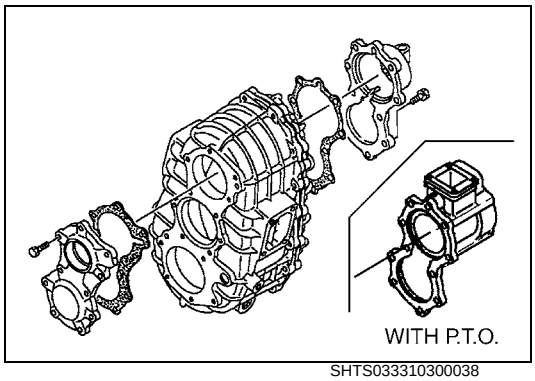
The liquid gasket must be ThreeBond #1215 or equivalent.

(2) Drive the oil seal into the retainer.

NOTICE

- **Do not damage the seal lip.**
- **The oil seal is inserted in the proper direction.**

(3) Coat the sealing surface between the seal lips with grease.

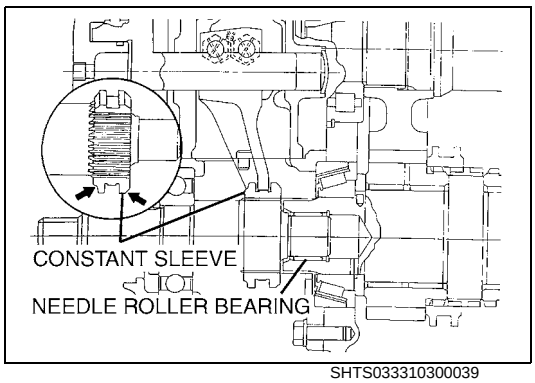


SHTS033310300038

14. INSTALL THE FRONT BEARING RETAINER AND REAR BEARING RETAINER OR POWER TAKE-OFF UNIT (MODEL: WITH POWER TAKE-OFF).

NOTICE

- **Coat the both sides of the gasket with liquid gasket.**
- **The liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



SHTS033310300039

15. INSTALL THE FRONT OUTPUT SHAFT BEARING RETAINER ON THE CASE.

(1) Install the needle roller bearing in the output shaft bore.
(2) Install the constant sleeve on the front output shaft.

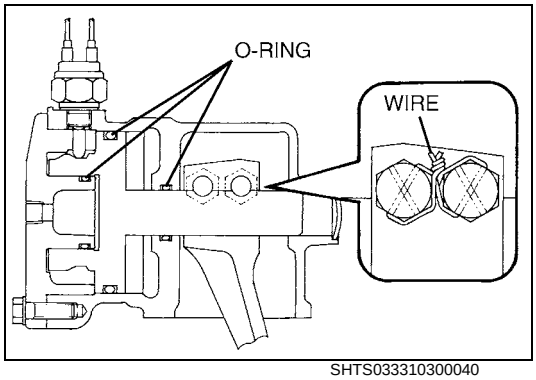
NOTICE

The constant sleeve is installed in proper direction.

(3) Install the bearing retainer on the case.

NOTICE

- **Coat the both sides of the gasket with liquid gasket.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



SHTS033310300040

16. ASSEMBLE THE 4WD SHIFT UNIT.

(1) Install the O-rings in the case, case cover and shift shaft.

NOTICE

Coat the O-rings with grease.

(2) Install the shift shaft into the case. When inserting the shaft, install the shift fork on the shaft.

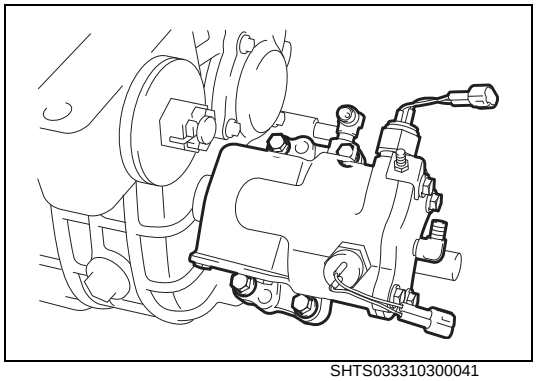
(3) Install the reamer bolts, and secure the bolts with wire.

(4) Install the case cover and cover.

NOTICE

- **Coat the both sides of the gasket with liquid gasket.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

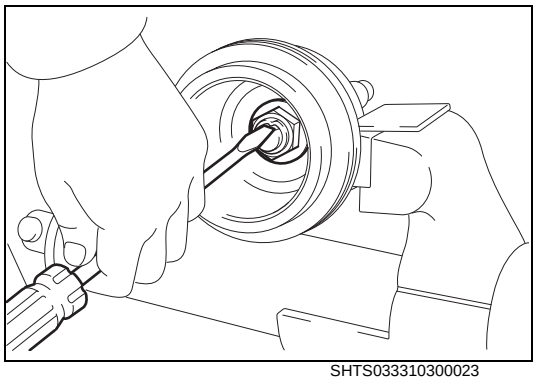
(5) Install the pins and switches.


SHTS033310300041

17. INSTALL THE 4WD SHIFT UNIT ON THE BEARING RETAINER.

NOTICE

- **Coat the both sides of the gasket with liquid gasket.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**


SHTS033310300023

18. ASSEMBLE THE HIGH-LOW SHIFT UNIT.

(1) Install the O-rings in the case, piston and case cover.

NOTICE

Coat the O-rings with grease.

(2) Install the rod and O-ring into the piston.

NOTICE

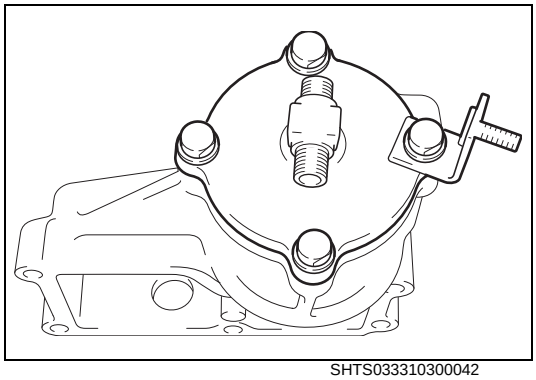
Coat the O-rings with grease.

(3) Tighten the lock nut and caulk the lock nut.

(4) Install the piston into the case.

NOTICE

Coat the sliding surface of the piston with the gear oil.

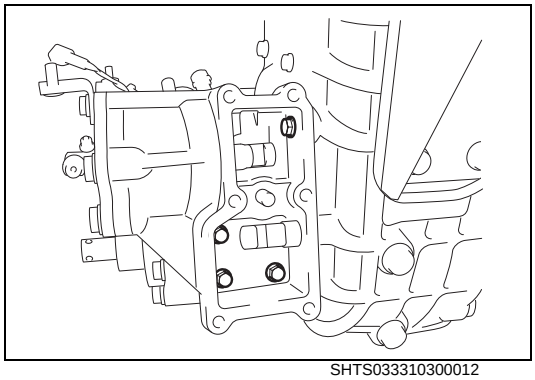

SHTS033310300042

(5) Install the case cover.

NOTICE

- **Coat the both sides of the gasket with liquid gasket.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

(6) Install the high detection switch.


SHTS033310300012

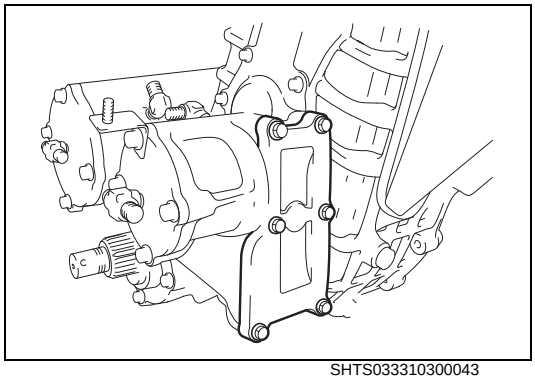
19. INSTALL THE HIGH-LOW SHIFT UNIT.

(1) Coat between the High-Low shift unit and the transfer case with the liquid gasket.

NOTICE

The liquid gasket must be ThreeBond #1215 or equivalent.

(2) Install the High-Low shift unit.

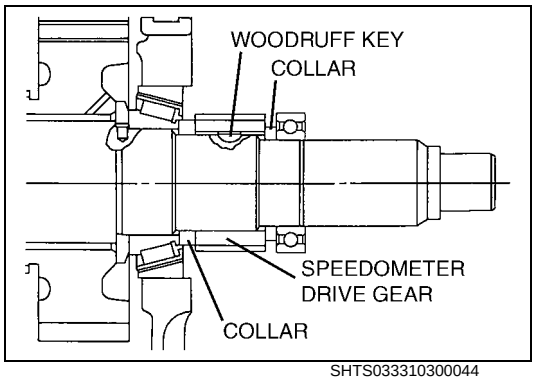

SHTS033310300043

(3) Coat between the case cover and case with the liquid gasket.

NOTICE

The liquid gasket must be ThreeBond #1215 or equivalent.

(4) Install the cover.

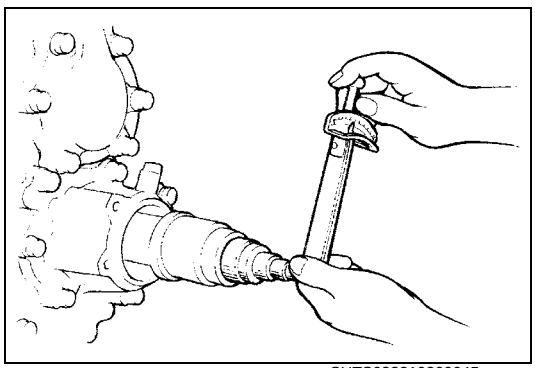


SHTS033310300044

20. INSTALL THE SPEEDOMETER DRIVE GEAR ON THE OUTPUT SHAFT.

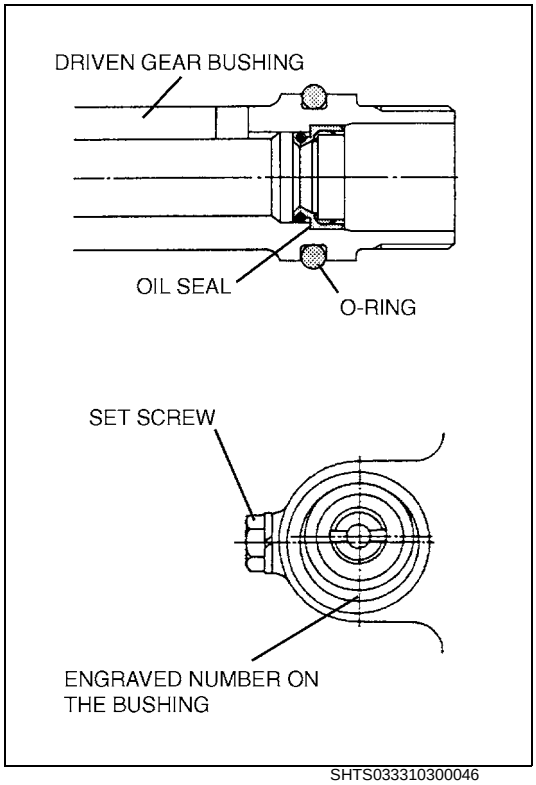
(1) Install the collar on the shaft.
(2) Install the woodruff key in the shaft, drive the speedometer drive gear on the shaft.
(3) Install the collar on the shaft.
(4) Install the ball bearing on the shaft.

21. INSTALL THE REAR OUTPUT SHAFT BEARING RETAINER.


SHTS033310300045

22. CHECK AND ADJUST THE OUTPUT SHAFT BEARING PRELOAD.

(1) Install the rear output bearing retainer with shims and gasket.
Assembly Standard:
1.8-2.1 N·m {18-22 kgf·cm, 15.7-19.0 lbf·in.}
(2) Measure the bearing preload. If not within specification, adjust the preload with shim.
Shims
Thickness: Unit: mm {in.}
0.08 {0.0031}, 0.10 {0.0039}, 0.13 {0.0051}
0.15 {0.0059}, 0.30 {0.0118}, 0.50 {0.0197}



SHTS033310300046

23. INSTALL THE SPEEDOMETER DRIVEN GEAR BUSHING.

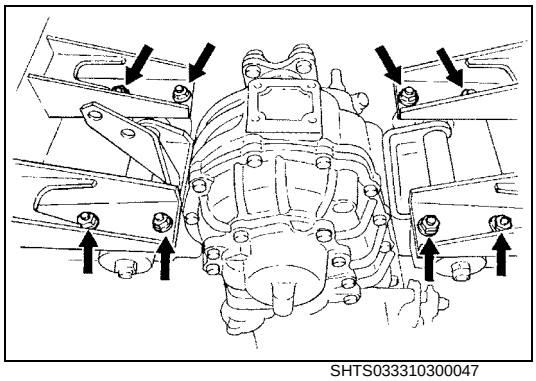
(1) Install the O-ring and oil seal to the bushing.

NOTICE

- **Coat the O-ring, oil seal and driven gear with grease.**
- **Be sure the oil seal is installed in the proper direction when replacing it.**

(2) Match the engraved number on the bushing to the set screw.

Number of the drive gear teeth	Number of the driven gear teeth	The engraved number should be matched to the set screw
6	19	19


SHTS033310300047

IMPORTANT POINTS - MOUNTING

1. INSTALL THE TRANSFER.

(1) Crane the transfer with chain block or place the transfer on the transmission jack.

(2) Align the bolt holes, install the fitting bolts and nuts.

2. CONNECT THE PROPELLER SHAFT.

3. CONNECT THE AIR PIPE AND HOSE.

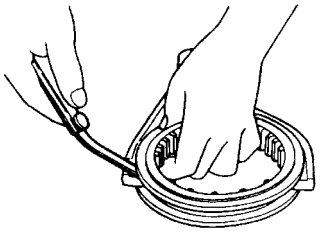
4. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.

5. FILL THE TRANSFER WITH GEAR OIL UP TO FILLER PLUG.

INSPECTION AND REPAIR

EN0333103H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Ball bearing, cylindrical roller bearing and tapered roller bearing: Wear, damage and rotation	—	—	Replace, if necessary.	Visual check
Needle roller bearing: Roundness	—	—	Replace, if necessary.	Visual check
Gears and constant sleeve: Wear, crack and damage	—	—	Replace, if necessary.	Visual check
Shift shaft: Wear and scoring	—	—	Replace, if necessary.	Visual check
Splines on shaft: Wear and damage	—	—	Replace, if necessary.	Visual check
Clearance between shift fork and constant sleeve	0.20-0.45 {0.0079-0.0177}	1.5 {0.0591}	Replace.	Measure 

AUTOMATIC TRANSMISSION (ALLISON 3000RDS, 3500RDS)

TR04-001

AUTOMATIC TRANSMISSION ASSEMBLY TR04-2

TROUBLESHOOTING TR04-2
SPECIAL TOOL TR04-2
DISMOUNTING AND MOUNTING TR04-2

AUTOMATIC TRANSMISSION ASSEMBLY

TROUBLESHOOTING

EN0332804F300001

NOTICE
When diagnosing transmission problems, refer to the Allison Shop Manual or troubleshooting procedures for detailed information on items that could be causing the problem.

SPECIAL TOOL

EN0332804K100001

Prior to removal and installing of automatic transmission, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	S0965-71370	SPACER COUPLING GUIDE	

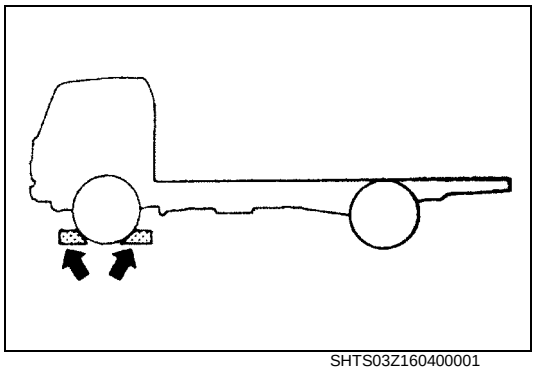
DISMOUNTING AND MOUNTING

EN0332804H100001

IMPORTANT POINTS - DISMOUNTING

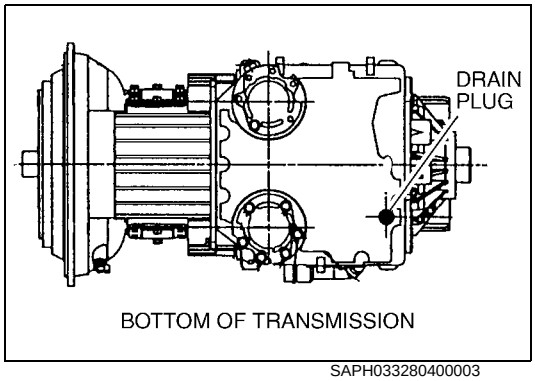
NOTICE
Allison transmission repairs are to be performed by an authorized Allison service dealer.

⚠ **WARNING**
Do not work on the transmission while it is hot. This can result in personal injury.


SHTS03Z160400001

1. BLOCK THE WHEELS.
(1) Park the vehicle on level ground.
(2) Block the wheels.

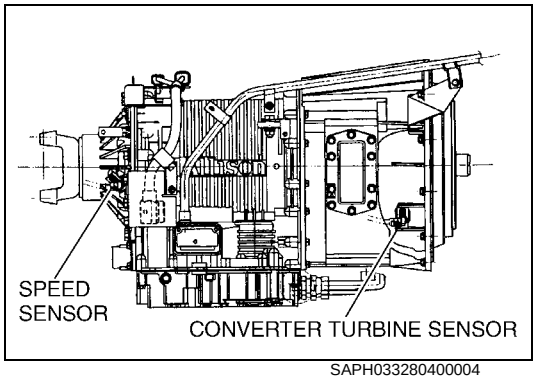
NOTICE
Be sure to apply wheel stoppers at the front tires.



SAPH033280400003

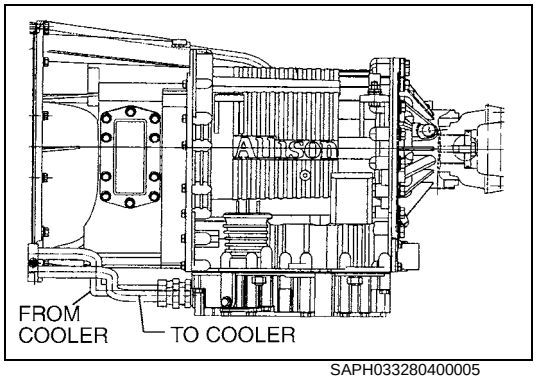
2. DRAIN THE AUTOMATIC TRANSMISSION FLUID.
(1) Place the drain pan under the transmission.
(2) Remove the drain plug from the transmission and allow the fluid to drain.

3. REMOVE THE PROPELLER SHAFTS.
(1) Disconnect the yoke from the propeller spider and remove the center bearing holder.
(2) Move the forward end of the propeller shaft out of the way.



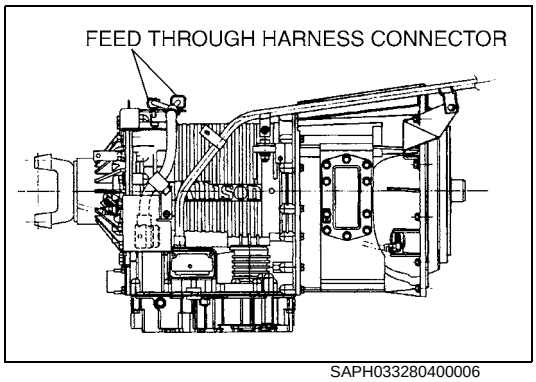
SAPH033280400004

4. REMOVE THE SPEED SENSOR HARNESS FROM THE REAR OF THE TRANSMISSION AND TURBINE SENSOR HARNESS FROM THE FRONT OF THE TRANSMISSION.



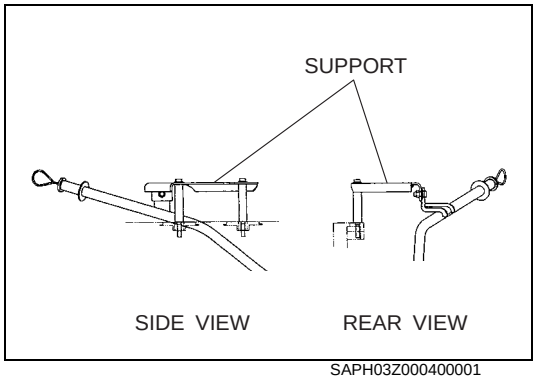
SAPH033280400005

5. DISCONNECT THE OIL COOLER LINES AT THE TRANSMISSION.



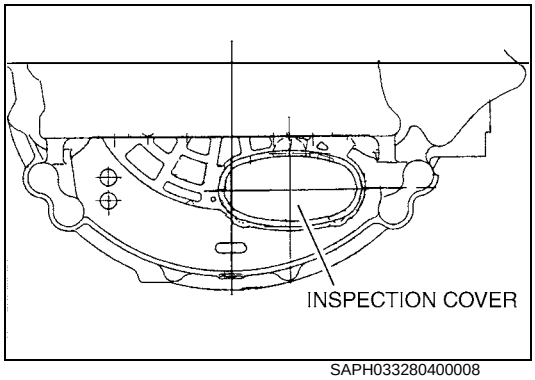
SAPH033280400006

6. DISCONNECT THE FEED THROUGH HARNESS CONNECTOR.



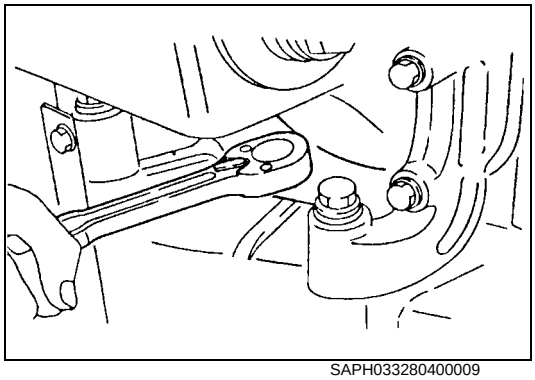
SAPH03Z000400001

7. REMOVE THE SUPPORT OF THE OIL LEVEL GAUGE FROM THE ENGINE CYLINDER BLOCK.



SAPH033280400008

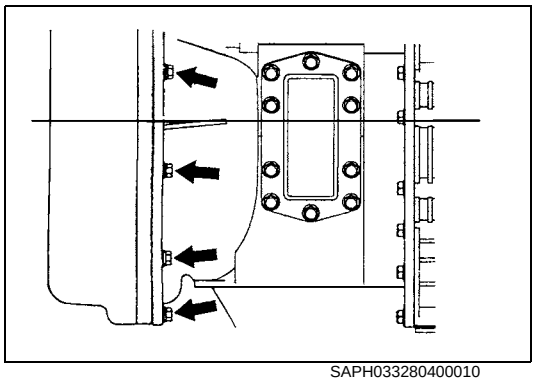
8. REMOVE INSPECTION COVER FROM THE BOTTOM FRONT SIDE OF THE FLYWHEEL HOUSING.


SAPH033280400009

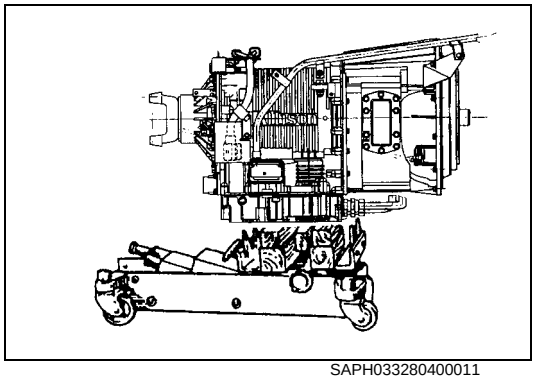
9. REMOVE THE SIX COUPLING BOLTS FROM THE FLYWHEEL.

(1) Turn the flywheel manually to match the attaching bolt to the slot on the inspection opening at the bottom front side of the flywheel housing.

(2) Remove the coupling bolts one by one.


SAPH033280400010

10. REMOVE THE CONVERTER HOUSING ATTACHING BOLTS LOWER THE TRANSMISSION.


SAPH033280400011

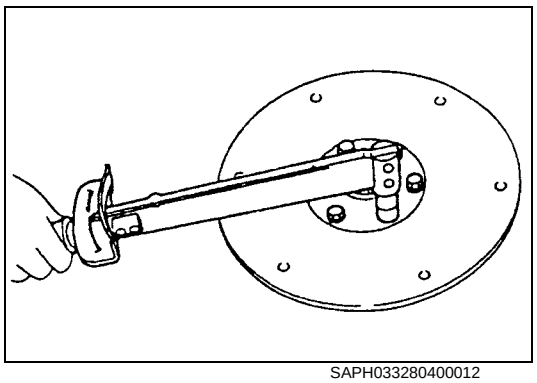
11. POSITION A TRANSMISSION JACK UNDER THE TRANSMISSION AND SECURE THE TRANSMISSION TO THE JACK WITH A SAFETY CHAIN OR WIRE CABLE.

12. REMOVE THE REMAINING CONVERTER HOUSING FROM THE FLYWHEEL HOUSING ATTACHING BOLTS.

13. PULL OUT THE TRANSMISSION BACKWARDS.

⚠ WARNING
Do not lower the front end of the transmission. If lowered, the torque converter may slide out of the transmission and you can be injured.

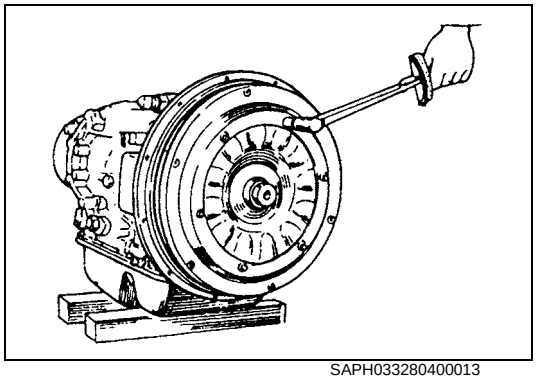
IMPORTANT POINTS - MOUNTING



SAPH033280400012

1. TIGHTEN THE FLEX PLATE, SPACER COUPLING AND WEAR PLATE.
Tightening Torque:
64-85 N·m {653-867 kgf·cm, 48-62 lbf·ft}

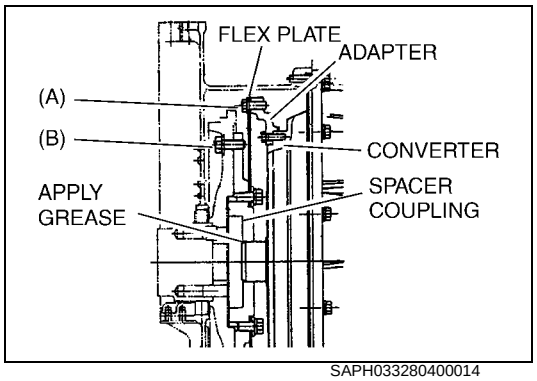
NOTICE
Before tightening, face the chamfered outer rim of the wear plate to the flex plate. If assembled to the contrary, the wear plate edge hits the flex plate and its strength is reduced. Painted surface of the wear plate should be located facing the transmission side.



SAPH033280400013

2. TIGHTEN THE TORQUE CONVERTER AND THE ADAPTER.
Tightening Torque:
24-29 N·m {245-296 kgf·cm, 18-21 lbf·ft}

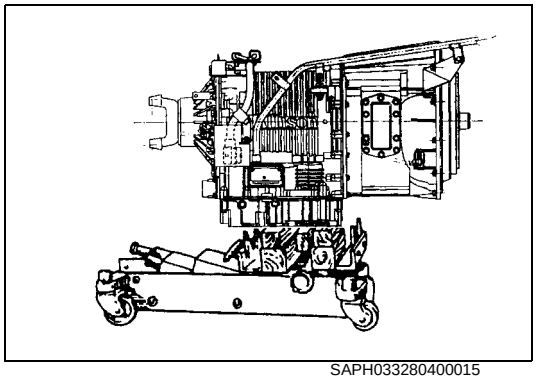
NOTICE
Apply grease containing molybdenum disulfide to the boss at the end of the torque converter before assembling. Without grease, the flex plate will not slide well and abnormal force will be generated, causing the flex plate to break.



SAPH033280400014

3. INSTALL THE FLEX PLATE, SPACER COUPLING AND WEAR PLATE. THEN TIGHTEN THE FLEX PLATE AND ADAPTER TOGETHER.
Tightening Torque:
44-54 N·m {449-551 kgf·cm, 31-39 lbf·ft}

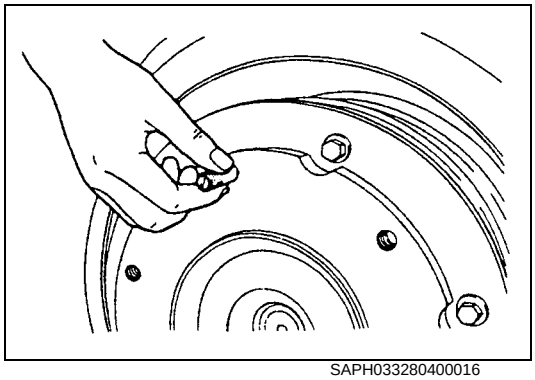
NOTICE
Flex plate's hole (A) and spacer's hole (B) must be same position (by this, lock the flywheel and (A)'s bolt is suitable)



SAPH033280400015

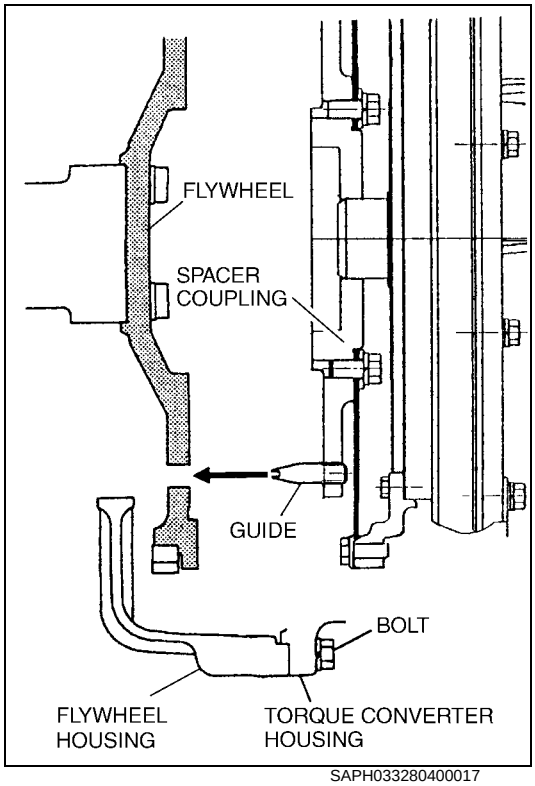
4. MOUNT THE TRANSMISSION ASSEMBLY ON A TRANSMISSION JACK. THEN MOVE THE ASSEMBLY INTO THE POSITION.

⚠ WARNING
Do not lower the front end of the transmission. If lowered, the torque converter may slide out of the transmission and you can be injured.



SAPH033280400016

5. SCREW THE SPECIAL TOOL "GUIDE" BY HAND INTO THE SPACER COUPLING OF THE TRANSMISSION ASSEMBLY. ROTATE THE TORQUE CONVERTER SO THAT THE GUIDE FACES DOWNWARD.
SST: Spacer coupling guide (S0965-71370)



SAPH033280400017

6. ROTATE THE ENGINE TO ALIGN THE FITTING HOLE OF THE ENGINE FLYWHEEL AND SPACER COUPLING WITH THE INSPECTION HOLE ON THE FRONT OF THE FLYWHEEL HOUSING.

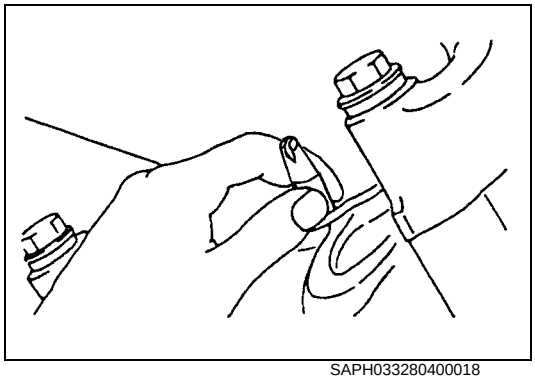
NOTICE
First switch off the power so that the engine will not start.

7. MOVE THE TRANSMISSION JACK SLOWLY AND INSERT THE GUIDE INTO THE FITTING HOLE OF THE FLYWHEEL.

⚠ WARNING
Do not lower the front side of the transmission. If lowered, the torque converter may slide out of the transmission and you can be injured.

8. MOVE THE TRANSMISSION JACK SLOWLY AND ADJUST BY BRINGING THE FITTING FACES OF THE TORQUE CONVERTER HOUSING AND THE FLYWHEEL HOUSING.

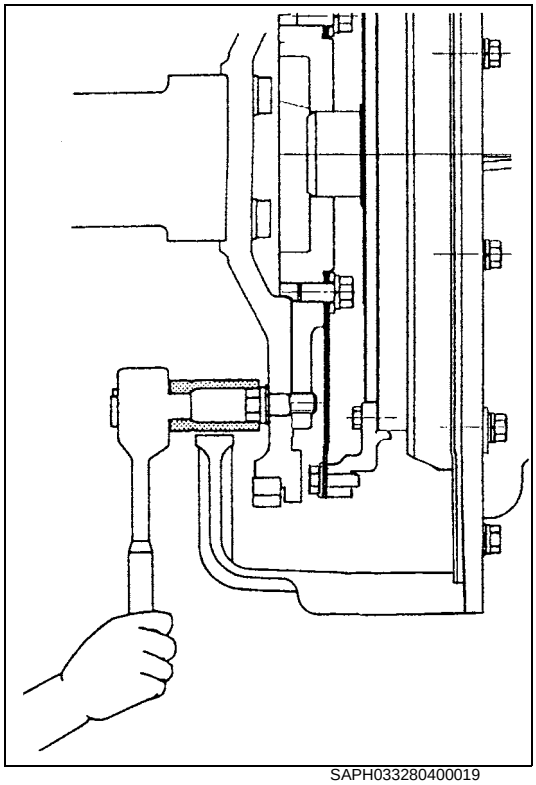
9. TIGHTEN THE BOLTS TO JOIN THE TORQUE CONVERTER HOUSING AND THE FLYWHEEL HOUSING.
Tightening Torque:
43-51 N·m {439-520 kgf·cm, 32-38 lbf·ft}



SAPH033280400018

10. LOWER AND REMOVE THE TRANSMISSION JACK.

11. TAKE THE GUIDE OUT OF THE INSPECTION HOLE ON THE FLYWHEEL HOUSING FRONT WITH A SCREW DRIVER.



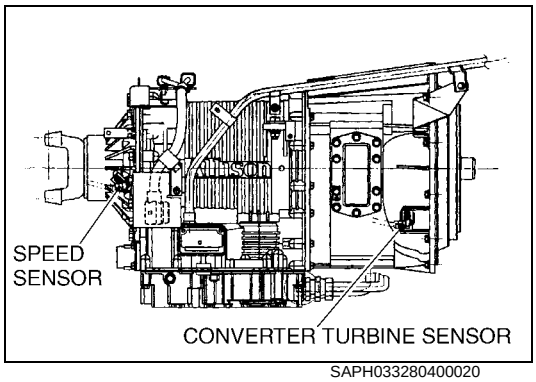
SAPH033280400019

12. LIGHTLY TIGHTEN THE BOLTS JOINING THE FLYWHEEL AND THE SPACER COUPLING THROUGH THE INSPECTION HOLE. IN ORDER TO TIGHTEN THE BOLTS, TURN THE RING GEAR WITH A SCREW DRIVER THROUGH THE TIMING ADJUSTMENT HOLE ON THE UPPER PART OF THE FLYWHEEL HOUSING.

NOTICE

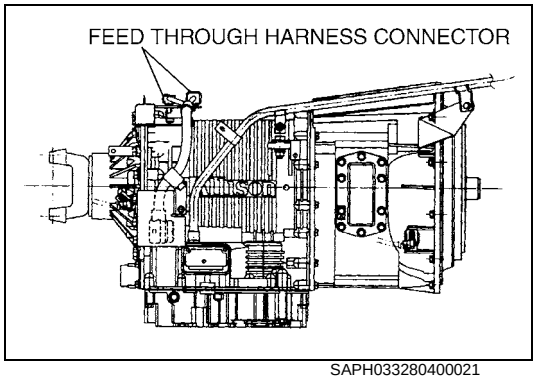
If the ring gear does not turn smoothly with a screw driver, remove the transmission and repeat the procedure again from 6 above, because the hub ends of the flywheel and the spacer coupling do not fit well. Tightening bolts in such a condition will cause damage to the bolts and jamming of the engine.

13. TIGHTEN THE BOLTS PRETIGHTENED IN STEP 12.
Tightening Torque:
64-85 N·m {653-867 kgf·cm, 48-62 lbf·ft}



SAPH033280400020

14. INSTALL THE SPEED SENSOR HARNESS TO THE REAR PART OF THE TRANSMISSION.

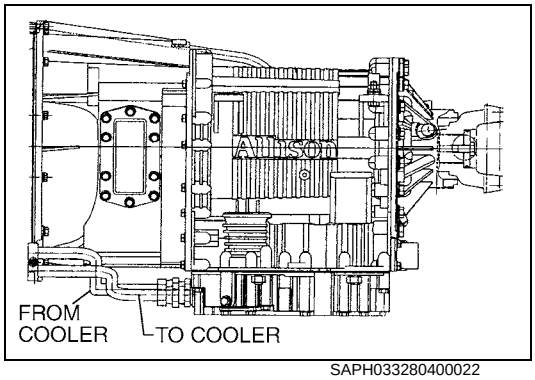


SAPH033280400021

15. CONNECT THE FEED THROUGH HARNESS CONNECTOR.

16. INSTALL THE PROPELLER SHAFT YOKE TO THE TRANSMISSION YOKE.

17. INSTALL THE CENTER BEARING HOLDER TO THE FRAME.



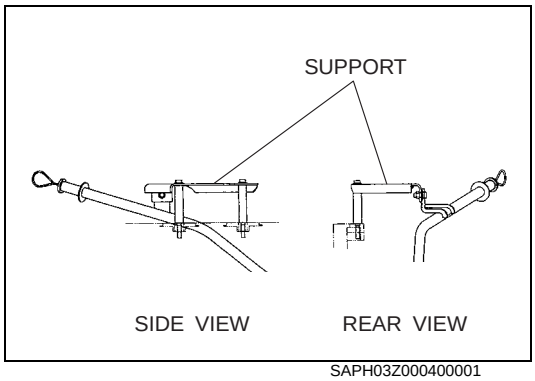
SAPH033280400022

18. CONNECT THE OIL COOLER LINE.

(1) For connecting the transmission case and joints, insert O-rings in the grooves of the joints before tightening.

NOTICE

Apply automatic transmission fluid to the O-rings when inserting them. If the fluid is not applied, the O-rings will not be inserted smoothly and will thus be damaged, causing oil to leak.



SAPH03Z000400001

19. INSTALL THE SUPPORT OF THE OIL LEVEL GAUGE TO THE ENGINE CYLINDER BLOCK.

20. REMOVE THE CAP OF THE OIL FILLER TUBE AND POUR AUTOMATIC TRANSMISSION FLUID INTO THE TUBE.

Automatic transmission fluid:
ATF DEXRON® 3

NOTICE

For further details, consult your nearest ALLISON representative or ALLISON service station.

P.T.O. (POWER TAKE-OFF) (TRANSMISSION SERIES: LX06S)

TR05-001

POWER TAKE-OFF ASSEMBLY TR05-2
DATA AND SPECIFICATIONS TR05-2
DESCRIPTION TR05-3
TROUBLESHOOTING TR05-3

POWER TAKE-OFF UNIT TR05-4
COMPOMENT LOCATOR TR05-4
OVERHAUL TR05-5
INSPECTION AND REPAIR TR05-10

POWER TAKE-OFF ASSEMBLY

DATA AND SPECIFICATIONS

EN0332005I200001

POWER TAKE-OFF

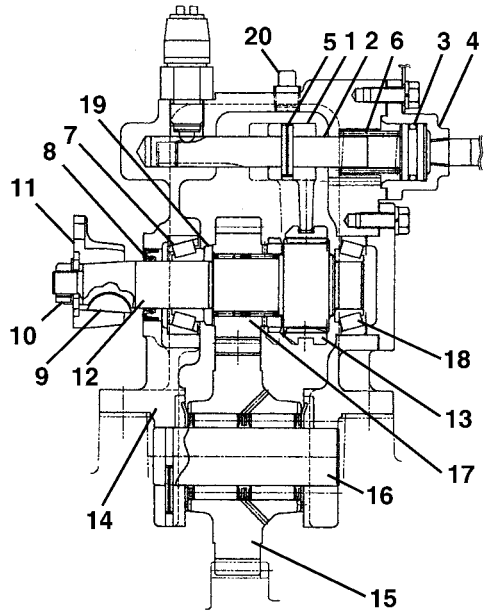
Type	**Side power take-off Driven by engaging the output shaft gear with counter 4th gear**		
Direction of rotation	**Opposite engine's**		
Gear ratio (P.T.O. output gear/ P.T.O. input gear)	**Transmission gear ratio**	**1st-8.190, 6th-1.000**	**16/31**
		1st-6.098, 6th-0.761	**21/31**
		1st-6.515, 6th-1.000	**20/31**
Size of output shaft flange	**25 x 50 mm {0.985 x 1.968 in.} (A x B: Refer to DESCRIPTION below)**		

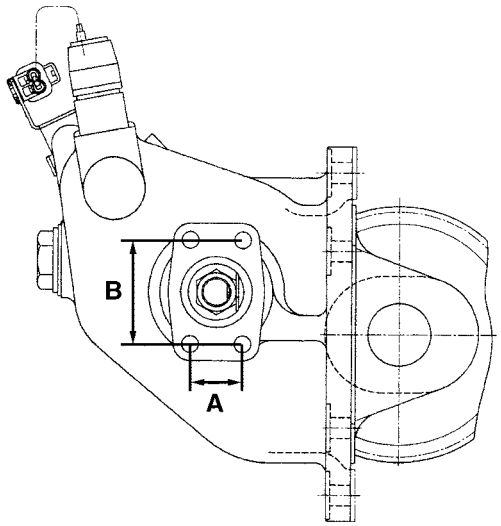
POWER TAKE-OFF CONTROL

Type	**Two switches in the cab engage and disengage the power take-off. These switches actuate a solenoid valve which regulate the compressed air to the control cylinder.**

DESCRIPTION

EN0332005C100001





SHTS033200500001

POWER TAKE-OFF UNIT

1	**Shift fork**	**11**	**Output shaft flange**
2	**Shift shaft**	**12**	**Output shaft**
3	**O-ring**	**13**	**Shift sleeve**
4	**Cylinder cup**	**14**	**Power take-off case**
5	**Spring pin**	**15**	**Input gear**
6	**Compression spring**	**16**	**Input shaft**
7	**Shim**	**17**	**Output gear**
8	**Oil seal**	**18**	**Taper roller bearing**
9	**Woodruff key**	**19**	**Collar**
10	**Lock nut**	**20**	**Screw plug**

TROUBLESHOOTING

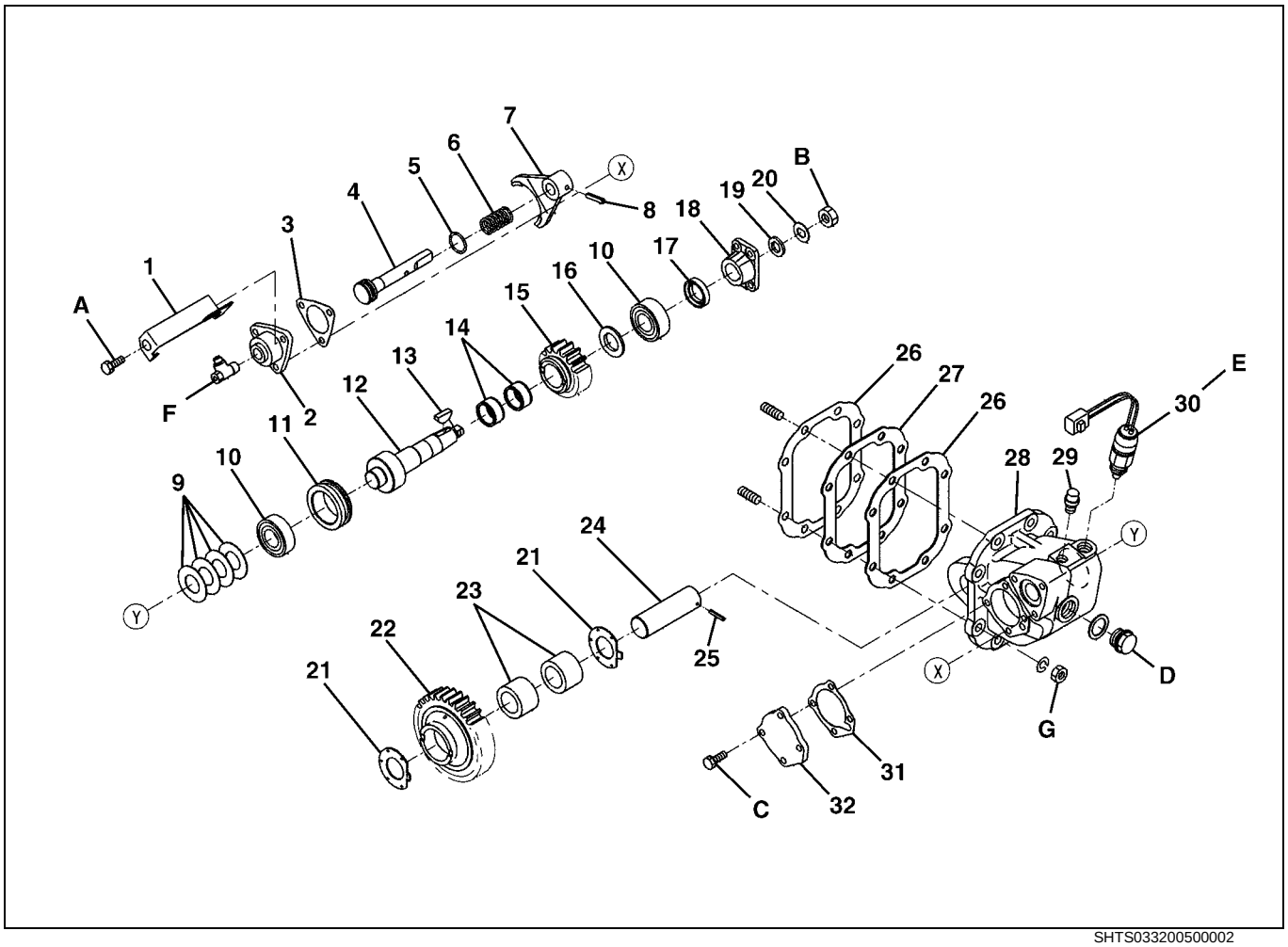
EN0332005F300001

Symptom	Possible cause	Remedy/Prevention
Noise	Bearing worn and/or damaged.	Replace bearing.
	Output gear worn and/or damaged.	Replace gear.
	To much play in gear backlash.	Use proper power take-off gasket.
	Shortage gear oil and/or low oil viscosity.	Add oil or change oil as required.
Can not be operated	Faulty switches	Replace switch.
	Faulty solenoid valve.	Replace solenoid valve.

POWER TAKE-OFF UNIT

COMPOMENT LOCATOR

EN0332005D100001



SHTS033200500002

1	Bracket	12	Output shaft	23	Needle roller bearing
2	Cylinder cap	13	Woodruff key	24	Input shaft
3	Packing	14	Needle roller bearing	25	Spring pin
4	Shift rod	15	Output gear	26	Power take-off case gasket
5	O-ring	16	Collar	27	Power take-off case adapter
6	Compression spring	17	Oil seal	28	Power take-off case
7	Shift fork	18	Output shaft flange	29	Screw plug
8	Spring pin	19	Plain washer	30	Power take-off position switch
9	Shim	20	Lock washer	31	Packing
10	Taper roller bearing	21	Spacer	32	Cap
11	Shift sleeve	22	Input gear		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	19-25 {194-255, 14-18}	E	49.0-68.5 {500-698, 36-50}
B	39.2-47.0 {400-480, 29-34}	F	39.5-58.5 {400-600, 29-43}
C	19-25 {194-255, 14-18}	G	54-68 {551-693, 40-50}
D	63.5-82.5 {648-841, 47-60}		

OVERHAUL

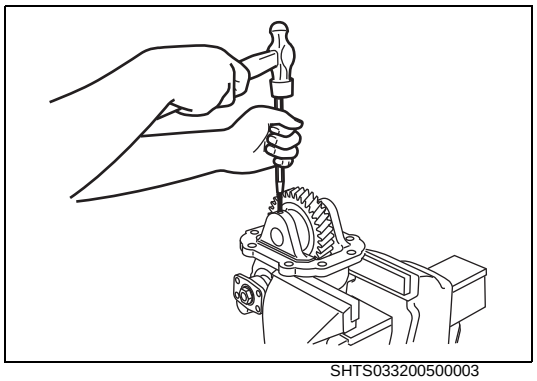
EN0332005H200001

IMPORTANT POINT - DISMOUNTING

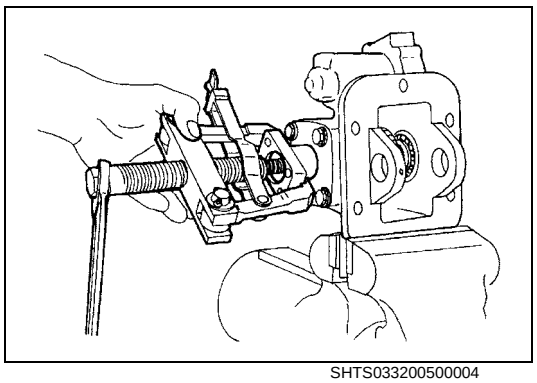
⚠ CAUTION
Do not work on the transmission while it is still hot.
This can result in personal injury.

1. DRAIN THE TRANSMISSION OIL.

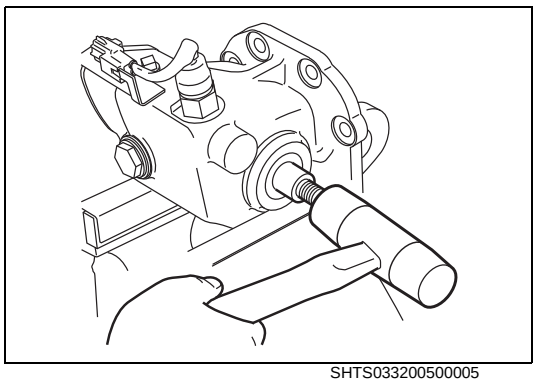
IMPORTANT POINTS - DISASSEMBLY


SHTS033200500003

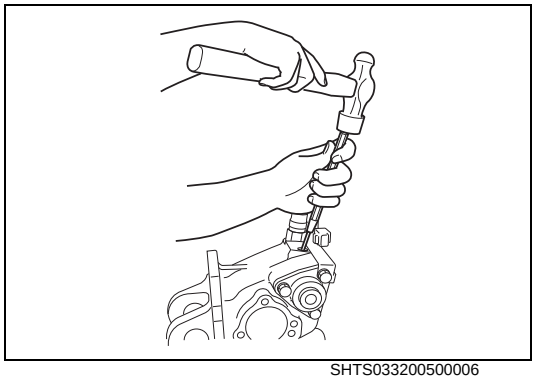
1. SET THE POWER TAKE-OFF ON A VISE.
REMOVE THE INPUT GEAR.
(1) Drive the spring pin into the hole of the shaft.
(2) Drive out the input shaft.


SHTS033200500004

2. REMOVE THE OUTPUT SHAFT FLANGE.
(1) Remove the lock nut.
(2) Use a suitable puller to remove the output shaft flange.


SHTS033200500005

3. REMOVE THE OUTPUT SHAFT.
(1) Remove the woodruff key.
(2) Remove the cap.
(3) Use a suitable tool to pull out the output shaft from the case. As the output shaft is removed, remove the taper roller bearing, shift sleeve, output gear, needle roller bearing, collar and shift fork from the output shaft and power take-off case.

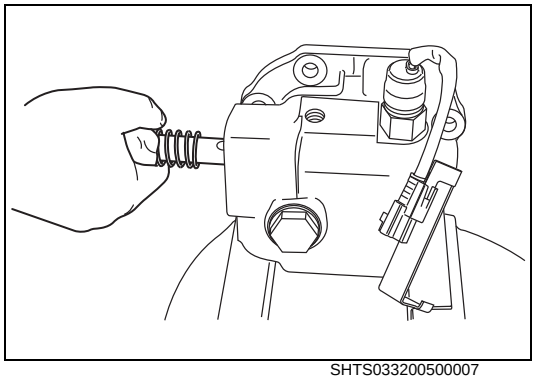

SHTS033200500006

4. REMOVE THE SHIFT ROD.

(1) Remove the screw plug.

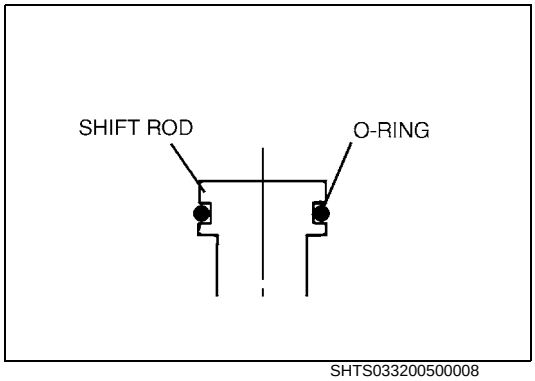
(2) Drive the spring pin into the hole of the shaft.

(3) Remove the cylinder cap.


SHTS033200500007

(4) Remove the shift rod.

IMPORTANT POINTS - ASSEMBLY

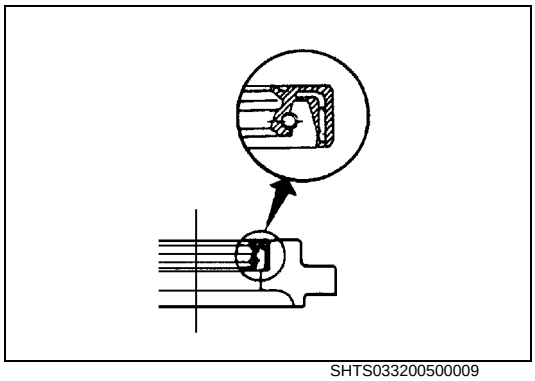


SHTS033200500008

1. INSTALL THE O-RING ON THE SHIFT ROD.

NOTICE

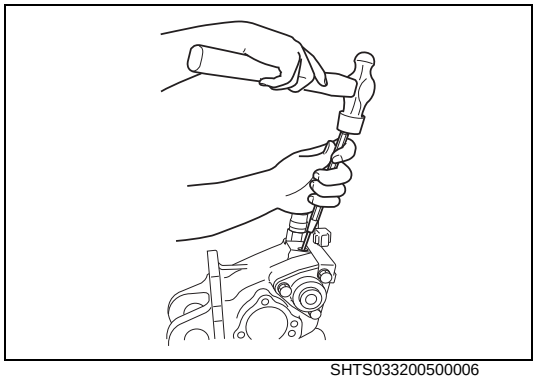
- **Coat the O-ring with grease.**
- **Be sure the O-ring is inserted in the proper direction.**


SHTS033200500009

2. INSTALL THE OIL SEAL INTO THE POWER TAKE-OFF CASE.

NOTICE

- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**
- **Coat the sealing surface between the seal lips with chassis grease.**


SHTS033200500006

3. INSTALL THE SHIFT ROD AND SHIFT FORK TO THE POWER TAKE-OFF CASE.

(1) Set the shift fork in its original position.

NOTICE

Be sure the shift fork is installed in the correct direction.

(2) Insert the shift rod into the case and the shift fork.
(3) Rotate the shift rod so that spring pin hole of the shift rod is aligned with spring pin hole of the shift fork.
(4) Install the spring pin into the spring pin hole.
(5) Install the screw plug.

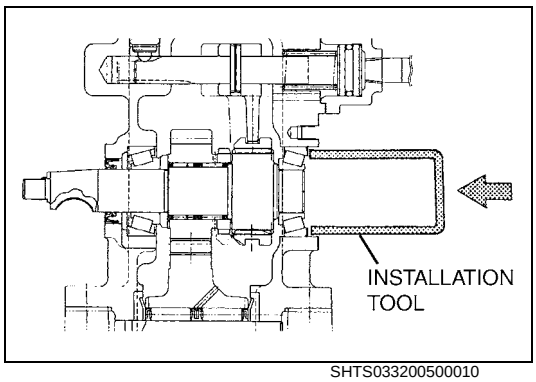
NOTICE

Wrap seal tape around the screw plug.

(6) Install the cylinder cap.

NOTICE

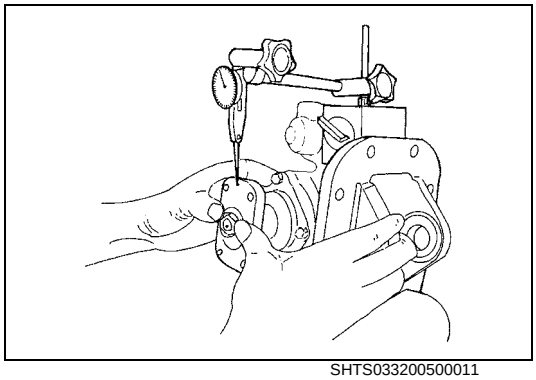
Apply grease to the inner surface of the cylinder cap.



SHTS033200500010

4. INSTALL THE OUTPUT SHAFT TO THE POWER TAKE-OFF CASE.

(1) Install the taper roller bearing outer race into the case.
(2) Set the shift sleeve in its original position.
(3) Install the output shaft through the shift sleeve, needle roller bearing, output gear and collar into the case.
(4) Drive the output shaft into the taper roller bearing inner race.
(5) Drive the taper roller bearing on the output shaft.
(6) Drive the outer race in the case.

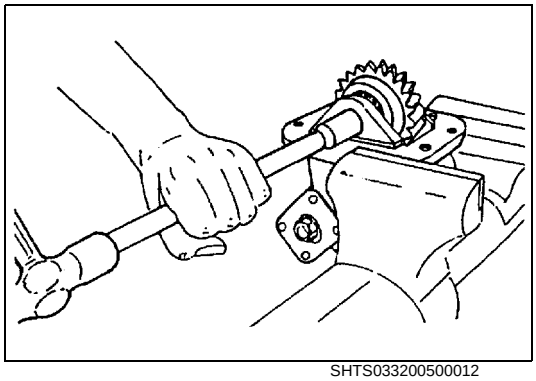

SHTS033200500011

5. CHECK THE OUTPUT SHAFT AXIAL PLAY.

(1) Use a dial gauge to check the output shaft axial play.
Assembly Standard: 0-0.05 mm {0-0.0019 in.}

(2) If it is not within specification, adjust the axial play with shims.

Shim Thickness: 0.05 mm {0.0020 in.}
0.10 mm {0.0039 in.}
0.20 mm {0.0079 in.}
0.50 mm {0.0197 in.}

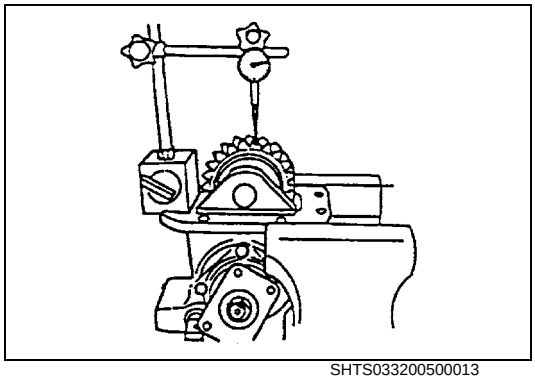

SHTS033200500012

6. INSTALL THE INPUT GEAR.

(1) Place the taper roller bearing, input gear, shims and spacer in its original position.
(2) Drive the input shaft through the input gear into the case.

NOTICE

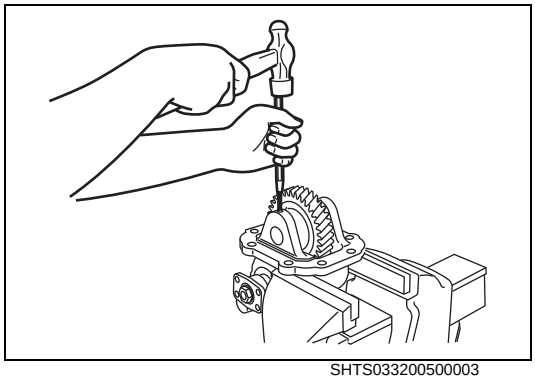
Rotate the input shaft so that slot of the input shaft is aligned with hole of the case.


SHTS033200500013

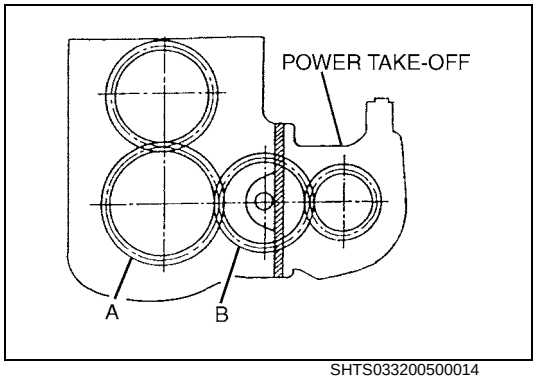
7. CHECK THE INPUT GEAR AXIAL PLAY.

(1) Use a dial gauge to check the input gear axial play.
Assembly Standard: 0-0.05 mm {0-0.0019 in.}

(2) If it is not within specification, adjust the axial play with shims.
Shim Thickness: 0.05 mm {0.0020 in.}
0.10 mm {0.0039 in.}
0.20 mm {0.0079 in.}
0.50 mm {0.0197 in.}


SHTS033200500003

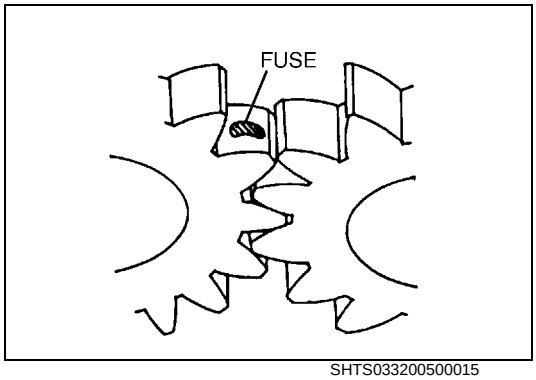
8. AFTER MEASURING THE AXIAL PLAY, INSTALL THE SPRING PIN INTO THE HOLE.



SHTS033200500014

IMPORTANT POINTS - MOUNTING

1. MEASURE THE BACKLASH BETWEEN THE GEAR "A" AND "B".



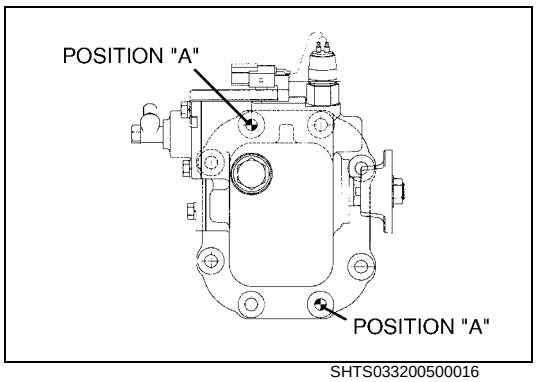
SHTS033200500015

(1) Put the fuse (ϕ1 x 10 mm {0.394 in.}) on the surface of gear B with grease.
(2) Rotate the gears and measure the thickness of fuse.
(3) The measurement should be carried out the three points on the gears.
Assembly Standard:
0.08-0.21 mm {0.0031-0.0082 in.}
(4) If it is not within specification, adjust the backlash with adapter.

Adapters are available in following size.

Groove line	Transmission gear ratio	Adapter Thickness
None	1st-8.190, 6th-1.000	1.98 mm {0.0779 in.}
	1st-6.098, 6th-0.761	10.19 mm {0.4012 in.}
	1st-6.515, 6th-1.000	8.15 mm {0.3209 in.}
One	1st-8.190, 6th-1.000	1.87 mm {0.0736 in.}
	1st-6.098, 6th-0.761	10.07 mm {0.3965 in.}
	1st-6.515, 6th-1.000	8.04 mm {0.3165 in.}
Two	1st-8.190, 6th-1.000	1.77 mm {0.0697 in.}
	1st-6.098, 6th-0.761	9.97 mm {0.3925 in.}
	1st-6.515, 6th-1.000	7.94 mm {0.3126 in.}

NOTICE
Gasket thickness: 0.19 mm {0.0075 in.}



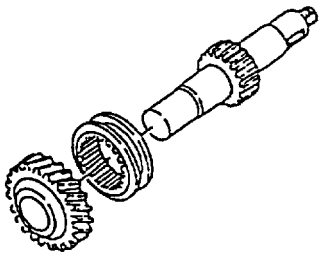
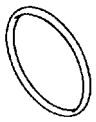
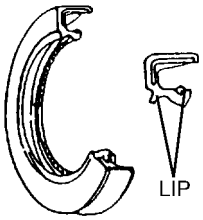
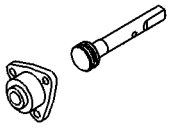
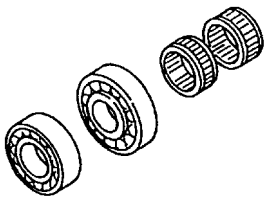
SHTS033200500016

2. INSTALL THE POWER TAKE-OFF ON THE TRANSMISSION.
(1) Install the power take-off on the transmission with gasket.
NOTICE
The trace of the liquid gasket should be continuous. The liquid gasket should be "ThreeBond #HP-17" or equivalent.
(2) Install the reamer bolts to the position "A".

3. FILL THE TRANSMISSION WITH TRANSMISSION OIL.

INSPECTION AND REPAIR

EN0332005H300001

Inspection item	Standard	Limit	Remedy	Inspection procedure
Output shaft and output gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
O-ring: Wear	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Oil seal lip: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift rod and cylinder cap bore: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing: Improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

P.T.O. (POWER TAKE-OFF) (TRANSMISSION SERIES: LJ06S)

TR05-002

POWER TAKE-OFF ASSEMBLY TR05-2
DATA AND SPECIFICATIONS TR05-2
DESCRIPTION TR05-2
TROUBLESHOOTING TR05-3

POWER TAKE-OFF UNIT TR05-4
COMPONENT LOCATOR TR05-4
OVERHAUL TR05-5
INSPECTION AND REPAIR TR05-10

POWER TAKE-OFF ASSEMBLY

DATA AND SPECIFICATIONS

EN0332205I200001

POWER TAKE-OFF

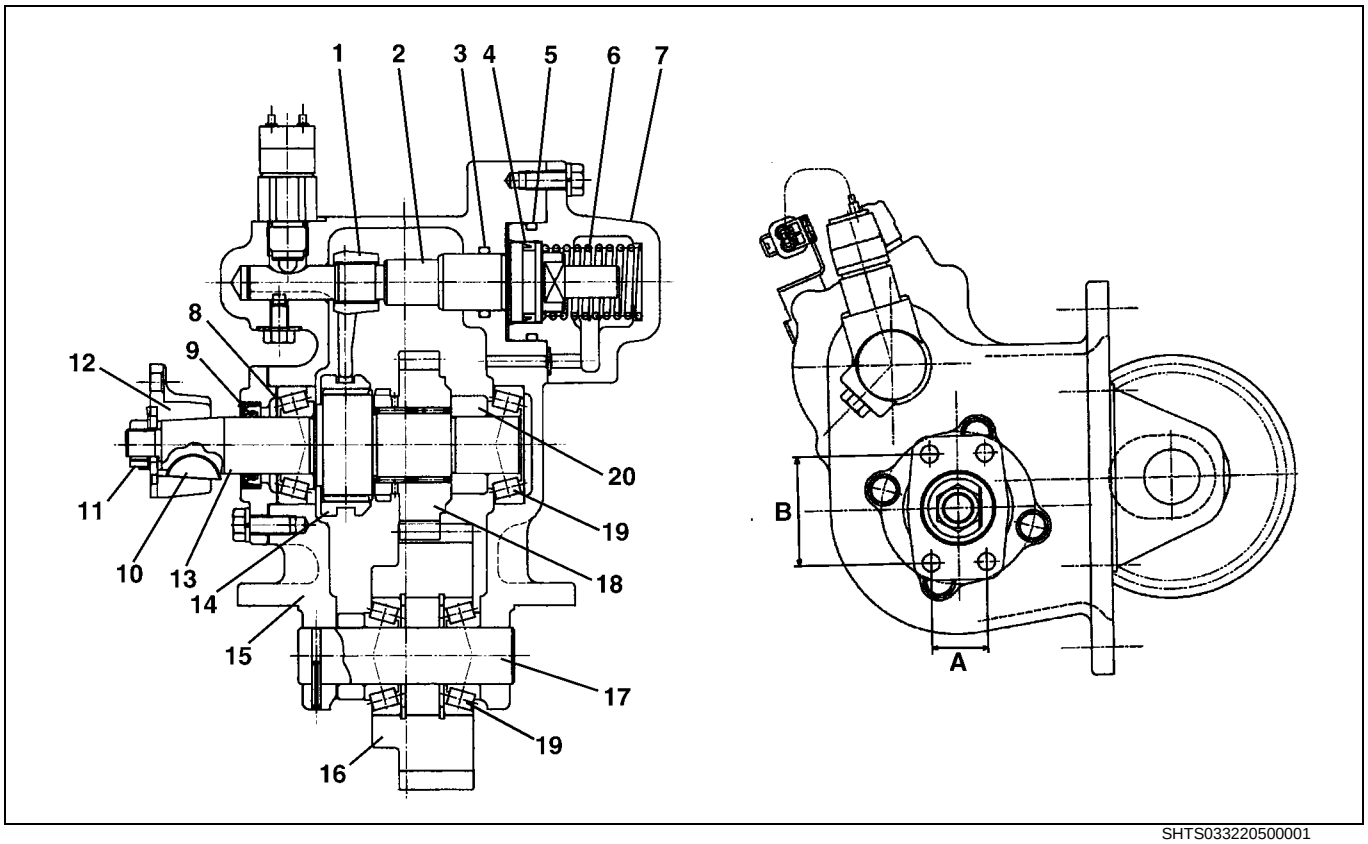
Type	**Side power take-off Driven by engaging the output shaft gear with counter 4th gear**
Direction of rotation	**Opposite engine's**
Gear ratio (P.T.O. output gear/ P.T.O. input gear)	**23/26**
Size of output shaft flange	**25 x 50 mm {0.985 x 1.968 in.} (A x B: Refer to DESCRIPTION below)**

POWER TAKE-OFF CONTROL

Type	**Two switches in the cab engage and disengage the power take-off. These switches actuate a solenoid valve which regulate the compressed air to the control cylinder.**

DESCRIPTION

EN0332205C100001



SHTS033220500001

POWER TAKE-OFF UNIT

1	**Shift fork**	**8**	**Shim**	**15**	**Power take-off case**
2	**Shift shaft**	**9**	**Oil seal**	**16**	**Input gear**
3	**O-ring**	**10**	**Woodruff key**	**17**	**Input shaft**
4	**Shift shaft piston cup**	**11**	**Lock nut**	**18**	**Output gear**
5	**O-ring**	**12**	**Output shaft flange**	**19**	**Taper roller bearing**
6	**Compression spring**	**13**	**Output shaft**	**20**	**Collar**
7	**Case cover**	**14**	**Shift sleeve**		

TROUBLESHOOTING

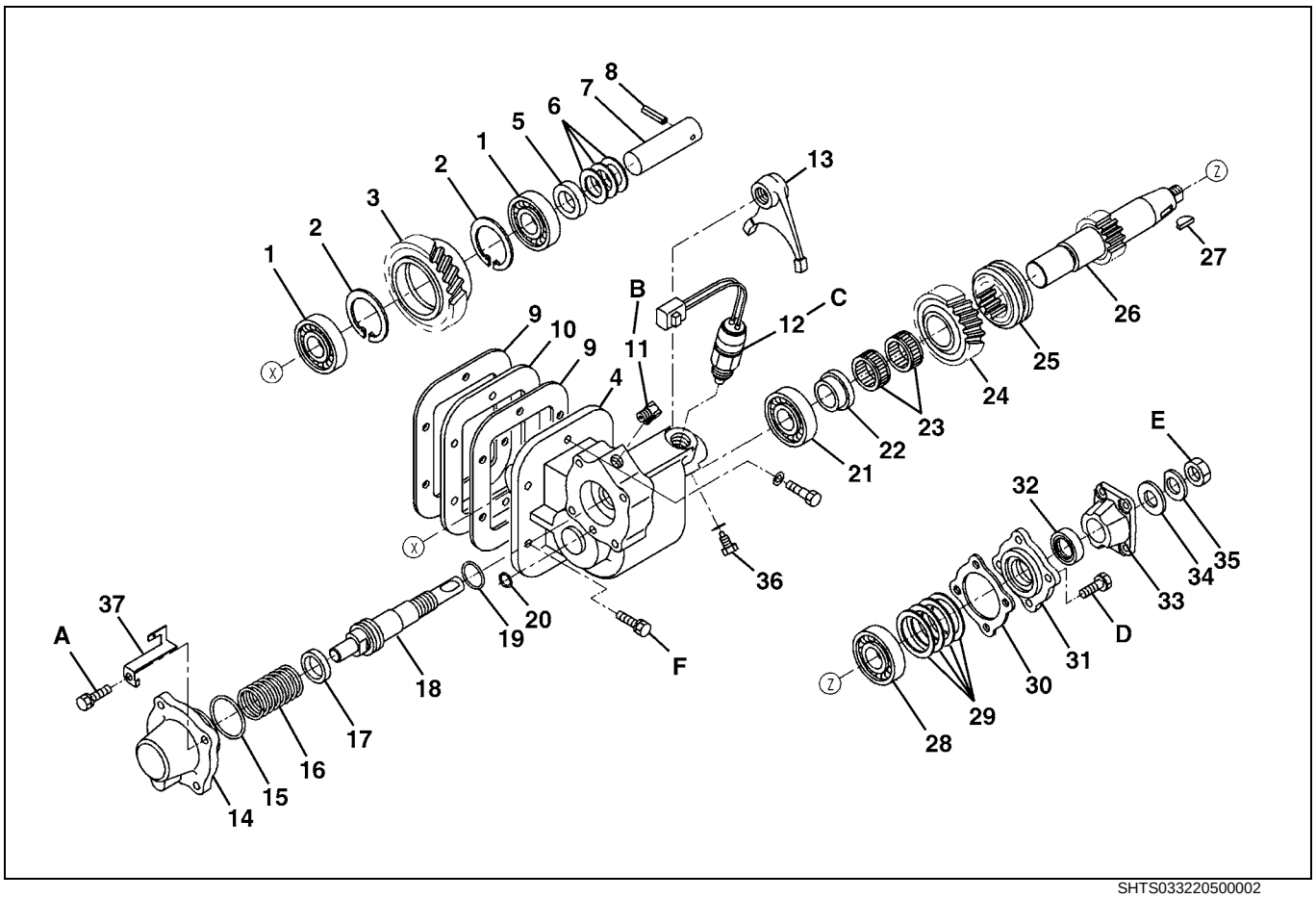
EN0332205F300001

Symptom	Possible cause	Remedy/Prevention
Noise	Bearing worn and/or damaged	Replace bearing.
	Output gear worn and/or damaged	Replace gear.
	Too much play in gear backlash	Use proper power take-off gasket.
	Shortage gear oil and/or low oil viscosity	Add oil or change oil as required.
Can not be operated	Faulty switches	Replace switch.
	Faulty solenoid valve	Replace solenoid valve.

POWER TAKE-OFF UNIT

COMPONENT LOCATOR

EN0332205D100001



SHTS033220500002

1	Taper roller bearing	14	Case cover	27	Woodruff key
2	Retainer ring	15	O-ring	28	Taper roller bearing
3	Input gear	16	Compression spring	29	Shim
4	Power take-off case	17	Shift shaft piston cup	30	Gasket
5	Spacer	18	Shift shaft	31	Seal cover
6	Shim	19	O-ring	32	Oil seal
7	Input shaft	20	O-ring	33	Output shaft flange
8	Spring pin	21	Taper roller bearing	34	Plain washer
9	Power take-off case gasket	22	Collar	35	Lock washer
10	Power take-off case adapter	23	Needle roller bearing	36	Set screw
11	Elbow	24	Output gear	37	Bracket
12	Power take-off position switch	25	Shift sleeve		
13	Shift fork	26	Output shaft		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	19-25 {200-250, 15-18}	F	(Transmission gear ratio: 1st-6.893, 6th-0.770)
B	39.5-58.5 {400-600, 29-43}		(Transmission gear ratio: 1st-6.477, 6th-0.723)
C	48.5-67.5 {500-700, 37-50}		54-68 {551-693, 40-50}
D	19-25 {200-250, 15-18}		(Transmission gear ratio: 1st-6.746, 6th-0.823)
E	39.2-47.0 {400-480, 29-34}		44.5-53.5 {454-545, 33-39}

OVERHAUL

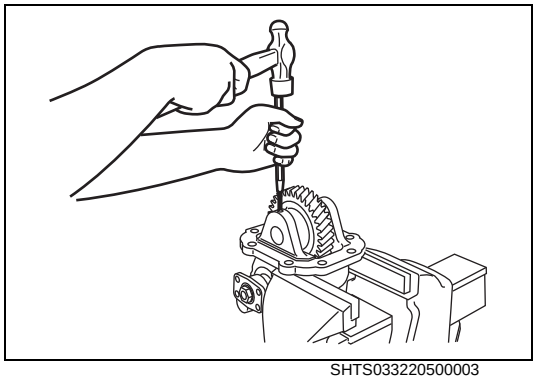
EN0332205H200001

IMPORTANT POINT - DISMOUNTING

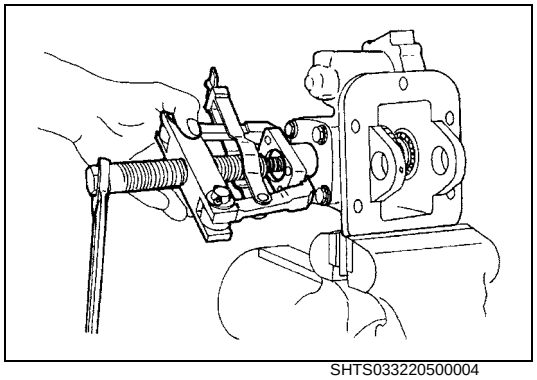
⚠ **CAUTION**
Do not work on the transmission while it is still hot.
This can result in personal injury.

1. DRAIN THE TRANSMISSION OIL.
EXHAUST ALL AIR FROM THE AIR TANKS.

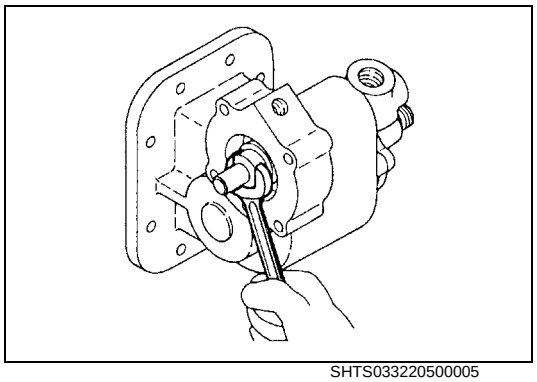
IMPORTANT POINTS - DISASSEMBLY


SHTS033220500003

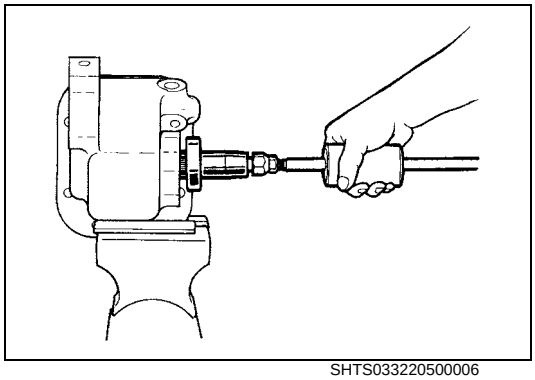
1. SET THE POWER TAKE-OFF ON A VISE.
REMOVE THE INPUT GEAR.
(1) Drive the spring pin into the hole of the shaft.
(2) Drive out the input shaft.


SHTS033220500004

2. REMOVE THE OUTPUT SHAFT FLANGE.
(1) Remove the lock nut.
(2) Use a suitable puller to remove the output shaft flange.


SHTS033220500005

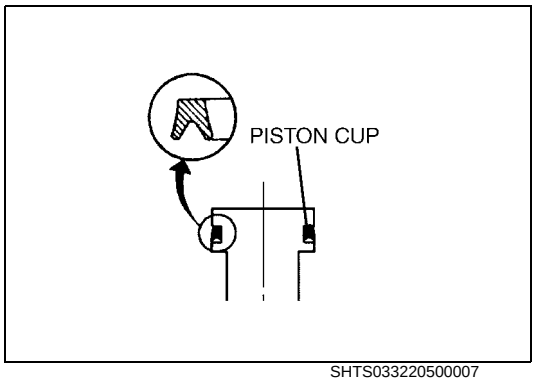
3. REMOVE THE SHIFT SHAFT.
(1) Remove the shift shaft set screw.
(2) Remove the case cover and compression spring.
(3) Unscrew the shift shaft to separate the shift shaft from the shift fork.


SHTS033220500006

4. REMOVE THE OUTPUT SHAFT.

(1) Remove the woodruff key.
(2) Remove the seal cover.
(3) Use a suitable tool to pull out the output shaft from the case. As the output shaft is removed, remove the taper roller bearing, shift sleeve, output gear, needle roller bearing, collar and shift fork from the output shaft and power take-off case.

IMPORTANT POINTS - ASSEMBLY

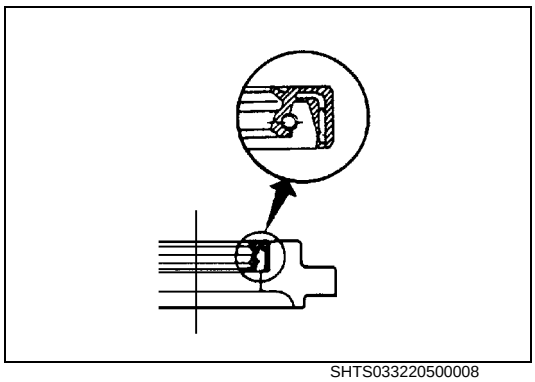


SHTS033220500007

1. INSTALL THE PISTON CUP ON THE SHIFT SHAFT.

NOTICE

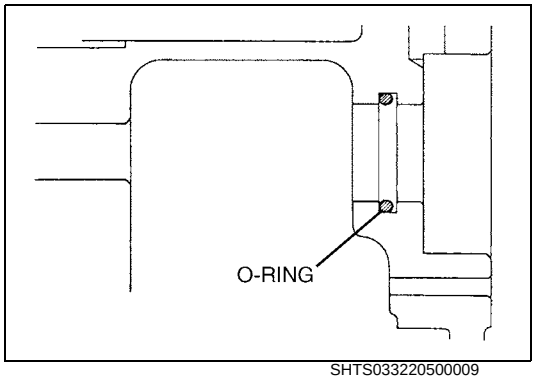
- **Coat the piston cup with grease.**
- **Be sure the piston cup is installed in the proper direction.**


SHTS033220500008

2. INSTALL THE OIL SEAL INTO THE SEAL COVER.

NOTICE

- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**
- **Coat the sealing surface between the seal lips with grease.**



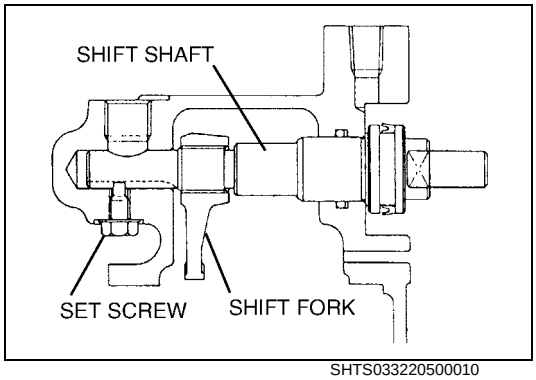
SHTS033220500009

3. INSTALL THE SHIFT SHAFT AND SHIFT FORK TO THE POWER TAKE-OFF CASE.

(1) Install the O-ring on the case.

NOTICE

Coat the O-ring with grease.

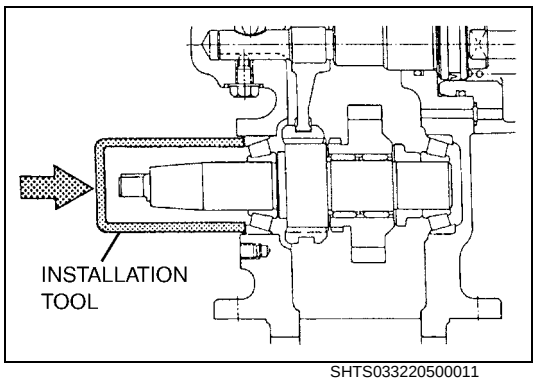


SHTS033220500010

(2) Set the shift fork in its original position.

NOTICE
Be sure the shift fork is installed in the correct direction.

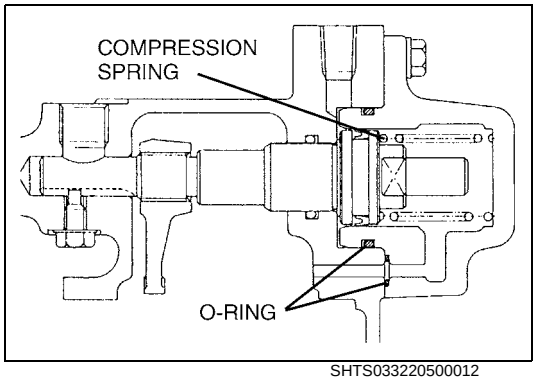
(3) Screw the shift shaft into the thread of the shift fork.
(4) Rotate the shift shaft so that slot of the shift shaft is aligned with set screw hole.



SHTS033220500011

4. INSTALL THE OUTPUT SHAFT TO THE POWER TAKE-OFF CASE.

(1) Install the taper roller bearing into the case.
(2) Set the shift sleeve in its original position.
(3) Install the output shaft through the shift sleeve, needle roller bearing, output gear and collar into the case.
(4) Drive the output shaft into the taper roller bearing inner race.
(5) Drive the taper roller bearing on the output shaft.
(6) Drive the outer race in the case.

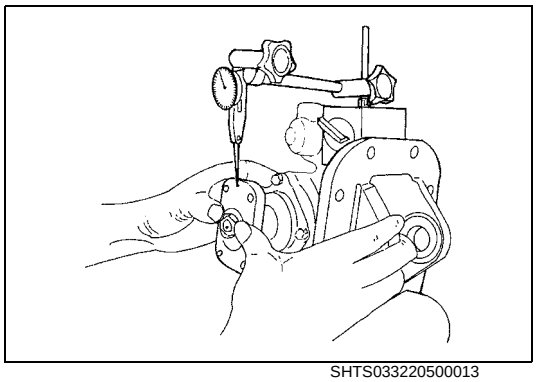


SHTS033220500012

5. INSTALL THE CASE COVER ON THE POWER TAKE-OFF CASE.

(1) Install the O-ring and compression spring on the case cover.

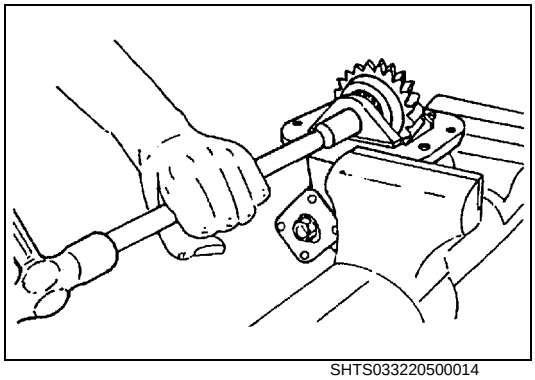
NOTICE
Coat the O-ring and inside of the case cover with grease.


SHTS033220500013

6. CHECK THE OUTPUT SHAFT AXIAL PLAY.

(1) Use a dial gauge to check the output shaft axial play.
Assembly Standard: 0-0.05 mm {0-0.0019 in.}

(2) If it is not within specification, adjust the axial play with shims.
Shim Thickness: 0.05 mm {0.0020 in.}
0.10 mm {0.0039 in.}
0.20 mm {0.0079 in.}
0.50 mm {0.0197 in.}


SHTS033220500014

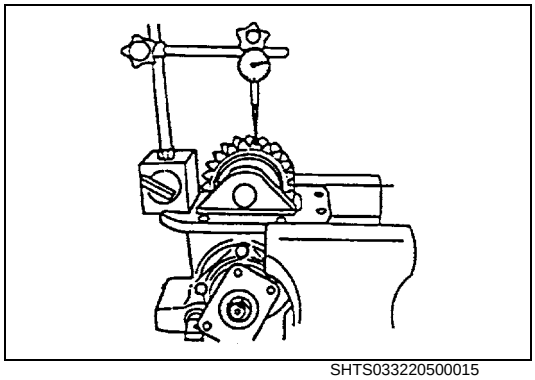
7. INSTALL THE INPUT GEAR.

(1) Place the taper roller bearing, input gear, shims and spacer in its original position.

(2) Drive the input shaft through the input gear into the case.

NOTICE

Rotate the input shaft so that slot of the input shaft is aligned with hole of the case.

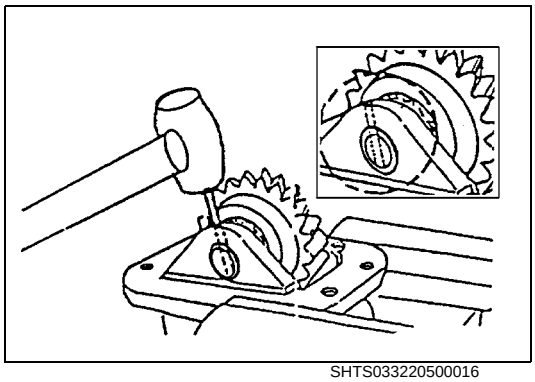

SHTS033220500015

8. CHECK THE INPUT GEAR AXIAL PLAY.

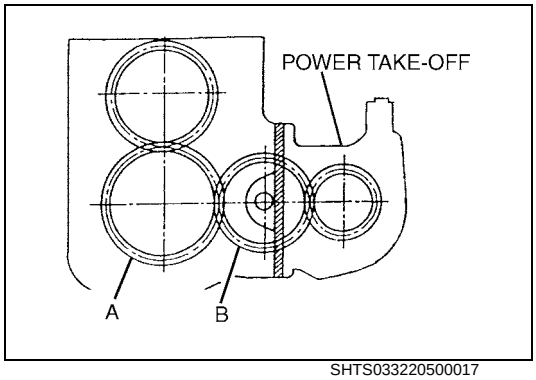
(1) Use a dial gauge to check the input gear axial play.
Assembly Standard: 0-0.05 mm {0-0.0019 in.}

(2) If it is not within specification, adjust the axial play with shims.

Shim Thickness: 0.05 mm {0.0020 in.}
0.10 mm {0.0039 in.}
0.20 mm {0.0079 in.}
0.50 mm {0.0197 in.}


SHTS033220500016

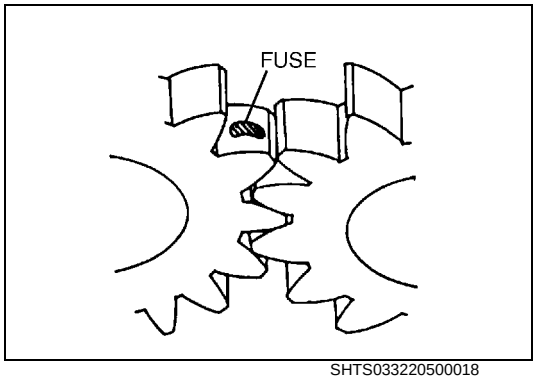
9. AFTER MEASURING THE AXIAL PLAY, INSTALL THE SPRING PIN INTO THE HOLE.



SHTS033220500017

IMPORTANT POINTS - MOUNTING

1. MEASURE THE BACKLASH BETWEEN THE GEAR "A" AND "B".



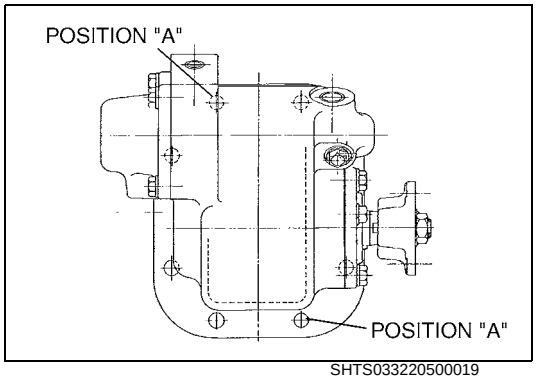
SHTS033220500018

(1) Put the fuse (ϕ1 x 10 mm {0.394 in.}) on the surface of gear "B" with grease.
(2) Rotate the gears and measure the thickness of fuse.
(3) The measurement should be carried out the three points on the gears.
Assembly Standard: 0.09-0.25 mm {0.0036-0.0098 in.}
(4) If it is not within specification, adjust the backlash with adapter.

Adapters are available in following size.

Groove line	Transmission gear ratio	Adapter Thickness
None	1st-6.477, 6th-0.723	6.12 mm {0.2409 in.}
	1st-6.893, 6th-0.770	
	1st-6.746, 6th-0.823	8.02 mm {0.3157 in.}
One	1st-6.477, 6th-0.723	5.99 mm {0.2358 in.}
	1st-6.893, 6th-0.770	
	1st-6.746, 6th-0.823	7.89 mm {0.3106 in.}
Two	1st-6.477, 6th-0.723	5.86 mm {0.2307 in.}
	1st-6.893, 6th-0.770	
	1st-6.746, 6th-0.823	7.76 mm {0.3055 in.}

NOTICE
Gasket thickness: 0.19 mm {0.0075 in.}



SHTS033220500019

2. INSTALL THE POWER TAKE-OFF ON THE TRANSMISSION.
(1) Install the power take-off on the transmission with gasket.

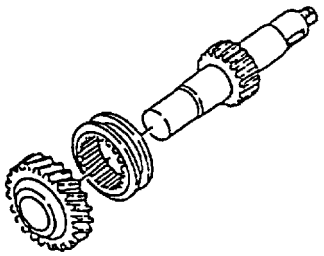
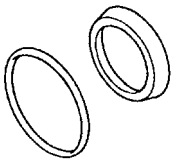
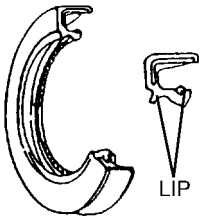
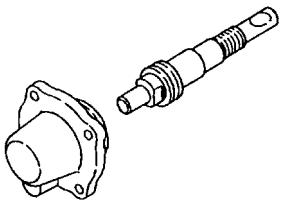
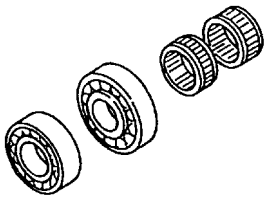
NOTICE
The trace of the liquid gasket should be continuous. The liquid gasket should be ThreeBond #HP-17 or equivalent.

(2) Install the reamer bolts to the position "A".

3. FILL THE TRANSMISSION WITH TRANSMISSION OIL.

INSPECTION AND REPAIR

EN0332205H300001

Inspection item	Standard	Limit	Remedy	Inspection procedure
Output shaft and output gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
O-ring and cup: Wear	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Oil seal lip: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift shaft and case cover bore: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing: Improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

P.T.O. (POWER TAKE-OFF) (TRANSMISSION SERIES: MF06S)

TR05-003

POWER TAKE-OFF ASSEMBLY TR05-2
DATA AND SPECIFICATIONS TR05-2
DESCRIPTION TR05-2
TROUBLESHOOTING TR05-3

POWER TAKE-OFF UNIT TR05-4
COMPONENT LOCATOR TR05-4
OVERHAUL TR05-5
INSPECTION AND REPAIR TR05-10

POWER TAKE-OFF ASSEMBLY

DATA AND SPECIFICATIONS

EN0332305I200001

POWER TAKE-OFF

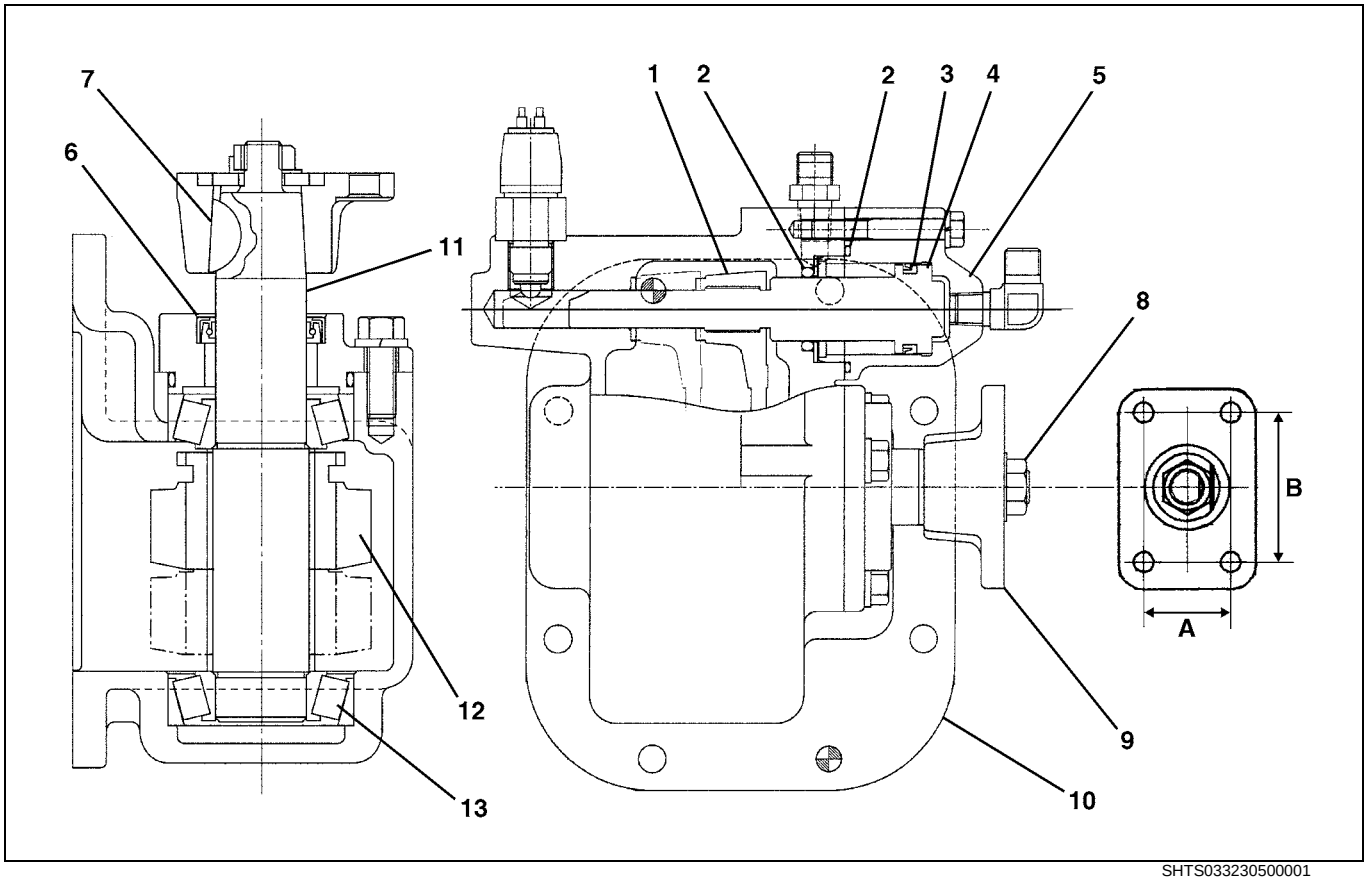
Type	**Side power take-off Driven by engaging the output shaft gear with reverse idler gear**
Direction of rotation	**Opposite engine's**
Gear ratio (P.T.O. output gear/ reverse idler gear)	**12/29**
Size of output shaft flange	**35 x 60 mm {1.378 x 2.362 in.} (A x B: Refer to DESCRIPTION below)**

POWER TAKE-OFF CONTROL

Type	**Two switches in the cab engage and disengage the power take-off. These switches actuate a solenoid valve which regulate the compressed air to the control cylinder.**

DESCRIPTION

EN0332305C100001



SHTS033230500001

POWER TAKE-OFF UNIT

1	**Shift fork**	**8**	**Lock nut**
2	**O-ring**	**9**	**Output shaft flange**
3	**Shift shaft piston cup**	**10**	**Power take-off case**
4	**Shift shaft**	**11**	**Output shaft**
5	**Case cover**	**12**	**Output gear**
6	**Oil seal**	**13**	**Taper roller bearing**
7	**Woodruff key**		

TROUBLESHOOTING

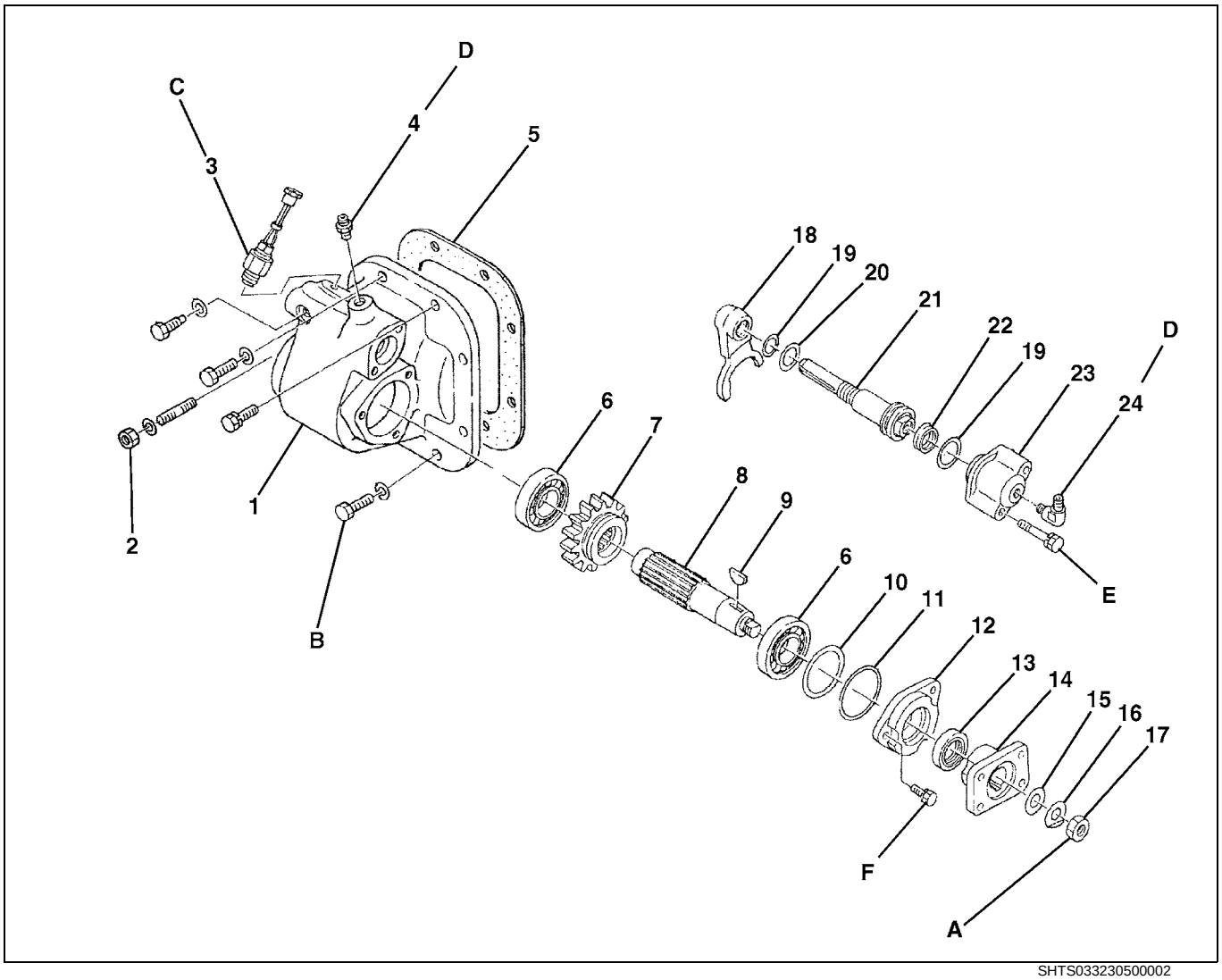
EN0332305F300001

Symptom	Possible cause	Remedy/Prevention
Noise	Bearing worn and/or damaged	Replace bearing.
	Output gear worn and/or damaged	Replace gear.
	Too much play in gear backlash	Use proper power take-off gasket.
	Shortage gear oil and/or low oil viscosity	Add oil or change oil as required.
Can not be operated	Faulty switches	Replace switch.
	Faulty solenoid valve	Replace solenoid valve.

POWER TAKE-OFF UNIT

COMPONENT LOCATOR

EN0332305D100001



SHTS033230500002

1	Power take-off case	13	Oil seal
2	Nut	14	Output shaft flange
3	Power take-off position switch	15	Plain washer
4	Connector	16	Lock washer
5	Power take-off case gasket	17	Lock nut
6	Taper roller bearing	18	Shift fork
7	Output gear	19	O-ring
8	Output shaft	20	Collar
9	Woodruff key	21	Shift shaft
10	Shim	22	Shift shaft piston cup
11	O-ring	23	Case cover
12	Seal cover	24	Elbow

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39.2-47 {400-480, 29-34}	D	39.5-58.5 {400-600, 29-43}
B	44.5-53.5 {450-545, 33-39}	E	19-25 {200-250, 15-18}
C	48.5-67.5 {500-690, 36-49}	F	49-62 {500-630, 36-45}

OVERHAUL

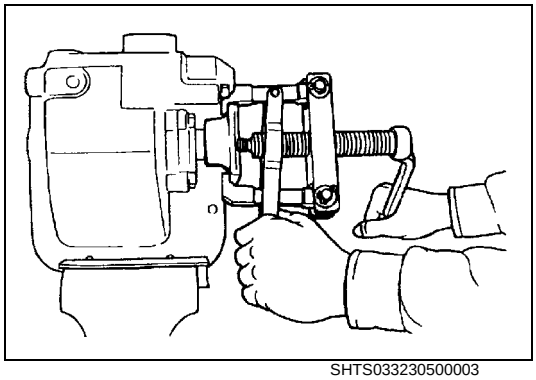
EN0332305H200001

IMPORTANT POINT - DISMOUNTING

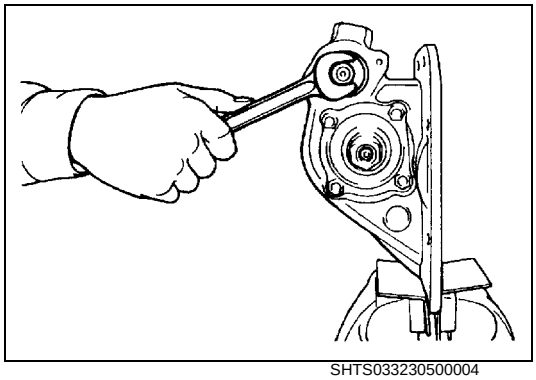
⚠ **CAUTION**
Do not work on the transmission while it is still hot.
This can result in personal injury.

1. DRAIN THE TRANSMISSION OIL.
EXHAUST ALL AIR FROM THE AIR TANKS.

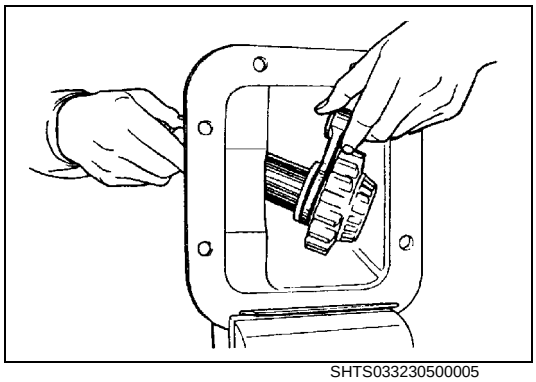
IMPORTANT POINTS - DISASSEMBLY


SHTS033230500003

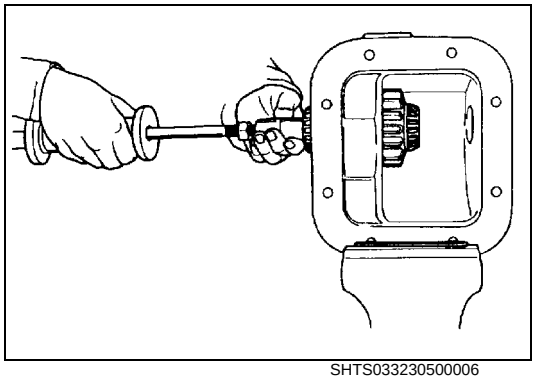
1. SET THE POWER TAKE-OFF ON A VISE.
REMOVE THE OUTPUT SHAFT FLANGE.
(1) Remove the lock nut.
(2) Use a suitable puller to remove the output shaft flange.


SHTS033230500004

2. REMOVE THE SHIFT SHAFT.
(1) Remove the case cover.
(2) Unscrew the shift shaft to separate the shift shaft from the shift fork.

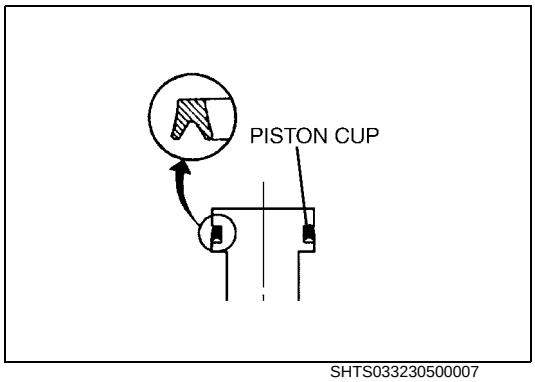

SHTS033230500005

3. REMOVE THE OUTPUT SHAFT.
(1) Remove the seal cover.
(2) Remove the shift fork from the output gear.


SHTS033230500006

(3) Use a suitable sliding hammer to pull out the output shaft with taper roller bearing from the case. As the output shaft is remove the output gear and taper roller bearing from the output shaft and power take-off case.

IMPORTANT POINTS - ASSEMBLY

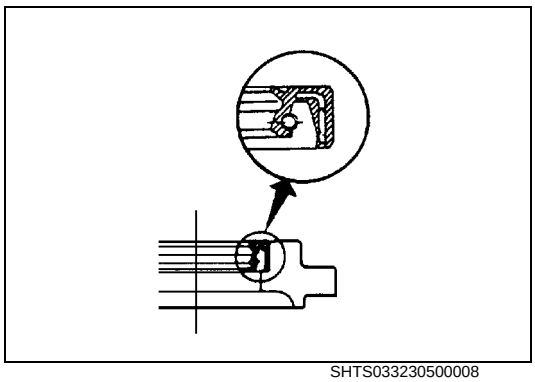


SHTS033230500007

1. INSTALL THE PISTON CUP ON THE SHIFT SHAFT.

NOTICE

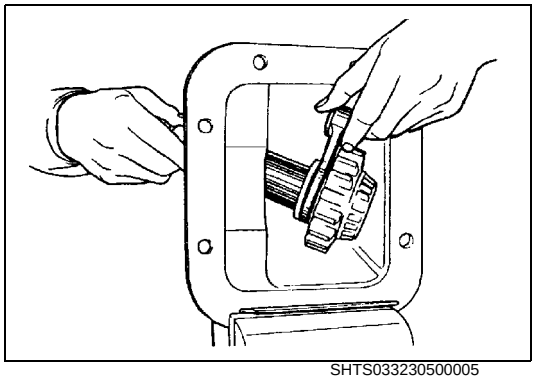
- **Coat the piston cup with grease.**
- **Be sure the piston cup is installed in the proper direction.**


SHTS033230500008

2. INSTALL THE OIL SEAL INTO THE SEAL COVER.

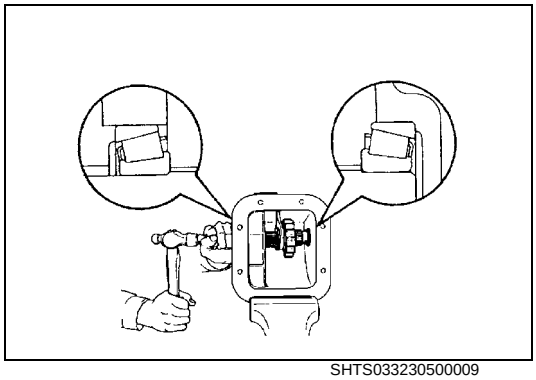
NOTICE

- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**
- **Coat the sealing surface between the seal lips with grease.**

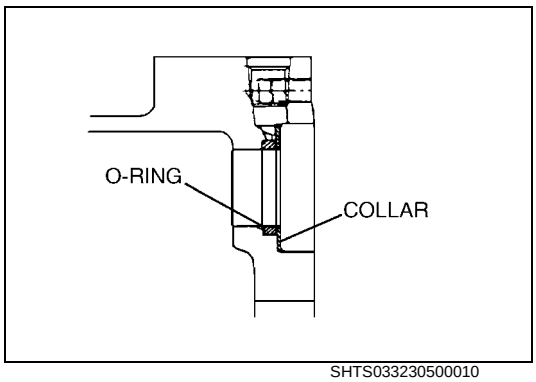

SHTS033230500005

3. INSTALL THE SHIFT FORK AND OUTPUT SHAFT TO THE POWER TAKE-OFF CASE.

(1) Install the output shaft through the output gear into the case.
(2) Set the shift fork in its original position.
(3) Set the taper roller bearing in its original position.


SHTS033230500009

(4) Drive the output shaft into the taper roller bearing inner race.
(5) Drive the taper roller bearing on the output shaft.
(6) Drive the outer race in the case.

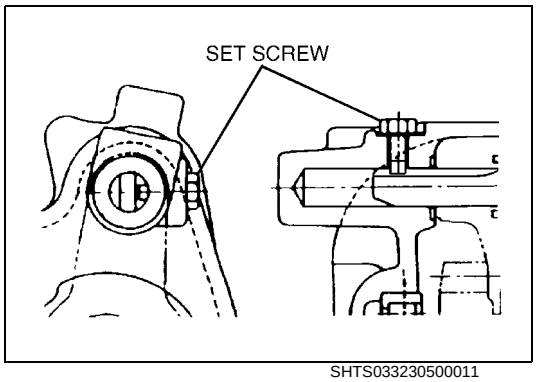


SHTS033230500010

4. INSTALL THE SHIFT SHAFT AND SHIFT FORK TO THE POWER TAKE-OFF CASE.
(1) Install the O-ring and collar on the case.

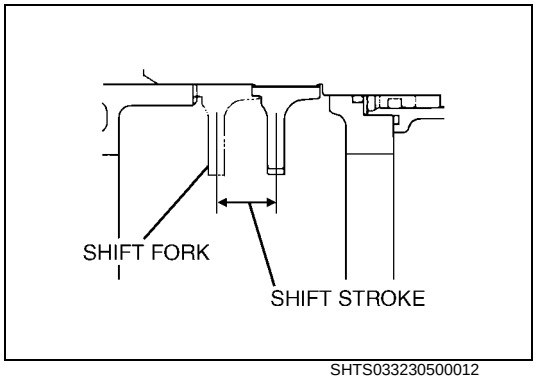
NOTICE
Coat the O-ring with grease.

(2) Screw the shift shaft into the thread of the shift fork.
(3) Check the rotating torque of shift shaft.
Assembly Standard: More than 4.9 N·m {50 kgf·cm, 3.61 lbf·ft}



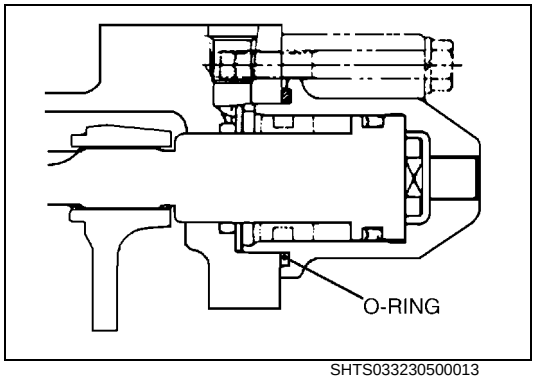
SHTS033230500011

(4) Rotate the shaft so that slot of the shift shaft is aligned with set screw hole.



SHTS033230500012

5. CHECK THE SHIFT FORK STROKE.
(1) Use a suitable measuring tool check the shift stroke.
Assembly Standard: 26.0-27.5 mm {1.024-1.082 in.}
(2) If it is not within specification, adjust the stroke by rotating the shift shaft.



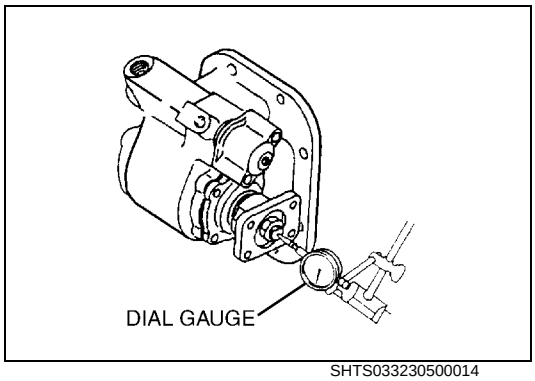
SHTS033230500013

6. INSTALL THE CASE COVER ON THE CASE.

(1) Install the O-ring on the case cover.

NOTICE

Coat the O-ring and inside of the case cover with grease.



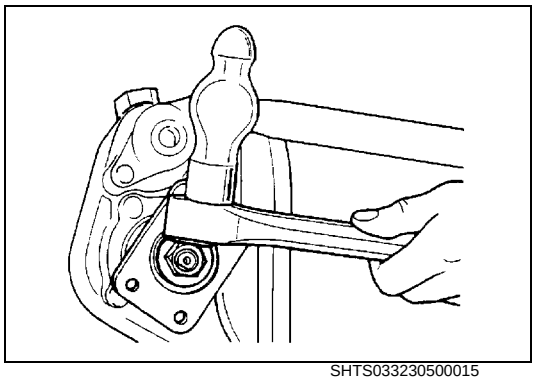
SHTS033230500014

7. CHECK THE OUTPUT SHAFT AXIAL PLAY.

(1) Use a dial gauge to check the output shaft axial play.
Assembly Standard: 0-0.05 mm {0-0.0019 in.}

(2) If it is not within specification, adjust the axial play with shims.

Shim Thickness: 0.05 mm {0.0020 in.}
0.10 mm {0.0039 in.}
0.20 mm {0.0079 in.}
0.50 mm {0.0197 in.}

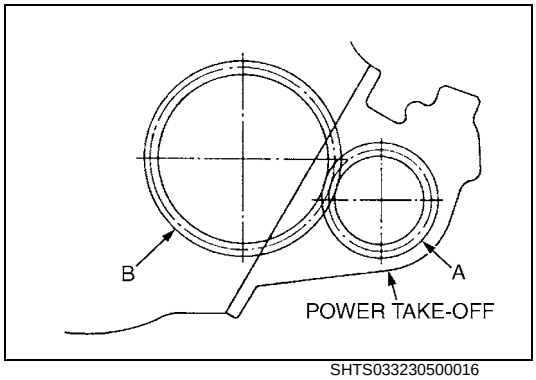

SHTS033230500015

8. INSTALL THE LOCK NUT ON THE OUTPUT SHAFT.

(1) Secure the lock nut by caulking the lock plate.

NOTICE

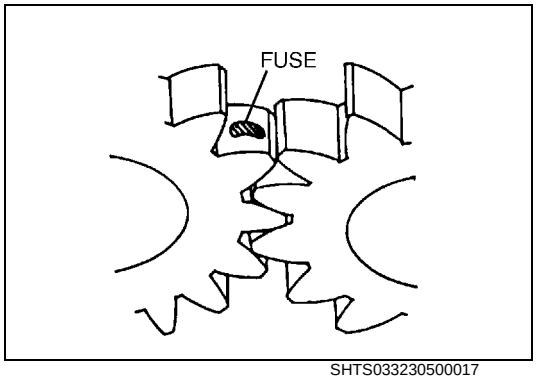
- **Stake the lock plate with the flat surface of the nut.**
- **For the lock plate contacting the protruding portion of the nut, caulk only the half on the tightening side.**



SHTS033230500016

IMPORTANT POINTS - MOUNTING

1. MEASURE THE BACKLASH BETWEEN THE GEAR "A" AND "B".



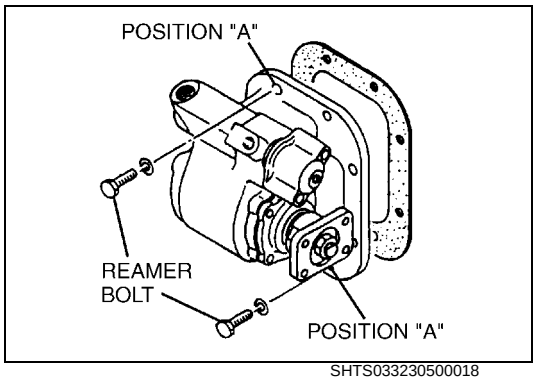
SHTS033230500017

(1) Put the fuse (ϕ1 x 10 mm {0.394 in.}) on the surface of gear "A" with grease.

(2) Rotate the gears and measure the thickness of fuse.

(3) The measurement should be carried out the three points on the gears.
Assembly Standard:
0.080-0.16 mm {0.0032-0.0062 in.}

NOTICE
Power take-off case gasket thickness: 0.5 mm {0.0197 in.}



SHTS033230500018

2. INSTALL THE POWER TAKE-OFF ON THE TRANSMISSION.

(1) Install the power take-off on the transmission with gasket.

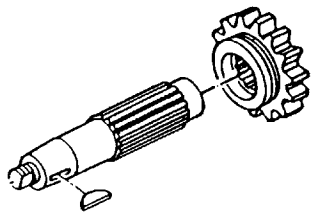
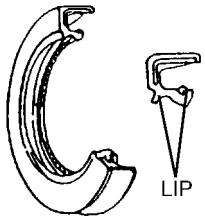
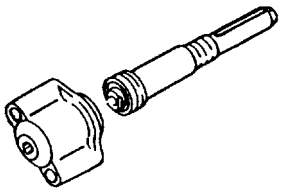
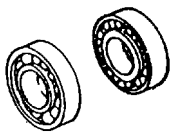
NOTICE
The trace of the liquid gasket should be continuous. The liquid gasket should be ThreeBond #HP-17 or equivalent.

(2) Install the reamer bolts to the position "A".

3. FILL THE TRANSMISSION WITH TRANSMISSION OIL.

INSPECTION AND REPAIR

EN0332305H300001

Inspection item	Standard	Limit	Remedy	Inspection procedure
Output shaft and output gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
O-ring and cup: Wear	**—**	**—**	**Replace, if necessary.**	**Visual check**
Oil seal lip: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift shaft and case cover bore: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing: Improper rotation	**—**	**—**	**Replace, if necessary.**	**Visual check** 

P.T.O. (POWER TAKE-OFF) (EATON)

TR05-004

POWER TAKE-OFF ASSEMBLY TR05-2
DATA AND SPECIFICATIONS..... TR05-2
DESCRIPTION TR05-2
TROUBLESHOOTING..... TR05-3

POWER TAKE-OFF UNIT (TYPE 1) TR05-4
COMPOMENT LOCATOR..... TR05-4
OVERHAUL TR05-4

POWER TAKE-OFF UNIT (TYPE 2) TR05-5
COMPOMENT LOCATOR..... TR05-5
OVERHAUL TR05-6

POWER TAKE-OFF ASSEMBLY

DATA AND SPECIFICATIONS

EN0332505I200001

POWER TAKE-OFF

Direction of rotation	Type 1	Counterclockwise viewed from output shaft flange
	Type 2	Clockwise viewed from output shaft flange
Size of output shaft flange	Type 1	35 x 60 mm {1.38 x 2.36 in.} (A x B: Refer to DESCRIPTION below)
	Type 2	Pitch circle diameter 79.3 mm {3.12 in.}

NOTICE
Type 1: Model for Taiwan
Type 2: Models for Australia, Chile, Indonesia, Ireland, New Zealand, Thailand and Vietnam

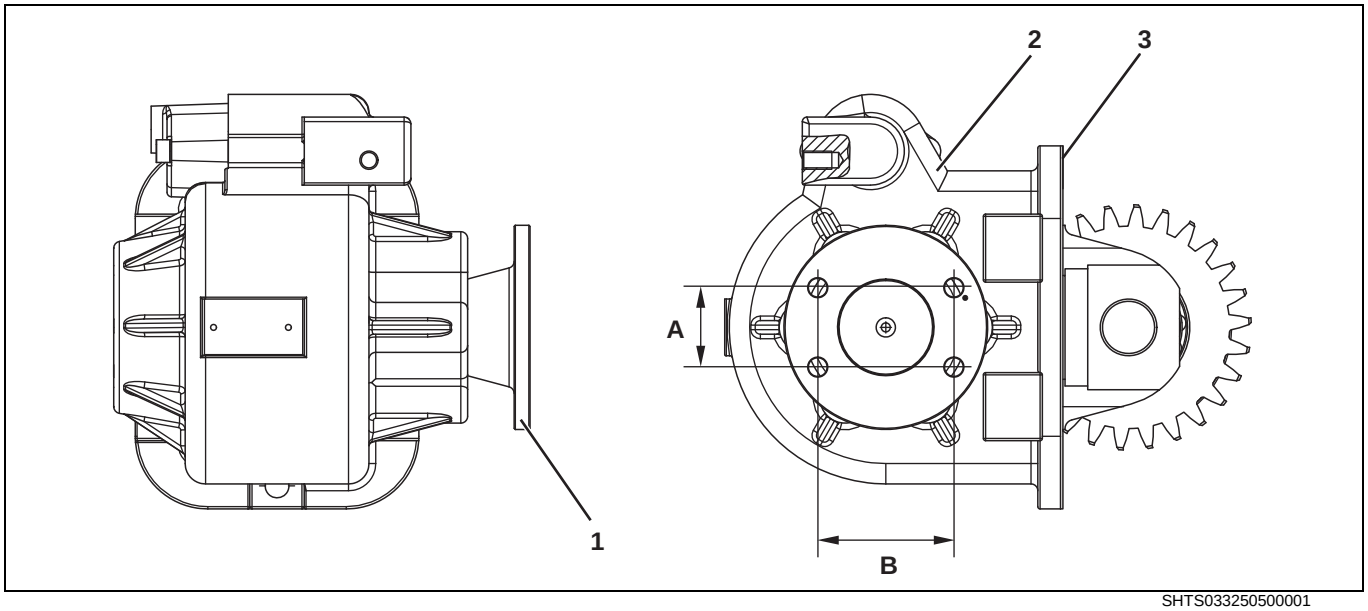
POWER TAKE-OFF CONTROL

Type	Electric-pneumatic control

DESCRIPTION

EN0332505C100001

TYPE 1

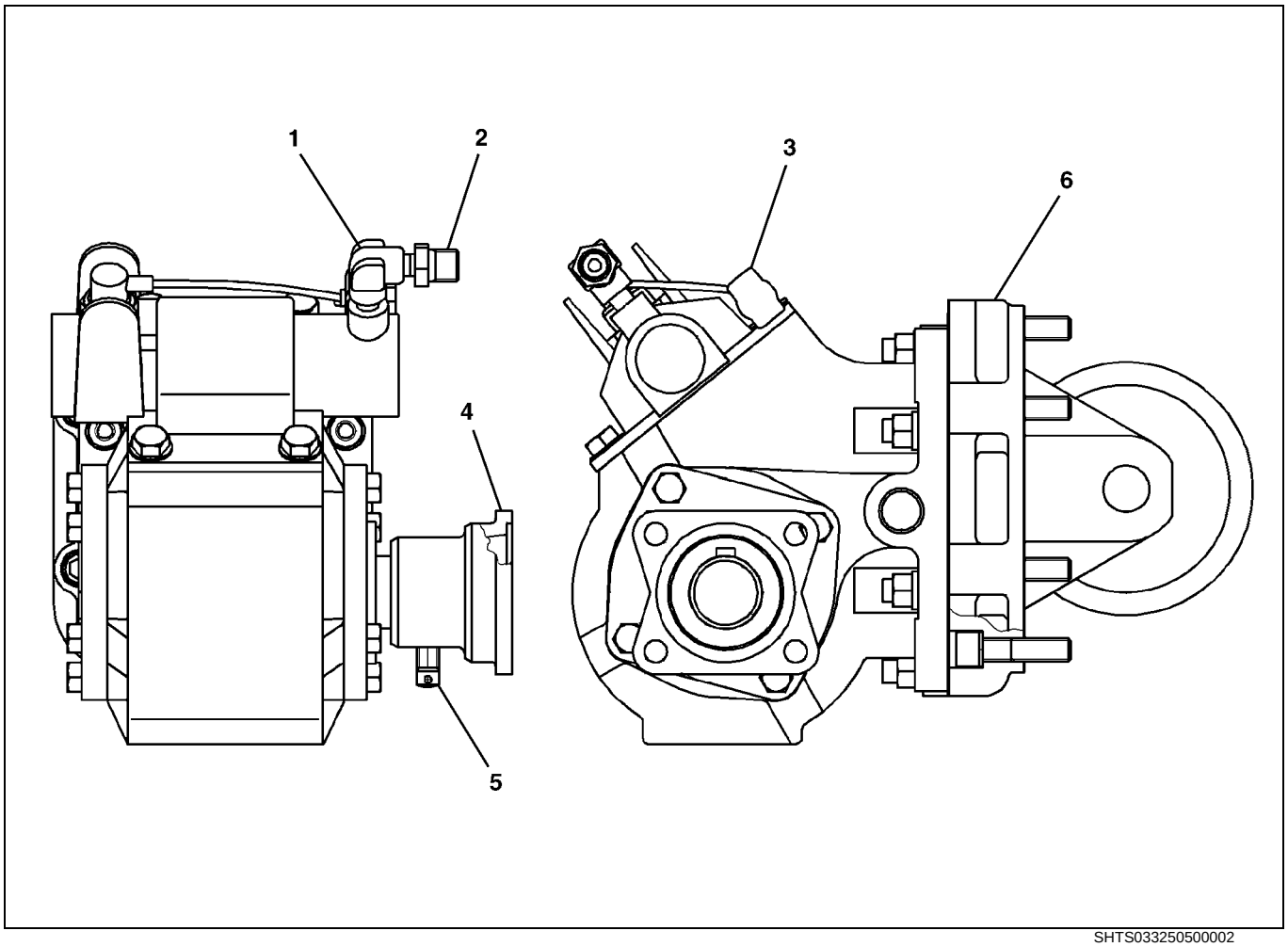


SHTS033250500001

POWER TAKE-OFF UNIT

1	Output shaft flange	3	Gasket
2	Power take-off unit		

TYPE 2



SHTS033250500002

POWER TAKE-OFF UNIT

1	**Harness**	**4**	**Output shaft flange**
2	**Elbow**	**5**	**Lock bolt**
3	**Connector**	**6**	**Adapter**

TROUBLESHOOTING

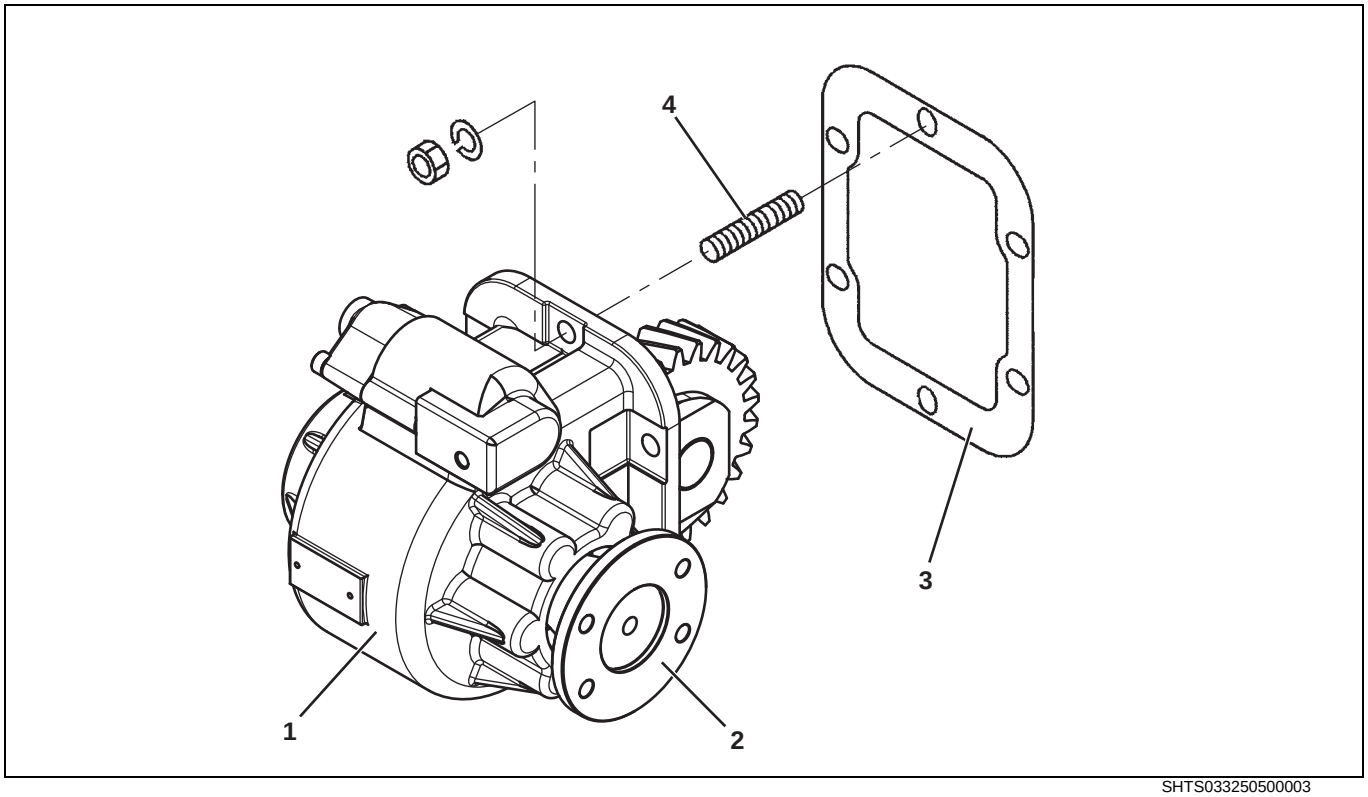
EN0332505F300001

Symptom	Possible cause	Remedy/Prevention
Noise	Bearing worn and/or damaged.	Replace bearing.
	Output gear worn and/or damaged.	Replace gear.
	To much play in gear backlash.	Use proper power take-off gasket.
	Shortage gear oil and/or low oil viscosity.	Add oil or change oil as required.

POWER TAKE-OFF UNIT (TYPE 1)

COMPOMENT LOCATOR

EN0332505D100001



SHTS033250500003

1	Power take-off unit	3	Gasket
2	Output shaft flange	4	Stud bolt

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	33-45 {337-458, 25-33}		

OVERHAUL

EN0332505H200001

IMPORTANT POINTS - DISMOUNTING

⚠ **CAUTION**
Do not work on the transmission while it is still hot.
This can result in personal injury.

1. DRAIN THE TRANSMISSION OIL.
EXHAUST ALL AIR FROM THE AIR TANKS.

2. REMOVE THE POWER TAKE-OFF AND GASKET.
(1) Remove the power take-off and gasket then clean the aperture pad using a putty knife or wire brush.

NOTICE
Stuff a rag in the aperture opening to prevent dirt from entering the transmission while you are cleaning it.

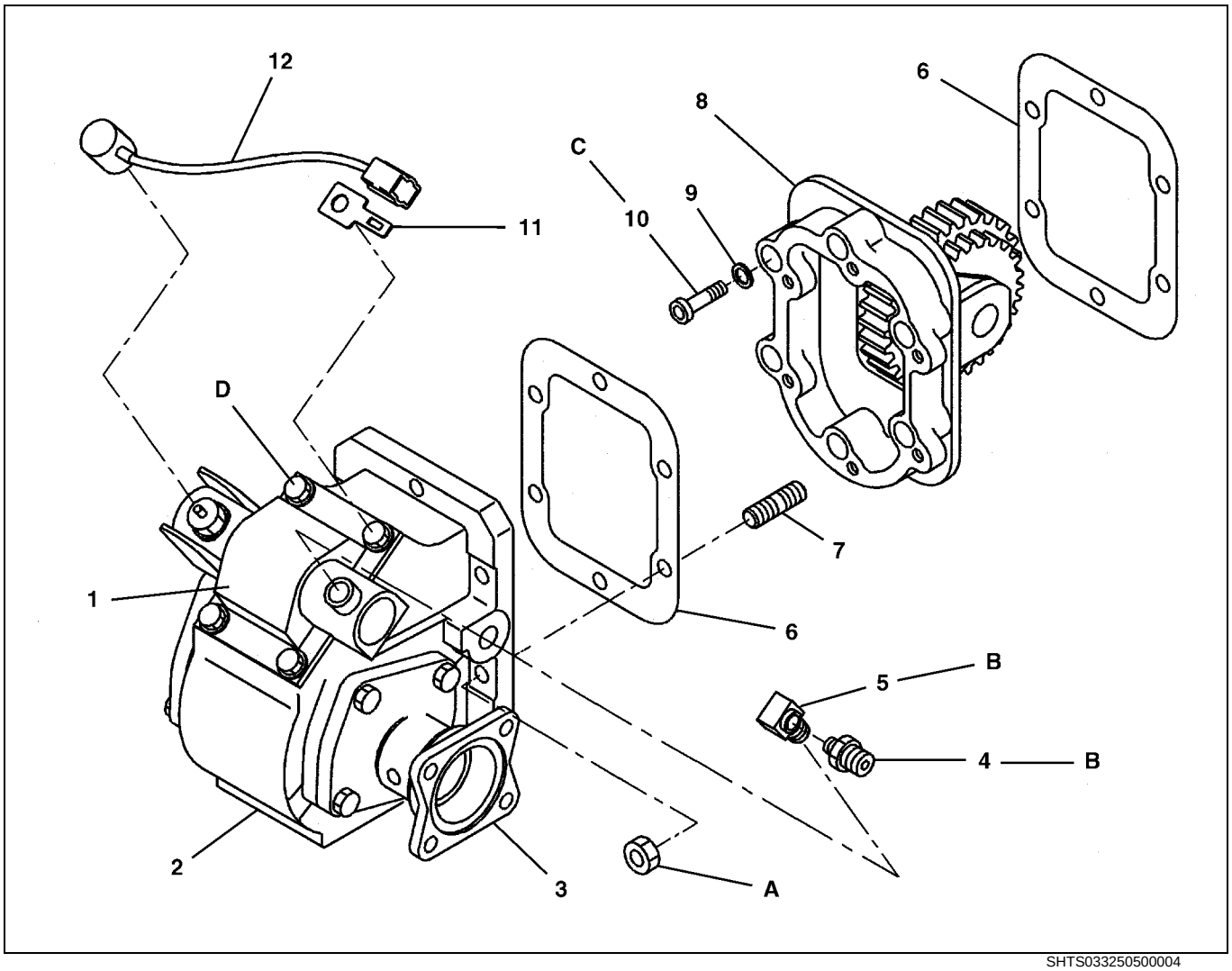
IMPORTANT POINT - MOUNTING

1. CHECK THE BACKLASH.
(1) Check the transmission gear and the gear backlash.

POWER TAKE-OFF UNIT (TYPE 2)

COMPOMENT LOCATOR

EN0332505D100002



SHTS033250500004

1	P.T.O. shift housing	7	Stud bolt
2	Power take-off unit	8	Adapter
3	Output shaft flange	9	Copper washer
4	Connector	10	Hexagon bolt
5	Elbow	11	Bracket
6	Gasket	12	Harness

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	48-54 {490-550, 36-39}	C	41-47 {419-479, 31-34}
B	10.8-16.2 {111-165, 9-11}	D	23-27 {235-275, 17-19}

OVERHAUL

EN0332505H200002

IMPORTANT POINTS - DISMOUNTING

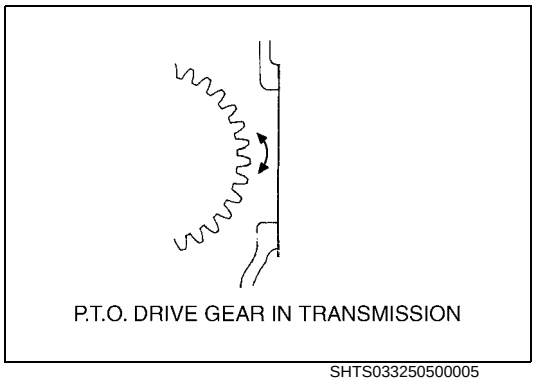
⚠ CAUTION
Do not work on the transmission while it is still hot.
This can result in personal injury.

1. DRAIN THE TRANSMISSION OIL.
EXHAUST ALL AIR FROM THE AIR TANKS.

2. REMOVE THE POWER TAKE-OFF AND GASKET.
(1) Remove the power take-off and gasket then clean the aperture pad using a putty knife or wire brush.

NOTICE
Stuff a rag in the aperture opening to prevent dirt from entering the transmission while you are cleaning it.

IMPORTANT POINTS - MOUNTING


P.T.O. DRIVE GEAR IN TRANSMISSION

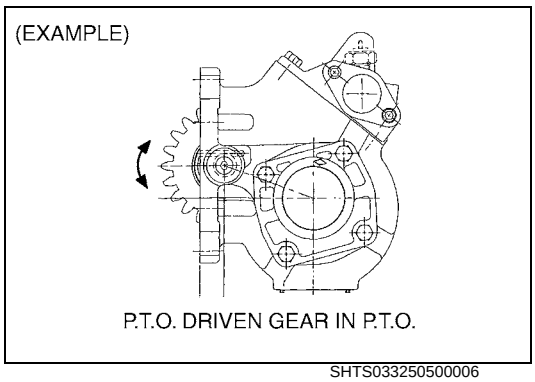
SHTS033250500005

1. CHECK THE BACKLASH.
(1) Using your hand, rock the P.T.O. drive gear in the transmission and the driven gear in the P.T.O. assembly.

NOTICE
Rocking the gears provides two important factors.

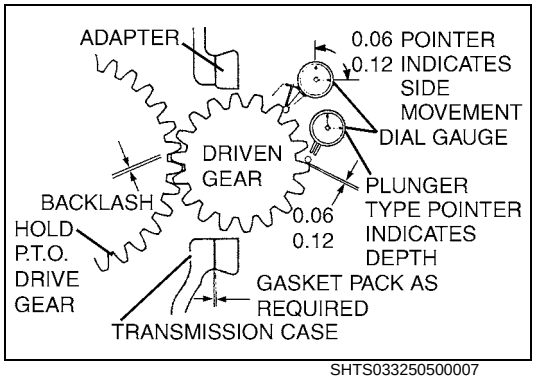
a. It shows you the amount of backlash that has been designed into each unit.

b. It is helpful in establishing the proper backlash when installing the P.T.O.



P.T.O. DRIVEN GEAR IN P.T.O.

SHTS033250500006



SHTS033250500007

2. CHECK THE BACKLASH BETWEEN THE P.T.O. DRIVE GEAR IN THE TRANSMISSION AND THE DRIVEN GEAR IN THE ADAPTER.

(1) Install the correct number of gaskets and adapter to the transmission.

NOTICE

- **Do not use sealant between gaskets because you may want to add or subtract gaskets to obtain proper backlash.**
- **Do not stack more than 3 gaskets together.**
- **Usually one thick gasket 0.50 mm {0.20 in.} will be required.**

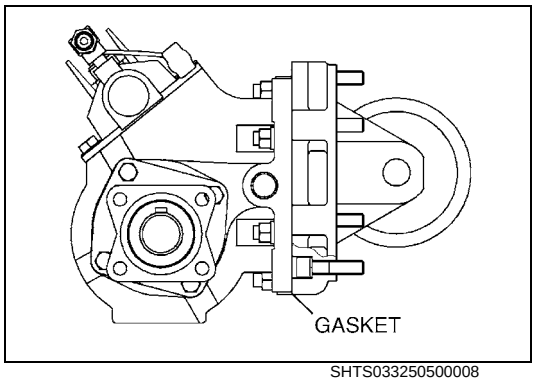
(2) Secure the adapter to the transmission.
(3) Mount the dial gauge so that it registers movement of the driven gear of the adapter.

NOTICE
See figure for proper location of dial indicator contact point. (Two common type dial gauges shown.)

(4) Hold the P.T.O. drive gear in transmission with a screw driver or bar and rock the driven gear in adapter back and forth with your hand.
(5) Note the total movement on the dial gauge. Then, adjust the backlash by adding or subtracting gaskets.
Assembly Standard: 0.15-0.30 mm {0.006-0.011 in.}

NOTICE
A 0.25 mm {0.010 in.} gasket will change backlash approx. 0.152 mm {0.006 in.}. A 0.51 mm {0.020 in.} gasket changes backlash approx. 0.305 mm {0.012 in.}.

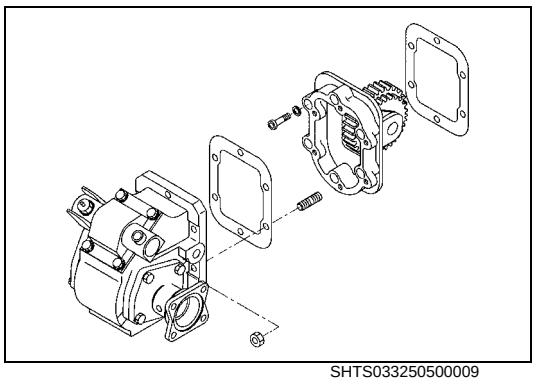
(6) After checking for proper backlash, remove the adapter and gaskets from the transmission. Keep the gaskets as a "package".



SHTS033250500008

3. CHECK THE BACKLASH BETWEEN DRIVEN GEAR IN THE ADAPTER AND INPUT GEAR IN THE P.T.O.

(1) Bench mount the adapter to the P.T.O. with gasket.
(2) Mount the dial gauge, then hold the input gear in P.T.O. with a screw driver or bar and rock the driven gear in adapter back and forth with your hand.
(3) Note the total movement on the dial gauge.
(4) Adjust the backlash by adding or subtracting gaskets.
Assembly Standard: 0.15-0.30 mm {0.006-0.011 in.}


SHTS033250500009

4. MOUNT THE ADAPTER AND THE P.T.O.

(1) Remount the adapter assembly, all gaskets and the P.T.O. to the transmission in their respective sequence.
(2) Secure all nuts and hexagon bolts to proper torque.
(3) Run the P.T.O. momentarily and check for noise.

NOTICE
The transmission and P.T.O. have no lubrication at this time so running time should be as short as possible.

a. If the P.T.O. whines it may be mounted too tight, too little backlash. This indicates that gaskets should be added.

b. If the P.T.O. clatters it may be mounted too loose, too much backlash. This indicates that gaskets should be removed.

TRANSMISSION/TRANSFER CONTROL TR06-001

TRANSMISSION CONTROL UNIT TR06-2
TROUBLESHOOTING TR06-2

TRANSMISSION CONTROL LINKAGE ... TR06-3
COMPONENT LOCATOR TR06-3
DISMOUNTING AND MOUNTING TR06-4
ADJUSTMENT TR06-5

POWER SHIFT
(TRANSMISSION SERIES:
LX06S, LJ06S) TR06-9
DESCRIPTION TR06-9
PROPOSAL TOOL TR06-10
COMPONENT LOCATOR TR06-11
OVERHAUL TR06-12
INSPECTION AND REPAIR TR06-21

POWER SHIFT
(TRANSMISSION SERIES:
MF06S, HK06S) TR06-22
DESCRIPTION TR06-22
SPECIAL TOOL TR06-23
COMPONENT LOCATOR TR06-24
OVERHAUL TR06-25
INSPECTION AND REPAIR TR06-31

TRANSFER SHIFT CONTROL
(TRANSFER SERIES: MA12C) TR06-32
DIAGRAM TR06-32
TROUBLESHOOTING TR06-33

TRANSMISSION CONTROL UNIT

TROUBLESHOOTING

EN03Z0306F300001

WITH POWER SHIFT

Symptom	Possible cause	Remedy/Prevention
Gears are difficult to engage or cannot be engaged when engine is not operating.	Control cable damaged, bent, deteriorated or deformed due to heat	Replace control cable.
	Loose parts	Inspect and tighten.
	Damaged shift lever assembly	Replace shift lever.
	Damaged power shift or faulty operation	Replace power shift.
	Damaged or bent parts on upper transmission cover section (lever, spring, etc.)	Replace.
	Faulty adjustment of control cable assembly and link rod	Adjust.
Shift operations are rough or heavy.	Faulty power shift operation [Air leakage (entering of foreign particles) in valves]	Replace power shift.
	Faulty power shift operation (air leakage in air pipes)	Inspect piping and correct problems.
	Mixing of contaminated water of foreign particles due to damaged boot of power shift (rusted ball joint, damaged O-ring, damaged packing, rusted or damaged rod)	Inspect parts and correct problems.
Excessive play in shift lever.	Worn bushing in joint or shift lever	Replace.
	Loose mounting bolts and nuts	Inspect and tighten.
Power shift slips out of gear on rough road.	Faulty adjustment of control cable assembly	Adjust.

WITHOUT POWER SHIFT

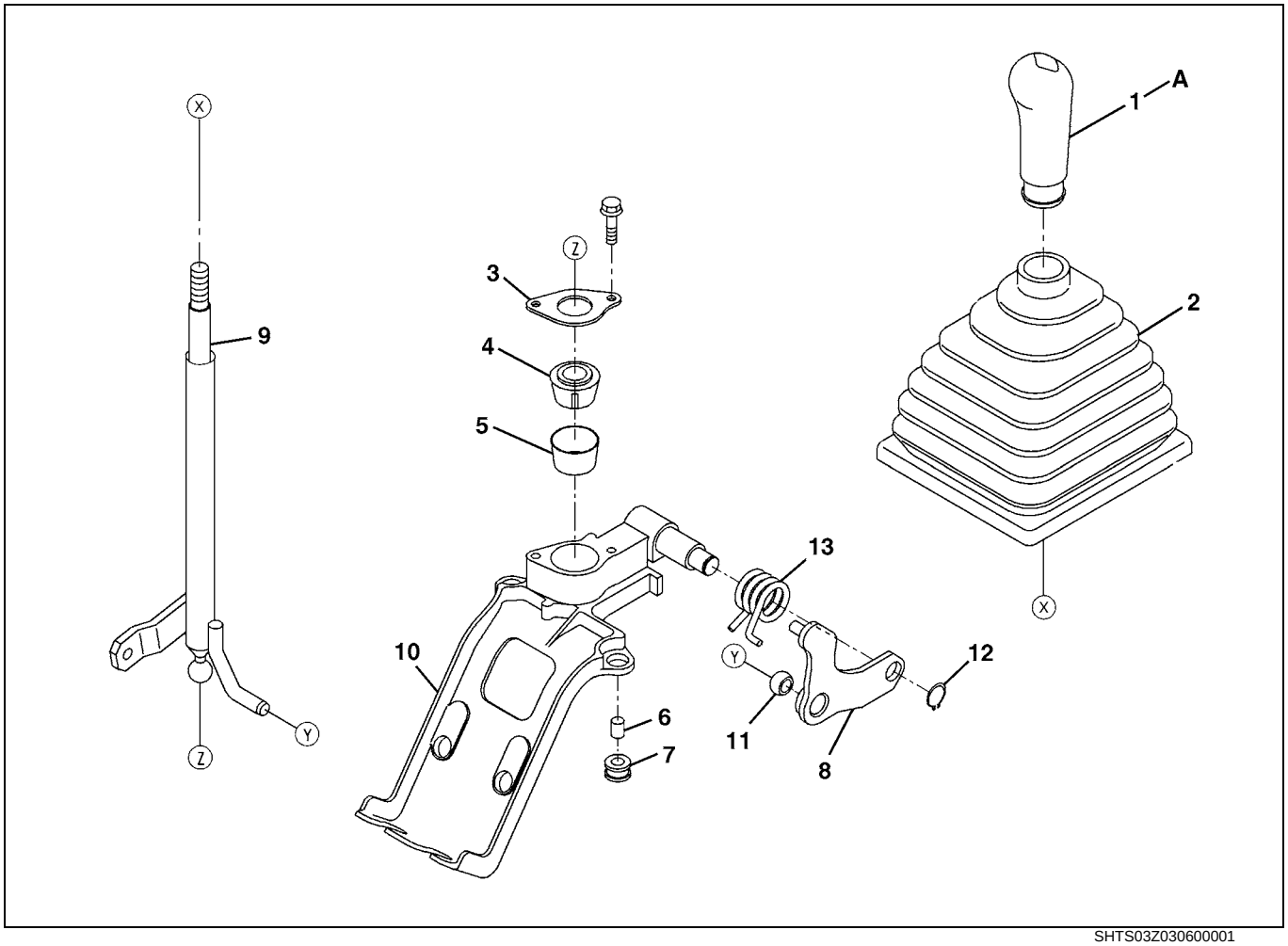
Symptom	Possible cause	Remedy/Prevention
Gears are difficult to engage or cannot be engaged when engine is not operating.	Control cable damaged, bent, deteriorated or deformed due to heat	Replace control cable.
	Loose parts	Inspect and tighten.
	Damaged shift lever assembly	Replace shift lever.
	Damaged or bent parts on upper transmission cover section (lever, spring, etc.)	Replace.
	Faulty adjustment of control cable assembly and link rod	Adjust.
Excessive play in shift lever.	Worn bushing in joint or shift lever	Replace.
	Loosen mounting bolts and nuts	Inspect and tighten.

TRANSMISSION CONTROL LINKAGE

COMPONENT LOCATOR

EN03Z0306D100001

CAB SIDE (REPRESENTATIVE TYPE)



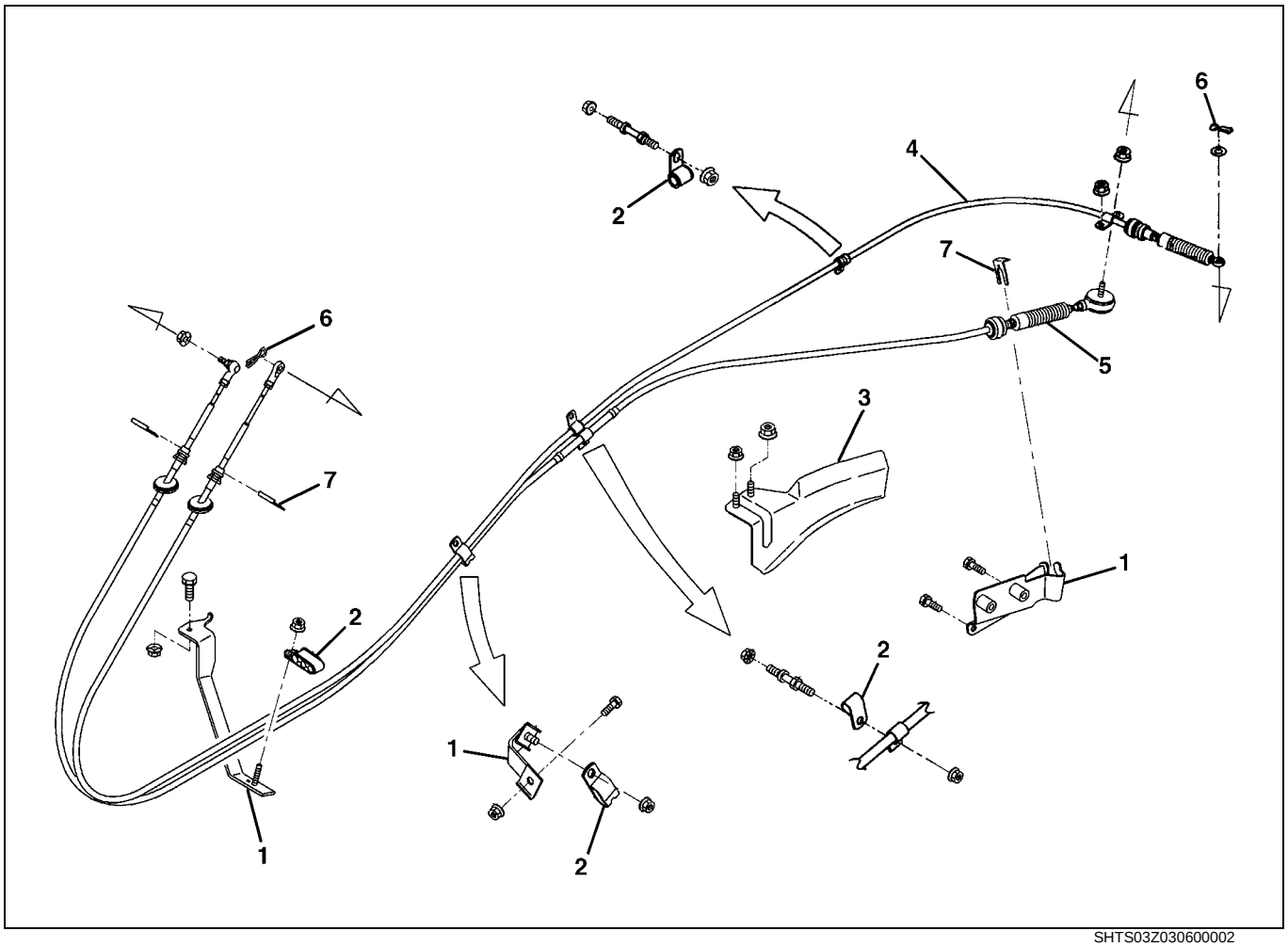
SHTS03Z030600001

1	Shift lever knob	8	Select lever
2	Shift lever boot	9	Shift lever
3	Plate	10	Control rod support
4	Ball joint	11	Ball
5	Rubber seat	12	E-ring
6	Distance piece	13	Spring
7	Rubber cushion		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	6.9-8.9 {70-90, 5.1-6.5}		

CHASSIS SIDE (REPRESENTATIVE TYPE)

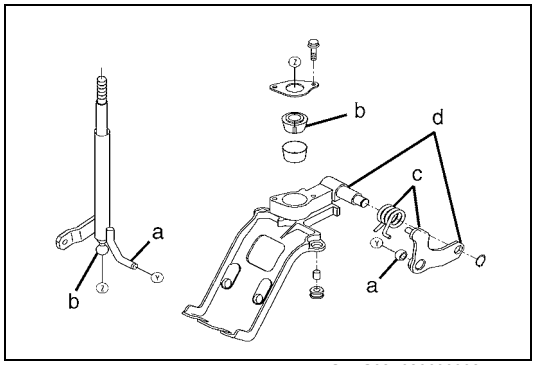


SHTS03Z030600002

1	**Cable retaining bracket**	**5**	**Control cable (Shift)**
2	**Clip**	**6**	**Pin**
3	**Gear control insulator**	**7**	**Clamp**
4	**Control cable (Select)**		

DISMOUNTING AND MOUNTING

EN03Z0306H100001



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IMPORTANT POINT - MOUNTING

1. COAT THE LITHIUM BASE GREASE OR CHASSIS GREASE.

(1) Coat lithium base grease to the following parts.

a. Shift lever and ball contact point

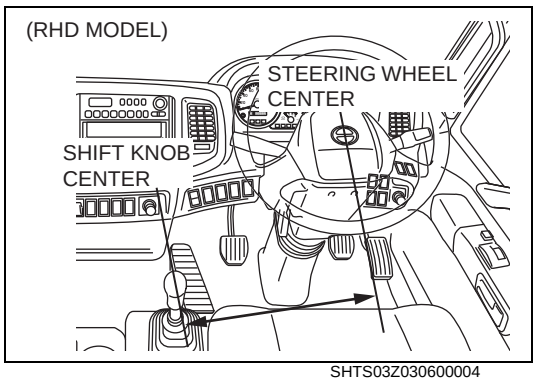
b. Shift lever and ball joint contact point

c. Select lever and spring contact point

d. Shift lever and select lever contact point

ADJUSTMENT

EN03Z0306H300001



SHTS03Z030600004

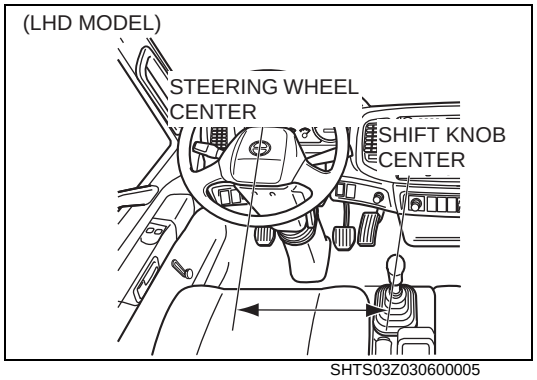
ADJUSTMENT PROCEDURE

1. ADJUST THE NEUTRAL POSITION OF THE GEAR SHIFT LEVER.

(1) Check that the distance between the knob center and the steering wheel center conforms to the following;

RHD MODEL

Transmission series	Assembly standard
LX06S (FC, FD) LJ06S (FD, GD)	310-340 mm {12.205-13.385 in.}
LX06S (FT, GT) LJ06S (FG), MF06S	350-380 mm {13.780-14.960 in.}
EATON FS6109, FS8209, FULLER RT8908LL, RTO11909ALL	375-405 mm {14.764-15.944 in.}
ZF9S109, ZF9S1110, ZF9S1310	340-370 mm {13.386-14.567 in.}



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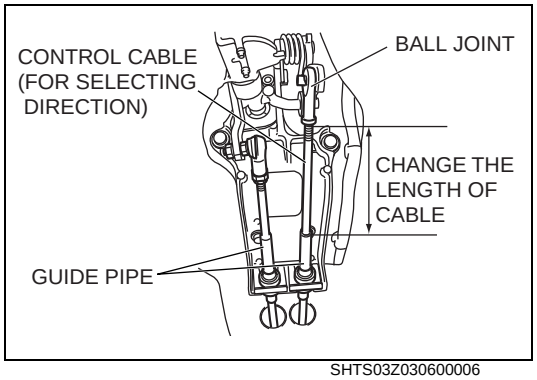
LHD MODEL

Transmission series	Assembly standard
LX06S, LJ06S	370-400 mm {14.567-15.748 in.}
MF06S	410-440 mm {16.142-17.323 in.}
HK06S, EATON FS6109, FS8209	385-415 mm {15.157-16.339 in.}



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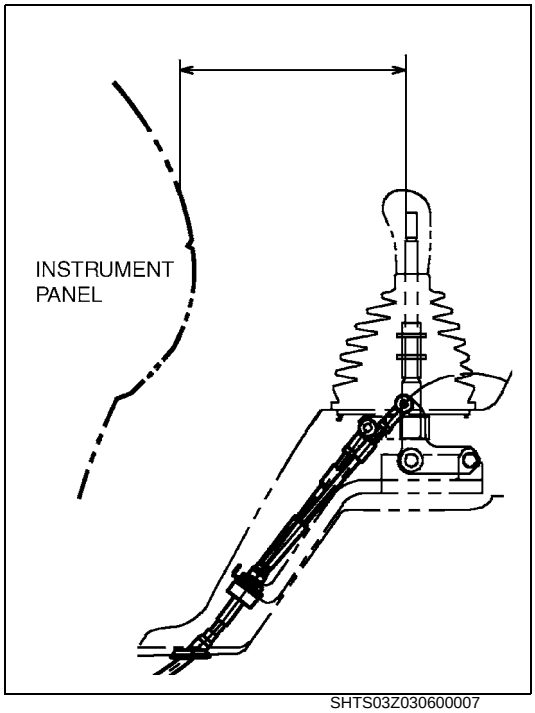
(2) If not, adjust the length of the select control cable.

Length of cable	Position of selecting direction
To lengthen it	Distance gets shorter. (Lever leans right side.)
To shorten it	Distance gets longer. (Lever leans left side.)

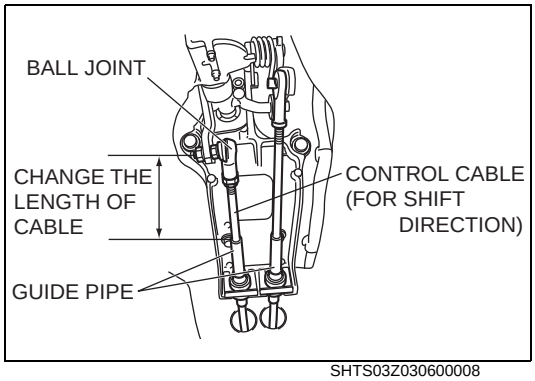
NOTICE

- **Do not adjust cables with holding guide pipe.**
- **When changing the length of cable, do not bend the cable.**



SHTS03Z030600007

(3) Check that the distance between the knob center and the instrument cluster conforms to the following;
Assembly standard: 235-265 mm {9.252-10.433 in.}



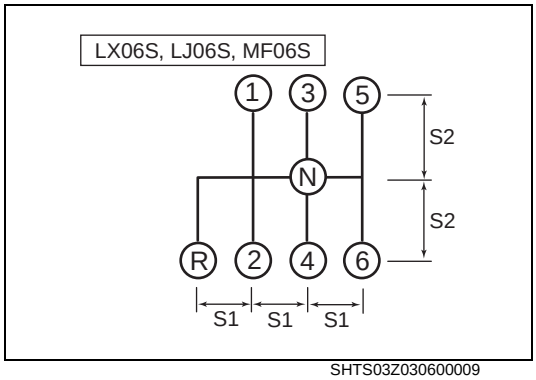
SHTS03Z030600008

(4) If not, adjust the length of the shift lever control cable.

Length of cable	Position of selecting direction
To lengthen it	Distance gets longer. (Lever leans backward.)
To shorten it	Distance gets shorter. (Lever leans frontward.)

NOTICE

- **Do not adjust cables with holding guide pipe.**
- **When changing the length of cable, do not bend the cable.**

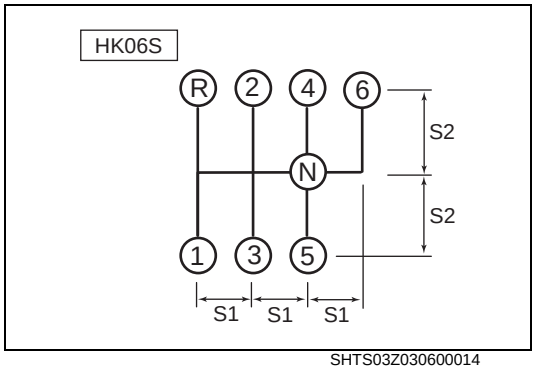


SHTS03Z030600009

2. CHECK THE SHIFT AND SELECT STROKE.

Select stroke: **Unit: mm {in.}**

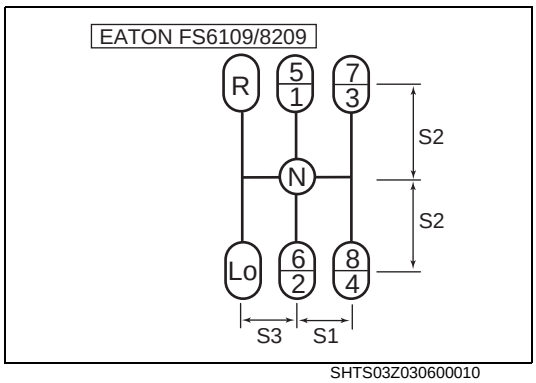
Transmission series	S1	S3
LX06S, LJ06S, MF06S	45-55 {1.772-2.165}	—
HK06S	40-50 {1.575-1.968}	—
EATON FS6109/8209	50-70 {1.968-2.755}	60-80 {2.362-3.149}
ZF9S109/9S1110/9S1310	30-50 {1.181-1.968}	—
FULLER RT8908LL/ RTO11909ALL	70-80 {2.756-3.150}	50-60 {1.968-2.362}



SHTS03Z030600014

Shift stroke: **Unit: mm {in.}**

Transmission series		S2
LX06S, LJ06S	Without power shift	100-120 {3.937-4.724}
	With power shift	90-110 {3.544-4.330}
MF06S	Without power shift	110-130 {4.330-5.118}
	With power shift	75-95 {2.952-3.740}
HK06S	With power shift	100-120 {3.937-4.724}
EATON FS6109/8209		110-130 {4.331-5.118}
ZF9S109/9S1110/9S1310		100-120 {3.937-4.724}
FULLER RT8908LL/RTO11909ALL		90-100 {3.554-3.937}



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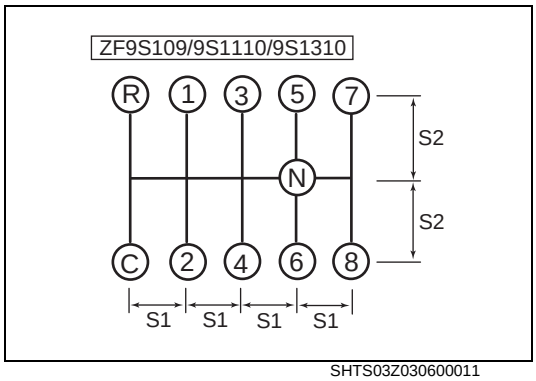

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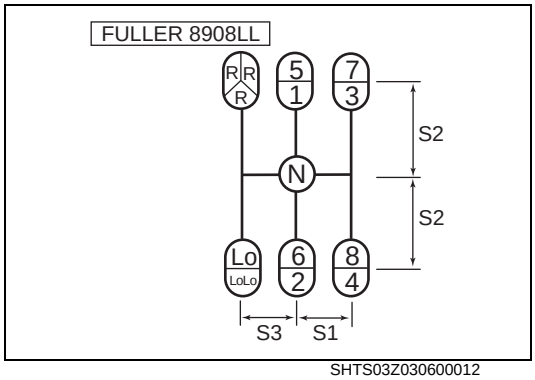
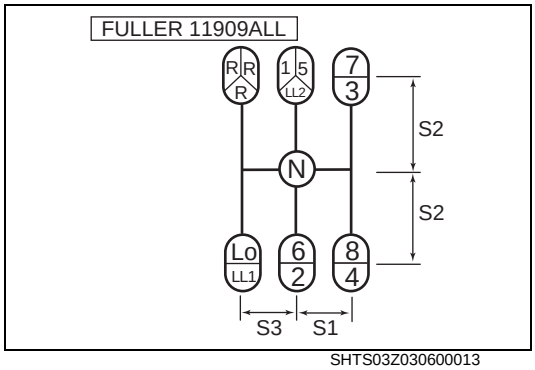


SHTS03Z030600012

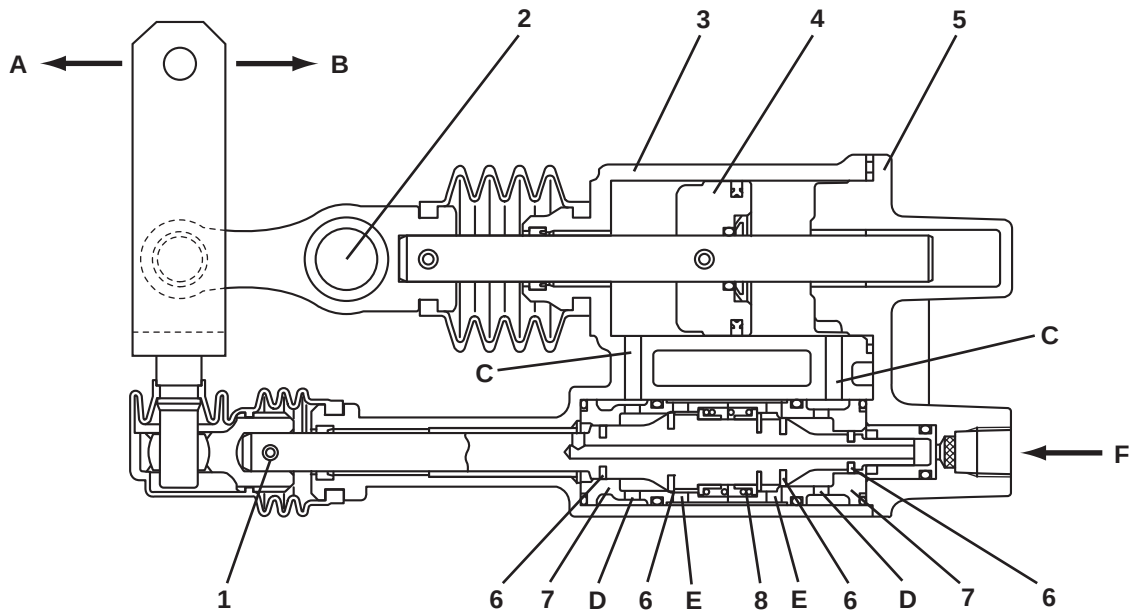


SHTS03Z030600013

POWER SHIFT (TRANSMISSION SERIES: LX06S, LJ06S)

DESCRIPTION

EN03Z0306C100001



SHTS03Z030600015

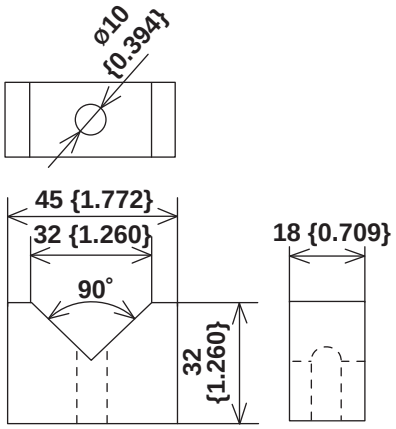
1	Valve joint	8	Return spring
2	Joint	A	Front
3	Booster cylinder	B	Rear
4	Piston	C	Air inlet and outlet
5	Cover	D	Air inlet
6	Valve seal	E	Air outlet
7	Valve seat	F	Compressed air

PROPOSAL TOOL

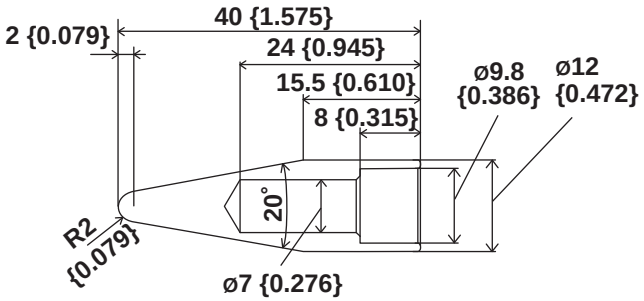
EN03Z0306K100001

Unit: mm {in.}

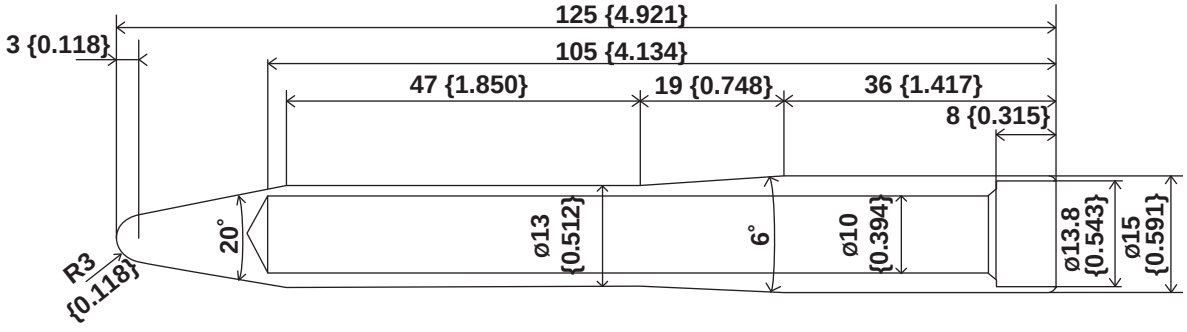
JIG "A"



JIG "B"



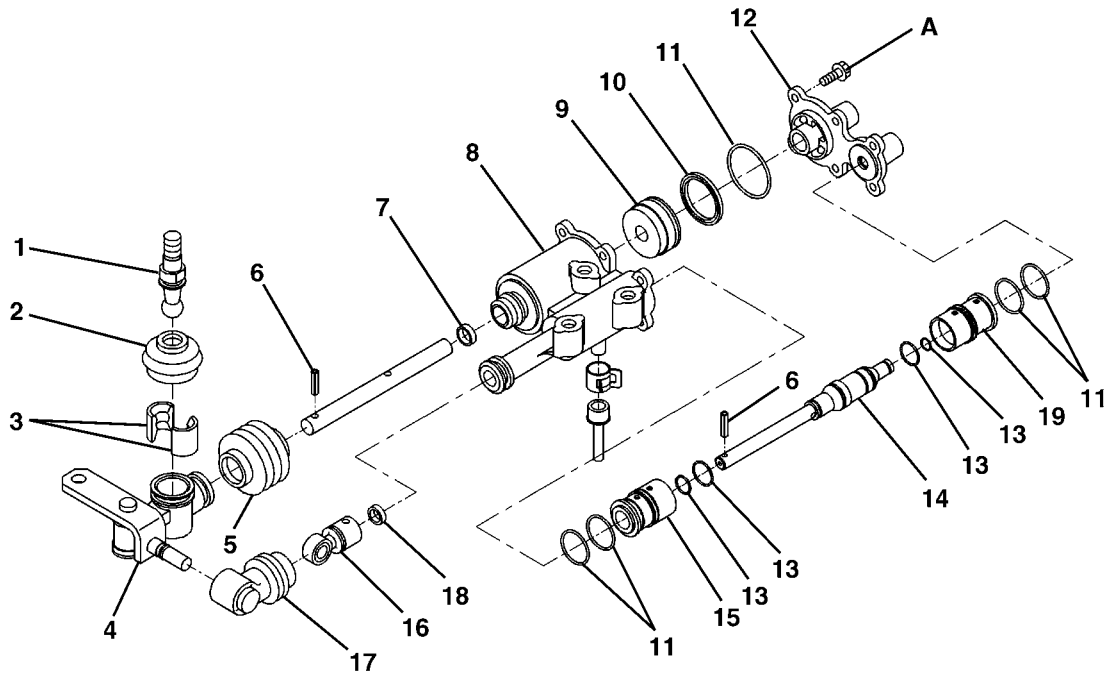
JIG "C"



SHTS03Z030600016

COMPONENT LOCATOR

EN03Z0306D100002



SHTS03Z030600017

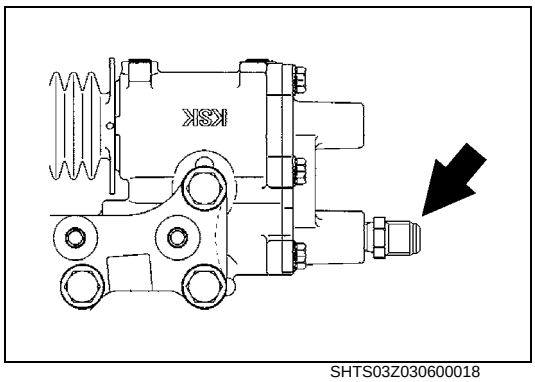
1	Ball joint stud	11	O-ring
2	Dust boot "C"	12	Cover
3	Ball joint	13	Valve seal
4	Joint	14	Power shift valve sub-assembly
5	Dust boot "A"	15	Valve seat "A"
6	Spring pin	16	Ball joint assembly
7	Rod seal "A"	17	Dust boot "B"
8	Booster cylinder	18	Rod seal "B"
9	Piston	19	Valve seat "B"
10	Piston seal		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	4.0-7.8 {40-80, 2.9-5.7}		

OVERHAUL

EN03Z0306H200001


SHTS03Z030600018

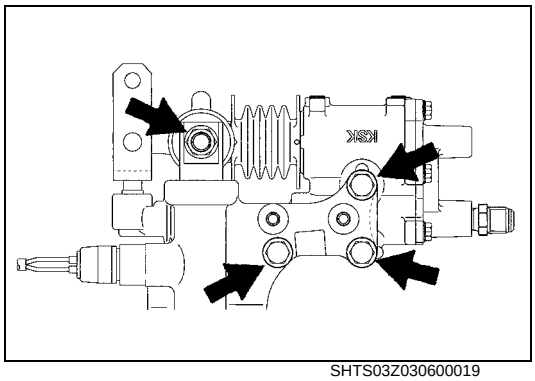
IMPORTANT POINT - DISMOUNTING

1. REMOVE THE AIR PIPE OF THE POWER SHIFT.

(1) Loosen the flare nuts of air pipe on the side of the power shift unit to remove the pipe.

NOTICE

Cover the removed air pipe and power shift unit to prevent foreign materials from entering.


SHTS03Z030600019

IMPORTANT POINT - MOUNTING

1. MOUNT THE POWER SHIFT.

(1) Mount the power shift to the transmission assembly.
Tightening Torque:
40.2-46.1 N·m {410-470 kgf·cm, 30-33 lbf·ft}

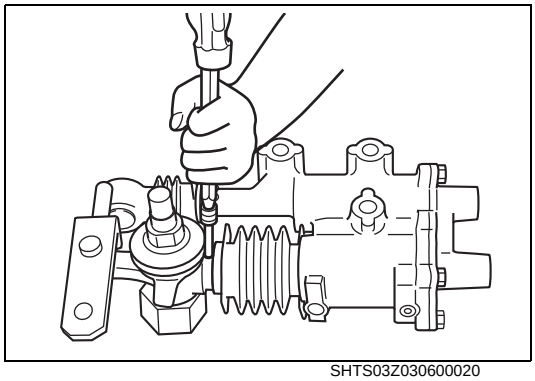
(2) Install the shift lever shaft to the power shift.
Tightening Torque:
75.5-91.2 N·m {770-929 kgf·cm, 56-67 lbf·ft}

IMPORTANT POINTS - DISASSEMBLY

1. CAUTIONS DURING DISASSEMBLY

(1) In order to maintain airtightness, handle all parts with care and do not forcefully remove any parts.

(2) Disassembly and assembly should be done in a clean position. Especially, remove dirt and dust attached to exterior parts before disassembling them and do operation with bare hands when assembling them, being careful not to allow foreign materials to enter.


SHTS03Z030600020

2. DISASSEMBLE THE POWER SHIFT.

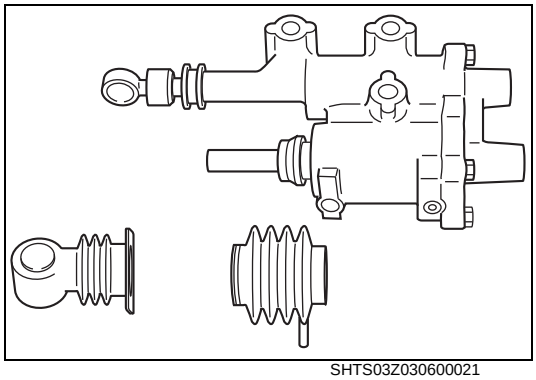
(1) Remove the clips and exhaust hoses.

(2) Remove the boot C by inserting a spacer 13-15 mm {0.512-0.590 in.} wide under the ball joint assembly and drive out the spring pin with a 5.0 mm {0.197 in.} diameter tapping rod.

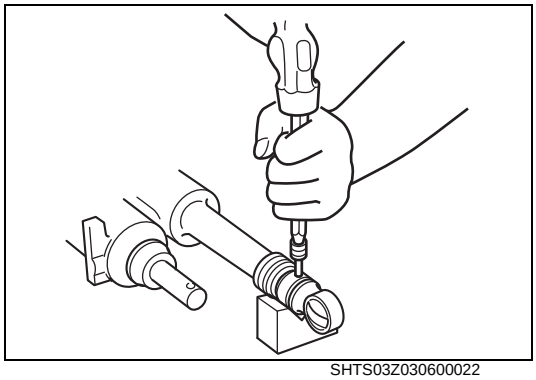
(3) Remove the joint assembly.

HINT

If the fitting part of the rod and joint assembly cannot be removed, tap the joint assembly body lightly to remove it. At this time, be careful not to damage the rod part in the booster cylinder.


SHTS03Z030600021

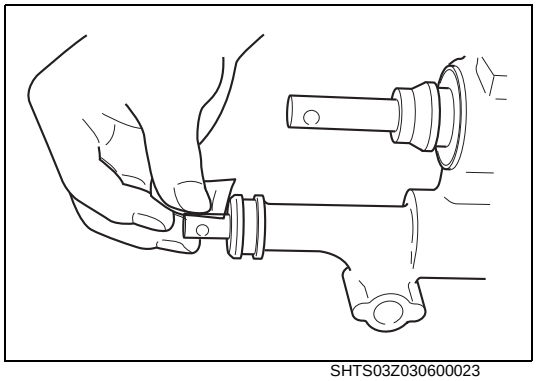
(4) Remove the boot "A" and "B".


SHTS03Z030600022

(5) Put the ball joint assembly on the jig "A" and drive out the spring pin with a tapping rod to remove the ball joint assembly.

HINT

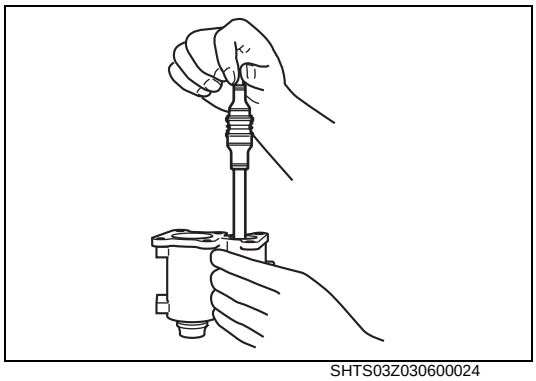
If the fitting part of the rod and ball joint assembly cannot be removed, tap the ball joint assembly body lightly to remove it. At this time, be careful not to damage the rod part in the booster cylinder.


SHTS03Z030600023

(6) When removing the power shift valve sub-assembly and piston from booster cylinder, rod seals can be damaged by holes for spring pin at the end. So wipe off grease on the end of the shaft and make sure that there is no flaws, burrs and gouge on the seals.

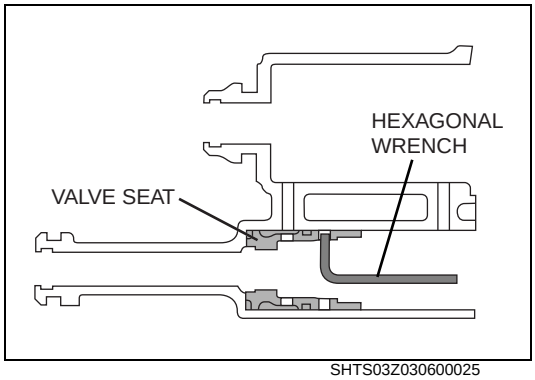
NOTICE

Remove flaws completely with a emery paper (No.1000) if there is any flaw, burr and gouge.


SHTS03Z030600024

3. PULL OUT THE POWER SHIFT VALVE AND PISTON.

(1) Remove the power shift valve sub-assembly from the booster cylinder slowly.

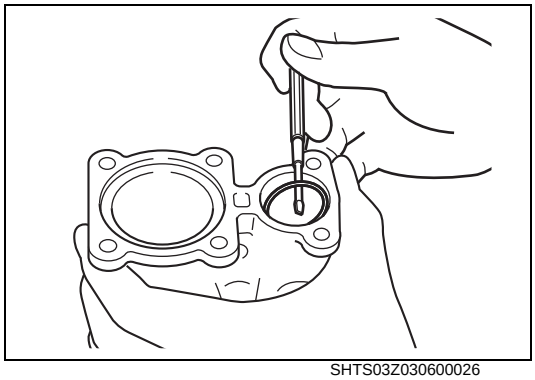


SHTS03Z030600025

(2) Pull out the valve seat "A" by inserting a hexagonal wrench 4 mm {0.157 in.} width across flats into the hole of the valve seat "A".

NOTICE

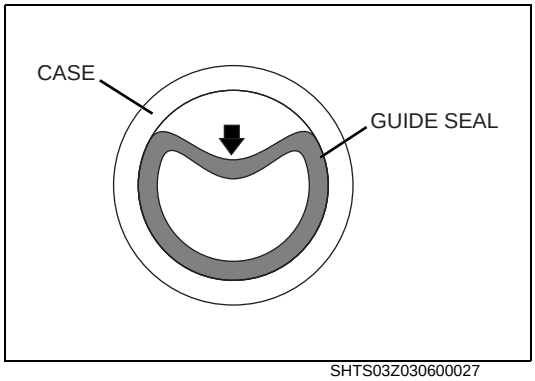
Be careful not to damage the inner surface of the cylinder.


SHTS03Z030600026

(3) Remove the O-ring on the inner part of the cylinder using a flat blade precision screwdriver etc.

NOTICE

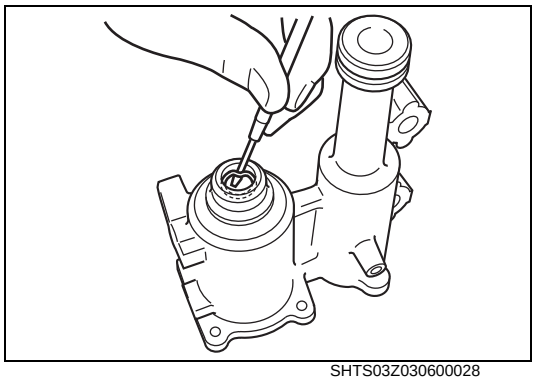
Be careful not to damage the inner surface of the cylinder.



SHTS03Z030600027

4. REMOVE THE ROD SEALS.

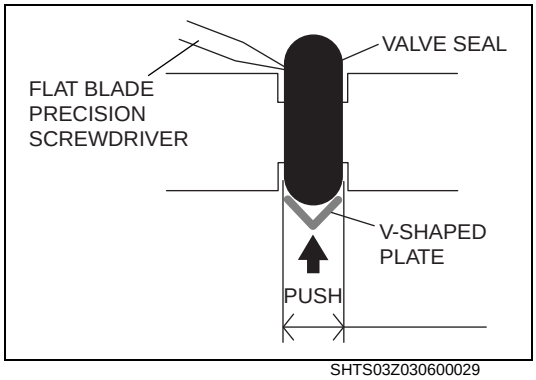
(1) Push aside the upper part of the rod seals inside slowly using a flat blade precision screwdriver etc.


SHTS03Z030600028

(2) Pull up the rod seals slowly by inserting another flat blade precision screwdriver between the cylinder and the rod seals with the rod seals pushed aside inside, and remove the rod seals.

NOTICE

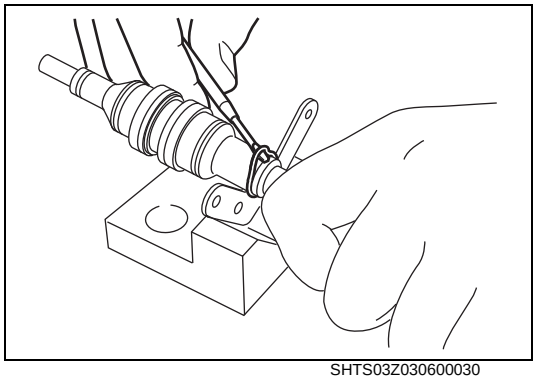
Be careful not to damage the inner groove of the cylinder by the point of the precision screwdriver etc.



SHTS03Z030600029

5. REMOVE THE VALVE SEAL.

(1) Attach the V-shaped plate 1.2-1.5 mm {0.0473-0.0590 in.} wide under the valve seal and push up the valve seal to rise it up.


SHTS03Z030600030

(2) Remove the valve seal by inserting a flat blade precision screwdriver between the power shift valve sub-assembly and valve seal.

NOTICE

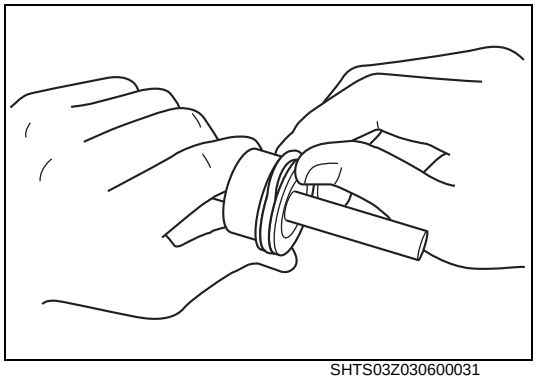
Be careful not to damage the valve shaft and valve seal.

IMPORTANT POINTS - ASSEMBLY

1. CAUTIONS DURING ASSEMBLY

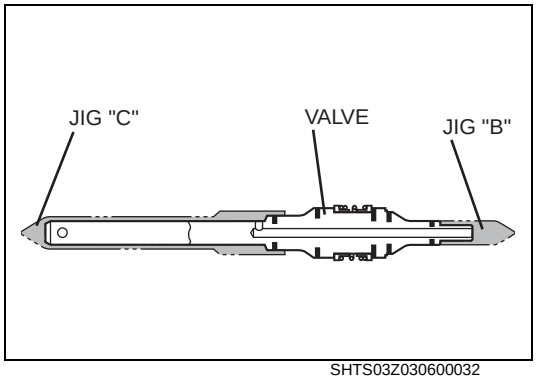
(1) In order to maintain airtightness, handle all parts with care and do not forcefully assemble any parts.

(2) Assemble parts carefully so that dirt and foreign materials do not enter the assembled parts.


SHTS03Z030600031

2. ASSEMBLE THE PISTON SEAL AND VALVE SEAL.

(1) Apply silicone grease to the piston seal and install it to the piston.



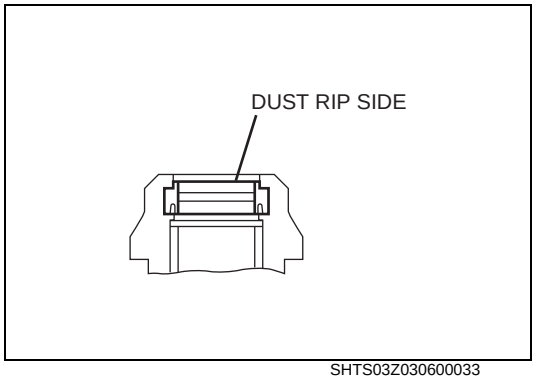
SHTS03Z030600032

(2) Apply silicone grease to the valve seal "A" and "B" and install them to the valve sub-assembly using a jig "B" and a Jig "C".

NOTICE

Be careful not to distort the valve seals.

(3) Apply silicone grease to the valve seal "C" and "D" and install it to the valve sub-assembly.



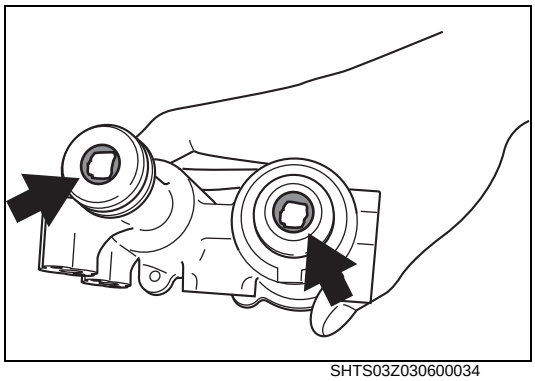
SHTS03Z030600033

3. ASSEMBLE THE ROD SEAL.

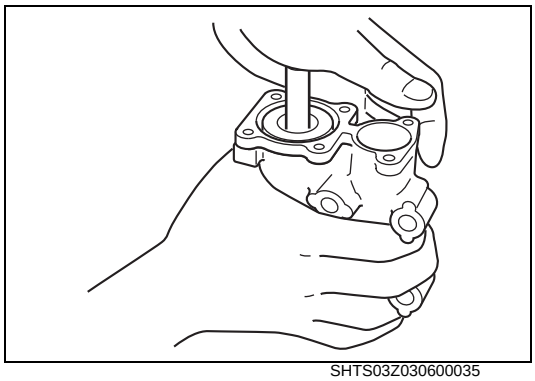
(1) Push the rod seals in the booster cylinder, bending them to fit them in easily with fingers.
Install the rod seals into the groove of the booster cylinder surely using a flat blade precision screwdriver.

NOTICE

- **Be careful of installing direction of the rod seals.**
- **Be careful not to damage the lip part of the booster cylinder and rod seals.**


SHTS03Z030600034

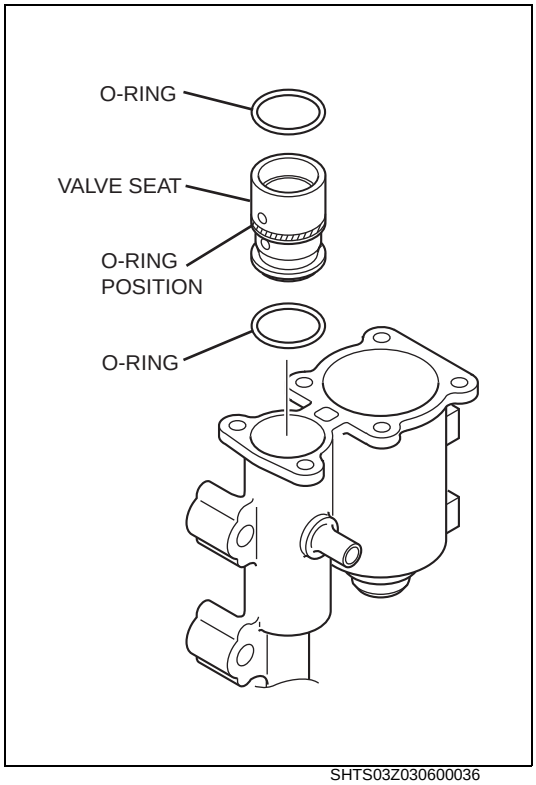
(2) Apply silicone grease to the inner surface of the rod seals.


SHTS03Z030600035

4. ASSEMBLE THE PISTON AND POWER SHIFT VALVE SUB-ASSEMBLY.

(1) Apply silicone grease to the inner surfaces of the valve cylinder part and piston cylinder part in the booster cylinder.

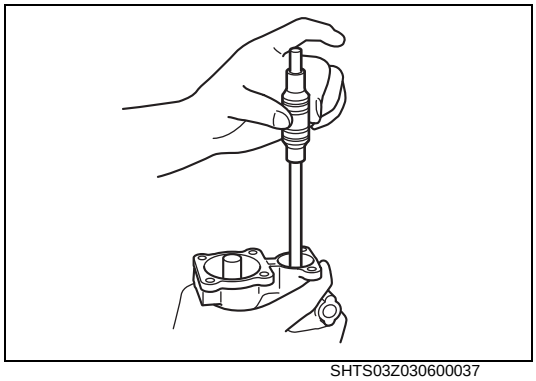
(2) Apply silicone grease to the outer periphery of the piston seal and insert the piston assembly into the booster cylinder slowly.



SHTS03Z030600036

(3) Insert the O-ring into the inner part of the booster cylinder.
(4) Fit the O-ring to the outer periphery of the valve seat "A".
(5) Apply silicone grease to the inner surface of the valve seat "A" and insert it into the inner part of the booster cylinder slowly.

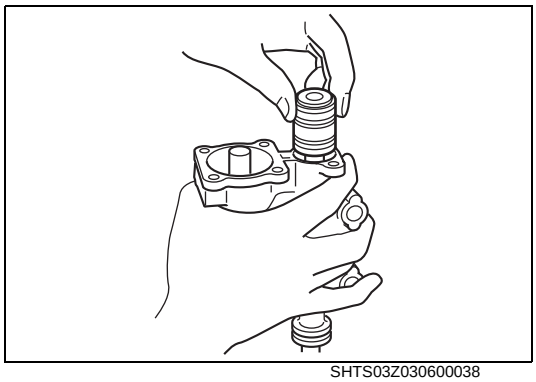
NOTICE
Be careful of inserting direction of the valve seat.



SHTS03Z030600037

(6) After applying silicone grease to the outer periphery of the valve seal, insert the valve sub-assembly into the booster cylinder slowly.

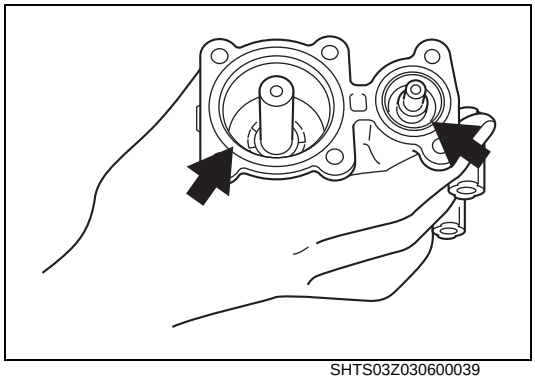
(7) Fit the O-ring to the valve seat "B".



SHTS03Z030600038

(8) Apply silicone grease to the inner surface of the valve seat "B" and insert it into the booster cylinder slowly.

NOTICE
Be careful of inserting direction of the valve seat.



SHTS03Z030600039

5. INSTALL THE COVER.

(1) Install the O-ring to the booster cylinder.

(2) Apply silicone grease to the inner surface of the bearing in the cover and install the cover to the booster cylinder.

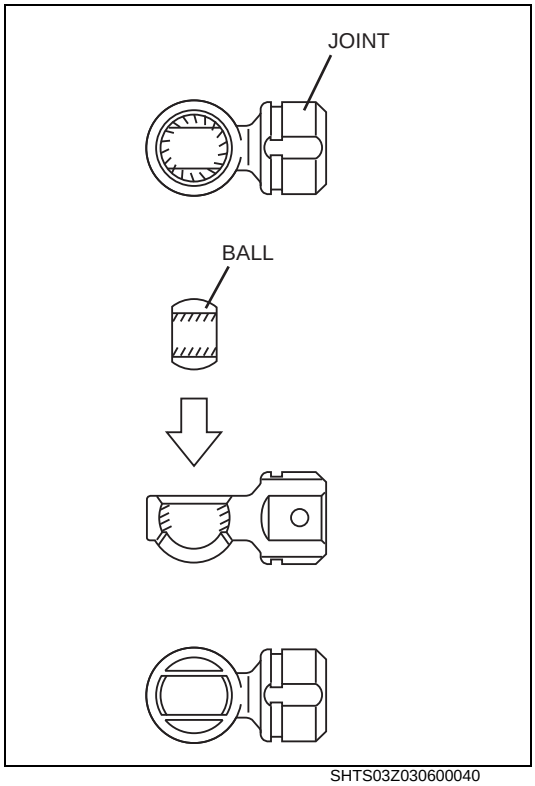
NOTICE

Tighten the bolts in twice to prevent the cover from distorting due to warp of the cover.

6. CHECK THE OPERATION.

(1) By moving the top of piston 3 or 4 times, make sure that it moves smoothly and sliding resistance is 9.8 N {1 kgf, 2.2 lbf} or less.

(2) Move the valve sub-assembly to make sure that its motion is smooth without binding.

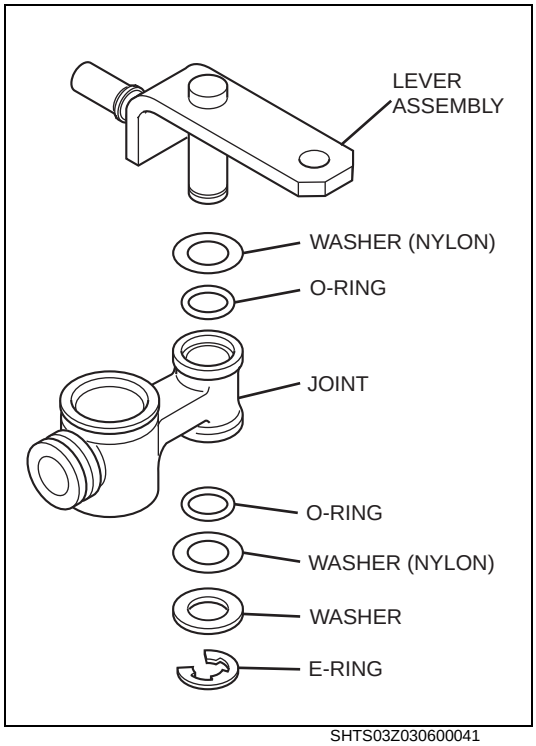


SHTS03Z030600040

7. ASSEMBLE THE BALL JOINT ASSEMBLY.

(1) Apply silicone grease to the whole of the ball and the inner surface of the ball joint case.

(2) Install the ball with it stood into the joint.



SHTS03Z030600041

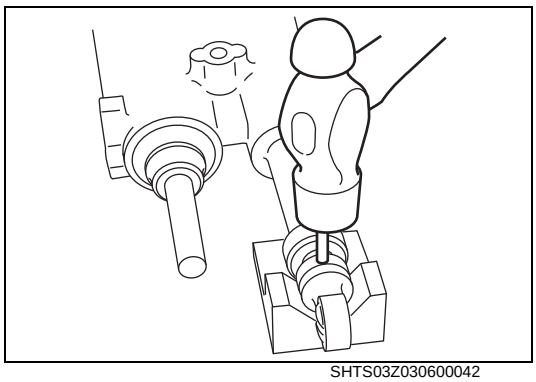
8. ASSEMBLE THE JOINT ASSEMBLY.

(1) Apply silicone grease to the O-ring and the inner surface of the joint.

(2) Install each component part to the lever assembly and install the E-ring.

NOTICE

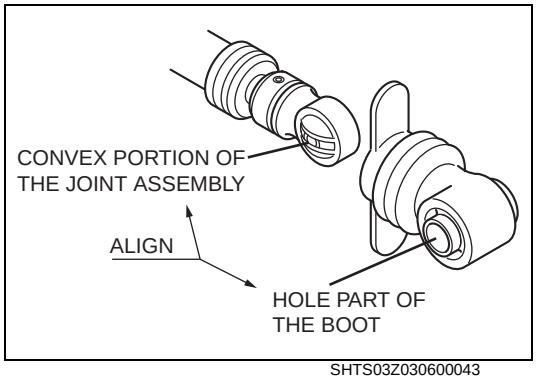
Be careful of installing position of the joint.


SHTS03Z030600042

9. ASSEMBLE THE BALL JOINT ASSEMBLY.

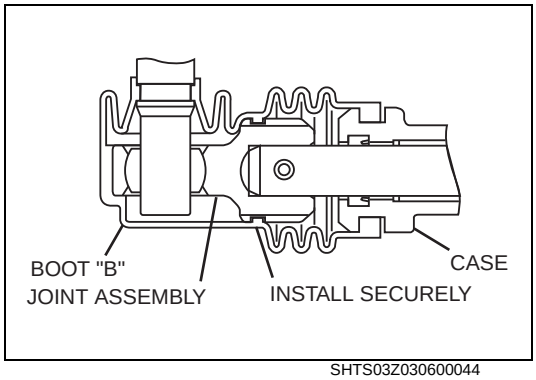
(1) Put the ball joint assembly on a jig "A" and align the hole of the valve assembly with the ball joint assembly to drive a new spring pin into them.

(2) Cover the ball joint assembly with the dust boot "B" and install the dust boot "B" into the groove of the booster cylinder.

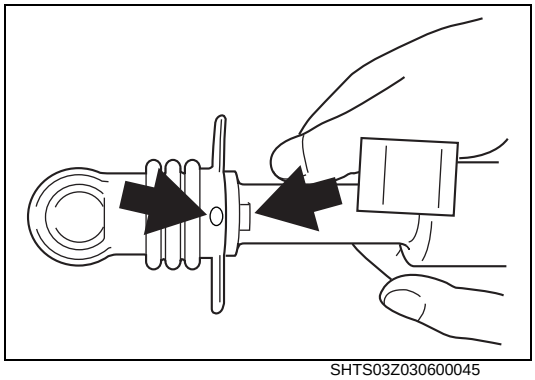


SHTS03Z030600043

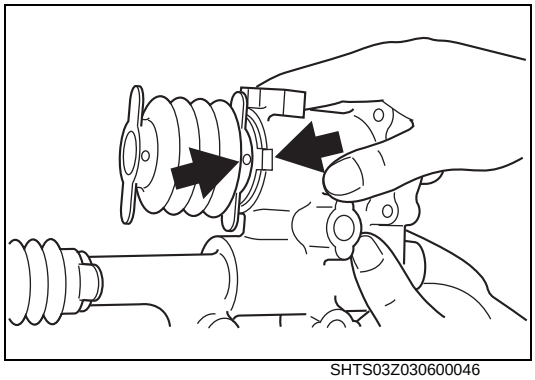
(3) Cover the convex portion of the ball joint assembly with the dust boot "B", aligning the convex portion with the hole part of the dust boot "B".
Install the inner convex portion of the dust boot "B" into the groove of the ball joint assembly securely.



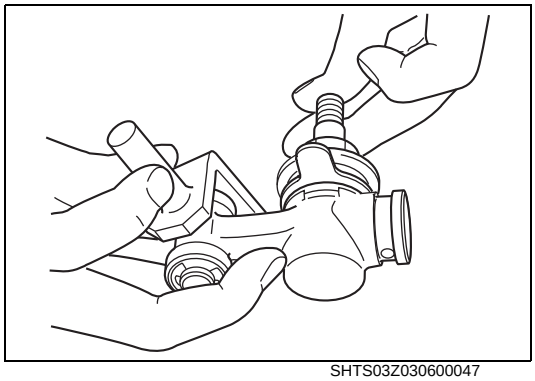
SHTS03Z030600044


SHTS03Z030600045

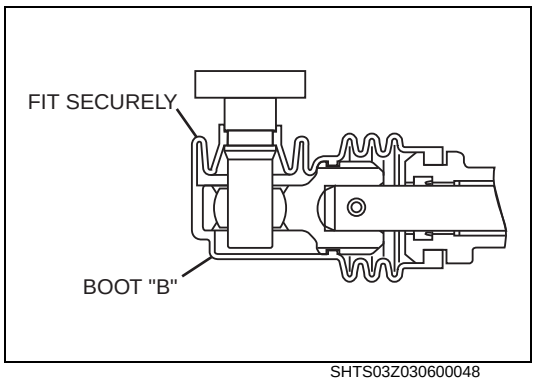
(4) Align the concave mark with the convex mark of boot "B".


SHTS03Z030600046

(5) Install the boot "A" to the groove of the booster cylinder and align the concave mark of the boot "A" with the convex mark of the booster cylinder.

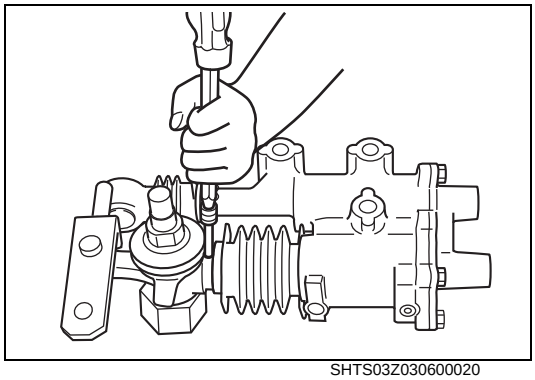

SHTS03Z030600047

(6) Apply silicone grease to the inner surface of the boot "C" and install it to the joint assembly.



SHTS03Z030600048

(7) Insert the top of the lever of the joint assembly to the boot "B" strongly.
Fit the boot "B" to the groove of the lever securely.


SHTS03Z030600020

(8) Insert a spacer 13-15 mm {0.512-0.590 in.} wide under the ball joint assembly.
And align the hole position of the ball joint assembly with the one of piston to drive the spring pin into them using a 7-8 mm {0.2756-0.3149 in.} diameter tapping rod.

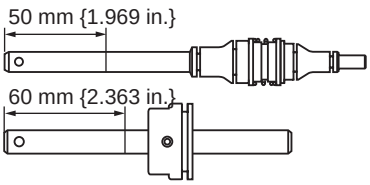
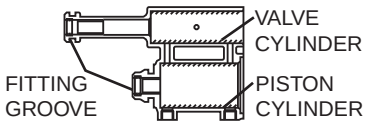
IMPORTANT POINT - INSPECTION

1. INSPECT AIR LEAKAGE.

(1) Supply the compressed air of 735 kPa {7.5 kgf/cm^2, 107 lbf/in.^{2}} and mark sure of the neutral of the valve and the valve operation of the both pushing and pulling direction.

INSPECTION AND REPAIR

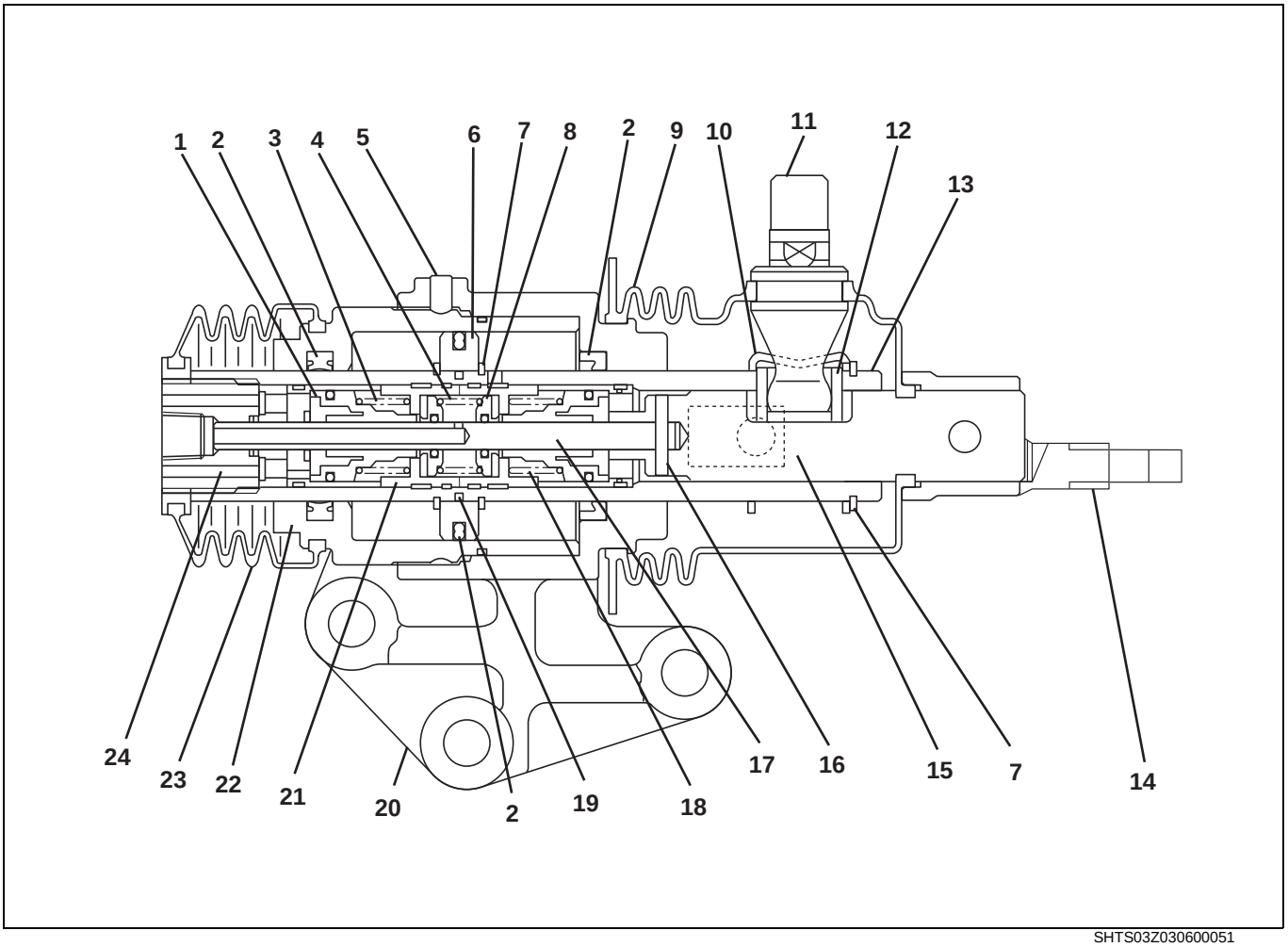
EN03Z0306H300002

Inspection item	Standard	Limit	Remedy	Inspection procedure
Valve seal, piston seal and dust boot: Setting, hardening, wear and deformation NOTICE As for the rod seal and O-ring, replace them with new one at regular maintenance as a rule.	**—**	**—**	**Replace the parts with new one, if necessary.**	**Visual check**
Piston and power shift sub-assembly: Flaws and scratches due to wear in the sliding surface "A" and "B" as shown in figure.	**A: 50 mm {1.969 in.} B: 60 mm {2.363 in.}**	**—**	**Replace the parts, if there is any flaw and scratch. Remove flaws with a emery paper (No.1000) if it is light.**	**Visual check** 
Piston cylinder part and valve cylinder part: Flaws and scratches	**—**	**—**	**Replace the parts, if there is any flaw and scratch. Remove flaws with a emery paper (No.1000) if it is light.**	**Visual check** 
Fitting groove part for rod seals: Flaws and scratches	**—**	**—**	**Replace the parts, if necessary.**	
Other parts: Wear, play and damage NOTICE If there is adhesion of foreign materials in the mesh filter of the cover, remove the foreign materials.	**—**	**—**	**Replace the parts, if necessary.**	**Visual check and measure**

POWER SHIFT (TRANSMISSION SERIES: MF06S, HK06S)

DESCRIPTION

EN03Z0306C100002



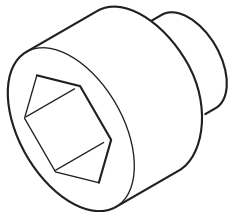
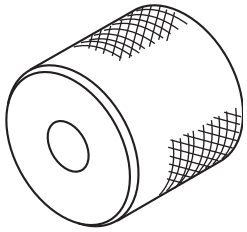
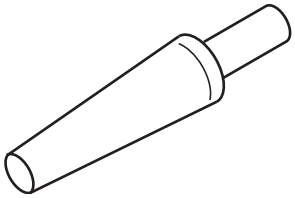
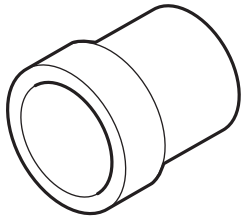
SHTS03Z030600051

1	Valve lifter	13	Shifter rod
2	Seal ring	14	Gear control lever
3	Spring "A"	15	Actuating rod
4	Spring "B"	16	Straight pin
5	Set screw	17	Pipe
6	Piston	18	Spring "C"
7	Retainer ring	19	O-ring
8	Valve seal	20	Housing
9	Boot "A"	21	Valve seat
10	Plate	22	Cylinder
11	Striker	23	Boot "B"
12	Guide sleeve	24	Connector

SPECIAL TOOL

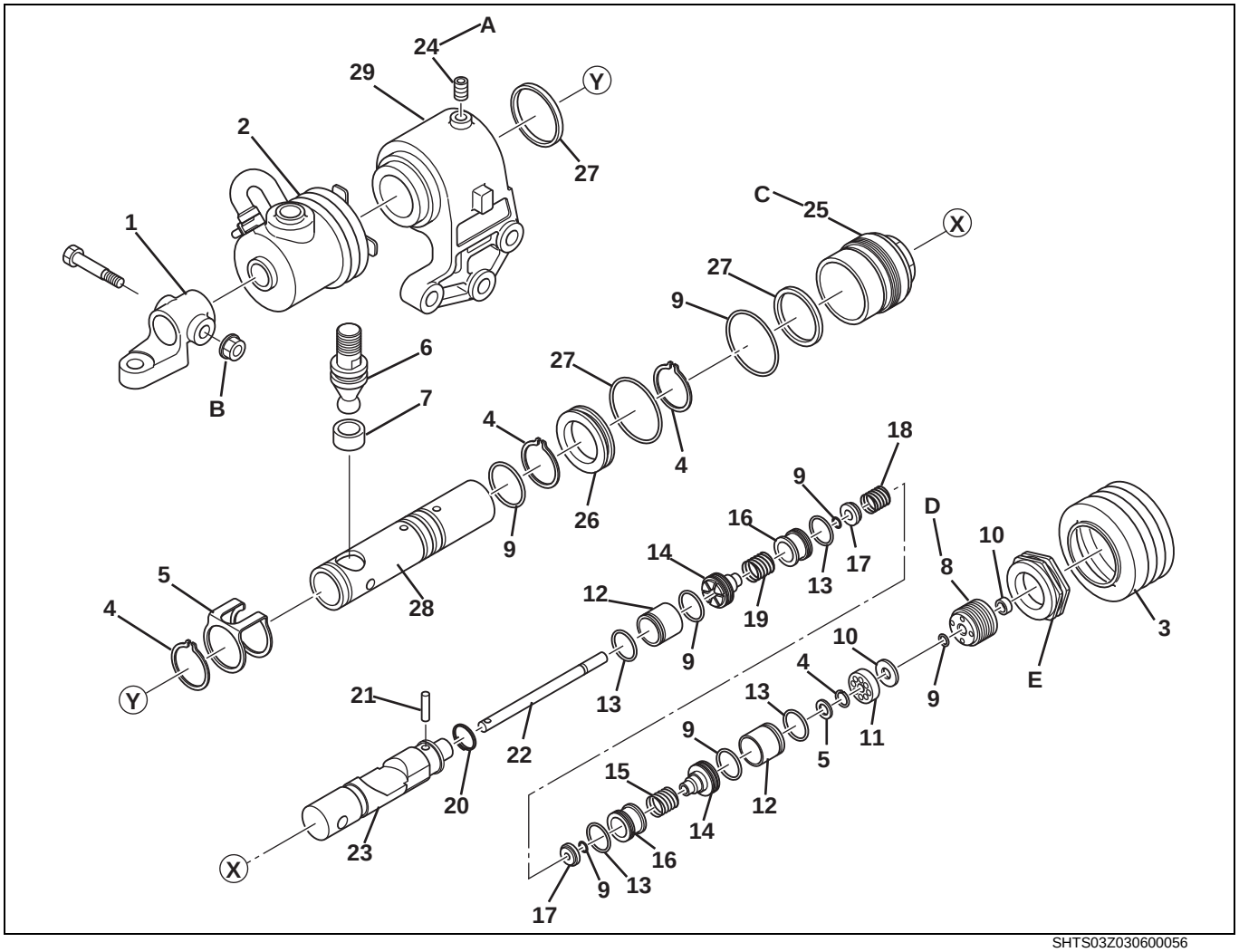
EN03Z0306K100002

Prior to starting a power shift overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0962-21200	SOCKET WRENCH	
	S0966-51370	INSERT TOOL	
	S0966-51380	INSERT TOOL	
	S0966-51390	SLEEVE	

COMPONENT LOCATOR

EN03Z0306D100003



SHTS03Z030600056

1	Gear control lever	16	Valve seat
2	Boot "A"	17	Valve seal
3	Boot "B"	18	Spring "B"
4	Retainer ring	19	Spring "A"
5	Plate	20	Clamp
6	Striker	21	Straight pin
7	Guide sleeve	22	Pipe
8	Connector	23	Actuating rod
9	O-ring	24	Set screw
10	Filter	25	Cylinder
11	Collar	26	Piston
12	Tube	27	Seal ring
13	Square ring	28	Shifter rod
14	Valve lifter	29	Housing
15	Spring "C"		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	1.9-3.4 {20-35, 1.5-2.5}	D	7.8-11.7 {80-120, 5.8-8.6}
B	23.5-26.5 {240-270, 18-19}	E	58-68 {600-700, 44-50}
C	98-117 {1,000-1,200, 73-86}		

OVERHAUL

EN03Z0306H200002

IMPORTANT POINTS - DISASSEMBLY

1. CAUTIONS DURING DISASSEMBLY

(1) In order to maintain airtightness, handle all parts with care and do not forcefully remove any parts.

(2) Remove dirt and dust attached to exterior parts before disassembling them.

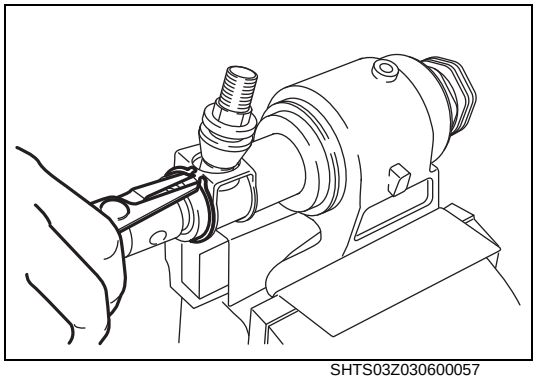
2. REMOVING THE BOOTS

(1) Remove the nut and the lever.

(2) Remove boots.

3. REMOVING THE STRIKER

(1) Remove the retainer ring, plate, guide sleeve and striker.



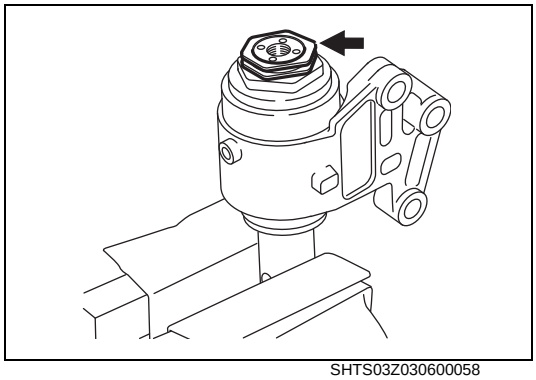
SHTS03Z030600057

4. REMOVING THE VALVE ASSEMBLY

(1) Remove the nut.

NOTICE

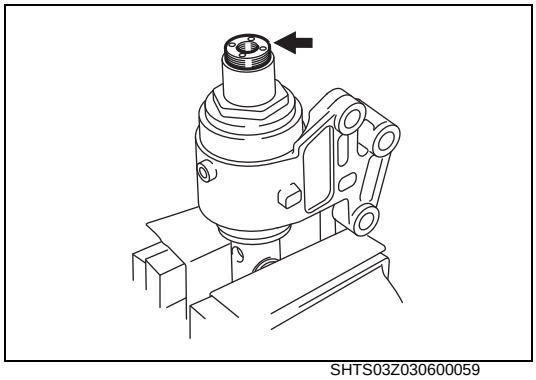
When working with the shifter rod fixed in place, the guide sleeve should be left installed for greater stability.



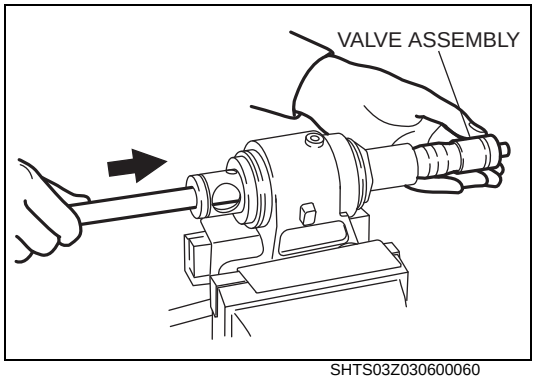
SHTS03Z030600058

(2) Remove the connector.

(3) Remove the O-ring and filter from the connector.



SHTS03Z030600059

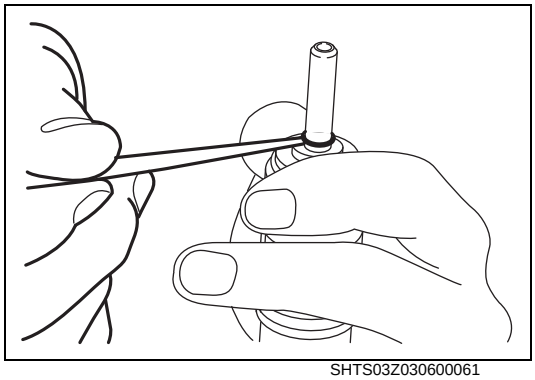


SHTS03Z030600060

(4) Use a suitable bar or similar tool carefully push out the valve assembly.

NOTICE

Avoid excessive force so that the valve seat and square ring are not damaged.


SHTS03Z030600061

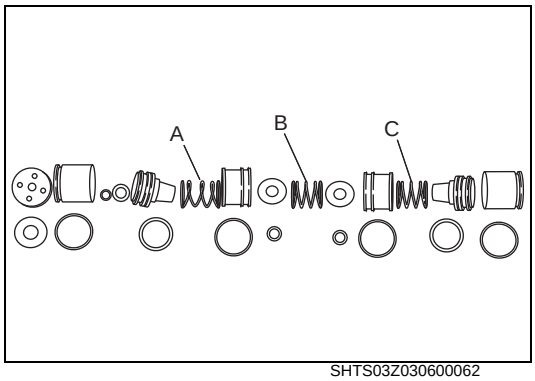
5. DISASSEMBLING THE VALVE ASSEMBLY

(1) Remove the collar with attached filter and the tube on one side.

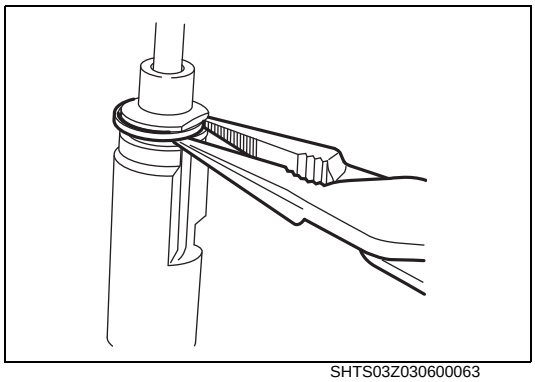
(2) Use a pin or similar tool and remove the retainer ring, and then remove each parts.

NOTICE

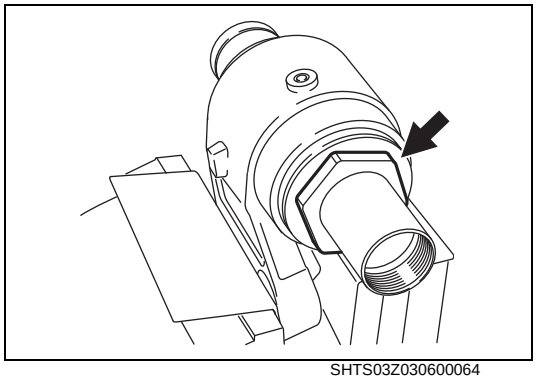
Keep springs "A", "B" and "C" in order so that they are not installed in the wrong positions.



SHTS03Z030600062


SHTS03Z030600063

(3) Remove the clamp. Then pull out the straight pin and disassemble the pipe and actuating rod.


SHTS03Z030600064

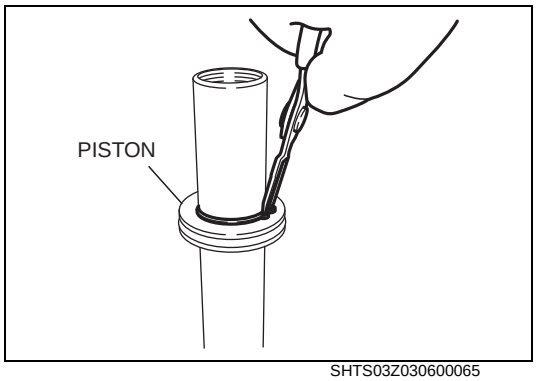
6. REMOVING THE CYLINDER AND PISTON ASSEMBLY

(1) Use a hexagonal socket wrench and remove the housing set screw.

(2) Loosen the cylinder threaded part with the special tool provided for that purpose, and remove the cylinder and piston assembly.
SST: Socket wrench (S0962-21200)

NOTICE
Loosen the cylinder threaded part carefully because it is fixed with adhesive.

(3) Remove the O-ring from the cylinder.



SHTS03Z030600065

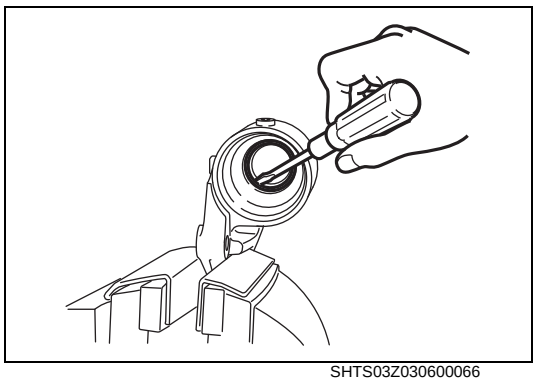
7. DISASSEMBLING THE PISTON ASSEMBLY

(1) Remove the retainer ring and the piston with attached seal ring.

(2) Remove the O-ring from the shifter rod and the retainer ring on the opposite side.

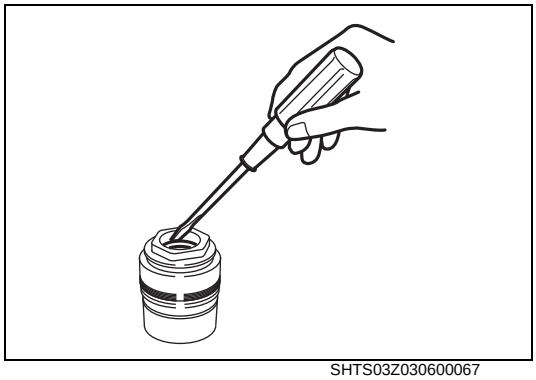
NOTICE
Be careful not to damage the shifter rod.

(3) Remove the seal ring from the piston.


SHTS03Z030600066

8. REMOVING THE SEAL RING INSIDE THE HOUSING AND CYLINDER

(1) Remove the plate holding the seal ring inside the housing, and take out the seal ring.


SHTS03Z030600067

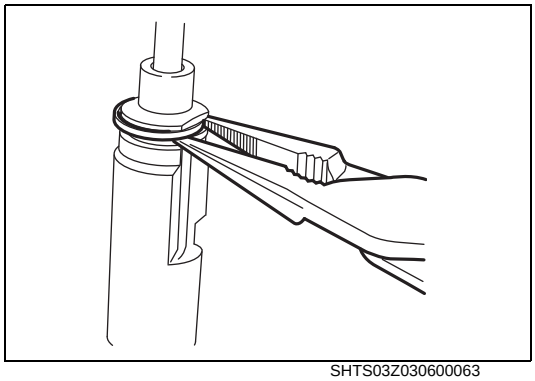
(2) Using a slotted screwdriver or similar tool, remove the seal ring inside the cylinder.

NOTICE
Be careful not to damage the cylinder.

IMPORTANT POINTS - ASSEMBLY

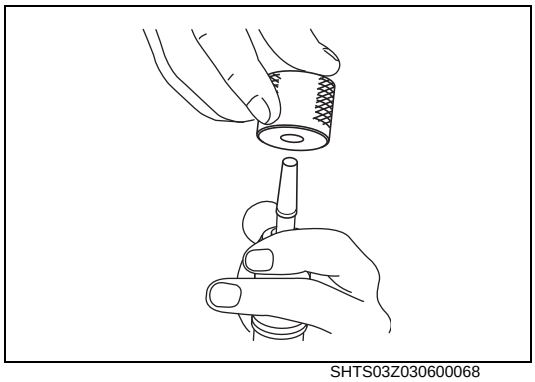
1. CAUTIONS DURING ASSEMBLY

(1) To maintain airtightness, handle all parts with care and do not forcefully assembly any parts.
(2) Assemble parts carefully so that dirt and foreign objects do not enter the assembled parts.


SHTS03Z030600063

2. ASSEMBLING THE VALVE ASSEMBLY

(1) Insert the straight pin into the actuating rod and install the pipe.
(2) Install the clamp.
(3) Apply grease (Airmaster Paste) to the new part's O-ring and square ring.
(4) Install O-rings on the valve seal and valve lifter.
(5) Install square ring on the valve seat and tube.

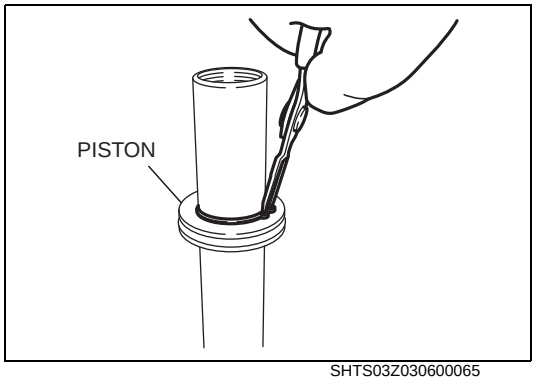

SHTS03Z030600068

(6) Install the tube, valve lifter, spring, valve seat, and valve seal, and plate on the pipe.
(7) Using the special tool, install a new retainer ring in the pipe groove.
SST:
Insert tool (S0966-51370)
Insert tool (S0966-51380)

NOTICE

- **Do not deform the retainer ring.**
- **Make sure the retainer ring is securely installed in the groove.**

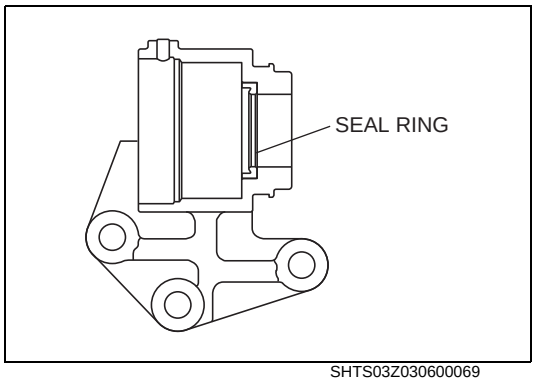
(8) Install the collar with attached filter.



SHTS03Z030600065

3. ASSEMBLING THE PISTON ASSEMBLY

(1) Apply grease (Airmaster Paste) to the new seal ring and piston.
(2) Install a new retainer ring in one side of the shifter rod groove.
(3) Install a new O-ring on the shifter rod.
(4) Insert the piston into the shifter rod and install a new retainer ring in the shifter rod groove on the opposite side.
(5) Measure the retainer ring mating face gap and make sure the retainer ring is securely installed in the shifter rod groove.
Standard value: Less than 6 mm {0.2362 in.}

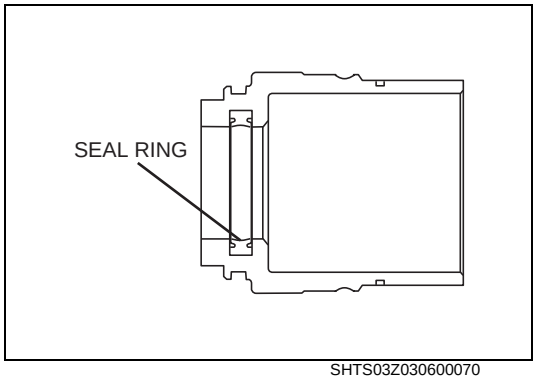


SHTS03Z030600069

4. INSTALLING THE SEAL RING INSIDE THE HOUSING AND CYLINDER

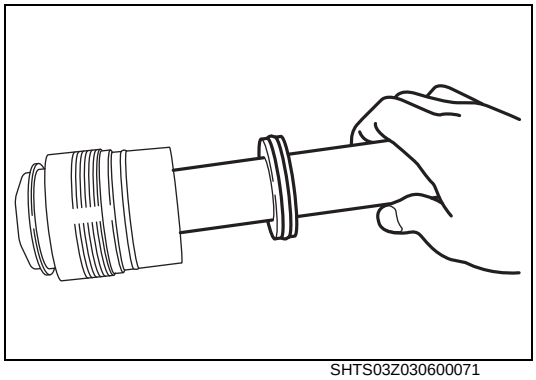
(1) Apply grease (Airmaster Paste) to the new seal ring.
(2) Install the seal ring inside the housing, making sure it is in the right direction.

NOTICE
If the seal ring is installed in a wrong direction, air will leak out.

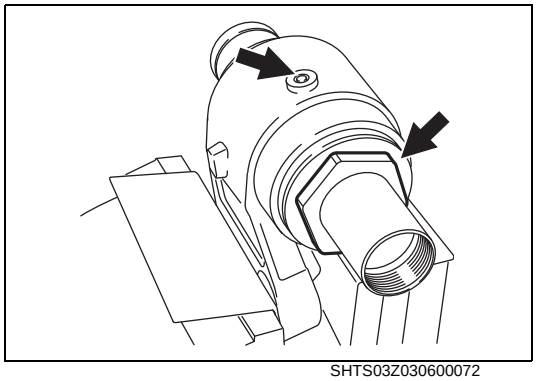


SHTS03Z030600070

(3) Apply grease (Airmaster Paste) to the new seal ring.
(4) Install the seal ring in the cylinder.

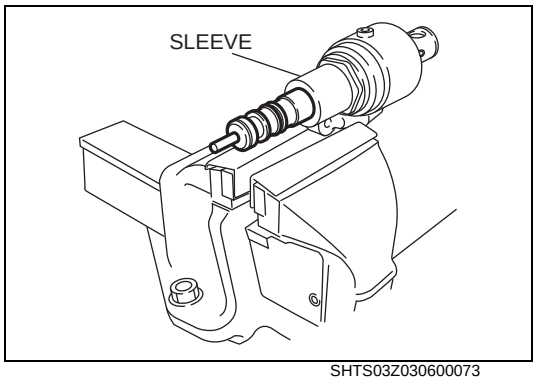

SHTS03Z030600071

5. INSTALLING THE CYLINDER AND PISTON ASSEMBLY
(1) Apply grease (Airmaster Paste) to the new O-ring and install the O-ring on the cylinder.
(2) Assemble the piston assembly on the cylinder.


SHTS03Z030600072

(3) Apply an adhesive to the cylinder threaded part (LOCTITE 242 or ThreeBond 1401B), and install the cylinder in the housing.
(4) Tighten the cylinder threaded part, using the special tool provided for that purpose.
SST: Socket wrench (S0962-21200)

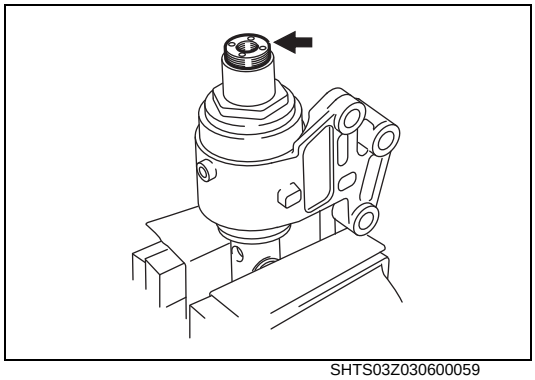
(5) Install a new set screw in the housing, using a hexagonal socket wrench.
(6) Caulk two points between the housing and set screw, using a center punch or hammer.



SHTS03Z030600073

6. INSTALLING THE VALVE ASSEMBLY
(1) Apply grease (Airmaster Paste) to the entire interior surface of the piston assembly shifter rod.
(2) Insert the valve assembly, into the shifter rod using the special tool provided for that purpose.
SST: Sleeve (S0966-51390)

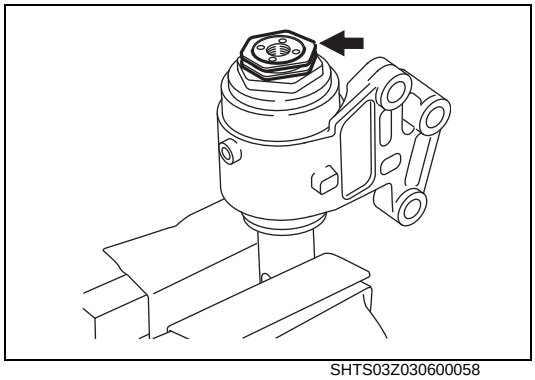
NOTICE
The special tool must be used because the shifter rod thread will damage the O-ring and square ring.


SHTS03Z030600059

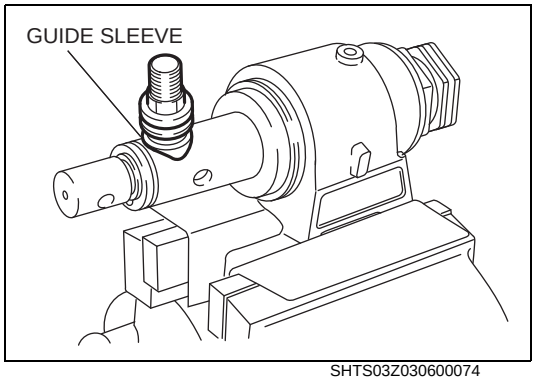
(3) Install a new O-ring and filter on the connector.
(4) Install the connector.

NOTICE

- **The connector tightening torque must be observed to avoid damaging the valve.**
- **When working with the shifter rod fixed in place, the guide sleeve should be left installed for greater stability.**


SHTS03Z030600058

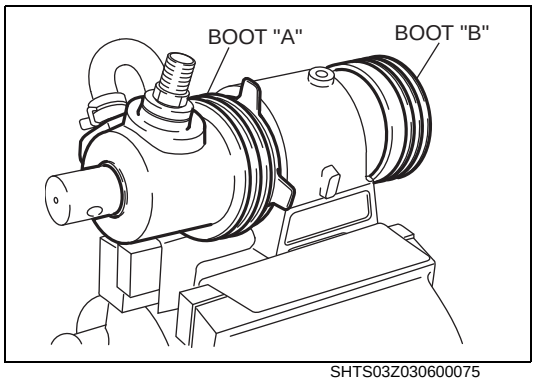
(5) Install the nut.



SHTS03Z030600074

7. INSTALLING THE STRIKER

(1) Apply grease (Airmaster Paste) to the guide sleeve, shifter rod, and striker.
(2) Line up the actuating rod flat surface and the shifter rod and guide sleeve installation hole, and then install the guide sleeve and striker.
(3) Install the plate.
(4) Install a new retainer ring in the shifter rod groove.
(5) Measure the retainer ring mating face gap and make sure that retainer ring is securely installed in the shifter rod groove.
Standard valve: Less than 6 mm {0.2362 in.}



SHTS03Z030600075

8. INSTALLING THE BOOTS

(1) Install boot "B" over the nut and cylinder groove.

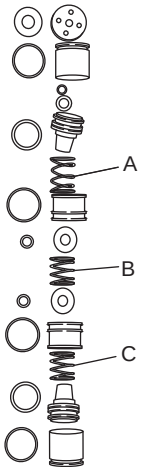
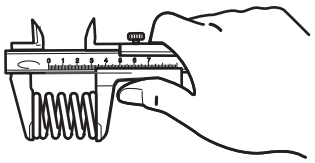
NOTICE

Install boot "B" so that the drip hole is at the bottom.

(2) Install boot "A" over the housing, actuating rod, and striker groove.
(3) Install the lever on the actuating rod with a bolt and nut.

INSPECTION AND REPAIR

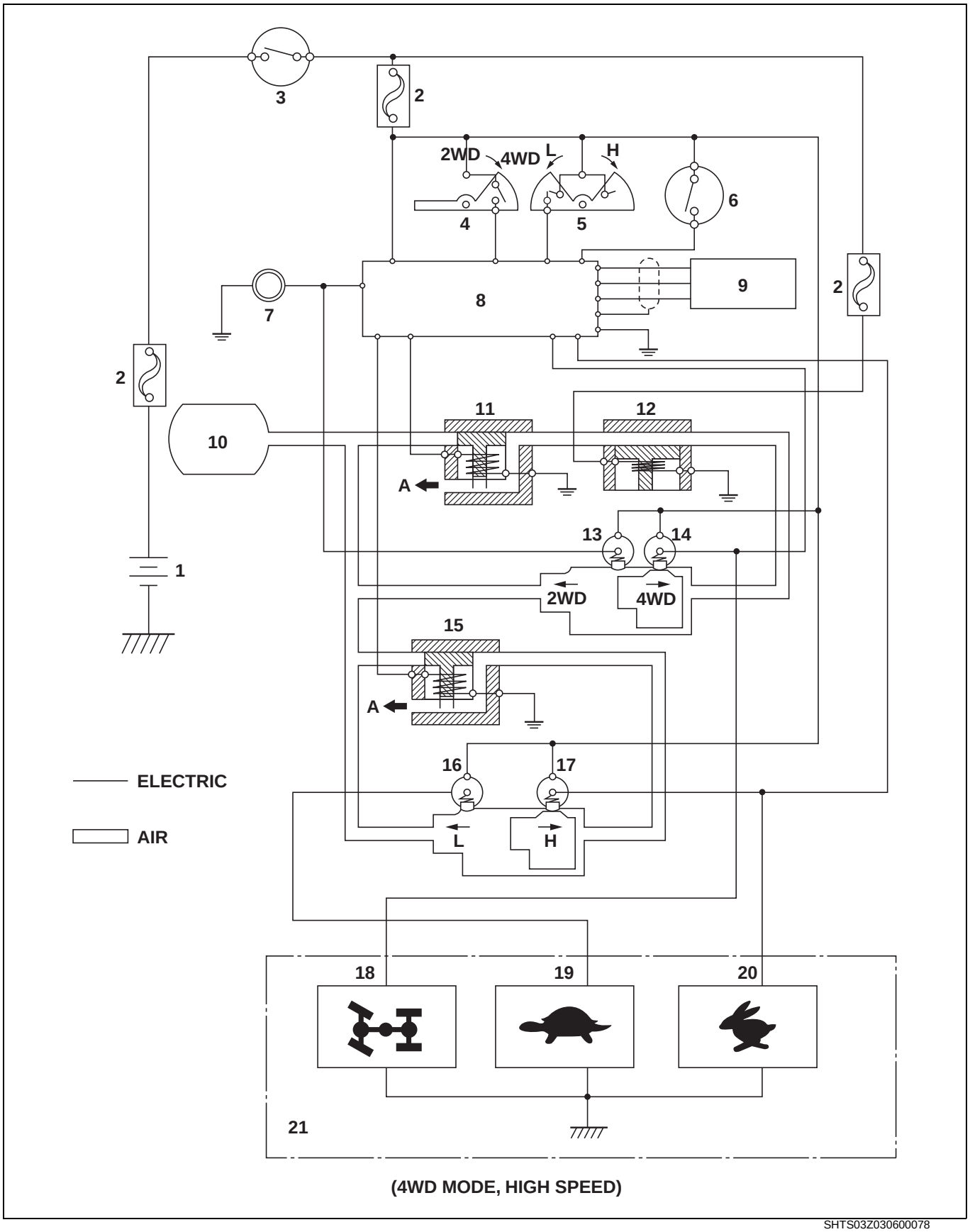
EN03Z0306H300003

Inspection item	Standard	Limit	Remedy	Inspection procedure
Spring length 	**A:** **41.3 (38.8-43.7) mm** **{1.63 (1.53-1.72) in.}** **B:** **31.9 (30.0-33.8) mm** **{1.26 (1.18-1.33) in.}** **C:** **25.0 (23.5-26.5) mm** **{0.98 (0.92-1.04) in.}**		**Replace if the standard range is exceeded.**	**Measure** 
Boots wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**
Filter dirtiness	**—**	**—**	**Replace, if necessary.**	**Visual check**

TRANSFER SHIFT CONTROL (TRANSFER SERIES: MA12C)

DIAGRAM

EN03Z0306J100001



(4WD MODE, HIGH SPEED)

SHTS03Z030600078

1	**Battery**	**12**	**Hold on solenoid valve**
2	**Fusible link**	**13**	**4WD selector warning switch**
3	**Starter switch**	**14**	**4WD detection switch**
4	**4WD selector switch**	**15**	**High-Low selector solenoid valve**
5	**High-Low selector switch**	**16**	**Low detection switch**
6	**Clutch pedal switch**	**17**	**High detection switch**
7	**Warning buzzer**	**18**	**4WD indicator light**
8	**Transfer controller**	**19**	**Low indicator light**
9	**Speedometer**	**20**	**High indicator light**
10	**Air tank**	**21**	**Instrument panel**
11	**4WD selector solenoid valve**	**A**	**Exhaust**

TROUBLESHOOTING

EN03Z0306F300002

Symptom	Possible cause	Remedy/Prevention
Transfer High-Low cannot be shift.	High-Low selector switch defective	Replace.
	High-Low selector solenoid valve defective	Replace.
	Clutch pedal switch defective	Replace.
	Transfer controller defective	Replace.
Transfer High-Low cannot be shift (Warning buzzer sounding during standing).	Speed sensor defective	Replace.
	Transfer controller defective	Replace.
Transfer High-Low can be shift without stepping clutch pedal.	Clutch pedal switch defective	Replace.
	Transfer controller defective	Replace.
Remain 4WD mode, High speed.	Fuse burned out	Replace.
	Transfer controller ECU defective	Replace.
Transfer 2WD-4WD cannot be shift.	4WD selector switch defective	Replace.
	4WD selector solenoid valve defective	Replace.
	4WD detection switch defective	Replace.
	High detection switch defective	Replace.
	Hold on solenoid valve defective	Replace.
	Fuse burned out	Replace.

PROPELLER SHAFT (LD0932)

PP02-001

PROPELLER SHAFT ASSEMBLY PP02-2
DATA AND SPECIFICATIONS..... PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING..... PP02-4
SPECIAL TOOL..... PP02-4
COMPONENT LOCATOR PP02-5
OVERHAUL PP02-7
INSPECTION AND REPAIR..... PP02-13

PROPELLER SHAFT ASSEMBLY

DATA AND SPECIFICATIONS

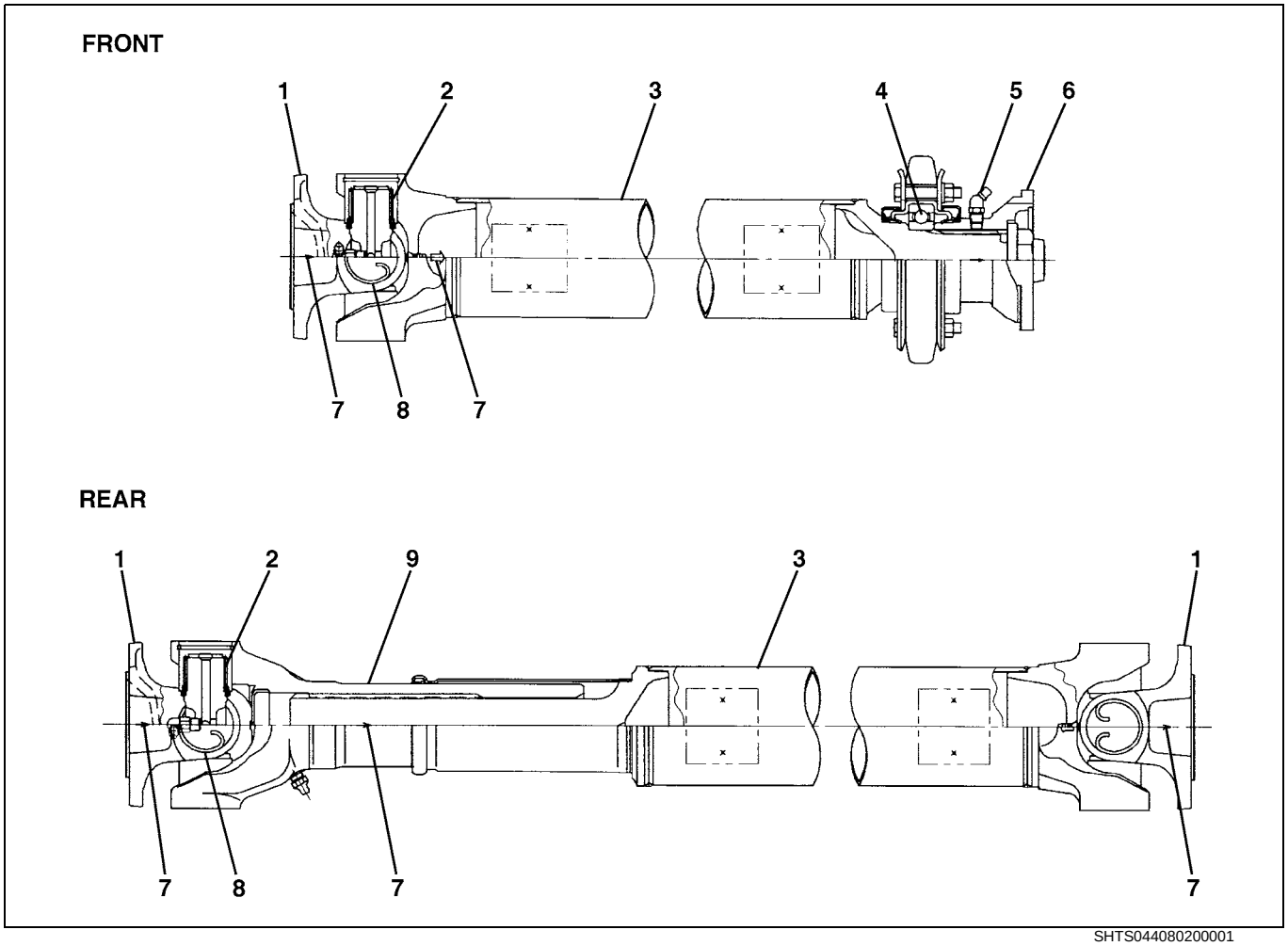
EN0440802I200001

Type	**Tubular shaft type**
Universal joint	**All metal, round bearing type with needle roller bearing**

DESCRIPTION

EN0440802C100001

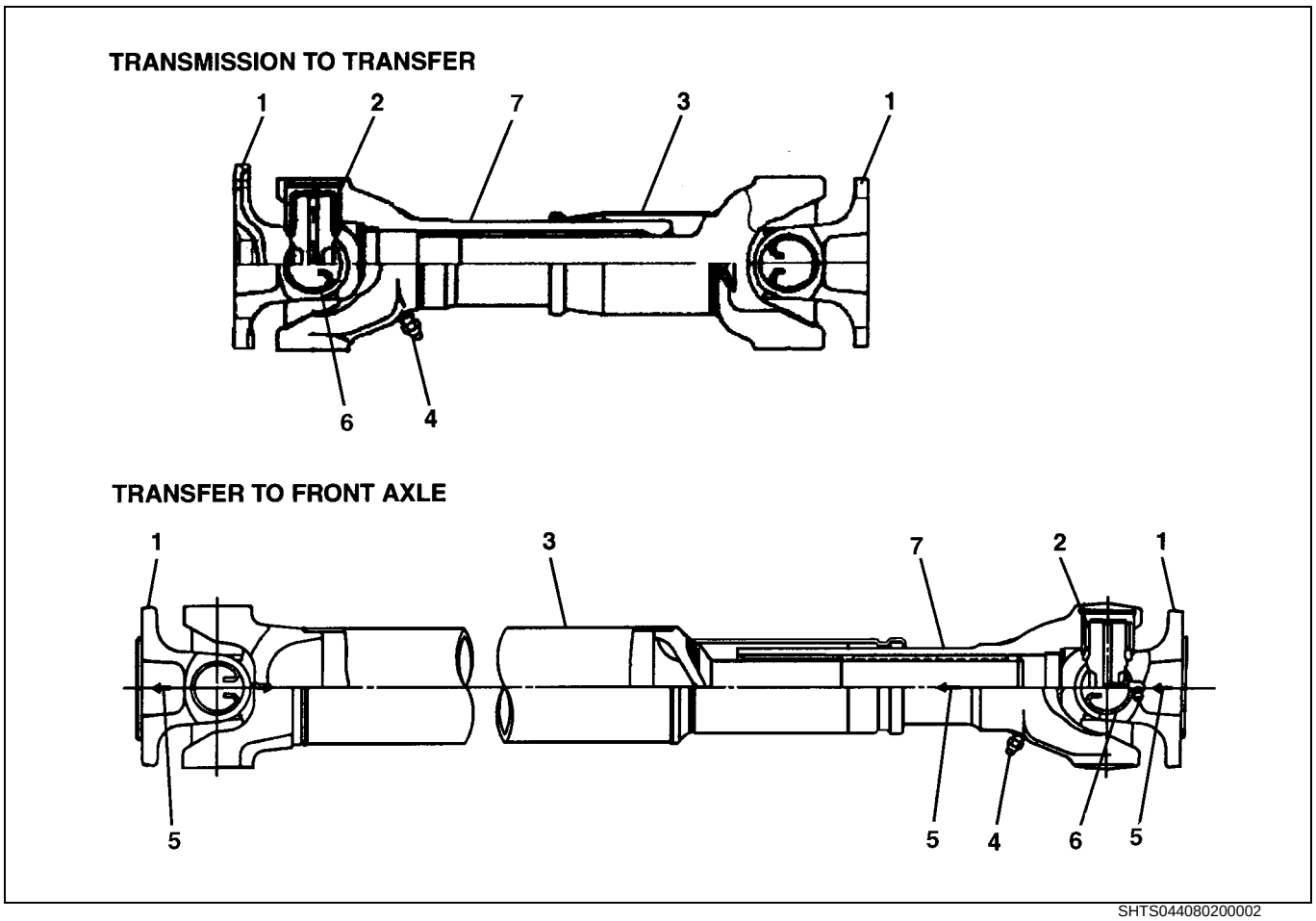
MODEL: FC



SHTS044080200001

1	Universal joint yoke	6	Universal joint flange
2	Needle roller bearing	7	Phasing arrow
3	Yoke shaft	8	Retainer ring
4	Center bearing	9	Sliding yoke
5	Lubrication fitting		

MODELS: FT, GT



SHTS044080200002

1	Universal joint yoke	5	Phasing arrow
2	Needle roller bearing	6	Retainer ring
3	Yoke shaft	7	Sliding yoke
4	Lubrication fitting		

TROUBLESHOOTING

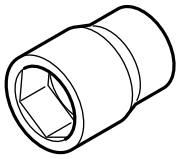
EN0440802F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Worn or damaged center bearing	Replace the bearing.
	Worn or damaged center bearing rubber cushion	Replace the rubber cushion.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0440802K100001

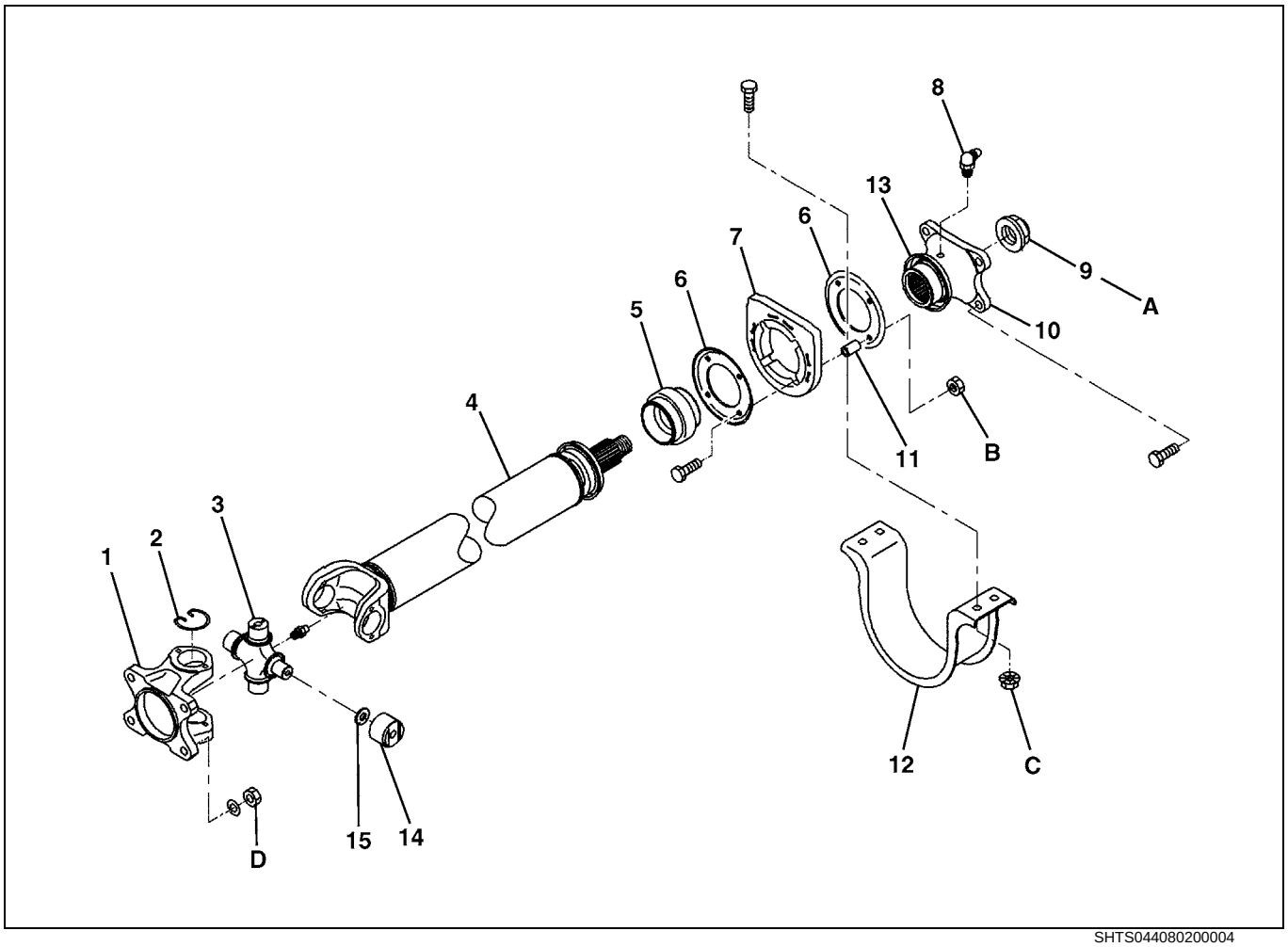
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	S0983-94104	SOCKET WRENCH	

COMPONENT LOCATOR

EN0440802D100001

FRONT



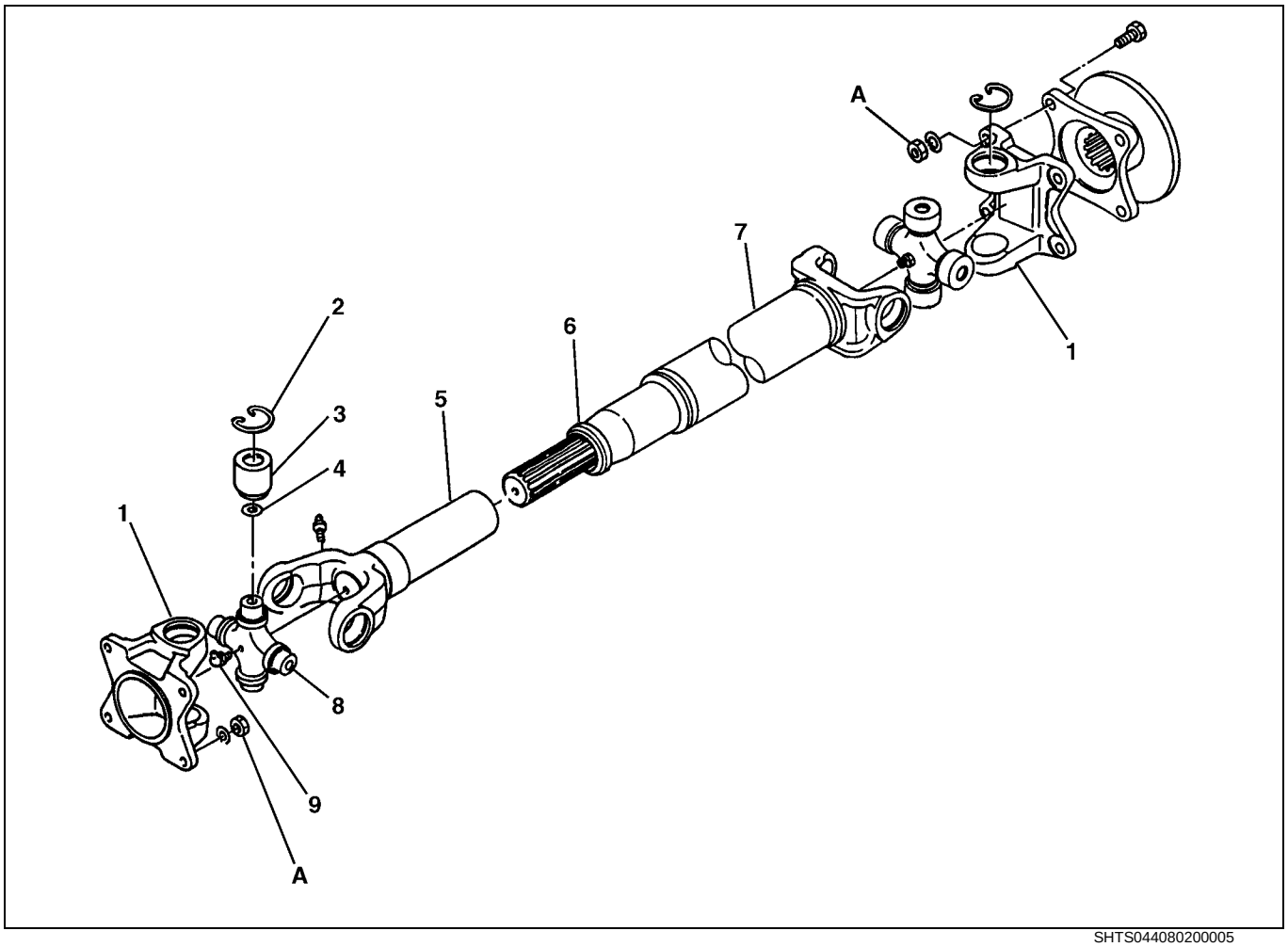
SHTS044080200004

1	Universal joint yoke	9	Lock nut
2	Retainer ring	10	Universal joint flange
3	Universal joint spider	11	Collar
4	Yoke shaft	12	Center bearing holder
5	Center bearing	13	Dust deflector
6	Center bearing plate	14	Needle roller bearing
7	Center bearing cushion	15	Thrust washer
8	Lubrication fitting		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	588.4-784.6 {6,000-8,000, 434-578}	C	41.5-61.5 {424-672, 31-45}
B	22.4-30.6 {229-312, 17-22}	D	61-91 {623-927, 45-67}

REAR



SHTS044080200005

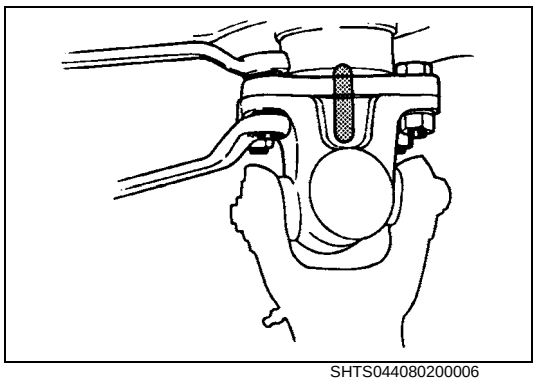
1	Universal joint yoke	6	Dust cover seal
2	Retainer ring	7	Yoke shaft
3	Needle roller bearing	8	Universal joint spider
4	Thrust washer	9	Lubrication fitting
5	Sliding yoke		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	61-91 {623-927, 45-67}		

OVERHAUL

EN0440802H200001


SHTS044080200006

IMPORTANT POINT - DISMOUNTING

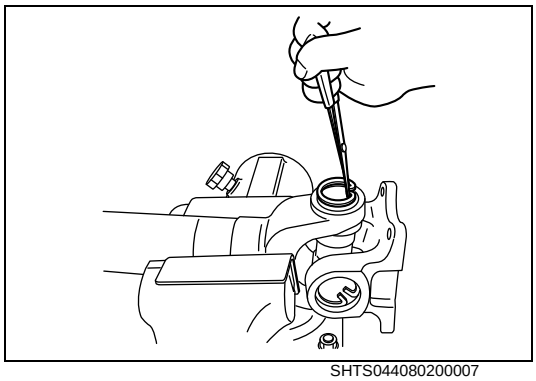
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and universal joint yoke.

(2) Remove the nuts and the bolts.

NOTICE

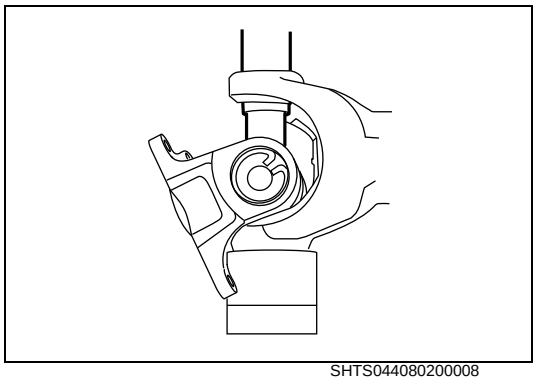
Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.


SHTS044080200007

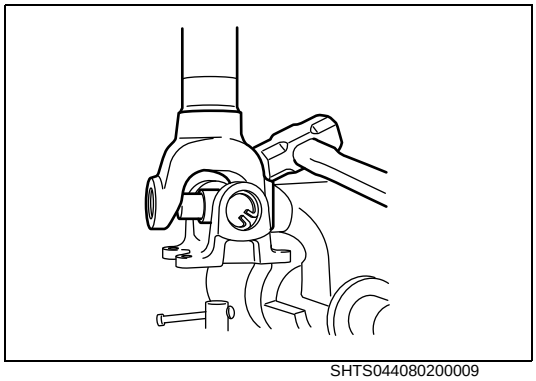
IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the retainer ring from the yoke.


SHTS044080200008

(2) Position the yoke under the arbor press and push universal joint partially out of the yoke lug. The bearing race will now protrude from the yoke.


SHTS044080200009

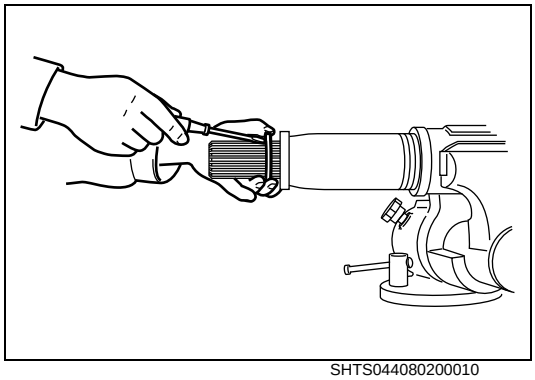
(3) Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise. Tap the yoke in area shown to achieve removal of universal joint bearing.

(4) Press the opposite bearing out of the yoke lug.

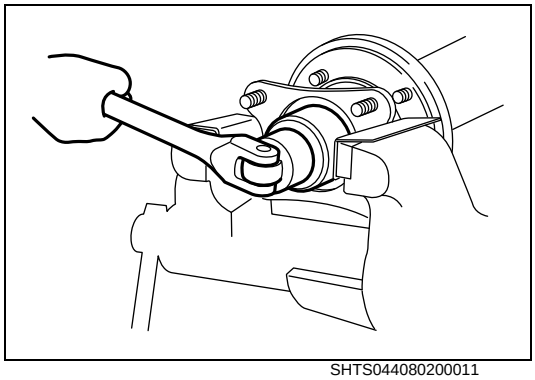
(5) Remove the spider with universal joint yoke from the yoke.

NOTICE

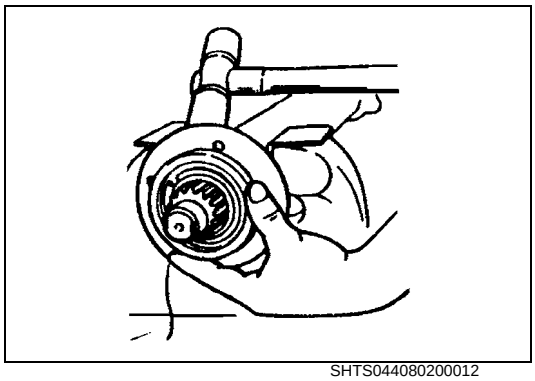
Keep the original location of the bearings, thrust washers, spider and retainer rings in mind. These parts have to be replaced in the same position as before disassembly when reassembling.


SHTS044080200010

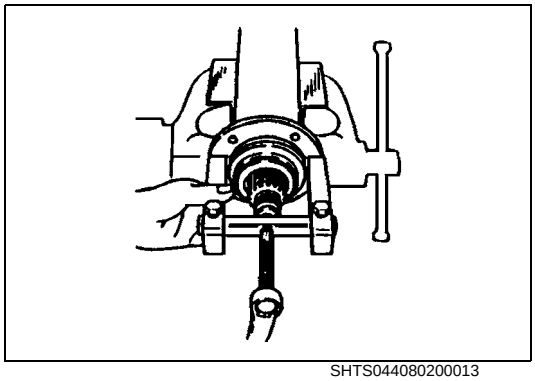
2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.
(1) Separate the yoke shaft and sliding yoke.
(2) Remove the dust cover seal from the yoke shaft.


SHTS044080200011

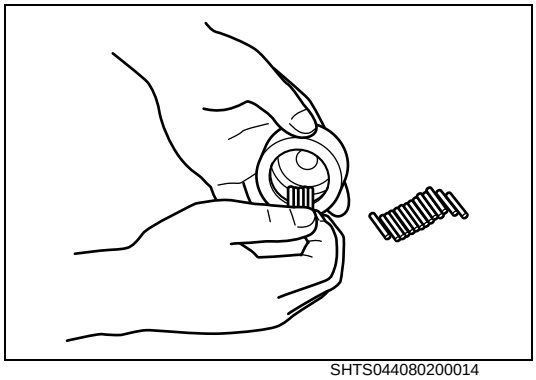
3. REMOVE THE CENTER BEARING.
(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
SST: Socket Wrench (S0983-94104)
(5) Remove the universal joint flange from the shaft.


SHTS044080200012

(6) Using a hammer, tap the bearing plate to make a clearance.


SHTS044080200013

(7) Using a commercial puller, remove the center bearing.
NOTICE
Be careful not to catch your fingers between bearing plate and dust deflector.


SHTS044080200014

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

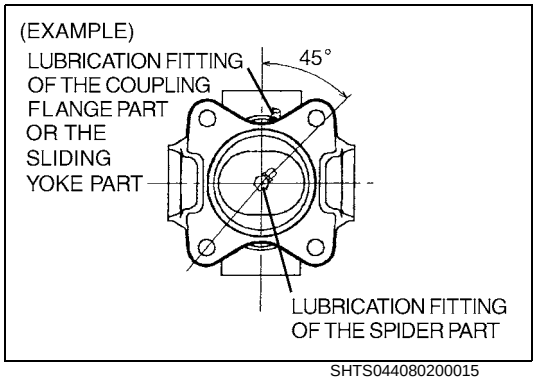
Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.

2. INSTALL THE UNIVERSAL JOINT SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

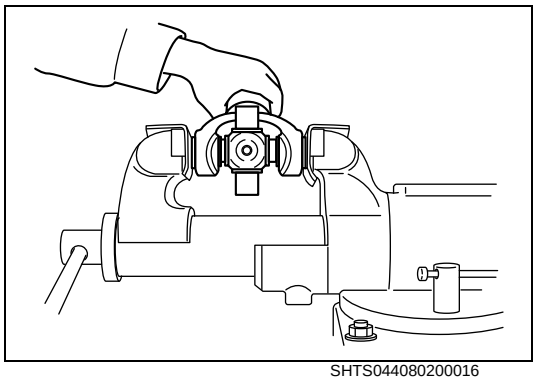
(1) Put the universal joint spider into the yoke and then set the needle roller bearings on the yoke.

NOTICE

When installing the spider to the yoke shaft, install the lubrication fitting to the spider should be made the direction of the lubrication fitting of the coupling flange part or the sliding yoke part as shown in the figure.



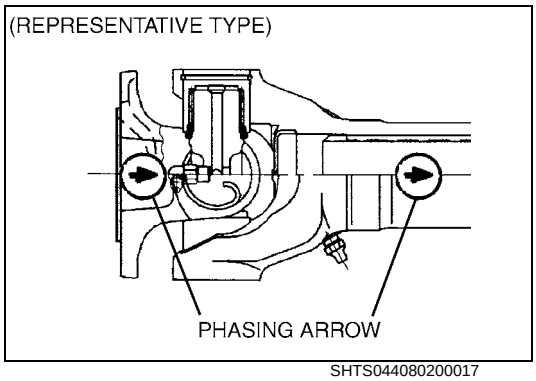
SHTS044080200015


SHTS044080200016

(2) Press the universal joint bearings into the yokes over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.

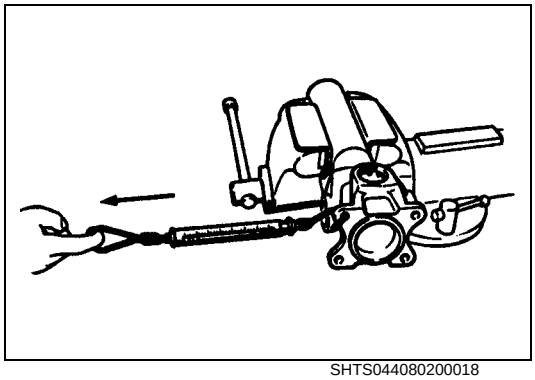


SHTS044080200017

(3) Install the universal joint yoke to the universal joint spider.

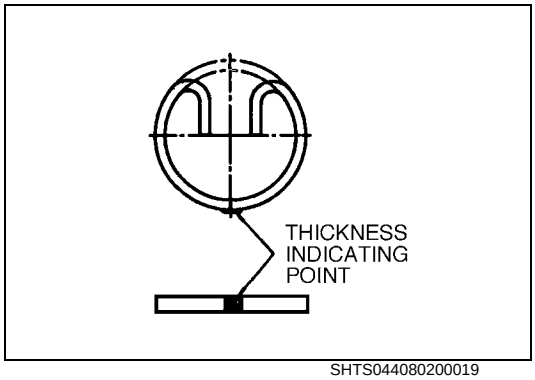
NOTICE

Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.



SHTS044080200018

3. CHECK THE STARTING TORQUE OF THE UNIVERSAL JOINT USING A SPRING BALANCER.
Assembly Standard: 1.47-4.9 N·m {15-50 kgf·cm, 13-43 lbf·in.}



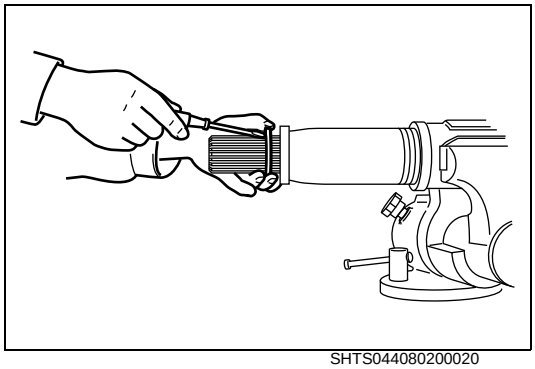
SHTS044080200019

(1) If the measuring value is below the assembly standard, replace the retainer ring with the thicker one.
(2) If the measuring value is above the assembly standard, replace the retainer ring with the thinner one.

NOTICE
Use retainer rings of the same thickness as possible for both ends.

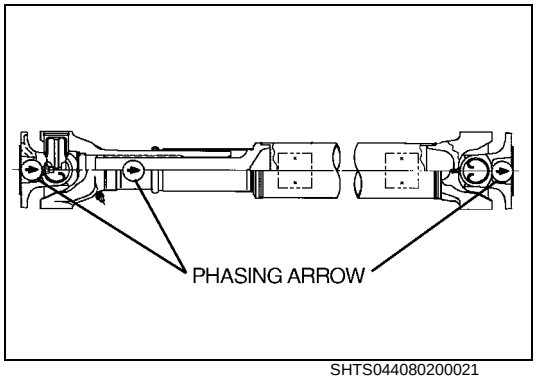
Unit: mm {in.}

Thickness of retainer ring	Color of thickness indication point
2.22 {0.0874}	White
2.30 {0.0906}	Red
2.38 {0.0937}	Green



SHTS044080200020

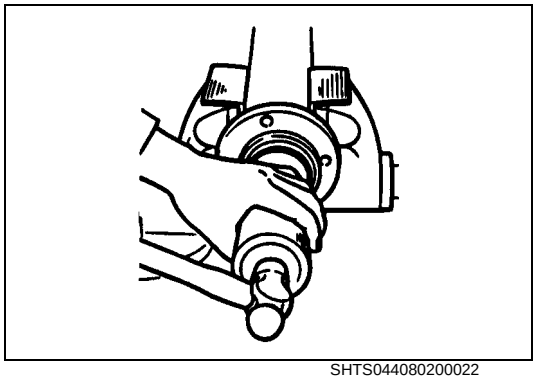
4. INSTALL THE DUST COVER SEAL.
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new dust cover seal on the shaft by pushing it in the seal groove.
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust cover seal.



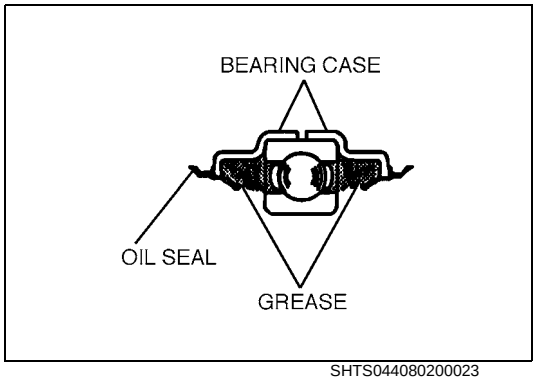
SHTS044080200021

5. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.

(1) Align the phasing arrows as shown in the figure.


SHTS044080200022

6. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING.

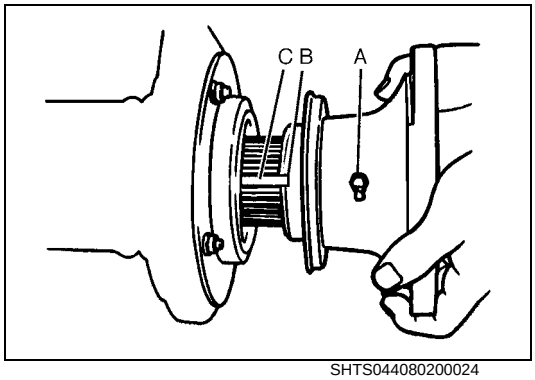


SHTS044080200023

NOTICE

Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.

Grease:
Refer to owner's manual.



SHTS044080200024

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to 80-100°C {76-212°F}.

NOTICE

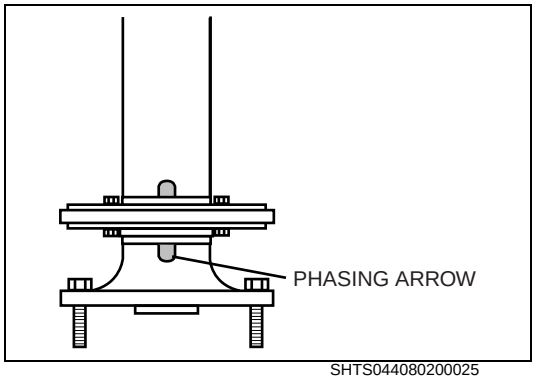
- **Do not heat the universal joint flange in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION
Never touch hot water or oil nor heated universal joint flange with your bare band. This can result in personal injury.

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

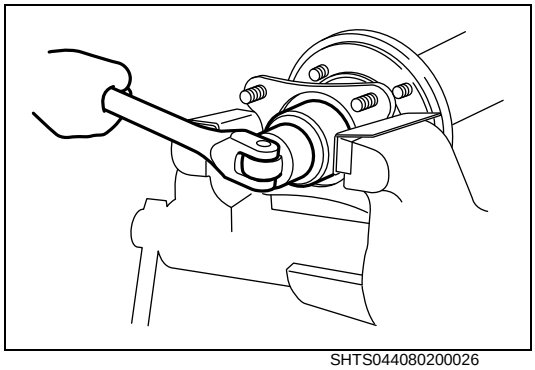
- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

NOTICE
Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper specified torque.

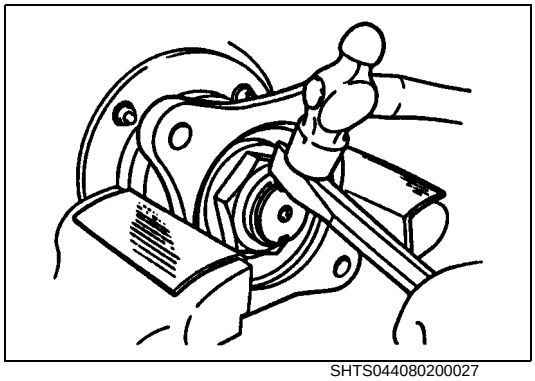


SHTS044080200025

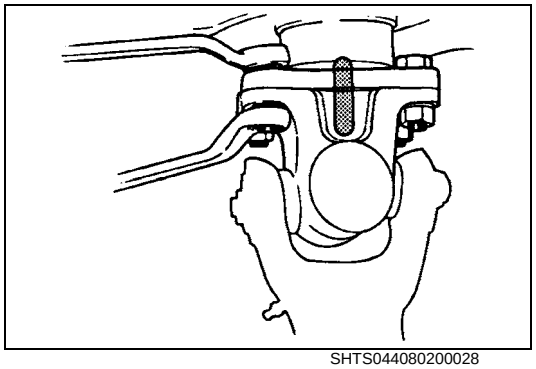
   c. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.


SHTS044080200026

   d. Using the special tool, tighten the lock nut.
   SST: Socket Wrench (S0983-94104)


SHTS044080200027

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


SHTS044080200028

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.

(1) Align the matching marks on the flange and universal joint yoke.

(2) Tighten the bolts and nuts.

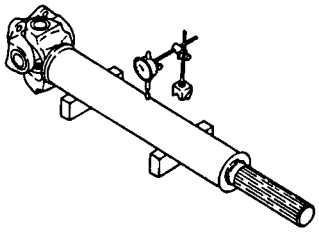
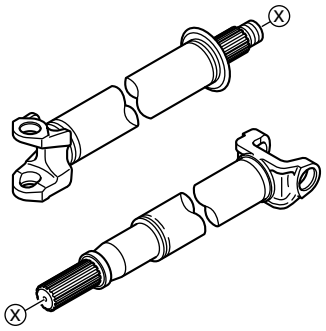
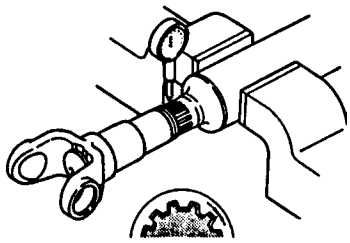
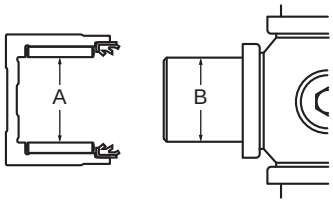
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0440802H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	**0-0.6 {0-0.0236}**	**1.0 {0.039}**	**Replace.**	**Measure** 
Crack in the welding beads	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Sliding spline damage	**—**	**—**	**Replace, if necessary.**	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 60 mm {2.362 in.} from the shaft center.)	**At spline 0.062-0.174 {0.0025-0.0068}**	**0.25 {0.0098}**	**Replace.**	**Measure** 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)	**0.024-0.064 {0.0010-0.0025}**	**0.1 {0.0039}**	**Replace needle roller bearing sub-assembly or universal joint spider.**	**Measure** 

PROPELLER SHAFT (LF0932)

PP02-002

PROPELLER SHAFT ASSEMBLY PP02-2

DATA AND SPECIFICATIONS..... PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING..... PP02-3
SPECIAL TOOL..... PP02-3
COMPONENT LOCATOR PP02-4
OVERHAUL PP02-6
INSPECTION AND REPAIR..... PP02-12

PROPELLER SHAFT ASSEMBLY

DATA AND SPECIFICATIONS

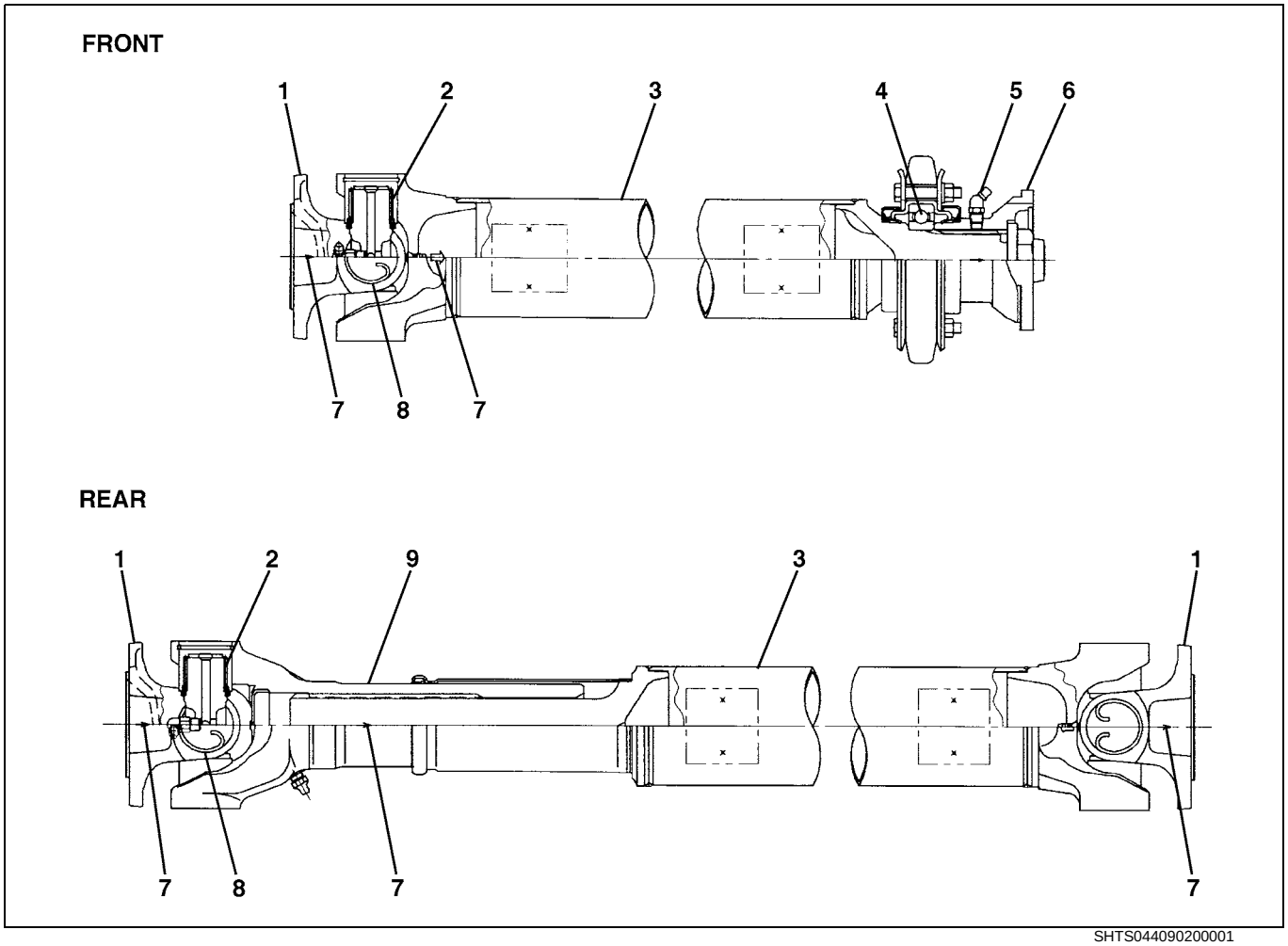
EN0440902I200001

Type	**Tubular shaft type**
Universal joint	**All metal, round bearing type with needle roller bearing**

DESCRIPTION

EN0440902C100001

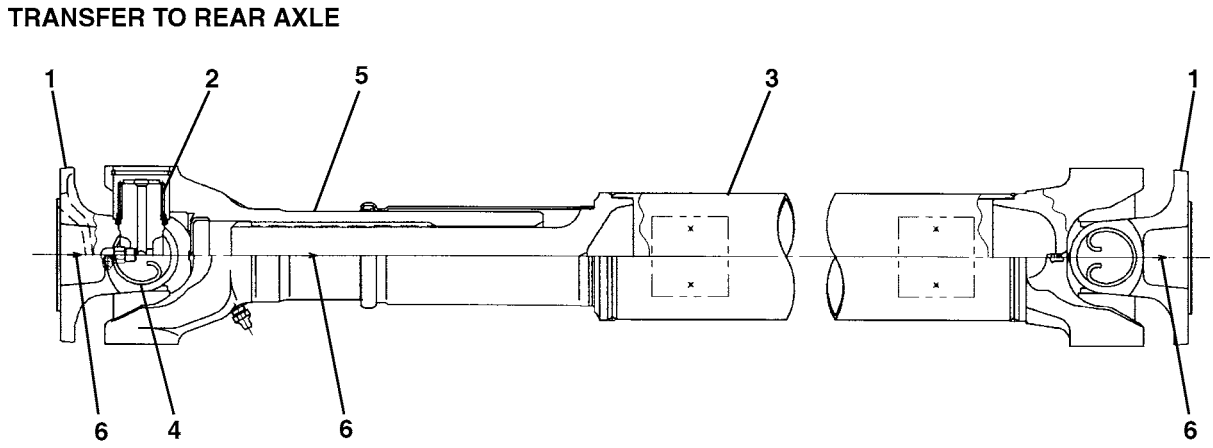
MODELS: FD, GD, FG (THAILAND)



SHTS044090200001

1	Universal joint yoke	6	Universal joint flange
2	Needle roller bearing	7	Phasing arrow
3	Yoke shaft	8	Retainer ring
4	Center bearing	9	Sliding yoke
5	Lubrication fitting		

MODELS: FT, GT



SHTS044090200002

1	**Universal joint yoke**	**4**	**Retainer ring**
2	**Needle roller bearing**	**5**	**Sliding yoke**
3	**Yoke shaft**	**6**	**Phasing arrow**

TROUBLESHOOTING

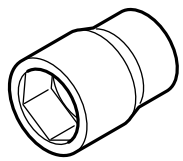
EN0440902F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Worn or damaged center bearing	Replace the bearing.
	Worn or damaged center bearing rubber cushion	Replace the rubber cushion.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0440902K100001

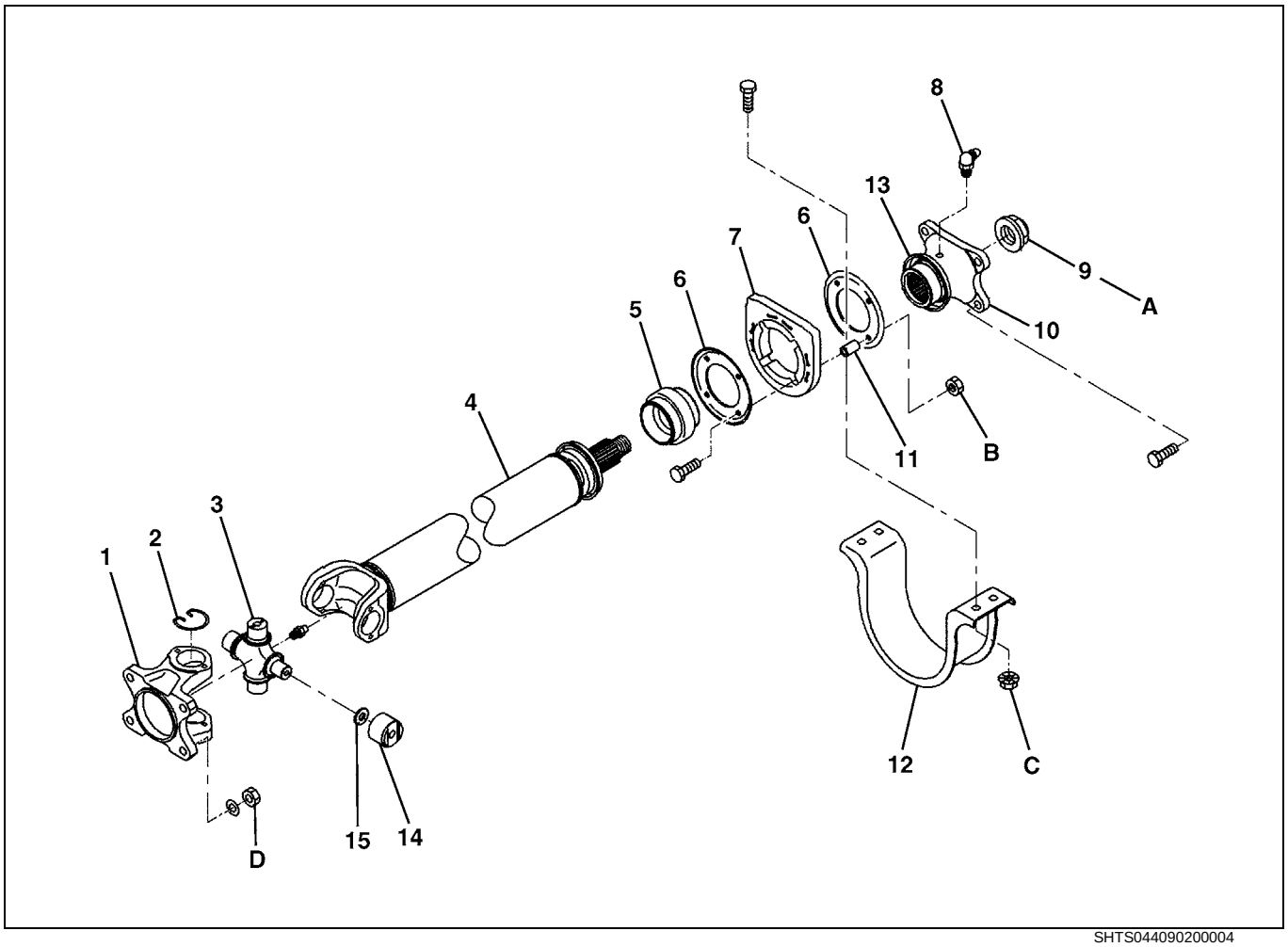
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	S0983-94104	SOCKET WRENCH	

COMPONENT LOCATOR

EN0440902D100001

FRONT



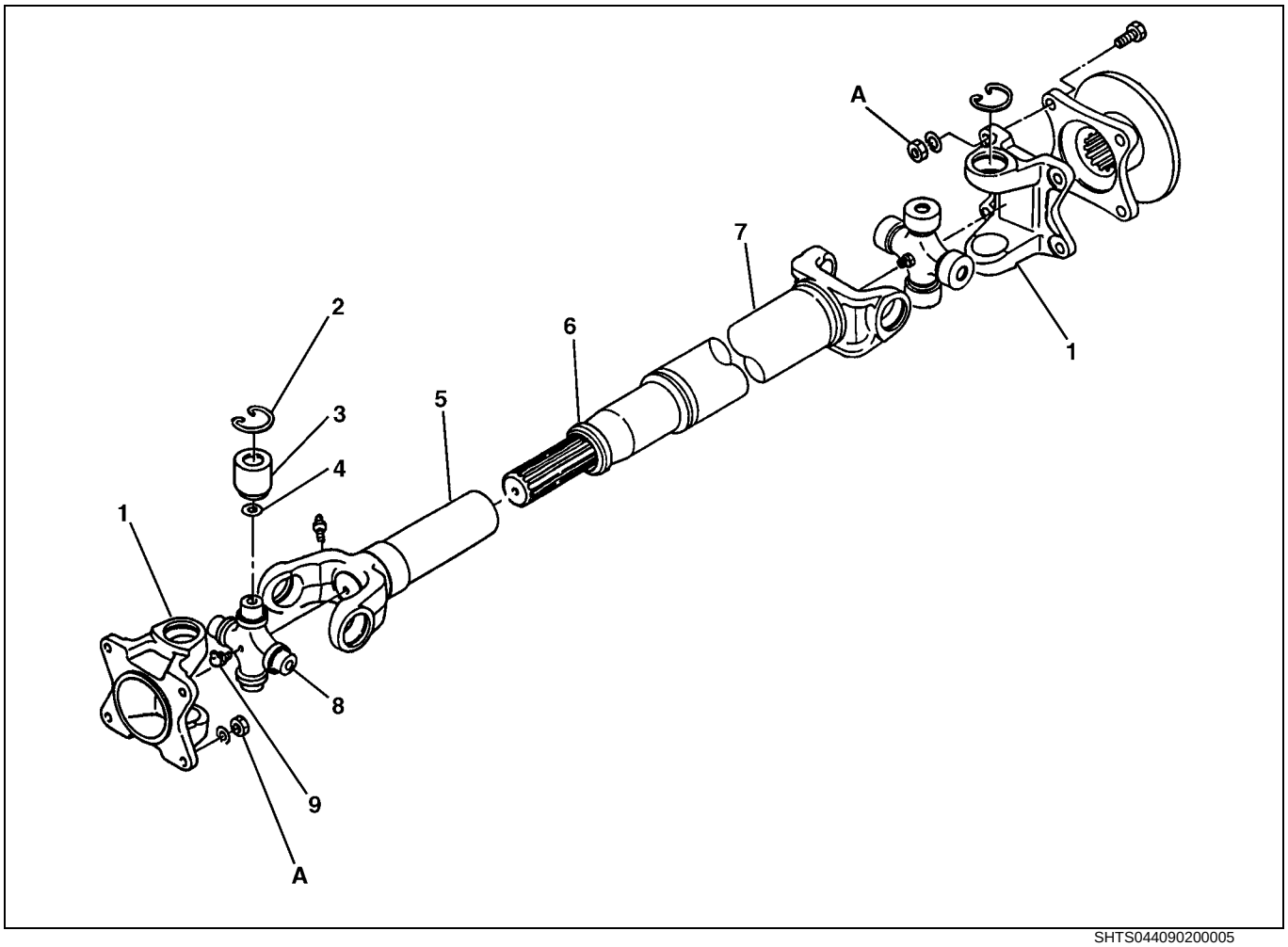
SHTS044090200004

1	Universal joint yoke	9	Lock nut
2	Retainer ring	10	Universal joint flange
3	Universal joint spider	11	Collar
4	Yoke shaft	12	Center bearing holder
5	Center bearing	13	Dust deflector
6	Center bearing plate	14	Needle roller bearing
7	Center bearing cushion	15	Thrust washer
8	Lubrication fitting		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	588.4-784.6 {6,000-8,000, 434-578}	C	41.5-61.5 {424-672, 31-45}
B	22.4-30.6 {229-312, 17-22}	D	61-91 {623-927, 45-67}

REAR



SHTS044090200005

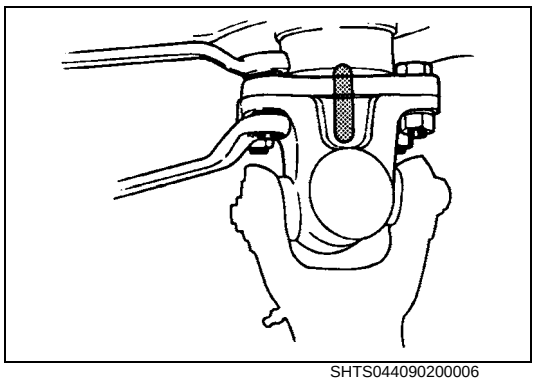
1	Universal joint yoke	6	Dust cover seal
2	Retainer ring	7	Yoke shaft
3	Needle roller bearing	8	Universal joint spider
4	Thrust washer	9	Lubrication fitting
5	Sliding yoke		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	61-91 {623-927, 45-67}		

OVERHAUL

EN0440902H200001


SHTS044090200006

IMPORTANT POINT - DISMOUNTING

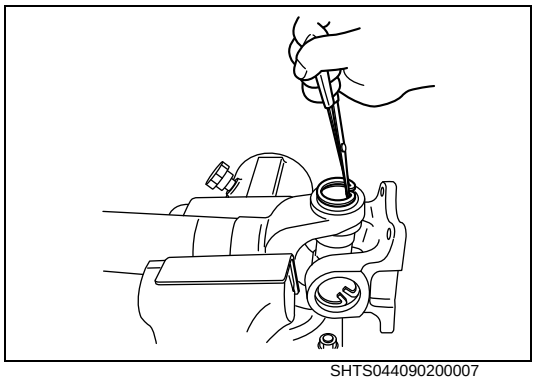
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and universal joint yoke.

(2) Remove the nuts and the bolts.

NOTICE

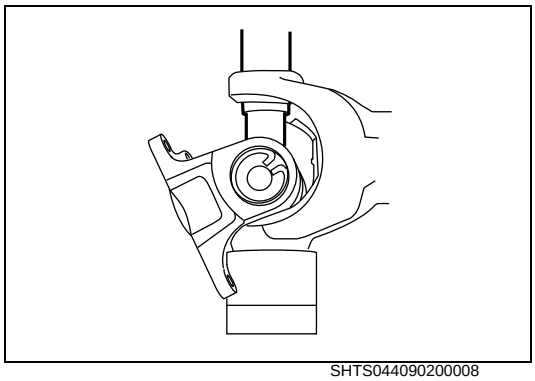
Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.


SHTS044090200007

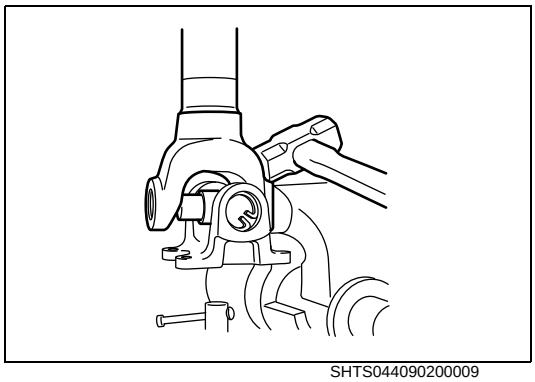
IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the retainer ring from the yoke.


SHTS044090200008

(2) Position the yoke under the arbor press and push universal joint partially out of the yoke lug. The bearing race will now protrude from the yoke.


SHTS044090200009

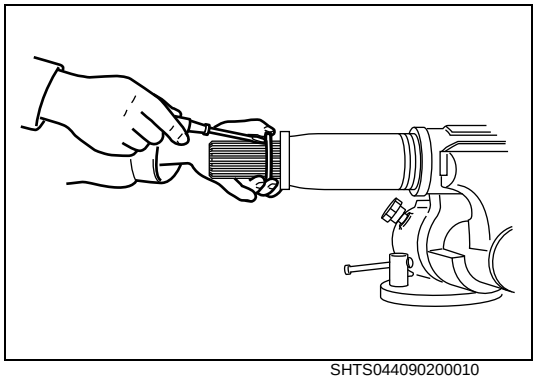
(3) Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise. Tap the yoke in area shown to achieve removal of universal joint bearing.

(4) Press the opposite bearing out of the yoke lug.

(5) Remove the spider with universal joint yoke from the yoke.

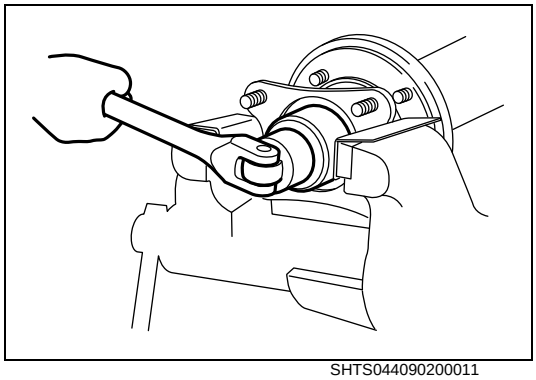
NOTICE

Keep the original location of the bearings, thrust washers, spider and retainer rings in mind. These parts have to be replaced in the same position as before disassembly when reassembling.


SHTS044090200010

2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE. (REAR)

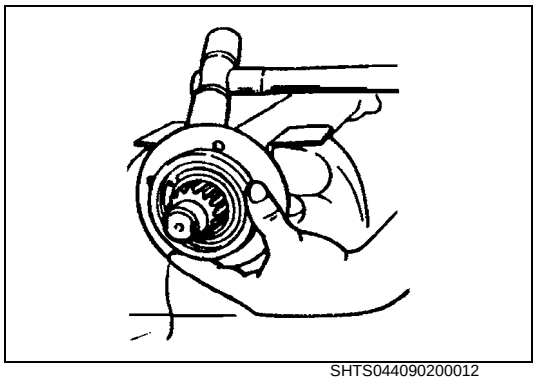
(1) Separate the yoke shaft and sliding yoke.
(2) Remove the dust cover seal from the yoke shaft.


SHTS044090200011

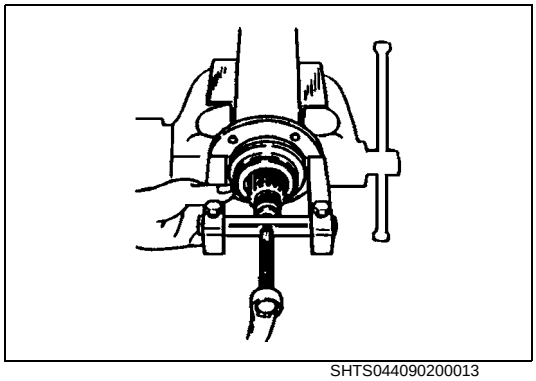
3. REMOVE THE CENTER BEARING.

(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
SST: Socket Wrench (S0983-94104)

(5) Remove the universal joint flange from the shaft.

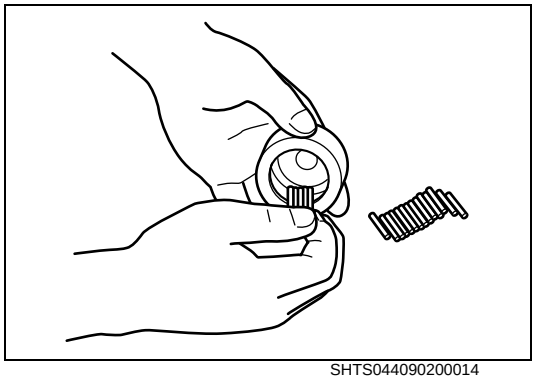

SHTS044090200012

(6) Using a hammer, tap the bearing plate to make a clearance.


SHTS044090200013

(7) Using a commercial puller, remove the center bearing.

NOTICE
Be careful not to catch your fingers between bearing plate and dust deflector.


SHTS044090200014

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

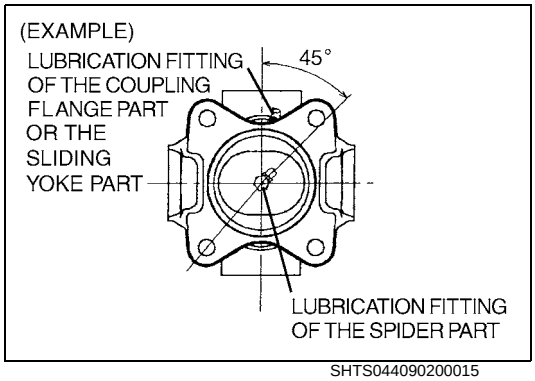
Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.

2. INSTALL THE UNIVERSAL JOINT SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

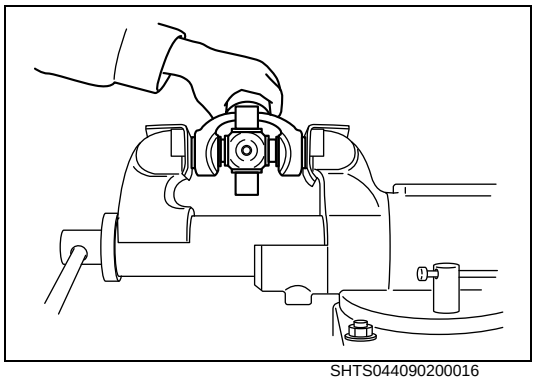
(1) Put the universal joint spider into the yoke and then set the needle roller bearings on the yoke.

NOTICE

When installing the spider to the yoke shaft, install the lubrication fitting to the spider should be made the direction of the lubrication fitting of the coupling flange part or the sliding yoke part as shown in the figure.



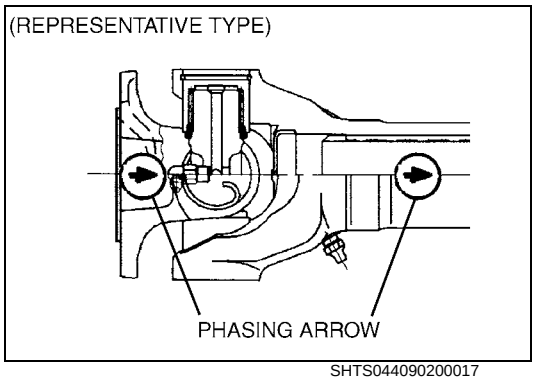
SHTS044090200015


SHTS044090200016

(2) Press the universal joint bearings into the yokes over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.

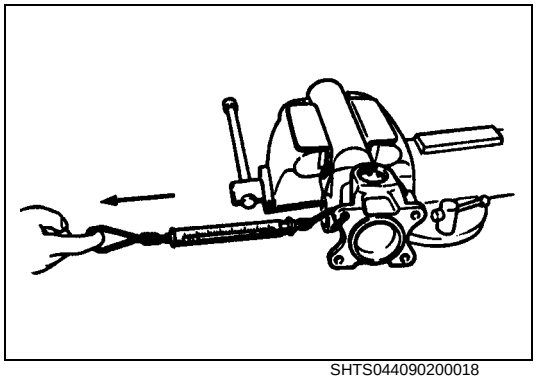


SHTS044090200017

(3) Install the universal joint yoke to the universal joint spider.

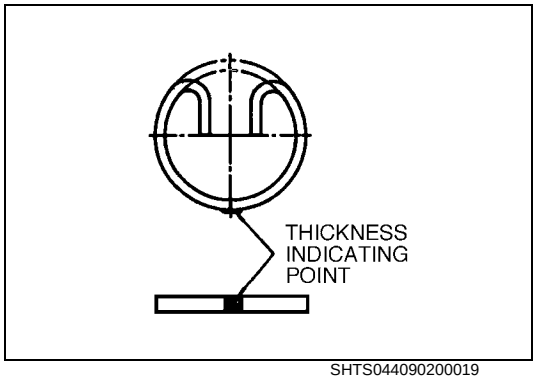
NOTICE

Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.



SHTS044090200018

3. CHECK THE STARTING TORQUE OF THE UNIVERSAL JOINT USING A SPRING BALANCER.
Assembly Standard: 1.47-4.9 N·m {15-50 kgf·cm, 13-43 lbf·in.}



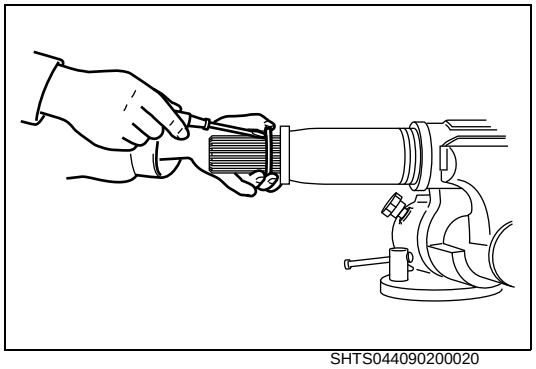
SHTS044090200019

(1) If the measuring value is below the assembly standard, replace the retainer ring with the thicker one.
(2) If the measuring value is above the assembly standard, replace the retainer ring with the thinner one.

NOTICE
Use retainer rings of the same thickness as possible for both ends.

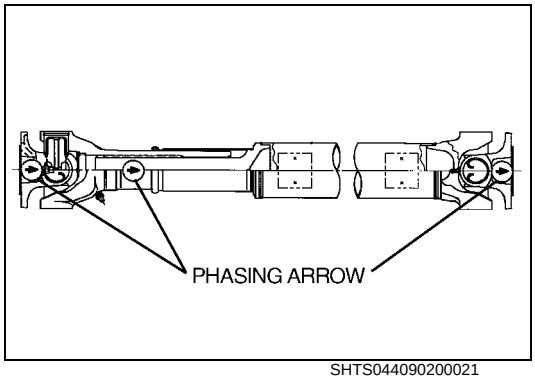
Unit: mm {in.}

Thickness of retainer ring	Color of thickness indication point
2.22 {0.0874}	White
2.30 {0.0906}	Red
2.38 {0.0937}	Green



SHTS044090200020

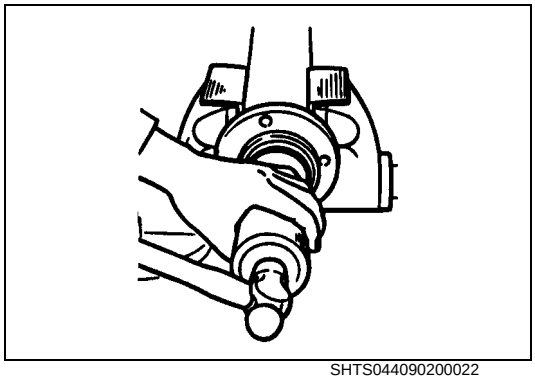
4. INSTALL THE DUST COVER SEAL.
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new dust cover seal on the shaft by pushing it in the seal groove.
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust cover seal.



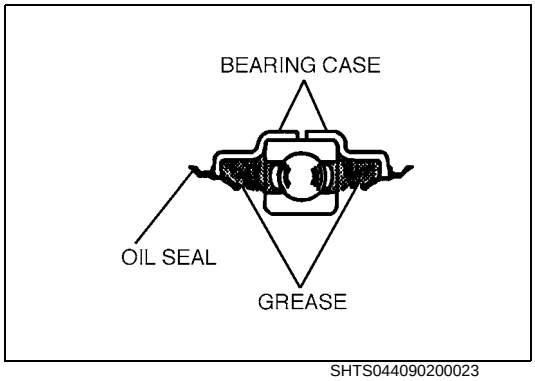
SHTS044090200021

5. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.

(1) Align the phasing arrows as shown in the figure.


SHTS044090200022

6. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING.

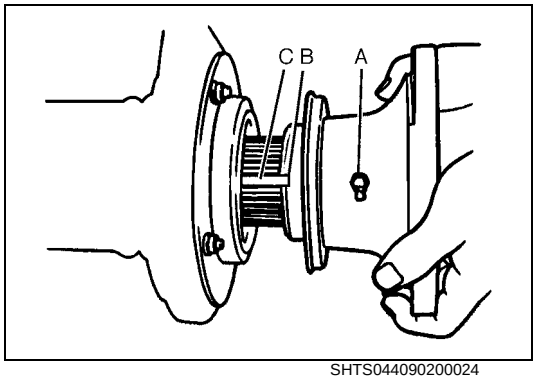


SHTS044090200023

NOTICE

Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.

Grease:
Refer to owner's manual.



SHTS044090200024

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to 80-100°C {76-212°F}.

NOTICE

- **Do not heat the universal joint flange in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

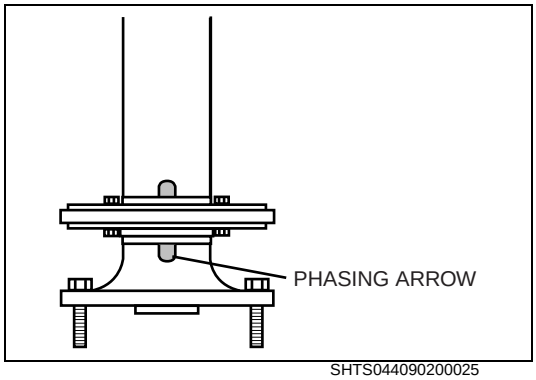
⚠ CAUTION
Never touch hot water or oil nor heated universal joint flange with your bare band. This can result in personal injury.

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

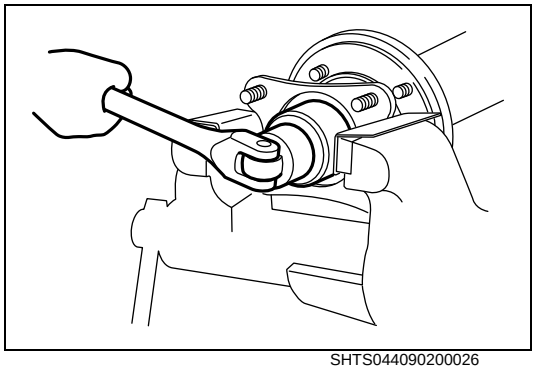
NOTICE
Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper specified torque.

   c. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.

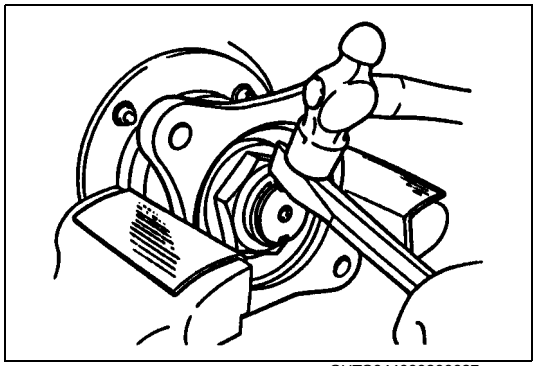


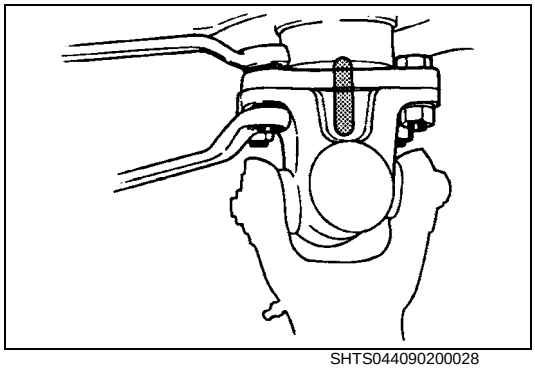
SHTS044090200025

   d. Using the special tool, tighten the lock nut.
   SST: Socket Wrench (S0983-94104)


SHTS044090200026

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


SHTS044090200027


SHTS044090200028

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.

(1) Align the matching marks on the flange and universal joint yoke.

(2) Tighten the bolts and nuts.

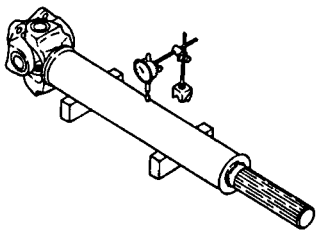
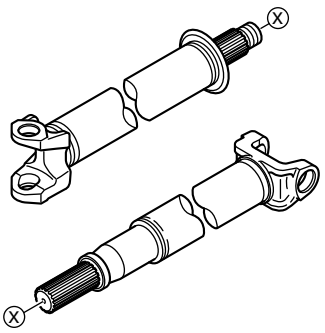
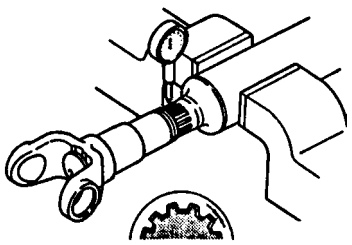
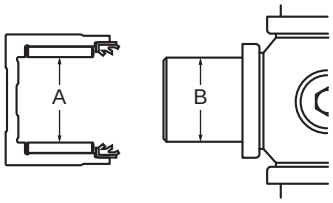
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0440902H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	0-0.6 {0-0.0236}	1.0 {0.039}	Replace.	Measure 
Crack in the welding beads	—	—	Replace, if necessary.	Visual check 
Sliding spline damage	—	—	Replace, if necessary.	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 60 mm {2.362 in.} from the shaft center.)	At spline 0.062-0.174 {0.0025-0.0068}	0.25 {0.0098}	Replace.	Measure 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)	0.024-0.064 {0.0010-0.0025}	0.1 {0.0039}	Replace needle roller bearing sub-assembly or universal joint spider.	Measure 

PROPELLER SHAFT (MC0000)

PP02-003

PROPELLER SHAFT ASSEMBLY PP02-2
DATA AND SPECIFICATIONS..... PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING..... PP02-3
SPECIAL TOOL..... PP02-3
COMPONENT LOCATOR PP02-4
OVERHAUL PP02-5
INSPECTION AND REPAIR..... PP02-10

PROPELLER SHAFT ASSEMBLY

DATA AND SPECIFICATIONS

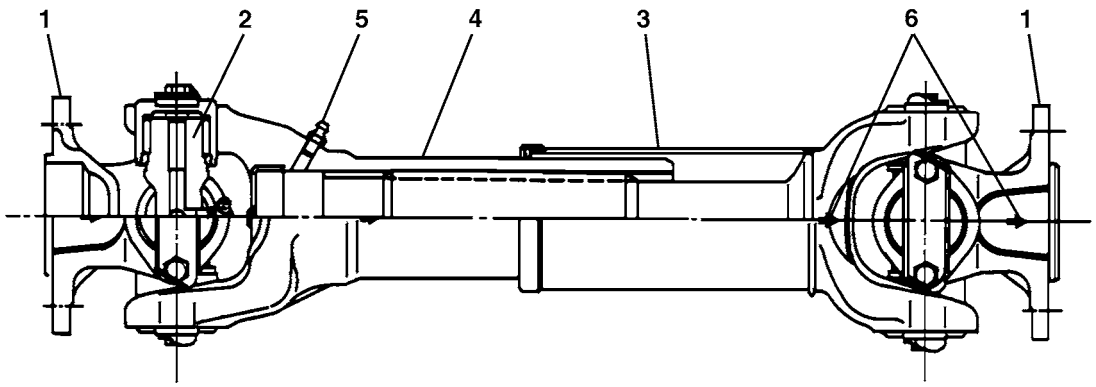
EN0441702I200001

Type	**Tubeless shaft type [Rear axle (Front) to Rear axle (Rear)]**
Universal joint	**All metal, round bearing type with needle roller bearing**

DESCRIPTION

EN0441702C100001

REAR AXLE (FRONT) TO REAR AXLE (REAR)



SHTS044170200001

1	**Universal joint yoke**	**4**	**Sliding yoke**
2	**Needle roller bearing**	**5**	**Lubrication fitting**
3	**Yoke shaft**	**6**	**Phasing arrow**

TROUBLESHOOTING

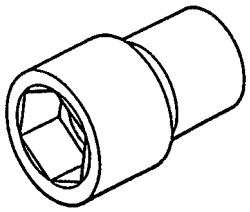
EN0441702F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0441702K100001

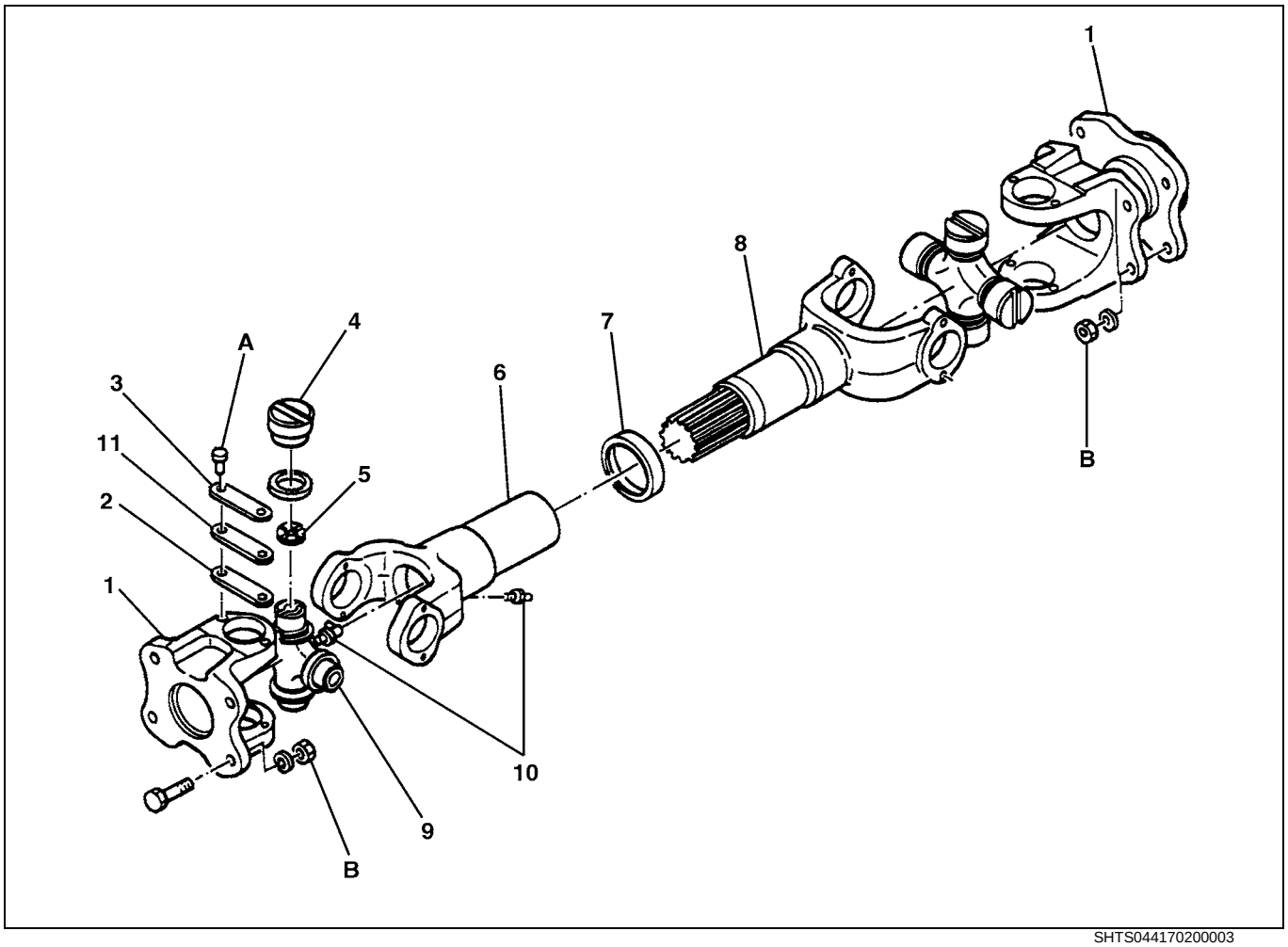
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	S0983-94601	SOCKET WRENCH	

COMPONENT LOCATOR

EN0441702D100001

REAR AXLE (FRONT) TO REAR AXLE (REAR)



SHTS044170200003

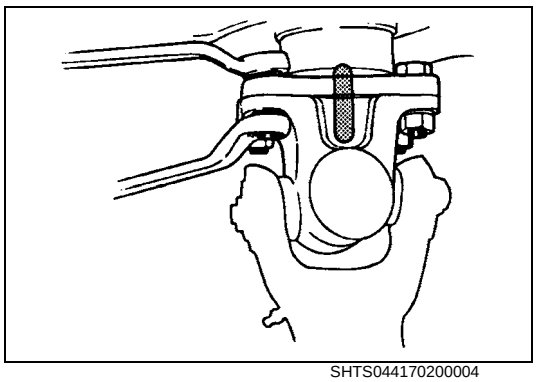
1	Universal joint yoke	7	Dust seal
2	Universal joint cap	8	Yoke shaft
3	Lock plate	9	Universal joint spider
4	Needle roller bearing	10	Lubrication fitting
5	Thrust washer	11	Balance piece (If so equipped)
6	Sliding yoke		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	25.5-31.3 {270-310, 20-22}	B	127.5-156.9 {1,300-1,600, 94-115}

OVERHAUL

EN0441702H200001



SHTS044170200004

IMPORTANT POINT - DISMOUNTING

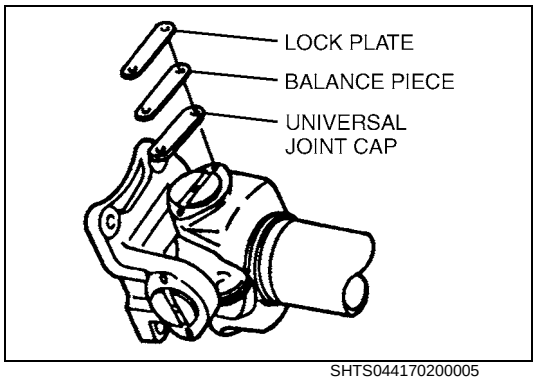
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and universal joint yoke.

(2) Remove the nuts and the bolts.

NOTICE

Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.



SHTS044170200005

IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the lock plate.

NOTICE

For some models, one additional lock plate is installed as an additional balance on one of the bearing.

(2) Remove the balance piece, if so equipped.

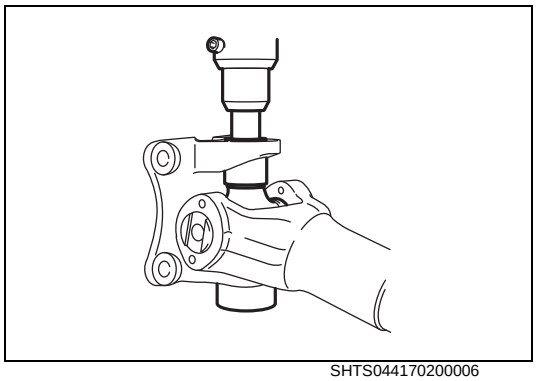
NOTICE

Some models are equipped with one, two, or three balance pieces between the lock plate and universal joint cap of one of the bearing.

(3) Remove the universal joint cap.

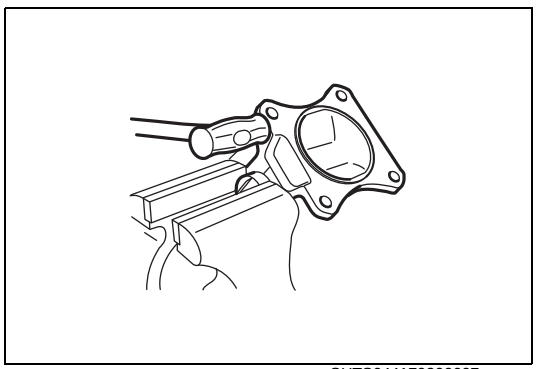
(4) Remove the universal joint bearings and universal joint spider from the universal joint yoke.

a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.



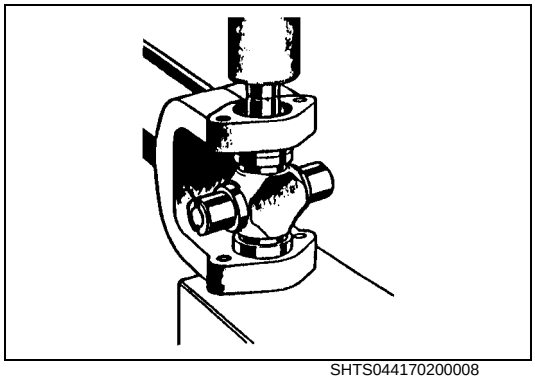
SHTS044170200006

b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of universal joint bearing.

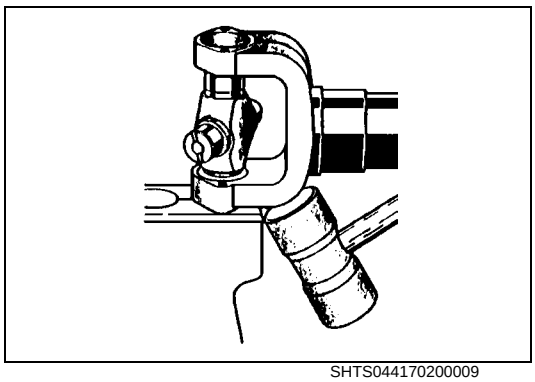


SHTS044170200007

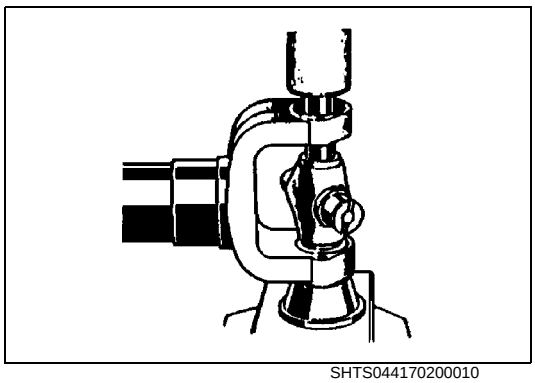
c. Press the opposite bearing out of he yoke lug.


SHTS044170200008

(5) Remove the needle roller bearings and universal joint spider from the yoke.
   a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
      The bearing race will now protrude from the yoke.


SHTS044170200009

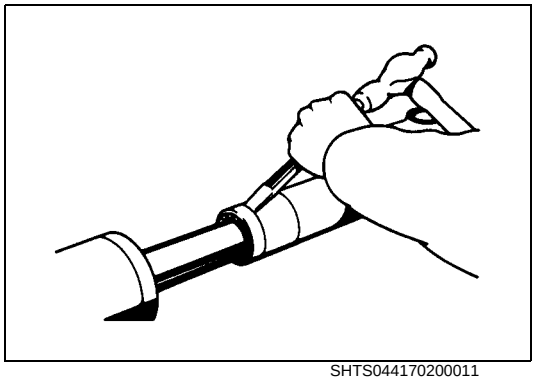
   b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
      Tap the yoke in area shown to achieve removal of needle roller bearing.


SHTS044170200010

   c. Place the yoke under the arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
   d. Press the opposite bearing out of the yoke lug.
   e. Remove the spider from the yoke.

NOTICE

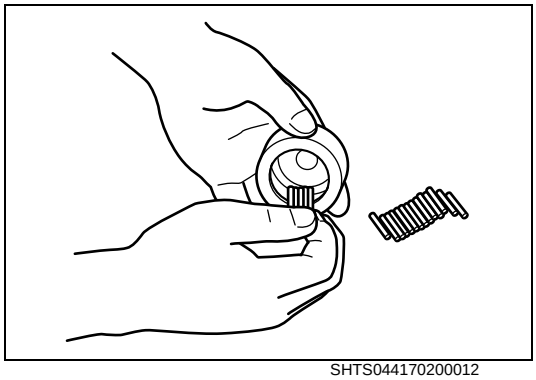
- **Keep the location and number of lock plate or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**


SHTS044170200011

2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.

(1) Uncaulk the felt ring retainer from the groove on the sliding yoke.
(2) Separate the yoke shaft and sliding yoke.
(3) Remove the felt seal, split retainers and felt ring retainer from the yoke shaft.

⚠ CAUTION
When uncaulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.


SHTS044170200012

IMPORTANT POINTS - ASSEMBLY

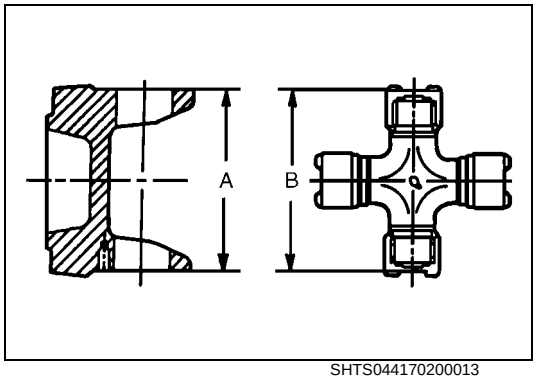
1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

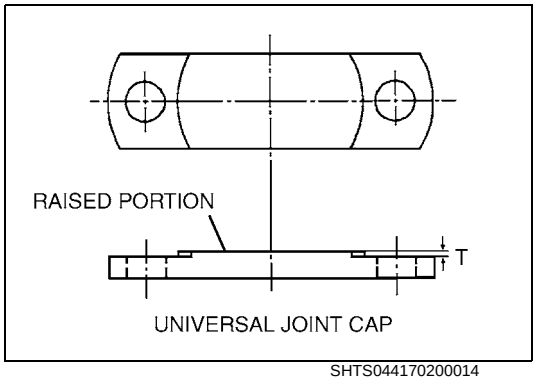
Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.



SHTS044170200013

2. INSTALL THE SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

(1) Select a thickness for the raised portion "T" of the universal joint cap so that measurements "B" is equivalent to measurements "A". Use universal joint caps of the same thickness as possible for both ends.



SHTS044170200014

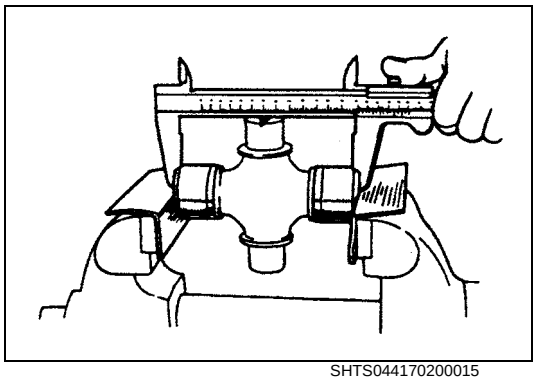
Universal joint caps are available in following thickness.

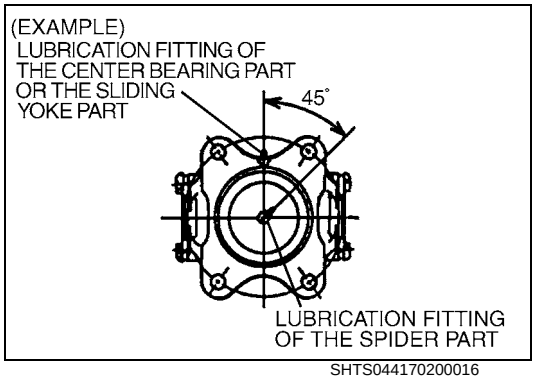
Unit: mm {in.}

Thickness of raised portion "T" of universal joint cap	Color code
0.00	Silver
0.04 {0.0016}	Yellow
0.08 {0.0031}	Black
0.12 {0.0047}	Green

NOTICE

When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.


SHTS044170200015

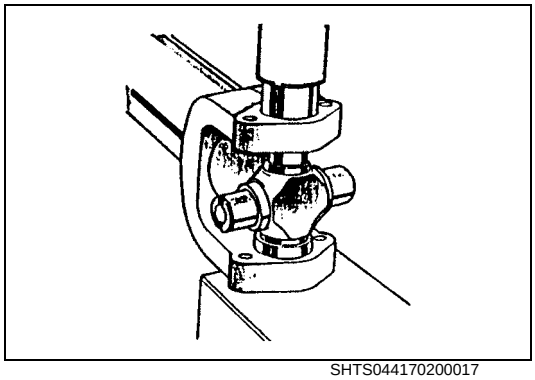


SHTS044170200016

(2) Put the universal joint spider into the yoke and then set the universal joint bearings on the yoke.

NOTICE

When installing the spider to the yoke shaft, install the lubrication fitting to the spider should be made an angle of 45° with the lubrication fitting of the center bearing part or the sliding yoke part as shown in the figure.

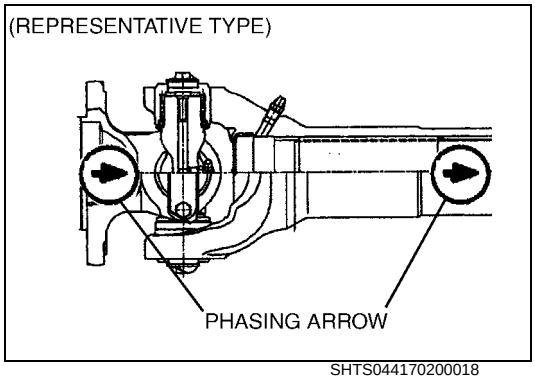

SHTS044170200017

(3) Press the universal joint bearings into the yokes over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.

(4) Install the universal joint yokes to the universal joint spider.



SHTS044170200018

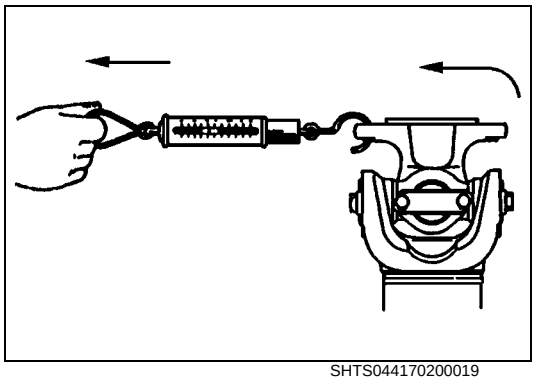
NOTICE

Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.

(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock plate, and tighten the universal joint cap.

NOTICE

Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing bore the yoke shaft and sliding yoke.


SHTS044170200019

(6) Check the starting torque of the universal joint using a spring balancer.

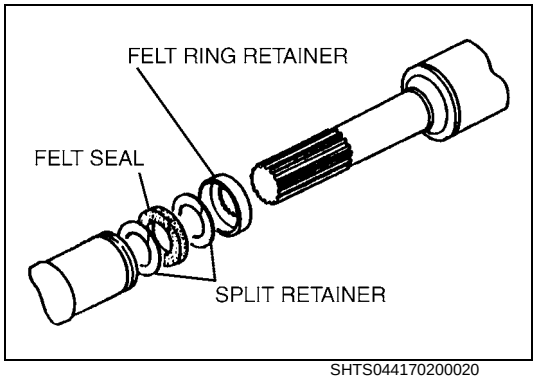
(7) After tightening the universal joint cap, bend the lock plate so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock plate and the bolt. Also, upon fitting the lock plate against the bolt, check the bent portion of the lock plate to make sure there are no cracks or fissures.

Assembly standard:

0.98-3.92 N·m {10-40 kgf·cm, 8.7-34.7 lbf·in.}

a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.

b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.



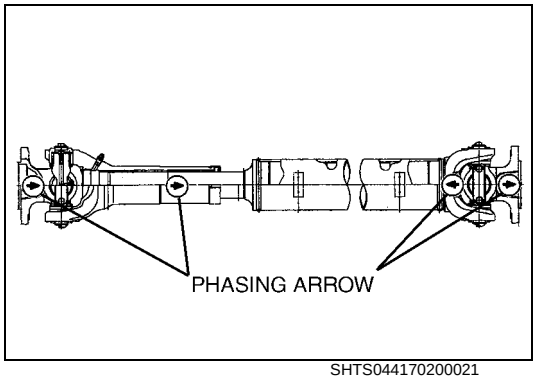
SHTS044170200020

3. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.

(1) Remove the stale grease from the spline of the yoke shaft.

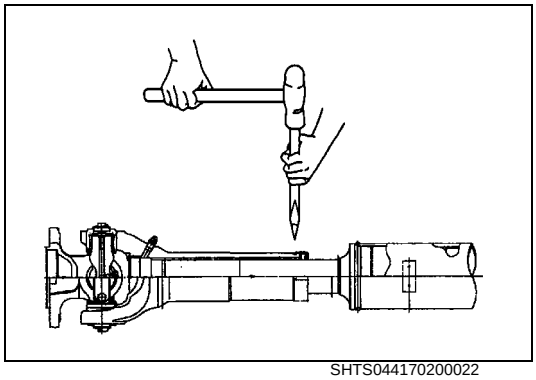
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt seal.



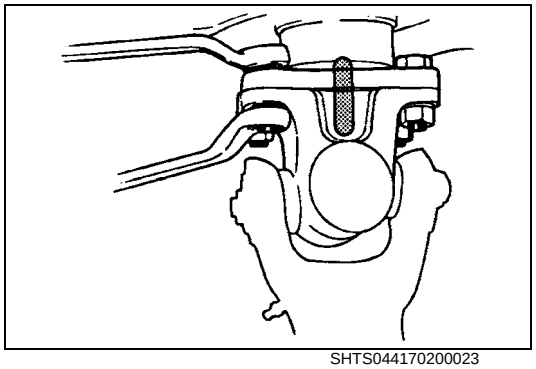
SHTS044170200021

(4) Align the phasing arrows as shown in figure.


SHTS044170200022

(5) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.
Caulking Width: 10-15 mm {0.394-0.591 in.}

⚠ CAUTION
When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.


SHTS044170200023

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.

(1) Align the matching marks on the flange and universal joint yoke.

(2) Tighten the bolts and nuts.

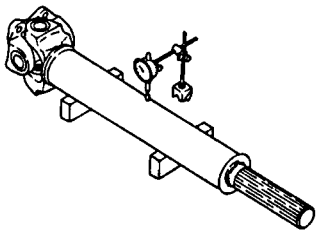
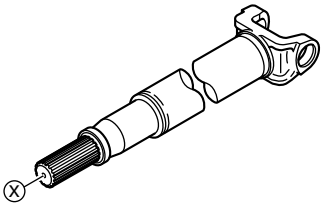
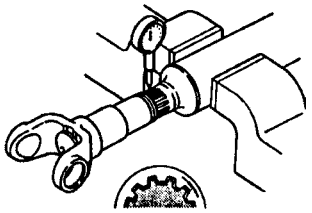
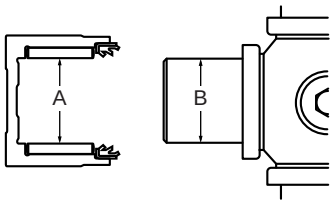
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0441702H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	0-0.5 {0-0.0197}	1.0 {0.0393}	Replace.	Measure 
Crack in the welding beads	—	—	Replace, if necessary.	Visual check 
Sliding spline damage	—	—	Replace, if necessary.	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80 mm {3.150 in.} from the shaft center.)	At spline 0.062-0.174 {0.0025-0.0068}	0.25 {0.0098}	Replace.	Measure 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)	0.020-0.054 {0.0008-0.0021}	0.1 {0.0039}	Replace needle roller bearing sub-assembly or universal joint spider.	Measure 

PROPELLER SHAFT (MC1040)

PP02-004

PROPELLER SHAFT ASSEMBLY PP02-2

DATA AND SPECIFICATIONS..... PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING..... PP02-3
SPECIAL TOOL..... PP02-3
COMPONENT LOCATOR PP02-4
OVERHAUL PP02-6
INSPECTION AND REPAIR..... PP02-14

PROPELLER SHAFT ASSEMBLY

DATA AND SPECIFICATIONS

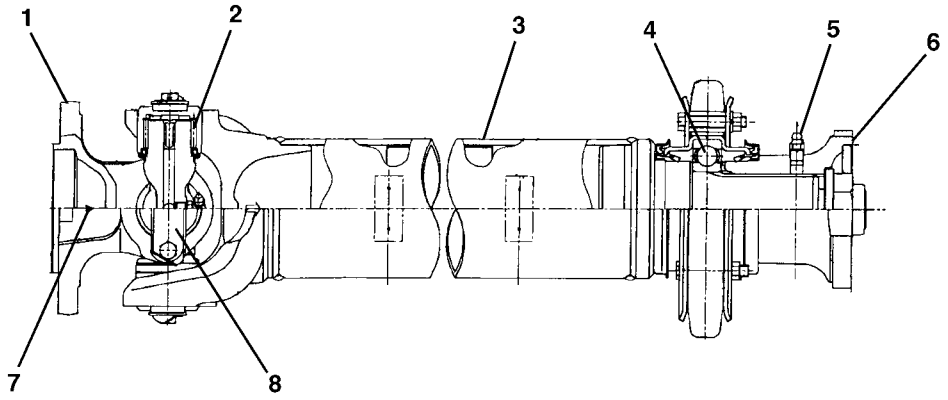
EN0441202I200001

Type	**Tubular shaft type**
Universal joint	**All metal, round bearing type with needle roller bearing**

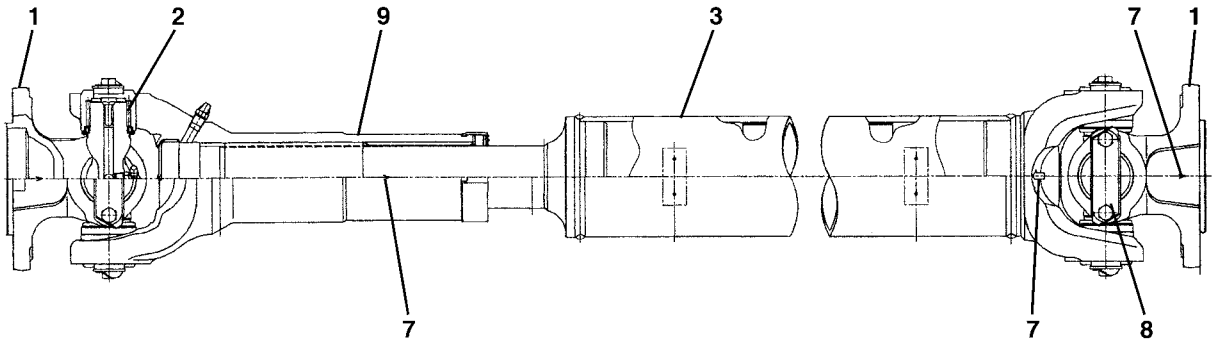
DESCRIPTION

EN0441202C100001

FRONT



REAR



SHTS044120200001

1	**Universal joint yoke**	**6**	**Universal joint flange**
2	**Needle roller bearing**	**7**	**Phasing arrow**
3	**Yoke shaft**	**8**	**Lock plate**
4	**Center bearing**	**9**	**Sliding yoke**
5	**Lubrication fitting**		

TROUBLESHOOTING

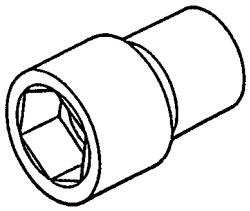
EN0441202F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Worn or damaged center bearing	Replace the bearing.
	Worn or damaged center bearing rubber cushion	Replace the rubber cushion.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0441202K100001

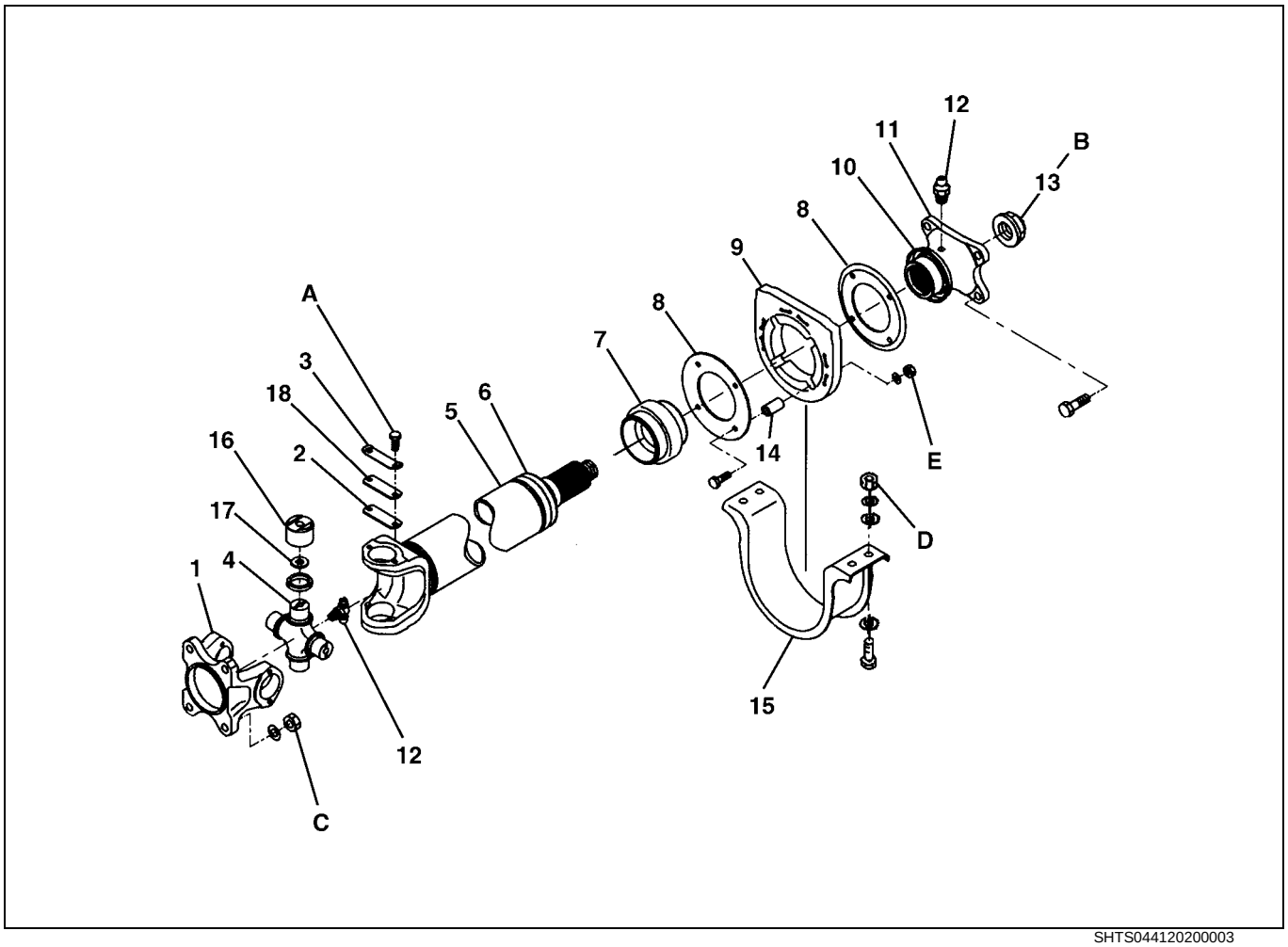
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	S0983-94601	SOCKET WRENCH	

COMPONENT LOCATOR

EN0441202D100001

FRONT



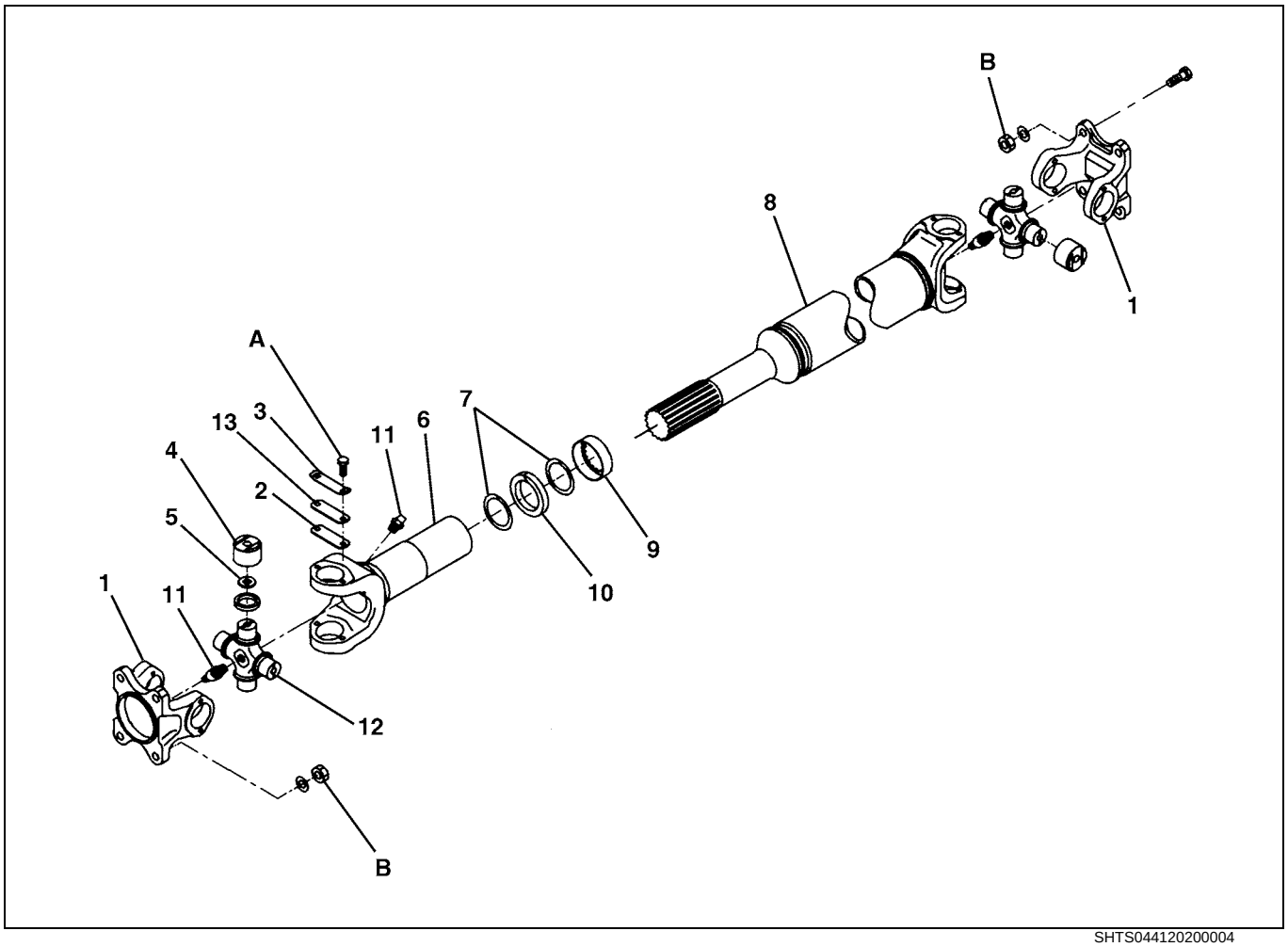
SHTS044120200003

1	Universal joint yoke	10	Dust deflector
2	Universal joint cap	11	Universal joint flange
3	Lock plate	12	Lubrication fitting
4	Universal joint spider	13	Lock nut
5	Yoke shaft	14	Collar
6	Dust deflector	15	Center bearing holder
7	Center bearing	16	Needle roller bearing
8	Center bearing plate	17	Thrust washer
9	Center bearing cushion	18	Balance piece (If so equipped)

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	25.5-31.3 {260-320, 19-23}	D	96-144 {980-1,470, 71-105}
B	588.5-784.5 {6,000-8,000, 434-578}	E	18.8-25.4 {190-260, 14-19}
C	127.4-156.8 {1,300-1,600, 94-115}		

REAR



SHTS044120200004

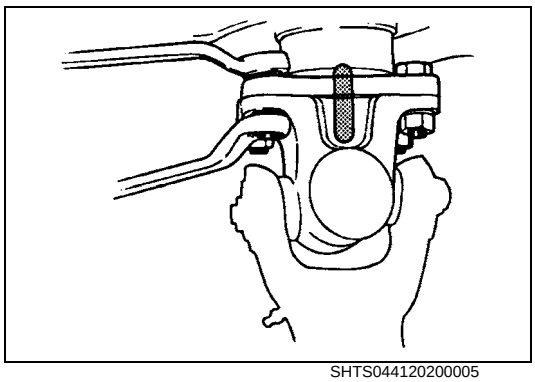
1	Universal joint yoke	8	Yoke shaft
2	Universal joint cap	9	Felt ring retainer
3	Lock plate	10	Felt seal
4	Needle roller bearing	11	Lubrication fitting
5	Thrust washer	12	Universal joint spider
6	Sliding yoke	13	Balance piece (If so equipped)
7	Split retainer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	25.5-31.3 {260-320, 19-23}	B	127.4-156.8 {1,300-1,600, 94-115}

OVERHAUL

EN0441202H200001



SHTS044120200005

IMPORTANT POINT - DISMOUNTING

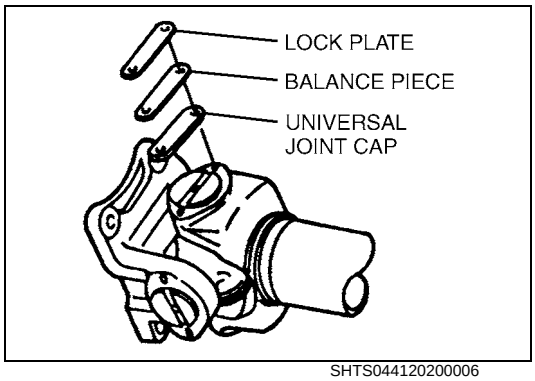
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and universal joint yoke.

(2) Remove the nuts and the bolts.

NOTICE

Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.



SHTS044120200006

IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the lock plate.

NOTICE

For some models, one additional lock plate is installed as an additional balance on one of the bearing.

(2) Remove the balance piece, if so equipped.

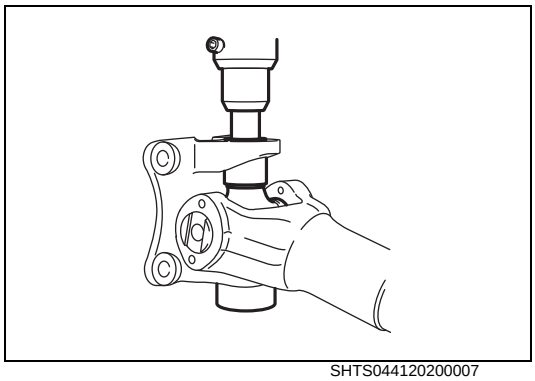
NOTICE

Some models are equipped with one, two, or three balance pieces between the lock plate and universal joint cap of one of the bearing.

(3) Remove the universal joint cap.

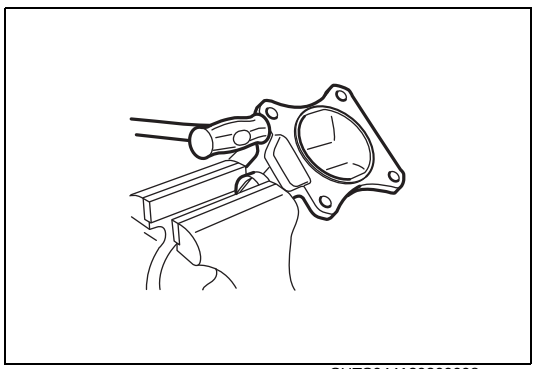
(4) Remove the universal joint bearings and universal joint spider from the universal joint yoke.

a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.



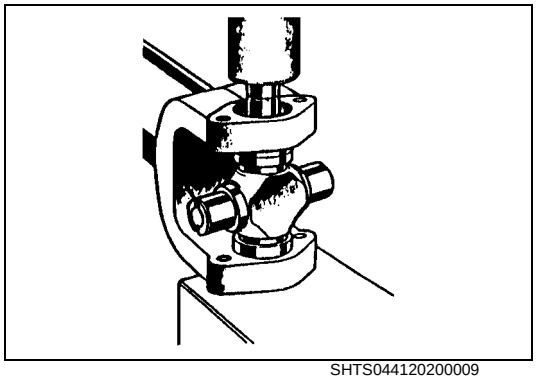
SHTS044120200007

b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of universal joint bearing.

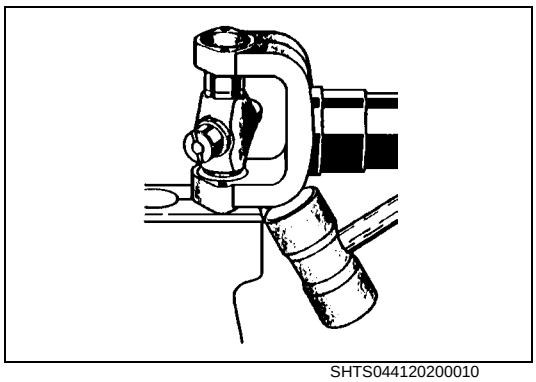


SHTS044120200008

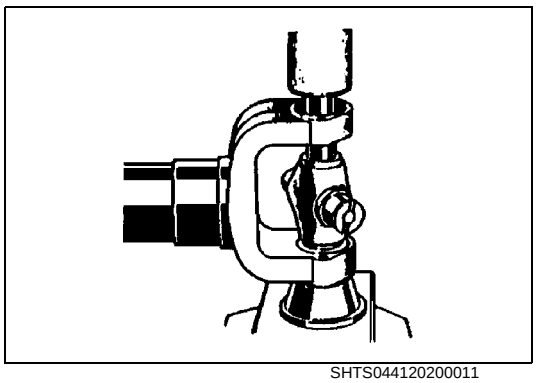
c. Press the opposite bearing out of he yoke lug.


SHTS044120200009

(5) Remove the needle roller bearings and universal joint spider from the yoke.
   a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
      The bearing race will now protrude from the yoke.


SHTS044120200010

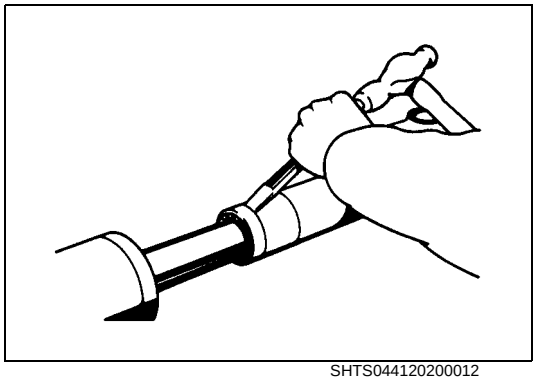
   b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
      Tap the yoke in area shown to achieve removal of needle roller bearing.


SHTS044120200011

   c. Place the yoke under the arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
   d. Press the opposite bearing out of the yoke lug.
   e. Remove the spider from the yoke.

NOTICE

- **Keep the location and number of lock plate or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**

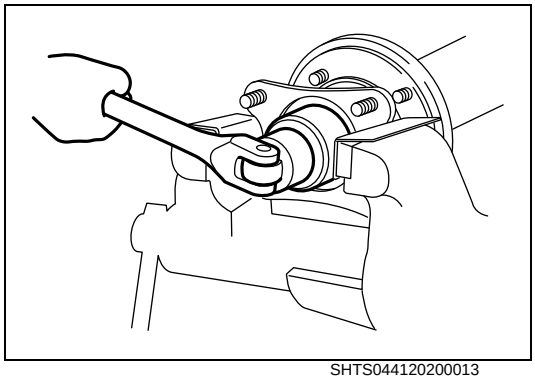

SHTS044120200012

2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.

(1) Uncaulk the felt ring retainer from the groove on the sliding yoke.
(2) Separate the yoke shaft and sliding yoke.
(3) Remove the felt seal, split retainers and felt ring retainer from the yoke shaft.

⚠ CAUTION

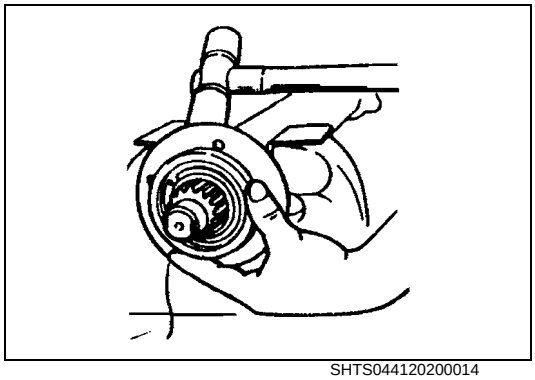
When uncaulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.


SHTS044120200013

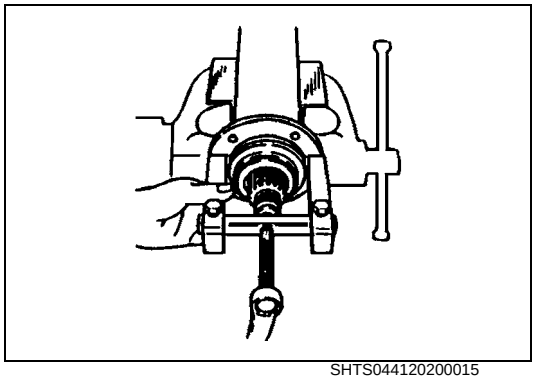
3. REMOVE THE CENTER BEARING.

(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
SST: Socket Wrench (S0983-94601)

(5) Remove the universal joint flange from the shaft.

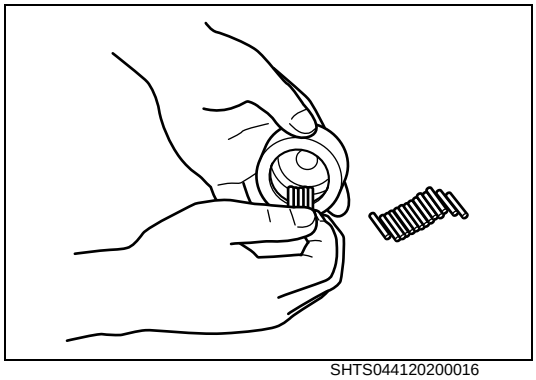

SHTS044120200014

(6) Using a hammer, tap the bearing plate to make a clearance.


SHTS044120200015

(7) Using a commercial puller, remove the center bearing.

NOTICE
Be careful not to catch your fingers between bearing plate and dust deflector.


SHTS044120200016

IMPORTANT POINTS - ASSEMBLY

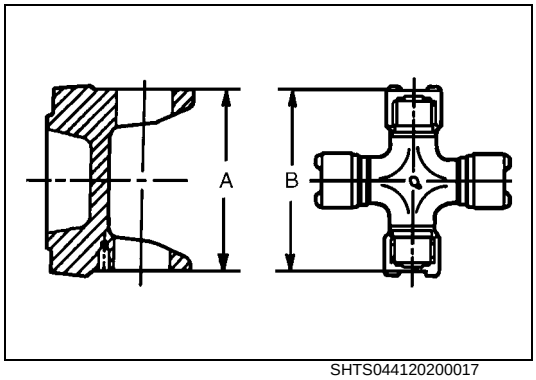
1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

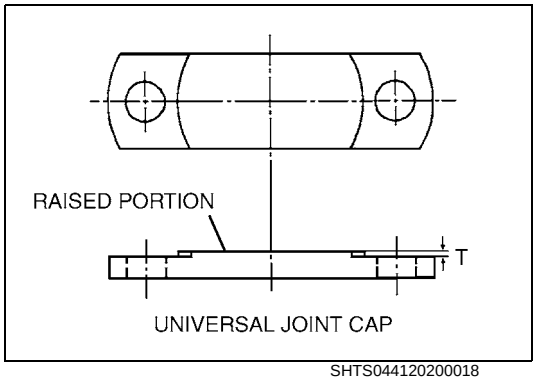
Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.



SHTS044120200017

2. INSTALL THE SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

(1) Select a thickness for the raised portion "T" of the universal joint cap so that measurements "B" is equivalent to measurements "A". Use universal joint caps of the same thickness as possible for both ends.



SHTS044120200018

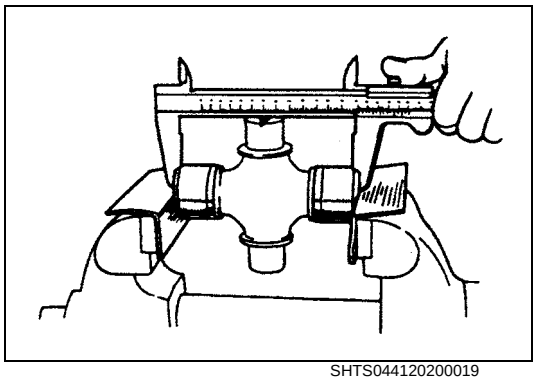
Universal joint caps are available in following thickness.

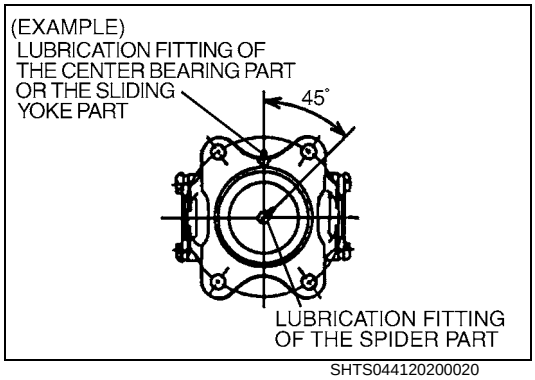
Unit: mm {in.}

Thickness of raised portion "T" of universal joint cap	Color code
0.00	Silver
0.04 {0.0016}	Yellow
0.08 {0.0031}	Black
0.12 {0.0047}	Green

NOTICE

When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.


SHTS044120200019

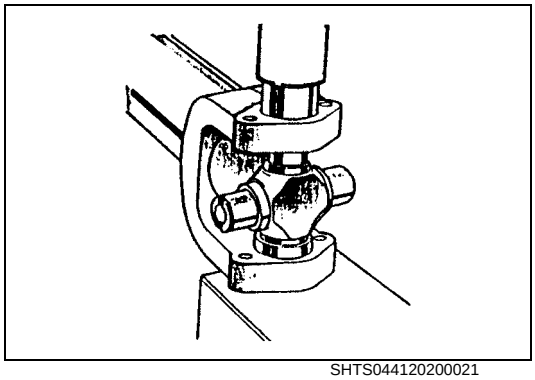


SHTS044120200020

(2) Put the universal joint spider into the yoke and then set the universal joint bearings on the yoke.

NOTICE

When installing the spider to the yoke shaft, install the lubrication fitting to the spider should be made an angle of 45° with the lubrication fitting of the center bearing part or the sliding yoke part as shown in the figure.

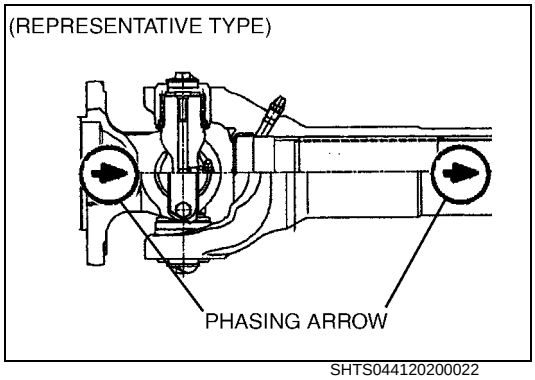

SHTS044120200021

(3) Press the universal joint bearings into the yokes over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.

(4) Install the universal joint yokes to the universal joint spider.



SHTS044120200022

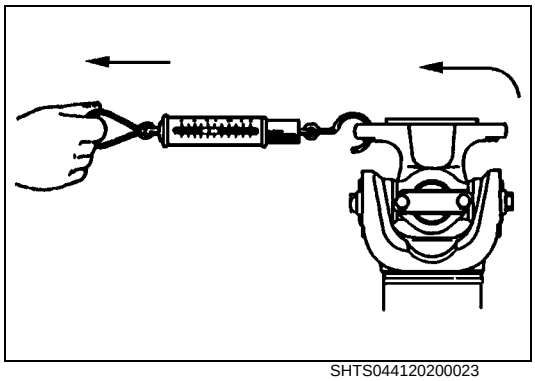
NOTICE

Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.

(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock plate, and tighten the universal joint cap.

NOTICE

Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing bore the yoke shaft and sliding yoke.


SHTS044120200023

(6) Check the starting torque of the universal joint using a spring balancer.

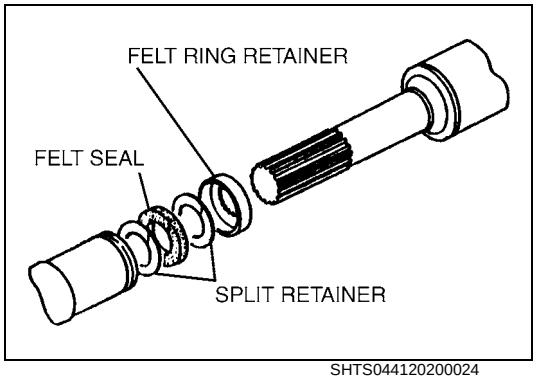
(7) After tightening the universal joint cap, bend the lock plate so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock plate and the bolt. Also, upon fitting the lock plate against the bolt, check the bent portion of the lock plate to make sure there are no cracks or fissures.

Assembly standard:

0.98-3.92 N·m {10-40 kgf·cm, 8.7-34.7 lbf·in.}

a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.

b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.



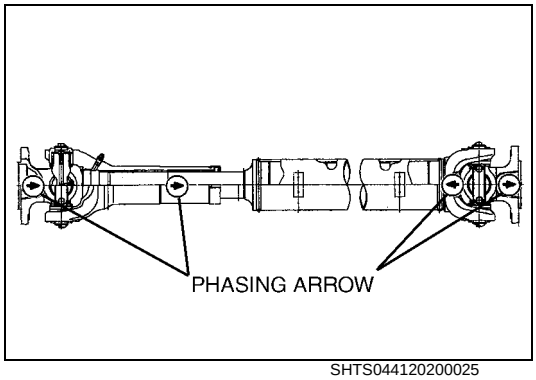
SHTS044120200024

3. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.

(1) Remove the stale grease from the spline of the yoke shaft.

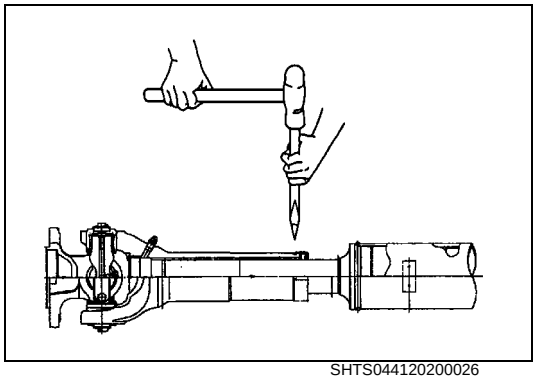
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt seal.



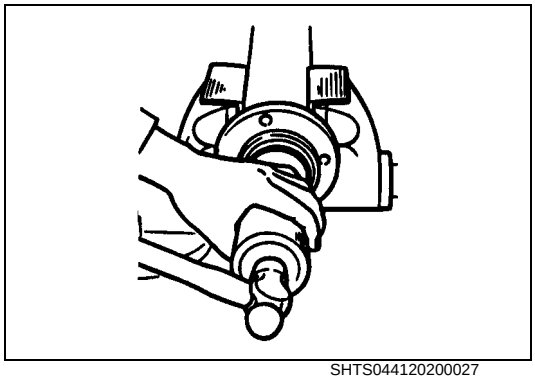
SHTS044120200025

(4) Align the phasing arrows as shown in figure.


SHTS044120200026

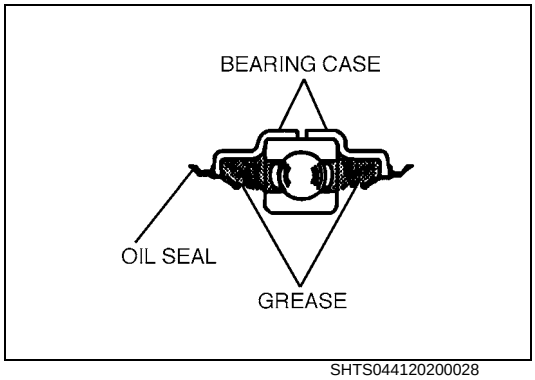
(5) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.
Caulking Width: 10-15 mm {0.394-0.591 in.}

⚠ CAUTION
When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.



SHTS044120200027

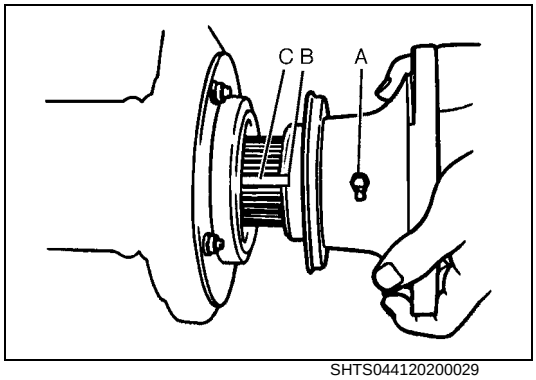
4. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING ASSEMBLY.



SHTS044120200028

NOTICE
Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.

Grease:
Refer to owner's manual.



SHTS044120200029

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to between 80-100°C {176-212°F}.

NOTICE

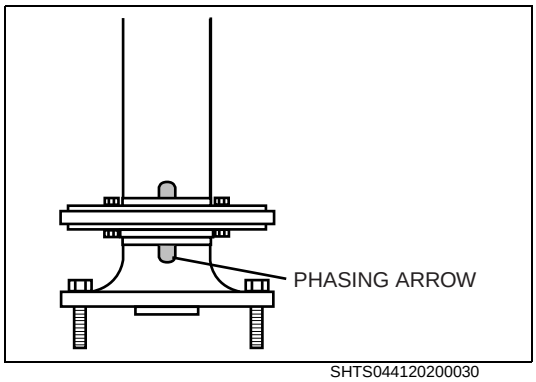
- **Do not heat the universal joint flange in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION
Never touch hot water or oil and heated universal joint flange with your bare band. This can result personal injury.

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

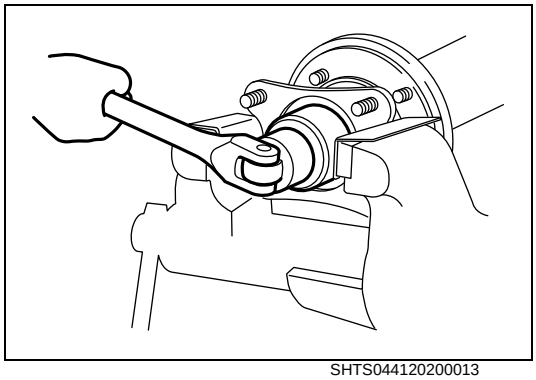
- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

NOTICE
Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.

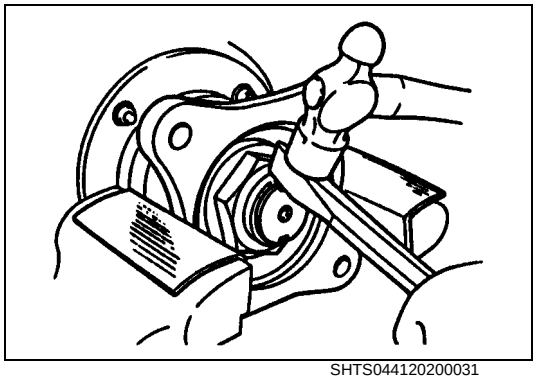


SHTS044120200030

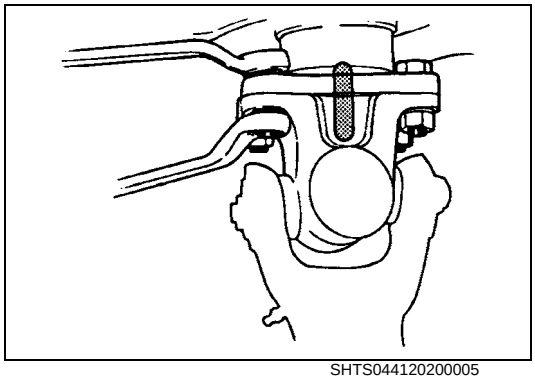
   c. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.


SHTS044120200013

   d. Using the special tool, tighten the lock nut.
   SST: Socket Wrench (S0983-94601)


SHTS044120200031

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


SHTS044120200005

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.

(1) Align the matching marks on the flange and universal joint yoke.

(2) Tighten the bolts and nuts.

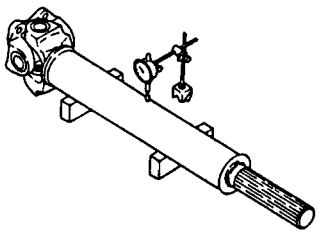
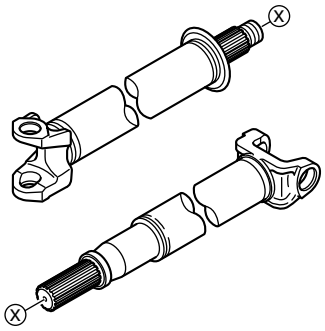
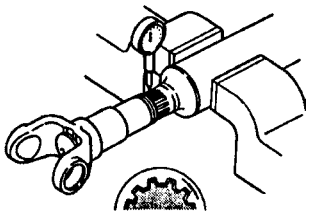
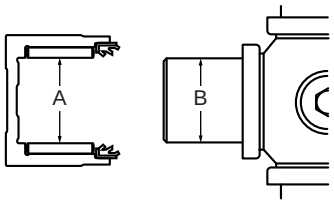
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0441202H300001

Unit: mm {in.}

Inspection item		Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	Front	0-0.5 {0-0.0197}	1.0 {0.0393}	Replace.	Measure 
	Rear	0-0.6 {0-0.0236}			
Crack in the welding beads		—	—	Replace, if necessary.	Visual check 
Sliding spline damage		—	—	Replace, if necessary.	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80 mm {3.150 in.} from the shaft center.)		At spline 0.062-0.174 {0.0025-0.0068}	0.3 {0.0118}	Replace.	Measure 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)		0.020-0.054 {0.0008-0.0021}	0.1 {0.0039}	Replace needle roller bearing sub-assembly or universal joint spider.	Measure 

PROPELLER SHAFT (HD1050)

PP02-005

PROPELLER SHAFT ASSEMBLY PP02-2
DATA AND SPECIFICATIONS..... PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING..... PP02-3
SPECIAL TOOL..... PP02-3
COMPONENT LOCATOR PP02-4
OVERHAUL PP02-7
INSPECTION AND REPAIR..... PP02-14

PROPELLER SHAFT ASSEMBLY

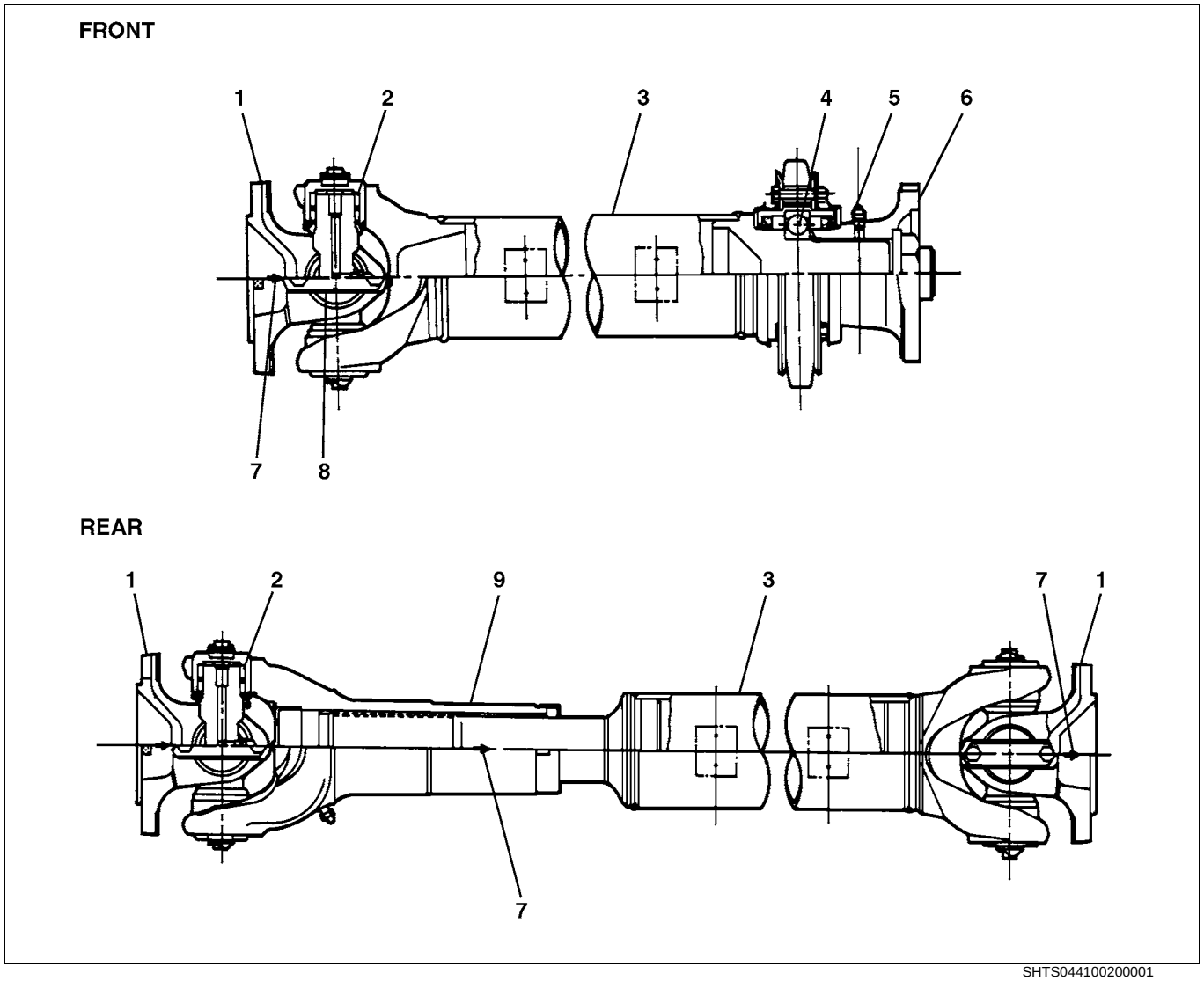
DATA AND SPECIFICATIONS

EN0441002I200001

Type	**Tubular shaft type**
Universal joint	**All metal, round bearing type with needle roller bearing**

DESCRIPTION

EN0441002C100001



SHTS044100200001

1	**Universal joint yoke**	**6**	**Universal joint flange**
2	**Needle roller bearing**	**7**	**Phasing arrow**
3	**Yoke shaft**	**8**	**Lock plate**
4	**Center bearing**	**9**	**Sliding yoke**
5	**Lubrication fitting**		

TROUBLESHOOTING

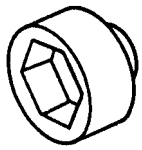
EN0441002F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Worn or damaged center bearing (If so equipped)	Replace the bearing.
	Worn or damaged center bearing rubber cushion (If so equipped)	Replace the rubber cushion.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0441002K100001

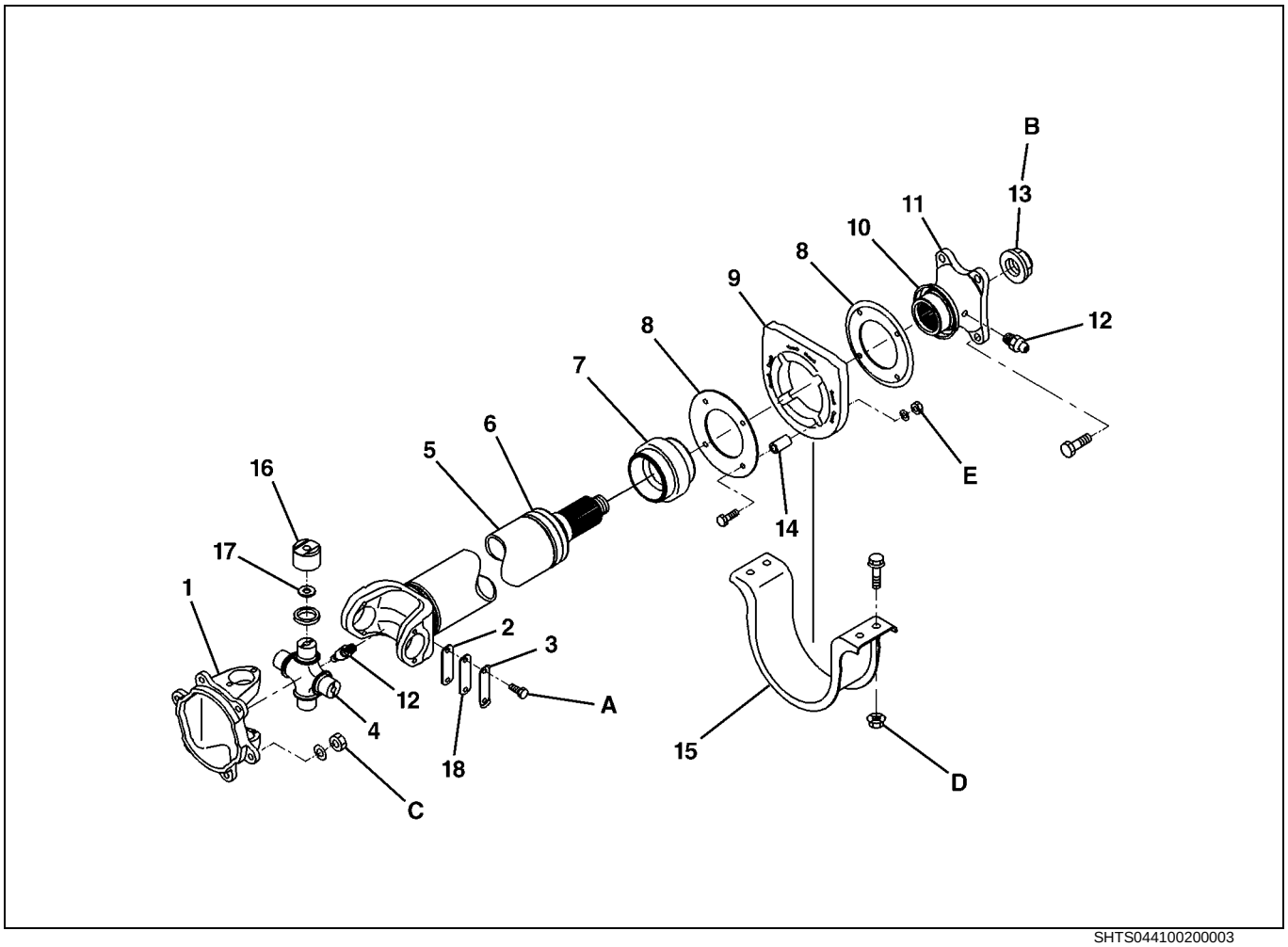
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool. (with center bearing type)

Illustration	Part number	Tool name	Remarks
	S0983-96502	SOCKET WRENCH	

COMPONENT LOCATOR

EN0441002D100001

FRONT [MODELS: FL, FM (IF SO EQUIPPED)]



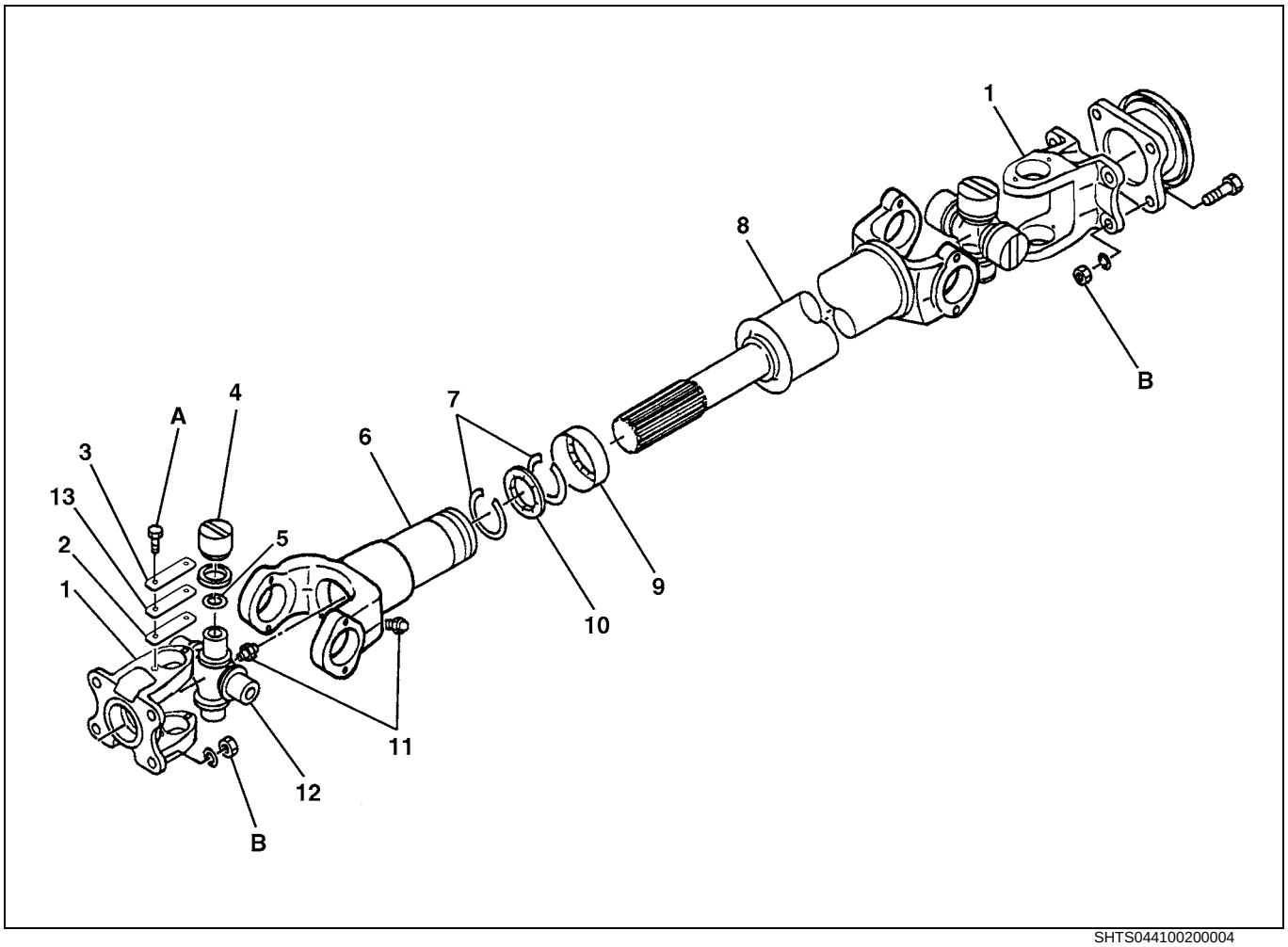
SHTS044100200003

1	Universal joint yoke	10	Dust deflector
2	Universal joint cap	11	Universal joint flange
3	Lock plate	12	Lubrication fitting
4	Universal joint spider	13	Lock nut
5	Yoke shaft	14	Collar
6	Dust deflector	15	Center bearing holder
7	Center bearing	16	Needle roller bearing
8	Center bearing plate	17	Thrust washer
9	Center bearing cushion	18	Balance piece (If so equipped)

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	49-61.8 {500-630, 36-45}	D	96-144 {980-1,470, 71-105}
B	784-980 {8,000-10,000, 579-723}	E	18.8-25.4 {190-260, 14-19}
C	65-87 {663-887, 48-64}		

REAR (MODELS: FL, FM)



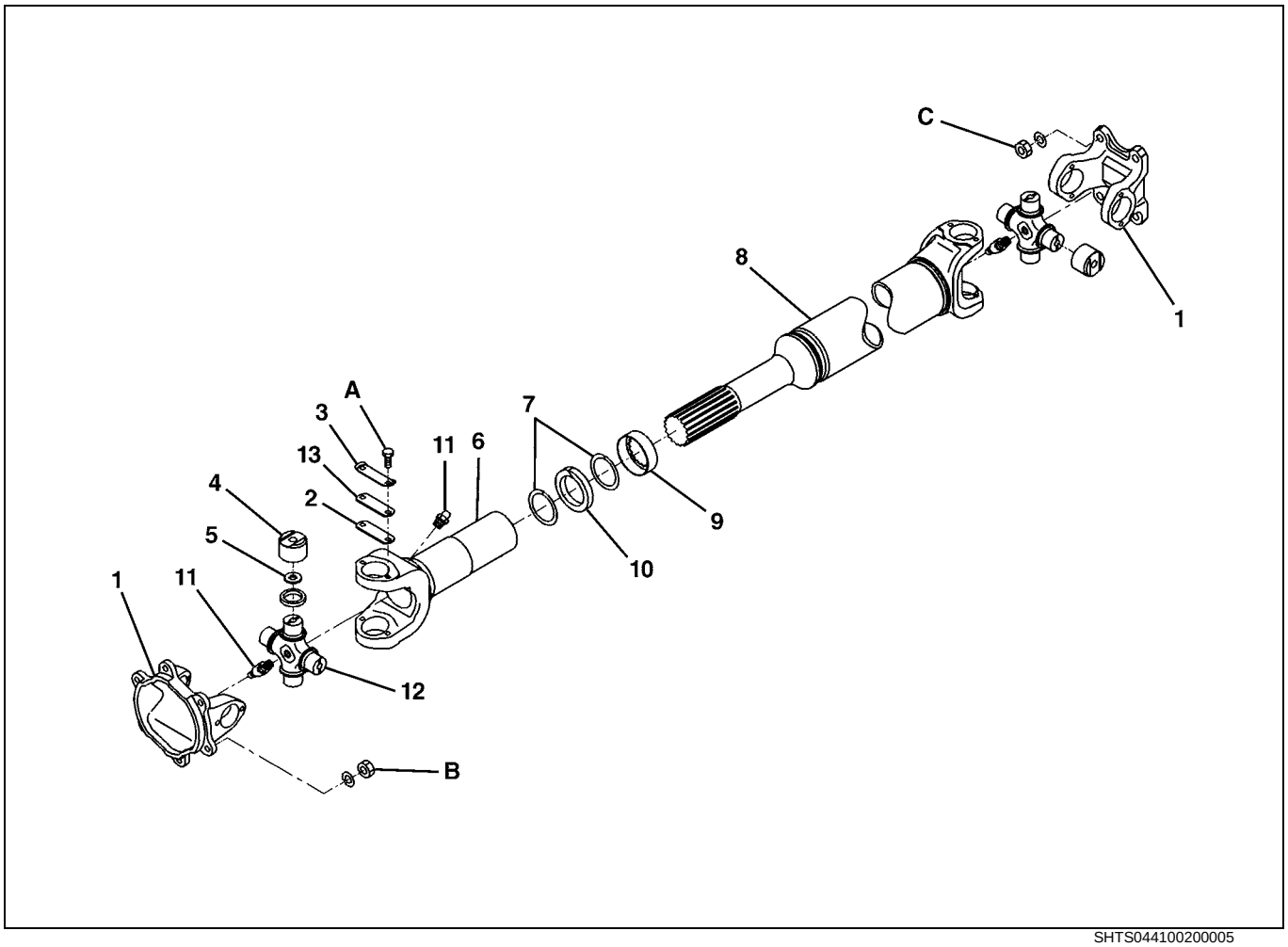
SHTS044100200004

1	Universal joint yoke	8	Yoke shaft
2	Universal joint cap	9	Felt ring retainer
3	Lock plate	10	Felt seal
4	Needle roller bearing	11	Lubrication fitting
5	Thrust washer	12	Universal joint spider
6	Sliding yoke	13	Balance piece (If so equipped)
7	Split retainer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	49-61.8 {500-630, 36-45}	B	166.8-225.4 {1,700-2,300, 123-166}

MODEL: SG



SHTS044100200005

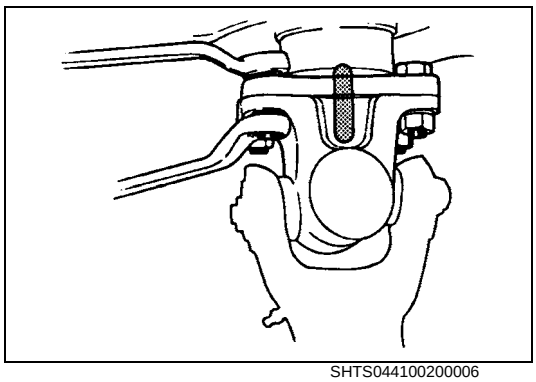
1	Universal joint yoke	8	Yoke shaft
2	Universal joint cap	9	Felt ring retainer
3	Lock plate	10	Felt seal
4	Needle roller bearing	11	Lubrication fitting
5	Thrust washer	12	Universal joint spider
6	Sliding yoke	13	Balance piece (If so equipped)
7	Split retainer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	49-61.8 {500-630, 36-45}	C	166.8-225.4 {1,700-2,300, 123-166}
B	63.8-85.2 {651-868, 48-62}		

OVERHAUL

EN0441002H200001



SHTS044100200006

IMPORTANT POINT - DISMOUNTING

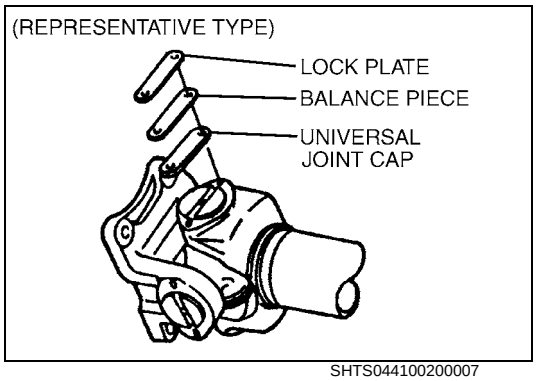
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and universal joint yoke.

(2) Remove the nuts and the bolts.

NOTICE

Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.



SHTS044100200007

IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the lock plate.

NOTICE

For some models, one additional lock plate is installed as an additional balance on one of the bearing.

(2) Remove the balance piece, if so equipped.

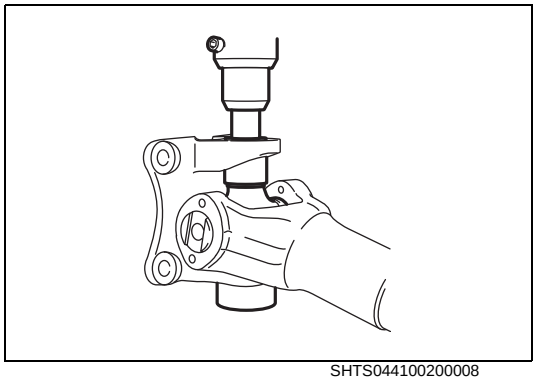
NOTICE

Some models are equipped with one, two, or three balance pieces between the lock plate and universal joint cap of one of the bearing.

(3) Remove the universal joint cap.

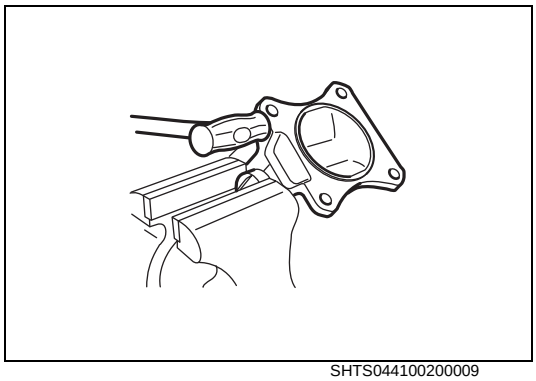
(4) Remove the needle roller bearings and universal joint spider from the universal joint yoke.

a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.



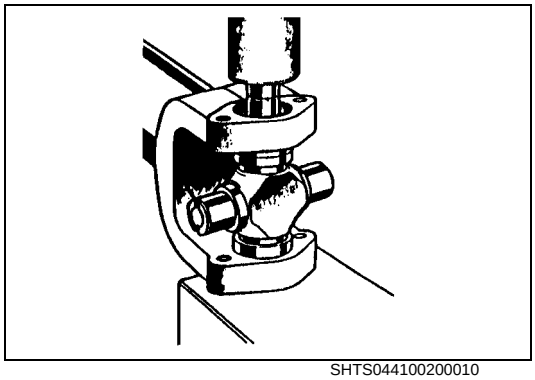
SHTS044100200008

b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of needle roller bearing.

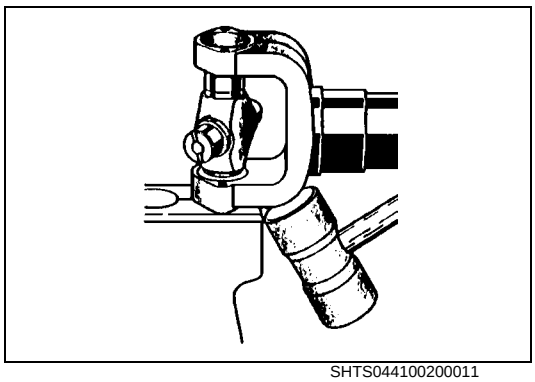


SHTS044100200009

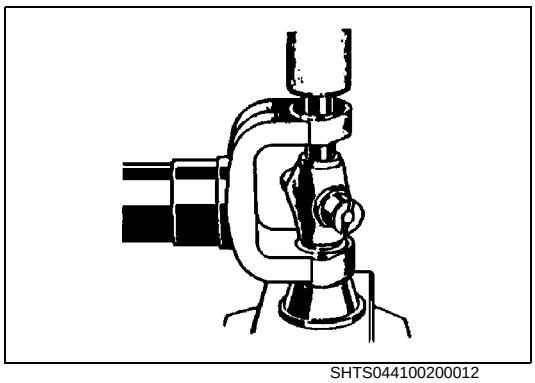
c. Press the opposite bearing out of the yoke lug.


SHTS044100200010

(5) Remove the needle roller bearings and universal joint spider from the yoke.
   a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
      The bearing race will now protrude from the yoke.


SHTS044100200011

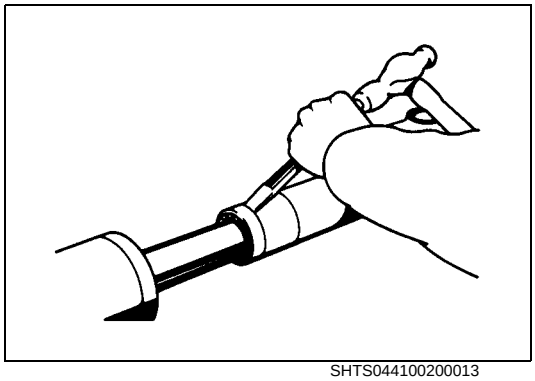
   b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
      Tap the yoke in area shown to achieve removal of needle roller bearing.


SHTS044100200012

   c. Place the yoke under the arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
   d. Press the opposite bearing out of the yoke lug.
   e. Remove the spider from the yoke.

NOTICE

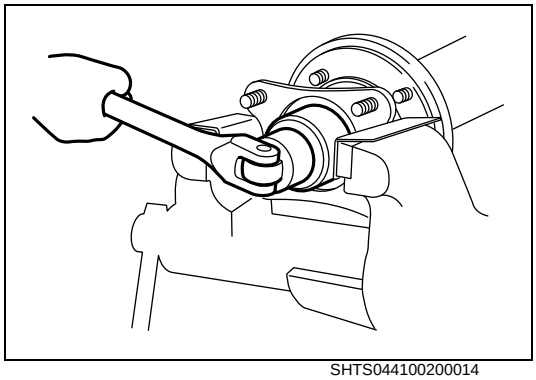
- **Keep the location and number of lock plate or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**


SHTS044100200013

2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.

(1) Uncaulk the felt ring retainer from the groove on the sliding yoke.
(2) Separate the yoke shaft and sliding yoke.
(3) Remove the felt seal, split retainers and felt ring retainer, or dust seal from the yoke shaft.

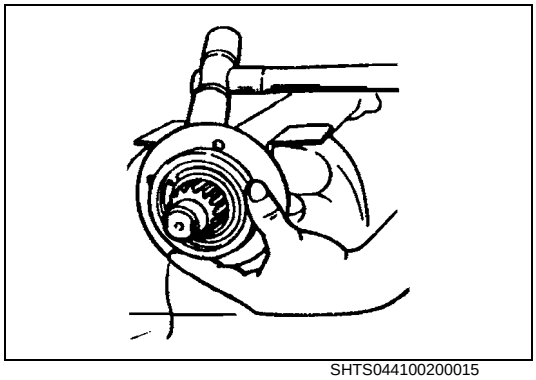
⚠ CAUTION
When uncaulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.


SHTS044100200014

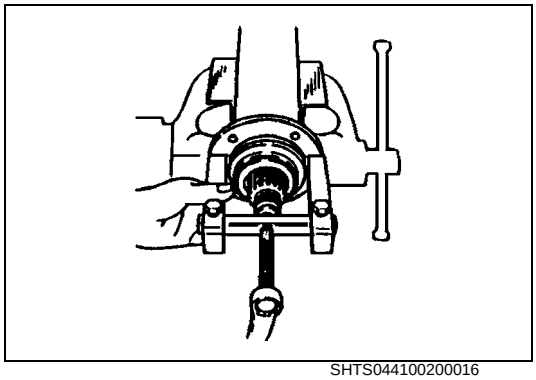
3. REMOVE THE CENTER BEARING.

(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
SST: Socket Wrench (S0983-96502)

(5) Remove the universal joint flange from the shaft.

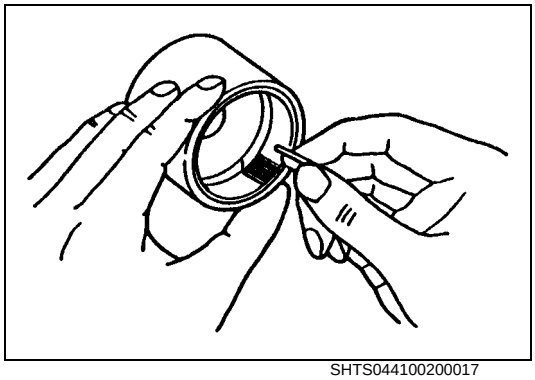

SHTS044100200015

(6) Using a hammer, tap the bearing plate to make a clearance.


SHTS044100200016

(7) Using a commercial puller, remove the center bearing subassembly.

NOTICE
Be careful not to catch your fingers between bearing plate and dust deflector.



SHTS044100200017

IMPORTANT POINTS - ASSEMBLY

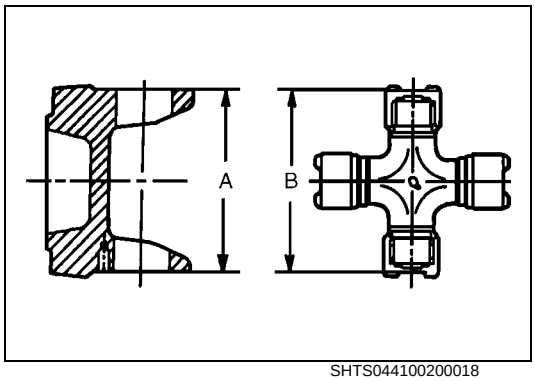
1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

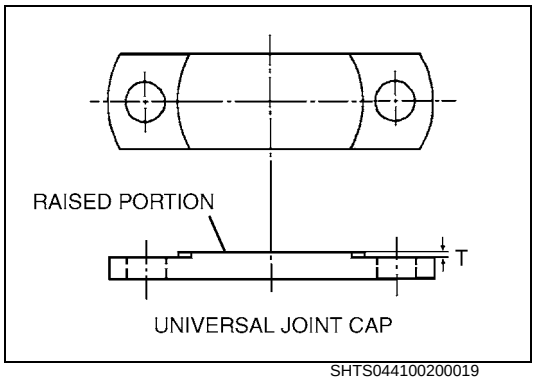
Remove the stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.



SHTS044100200018

2. INSTALL THE SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

(1) Select a thickness for the raised portion "T" of the universal joint cap so that measurements "B" is equivalent to measurement "A". Use universal joint caps of the same thickness as possible for both ends.

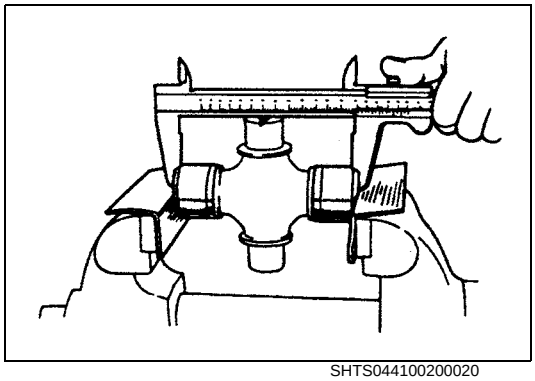


SHTS044100200019

Universal joint caps are available in following thickness.

Unit: mm {in.}

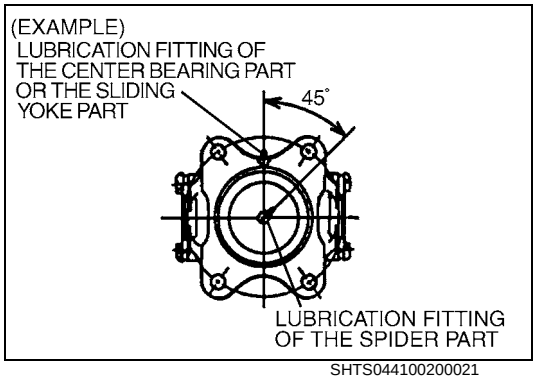
Thickness of raised portion "T" of universal joint cap	Color code
0.00	Silver
0.04 {0.0016}	Yellow
0.08 {0.0031}	Black
0.12 {0.0047}	Green



SHTS044100200020

NOTICE

When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.

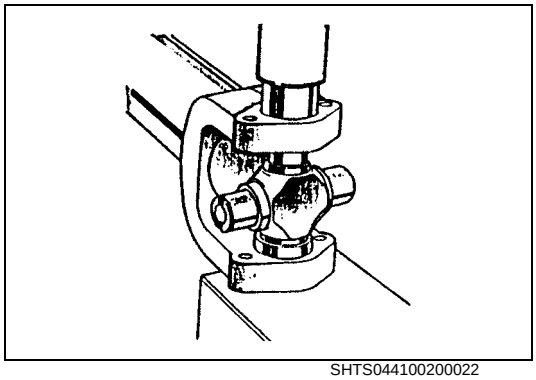


SHTS044100200021

(2) Put the spider into the yoke and then set the needle roller bearings on the yoke.

NOTICE

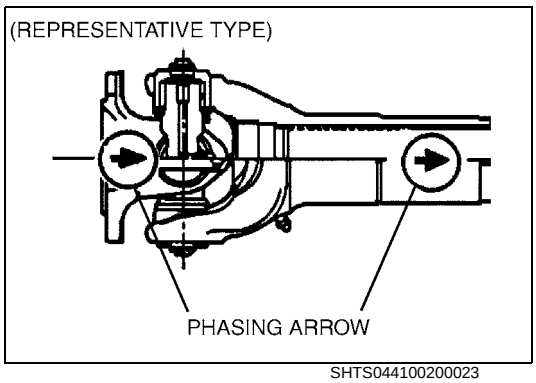
When installing the spider to the yoke, install the lubrication fitting to the spider should be made an angle of 45° with the lubrication fitting of the center bearing part or the sliding yoke part as shown in the figure.


SHTS044100200022

(3) Press the universal joint bearings into the yoke over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.



SHTS044100200023

(4) Install the universal joint yoke to the universal joint spider.

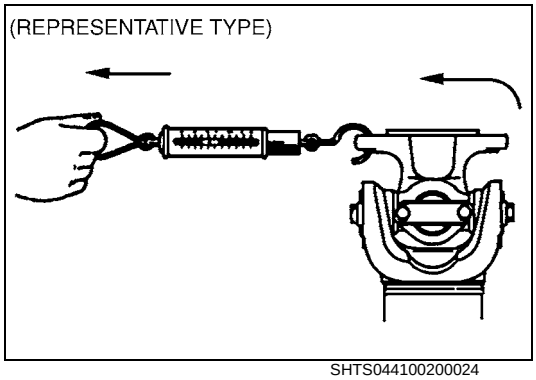
NOTICE

Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.

(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock washer, and tighten the universal joint cap.

NOTICE

Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing bore the yoke shaft and sliding yoke.



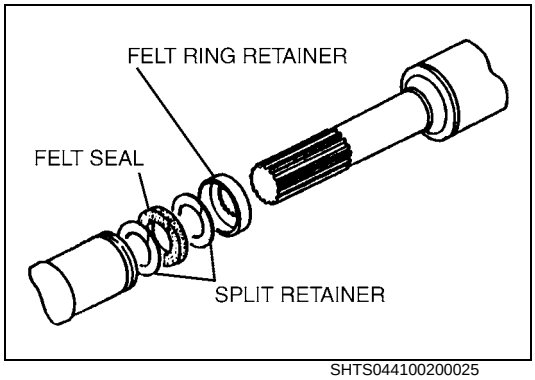
SHTS044100200024

(6) Check the starting torque of the universal joint using a spring balancer.

Assembly standard:
0.98-4.90 N·m {10-50 kgf·cm, 8.7-43.3 lbf·in.}

(7) After checking the starting torque, bend the lock plate so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock plate and the bolt. Also, upon fitting the lock plate against the bolt, check the bent portion of the lock washer to make sure there are no cracks or fissures.

a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.
b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.



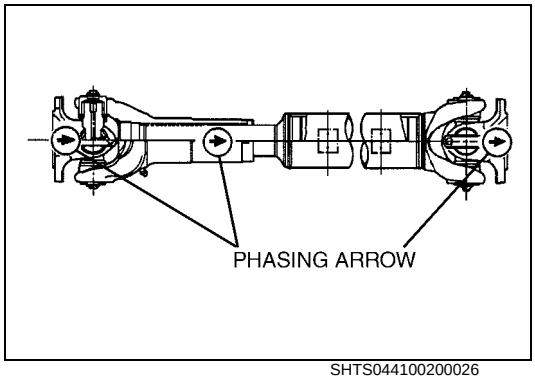
SHTS044100200025

3. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.

(1) Remove the stale grease from the spline of the yoke shaft.

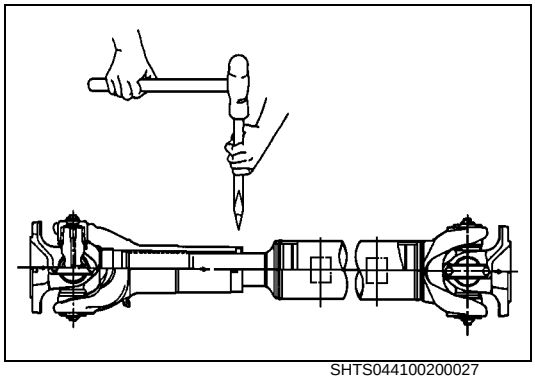
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt ring.



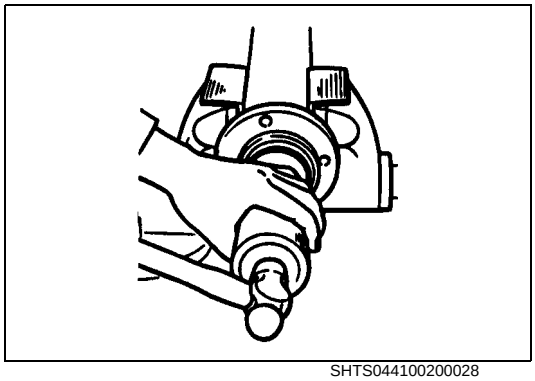
SHTS044100200026

(4) Align the phasing arrows as shown in figure.

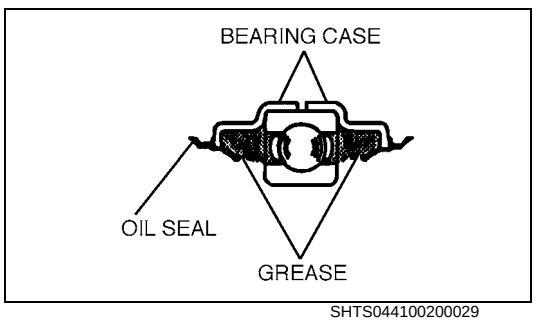

SHTS044100200027

(5) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.
Caulking Width: 10-15 mm {0.394-0.591 in.}

⚠ CAUTION
When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.


SHTS044100200028

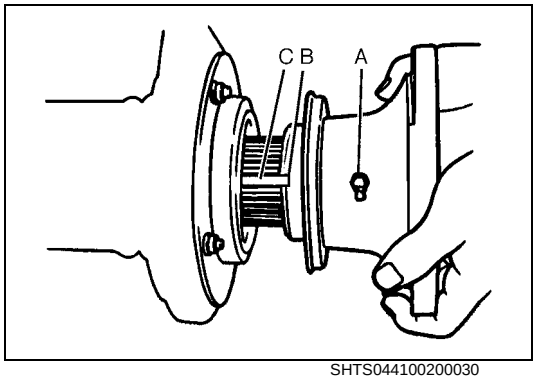
4. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING ASSEMBLY.



SHTS044100200029

NOTICE
Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.

Grease:
Refer to owner's manual.



SHTS044100200030

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to between 80-100°C {176-212°F}.

NOTICE

- **Do not heat the universal joint flange in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

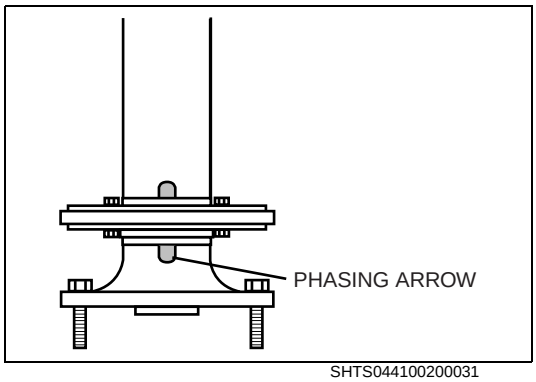
⚠ CAUTION
Never touch hot water or oil and heated universal joint flange with your bare band. This can result personal injury.

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

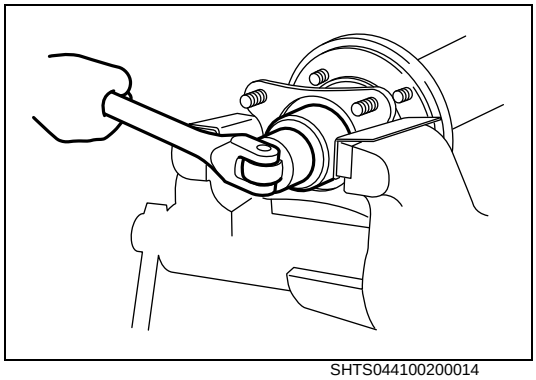
NOTICE
Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.

   c. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.

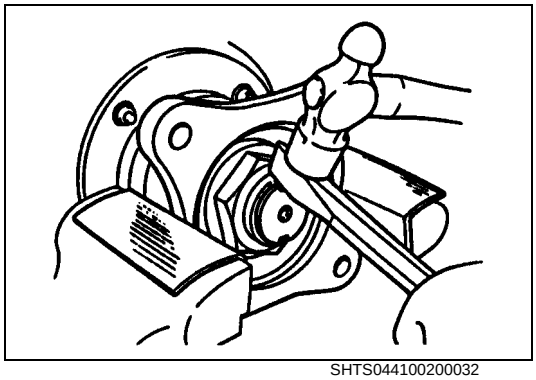


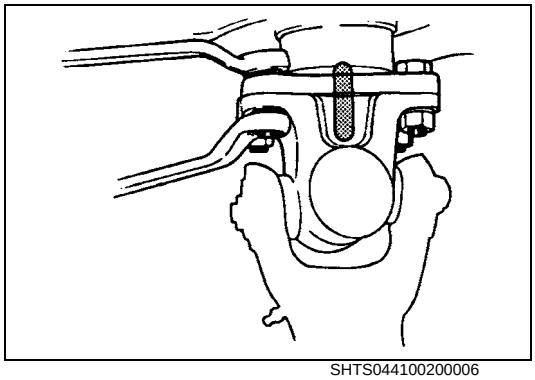
SHTS044100200031

   d. Using the special tool, tighten the lock nut.
   SST: Socket Wrench (S0983-96502)


SHTS044100200014

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


SHTS044100200032


SHTS044100200006

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.

(1) Align the matching marks on the flange and universal joint yoke.

(2) Tighten the bolts and nuts.

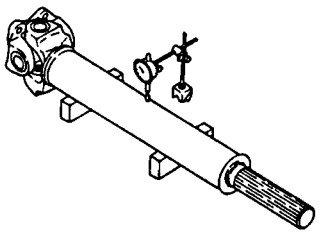
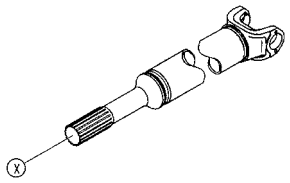
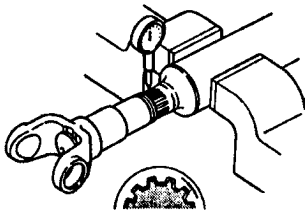
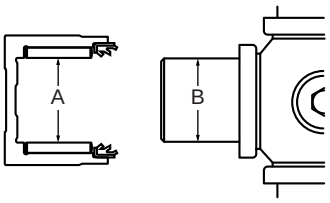
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0441002H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	**0-0.6 {0-0.0236}**	**1.0 {0.039}**	**Replace.**	**Measure** 
Crack in the welding beads	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Sliding spline damage	**—**	**—**	**Replace, if necessary.**	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80 mm {3.145 in.} from the shaft center.)	**At spline 0.062-0.174 {0.0025-0.0068}**	**0.3 {0.0118}**	**Replace.**	**Measure** 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)	**0.025-0.075 {0.0010-0.0029}**	**0.1 {0.0039}**	**Replace needle roller bearing sub-assembly or universal joint spider.**	**Measure** 

PROPELLER SHAFT (HE1160)

PP02-006

PROPELLER SHAFT ASSEMBLY PP02-2
DATA AND SPECIFICATIONS PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING PP02-3
SPECIAL TOOL PP02-3
COMPONENT LOCATOR PP02-4
OVERHAUL PP02-6
INSPECTION AND REPAIR PP02-14

PROPELLER SHAFT ASSEMBLY

DATA AND SPECIFICATIONS

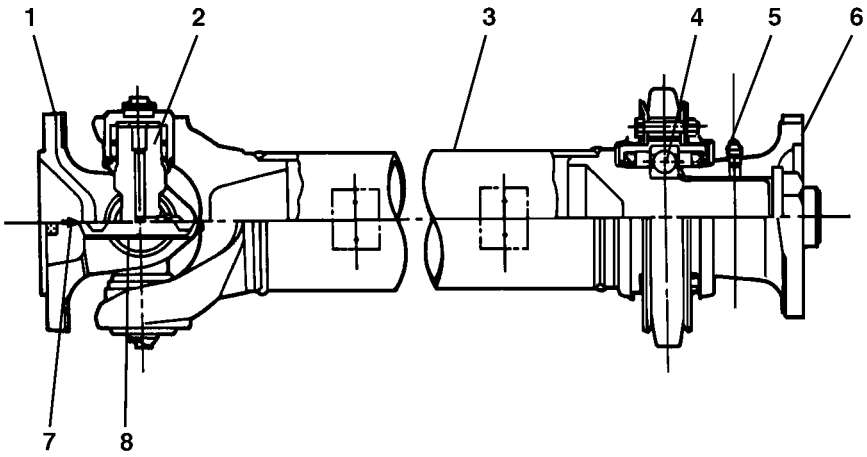
EN0441102I200001

Type	**Tubular shaft type**
Universal joint	**All metal, round bearing type with needle roller bearing**

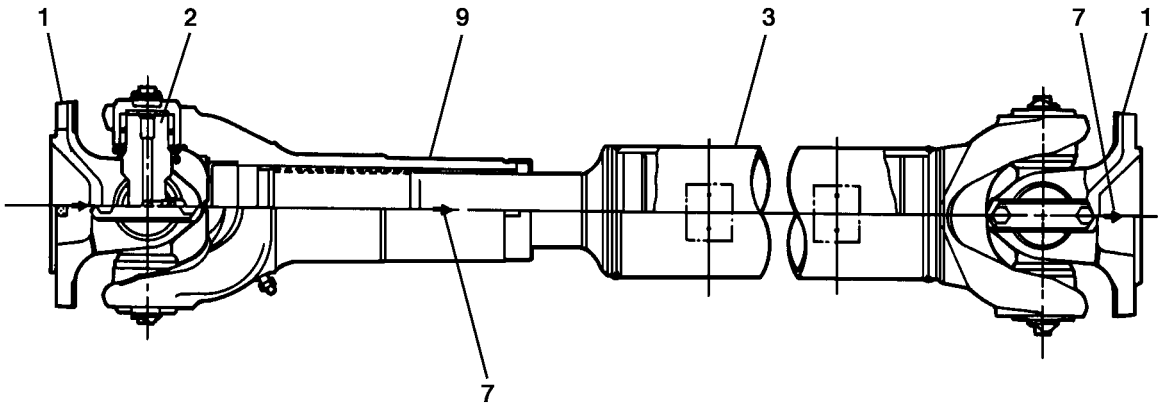
DESCRIPTION

EN0441102C100001

TRANSMISSION TO REAR AXLE (FRONT) (IF SO EQUIPPED)



TRANSMISSION TO REAR AXLE



SHTS044110200001

1	**Universal joint yoke**	**6**	**Universal joint flange**
2	**Needle roller bearing**	**7**	**Phasing arrow**
3	**Yoke shaft**	**8**	**Lock plate**
4	**Center bearing**	**9**	**Sliding yoke**
5	**Lubrication fitting**		

TROUBLESHOOTING

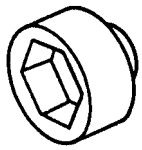
EN0441102F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Worn or damaged center bearing (If so equipped)	Replace the bearing.
	Worn or damaged center bearing rubber cushion (If so equipped)	Replace the rubber cushion.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0441102K100001

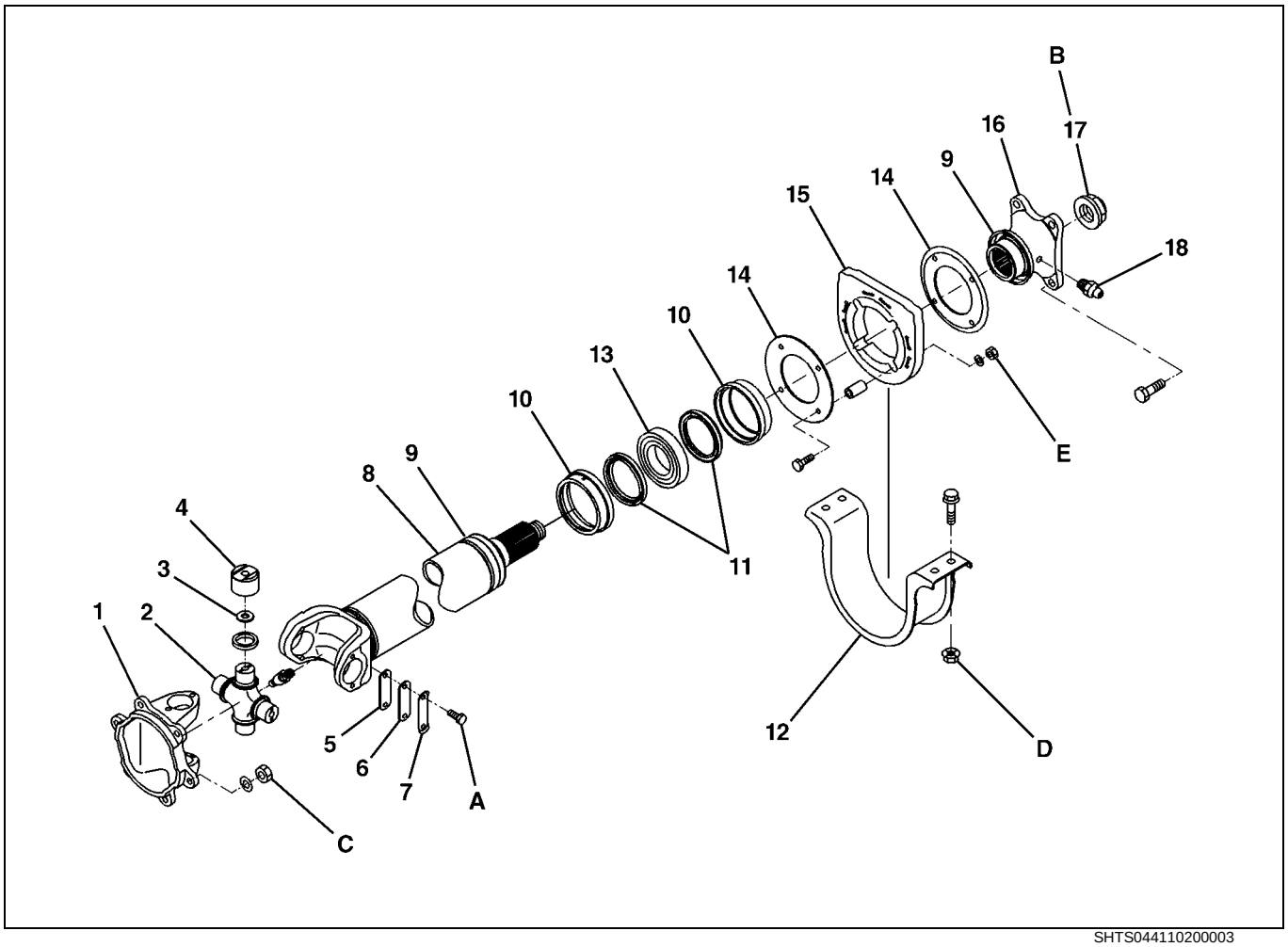
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool. (with center bearing type)

Illustration	Part number	Tool name	Remarks
	S0983-96502	SOCKET WRENCH	

COMPONENT LOCATOR

EN0441102D100001

TRANSMISSION TO REAR AXLE (FRONT) (IF SO EQUIPPED)



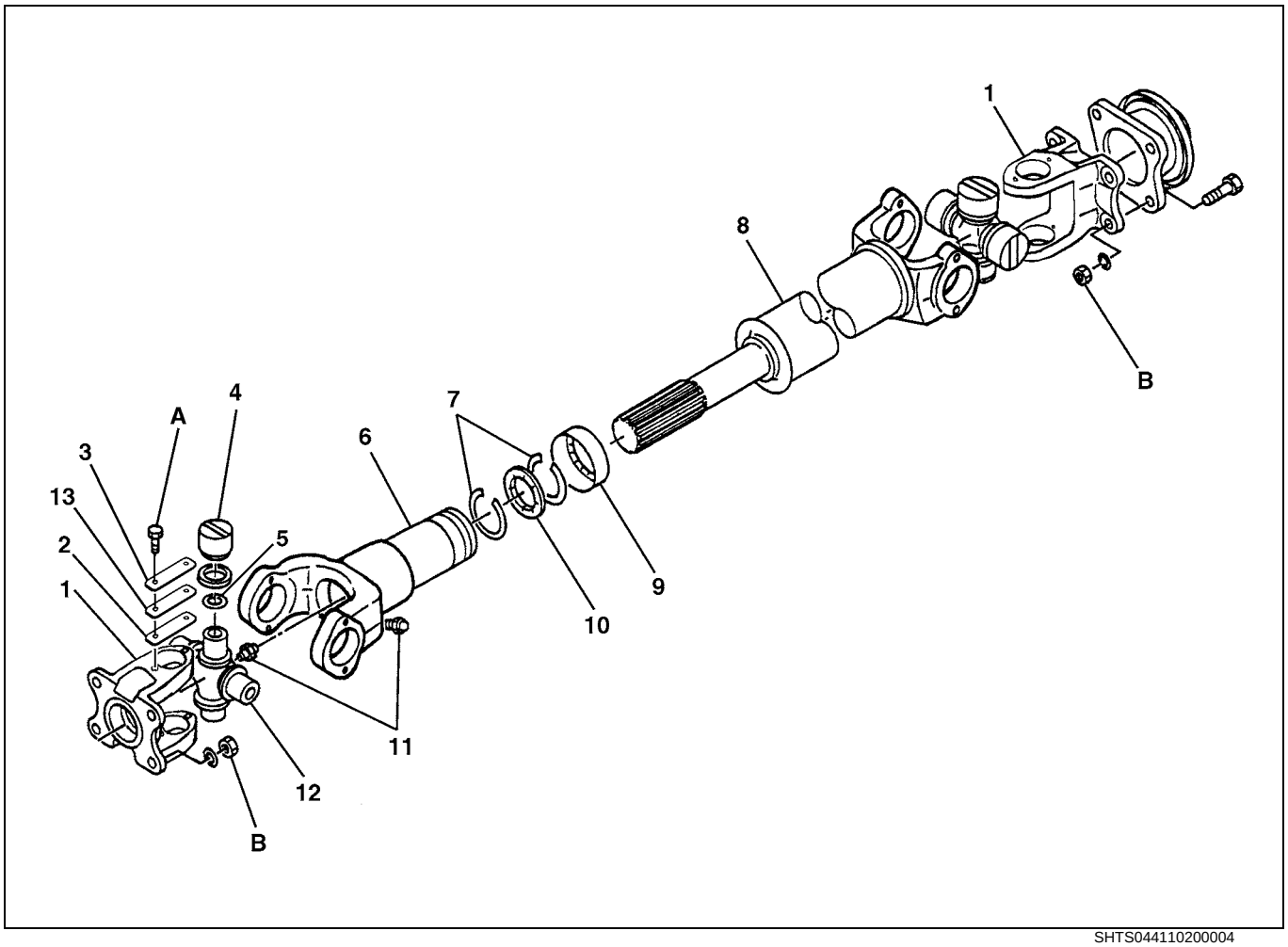
SHTS044110200003

1	Universal joint yoke	10	Center bearing support case
2	Universal joint spider	11	Oil seal
3	Thrust washer	12	Center bearing holder
4	Needle roller bearing	13	Center bearing
5	Universal joint cap	14	Center bearing plate
6	Balance piece (If so equipped)	15	Center bearing cushion
7	Lock plate	16	Universal joint flange
8	Yoke shaft	17	Lock nut
9	Dust deflector	18	Lubrication fitting

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	49-61.8 {500-630, 36-45}	D	96-144 {980-1,470, 71-105}
B	784-980 {8,000-10,000, 579-723}	E	18.8-25.4 {190-260, 14-19}
C	ϕ12: 65-87 {663-887, 48-64}		
	ϕ16: 166.8-225.3 {1,700-2,300, 123-166}		

TRANSMISSION TO REAR AXLE



SHTS044110200004

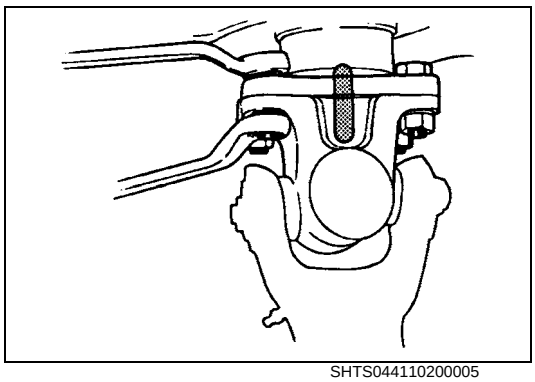
1	Universal joint yoke	8	Yoke shaft
2	Universal joint cap	9	Felt ring retainer
3	Lock plate	10	Felt seal
4	Needle roller bearing	11	Lubrication fitting
5	Thrust washer	12	Universal joint spider
6	Sliding yoke	13	Balance piece (If so equipped)
7	Split retainer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	49-61.8 {500-630, 36-45}	B	ϕ12: 65-87 {663-887, 48-64} ϕ16: 166.8-225.3 {1,700-2,300, 123-166}

OVERHAUL

EN0441102H200001



SHTS044110200005

IMPORTANT POINT - DISMOUNTING

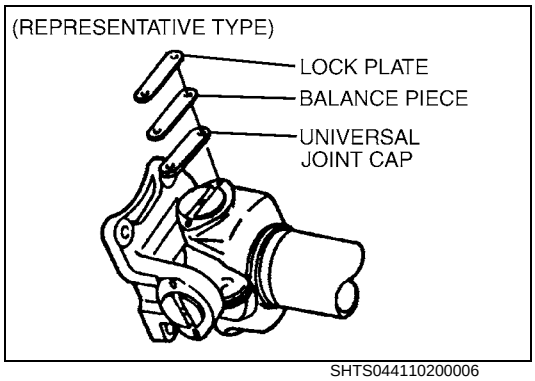
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and universal joint yoke.

(2) Remove the nuts and the bolts.

NOTICE

Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.



SHTS044110200006

IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the lock plate.

NOTICE

For some models, one additional lock plate is installed as an additional balance on one of the bearing.

(2) Remove the balance piece, if so equipped.

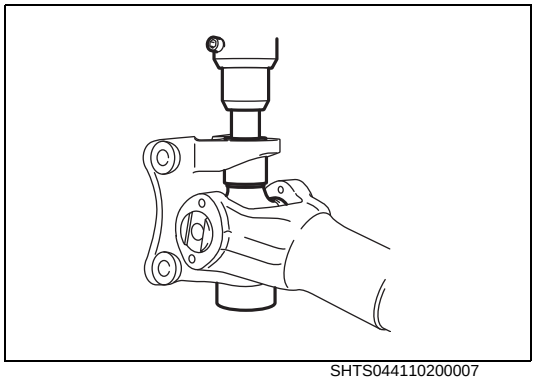
NOTICE

Some models are equipped with one, two, or three balance pieces between the lock plate and universal joint cap of one of the bearing.

(3) Remove the universal joint cap.

(4) Remove the needle roller bearings and universal joint spider from the universal joint yoke.

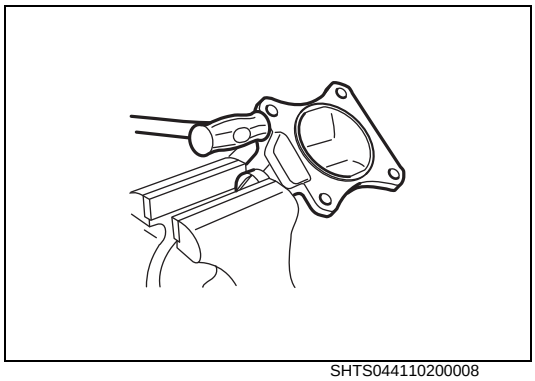
a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.



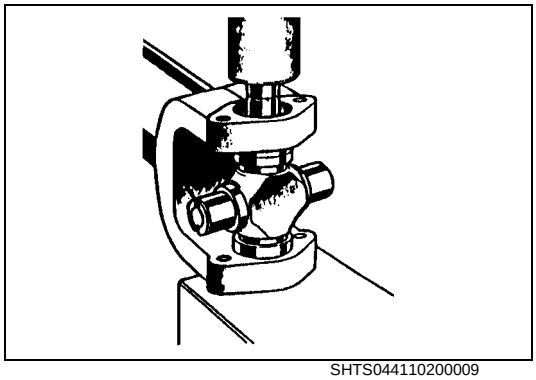
SHTS044110200007

b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of needle roller bearing.

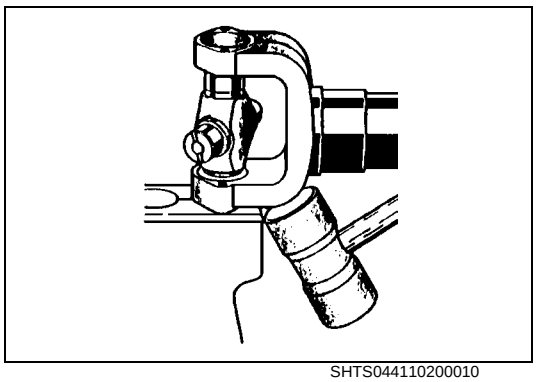
c. Press the opposite bearing out of the yoke lug.



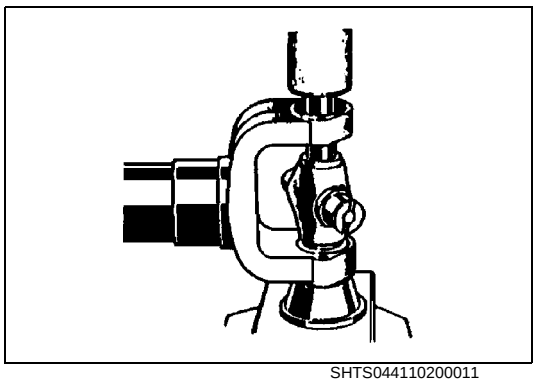
SHTS044110200008


SHTS044110200009

(5) Remove the needle roller bearings and universal joint spider from the yoke.
   a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
      The bearing race will now protrude from the yoke.


SHTS044110200010

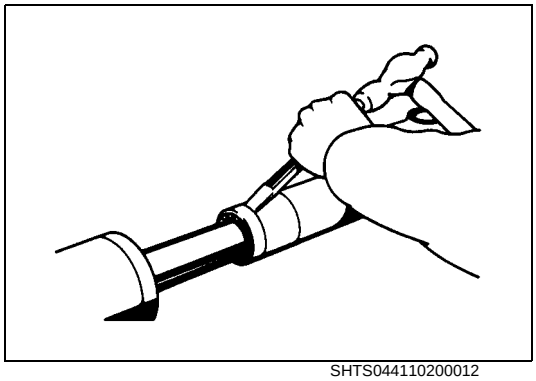
   b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
      Tap the yoke in area shown to achieve removal of needle roller bearing.


SHTS044110200011

   c. Place the yoke under the arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
   d. Press the opposite bearing out of the yoke lug.
   e. Remove the spider from the yoke.

NOTICE

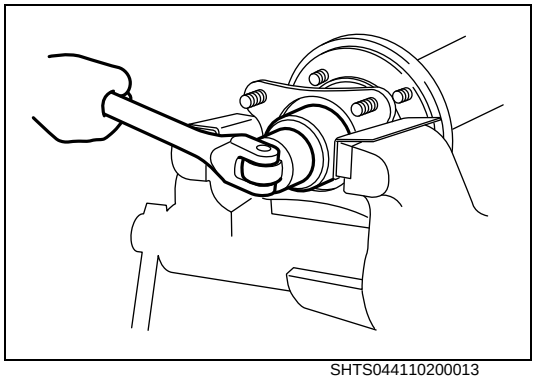
- **Keep the location and number of lock plate or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**


SHTS044110200012

2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.

(1) Uncaulk the felt ring retainer from the groove on the sliding yoke.
(2) Separate the yoke shaft and sliding yoke.
(3) Remove the felt seal, split retainers and felt ring retainer, or dust seal from the yoke shaft.

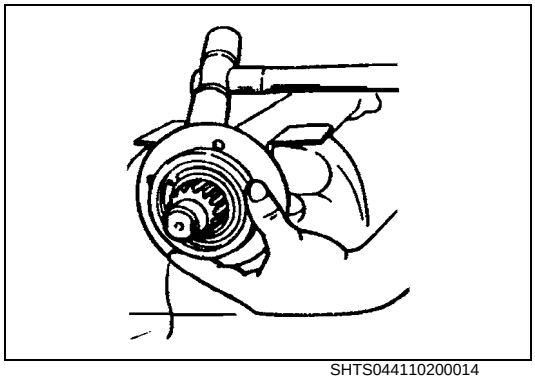
⚠ CAUTION
When uncaulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.


SHTS044110200013

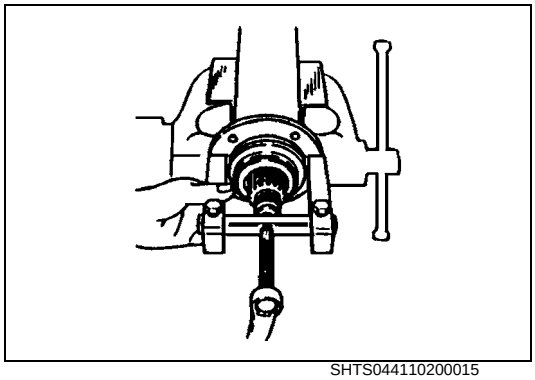
3. REMOVE THE CENTER BEARING. (IF SO EQUIPPED)

(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
SST: Socket Wrench (S0983-96502)

(5) Remove the universal joint flange from the shaft.

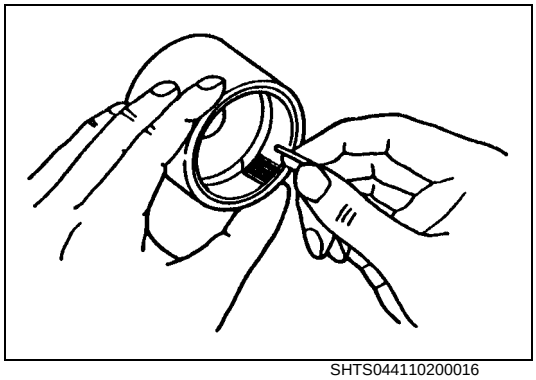

SHTS044110200014

(6) Using a hammer, tap the bearing plate to make a clearance.


SHTS044110200015

(7) Using a commercial puller, remove the center bearing subassembly.

NOTICE
Be careful not to catch your fingers between bearing plate and dust deflector.



SHTS044110200016

IMPORTANT POINTS - ASSEMBLY

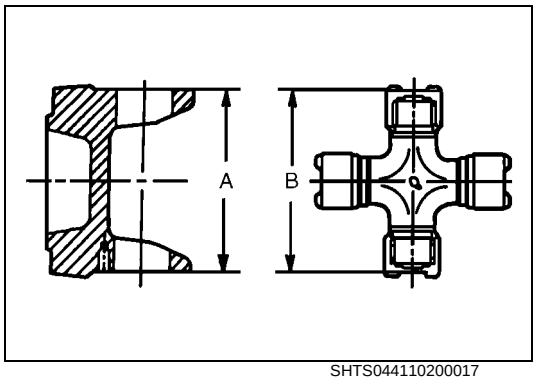
1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

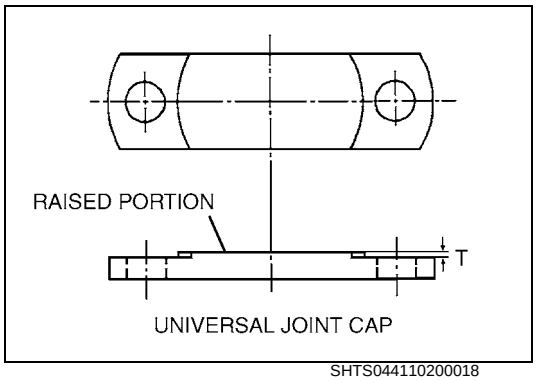
Remove the stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.



SHTS044110200017

2. INSTALL THE SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

(1) Select a thickness for the raised portion "T" of the universal joint cap so that measurements "B" is equivalent to measurement "A". Use universal joint caps of the same thickness as possible for both ends.

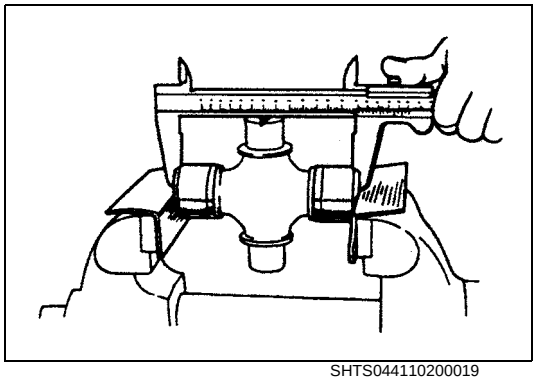


SHTS044110200018

Universal joint caps are available in following thickness.

Unit: mm {in.}

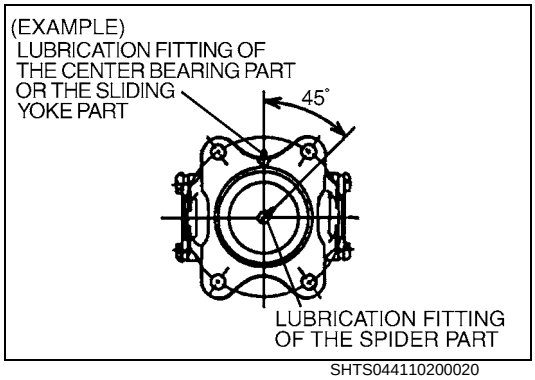
Thickness of raised portion "T" of universal joint cap	Color code
0.00	Silver
0.04 {0.0016}	Yellow
0.08 {0.0031}	Black
0.12 {0.0047}	Green



SHTS044110200019

NOTICE

When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.

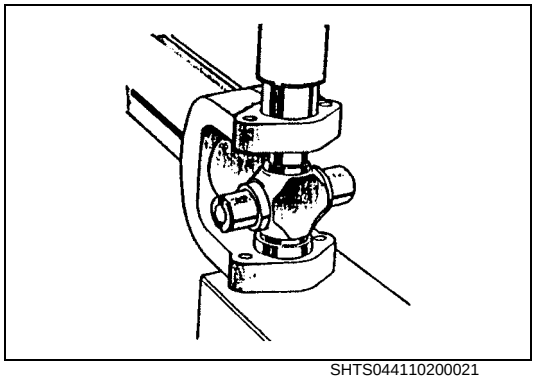


SHTS044110200020

(2) Put the spider into the yoke and then set the needle roller bearings on the yoke.

NOTICE

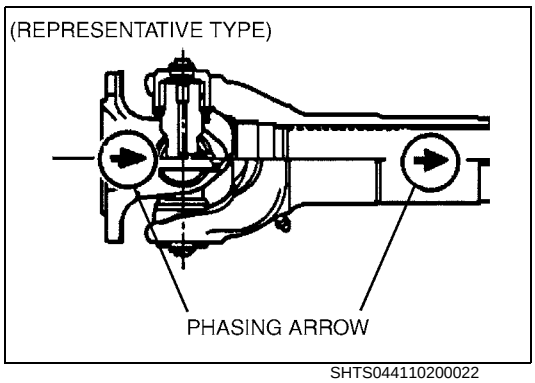
When installing the spider to the yoke, install the lubrication fitting to the spider should be made an angle of 45° with the lubrication fitting of the center bearing part or the sliding yoke part as shown in the figure.


SHTS044110200021

(3) Press the universal joint bearings into the yoke over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.



SHTS044110200022

(4) Install the universal joint yoke to the universal joint spider.

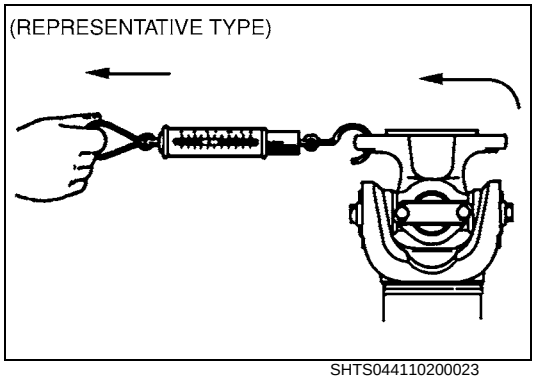
NOTICE

Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.

(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock washer, and tighten the universal joint cap.

NOTICE

Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing bore the yoke shaft and sliding yoke.



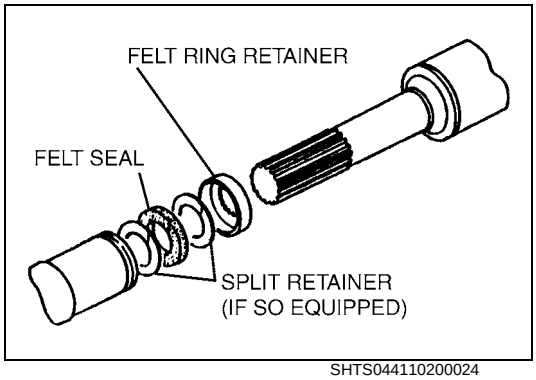
SHTS044110200023

(6) Check the starting torque of the universal joint using a spring balancer.

Assembly standard:
0.98-4.90 N·m {10-50 kgf·cm, 8.7-43.3 lbf·in.}

(7) After checking the starting torque, bend the lock plate so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock plate and the bolt. Also, upon fitting the lock plate against the bolt, check the bent portion of the lock washer to make sure there are no cracks or fissures.

a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.
b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.



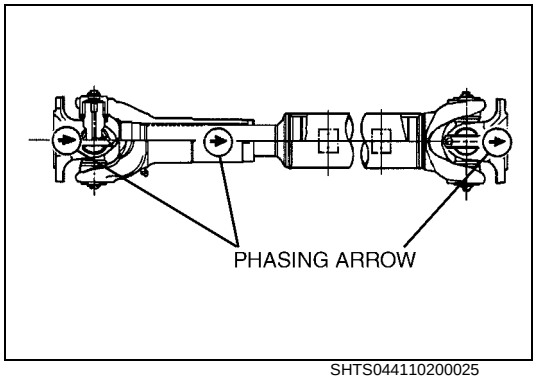
SHTS044110200024

3. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.

(1) Remove the stale grease from the spline of the yoke shaft.

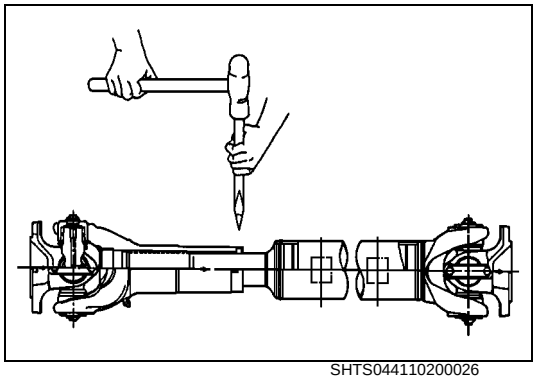
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt ring.



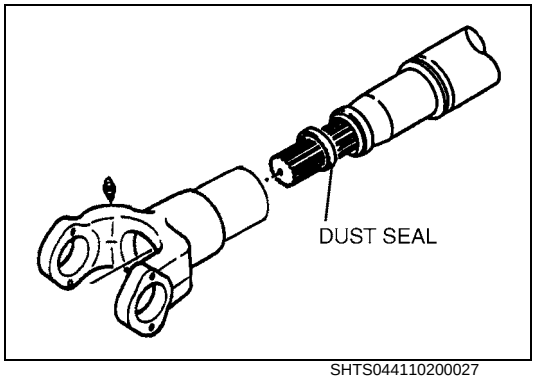
SHTS044110200025

(4) Align the phasing arrows as shown in figure.


SHTS044110200026

(5) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.
Caulking Width: 10-15 mm {0.394-0.591 in.}

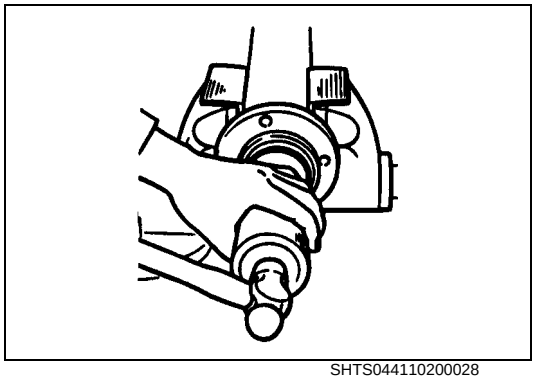
⚠ CAUTION
When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.



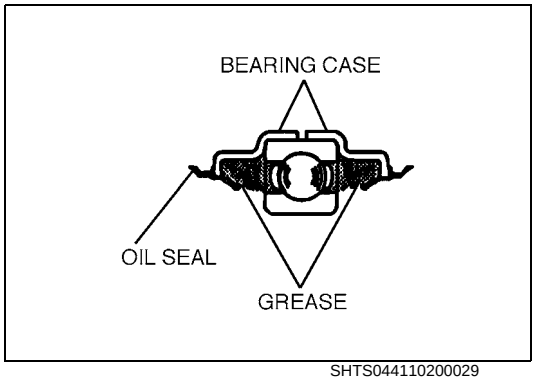
SHTS044110200027

4. INSTALL THE DUST COVER SEAL.

(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new dust cover seal on the shaft by pushing it in the dust cover seal groove.
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust cover seal.


SHTS044110200028

5. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING ASSEMBLY. (IF SO EQUIPPED)

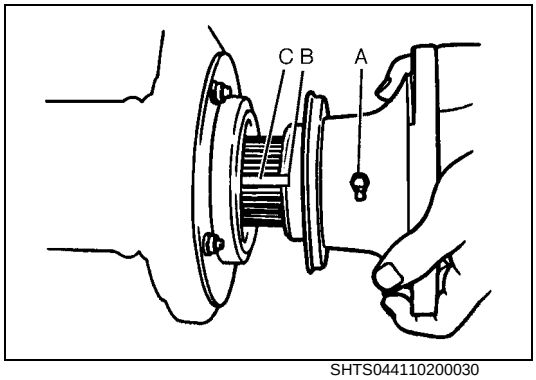


SHTS044110200029

NOTICE

Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.

Grease:
Refer to owner's manual.



SHTS044110200030

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to between 80-100°C {176-212°F}.

NOTICE

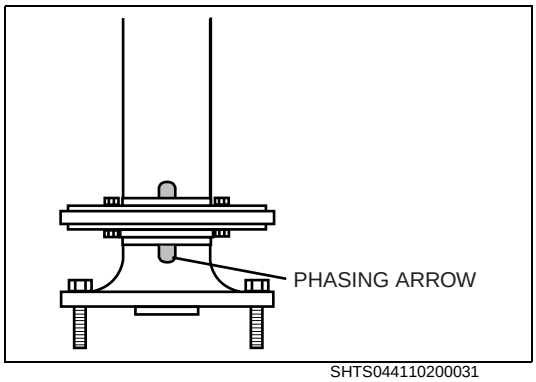
- **Do not heat the universal joint flange in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

⚠ CAUTION
Never touch hot water or oil and heated universal joint flange with your bare band. This can result personal injury.

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

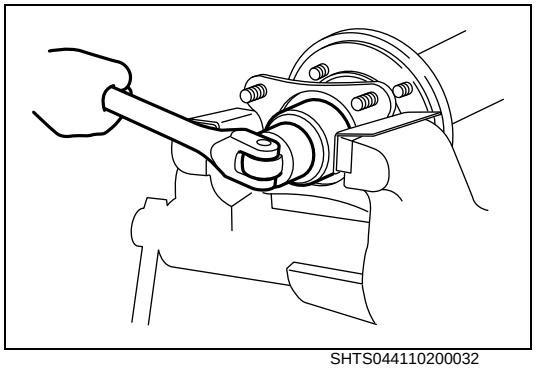
- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

NOTICE
Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.

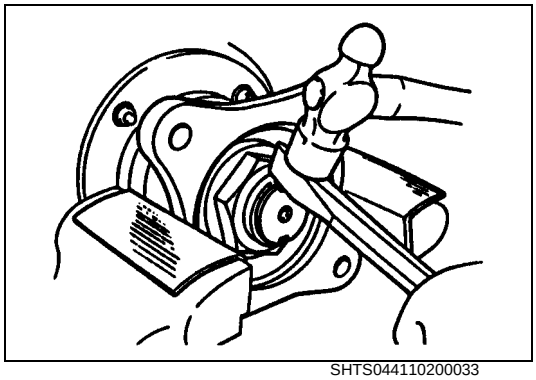


SHTS044110200031

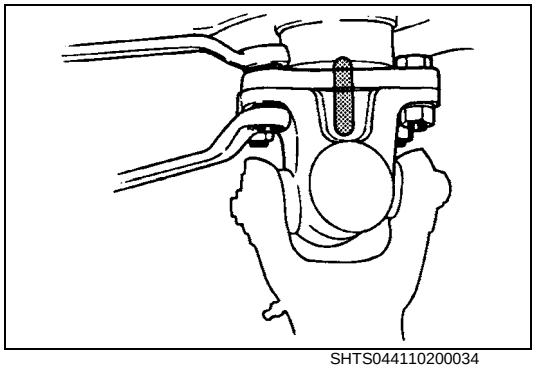
   c. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.


SHTS044110200032

   d. Using the special tool, tighten the lock nut.
   SST: Socket Wrench (S0983-96502)


SHTS044110200033

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


SHTS044110200034

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.

(1) Align the matching marks on the flange and universal joint yoke.

(2) Tighten the bolts and nuts.

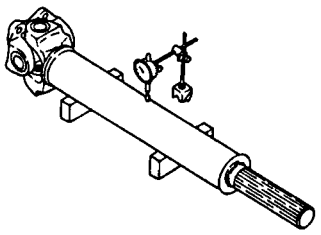
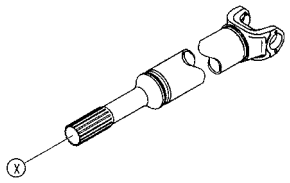
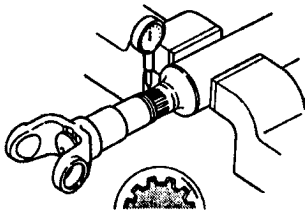
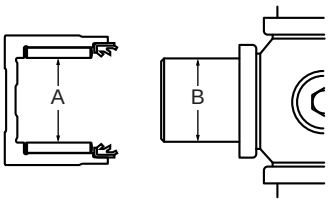
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0441102H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	**0-0.6 {0-0.0236}**	**1.0 {0.039}**	**Replace.**	**Measure** 
Crack in the welding beads	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Sliding spline damage	**—**	**—**	**Replace, if necessary.**	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80 mm {3.145 in.} from the shaft center.)	**At spline 0.062-0.174 {0.0025-0.0068}**	**0.3 {0.0118}**	**Replace.**	**Measure** 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)	**0.025-0.075 {0.0010-0.0029}**	**0.1 {0.0039}**	**Replace needle roller bearing sub-assembly or universal joint spider.**	**Measure** 

PROPELLER SHAFT (HY1345)

PP02-007

PROPELLER SHAFT ASSEMBLY PP02-2
DATA AND SPECIFICATIONS..... PP02-2
DESCRIPTION PP02-2
TROUBLESHOOTING..... PP02-3
SPECIAL TOOL..... PP02-3
COMPONENT LOCATOR PP02-4
OVERHAUL PP02-6
INSPECTION AND REPAIR..... PP02-12

PROPELLER SHAFT ASSEMBLY

DATA AND SPECIFICATIONS

EN0441402I200001

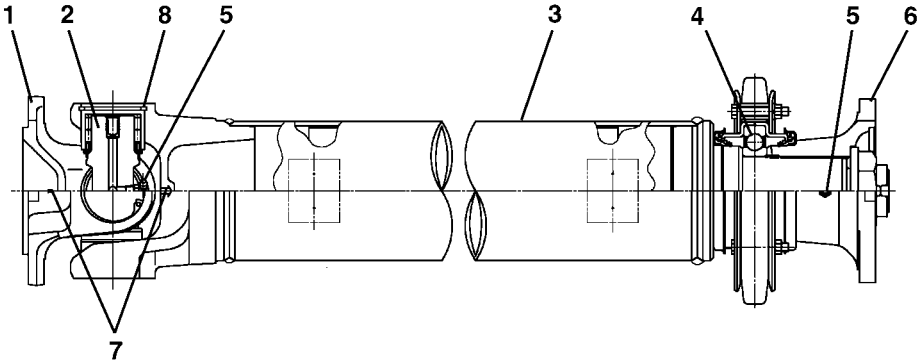
Type	**Tubular shaft type**
Universal joint	**All metal, round bearing type with needle roller bearing**

DESCRIPTION

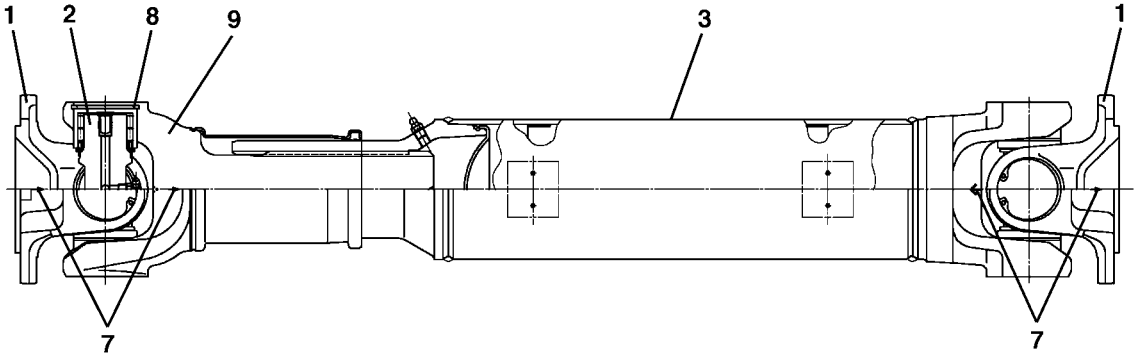
EN0441402C100001

(REPRESENTATIVE TYPE)

TRANSMISSION TO REAR AXLE (FRONT)



TRANSMISSION TO REAR AXLE (REAR)



SHTS044140200001

1	Flange yoke	6	Flange coupling
2	Needle roller bearing	7	Phasing arrow
3	Yoke shaft	8	Retainer ring
4	Center bearing	9	Sliding yoke
5	Lubrication fitting		

TROUBLESHOOTING

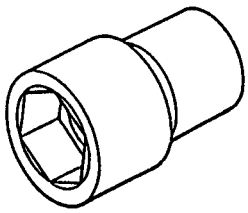
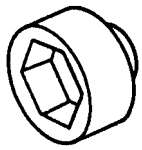
EN0441402F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal vibration when driving.	Looseness of universal joint yoke and flange tightening nuts	Tighten the nuts.
	Looseness of universal joint flange lock nut	Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely.
	Excessively bent propeller shaft	Replace the shaft.
	Worn or damaged universal joint	Replace the universal joint.
	Worn or damaged center bearing (If so equipped)	Replace the bearing.
	Worn or damaged center bearing rubber cushion (If so equipped)	Replace the rubber cushion.
	Incorrect phasing of the yokes	Match the phasing arrows correctly.

SPECIAL TOOL

EN0441402K100001

Prior to starting a propeller shaft overhaul, it is necessary to have these special tools. (with center bearing type)

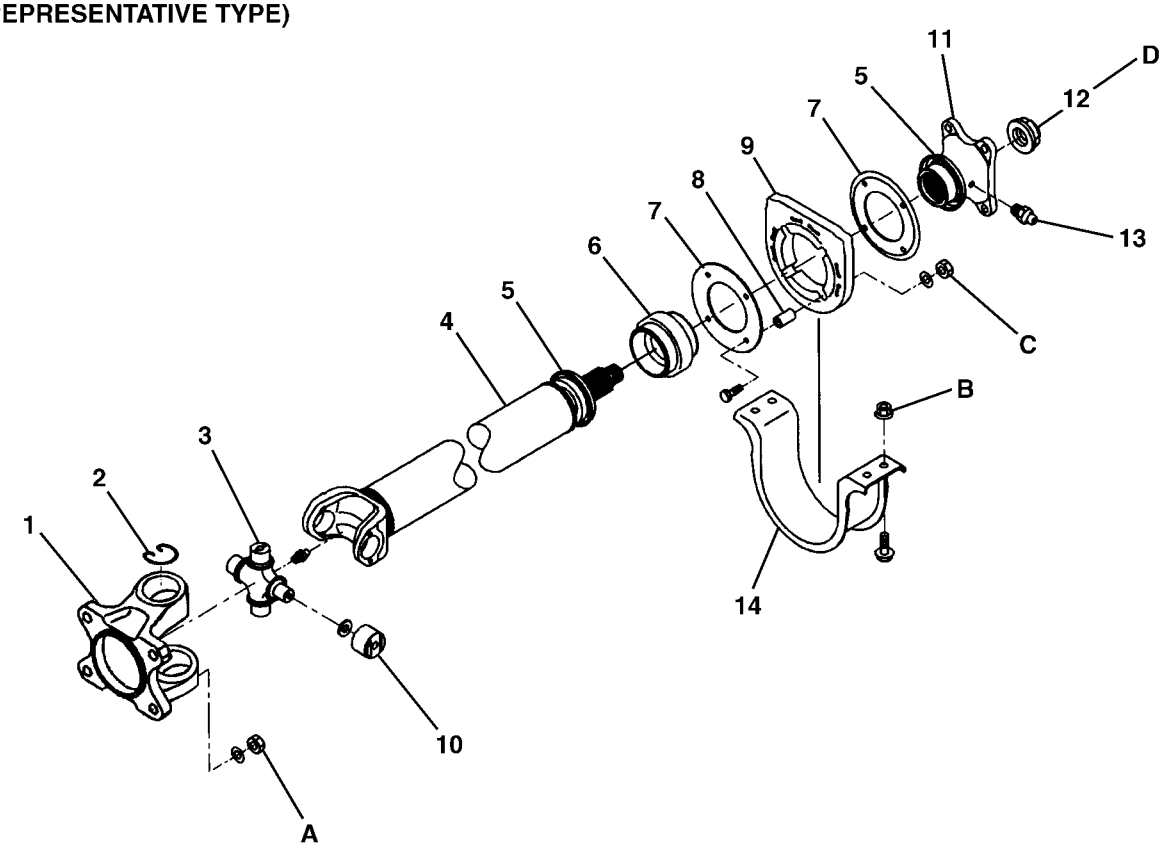
Illustration	Part number	Tool name	Remarks
	S0983-94601	SOCKET WRENCH	
	S0983-96502	SOCKET WRENCH	

COMPONENT LOCATOR

EN0441402D100001

TRANSMISSION TO REAR AXLE (FRONT) (IF SO EQUIPPED)

(REPRESENTATIVE TYPE)



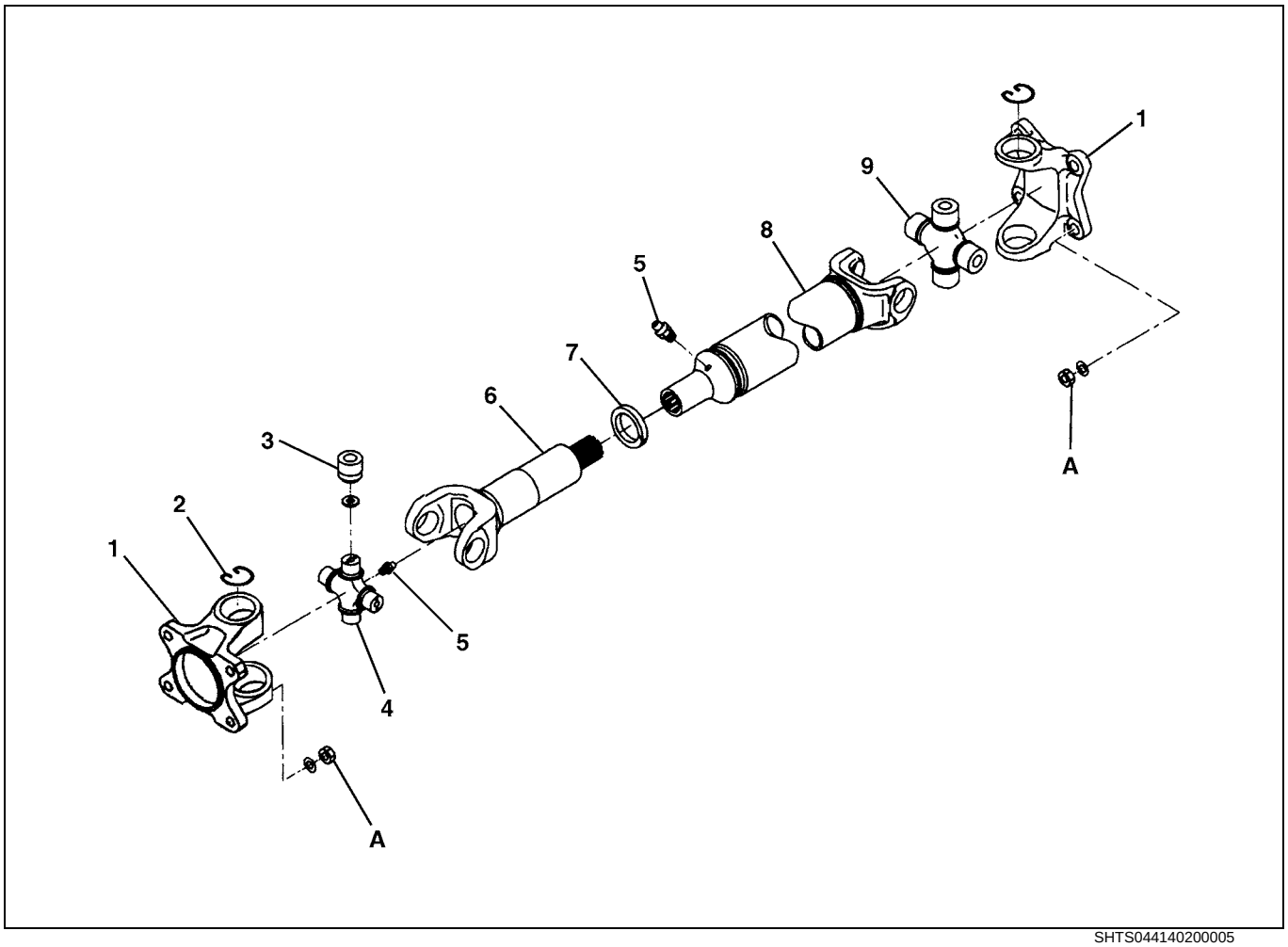
SHTS044140200004

1	Flange yoke	8	Collar
2	Retainer ring	9	Center bearing cushion
3	Universal joint spider	10	Needle roller bearing
4	Yoke shaft	11	Flange coupling
5	Dust deflector	12	Lock nut
6	Center bearing	13	Lubrication fitting
7	Center bearing plate	14	Center bearing holder

Tightening torque — Unit: N·m {kgf·cm, lbf·ft}

A	167-225 {1,700-2,300, 123-165}	C	19-25 {200-250, 15-18}
B	96-144 {980-1,460, 71-105}	D	784-980 {8,000-10,000, 579-722}

TRANSMISSION TO REAR AXLE (REAR)



SHTS044140200005

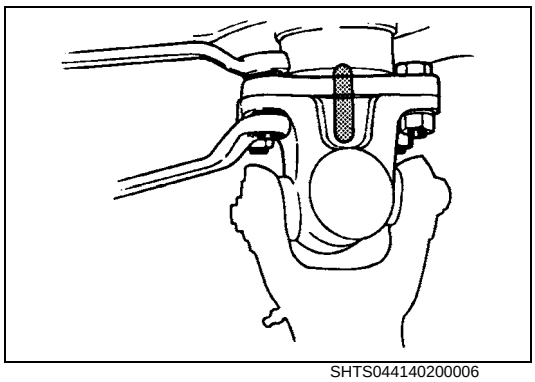
1	Flange yoke	6	Sliding yoke
2	Retainer ring	7	Dust cover seal
3	Needle roller bearing	8	Yoke shaft
4	Universal joint spider	9	Universal joint assembly
5	Lubrication fitting		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	167-225 {1,700-2,300, 123-165}		

OVERHAUL

EN0441402H200001


SHTS044140200006

IMPORTANT POINT - DISMOUNTING

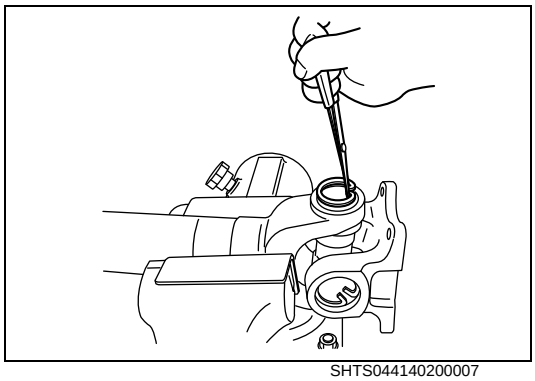
1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.

(1) Make aligning marks on the flange and flange yoke.

(2) Remove the nuts and the bolts.

NOTICE

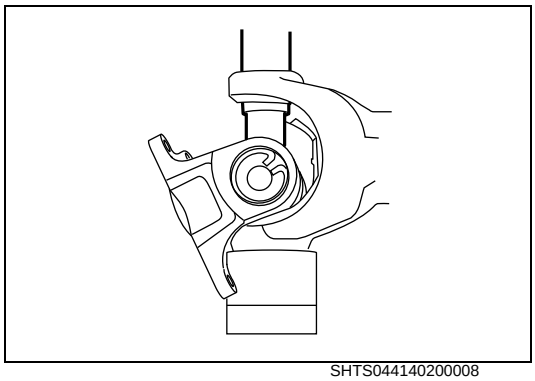
Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.


SHTS044140200007

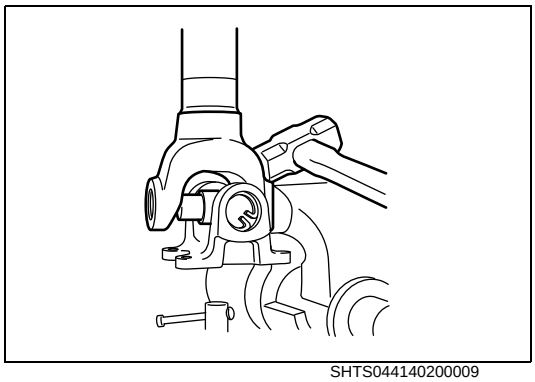
IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.

(1) Remove the retainer ring from the yoke.


SHTS044140200008

(2) Position the yoke under the arbor press and push universal joint partially out of the yoke lug. The bearing race will now protrude from the yoke.


SHTS044140200009

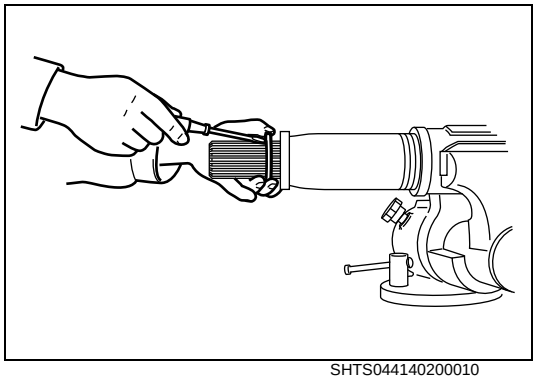
(3) Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise. Tap the yoke in area shown to achieve removal of universal joint bearing.

(4) Press the opposite bearing out of the yoke lug.

(5) Remove the spider with flange yoke from the yoke.

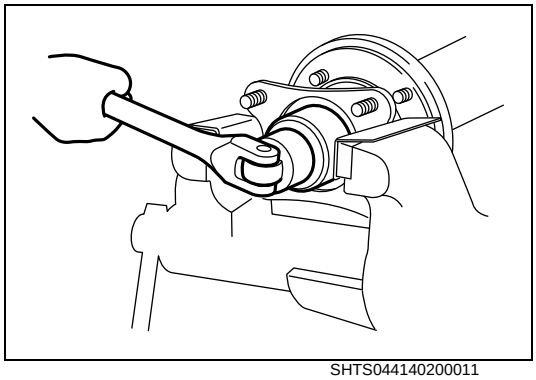
NOTICE

Keep the original location of the bearings, thrust washers, spider and retainer rings in mind. These parts have to be replaced in the same position as before disassembly when reassembling.


SHTS044140200010

2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.

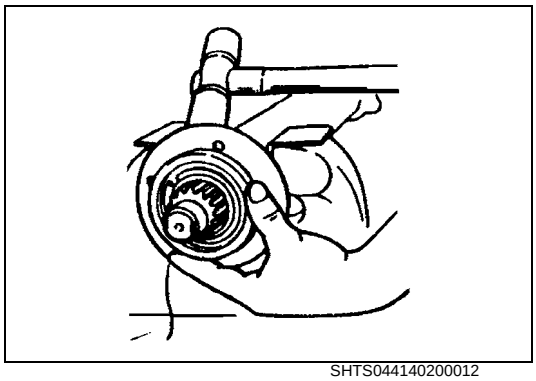
(1) Separate the yoke shaft and sliding yoke.
(2) Remove the dust cover seal from the yoke shaft.


SHTS044140200011

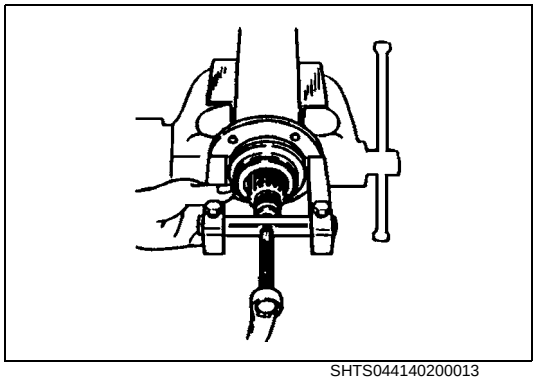
3. REMOVE THE CENTER BEARING. (IF SO EQUIPPED)

(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
SST:
Socket Wrench (S0983-94601)
Socket Wrench (S0983-96502)

(5) Remove the flange coupling from the shaft.

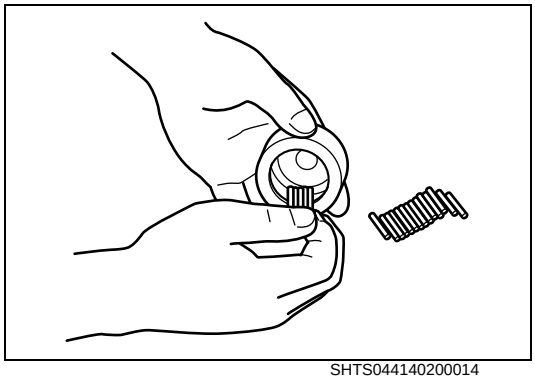

SHTS044140200012

(6) Using a hammer, tap the bearing plate to make a clearance.


SHTS044140200013

(7) Using a commercial puller, remove the center bearing.

NOTICE
Be careful not to catch your fingers between bearing plate and dust deflector.



SHTS044140200014

IMPORTANT POINTS - ASSEMBLY

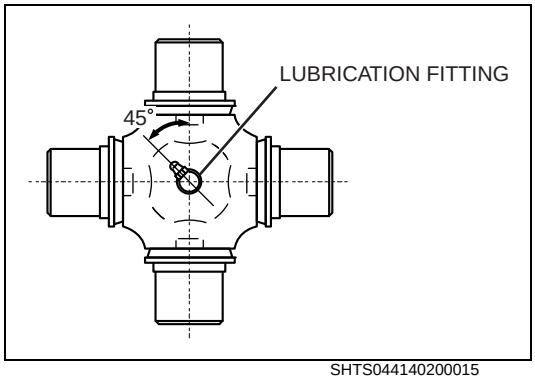
1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

NOTICE

Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.



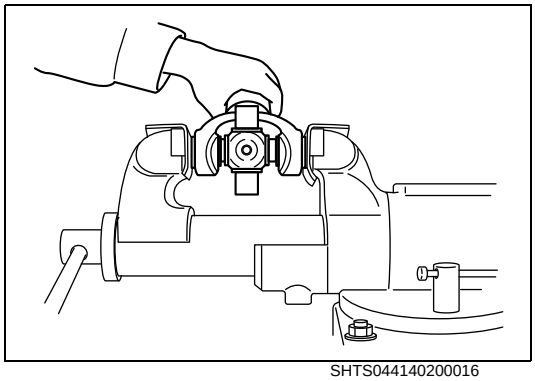
SHTS044140200015

2. INSTALL THE UNIVERSAL JOINT SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.

(1) Put the universal joint spider into the yoke and then set the needle roller bearings on the yoke.

NOTICE

When installing the spider to the yoke shaft, install the lubrication fitting to the spider should be made the direction of the lubrication fitting of the center bearing part or the sliding yoke part as shown in the figure.

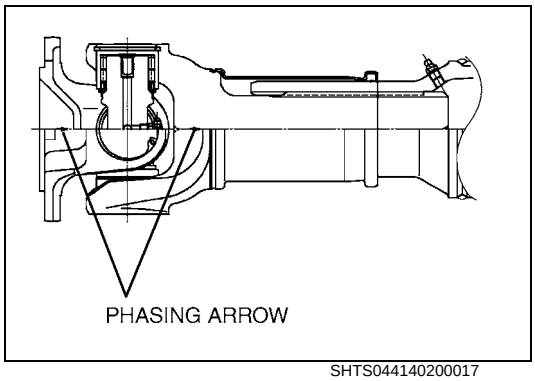


SHTS044140200016

(2) Press the universal joint bearings into the yokes over the spider journal.

NOTICE

Pay attention not to damage the seal lip of the universal joint bearing when installing.

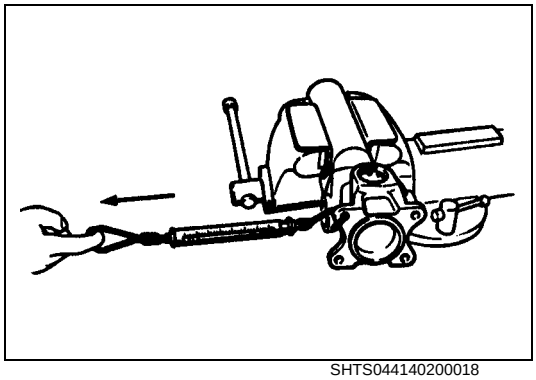


SHTS044140200017

(3) Install the flange yoke to the universal joint spider.

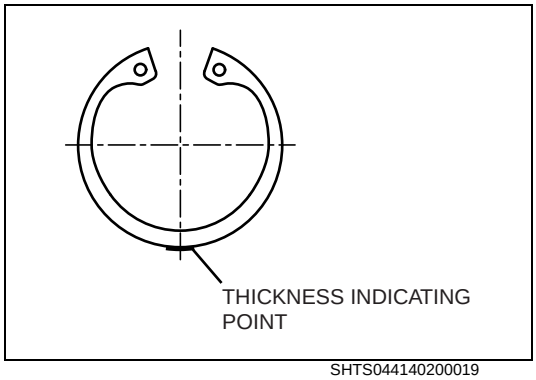
NOTICE

Match the phasing arrows on the flange yoke with the phasing arrows on the yoke shaft or sliding yoke.



SHTS044140200018

3. CHECK THE STARTING TORQUE OF THE UNIVERSAL JOINT USING A SPRING BALANCER.
Assembly standard:
2.45-6.86 N·m {25-70 kgf·cm, 21.7-60.7 lbf·in.}



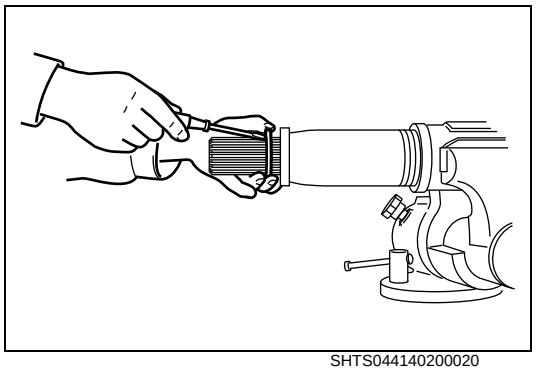
SHTS044140200019

(1) If the measuring value is below the assembly standard, replace the retainer ring with the thicker one.
(2) If the measuring value is above the assembly standard, replace the retainer ring with the thinner one.

NOTICE
Use retainer rings of the same thickness as possible for both ends.

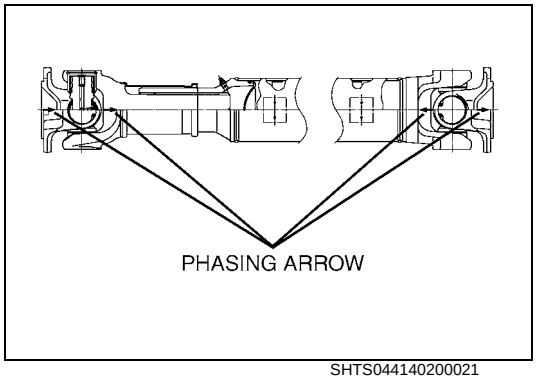
Unit: mm {in.}

Thickness of retainer ring	Color of thickness indication point
2.78 {0.1094}	White
2.81 {0.1106}	Red
2.84 {0.1118}	Green
2.87 {0.1130}	Blue
2.90 {0.1142}	Yellow



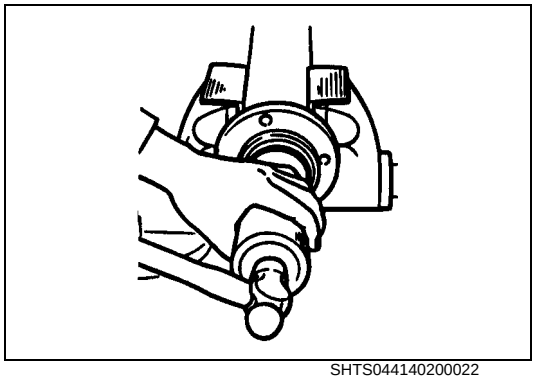
SHTS044140200020

4. INSTALL THE DUST COVER SEAL.
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new dust cover seal on the shaft by pushing it in the seal groove.
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust cover seal.

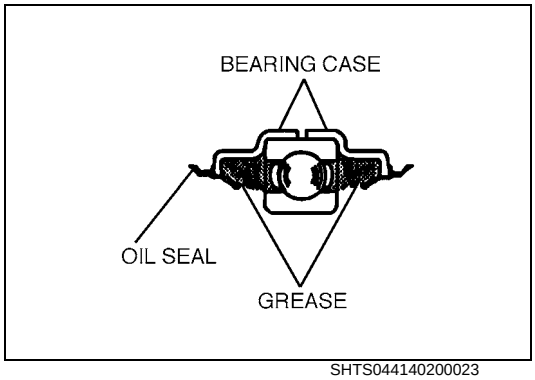


SHTS044140200021

5. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.
(1) Align the phasing arrows as shown in the figure.


SHTS044140200022

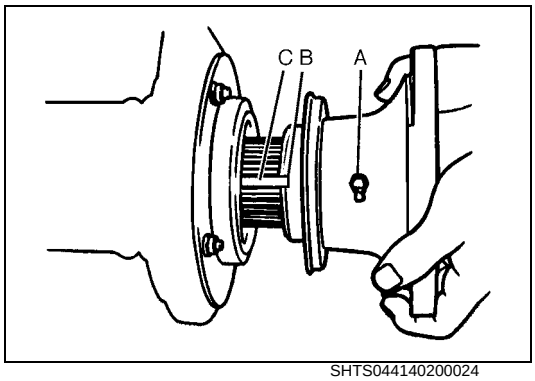
6. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING. (IF SO EQUIPPED)



SHTS044140200023

NOTICE
Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.

Grease:
Refer to Owner's manual.



SHTS044140200024

(1) Install the flange coupling.
   a. Prior to installing, heat the flange coupling in either water or oil that has been heated to 80-100°C {176-212°F}.

NOTICE
- **Do not heat the flange coupling in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

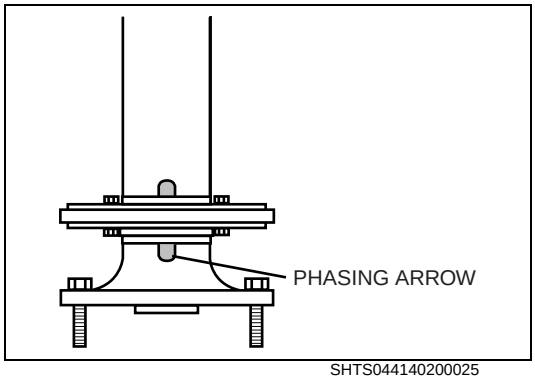
⚠ CAUTION
Never touch hot water or oil nor heated flange coupling with your bare band. This can result in personal injury.

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

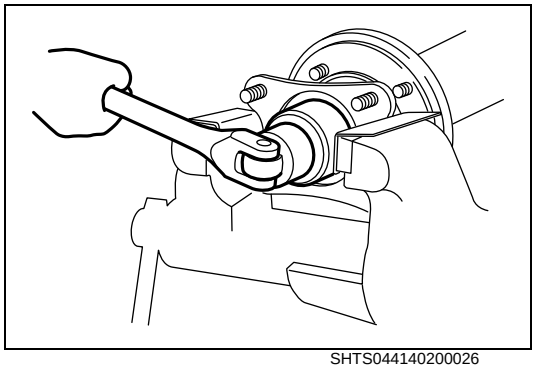
- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

NOTICE
Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper specified torque.

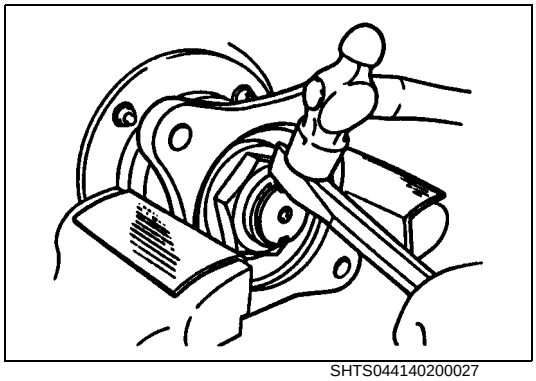
   c. Align the phasing arrows on the flange coupling, yoke shaft and sliding yoke in line as shown in figure.



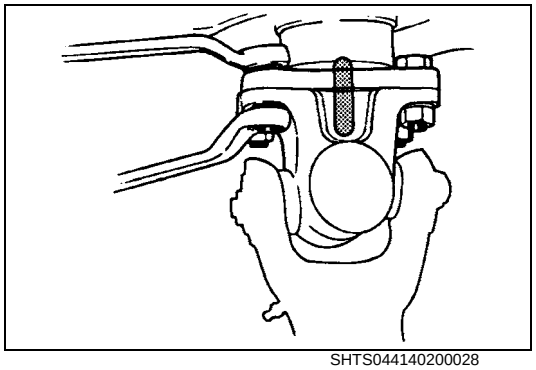
SHTS044140200025


SHTS044140200026

d. Using the special tool, tighten the lock nut.
SST:
Socket Wrench (S0983-94601)
Socket Wrench (S0983-96502)


SHTS044140200027

(2) Caulk the lock nut.
a. Caulk deeper than 1.5 mm {0.06 in.}
b. The caulking should fill the groove thoroughly.
c. The caulking should be done without rift.


SHTS044140200028

IMPORTANT POINT - MOUNTING

1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.
(1) Align the matching marks on the flange and flange yoke.
(2) Tighten the bolts and nuts.

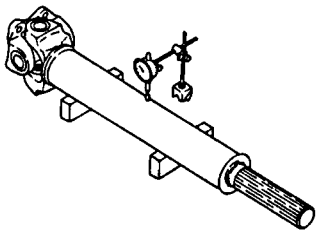
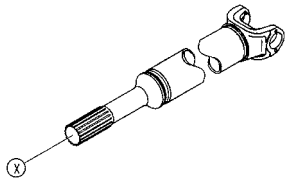
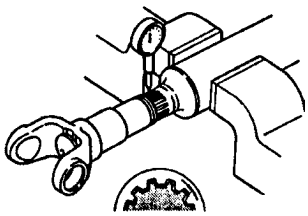
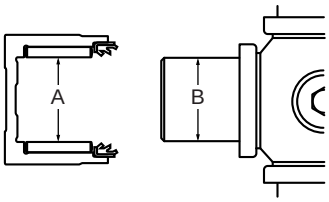
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

Grease:
Refer to Owner's manual.

INSPECTION AND REPAIR

EN0441402H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Propeller shaft damage and bend	**0-0.5 {0-0.0197}**	**1.0 {0.039}**	**Replace.**	**Measure** 
Crack in the welding beads	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Sliding spline damage	**—**	**—**	**Replace, if necessary.**	
Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80 mm {3.145 in.} from the shaft center.)	**At spline 0.062-0.174 {0.0025-0.0068}**	**0.3 {0.0118}**	**Replace.**	**Measure** 
Clearance (C) between universal joint spider and needle roller bearing (C = A - B)	**0.039-0.089 {0.0016-0.0035}**	**0.1 {0.0039}**	**Replace needle roller bearing sub-assembly or universal joint spider.**	**Measure** 

DIFFERENTIAL EQUIPMENT (LOCKING TYPE DIFFERENTIAL GEAR)

DF01-001

LOCKING TYPE DIFFERENTIAL GEAR (NO SPIN)..... DF01-2

DATA AND SPECIFICATIONS..... DF01-2
DESCRIPTION DF01-2
PROPOSAL TOOL DF01-3
INSPECTION..... DF01-3
TROUBLESHOOTING..... DF01-6
COMPONENT LOCATOR DF01-6
OVERHAUL DF01-7
INSPECTION AND REPAIR..... DF01-9

LOCKING TYPE DIFFERENTIAL GEAR (NO SPIN)

DATA AND SPECIFICATIONS

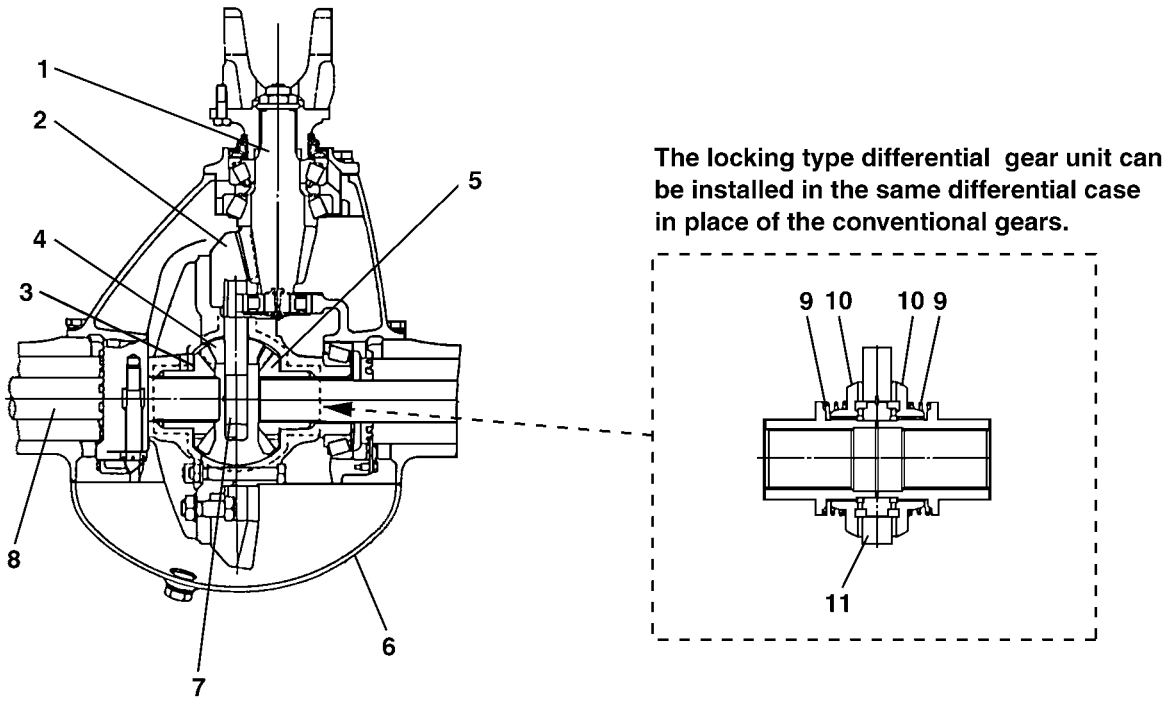
EN05Z0501I200001

Differential carrier series	SH13	SH16
Type	Silent type (with two hold-out rings)	
Diameter of spider ring Unit: mm {in.}	125 {4.92}	148 {5.83}
Diameter of spider shaft Unit: mm {in.}	24 {0.94}	26 {1.02}
Max. allowable torque par side Unit: N·m {kgf·m, lbf·ft}	9,806 {1,000, 7,233}	17,651 {1,800, 13,019}

DESCRIPTION

EN05Z0501C100001

(REPRESENTATIVE TYPE)



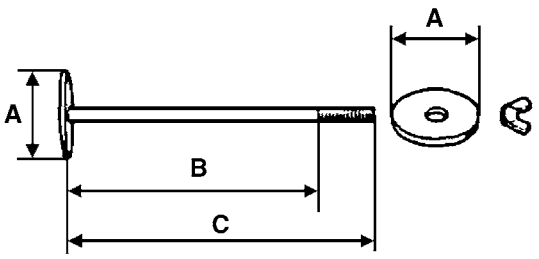
SHTS05Z050100001

1	Pinion gear	7	Spider
2	Ring gear	8	Axle shaft
3	Thrust washer	9	Spring
4	Differential pinion	10	Driven clutch
5	Differential side gear	11	Spider with center cam
6	Axle housing		

PROPOSAL TOOL

EN05Z0501K100001

ASSEMBLING TOOL



SHTS05Z050100002

Dimension of tool **Unit: mm {in.}**

Differential carrier series	A	B	C
SH13	47 {1.85}	155 {6.10}	180 {7.09}
SH16	53 {2.09}	205 {8.07}	230 {9.06}

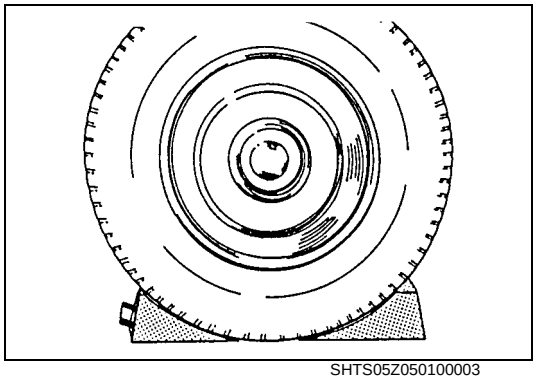
INSPECTION

EN05Z0501H300001

NOTICE
Before overhauling, the operation of locking differential can be confirmed using the following procedure:

1. SUPPORT THE FRAME WITH STANDS.

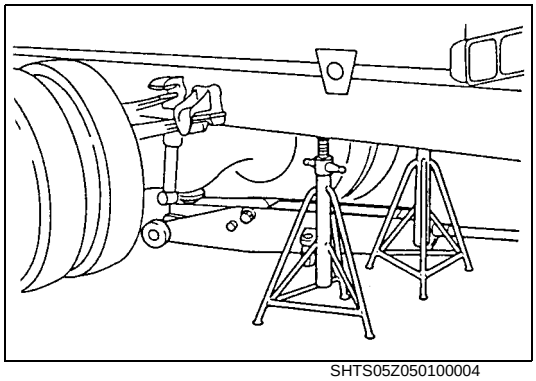
(1) Park the vehicle on a level ground, apply the parking brake and block the front wheels.



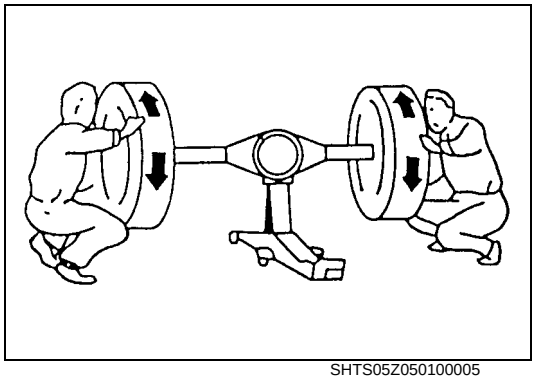
SHTS05Z050100003

(2) Jack up the rear axle and support the frame with stands.

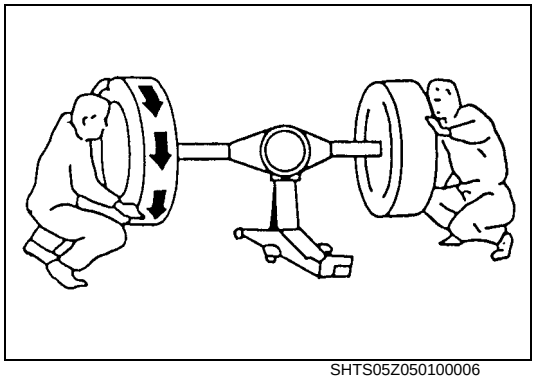
NOTICE
Do not run the engine.



SHTS05Z050100004

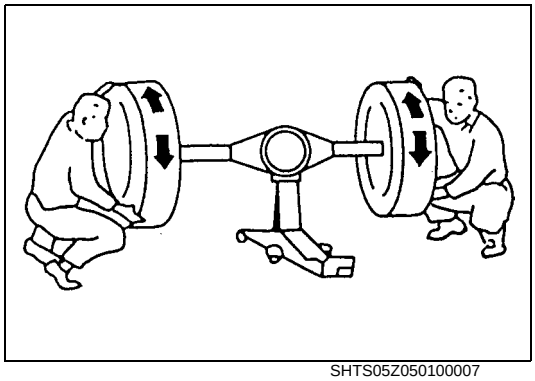

SHTS05Z050100005

(3) Press the 4WD selector switch and release the parking brake. Check to see that both rear wheels can be rotated slightly in both directions. (About 5-6 cm {1.97-2.36 in.})

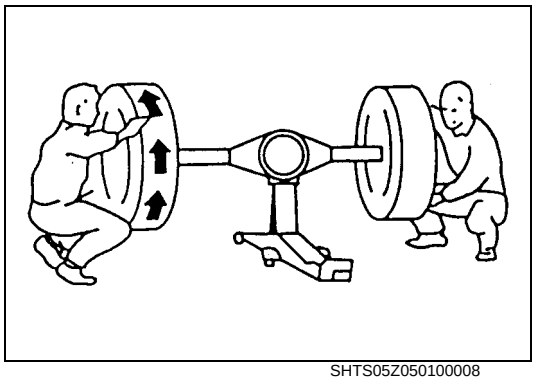

SHTS05Z050100006

2. LEFT SIDE INSPECTION

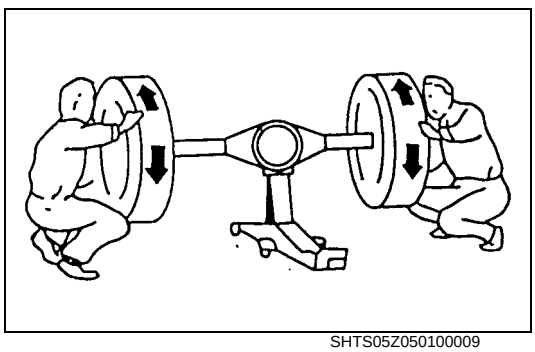
(1) Turn the right wheel in the forward direction until it stops, and hold the wheel in the stopped position and turn the left wheel in the rearward direction. A clicking noise in the differential should be heard.


SHTS05Z050100007

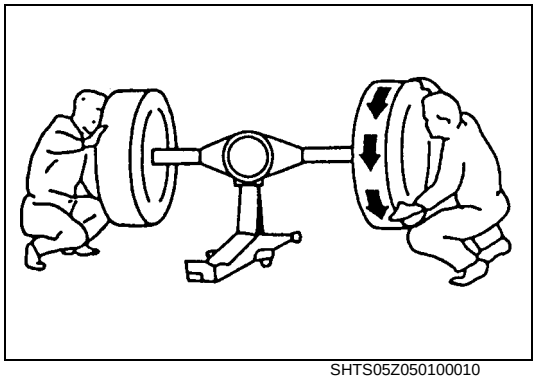
(2) Next, turn the right wheel in the rearward direction slightly. The wheel can be turned only slightly, as in step (3) above.


SHTS05Z050100008

(3) Turn the right wheel in the rearward direction until it stops, and hold the wheel in the stopped position and turn the left wheel in the forward direction. A clicking noise in the differential should be heard.

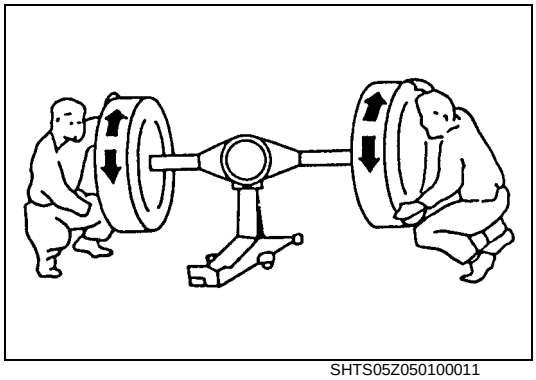

SHTS05Z050100009

(4) Next, turn the right wheel in the forward direction slightly. The left wheel can be turned only slightly, as in step (3) above.

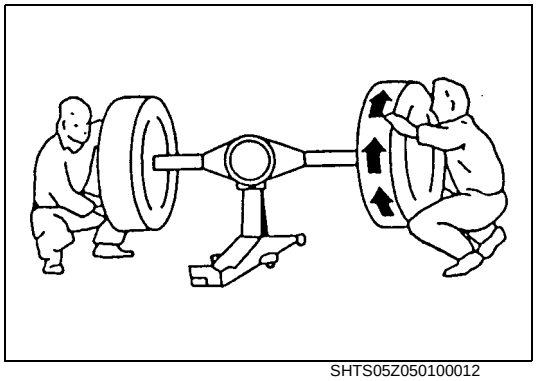

SHTS05Z050100010

3. RIGHT SIDE INSPECTION

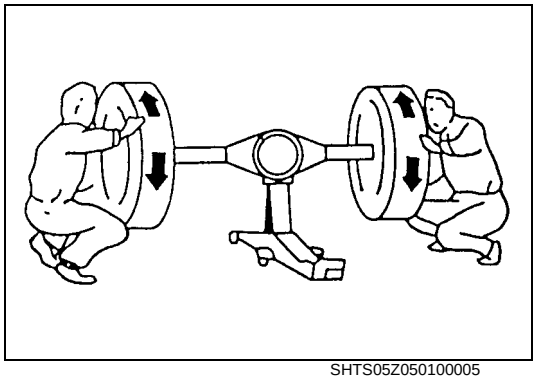
(1) Turn the left wheel in the forward direction until it stops, and hold the wheel in the stopped position and turn the right wheel in the rearward direction. A clicking noise in the differential should be heard.


SHTS05Z050100011

(2) Next, turn the left wheel in the rearward direction slightly. The right wheel can be turned only slightly, as in step (3) above.


SHTS05Z050100012

(3) Turn the left wheel in the rearward direction until it stops, and hold the wheel in the stopped position and turn the right wheel in the forward direction. A clicking noise in the differential should be heard.


SHTS05Z050100005

(4) Next, turn the left wheel in the forward direction slightly. The right wheel can be turned only slightly, as in step (3) above.

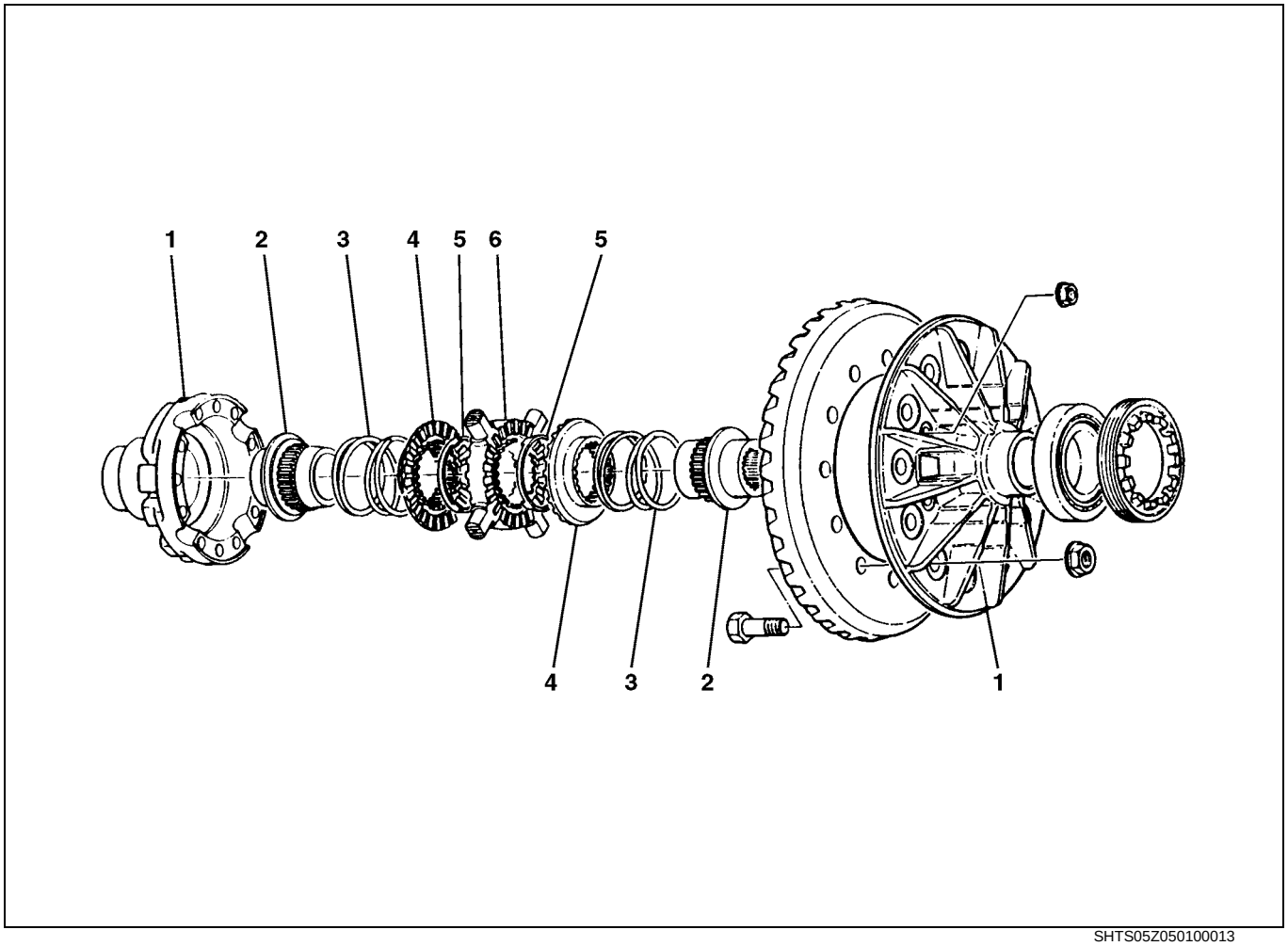
TROUBLESHOOTING

EN05Z0501F300001

Symptom	Possible cause	Remedy/Prevention
Faint clicking noise while turning.	Normal differential operation (Clutch teeth)	
Faint clicking noise while going straight.	Tire diameters are different between the left and right side.	Adjust the tire inflation pressure or replace tire.
Steering wheel pulls to one side, when accelerating.	Clutch and cam teeth and/or spring on either side are defective.	Replace the defective parts.
Clicking noise when alternately accelerating and decelerating while turning.	Normal differential operation (Clutch teeth)	
Abnormal wear and dragging of tire.	Driven clutch and/or spider with center cam on either side are defective.	Replace the defective parts.
Clutch teeth disengages when starting to drive in 1st gear.	Excessive wear of clutch teeth.	Replace the defective parts.

COMPONENT LOCATOR

EN05Z0501D100001

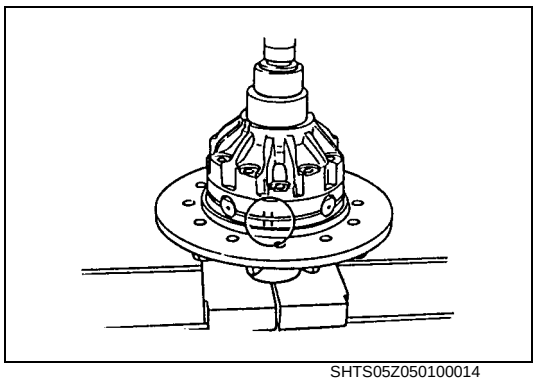


SHTS05Z050100013

1	**Differential case**	**4**	**Driven clutch**
2	**Differential side gear**	**5**	**Hold-out ring**
3	**Spring**	**6**	**Spider with center cam**

OVERHAUL

EN05Z0501H200001



SHTS05Z050100014

IMPORTANT POINT - DISASSEMBLY

NOTICE

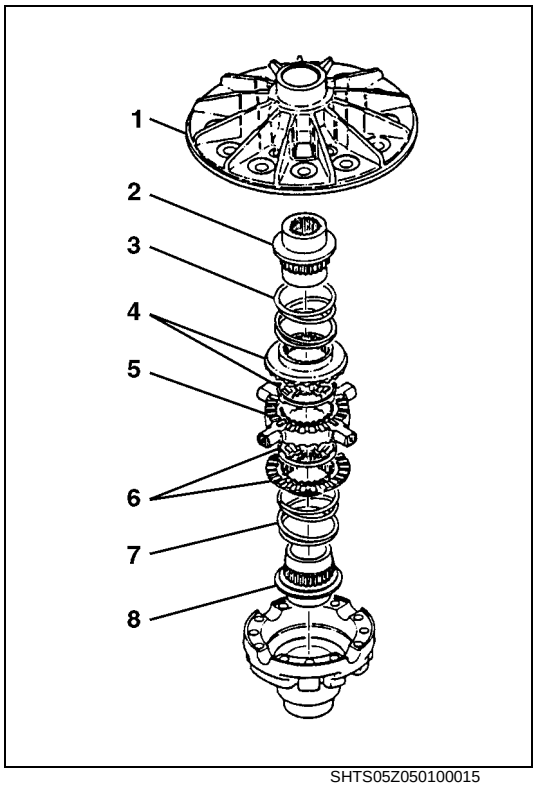
Refer to the chapter "DIFFERENTIAL CARRIER".

1. DISASSEMBLE THE DIFFERENTIAL GEAR

(1) Make aligning marks to the differential gear case before disassembling.

NOTICE

The differential case may suddenly open while disassembling therefore, place the differential gear assembly in a press.



SHTS05Z050100015

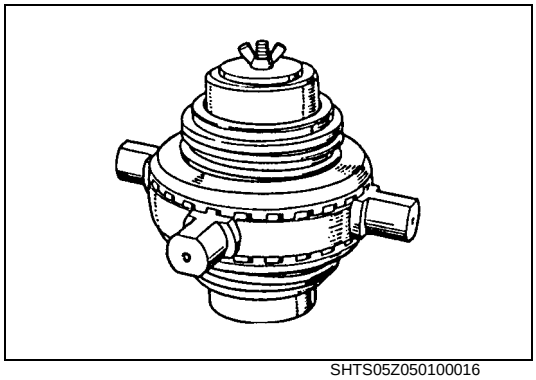
IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLE THE DIFFERENTIAL GEAR.

(1) Refer to the chapter **"DIFFERENTIAL CARRIER"**.

NOTICE

- **Align the side gear spline and the driven clutch.**
- **Align indented side of the hold-out ring to driven clutches and the another side to spider.**

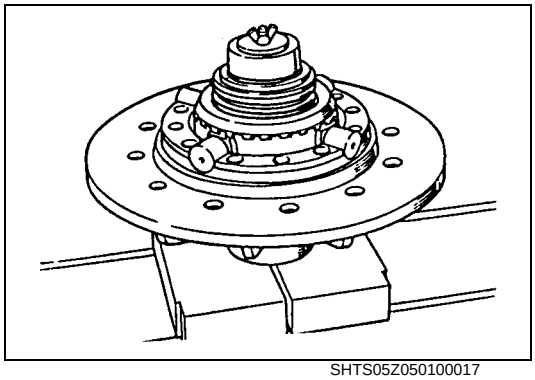


SHTS05Z050100016

(2) Hold the parts using the proposal tool.
Proposal tool: Assembling tool

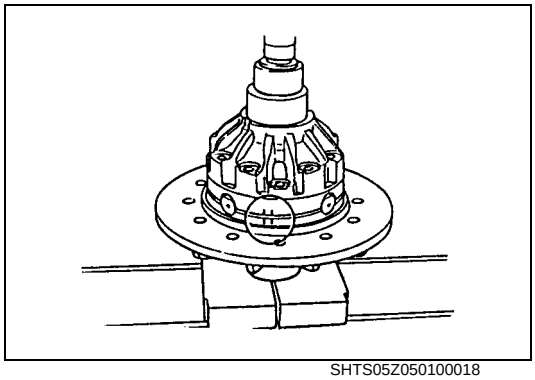
NOTICE

Align the spline of the side gear and the driven clutch.



SHTS05Z050100017

(3) Install the differential gear assembly to the differential case.

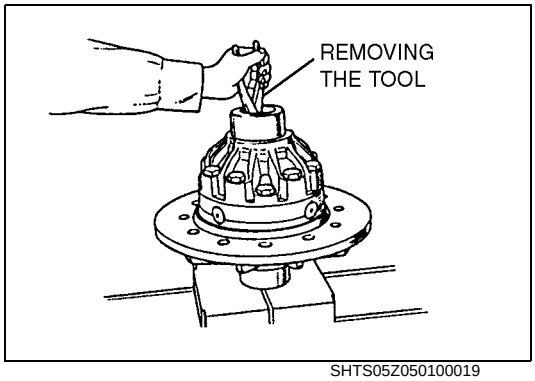


SHTS05Z050100018

2. ASSEMBLE THE DIFFERENTIAL CASE.

NOTICE

- **Align the aligning marks before assembling.**
- **Apply the gear oil on all inner parts.**
- **Since the differential case is under pressure from locking differential springs, depress the differential case with a press. Also, remember that the assembly will not fit into the differential case unless the locking differential side gear and the driven clutch spline are aligned.**



SHTS05Z050100019

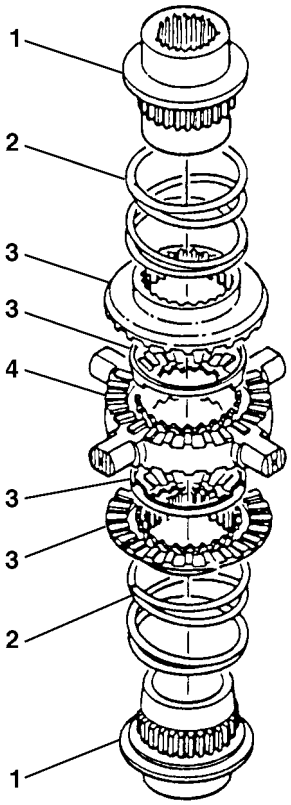
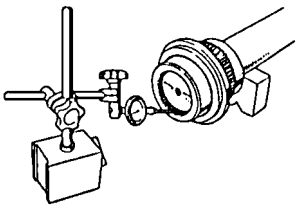
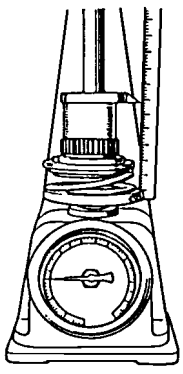
(1) If the differential gear is assembled using a tool, be sure to remove the tool from the differential gear.

INSPECTION AND REPAIR

EN05Z0501H300002

Regarding differential case and related parts, refer to the chapter **"DIFFERENTIAL CARRIER"**.

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Side gear 1. Spline, Flange: Wear and damage	**—**	**—**	**Repair or replace, if necessary.**	**Visual check** 
Spring 2. Damage	**—**	**—**	**Replace, if necessary.**	
Driven clutch assembly 3. (with hold-out ring) Spline and Teeth: Wear and damage Hold-out ring movement	**Ring rotates on clutch by hand**	**—**	**Repair or replace, if necessary. Ring and clutch may be replaced individually.**	
Spider assembly 4. Teeth: Wear and damage Center cam free movement	**Rotates freely within limit of key in spider**	**—**	**Replace, if necessary.**	
Side gear and axle shaft: Spline backlash	**0.05-0.15 {0.0020-0.0059}**	**0.03 {0.0012}**	**Replace the side gear and/or axle shaft.**	**Measure** 
Spring: Setting load at specified height	**SH13: 294.2 N {30.0 kgf, 66.1 lbf} at 20.2 {0.795}**	**235.4 N {24 kgf, 52.9 lbf}**	**Replace.**	**Measure** 
	SH16: 350.1 N {35.7 kgf, 78.7 lbf} at 23.2 {0.913}	**274.6 N {28 kgf, 61.7 lbf}**		

DIFFERENTIAL EQUIPMENT (LOCKING TYPE DIFFERENTIAL GEAR: MANUAL TYPE) DF01-002

LOCKING TYPE DIFFERENTIAL GEAR (MANUAL TYPE)..... DF01-2

DATA AND SPECIFICATIONS..... DF01-2
COMPOSITION AND OPERATION..... DF01-3
TROUBLESHOOTING..... DF01-5
COMPONENT LOCATOR..... DF01-5
OVERHAUL..... DF01-6
INSPECTION AND REPAIR..... DF01-7

LOCKING TYPE DIFFERENTIAL GEAR (MANUAL TYPE)

DATA AND SPECIFICATIONS

EN05Z0501I200001

Differential carrier series	**SH18**
Type	**Manual type**
Operation	**Simultaneous operation with inter-axle differential lock**

COMPOSITION AND OPERATION

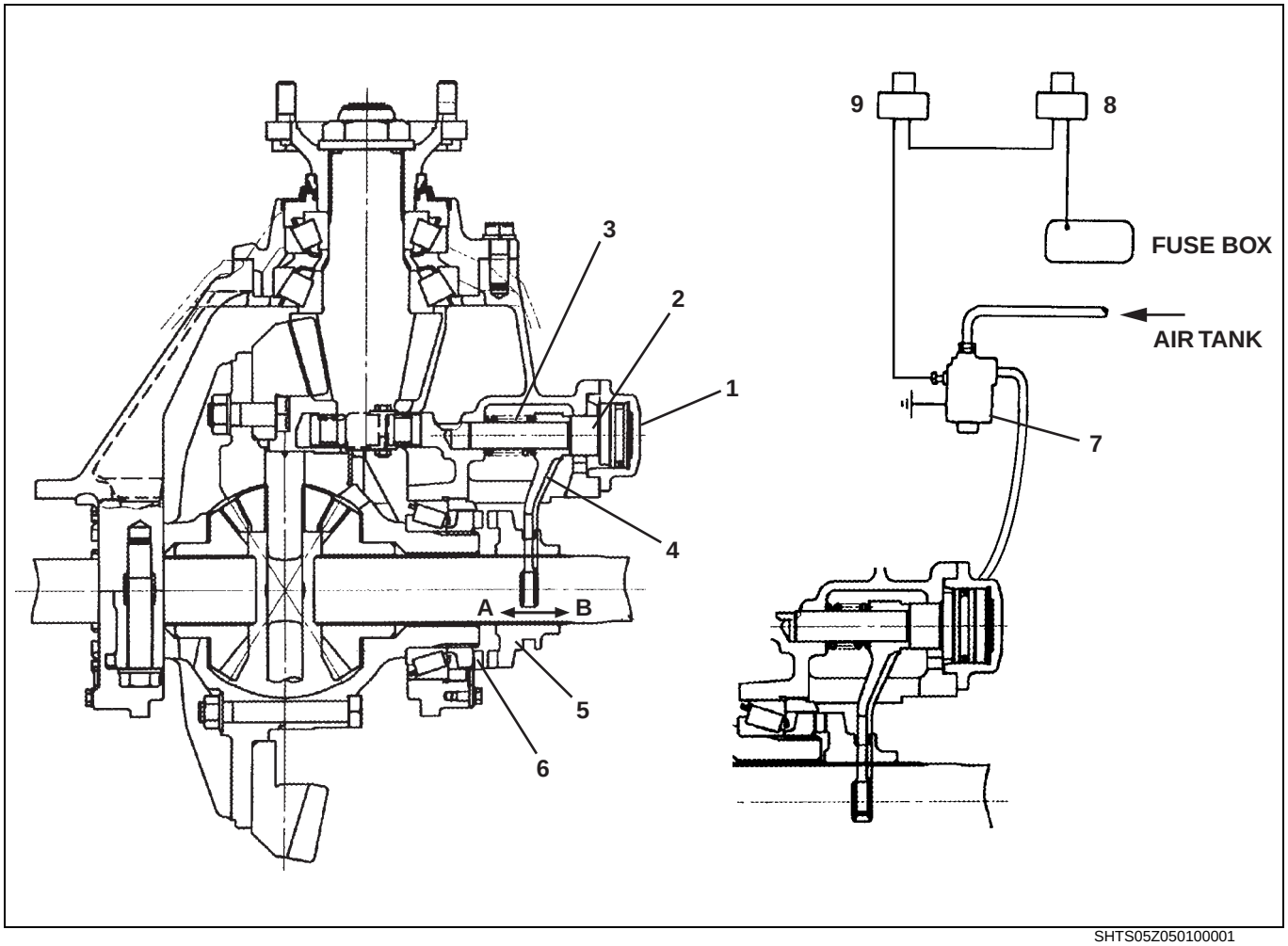
EN05Z0501C100001

OUTLINE

- Driven force will be equally transferred to LH/RH wheels due to LH/RH driving wheels to be directly connected by locking differential of rear-rear wheel. Accordingly, "differential lock" will enable to start out with driven force of another one even when a wheel of one side slipping. Then it will operate simultaneously with "inter-axle differential lock".

COMPOSITION

- Manual differential lock is composed of such additional devices as air shift (air cylinder, piston, shift fork, sleeve and the like), switch, solenoid valve and the like in addition to standard differential carrier, which can be switched "ON", "OFF" for "differential lock" with a switch operation at driver's seat in the cab.
- When differential lock switch is turned "ON", piston is pushed with air pressure and sleeve "A" synchronized with piston will interlock sleeve "B", fixed to differential case side to operate "differential lock".

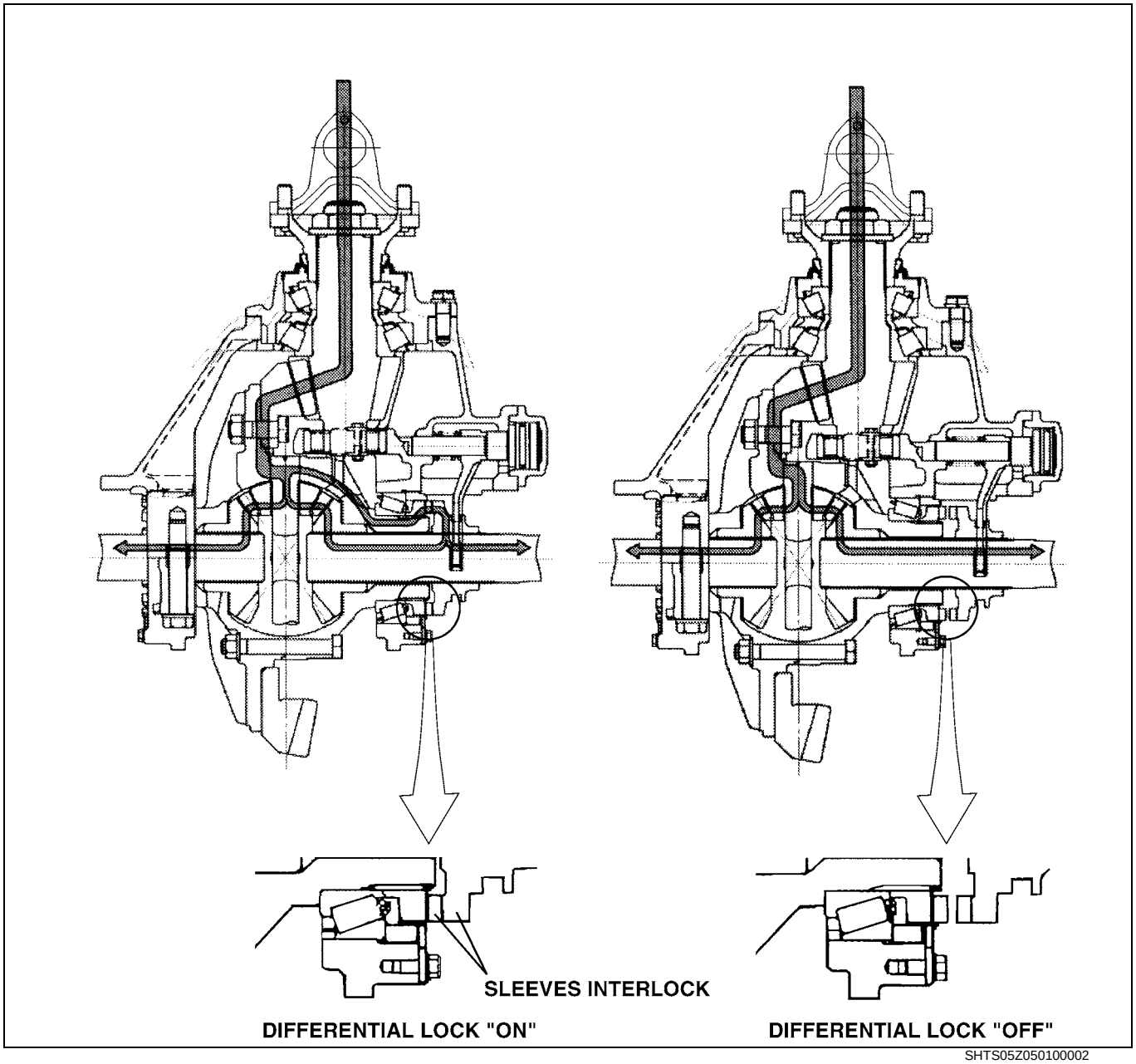


SHTS05Z050100001

1	Cylinder cover	7	Solenoid valve
2	Piston	8	Differential lock switch
3	Spring	9	Differential lock change switch
4	Shift fork	A	Lock
5	Sleeve "A"	B	Release
6	Sleeve "B"		

OPERATION

- When switching differential lock change switch into "manual" side and turning "ON" differential lock switch, solenoid valve will operate and compressed air of air tank will be sent to air cylinder, by which piston, shift fork and sleeve will be pushed and sleeves will be interlocked for differential lock.
  At the same time, buzzer will beep to indicate differential lock operation.
- When differential lock switch turned "OFF", compressed air in the air cylinder will be discharged through solenoid valve. Differential lock will be released by pushing back shift fork, sleeve and piston with a spring.



SHTS05Z050100002

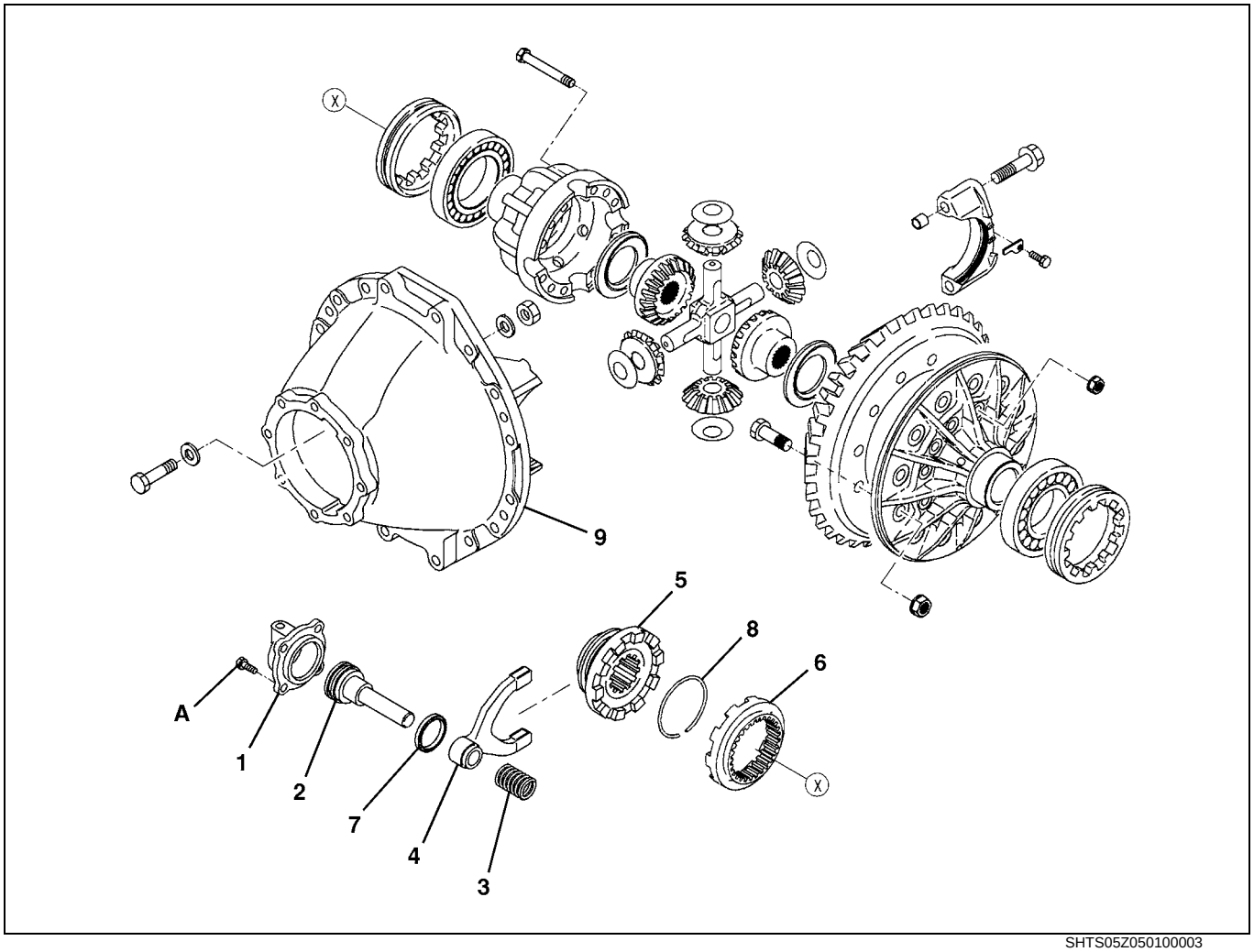
TROUBLESHOOTING

EN05Z0501F300001

Symptom	Possible cause	Remedy/Prevention
Can not be operated	Faulty switches	Replace switch
	Faulty solenoid valve	Replace solenoid valve
Does not release	Defective piston return spring	Replace spring

COMPONENT LOCATOR

EN05Z0501D100001



SHTS05Z050100003

1	**Cylinder cover**	**6**	**Sleeve "B"**
2	**Piston**	**7**	**Piston seal**
3	**Spring**	**8**	**Retainer**
4	**Shift fork**	**9**	**Differential carrier cover**
5	**Sleeve "A"**		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

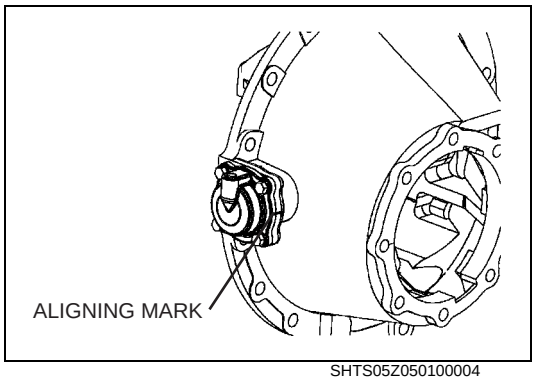
A	**37.5-48.5 {380-490, 28-35}**		

OVERHAUL

EN05Z0501H200001

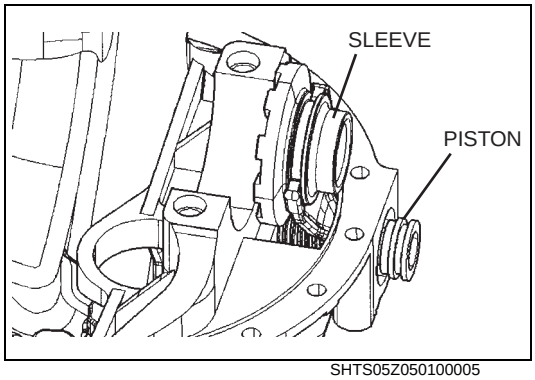
IMPORTANT POINTS - DISASSEMBLY

NOTICE
Refer to the chapter "DIFFERENTIAL CARRIER".



SHTS05Z050100004

1. REMOVAL OF CASE COVER
(1) Put a aligning mark on case cover and differential carrier case.
(2) Taking off the bolts, remove case cover.



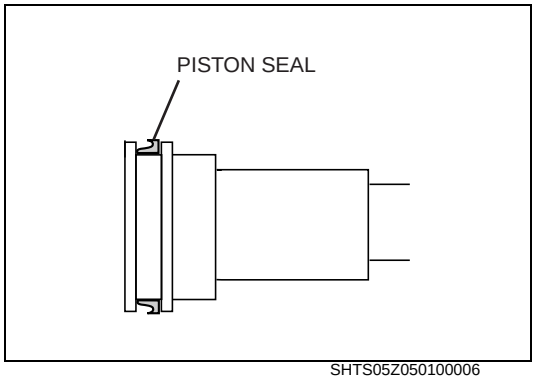
SHTS05Z050100005

2. REMOVAL OF SHIFT FORK, SLEEVE AND PISTON
(1) Pulling out piston, remove spring, shift fork and sleeve.
(2) Remove sleeve out of shift fork.

HINT
A notch to prevent from detachment of sleeve on shift fork can be tapped with a copper hammer to remove sleeve off.

(3) Remove piston seal from piston.

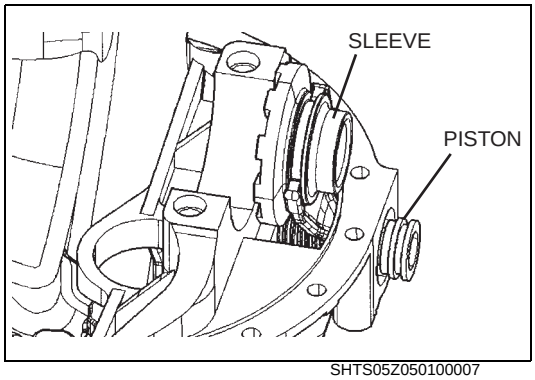
IMPORTANT POINTS - ASSEMBLY



SHTS05Z050100006

1. INSTALLATION OF PISTON
(1) Apply gear oil on the moving portion of piston.
(2) Applying silicon grease on new piston seal, install it as shown in the figure with much care to the direction of piston seal.

2. CLEANING THE INSTALLING SURFACE OF CASE COVER
(1) Clean off any dirt on the contacting surface of case cover and differential carrier cover with a scraper.

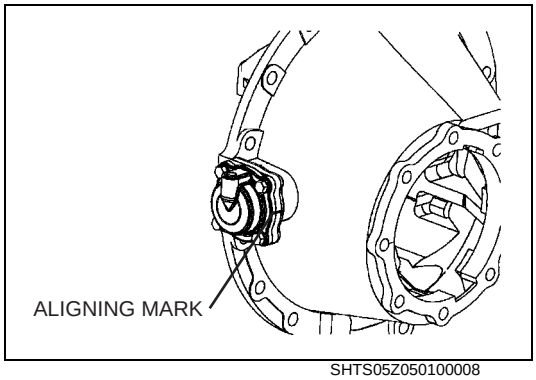


SHTS05Z050100007

3. INSTALLATION OF SLEEVE, SHIFT FORK AND PISTON
(1) Putting in piston, install sleeve, shift fork and piston.

NOTICE
Be careful to the installing direction as shift fork has a direction to be installed.

HINT
A notch to prevent from detachment of sleeve on shift fork can be tapped off with a copper hammer to install sleeve.



SHTS05Z050100008

4. INSTALLATION OF CASE COVER

(1) Apply liquid gasket on case cover.

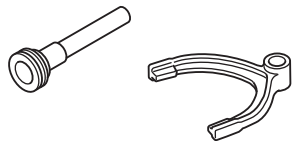
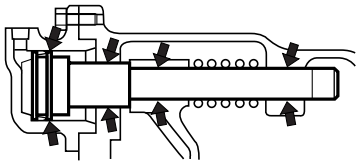
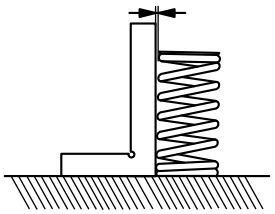
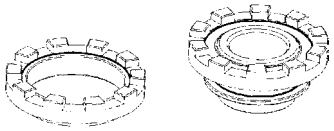
NOTICE

- **The liquid gasket must be ThreeBond #1215, #1216 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 5 mm {0.20 in.} away from the edge.**

(2) Aligning the aligning mark, install case cover.

INSPECTION AND REPAIR

EN05Z0501H300001

Inspection item	Standard	Limit	Remedy	Inspection procedure
Shift fork and piston: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift fork and piston case sliding surface: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Return spring: Squareness	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Sleeve: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SH13)

DF02-001

DIFFERENTIAL CARRIER (SH13) DF02-2

DATA AND SPECIFICATIONS DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING DF02-3
SPECIAL TOOL DF02-3
COMPONENT LOCATOR DF02-4
OVERHAUL DF02-6
INSPECTION AND REPAIR DF02-19

DIFFERENTIAL CARRIER (SH13)

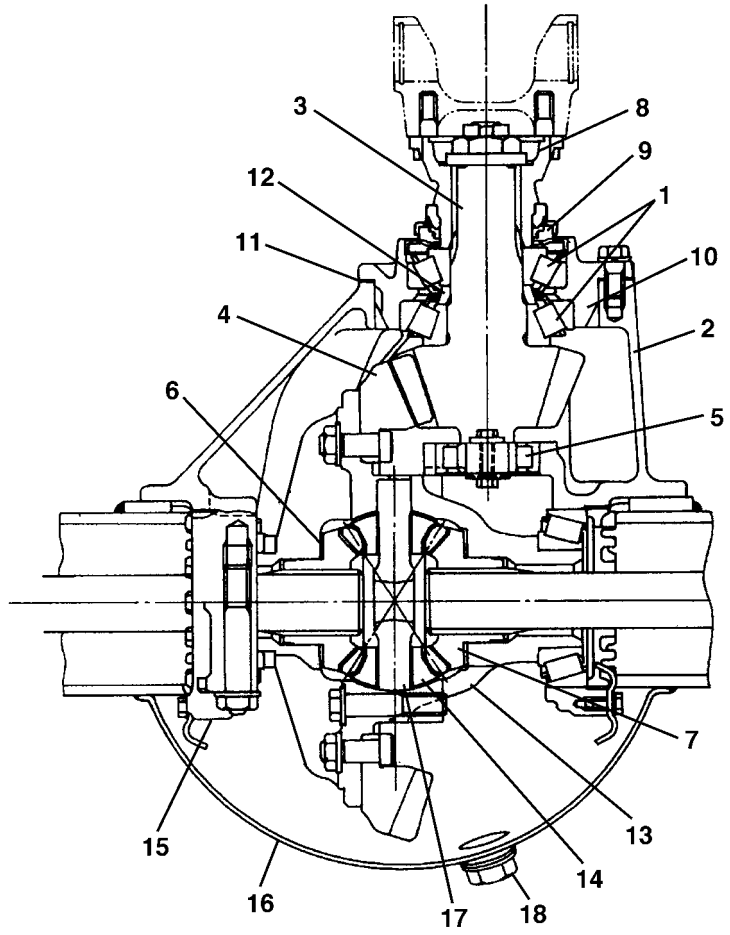
DATA AND SPECIFICATIONS

EN0550402I200001

Type	**Single-reduction, single-speed, by hypoid gearing**
Gear ratios	**3.636, 3.900, 4.100, 4.333, 4.625, 5.142**
Oil capacity	**3.7 L {0.81 Imp gal. / 0.98 U.S. gal.}**

DESCRIPTION

EN0550402C100001



SHTS055040200001

1	Taper roller bearing	10	Bearing cage
2	Differential carrier case	11	Adjusting shim
3	Hypoid pinion	12	Spacer
4	Hypoid ring gear	13	Differential case
5	Cylindrical roller bearing	14	Differential pinion gear
6	Thrust washer	15	Bearing cap
7	Differential side gear	16	Axle housing
8	Flange yoke coupling	17	Spider
9	Oil seal	18	Oil filler plug

TROUBLESHOOTING

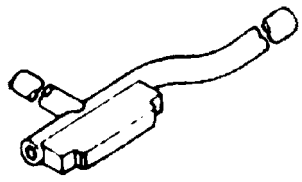
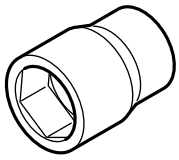
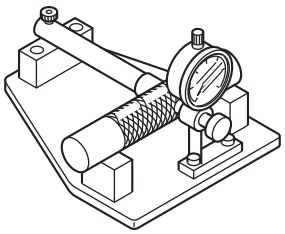
EN0550402F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil; check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

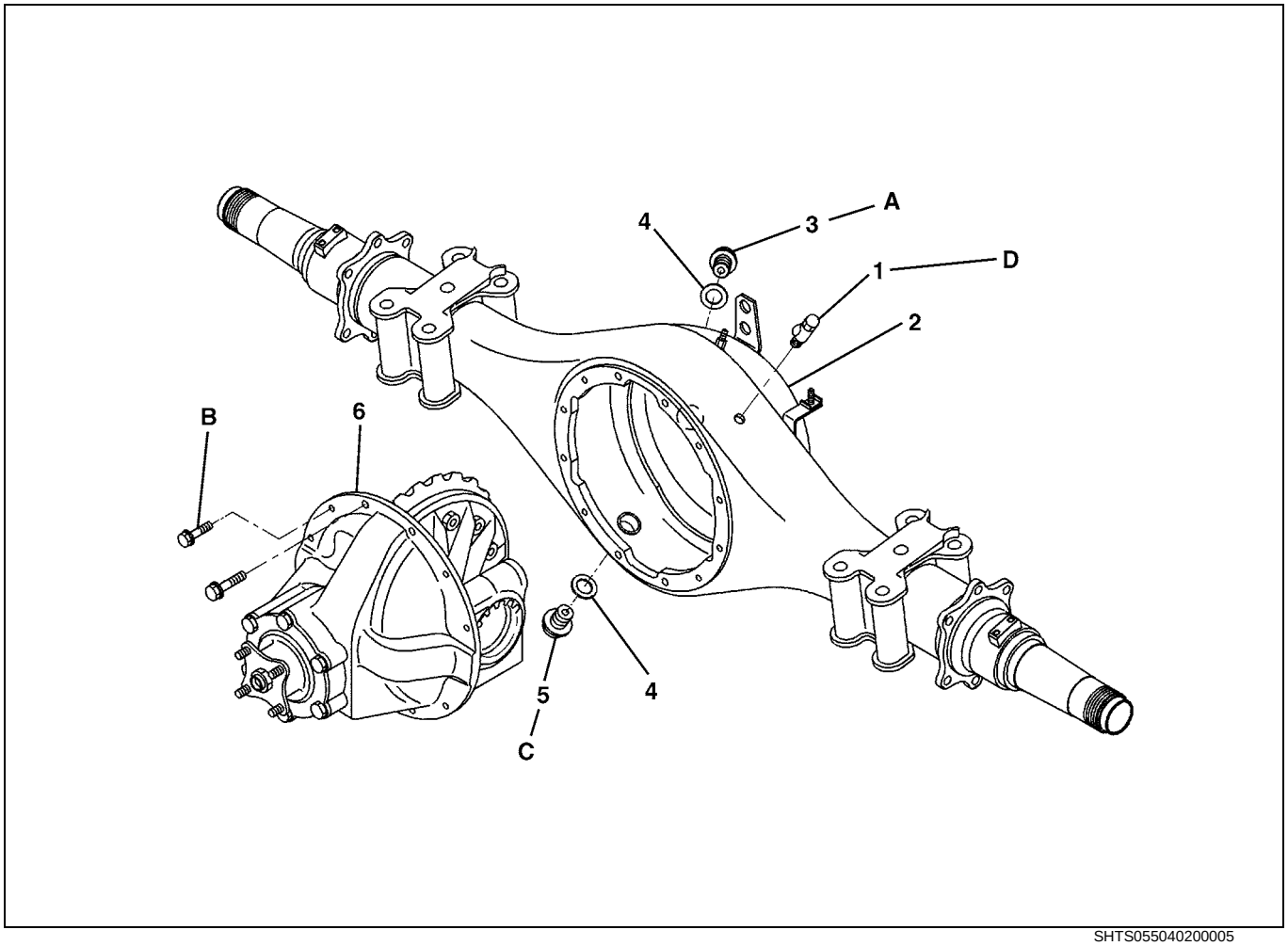
EN0550402K100001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51150	ADJUSTER TOOL	
	S0983-94104	SOCKET WRENCH	
	S0964-01022	GAUGE ASSEMBLY	

COMPONENT LOCATOR

EN0550402D100001

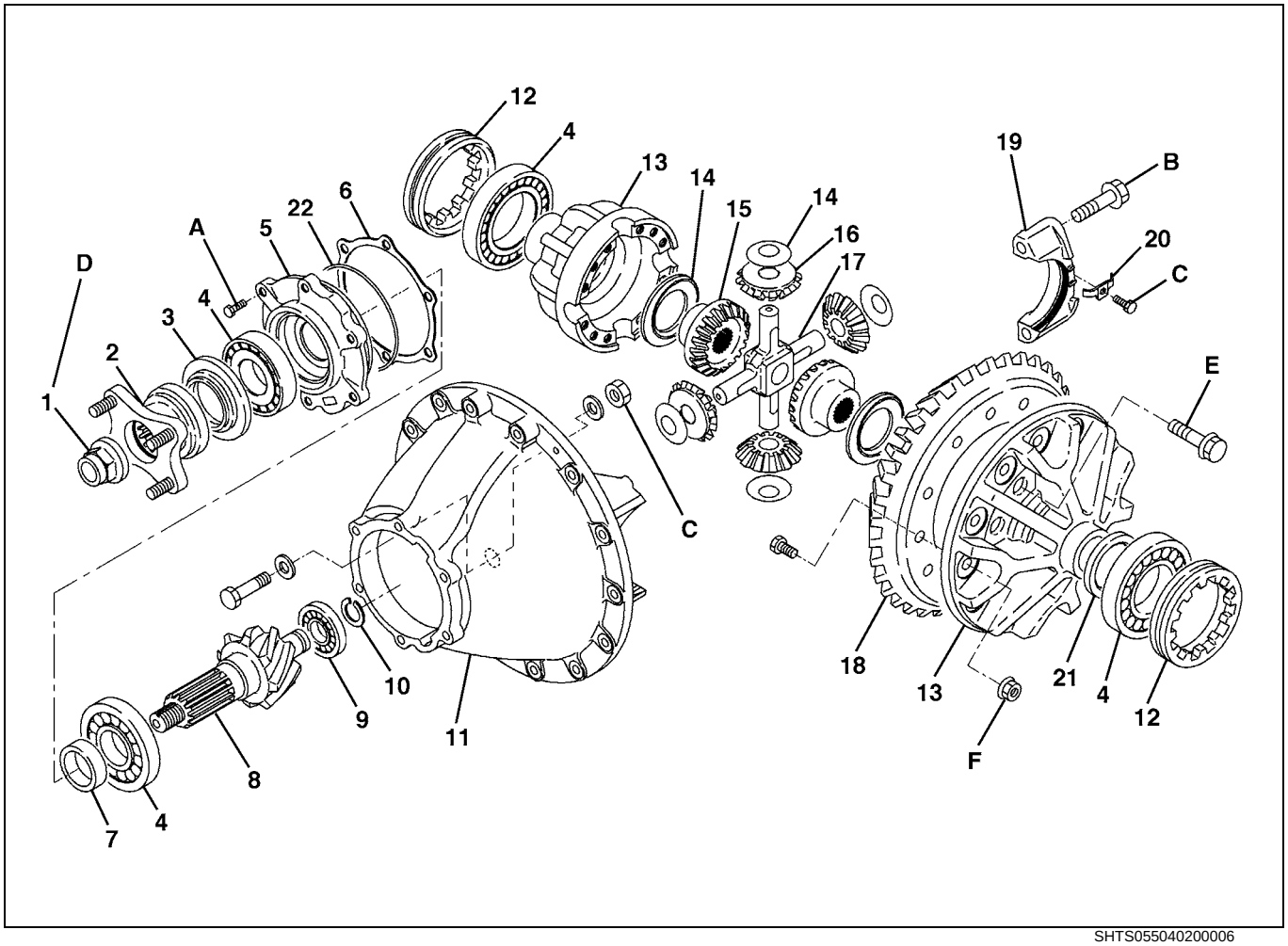


SHTS055040200005

1	Air breather	4	Gasket
2	Axle housing assembly	5	Oil drain plug
3	Oil filler plug	6	Differential carrier assembly

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	78.4-117.6 {800-1,200, 58-86}	C	78.4-117.6 {800-1,200, 58-86}
B	ϕ12: 84.5-107.5 {860-1,100, 63-79}	D	9.8-19.6 {100-200, 7-14}
	ϕ14: 113-147 {1,150-1,500, 83-108}		



SHTS055040200006

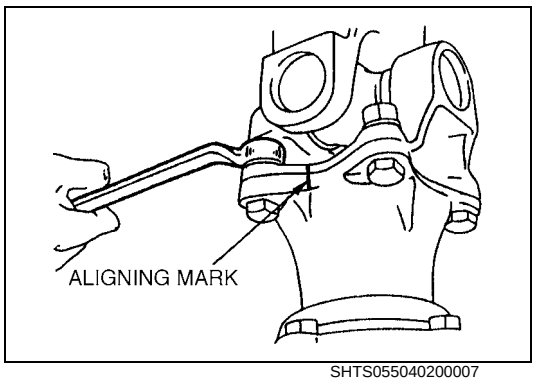
1	Lock nut	12	Adjusting nut
2	Flange yoke coupling	13	Differential case
3	Oil seal	14	Thrust washer
4	Taper roller bearing	15	Differential side gear
5	Bearing cage	16	Differential pinion gear
6	Adjusting shim	17	Spider
7	Spacer	18	Hypoid ring gear
8	Hypoid pinion	19	Bearing cap
9	Cylindrical roller bearing	20	Lock plate
10	Retainer ring	21	Differential case spacer
11	Differential carrier case	22	O-ring

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	63.9-85.3 {650-870, 48-62}	D	374-500 {3,800-5,100, 276-368}
B	197-225 {2,000-2,300, 145-166}	E	246-294 {2,500-3,000, 182-216}
C	19-25 {190-260, 14-18}	F	246-294 {2,500-3,000, 182-216}

OVERHAUL

EN0550402H200001



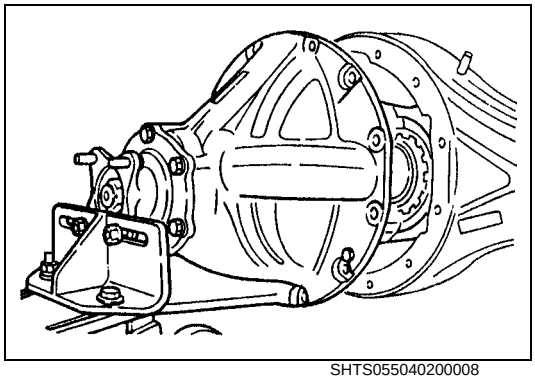
SHTS055040200007

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.


SHTS055040200008

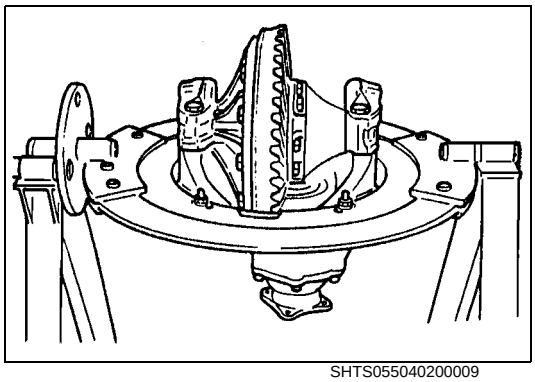
2. DISMOUNTING OF THE DIFFERENTIAL CARRIER ASSEMBLY

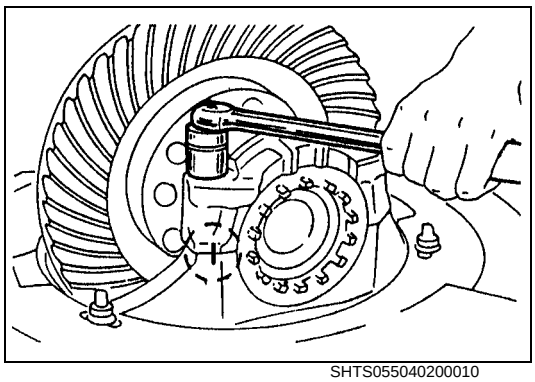
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.

IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.


SHTS055040200009


SHTS055040200010

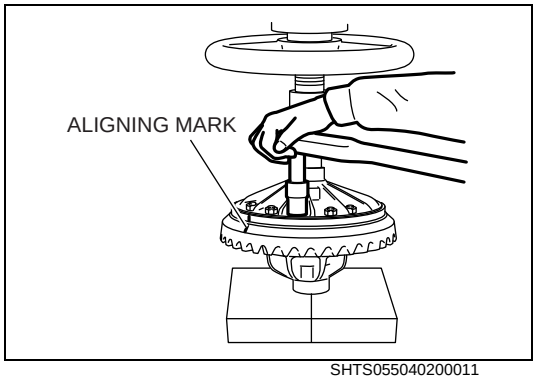
2. DIFFERENTIAL CASE

(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

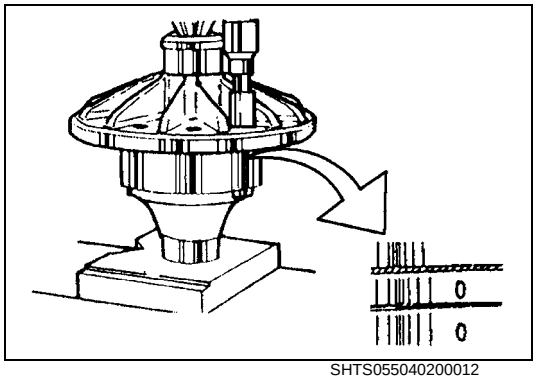
(2) Using a puller, remove the taper roller bearing.



SHTS055040200011

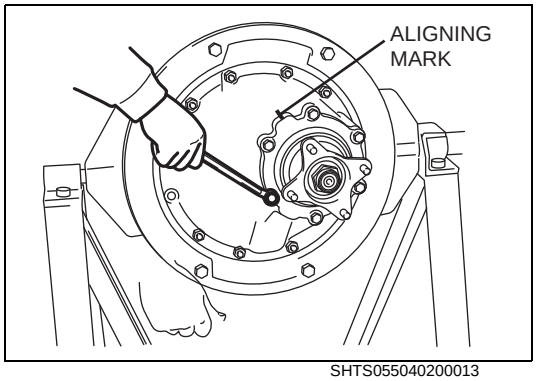
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts, nuts and then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055040200012

(4) Disassemble the differential case.

NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.

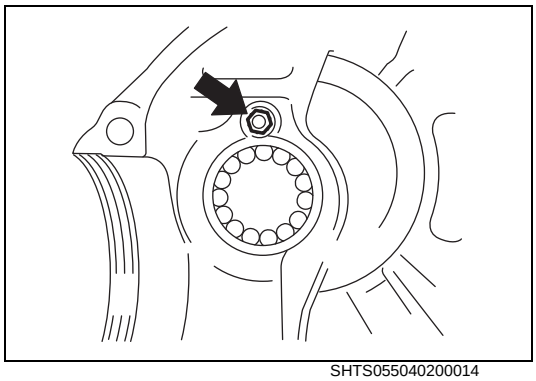


SHTS055040200013

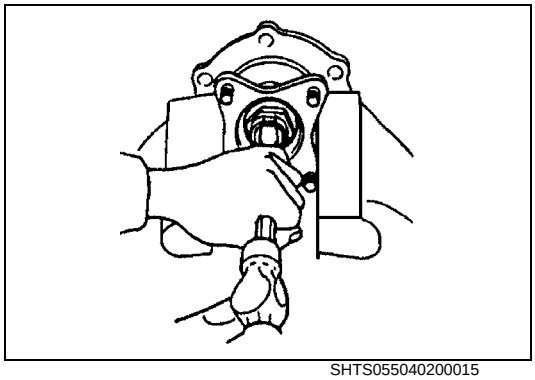
3. HYPOID PINION

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

NOTICE
Make aligning mark the differential cage and differential carrier.

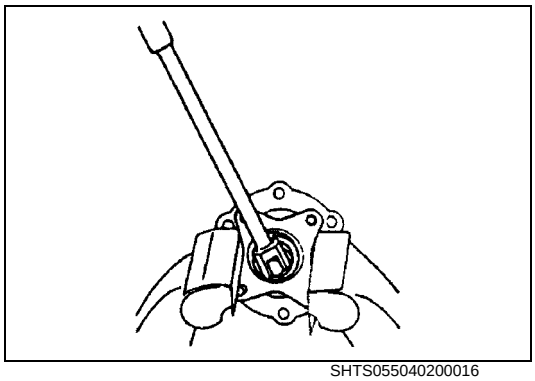

SHTS055040200014

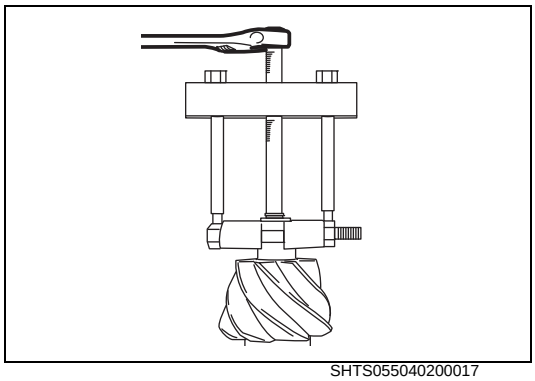
(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


SHTS055040200015

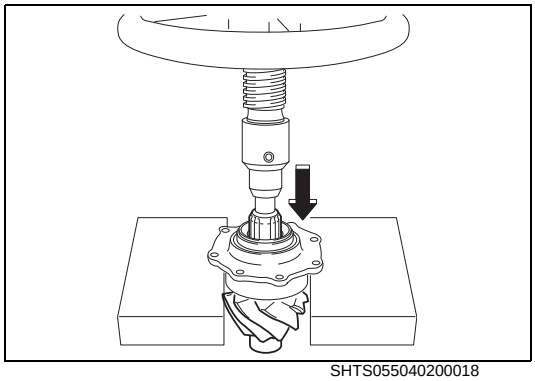
4. BEARING CAGE

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-94104)

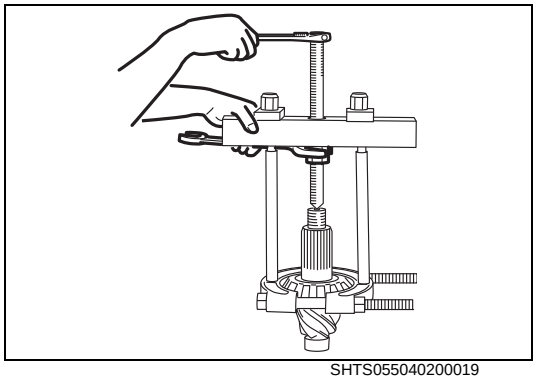

SHTS055040200016


SHTS055040200017

(2) Using a puller, remove the cylindrical roller bearing inner race.


SHTS055040200018

(3) Using a press, remove the hypoid pinion.


SHTS055040200019

(4) Using a puller, remove the taper roller bearing inner race.

IMPORTANT POINTS - ASSEMBLY

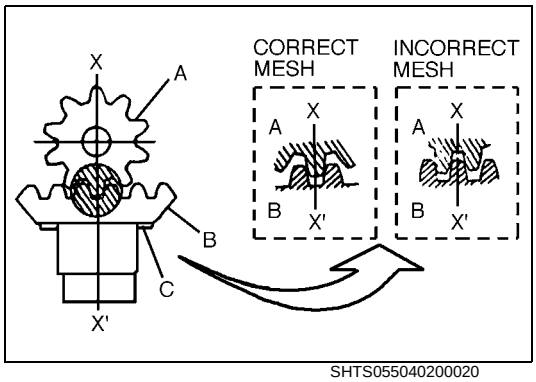
1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

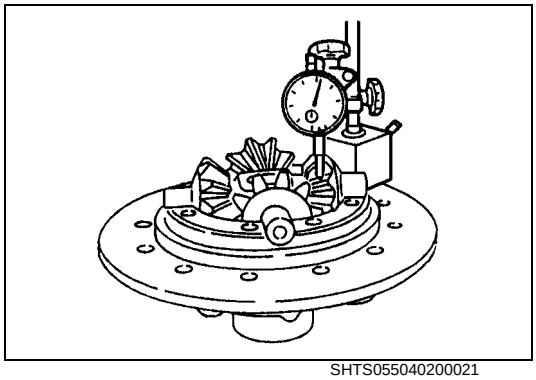
NOTICE

Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

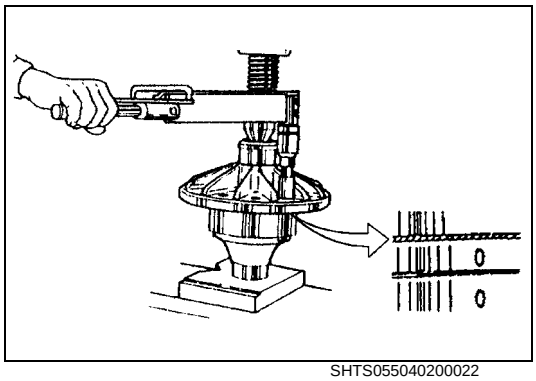
- A: Pinion
- B: Side gear
- C: Thrust washer



SHTS055040200020


SHTS055040200021

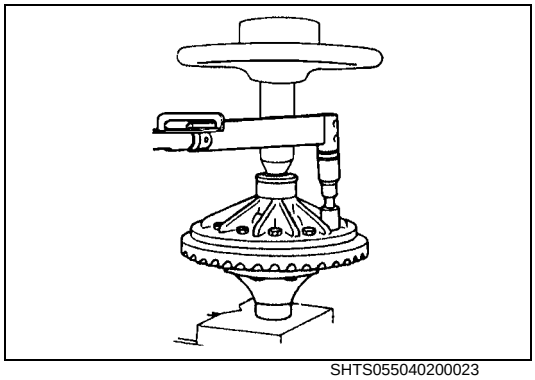
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}


SHTS055040200022

(3) Assemble the differential case.

NOTICE

- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

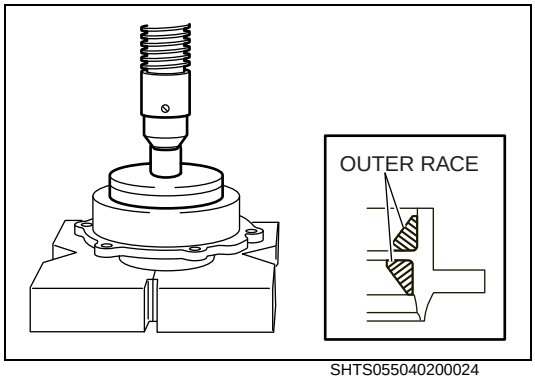


SHTS055040200023

(4) Install the ring gear to the differential case and tighten it with bolts and nuts.

NOTICE

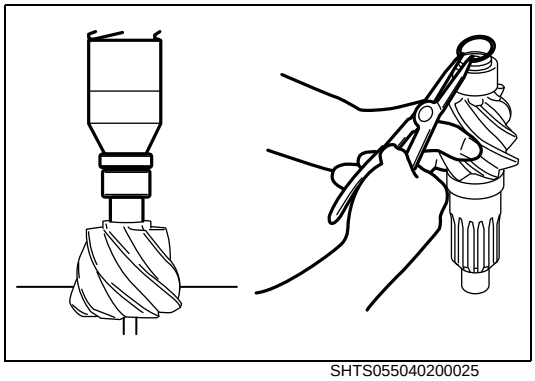
Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.



SHTS055040200024

2. HYPOID PINION

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

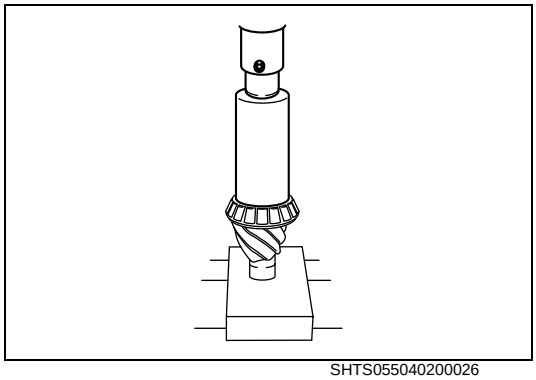


SHTS055040200025

(2) Installing the cylindrical roller bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

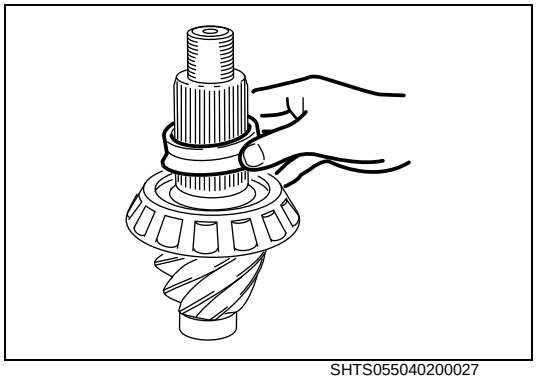
⚠ CAUTION

The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.



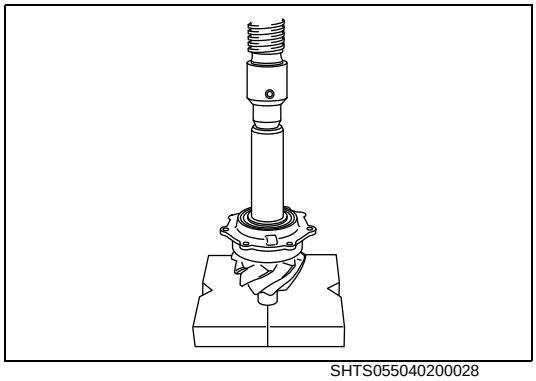
SHTS055040200026

(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the inner taper roller bearing inner race.



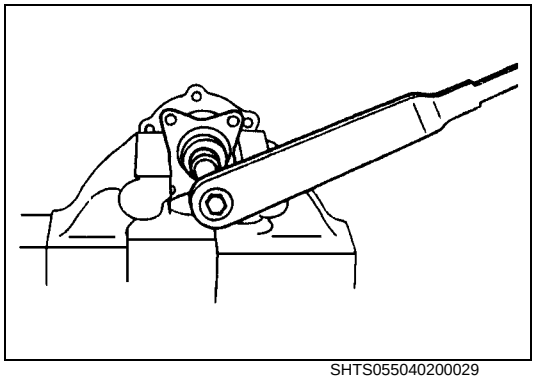
SHTS055040200027

   c. Install the spacer.



SHTS055040200028

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


SHTS055040200029

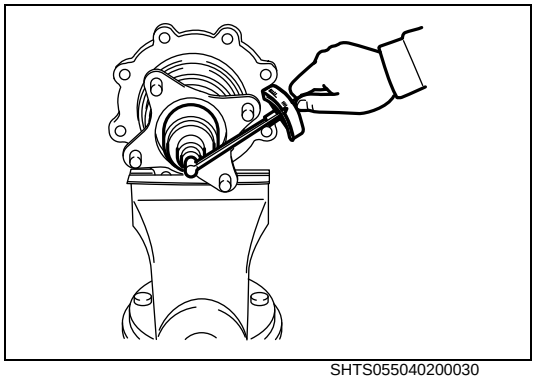
3. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-94104)


SHTS055040200030

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

Assembly Standard: Turning torque Unit: N·m {kgf·cm, lbf·ft}

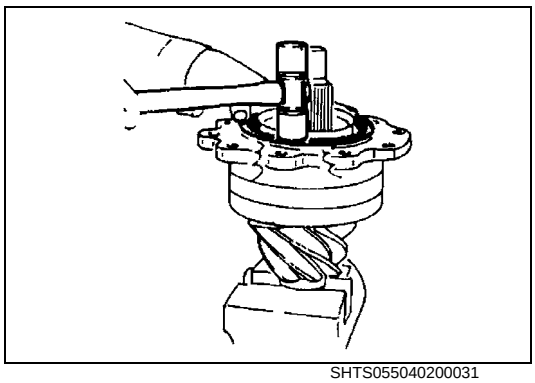
New bearing	Re-used bearing
1.97-2.94 {20-30, 1.5-2.1}	1.47-2.45 {15-25, 1.1-1.8}

Adjusting spacer thickness:

20 kinds of thicknesses ranging from 13.900 to 14.375 mm {0.5473 to 0.5659 in.} each differing 0.025 mm {0.001 in.}

NOTICE

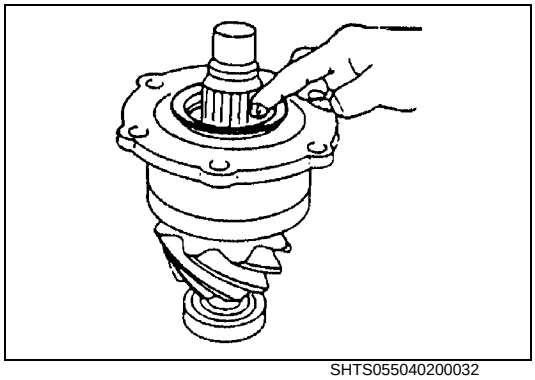
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.


SHTS055040200031

(3) After adjusting the preload, install the new oil seal.

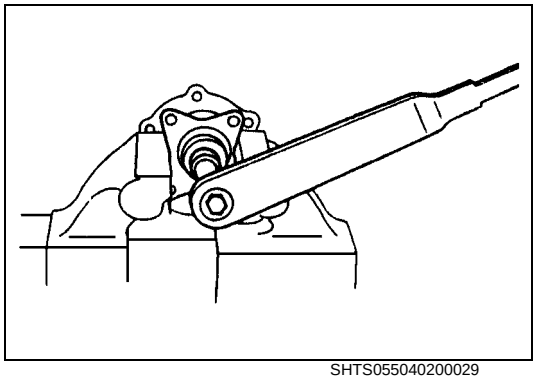
NOTICE

Tap the oil seal in small steps and evenly to prevent it from being at slant position.


SHTS055040200032

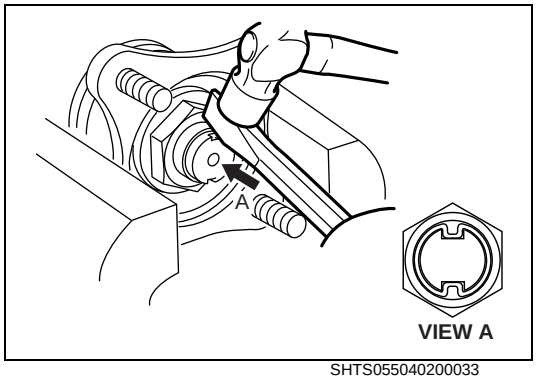
NOTICE

Apply wheel bearing grease on the oil seal lip part.



SHTS055040200029

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-94104)

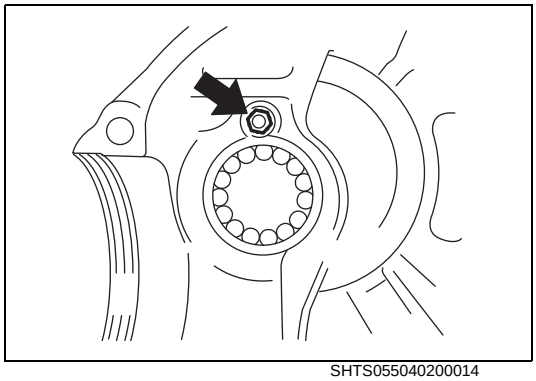


SHTS055040200033

(5) Using a chisel and a hammer, caulk the lock nut.

NOTICE

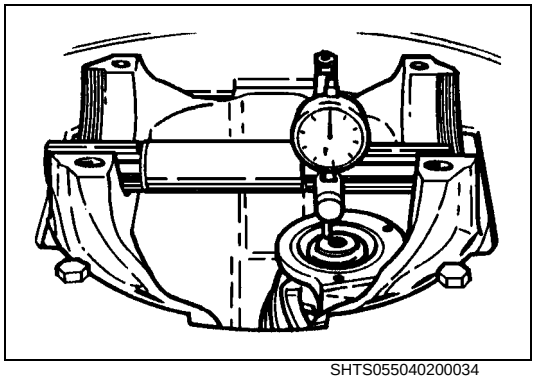
- **Caulk the nut securely as shown.**
- **Make sure that there is no rift in the caulked position.**



SHTS055040200014

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.


SHTS055040200034

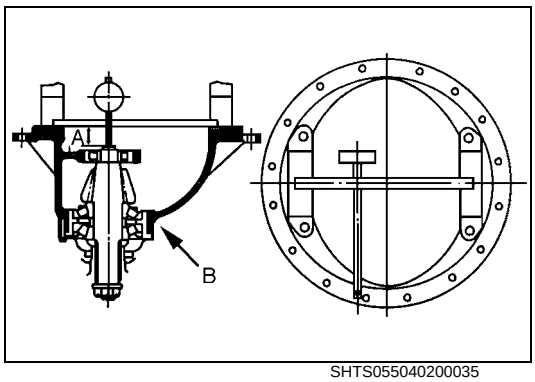
5. ADJUSTMENT OF THE PINION FITTING HEIGHT (CONICAL DISTANCE)

(1) Apply bearing grease to the O-ring installation groove of the differential carrier cage and to the new O-ring.

(2) Install the O-ring in the O-ring installation groove of the differential carrier cage.

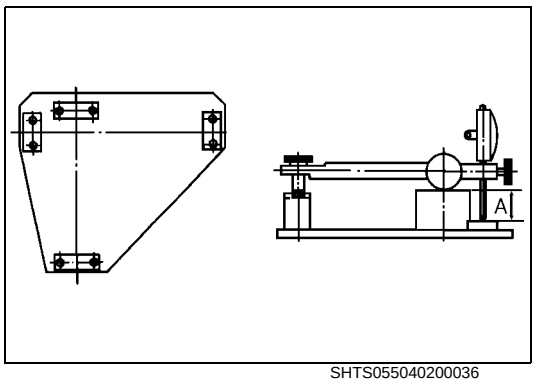
NOTICE
Always use a new O-ring.

(3) Install the bearing cage assembly and adjust the height with shims.
SST: Gauge Assembly (S0964-01022)



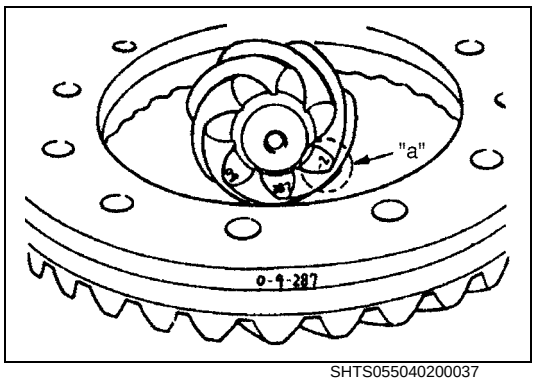
SHTS055040200035

A: 21.5 mm {0.846 in.}
B: Adjusting shim
Thickness: 0.30 mm {0.0118 in.}
0.40 mm {0.0157 in.}
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}



SHTS055040200036

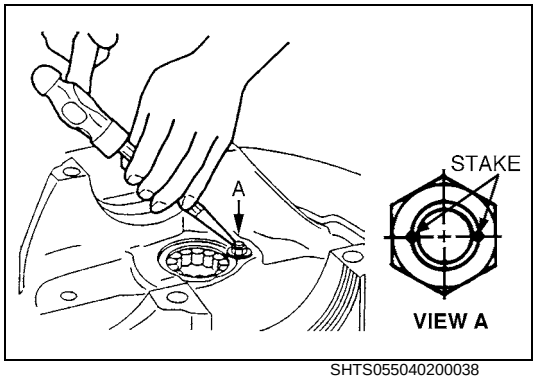
(4) How to use the pinion depth gauge: Set the pinion depth gauge.
A: 21.5 mm {0.846 in.}



SHTS055040200037

EXAMPLE:
In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

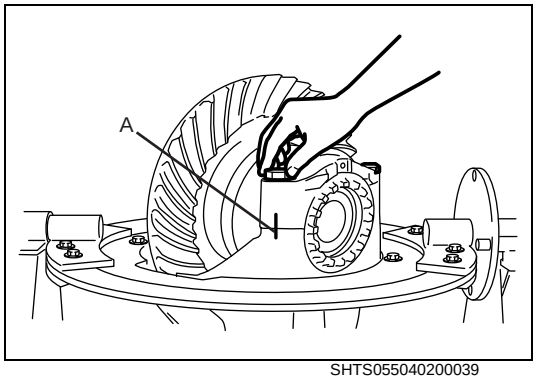
Standard pinion height "A"				Measuring part (A')
21.5 mm	–	0.2 mm	=	21.3 mm
		The engraved value "a"		



SHTS055040200038

6. CYLINDRICAL ROLLER BEARING

(1) Stake the lock nut securely as shown in the figure.



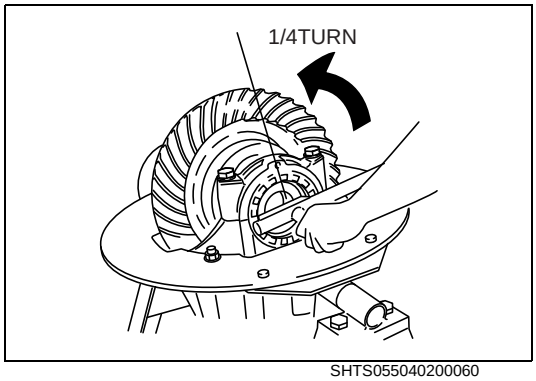
SHTS055040200039

7. ADJUSTMENT OF HYPOID RING GEAR BACKLASH

(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE

Align the aligning marks "A".

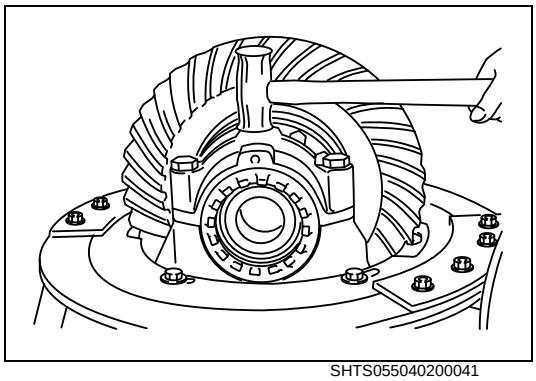


SHTS055040200060

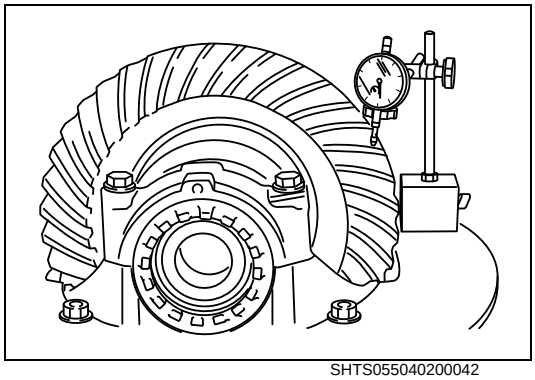
(2) Adjust the preload of the side bearing provisionally.

a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.

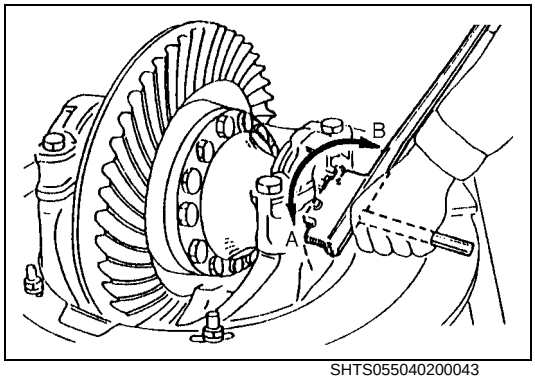
SST: Adjuster Tool (S0966-51150)


SHTS055040200041

b. Hit the bearing cap with a copper hammer.

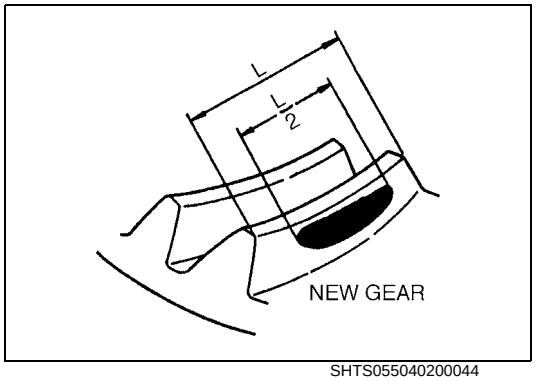

SHTS055040200042

(3) Measure the gear backlash at three or four points on the circumference of the gear.
Assembly standard: 0.25-0.33 mm {0.010-0.013 in.}



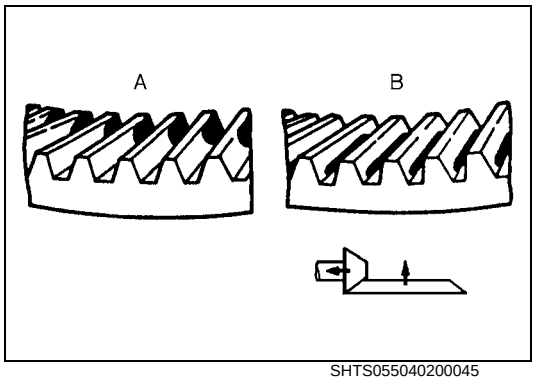
SHTS055040200043

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: "A"-Decrease "B"-Increase
SST: Adjuster Tool (S0966-51150)



SHTS055040200044

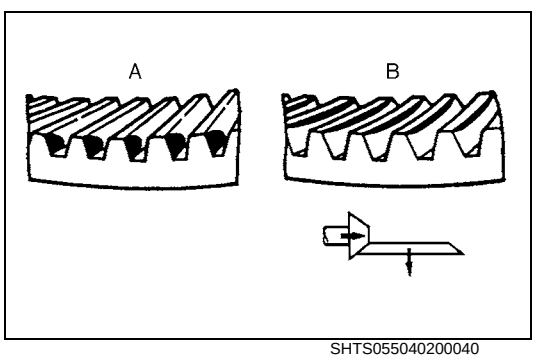
8. INSPECTION AND ADJUSTMENT OF GEAR MESHING
(1) Satisfactory gear meshing.
NOTICE
New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.



SHTS055040200045

(2) Example of the unsatisfactory engagement
a. Toe and flank contact

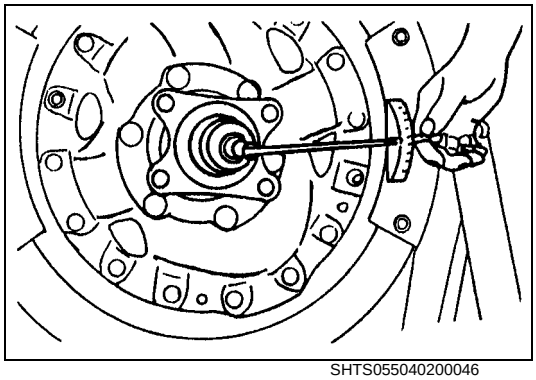
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



SHTS055040200040

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


SHTS055040200046

9. MEASUREMENT AND ADJUSTMENT OF THE SIDE BEARING

(1) Measure the total preload using a torque wrench at the flange coupling.

NOTICE

Total preload = Side bearing preload + Pinion bearing preload (refer to item 3).

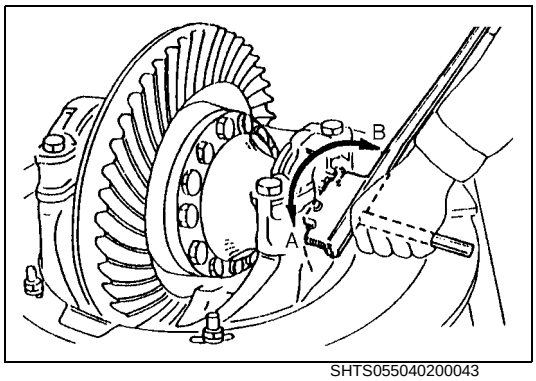
Assembly standard: Side bearing preload turning torque

Unit: N·m {kgf·cm, lbf·ft}

Gear ratio	3.636	3.900	4.100	4.333	4.625	5.142
New bearing	0.54-0.81 {5.5-8.2, 0.40-0.59}	0.51-0.75 {5.2-7.3, 0.38-0.54}	0.48-0.71 {4.9-7.3, 0.36-0.52}	0.46-0.67 {4.7-6.9, 0.34-0.49}	0.43-0.63 {4.4-6.4, 0.32-0.46}	0.39-0.47 {3.9-4.8, 0.28-0.34}
Re-used bearing	0.40-0.67 {4.1-6.8, 0.30-0.49}	0.38-0.62 {3.9-6.4, 0.29-0.46}	0.36-0.59 {3.7-6.0, 0.27-0.44}	0.34-0.56 {3.5-5.4, 0.24-0.39}	0.32-0.52 {3.3-5.4, 0.24-0.39}	0.29-0.38 {3.0-3.8, 0.22-0.27}

NOTICE

The gear ratio is indicated on the bearing cage.

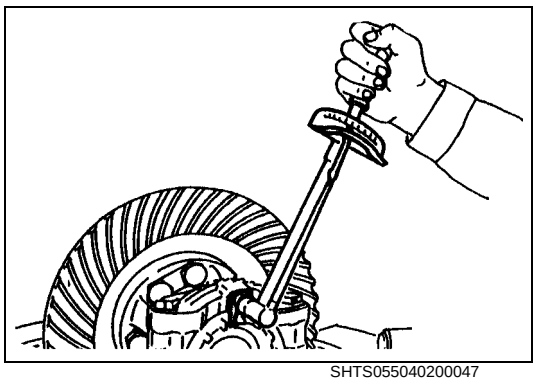


SHTS055040200043

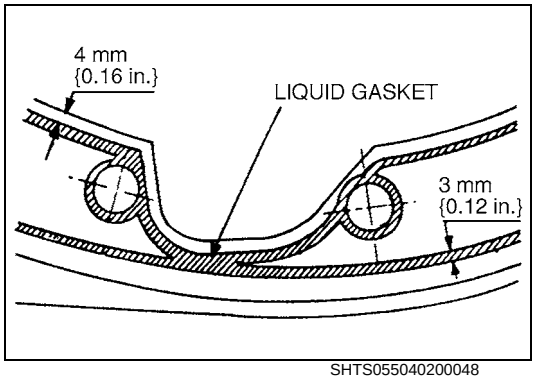
(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload

SST: Adjuster Tool (S0966-51150)


SHTS055040200047

(3) Tighten the bearing cap and install the lock plate.



SHTS055040200048

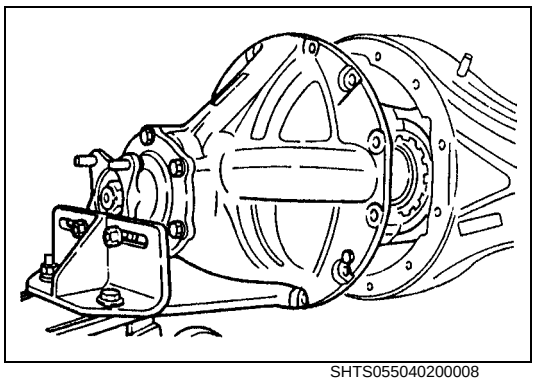
IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Apply liquid gasket on the face of the housing flange.

NOTICE

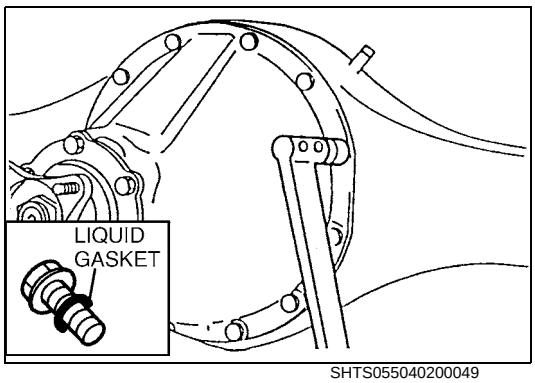
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 4 mm {0.16 in.} away from the edge.**


SHTS055040200008

(2) Using a jack, install the differential carrier assembly to the axle housing.

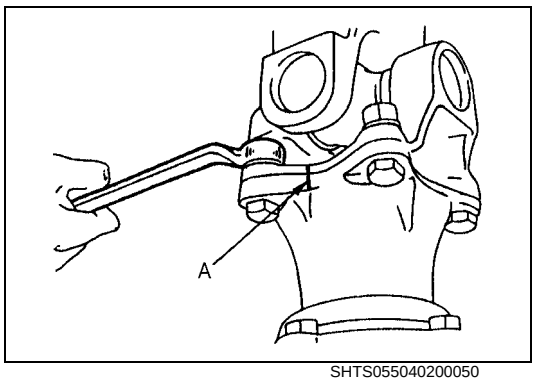
NOTICE

Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055040200049

(3) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ12 bolts (8 pieces), install the bolts and tighten them regularly.



SHTS055040200050

(4) Connect the propeller shaft.

NOTICE

Align the aligning marks "A".

Tightening Torque:
61-91 N·m {623-927 kgf·cm, 45-67 lbf·ft}

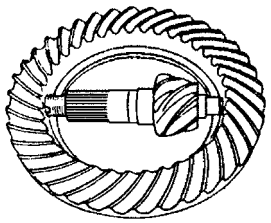
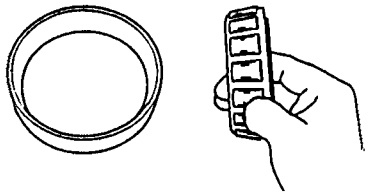
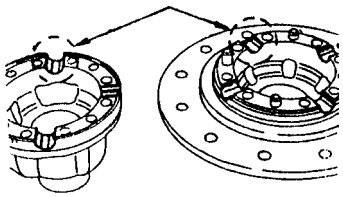
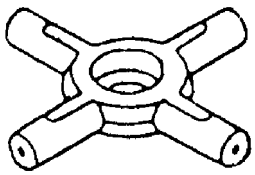
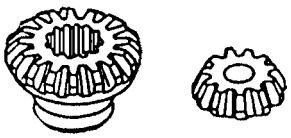
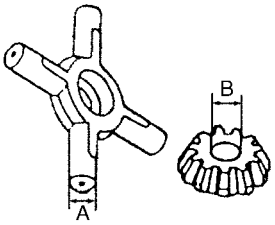
(5) Fill the axle housing with specified gear oil up to the filler plug hole.

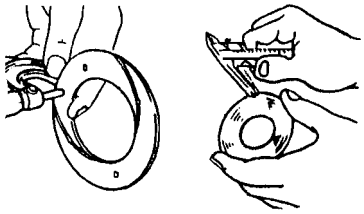
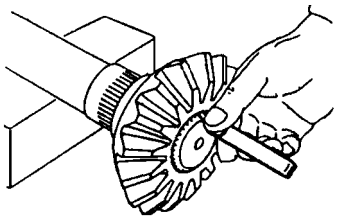
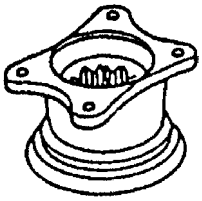
Gear oil:
Refer to the owner's manual

INSPECTION AND REPAIR

EN0550402H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 24 {0.945} B-A: 0.141-0.261 {0.0056-0.0103}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.5-1.7 {0.060-0.066}	**1.3 {0.051}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SH14)

DF02-002

DIFFERENTIAL CARRIER (SH14) DF02-2
DATA AND SPECIFICATIONS DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING DF02-3
SPECIAL TOOL DF02-4
COMPONENT LOCATOR DF02-5
OVERHAUL DF02-7
INSPECTION AND REPAIR DF02-19

DIFFERENTIAL CARRIER (SH14)

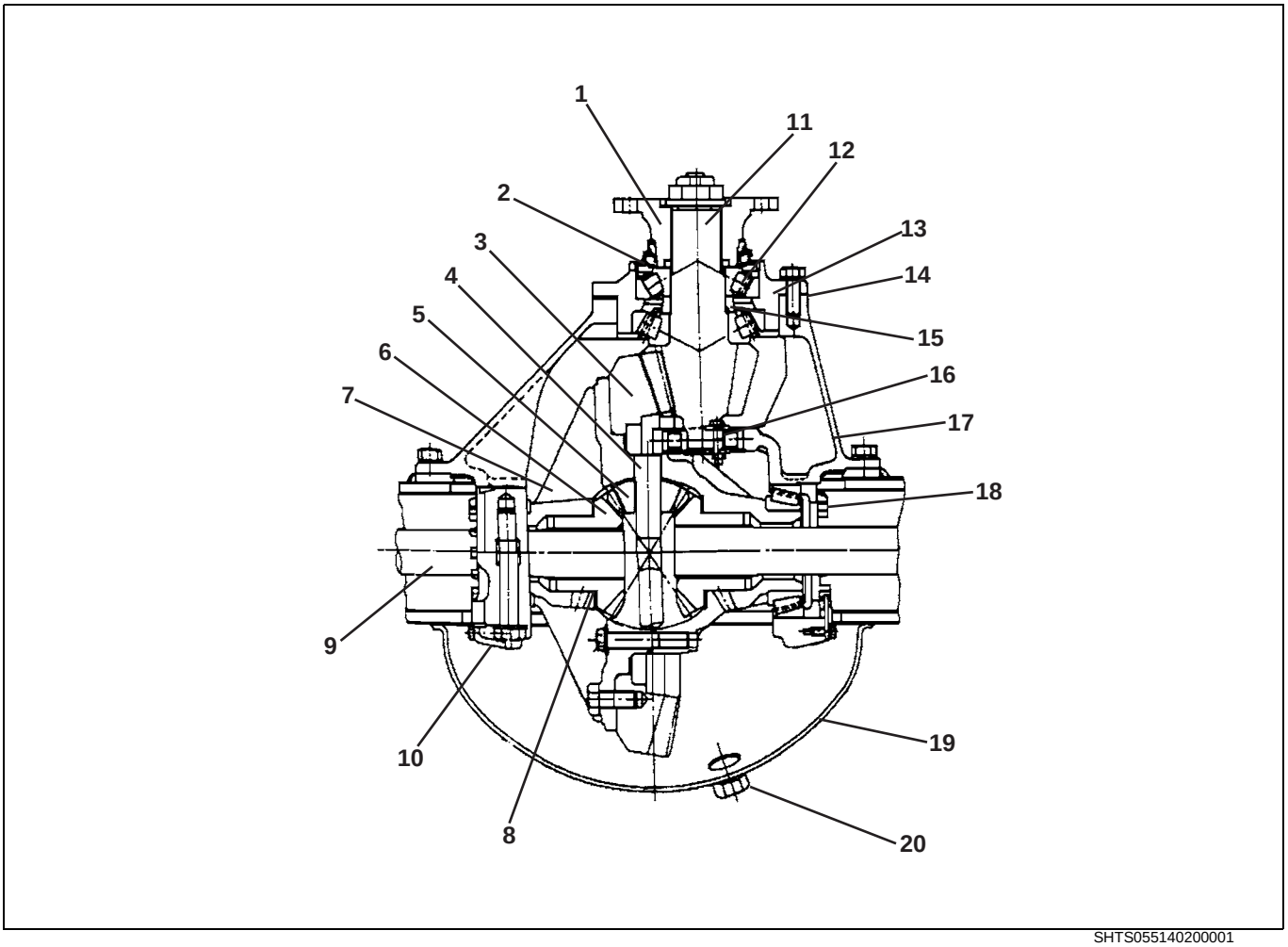
DATA AND SPECIFICATIONS

EN0551402I200001

Type	**Single-reduction, single-speed, by hypoid gearing**
Gear ratios	**4.875, 5.125**
Oil capacity	**5.5 L {1.21 Imp gal. / 1.45 U.S gal.}**

DESCRIPTION

EN0551402C100001



SHTS055140200001

1	Flange yoke coupling	8	Thrust washer	15	Spacer
2	Oil seal	9	Axle shaft	16	Cylindrical roller bearing
3	Hypoid ring gear	10	Bearing cap	17	Differential carrier case
4	Spider	11	Hypoid pinion	18	Adjusting nut
5	Differential pinion gear	12	Taper roller bearing	19	Axle housing
6	Differential side gear	13	Bearing cage	20	Oil filler plug
7	Differential case	14	Adjusting shim		

TROUBLESHOOTING

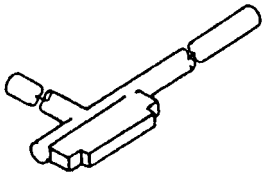
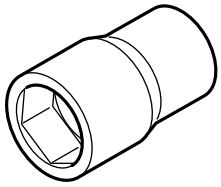
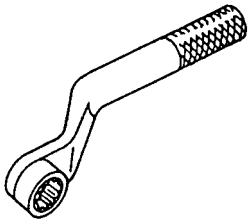
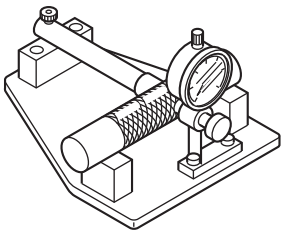
EN0551402F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil, check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

EN0551402K100001

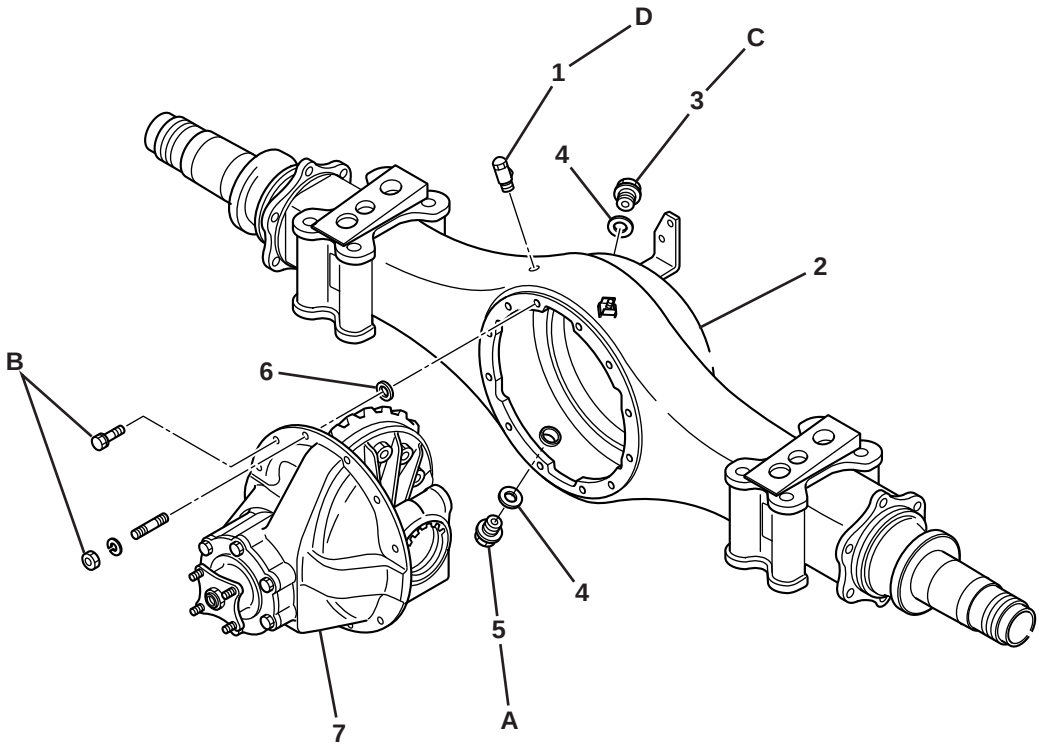
Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51040	ADJUSTER TOOL	
	S0983-94601	SOCKET WRENCH	
	S0960-31150	SOCKET WRENCH	
	S0964-01151	GAUGE ASSEMBLY	

COMPONENT LOCATOR

EN0551402D100001

(EXAMPLE)

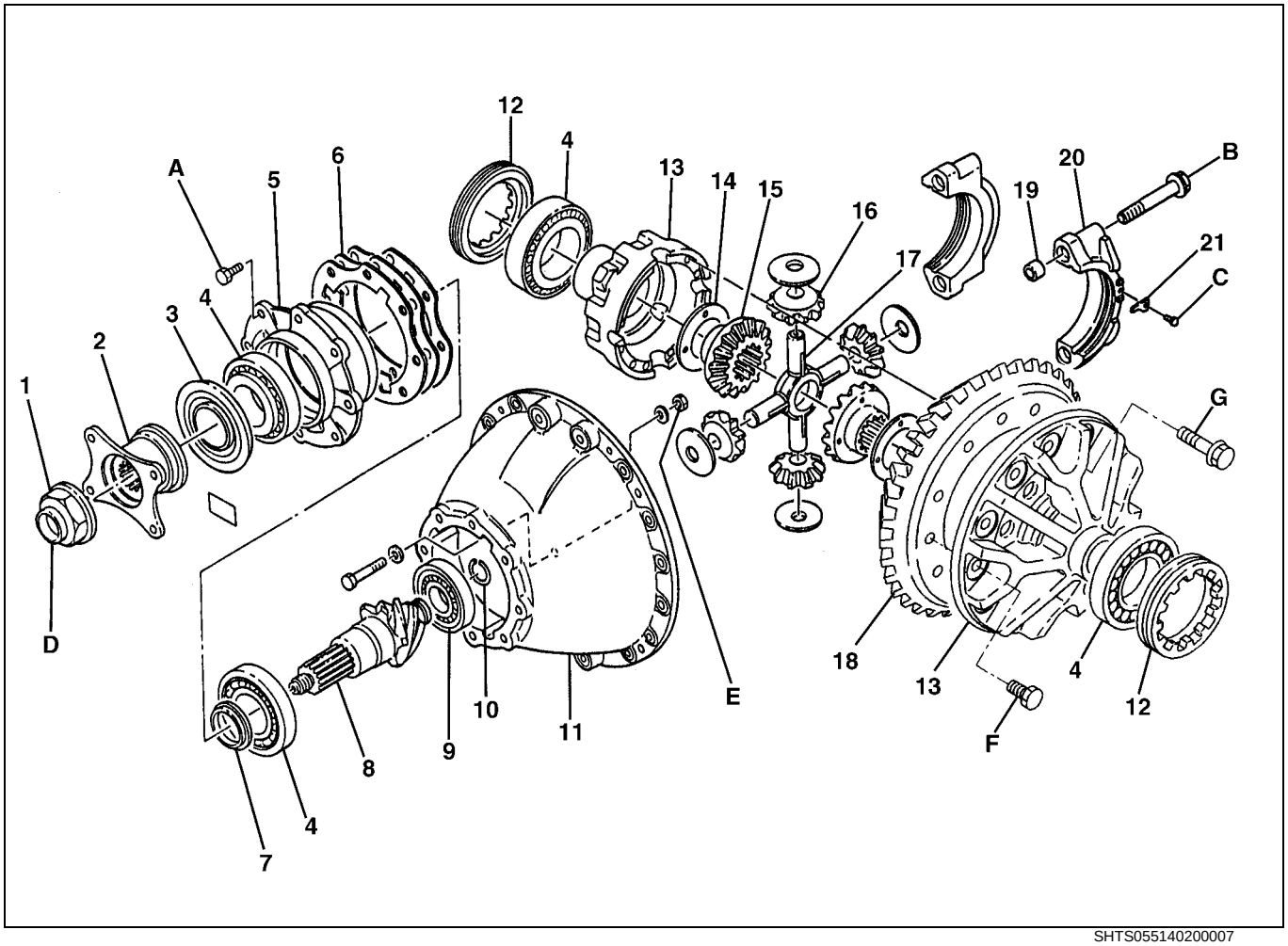


SHTS055140200006

1	Air breather	5	Oil drain plug
2	Axle housing assembly	6	O-ring
3	Oil filler plug	7	Differential carrier assembly
4	Gasket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39.2-117.6 {400-1,200, 29-86}	C	78.4-117.6 {800-1,200, 58-86}
B	113-147 {1,150-1,500, 83-108}	D	9.8-19.6 {100-200, 7-14}



SHTS055140200007

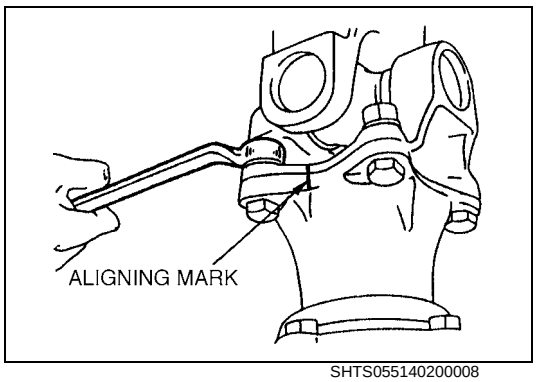
1	Lock nut	8	Hypoid pinion	15	Differential side gear
2	Flange yoke coupling	9	Cylindrical roller bearing	16	Differential pinion gear
3	Oil seal	10	Retainer ring	17	Spider
4	Taper roller bearing	11	Differential carrier case	18	Hypoid ring gear
5	Bearing cage	12	Adjusting nut	19	Collar
6	Adjusting shim	13	Differential case	20	Bearing cap
7	Spacer	14	Thrust washer	21	Lock plate

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	108-148 {1,100-1,500, 80-108}	E	19-25 {190-260, 14-18}
B	275-353 {2,800-3,600, 203-260}	F	363-421 {3,700-4,300, 268-311}
C	19-25 {190-260, 14-18}	G	167-215 {1,700-2,200, 123-159}
D	589-781 {6,000-8,000, 434-578}		

OVERHAUL

EN0551402H200001



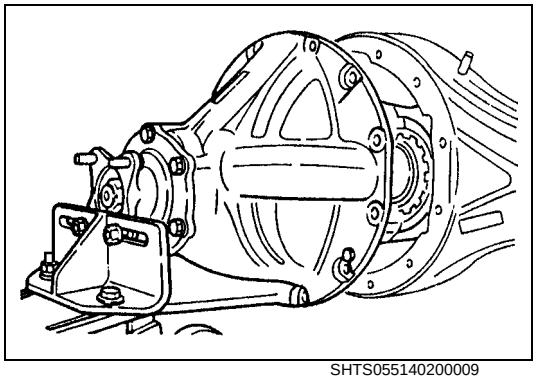
SHTS055140200008

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

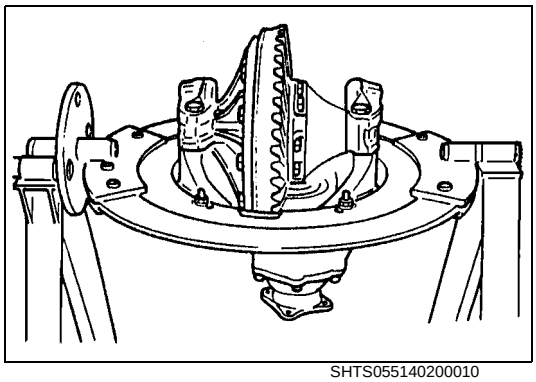
Make aligning marks before disassembling.


SHTS055140200009

2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.

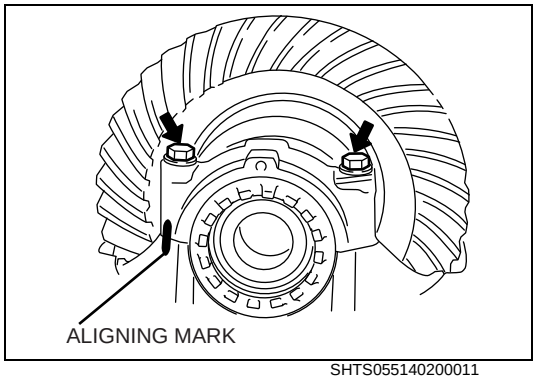
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


SHTS055140200010

IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.



SHTS055140200011

2. DIFFERENTIAL CASE

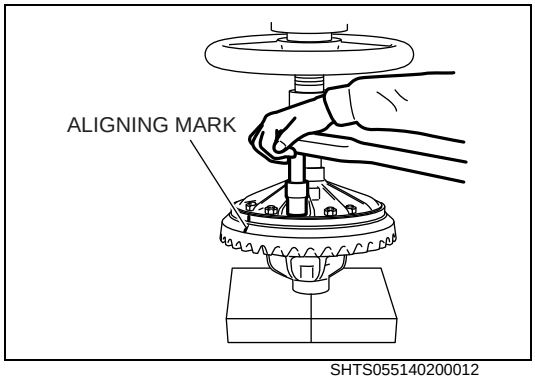
(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

SST: Socket Wrench (S0960-31150)

(2) Using a puller, remove the taper roller bearing.

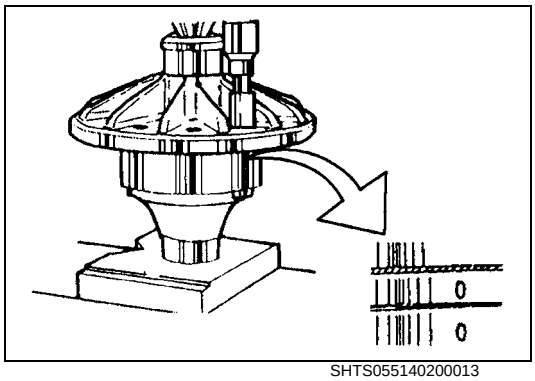


SHTS055140200012

(3) Dismounting the ring gear

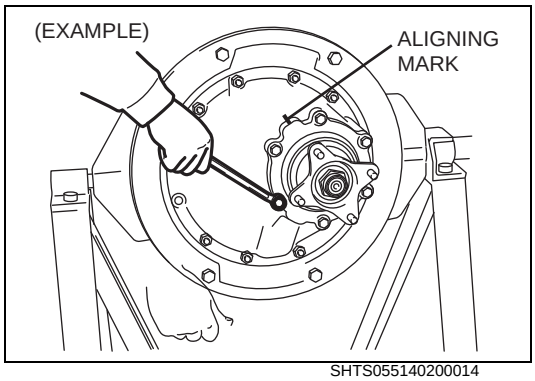
a. Make aligning mark both the differential case and the ring gear.
b. Using press, fix the differential gear assembly.
c. Remove the bolts and then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055140200013

(4) Disassemble the differential case.

NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.

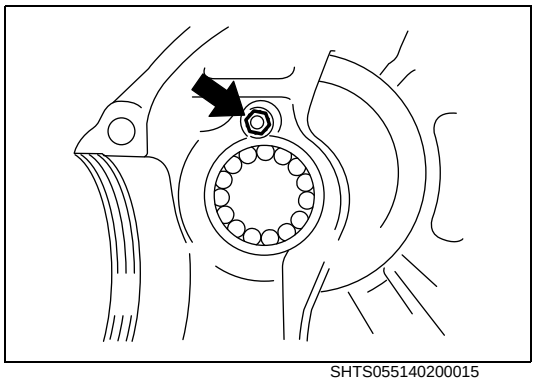


SHTS055140200014

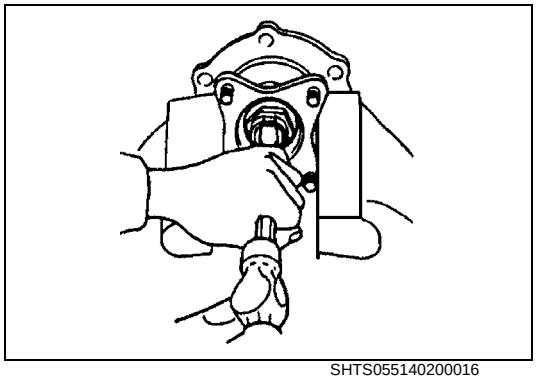
3. HYPOID PINION

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

NOTICE
Make aligning mark the differential cage and differential carrier.

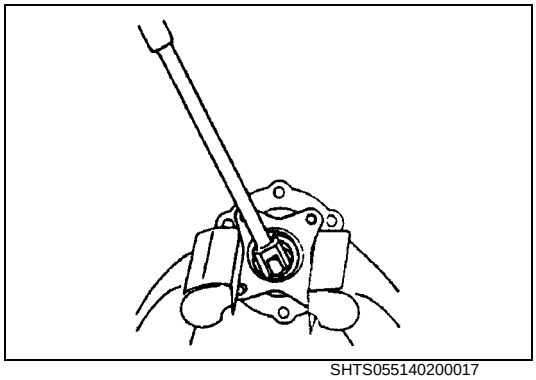

SHTS055140200015

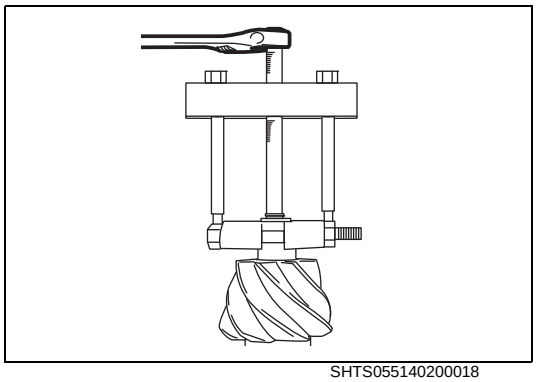
(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


SHTS055140200016

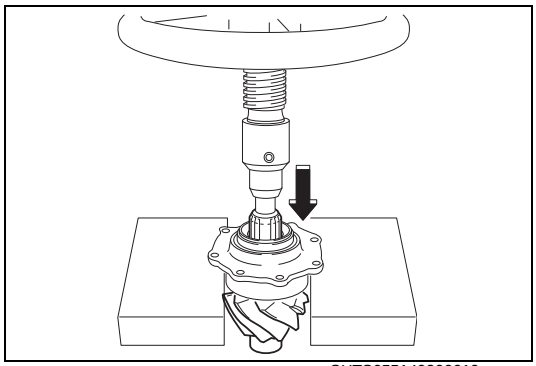
4. BEARING CAGE

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-94601)

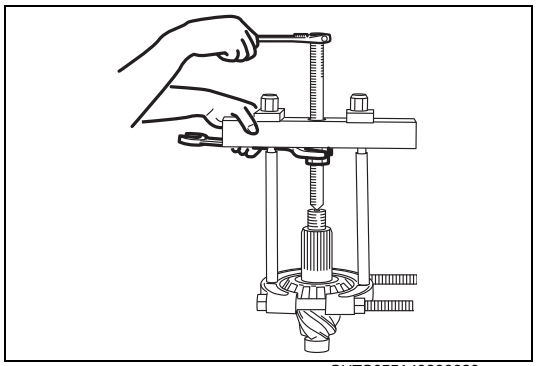

SHTS055140200017


SHTS055140200018

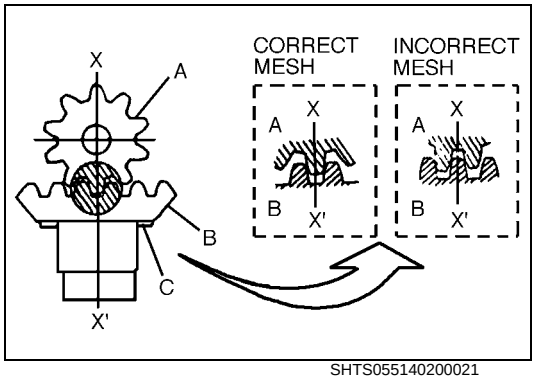
(2) Using a puller, remove the taper roller bearing outer race.


SHTS055140200019

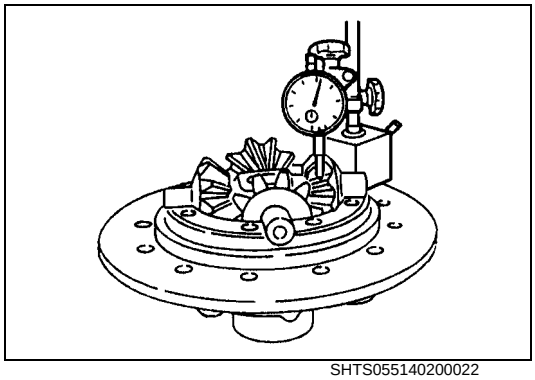
(3) Using a press, remove the hypoid pinion.

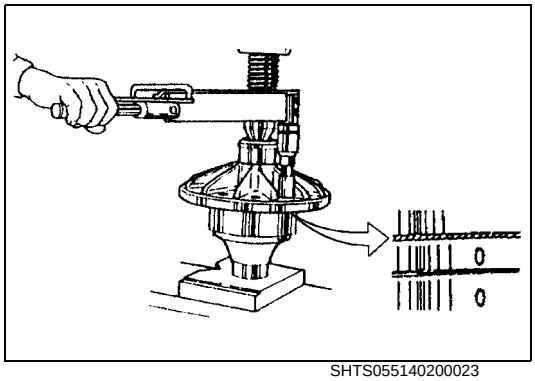

SHTS055140200020

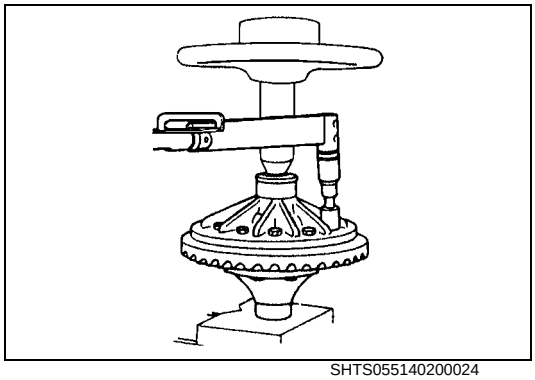
(4) Using a puller, remove the taper roller bearing inner race.



SHTS055140200021


SHTS055140200022


SHTS055140200023


SHTS055140200024

IMPORTANT POINTS - ASSEMBLY

1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

NOTICE

Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

- A: Pinion
- B: Side gear
- C: Thrust washer

(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}

(3) Assemble the differential case.

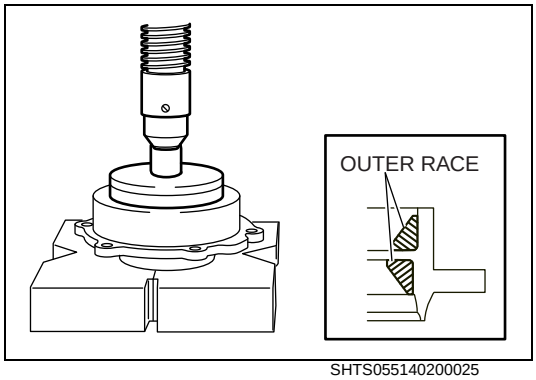
NOTICE

- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

(4) Install the ring gear to the differential case and tighten it with bolts.

NOTICE

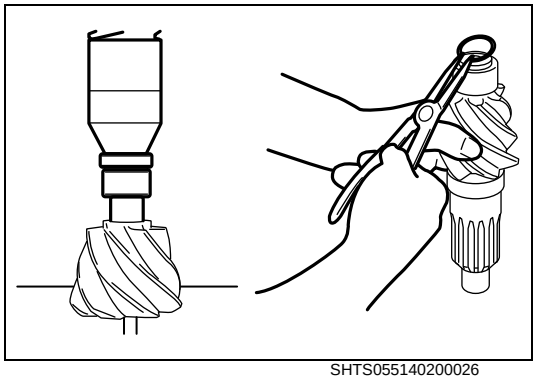
Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.



SHTS055140200025

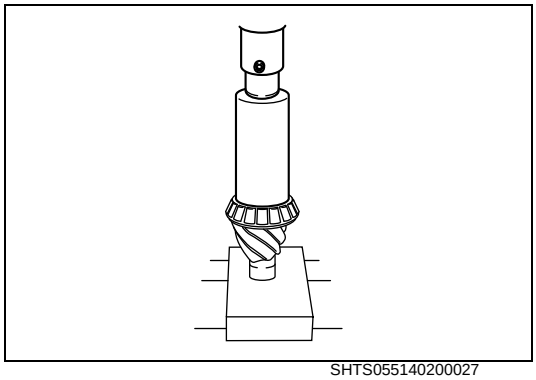
2. HYPOID PINION

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

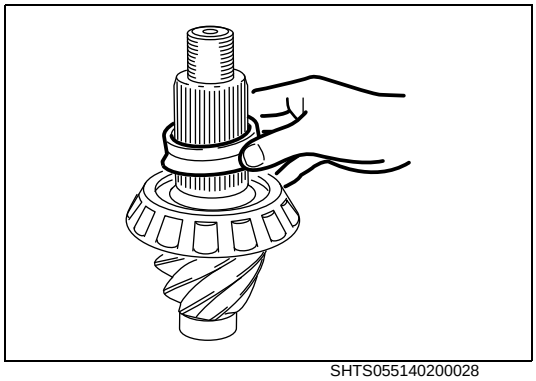

SHTS055140200026

(2) Installing the pilot bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

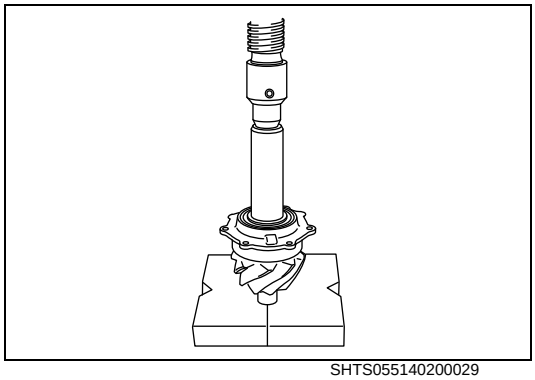
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS055140200027

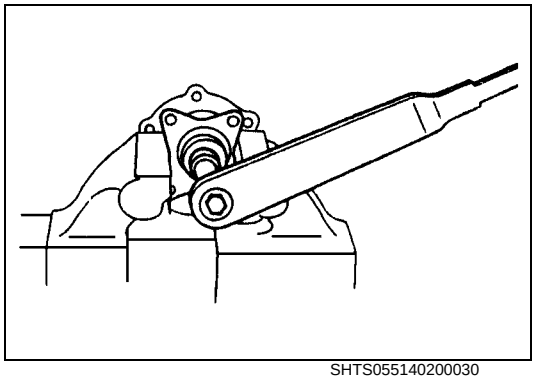
(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.


SHTS055140200028

   c. Install the spacer.


SHTS055140200029

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


SHTS055140200030

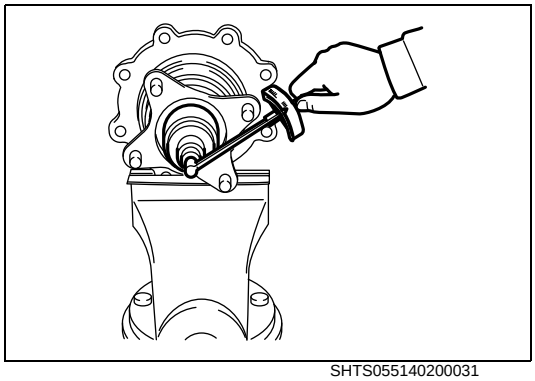
3. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-94601)


SHTS055140200031

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

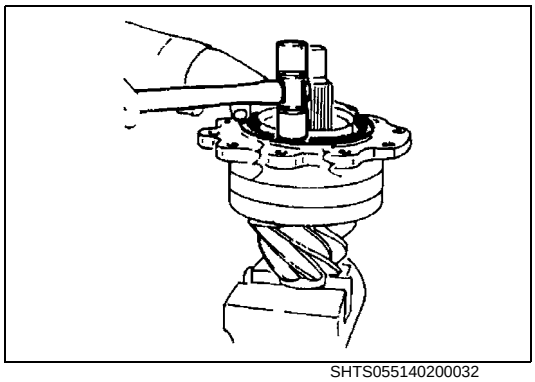
Assembly Standard: Turning torque **Unit: N·m {kgf·cm, lbf·ft}**

New bearing	Re-used bearing
1.97-2.45 {20-25, 1.5-1.8}	1.47-1.96 {15-20, 1.1-1.4}

Adjusting spacer thickness:
17 kinds of thicknesses ranging from 13.975 to 14.375 mm {0.550 to 0.566 in.} each differing 0.025 mm {0.001 in.}

NOTICE

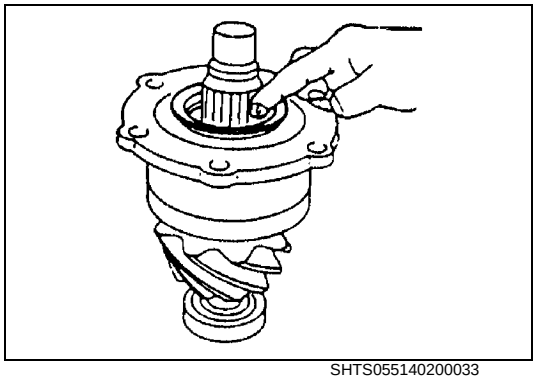
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.


SHTS055140200032

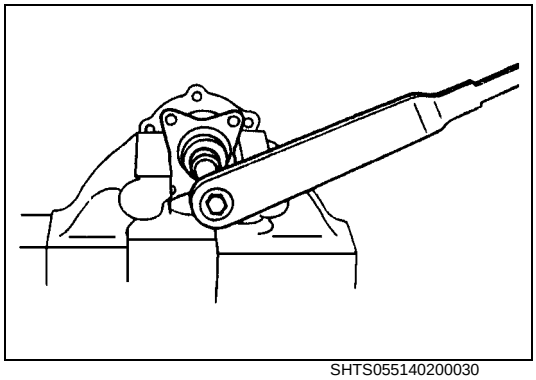
(3) After adjusting the preload, install the new oil seal.

NOTICE

Tap the oil seal in small steps and evenly to prevent it from being at slant position.

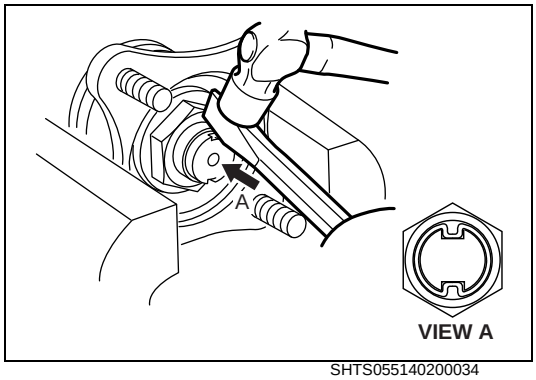

SHTS055140200033

NOTICE
Apply wheel bearing grease on the oil seal lip part.


SHTS055140200030

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-94601)

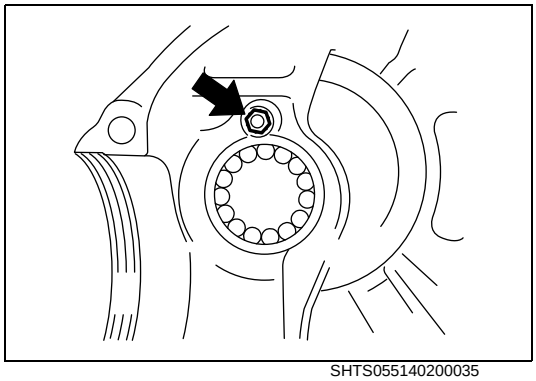
(5) Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.



SHTS055140200034

(6) Caulk the lock nut.

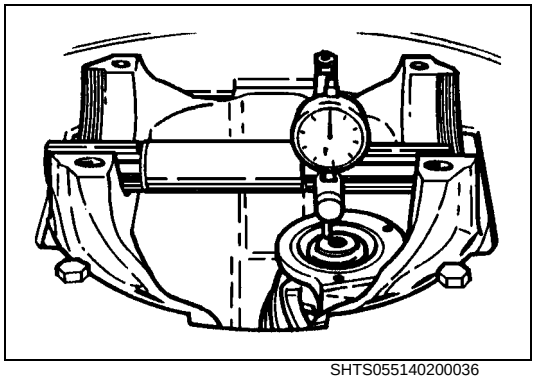
NOTICE
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**


SHTS055140200035

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

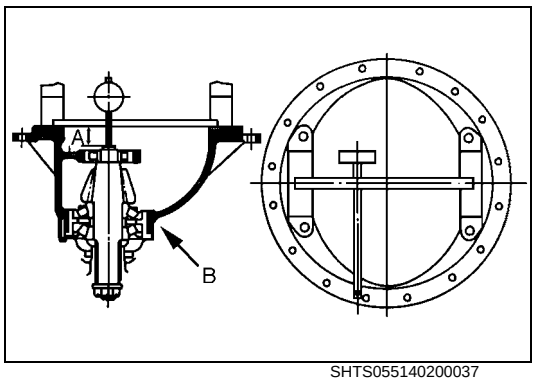
(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

NOTICE
Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.


SHTS055140200036

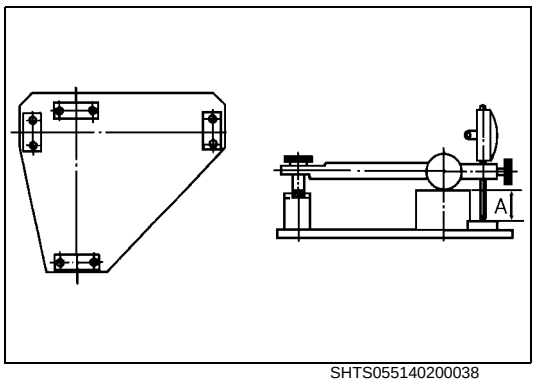
5. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE)

(1) Install the pinion cage assembly and adjust the height with shims.
SST: Gauge Assembly (S0964-01151)



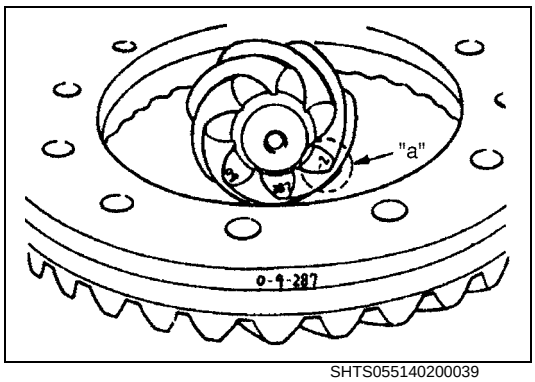
SHTS055140200037

A: 27 mm {1.063 in.}
B: Adjusting shim
Thickness: 0.30 mm {0.0118 in.}
0.40 mm {0.0157 in.}
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}



SHTS055140200038

(2) How to use the pinion depth gauge: Set the pinion depth gauge.
A: 27 mm {1.063 in.}



SHTS055140200039

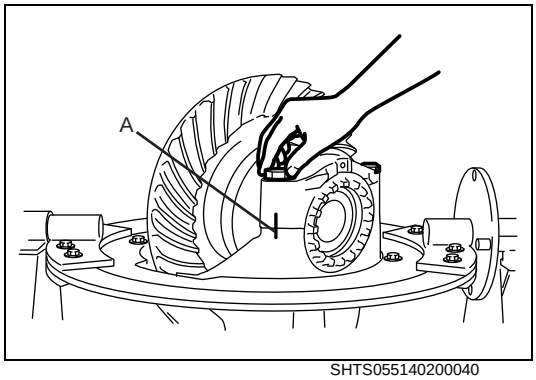
EXAMPLE:

In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

Standard pinion height "A"				Measuring part (A')
27.0 mm	–	0.2 mm	=	26.8 mm
		The engraved value "a"		

NOTICE

Upon completing the adjustment, remove the bearing cage assembly and apply liquid gasket (ThreeBond #1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.



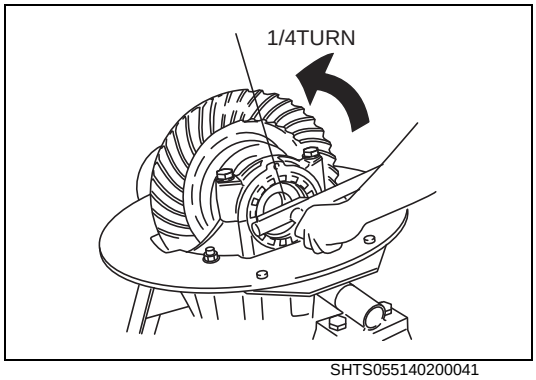
SHTS055140200040

6. ADJUSTMENT OF HYPOID RING GEAR BACKLASH

(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE

Align the aligning marks "A".

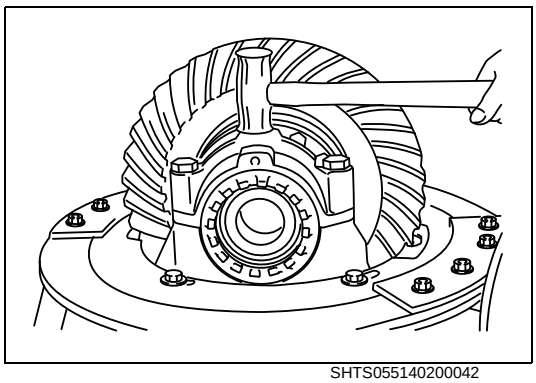


SHTS055140200041

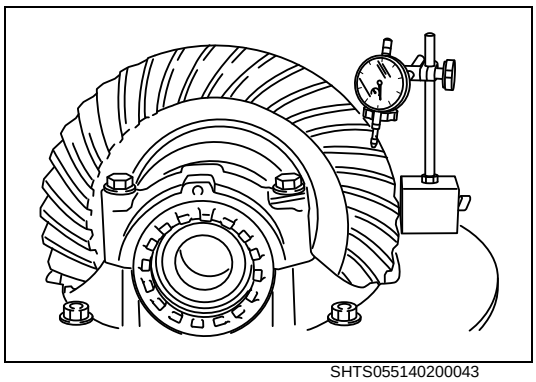
(2) Adjust the preload of the side bearing provisionally.

a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.

SST: Adjuster Tool (S0966-51040)

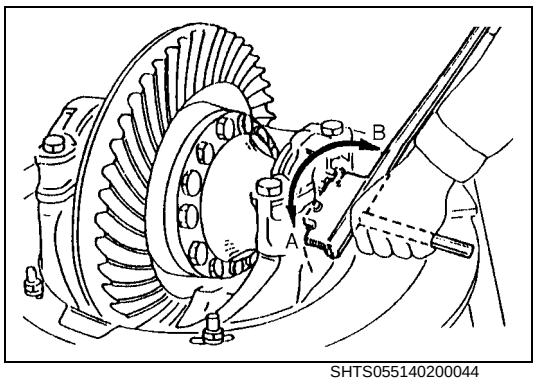

SHTS055140200042

b. Hit the bearing cap with a copper hammer.


SHTS055140200043

(3) Measure the gear backlash at three or four points on the circumference of the gear.

Assembly Standard: 0.25-0.33 mm {0.010-0.013 in.}

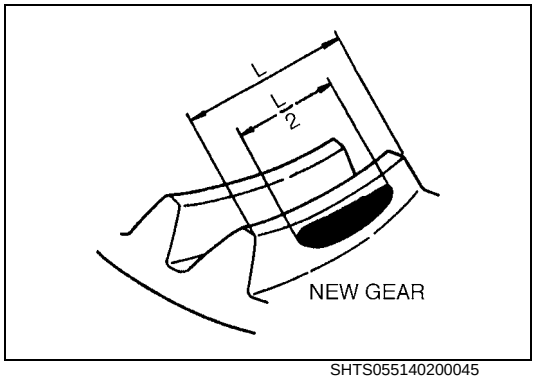


SHTS055140200044

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.

BACKLASH: "A"-Decrease "B"-Increase

SST: Adjuster Tool (S0966-51040)



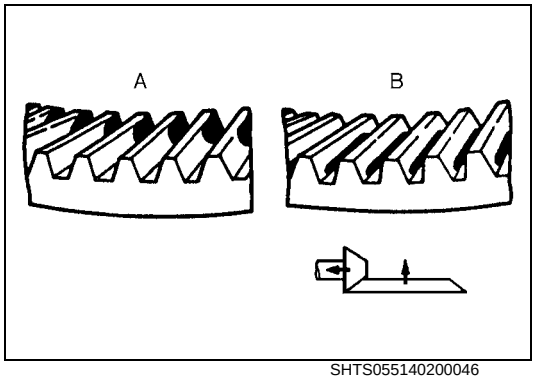
SHTS055140200045

7. INSPECTION AND ADJUSTMENT OF GEAR MESHING

(1) Satisfactory gear meshing.

NOTICE

New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.

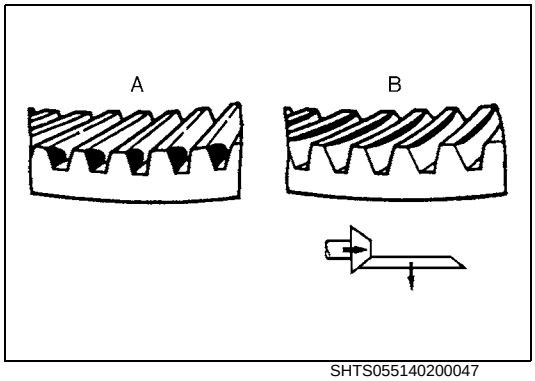


SHTS055140200046

(2) Example of the unsatisfactory engagement

a. Toe and flank contact

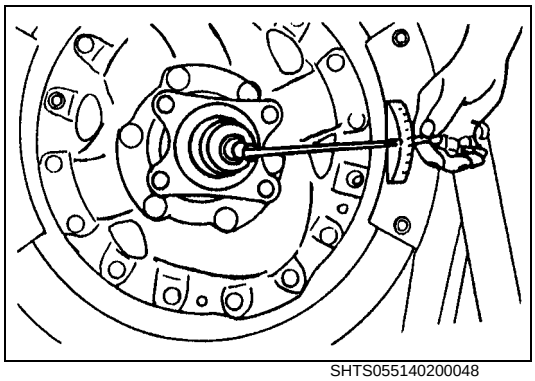
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



SHTS055140200047

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


SHTS055140200048

8. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING

(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

NOTICE

Total preload = side bearing preload + pinion bearing preload (Refer to item 3).

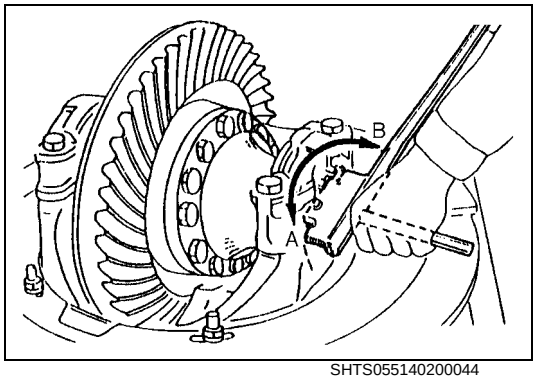
Assembly standard:

Side bearing preload turning torque **Unit: N·m {kgf·cm, lbf·ft}**

Gear ratio	4.875	5.125
New bearing	0.41-0.60 {4.2-6.1, 0.30-0.44}	0.39-0.47 {4.0-4.8, 0.29-0.35}
Re-used bearing	0.31-0.50 {3.1-5.1, 0.23-0.37}	0.29-0.38 {3.0-3.8, 0.22-0.28}

NOTICE

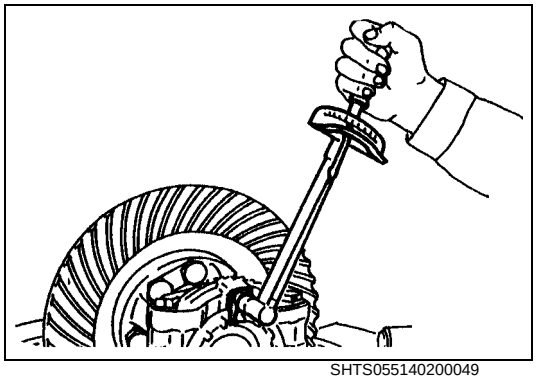
The gear ratio is indicated on the bearing cage.



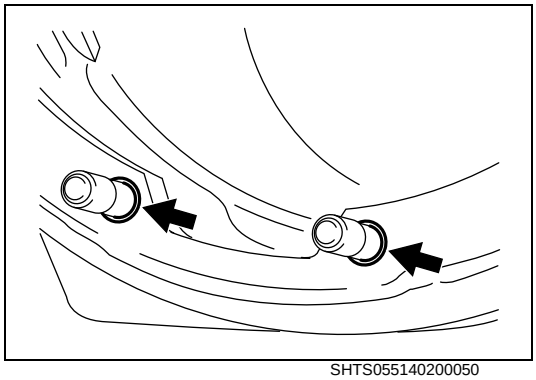
SHTS055140200044

(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload
  SST: Adjuster Tool (S0966-51040)


SHTS055140200049

(3) Tighten the bearing cap and install the lock plate.

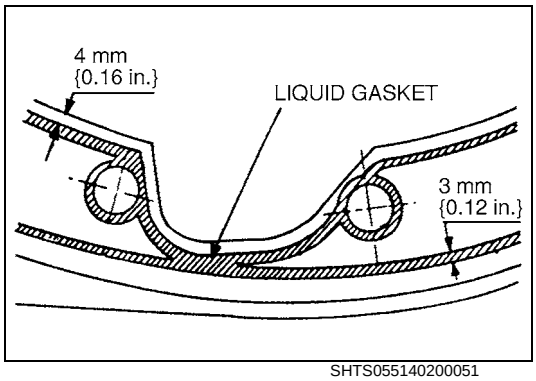

SHTS055140200050

IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.

(2) Install a new O-ring.

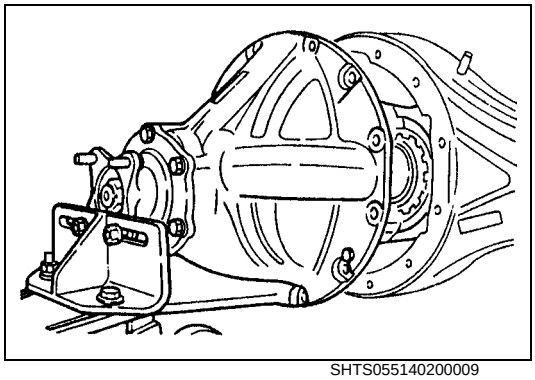


SHTS055140200051

(3) Apply liquid gasket on the face of the housing flange.

NOTICE

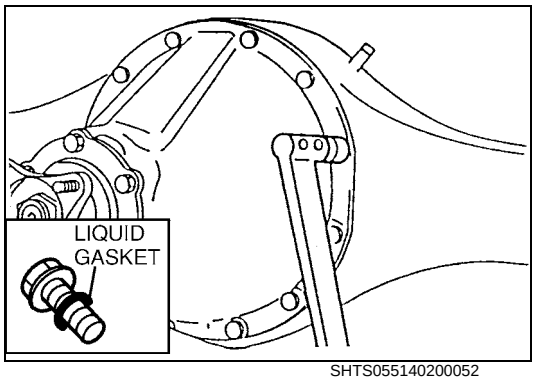
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 4 mm {0.16 in.} away from the edge.**



SHTS055140200009

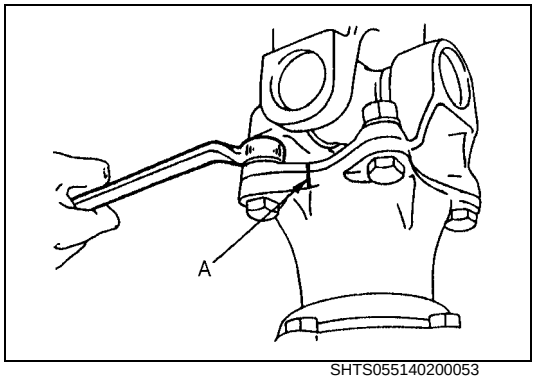
(4) Using a jack, install the differential carrier assembly to the axle housing.

NOTICE
Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055140200052

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ14 bolts (10 pieces), install the bolts and tighten them regularly.



SHTS055140200053

(6) Connect the propeller shaft.

NOTICE
Align the aligning marks "A".

Tightening Torque:
61-91 N·m {623-927 kgf·cm, 45-67 lbf·ft}

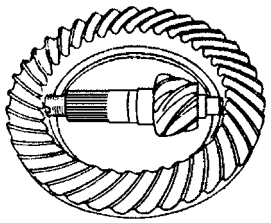
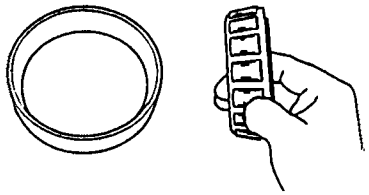
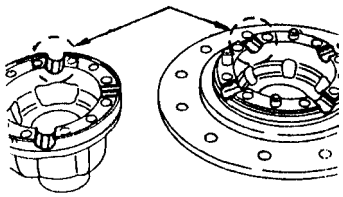
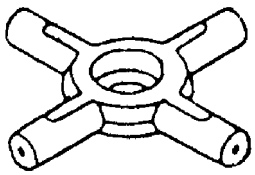
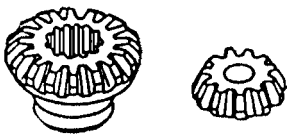
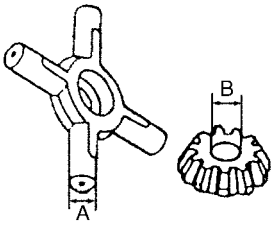
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

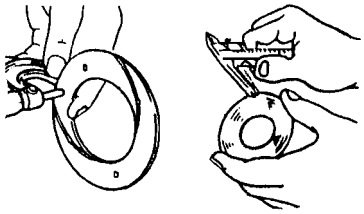
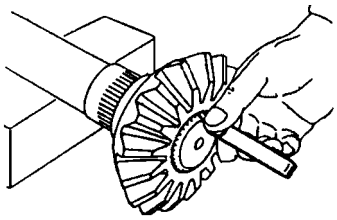
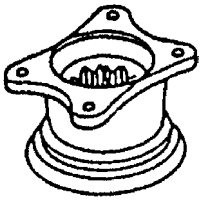
Gear oil:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0551402H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 26 {1.024}** **B-A: 0.140-0.201 {0.0055-0.0079}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.7-1.9 {0.067-0.074}	**1.5 {0.059}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SH16)

DF02-003

DIFFERENTIAL CARRIER (SH16) DF02-2

DATA AND SPECIFICATIONS DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING DF02-3
SPECIAL TOOL DF02-4
COMPONENT LOCATOR DF02-5
OVERHAUL DF02-7
INSPECTION AND REPAIR DF02-20

DIFFERENTIAL CARRIER (SH16)

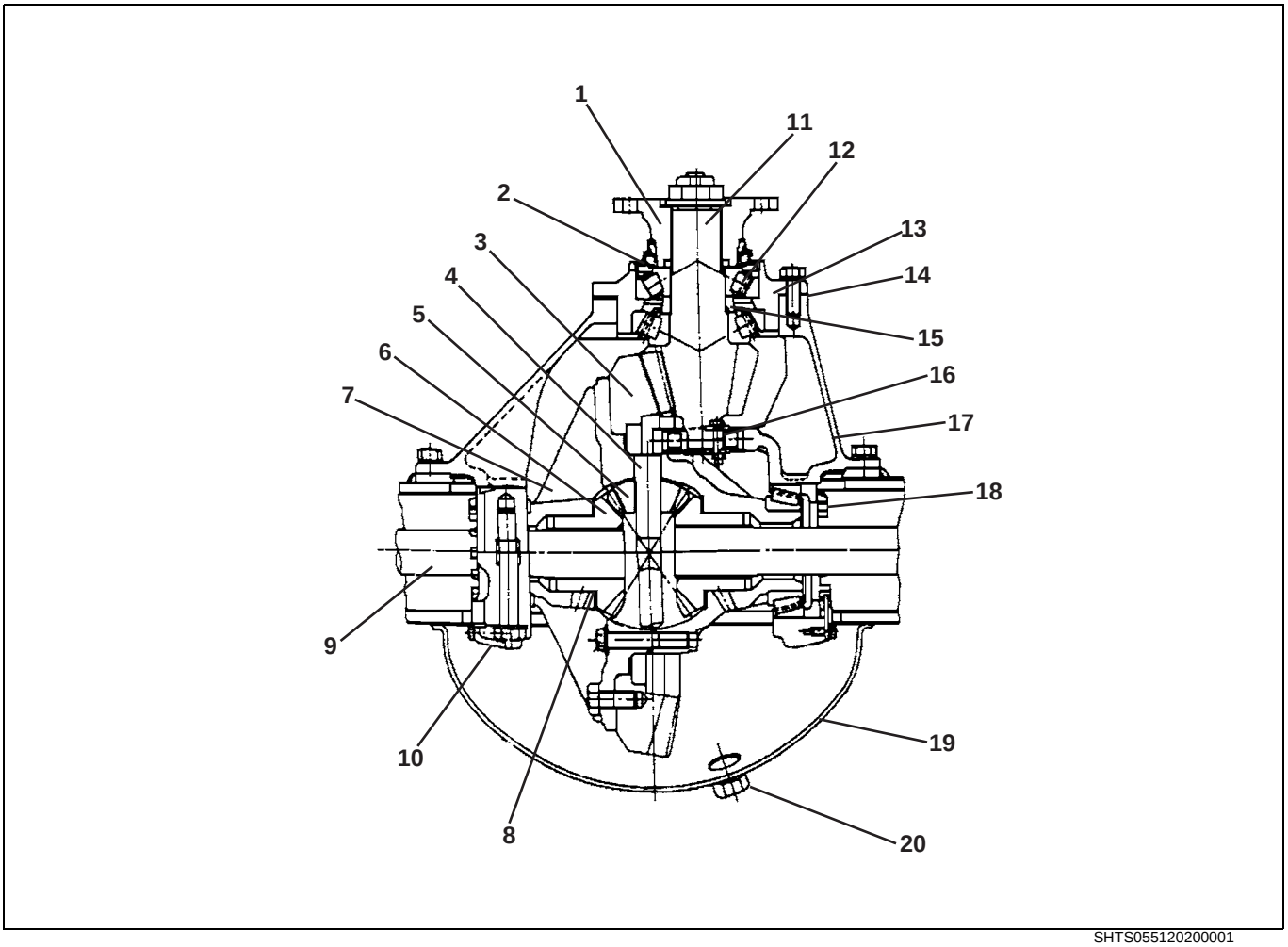
DATA AND SPECIFICATIONS

EN0551202I200001

Type	**Single-reduction, single-speed, by hypoid gearing**
Gear ratios	**4.300, 4.625, 4.875, 5.125, 5.428, 5.857**
Oil capacity	**8 L {1.76 lmp gal. / 12.12 U.S gal.}**

DESCRIPTION

EN0551202C100001



SHTS055120200001

1	Flange yoke coupling	8	Thrust washer	15	Spacer
2	Oil seal	9	Axle shaft	16	Cylindrical roller bearing
3	Hypoid ring gear	10	Bearing cap	17	Differential carrier case
4	Spider	11	Hypoid pinion	18	Adjusting nut
5	Differential pinion gear	12	Taper roller bearing	19	Axle housing
6	Differential side gear	13	Bearing cage	20	Oil filler plug
7	Differential case	14	Adjusting shim		

TROUBLESHOOTING

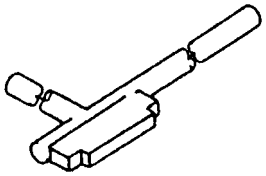
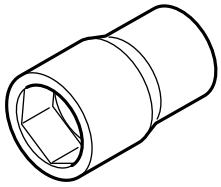
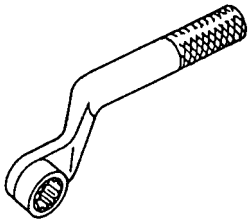
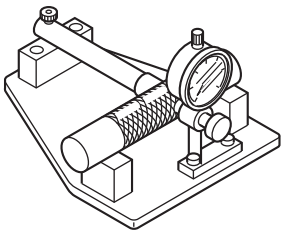
EN0551202F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil, check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

EN0551202K100001

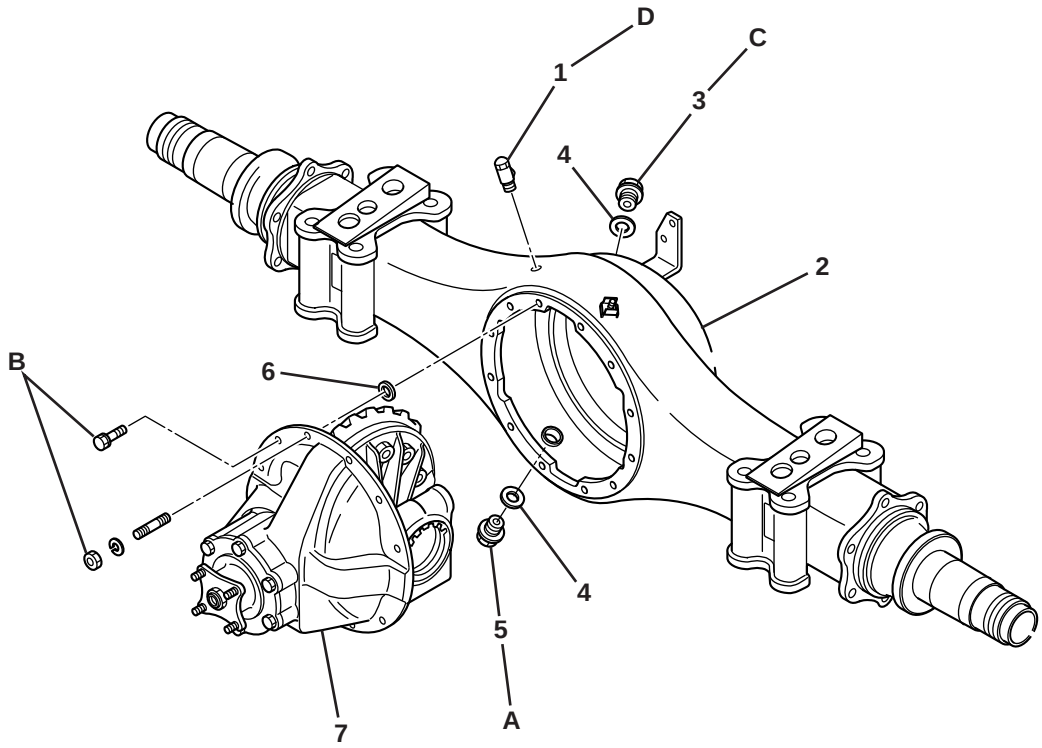
Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51040	ADJUSTER TOOL	
	S0983-94601	SOCKET WRENCH	
	S0960-31150	SOCKET WRENCH	
	S0964-01151	GAUGE ASSEMBLY	

COMPONENT LOCATOR

EN0551202D100001

(EXAMPLE)

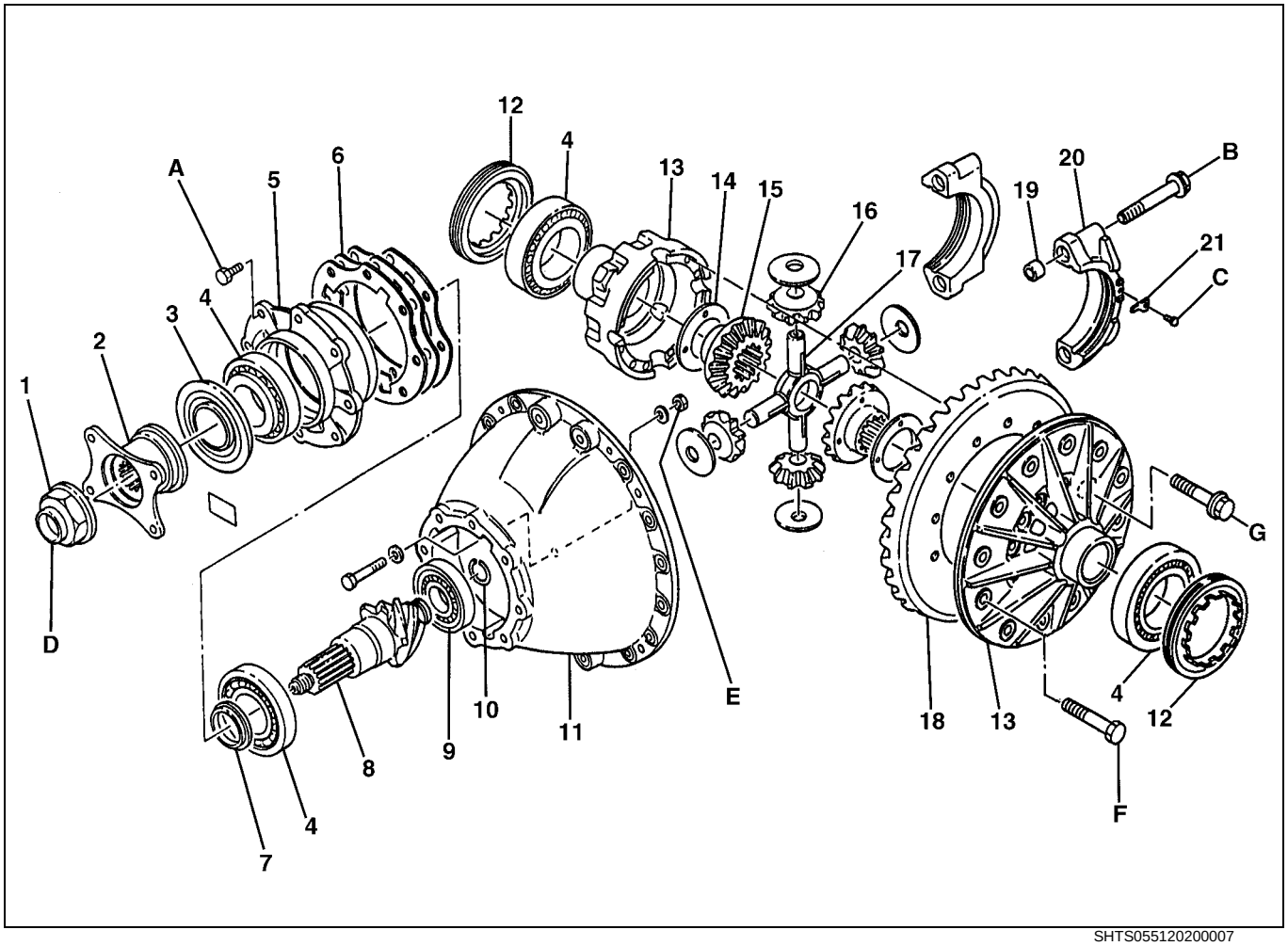


SHTS055120200006

1	Air breather	5	Oil drain plug
2	Axle housing assembly	6	O-ring
3	Oil filler plug	7	Differential carrier assembly
4	Gasket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39.2-68.6 {400-700, 29-50}	C	78.4-117.6 {800-1,200, 58-86}
B	113-147 {1,150-1,500, 83-108}	D	9.8-19.6 {100-200, 7-14}



SHTS055120200007

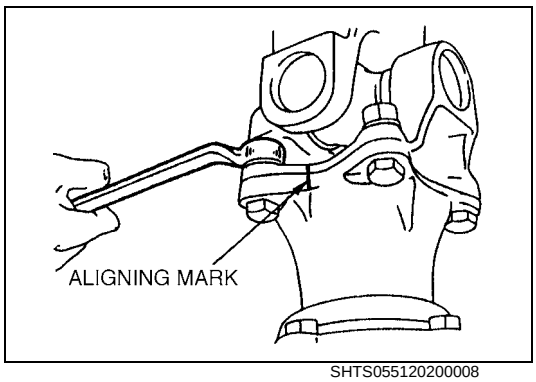
1	Lock nut	8	Hypoid pinion	15	Differential side gear
2	Flange yoke coupling	9	Cylindrical roller bearing	16	Differential pinion gear
3	Oil seal	10	Retainer ring	17	Spider
4	Taper roller bearing	11	Differential carrier case	18	Hypoid ring gear
5	Bearing cage	12	Adjusting nut	19	Collar
6	Adjusting shim	13	Differential case	20	Bearing cap
7	Spacer	14	Thrust washer	21	Lock plate

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	108-147 {1,100-1,500, 80-108}	E	19-25 {190-260, 14-18}
B	275-353 {2,800-3,600, 203-260}	F	363-421 {3,700-4,300, 268-311}
C	19-25 {190-260, 14-18}	G	246-294 {2,500-3,000, 181-216}
D	589-781 {6,000-8,000, 434-578}		

OVERHAUL

EN0551202H200001



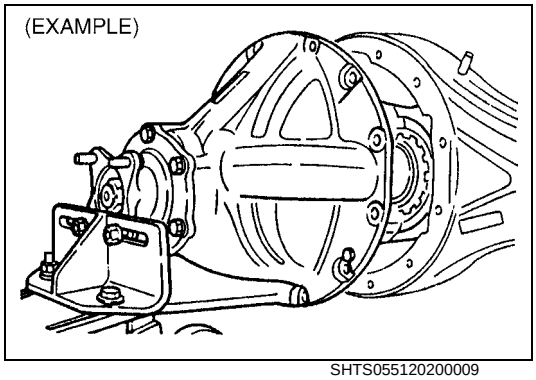
SHTS055120200008

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.

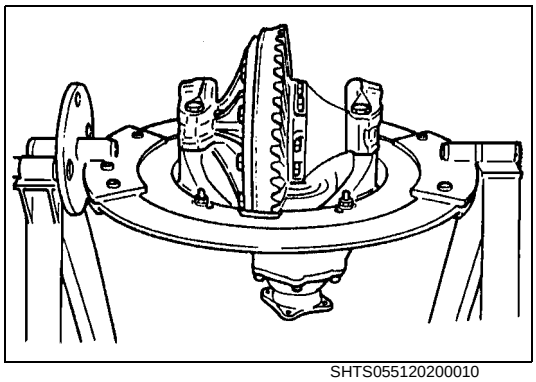


SHTS055120200009

2. DISMOUNTING OF THE DIFFERENTIAL CARRIER ASSEMBLY

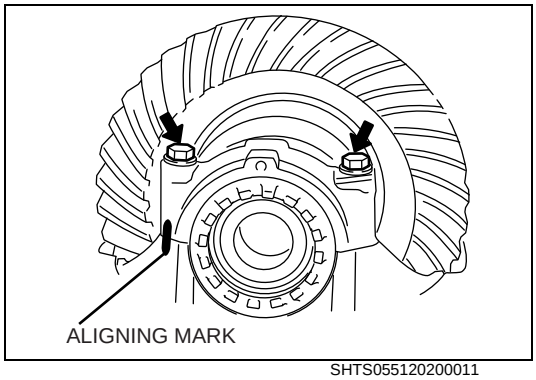
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


SHTS055120200010

IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.



SHTS055120200011

2. DIFFERENTIAL CASE

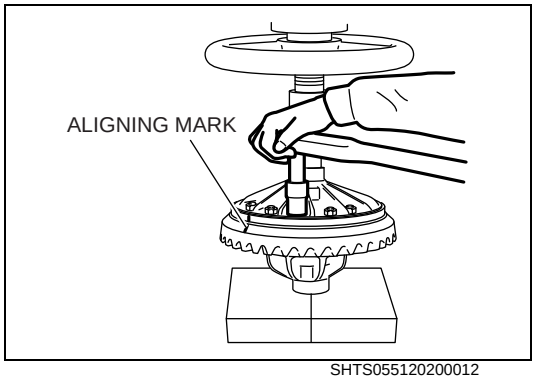
(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

SST: Socket Wrench (S0960-31150)

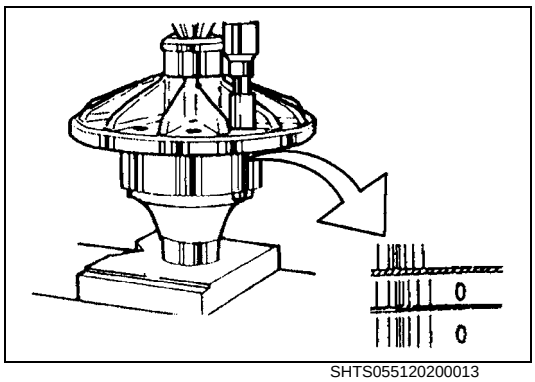
(2) Using a puller, remove the taper roller bearing.



SHTS055120200012

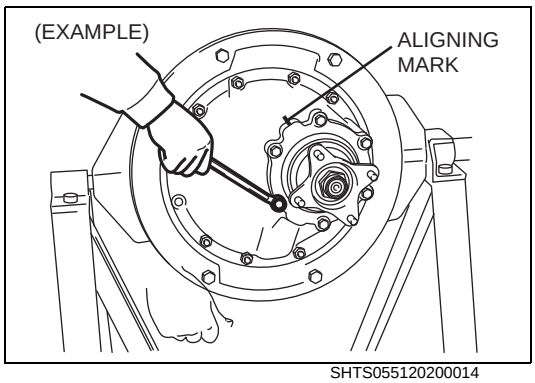
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts and then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055120200013

(4) Disassemble the differential case.

NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.

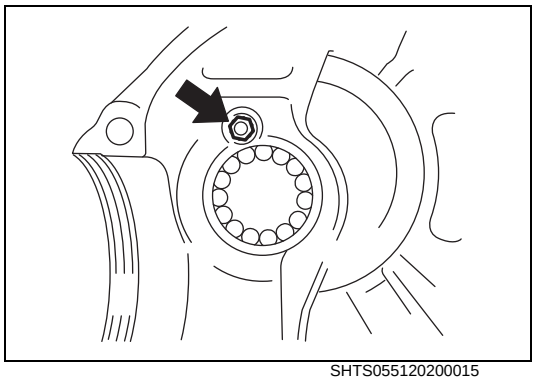


SHTS055120200014

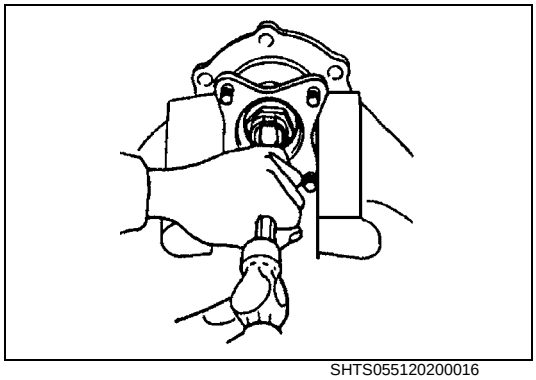
3. HYPOID PINION

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

NOTICE
Make aligning mark the differential cage and differential carrier.

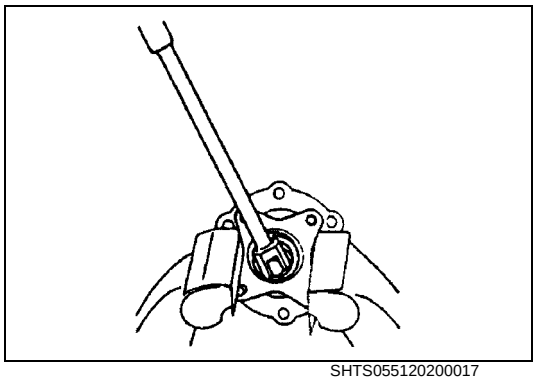

SHTS055120200015

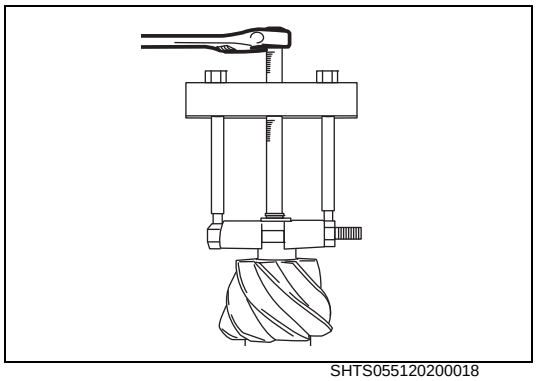
(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


SHTS055120200016

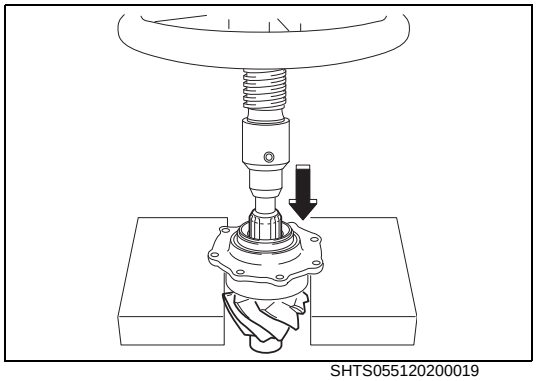
4. BEARING CAGE

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-94601)

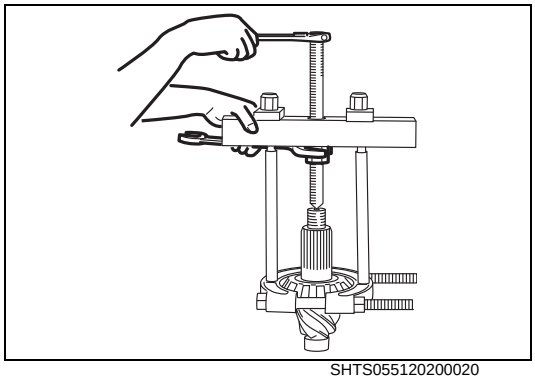

SHTS055120200017


SHTS055120200018

(2) Using a puller, remove the cylindrical roller bearing inner race.


SHTS055120200019

(3) Using a press, remove the hypoid pinion.


SHTS055120200020

(4) Using a puller, remove the taper roller bearing inner race.

IMPORTANT POINTS - ASSEMBLY

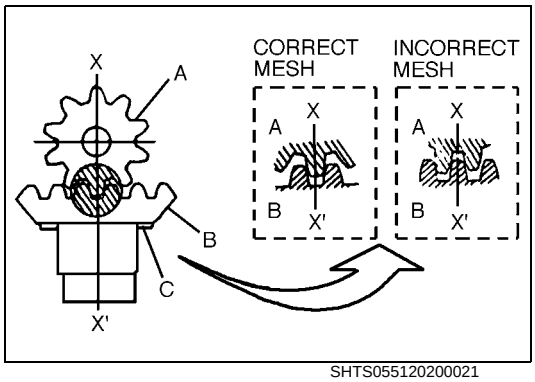
1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

NOTICE

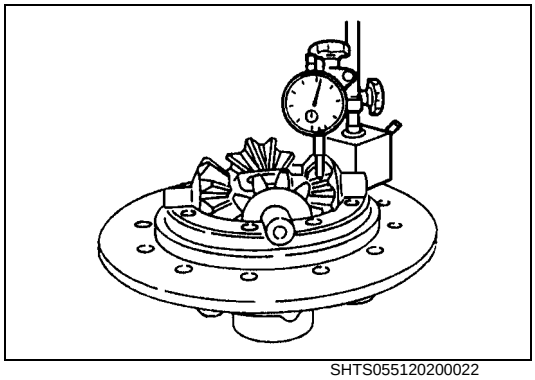
Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

- A: Pinion
- B: Side gear
- C: Thrust washer



SHTS055120200021

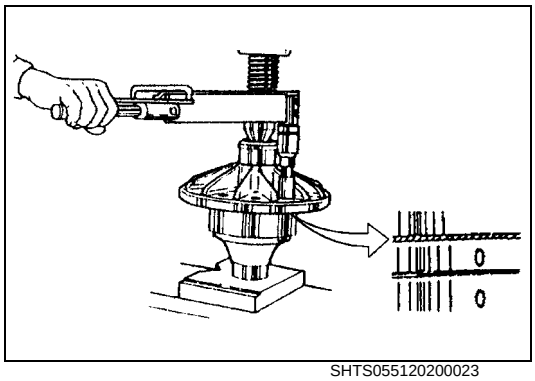
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}

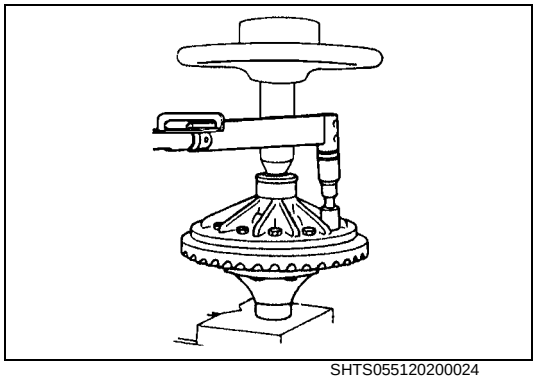

SHTS055120200022

(3) Assemble the differential case.

NOTICE

- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

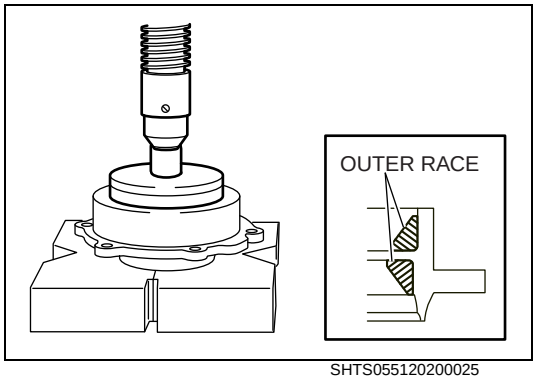

SHTS055120200023


SHTS055120200024

(4) Install the ring gear to the differential case and tighten it with bolts.

NOTICE

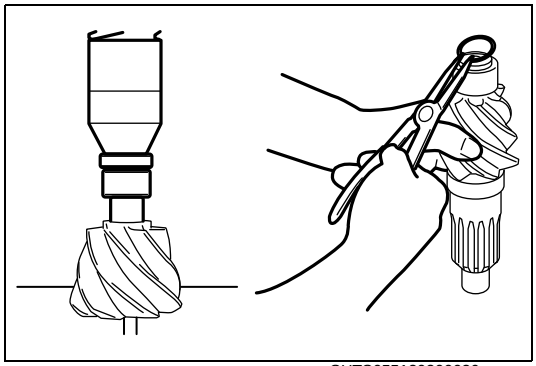
Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.



SHTS055120200025

2. HYPOID PINION

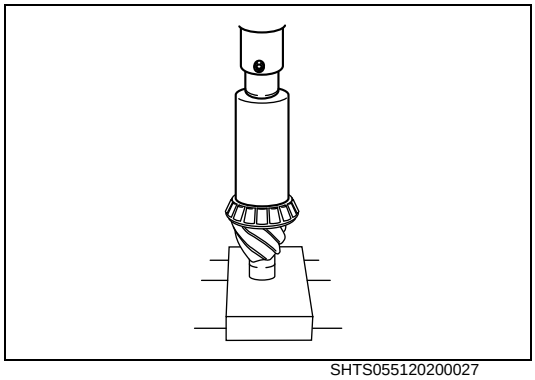
(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.


SHTS055120200026

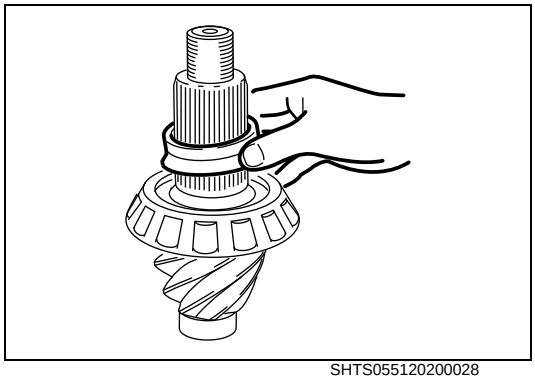
(2) Installing the cylindrical roller bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

⚠ CAUTION

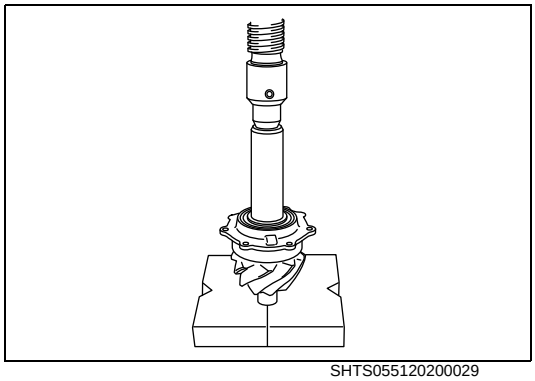
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS055120200027

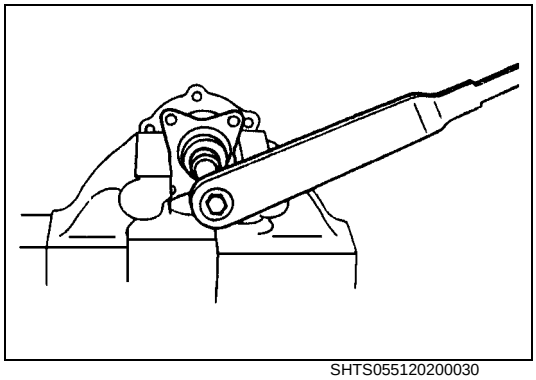
(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the inner taper roller bearing inner race.


SHTS055120200028

   c. Install the spacer.


SHTS055120200029

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


SHTS055120200030

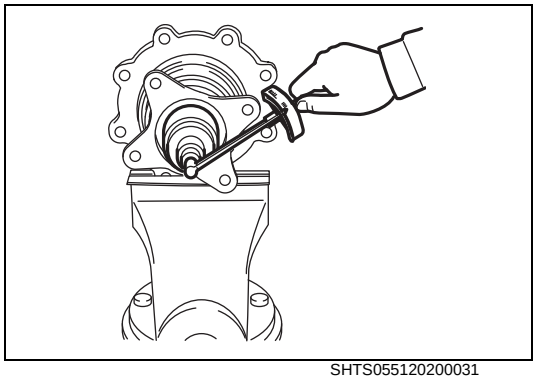
3. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-94601)


SHTS055120200031

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

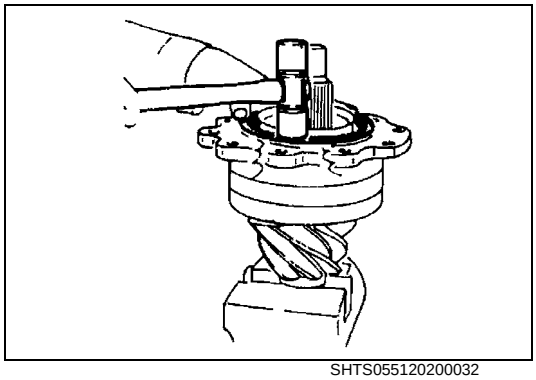
Assembly Standard: Turning torque Unit: N·m {kgf·cm, lbf·ft}

New bearing	Re-used bearing
1.97-2.94 {20-30, 1.5-2.1}	1.47-2.45 {15-25, 1.1-1.8}

Adjusting spacer thickness:
17 kinds of thicknesses ranging from 17.250 to 17.650 mm {0.679 to 0.694 in.} each differing 0.025 mm {0.001 in.}

NOTICE

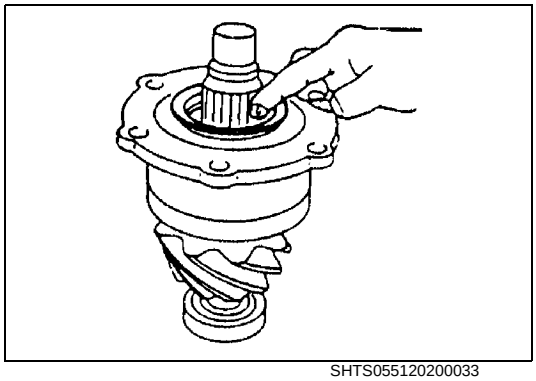
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.


SHTS055120200032

(3) After adjusting the preload, install the new oil seal.

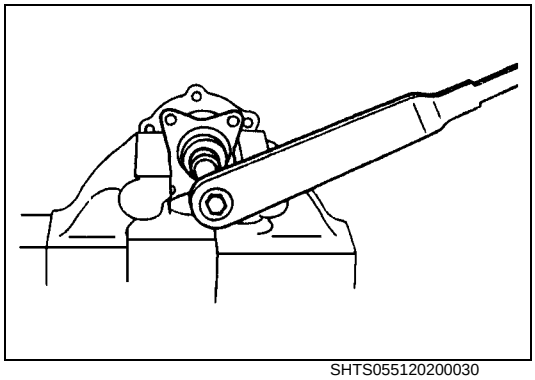
NOTICE

Tap the oil seal in small steps and evenly to prevent it from being at slant position.


SHTS055120200033

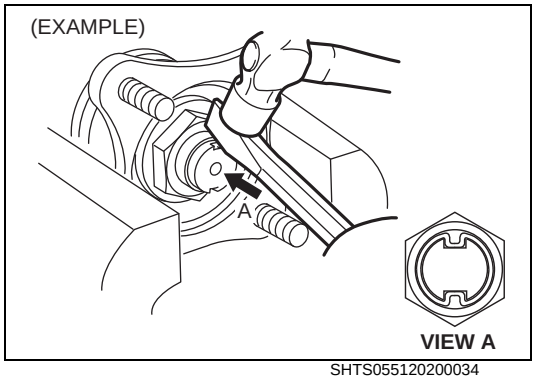
NOTICE

- **Apply the liquid gasket (ThreeBond#1207B or equivalent) on the outer circumference of the oil seal.**
- **Apply wheel bearing grease on the oil seal lip part.**



SHTS055120200030

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-94601)

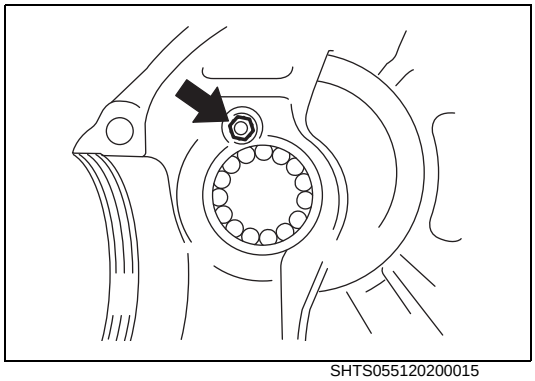


SHTS055120200034

(5) Caulk the lock nut.

NOTICE

- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulked position.**



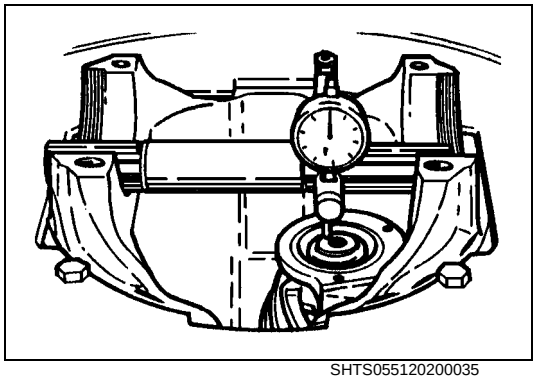
SHTS055120200015

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

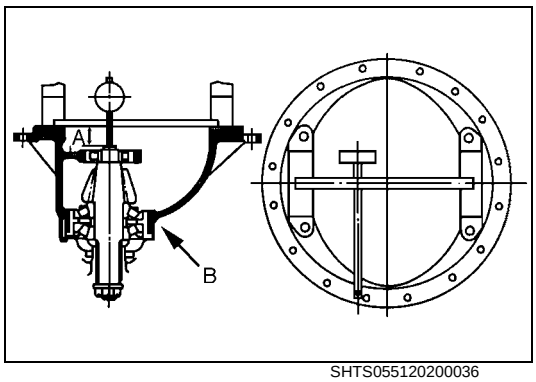
NOTICE

Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.


SHTS055120200035

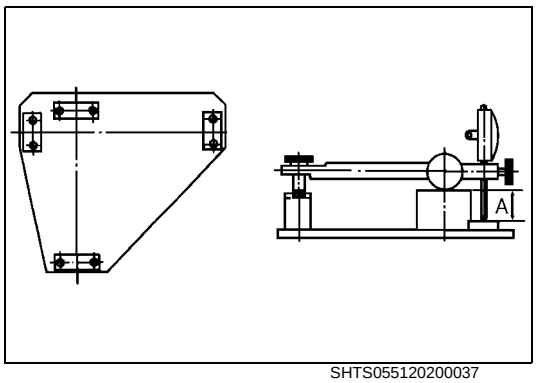
5. ADJUSTMENT OF THE PINION FITTING HEIGHT (CONICAL DISTANCE)

(1) Install the bearing cage assembly and adjust the height with shims.
SST: Gauge Assembly (S0964-01151)



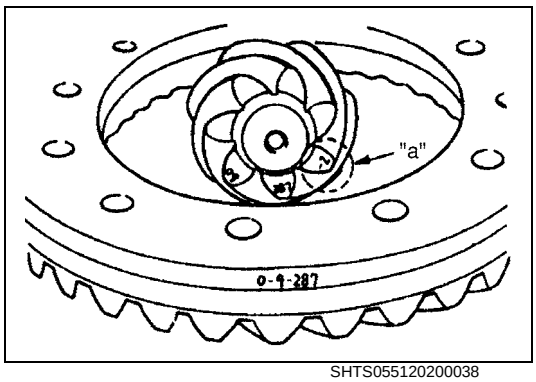
SHTS055120200036

A: 33 mm {1.299 in.}
B: Adjusting shim
Thickness: 0.30 mm {0.0118 in.}
0.40 mm {0.0157 in.}
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}



SHTS055120200037

(2) How to use the pinion depth gauge:
Set the pinion depth gauge.
A: 33 mm {1.299 in.}



SHTS055120200038

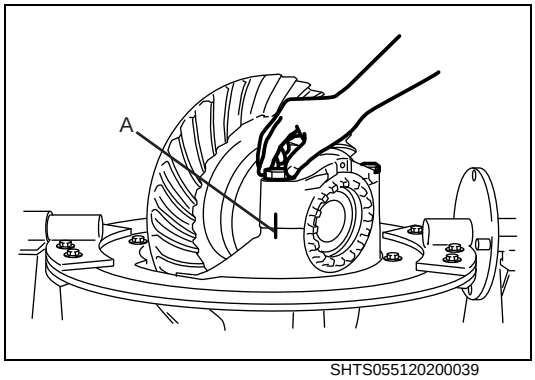
EXAMPLE:

In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

Standard pinion height "A"		The engraved value "a"		Measuring part (A')
33.0 mm	–	0.2 mm	=	32.8 mm

NOTICE

Upon completing the adjustment, remove the bearing cage assembly and apply liquid gasket (ThreeBond #1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.



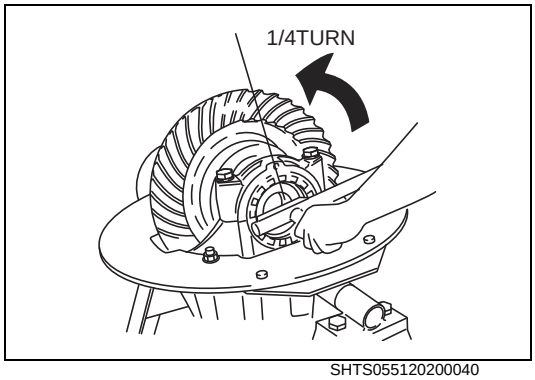
SHTS055120200039

6. ADJUSTMENT OF THE HYPOID RING GEAR BACKLASH

(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE

Align the aligning marks "A".

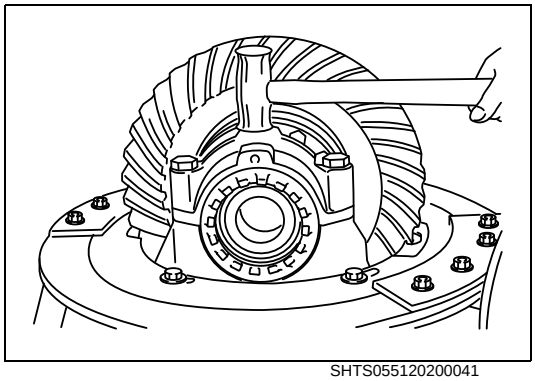


SHTS055120200040

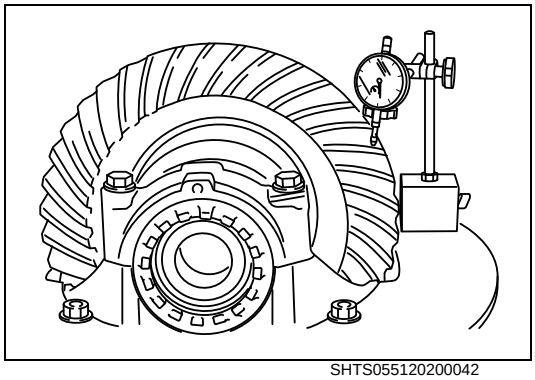
(2) Adjust the preload of the side bearing provisionally.

a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.

SST: Adjuster Tool (S0966-51040)


SHTS055120200041

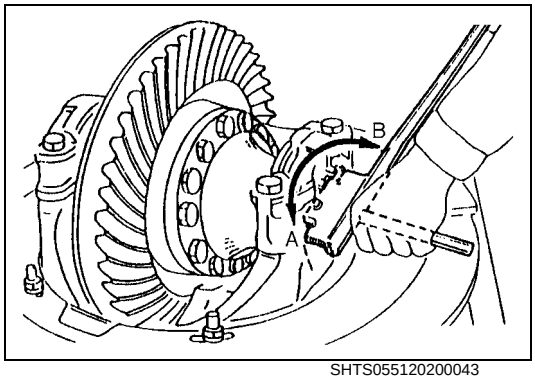
b. Hit the bearing cap with a copper hammer.


SHTS055120200042

(3) Measure the gear backlash at three or four points on the circumference of the gear.

Assembly standard:

Gear ratio	Backlash
4.300, 5.125, 5.428, 5.857	0.25-0.33 mm {0.010-0.013 in.}
4.625, 4.875	0.30-0.41 mm {0.012-0.016 in.}

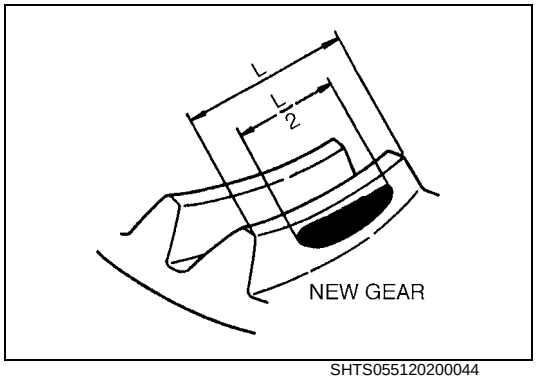


SHTS055120200043

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.

BACKLASH: "A"-Decrease "B"-Increase

SST: Adjuster Tool (S0966-51040)



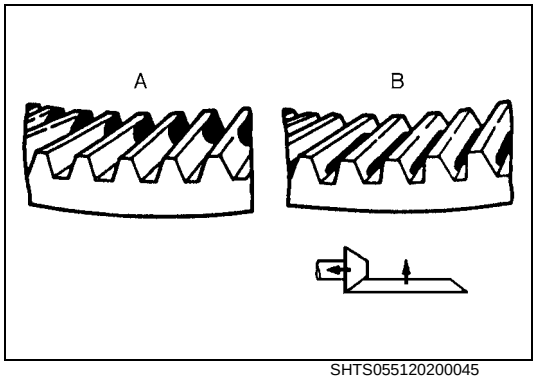
SHTS055120200044

7. INSPECTION AND ADJUSTMENT OF GEAR MESHING

(1) Satisfactory gear meshing.

NOTICE

New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.



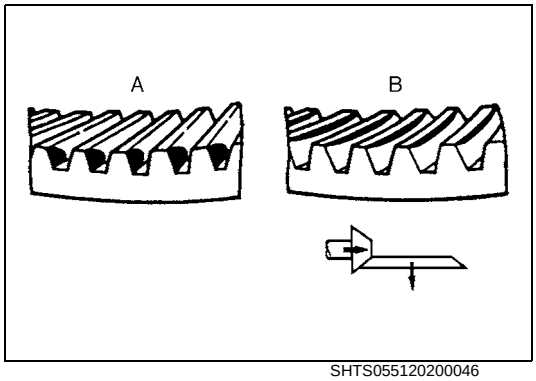
SHTS055120200045

(2) Example of the unsatisfactory engagement

a. Toe and flank contact

A: Toe contact - Unadjust, replace the pinion and ring gear as a set.

B: Flank contact - Adjust

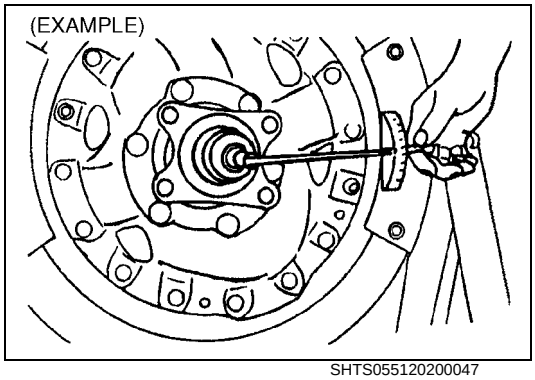


SHTS055120200046

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.

B: Face contact - Adjust



SHTS055120200047

8. MEASUREMENT AND ADJUSTMENT OF THE SIDE BEARING

(1) Measure the total preload using a torque wrench at the flange coupling.

NOTICE

Total preload = Side bearing preload + Pinion bearing preload (Refer to item 3).

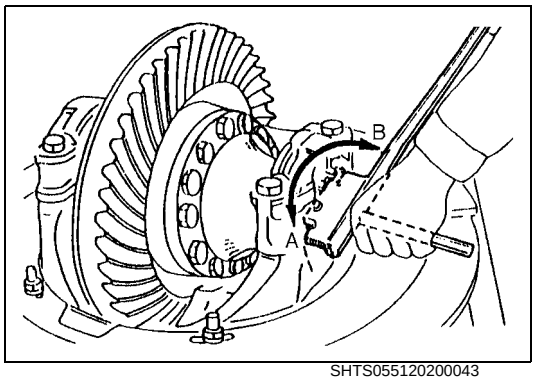
Assembly standard: Side bearing preload turning torque

Unit: N·m {kgf·cm, lbf·ft}

Gear ratio	4.300	4.625	4.875	5.125	5.428	5.857
New bearing	0.46-0.68 {4.7-6.9, 0.34-0.50}	0.43-0.63 {4.4-6.4, 0.32-0.46}	0.41-0.60 {4.2-6.1, 0.30-0.44}	0.39-0.57 {4.0-5.8, 0.29-0.42}	0.37-0.54 {3.7-5.5, 0.27-0.39}	0.34-0.50 {3.5-5.1, 0.25-0.37}
Re-used bearing	0.35-0.57 {3.5-5.8, 0.26-0.42}	0.32-0.53 {3.3-5.4, 0.24-0.39}	0.31-0.50 {3.1-5.1, 0.23-0.37}	0.29-0.47 {3.0-4.8, 0.21-0.35}	0.28-0.45 {2.8-4.6, 0.21-0.33}	0.26-0.41 {2.6-4.2, 0.19-0.30}

NOTICE

The gear ratio is indicated on the bearing cage.

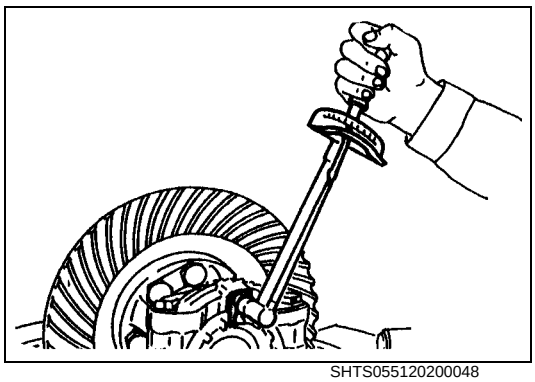


SHTS055120200043

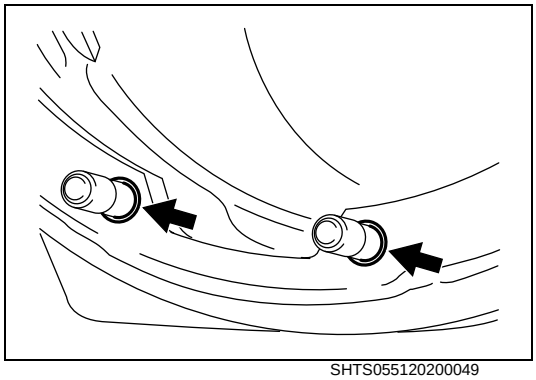
(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload

SST: Adjuster Tool (S0966-51040)


SHTS055120200048

(3) Tighten the bearing cap and install the lock plate.

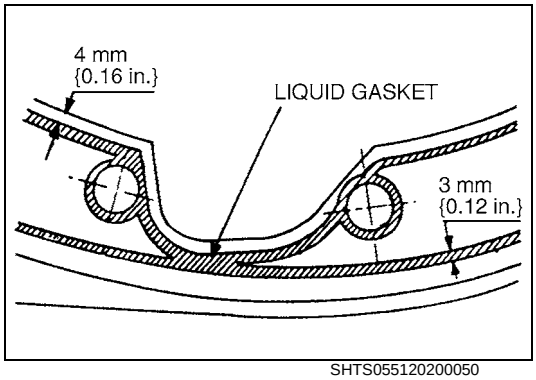

SHTS055120200049

IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.

(2) Install a new O-ring.

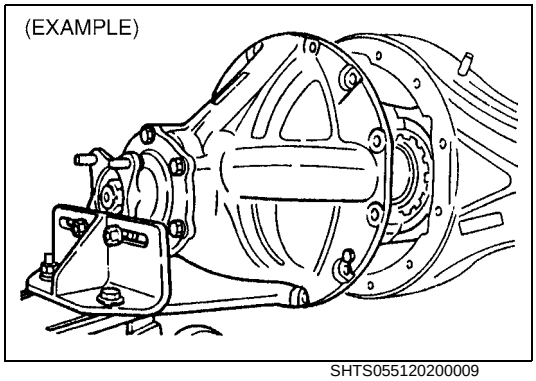


SHTS055120200050

(3) Apply liquid gasket on the face of the housing flange.

NOTICE

- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 4 mm {0.16 in.} away from the edge.**

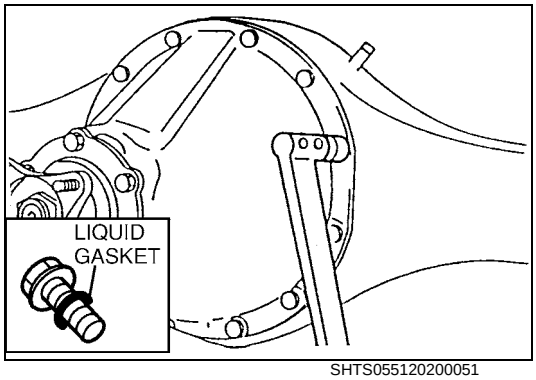


SHTS055120200009

(4) Using a jack, install the differential carrier assembly to the axle housing.

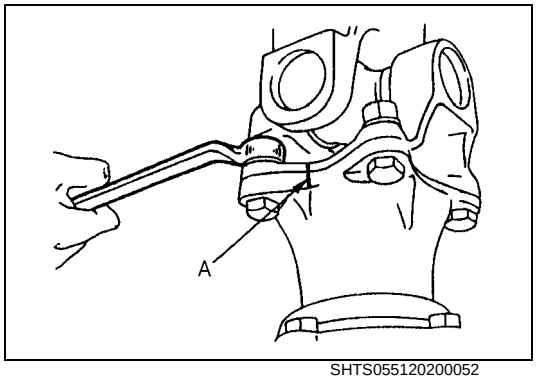
NOTICE

Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055120200051

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ14 bolts (12 pieces), install the bolts and tighten them regularly.



SHTS055120200052

(6) Connect the propeller shaft.

NOTICE

Align the aligning marks "A".

Tightening Torque:
61-91 N·m {623-927 kgf·cm, 45-67 lbf·ft}

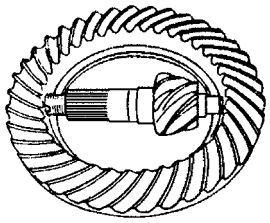
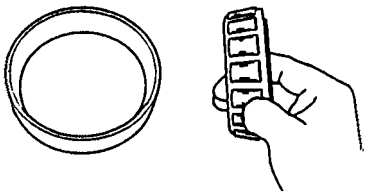
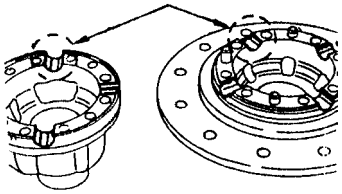
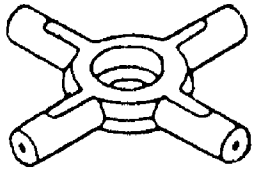
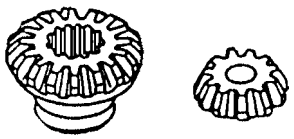
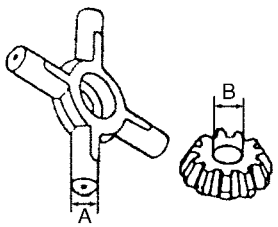
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

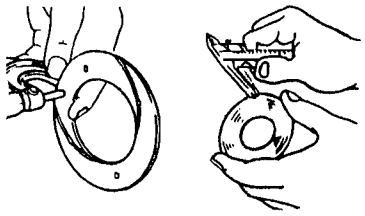
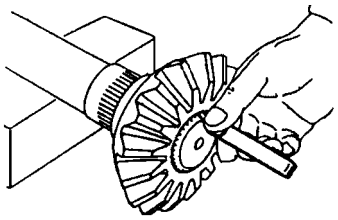
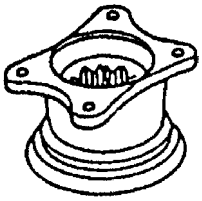
Gear oil:
Refer to owner's manual.

INSPECTION AND REPAIR

EN0551202H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 26 {1.024}** **B-A: 0.140-0.201 {0.0055-0.0079}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.7-1.9 {0.067-0.074}	**1.5 {0.059}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SH17)

DF02-004

DIFFERENTIAL CARRIER (SH17) DF02-2

DATA AND SPECIFICATIONS DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING DF02-3
SPECIAL TOOL DF02-4
COMPONENT LOCATOR DF02-5
OVERHAUL DF02-7
INSPECTION AND REPAIR DF02-19

DIFFERENTIAL CARRIER (SH17)

DATA AND SPECIFICATIONS

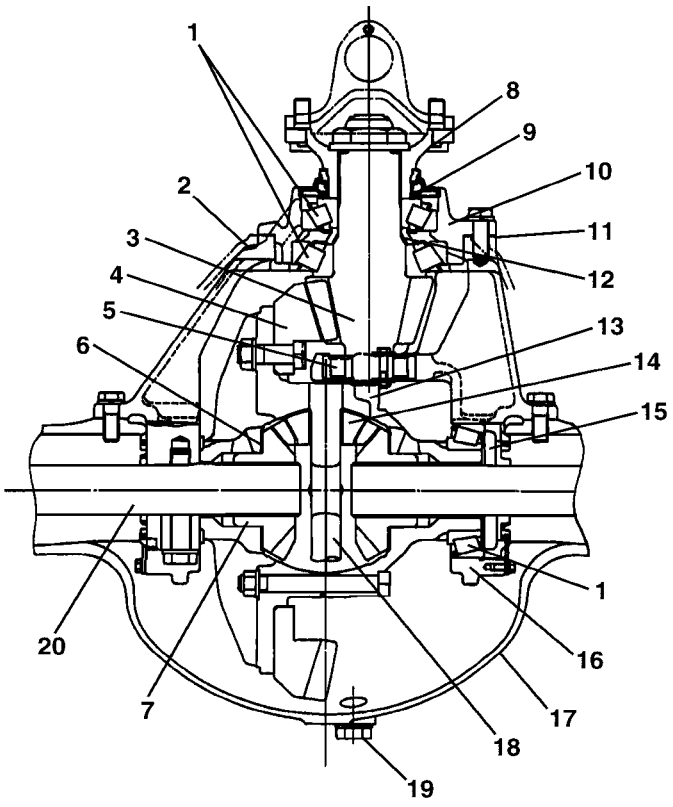
EN0551502I200001

Type	**Single-reduction, single-speed, by hypoid gearing**
Gear ratios	**4.100, 4.300, 4.625, 4.875, 5.250, 5.428, 5.857, 6.142, 6.428, 7.166**
Oil capacity	**11 L {2.42 lmp gal. / 2.91 U.S gal.}**

DESCRIPTION

EN0551502C100001

(REPRESENTATIVE TYPE)



SHTS055150200001

1	**Taper roller bearing**	**8**	**Flange yoke coupling**	**15**	**Adjusting nut**
2	**Differential carrier case**	**9**	**Oil seal**	**16**	**Bearing cap**
3	**Hypoid pinion**	**10**	**Bearing cage**	**17**	**Axle housing**
4	**Hypoid ring gear**	**11**	**Adjusting shim**	**18**	**Spider**
5	**Cylindrical roller bearing**	**12**	**Spacer**	**19**	**Oil filler plug**
6	**Thrust washer**	**13**	**Differential case**	**20**	**Axle shaft**
7	**Differential side gear**	**14**	**Differential pinion gear**		

TROUBLESHOOTING

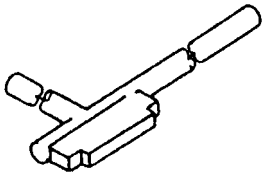
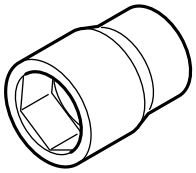
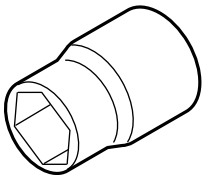
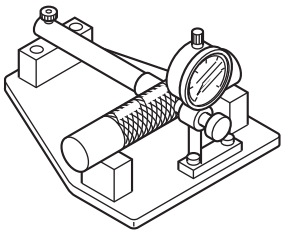
EN0551502F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil, check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

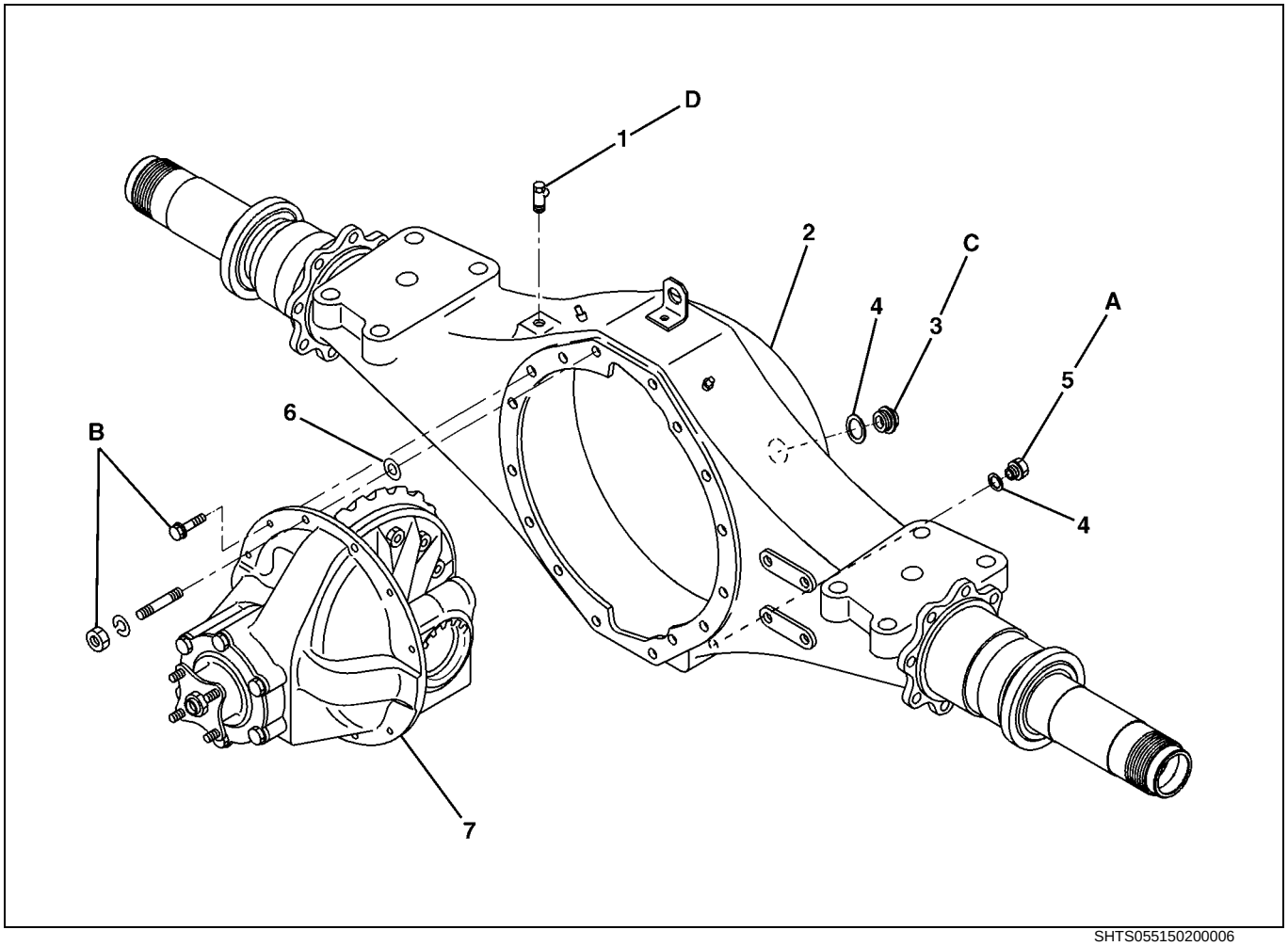
EN0551502K100001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51180	ADJUSTER TOOL	
	S0983-95501	SOCKET WRENCH	
	S0983-93003	SOCKET WRENCH	
	S0964-01210	GAUGE ASSEMBLY	

COMPONENT LOCATOR

EN0551502D100001



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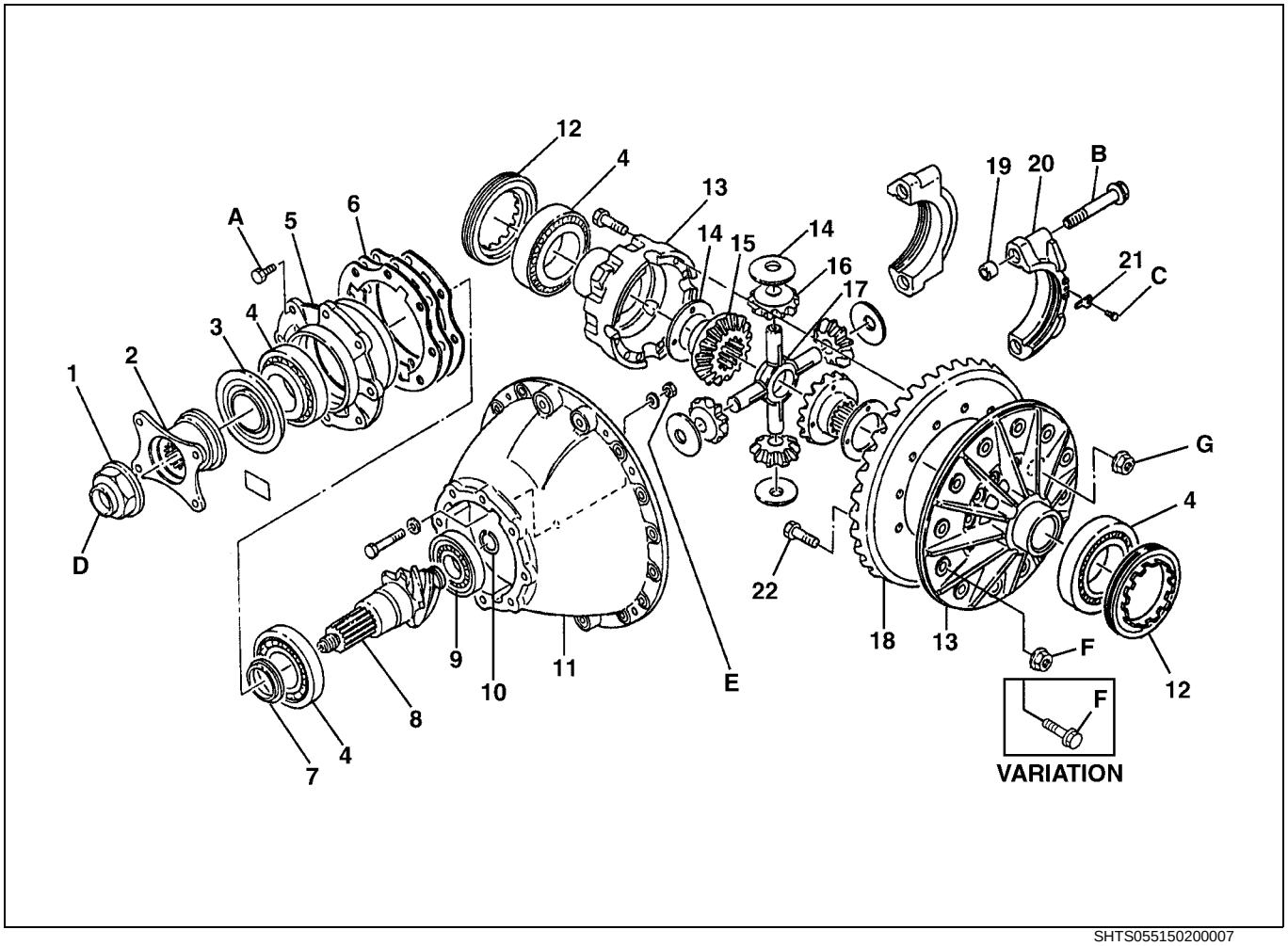
1	Air breather	5	Oil drain plug
2	Axle housing assembly	6	O-ring
3	Oil filler plug	7	Differential carrier assembly
4	Gasket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39.2-68.6 {400-700, 29-50}	C	78.4-117.6 {800-1,200, 58-86}
B	167-213 {1,700-2,200, 123-159}	D	9.8-19.6 {100-200, 7-14}



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1	Lock nut	9	Cylindrical roller bearing	17	Spider
2	Flange yoke coupling	10	Retainer ring	18	Hypoid ring gear
3	Oil seal	11	Differential carrier case	19	Collar
4	Taper roller bearing	12	Adjusting nut	20	Bearing cap
5	Bearing cage	13	Differential case	21	Lock plate
6	Adjusting shim	14	Thrust washer	22	Bolt (If so equipped)
7	Spacer	15	Differential side gear		
8	Hypoid pinion	16	Differential pinion gear		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	167-223 {1,700-2,300, 123-166}	E	19-25 {190-260, 14-18}
B	344-460 {3,500-4,700, 254-336}	F	461-559 {4,700-5,700, 340-412}
C	19-25 {190-260, 14-18}	G	246-294 {2,500-3,000, 181-216}
D	589-781 {6,000-8,000, 434-578}		

OVERHAUL

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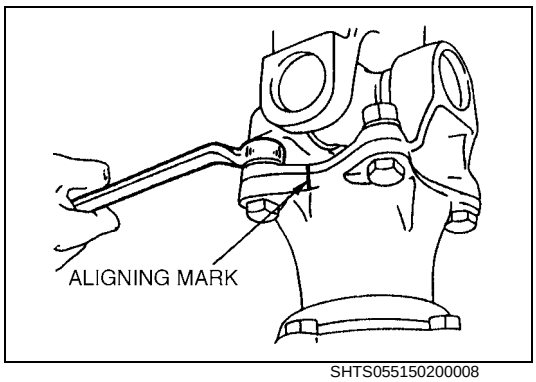


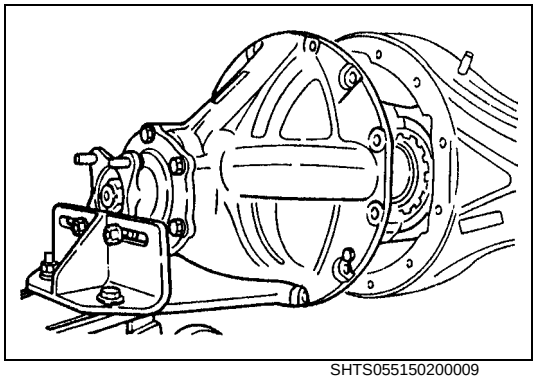
SHTS055150200008

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.


SHTS055150200009

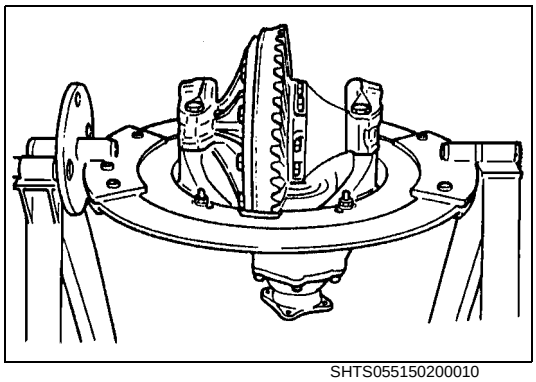
2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.

(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.

IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.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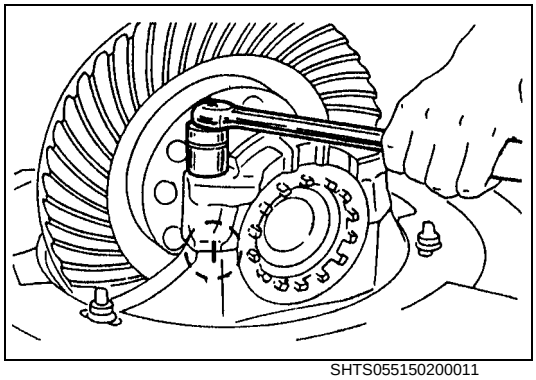

SHTS055150200011

2. DIFFERENTIAL CASE

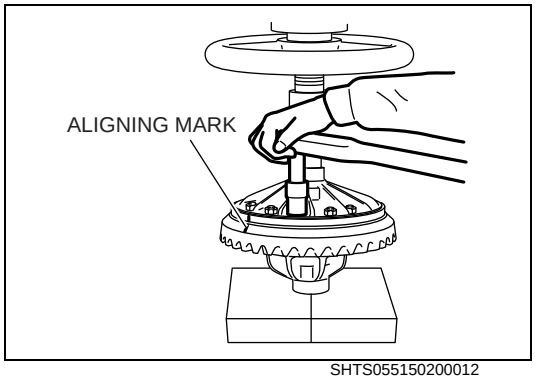
(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

SST: Socket Wrench (S0983-93003)

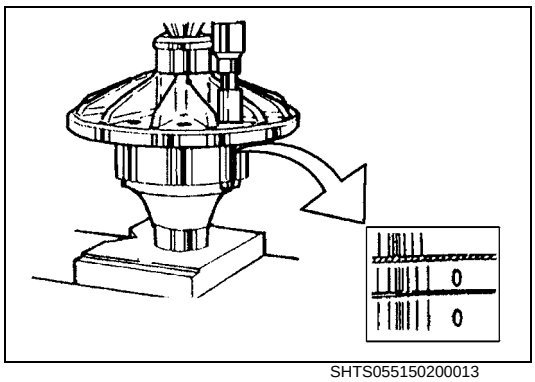
(2) Using a puller, remove the taper roller bearing.



SHTS055150200012

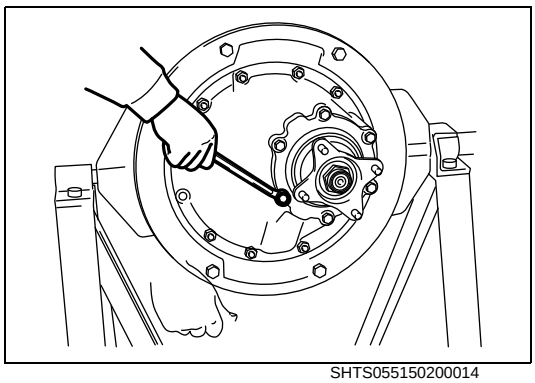
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts, nuts (Gear ratio 6.428: bolts only) and then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055150200013

(4) Disassemble the differential case.

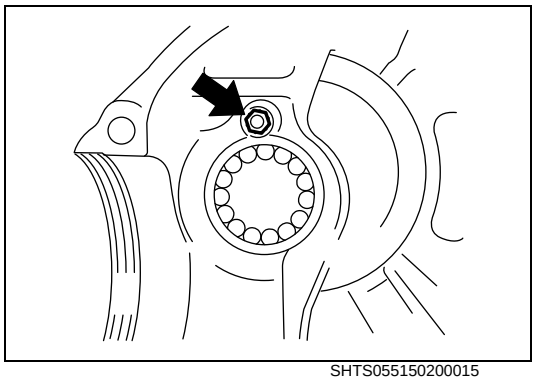
NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts and nuts so that the case separates.


SHTS055150200014

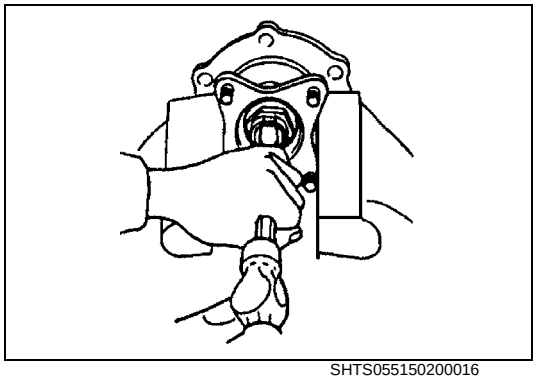
3. HYPOID PINION

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

NOTICE
Make aligning mark the differential cage and differential carrier.

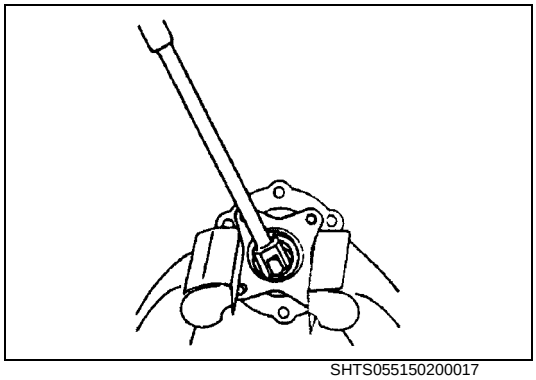

SHTS055150200015

(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


SHTS055150200016

4. BEARING CAGE

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-95501)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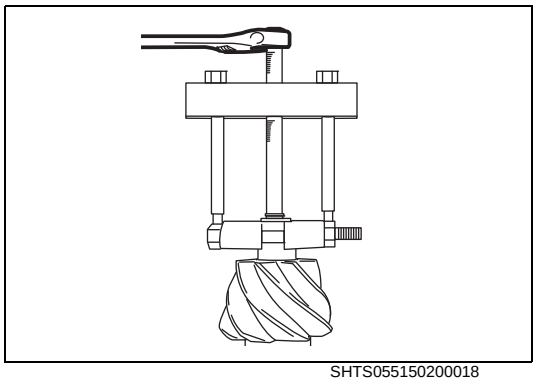
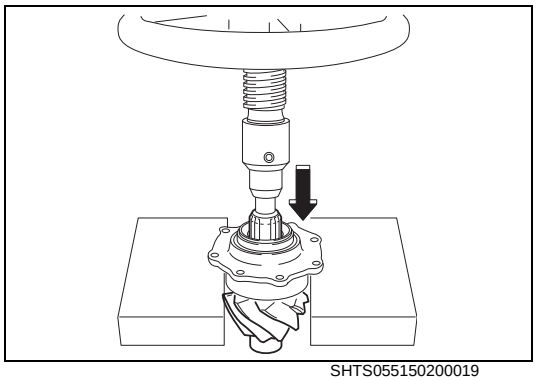
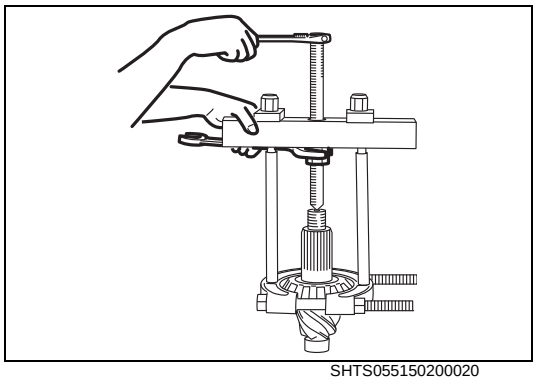

SHTS055150200018

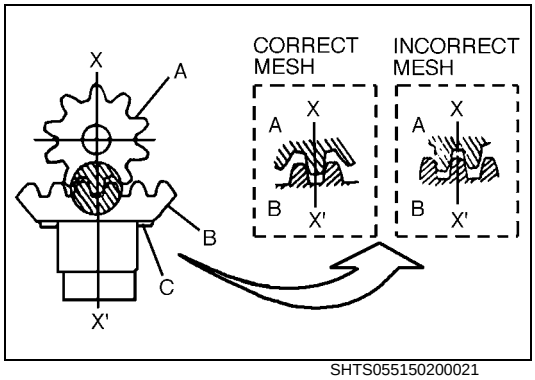
(2) Using a puller, remove the cylindrical roller bearing inner race.


SHTS055150200019

(3) Using a press, remove the hypoid pinion.


SHTS055150200020

(4) Using a puller, remove the taper roller bearing inner race.



SHTS055150200021

IMPORTANT POINTS - ASSEMBLY

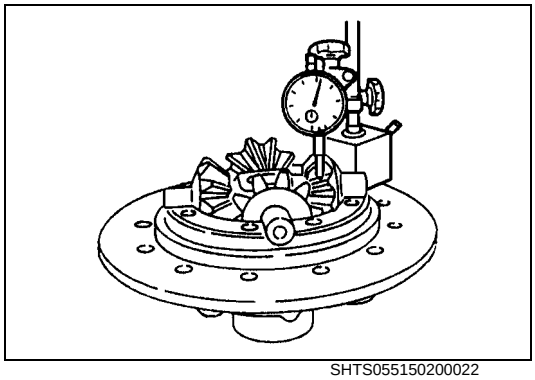
1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

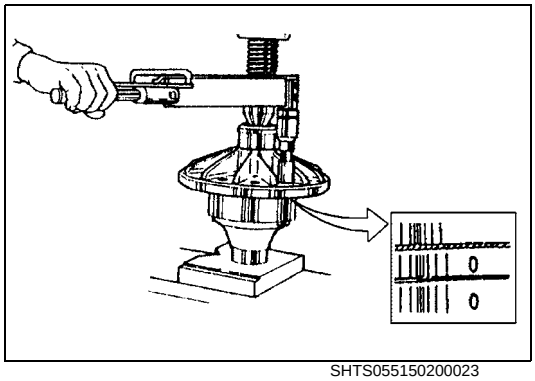
NOTICE

Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

- A: Pinion
- B: Side gear
- C: Thrust washer


SHTS055150200022

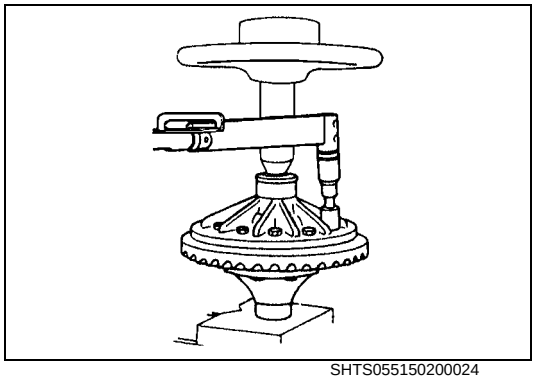
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}


SHTS055150200023

(3) Assemble the differential case.

NOTICE

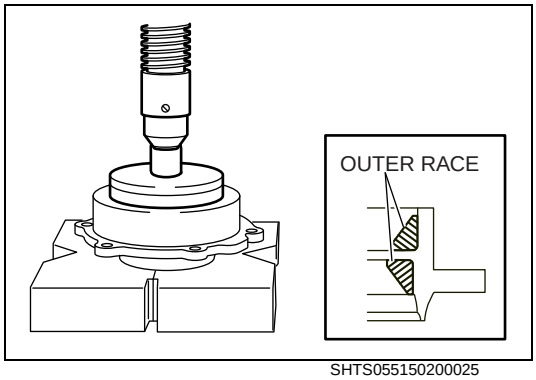
- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**


SHTS055150200024

(4) Install the ring gear to the differential case and tighten it with bolts and nuts.

NOTICE

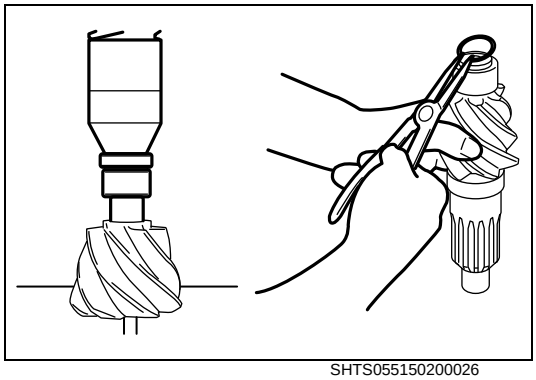
Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.



SHTS055150200025

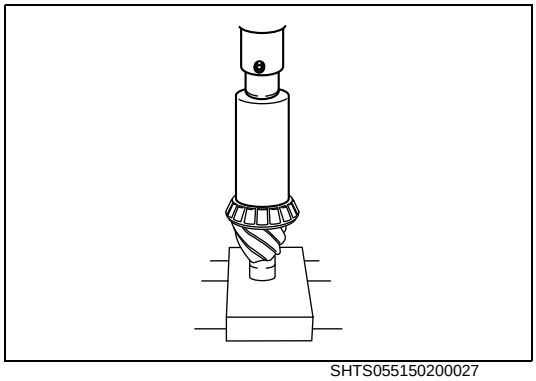
2. HYPOID PINION

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

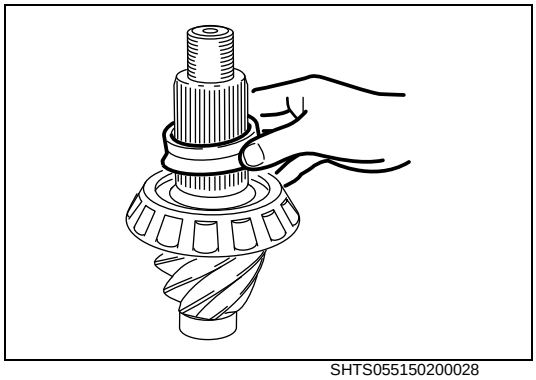

SHTS055150200026

(2) Installing the pilot bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

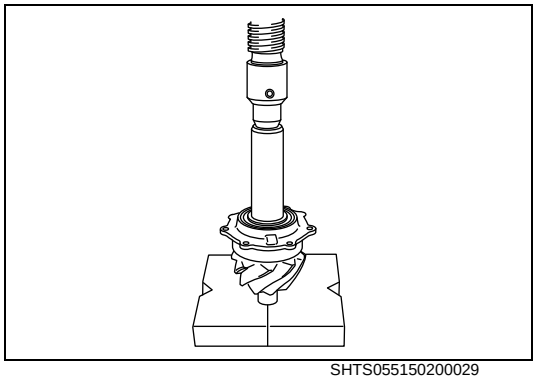
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS055150200027

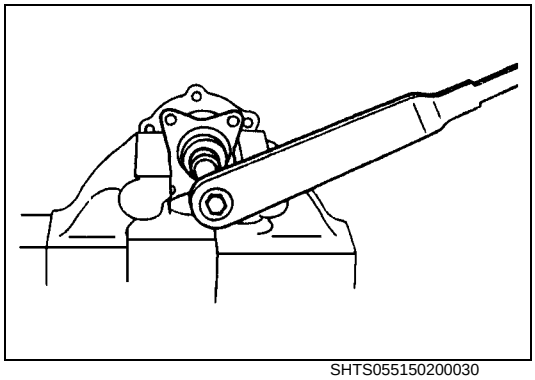
(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.


SHTS055150200028

   c. Install the spacer.


SHTS055150200029

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


SHTS055150200030

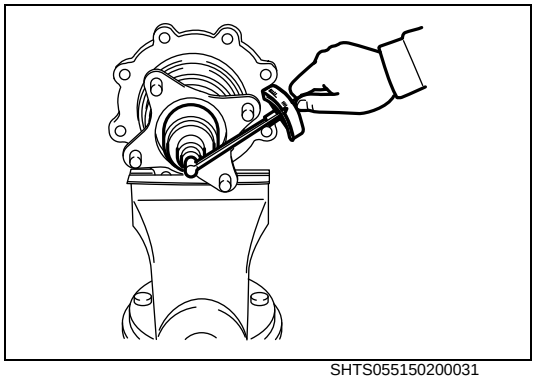
3. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-95501)


SHTS055150200031

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

Assembly Standard: Turning torque **Unit: N·m {kgf·cm, lbf·ft}**

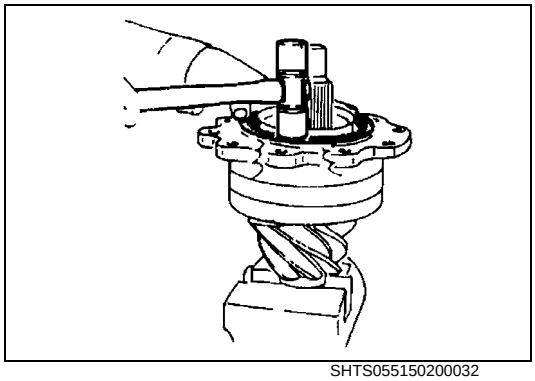
New bearing	Re-used bearing
1.97-2.45 {20-25, 1.5-1.8}	1.47-1.96 {15-20, 1.1-1.4}

Adjusting spacer thickness:

23 kinds of thicknesses ranging from 16.250 to 16.800 mm {0.640 to 0.661 in.} each differing 0.025 mm {0.001 in.}

NOTICE

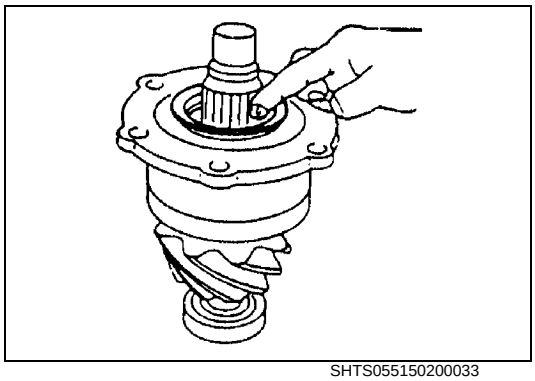
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.


SHTS055150200032

(3) After adjusting the preload, install the new oil seal.

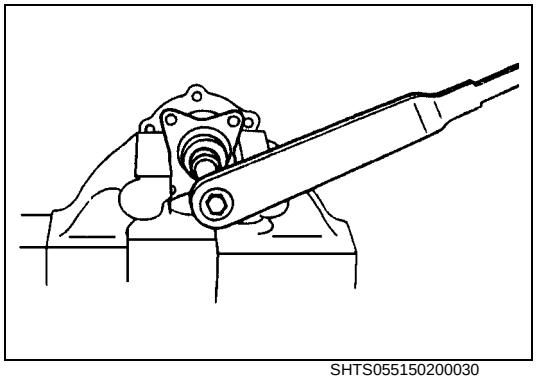
NOTICE

Tap the oil seal in small steps and evenly to prevent it from being at slant position.


SHTS055150200033

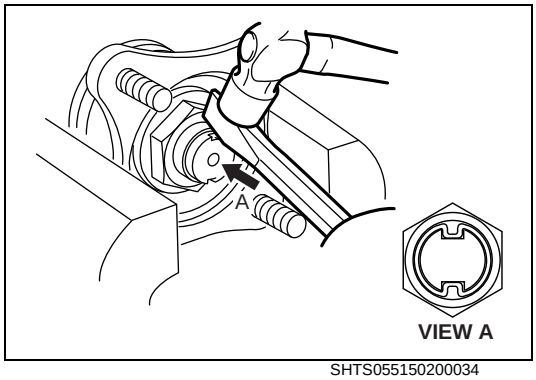
NOTICE

Apply wheel bearing grease on the oil seal lip part.



SHTS055150200030

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-95501)

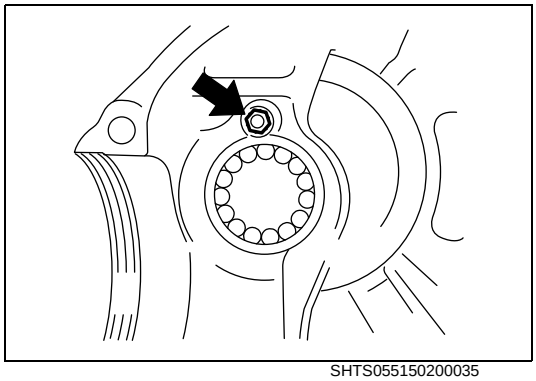


SHTS055150200034

(5) Caulk the lock nut.

NOTICE

- **Caulk the nut securely as shown.**
- **Make sure that there is no rift in the caulk position.**



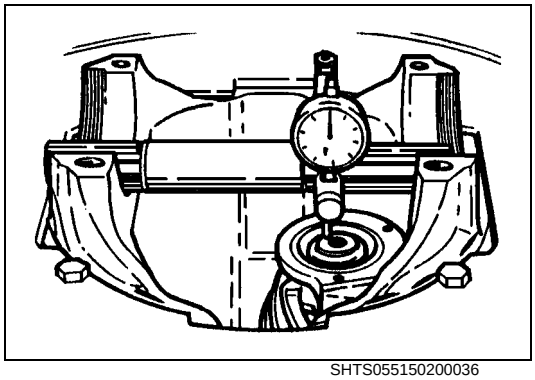
SHTS055150200035

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

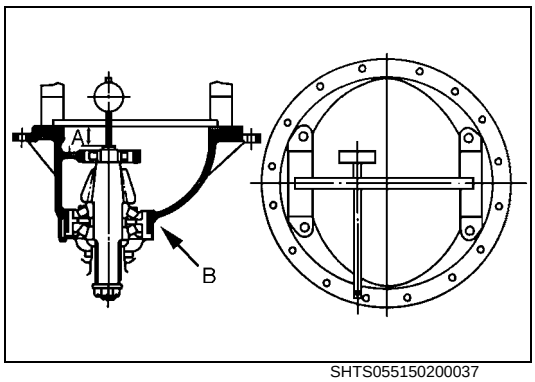
NOTICE

Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.


SHTS055150200036

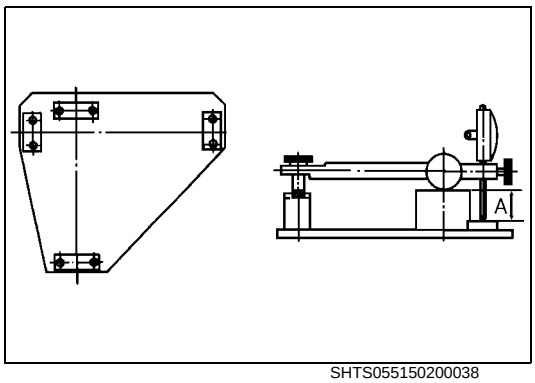
5. ADJUSTMENT OF THE PINION FITTING HEIGHT (CONICAL DISTANCE)

(1) Install the pinion cage assembly and adjust the height with shims.
SST: Gauge Assembly (S0964-01210)



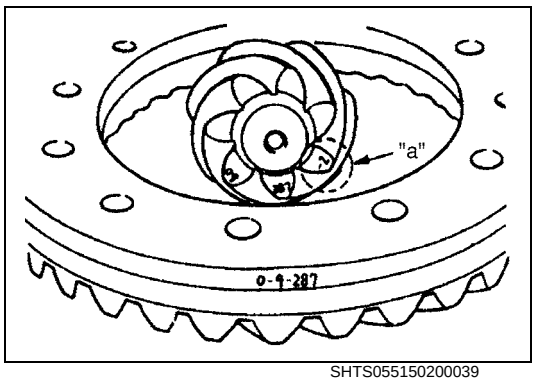
SHTS055150200037

A: 34 mm {1.339 in.}
B: Adjusting shim
Thickness: 0.30 mm {0.0118 in.}
0.40 mm {0.0157 in.}
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}



SHTS055150200038

(2) How to use the pinion depth gauge:
Set the pinion depth gauge.
A: 34 mm {1.339 in.}



SHTS055150200039

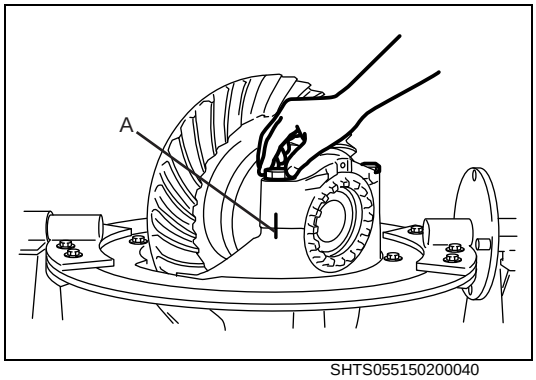
EXAMPLE:

In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

Standard pinion height "A"		The engraved value "a"		Measuring part (A')
34.0 mm	–	0.2 mm	=	33.8 mm

NOTICE

Upon completing the adjustment, remove the bearing cage assembly and apply liquid gasket (ThreeBond #1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.



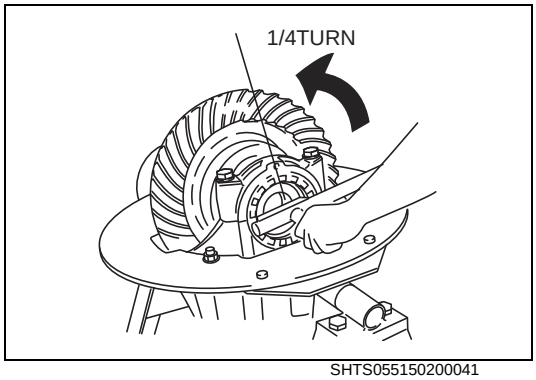
SHTS055150200040

6. ADJUSTMENT OF HYPOID RING GEAR BACKLASH

(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE

Align the aligning marks "A".

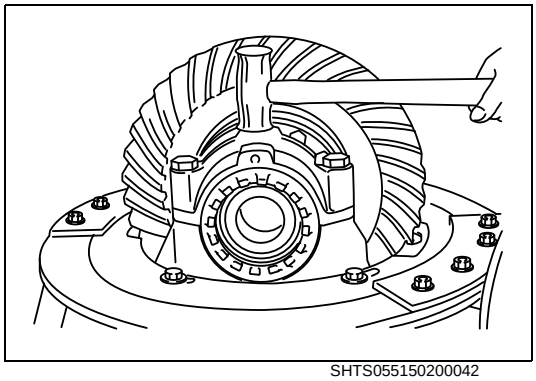


SHTS055150200041

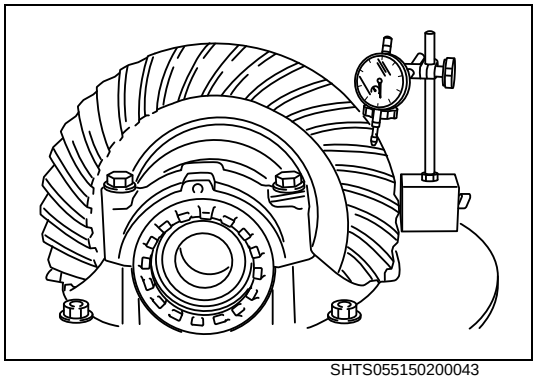
(2) Adjust the preload of the side bearing provisionally.

a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.

SST: Adjuster Tool (S0966-51180)


SHTS055150200042

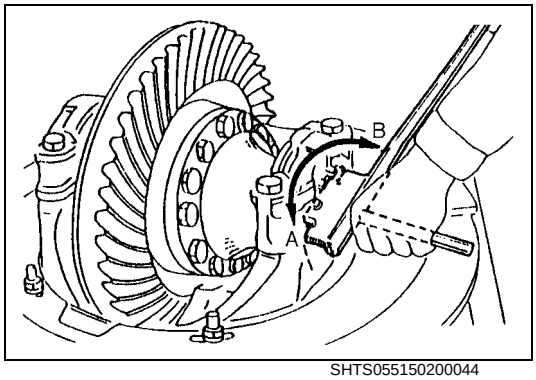
b. Hit the bearing cap with a copper hammer.


SHTS055150200043

(3) Measure the gear backlash at three or four points on the circumference of the gear.

Assembly standard:

Gear ratio	Backlash
Except 6.428	0.30-0.41 mm {0.012-0.016 in.}
6.428	0.25-0.33 mm {0.010-0.013 in.}

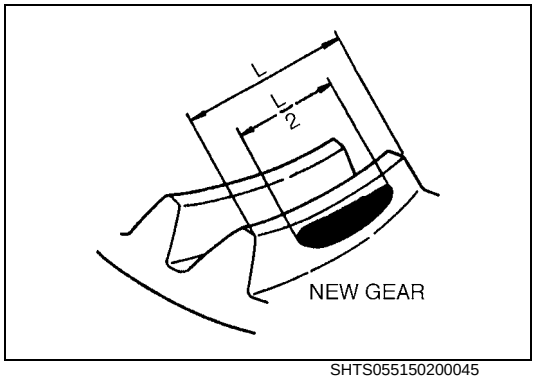


SHTS055150200044

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.

BACKLASH: "A"-Decrease "B"-Increase

SST: Adjuster Tool (S0966-51180)



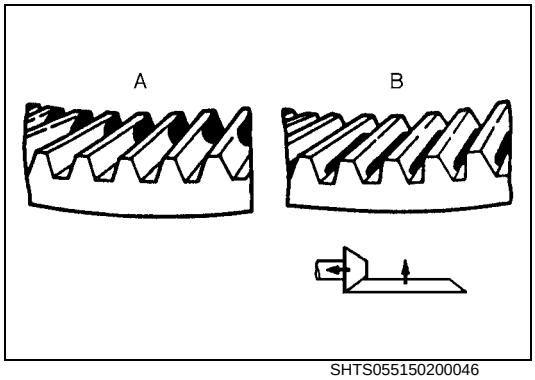
SHTS055150200045

7. INSPECTION AND ADJUSTMENT OF GEAR MESHING

(1) Satisfactory gear meshing.

NOTICE

New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.



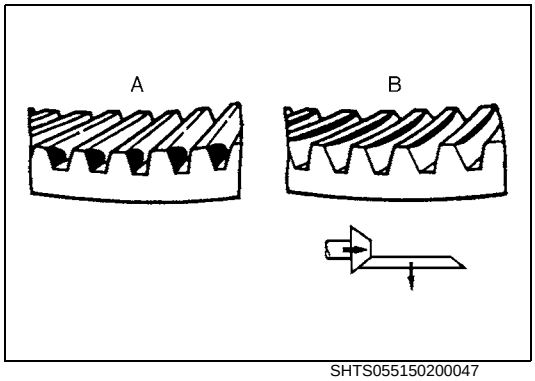
SHTS055150200046

(2) Example of the unsatisfactory engagement

a. Toe and flank contact

A: Toe contact - Unadjust, replace the pinion and ring gear as a set.

B: Flank contact - Adjust

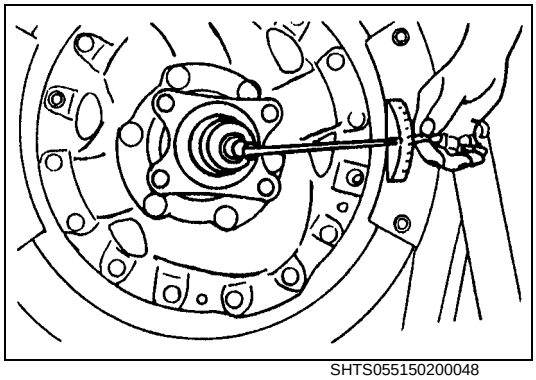


SHTS055150200047

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.

B: Face contact - Adjust


SHTS055150200048

8. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING

(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

NOTICE

Total preload = Side bearing preload + Pinion bearing preload (refer to item 3).

Assembly standard: Side bearing preload turning torque

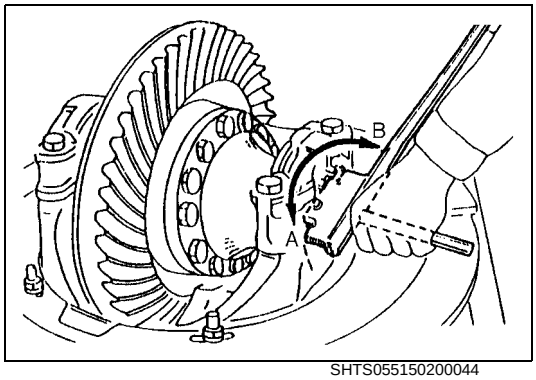
Unit: N·m {kgf·cm, lbf·ft}

Gear ratio	4.100	4.300	4.625	4.875	5.250
New bearing	0.48-0.59 {4.9-6.0, 0.36-0.44}	0.46-0.57 {4.7-5.8, 0.34-0.41}	0.43-0.53 {4.4-5.4, 0.32-0.39}	0.41-0.50 {4.2-5.1, 0.30-0.37}	0.38-0.46 {3.9-4.7, 0.28-0.34}
Re-used bearing	0.36-0.47 {3.7-4.8, 0.27-0.35}	0.35-0.45 {3.6-4.6, 0.26-0.33}	0.32-0.42 {3.3-4.3, 0.24-0.31}	0.31-0.40 {3.1-4.1, 0.23-0.29}	0.29-0.37 {2.9-3.8, 0.21-0.25}

Gear ratio	5.428	5.857	6.142	6.428	7.166
New bearing	0.37-0.45 {3.7-4.6, 0.27-0.33}	0.34-0.41 {3.5-4.1, 0.25-0.30}	0.32-0.39 {3.3-4.0, 0.24-0.29}	0.31-0.38 {3.2-3.8, 0.23-0.28}	0.28-0.34 {2.8-3.4, 0.21-0.25}
Re-used bearing	0.28-0.36 {2.8-3.6, 0.20-0.26}	0.26-0.33 {2.6-3.4, 0.19-0.24}	0.24-0.31 {2.5-3.2, 0.18-0.23}	0.23-0.30 {2.4-3.1, 0.17-0.22}	0.21-0.27 {2.1-2.7, 0.15-0.20}

NOTICE

The gear ratio is indicated on the bearing cage.

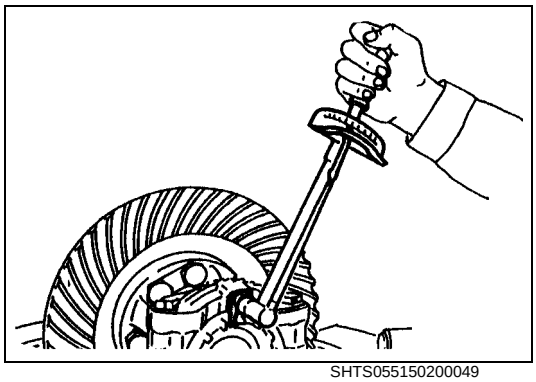


SHTS055150200044

(2) If necessary, adjust the side bearing preload with the adjusting nut.

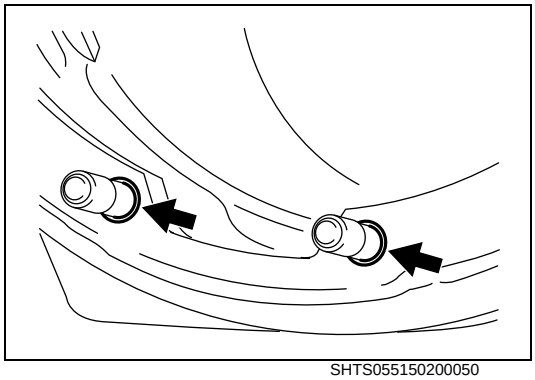
- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload

SST: Adjuster Tool (S0966-51180)


SHTS055150200049

(3) Tighten the bearing cap and install the lock plate.

SST: Socket Wrench (S0983-93003)

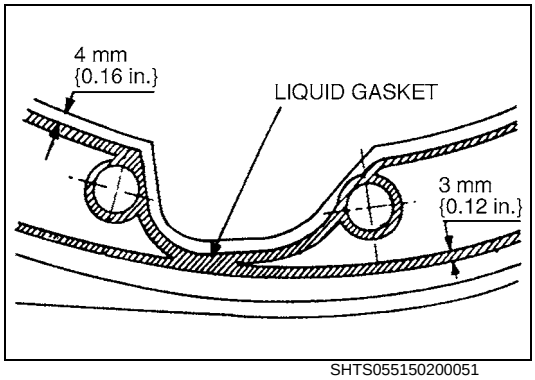

SHTS055150200050

IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.

(2) Install a new O-ring.

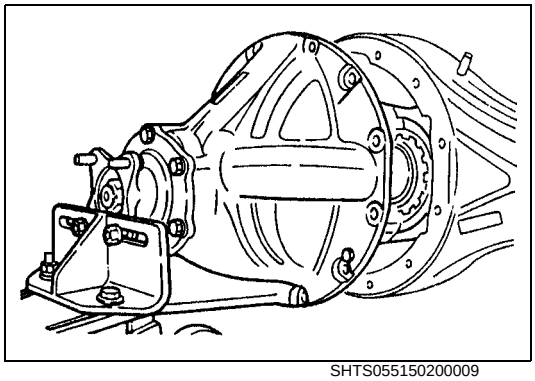


SHTS055150200051

(3) Apply liquid gasket on the face of the housing flange.

NOTICE

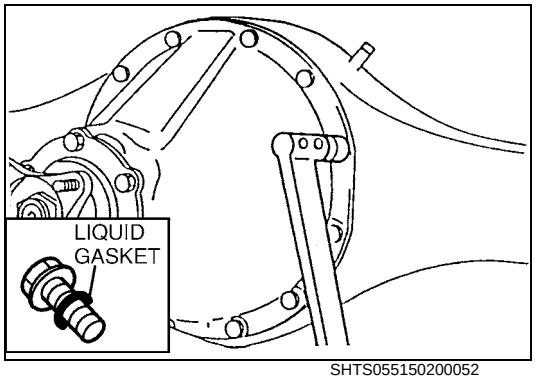
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 4 mm {0.16 in.} away from the edge.**


SHTS055150200009

(4) Using a jack, install the differential carrier assembly to the axle housing.

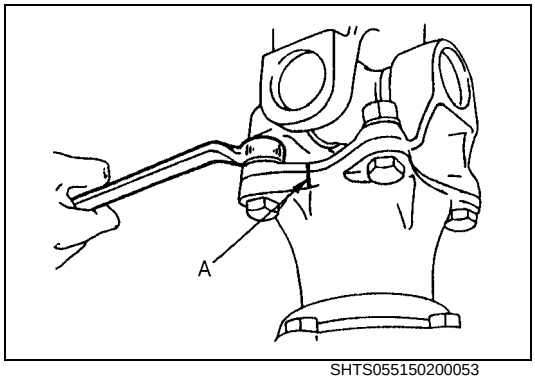
NOTICE

Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055150200052

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ16 bolts (12 pieces), install the bolts and tighten them regularly.



SHTS055150200053

(6) Connect the propeller shaft.

NOTICE

Align the aligning marks "A".

Tightening Torque:
ϕ14 bolt: 127.5-156.9 N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}
ϕ16 bolt: 166.8-225.4 N·m {1,700-2,300 kgf·cm, 123-166 lbf·ft}

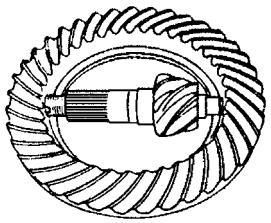
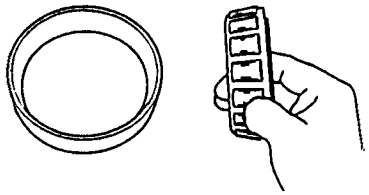
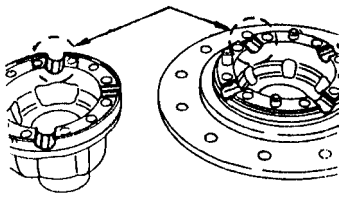
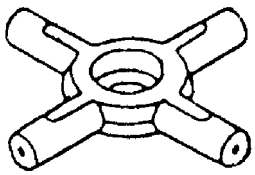
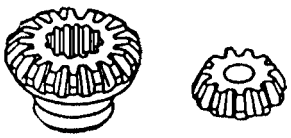
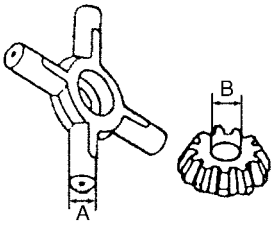
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

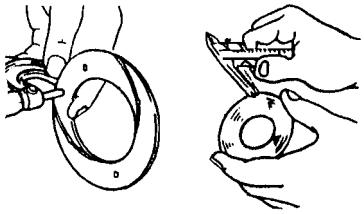
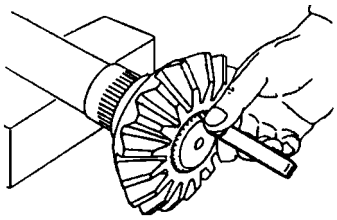
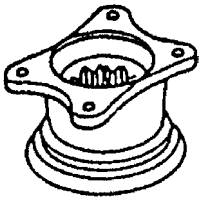
Gear oil:
Refer to the owner's manual.

INSPECTION AND REPAIR

EN0551502H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 32 {1.260} B-A: 0.145-0.190 {0.006-0.007}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.7-1.9 {0.067-0.074}	**1.5 {0.059}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SH18)

DF02-005

DIFFERENTIAL CARRIER (SH18) DF02-2

DATA AND SPECIFICATIONS DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING DF02-3
SPECIAL TOOL DF02-4
COMPONENT LOCATOR DF02-5
OVERHAUL DF02-7
INSPECTION AND REPAIR DF02-20

DIFFERENTIAL CARRIER (SH18)

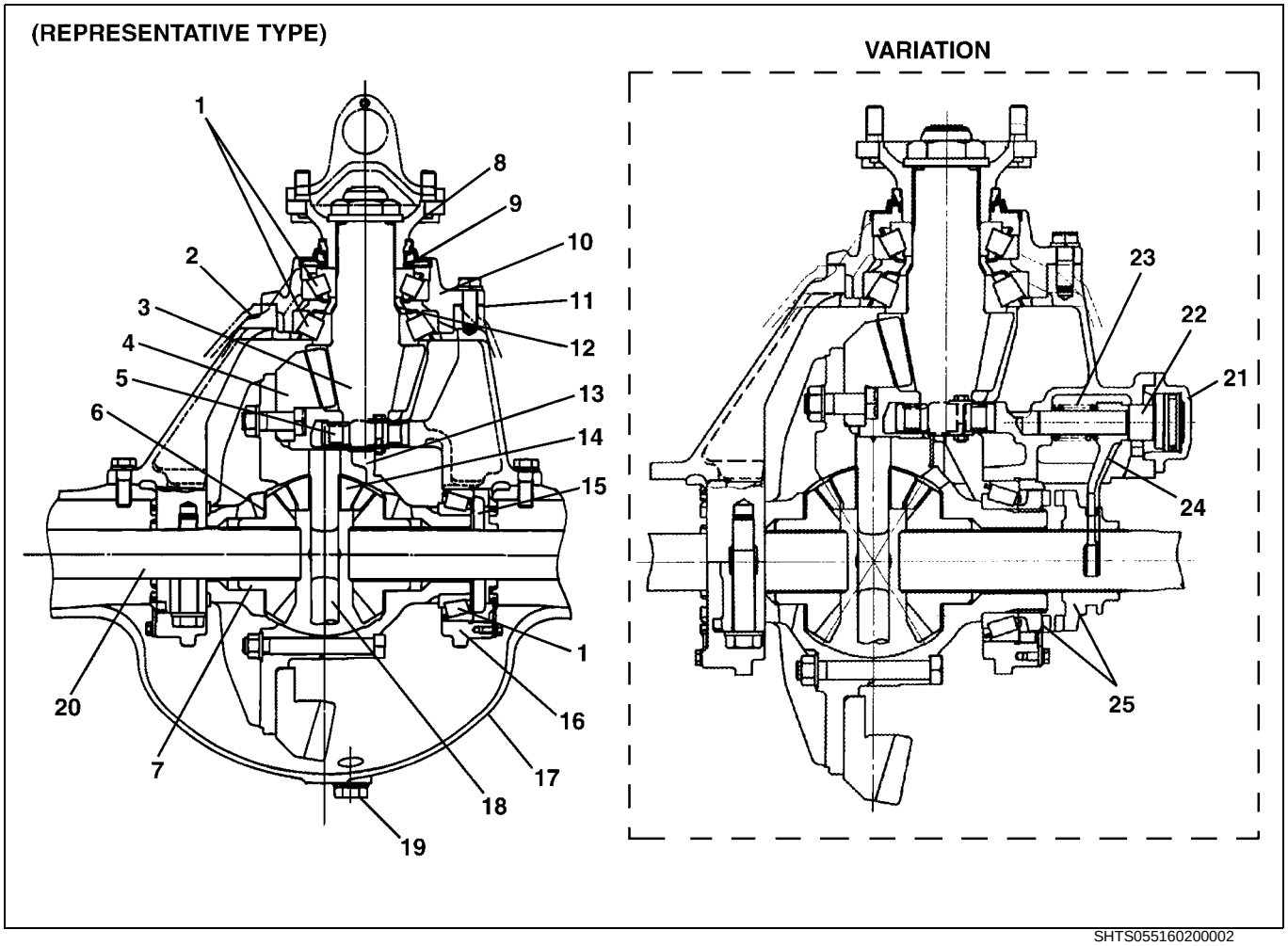
DATA AND SPECIFICATIONS

EN0551602I200001

Type	Single-reduction, single-speed, by hypoid gearing
Gear ratios	3.900, 4.333, 4.555
Oil capacity	11 L {2.42 Imp gal. / 2.91 U.S gal.}

DESCRIPTION

EN0551602C100001



SHTS055160200002

1	Taper roller bearing	10	Bearing cage	19	Oil filler plug
2	Differential carrier case	11	Adjusting shim	20	Axle shaft
3	Hypoid pinion	12	Spacer	21	Cylinder cover (If so equipped)
4	Hypoid ring gear	13	Differential case	22	Piston (If so equipped)
5	Cylindrical roller bearing	14	Differential pinion gear	23	Spring (If so equipped)
6	Thrust washer	15	Adjusting nut	24	Shift fork (If so equipped)
7	Differential side gear	16	Bearing cap	25	Sleeve (If so equipped)
8	Flange yoke coupling	17	Axle housing		
9	Oil seal	18	Spider		

TROUBLESHOOTING

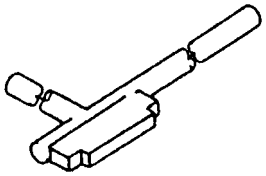
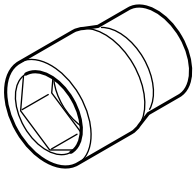
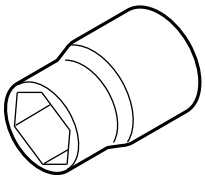
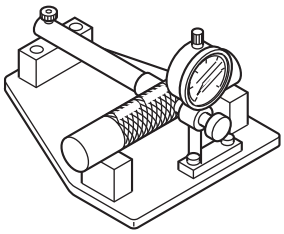
EN0551602F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil; check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

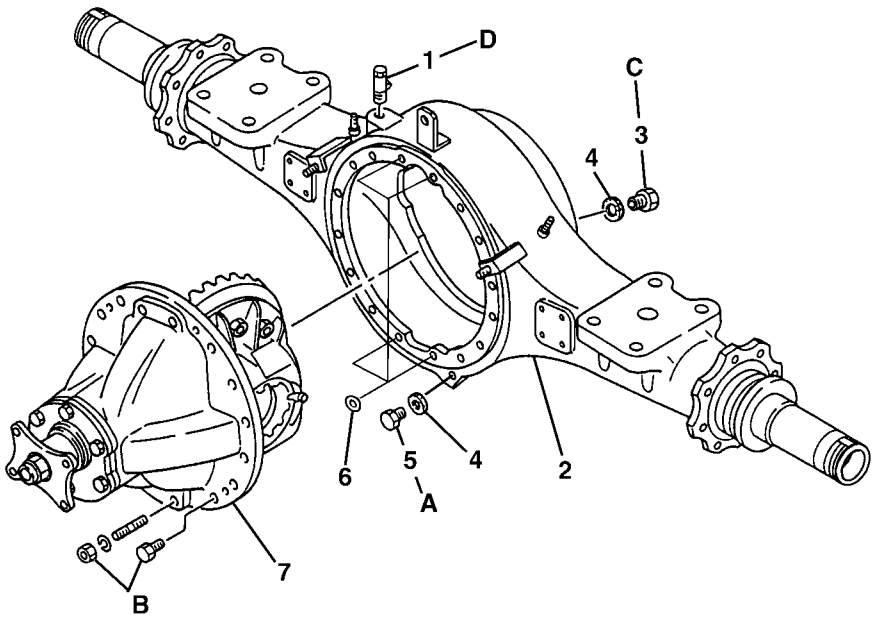
EN0551602K100001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51180	ADJUSTER TOOL	
	S0983-96502	SOCKET WRENCH	
	S0983-93003	SOCKET WRENCH	
	S0964-01231	GAUGE ASSEMBLY	

COMPONENT LOCATOR

EN0551602D100001



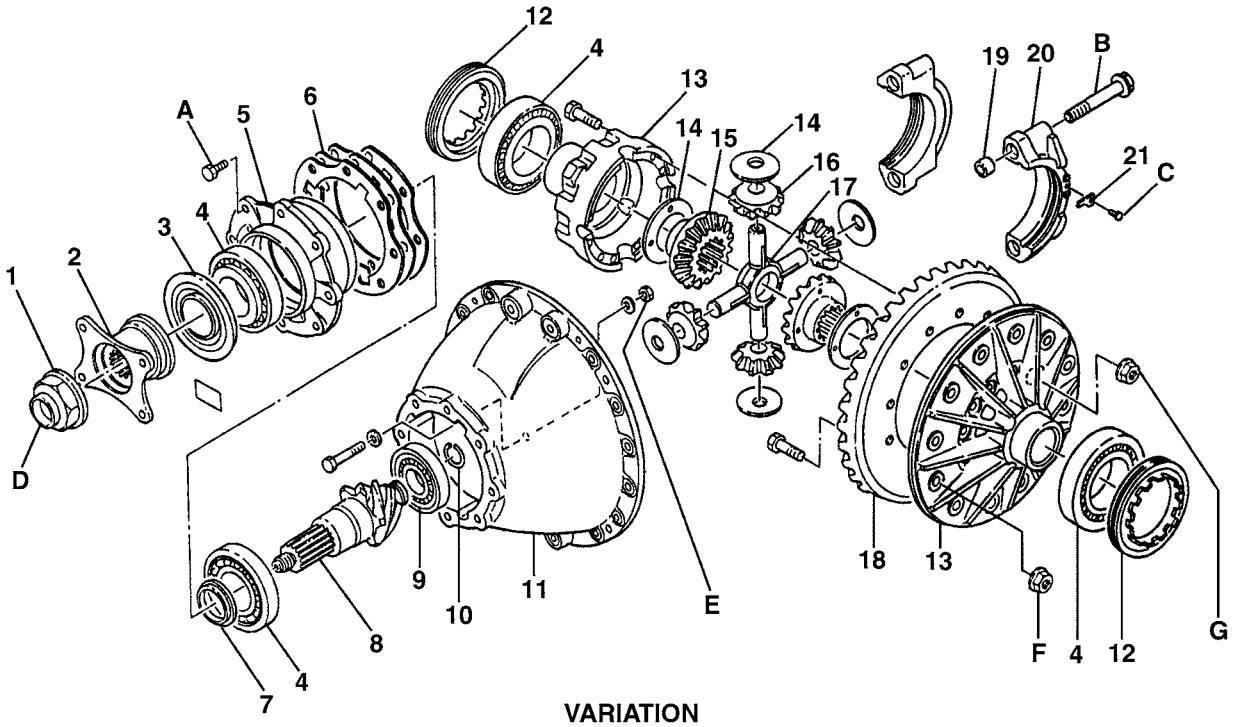
SHTS055160200007

1	Air breather	5	Oil drain plug
2	Axle housing assembly	6	O-ring
3	Oil filler plug	7	Differential carrier assembly
4	Gasket		

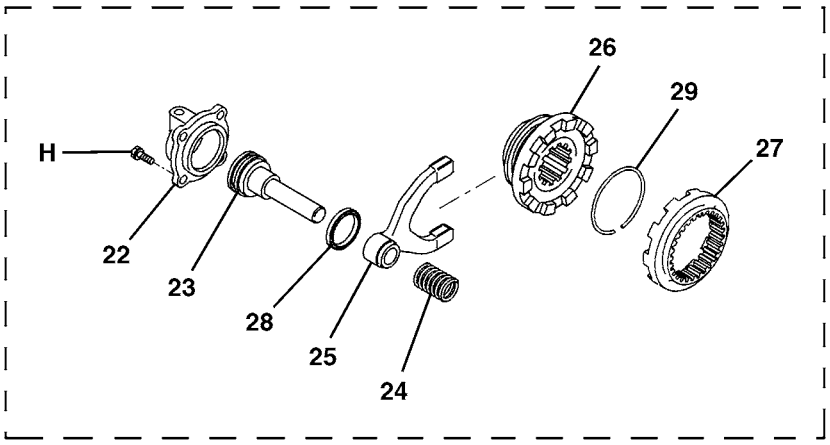
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39.2-68.6 {400-700, 29-50}	C	78.4-117.6 {800-1,200, 58-86}
B	167-213 {1,700-2,200, 123-159}	D	9.8-19.6 {100-200, 7-14}

(REPRESENTATIVE TYPE)



VARIATION



SHTS055160200008

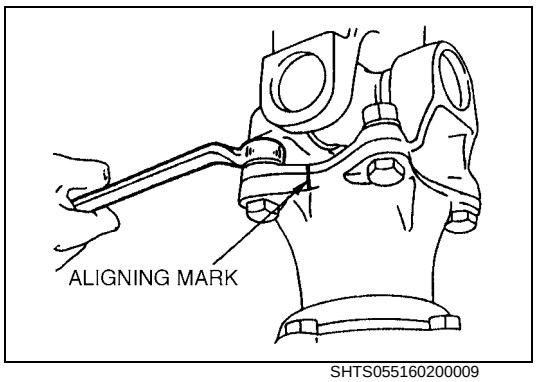
1	Lock nut	11	Differential carrier case	21	Lock plate
2	Flange yoke coupling	12	Adjusting nut	22	Cylinder cover (If so equipped)
3	Oil seal	13	Differential case	23	Piston (If so equipped)
4	Taper roller bearing	14	Thrust washer	24	Spring (If so equipped)
5	Bearing cage	15	Differential side gear	25	Shift fork (If so equipped)
6	Adjusting shim	16	Differential pinion gear	26	Sleeve (If so equipped)
7	Spacer	17	Spider	27	Sleeve (If so equipped)
8	Hypoid pinion	18	Hypoid ring gear	28	Piston seal (If so equipped)
9	Cylindrical roller bearing	19	Collar	29	Retainer (If so equipped)
10	Retainer ring	20	Bearing cap		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	167-223 {1,700-2,300, 123-166}	E	19-25 {190-260, 14-18}
B	344-456 {3,500-4,700, 254-336}	F	461-559 {4,700-5,700, 340-412}
C	19-25 {190-260, 14-18}	G	314-406 {3,200-4,140, 232-299}
D	589-781 {6,000-8,000, 434-578}	H	37.5-48.5 {380-490, 28-35}

OVERHAUL

EN0551602H200001



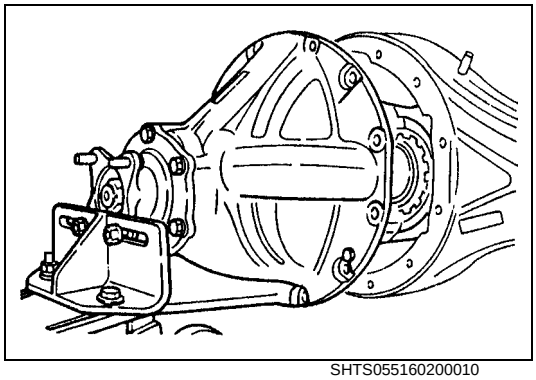
SHTS055160200009

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

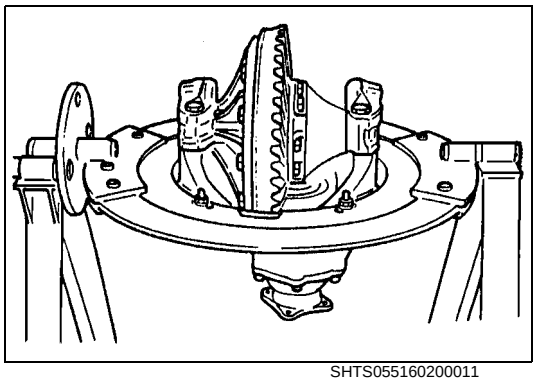
Make aligning marks before disassembling.


SHTS055160200010

2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.

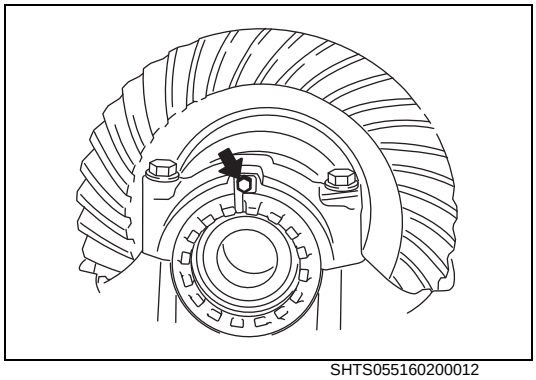
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


SHTS055160200011

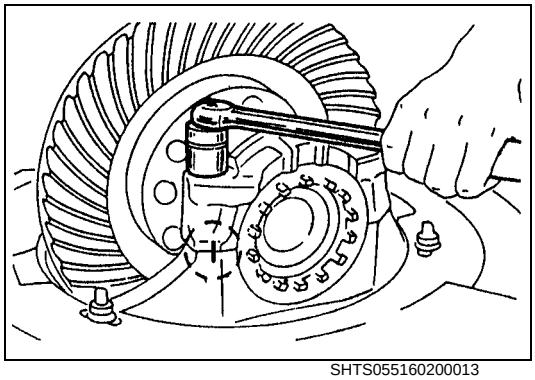
IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON THE WORK STAND.


SHTS055160200012

2. DIFFERENTIAL CASE

(1) Remove the lock plate.

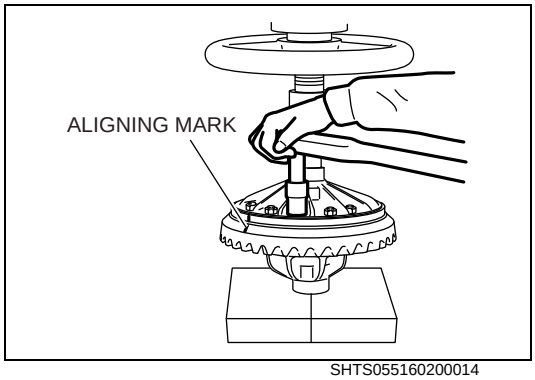

SHTS055160200013

(2) Remove the bearing cap then remove the differential case assembly with a wire and a chain block.

NOTICE
Make aligning marks before disassembling.

SST: Socket Wrench (S0983-93003)

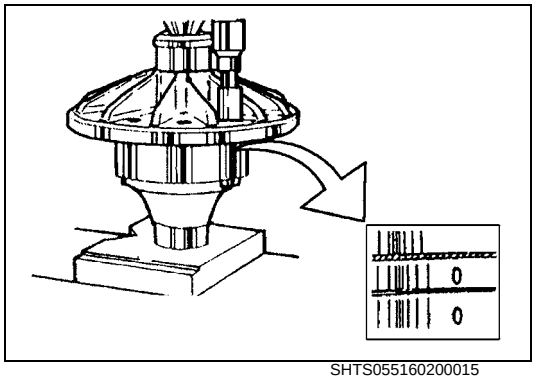
(3) Using a puller, remove the taper roller bearing.



SHTS055160200014

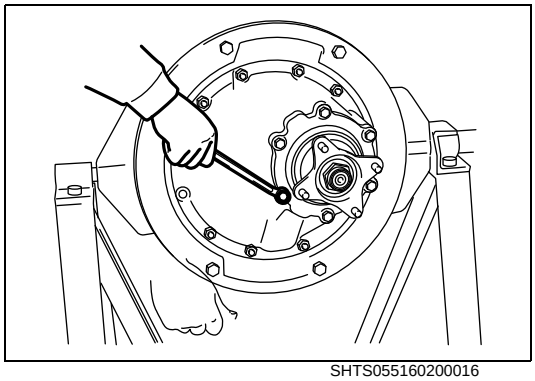
(4) Disassemble the ring gear.
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055160200015

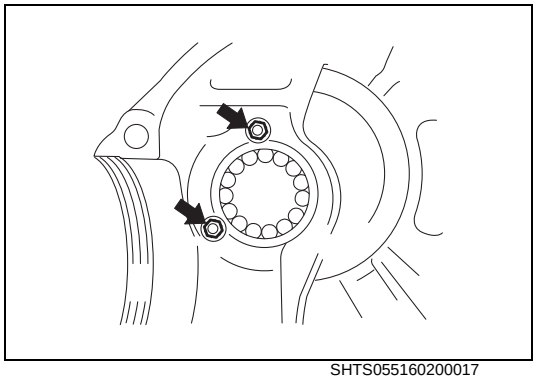
(5) Disassemble the differential case.

NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts and nuts so that the case separates.

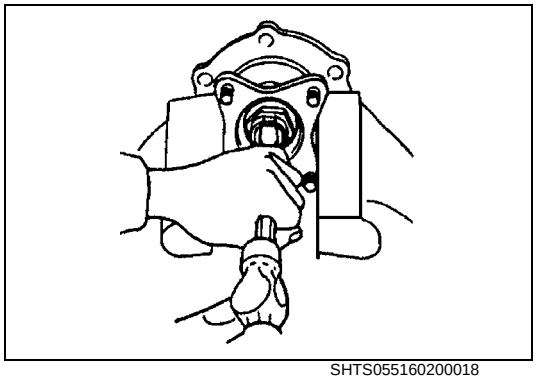

SHTS055160200016

3. DISASSEMBLE THE HYPOID PINION.

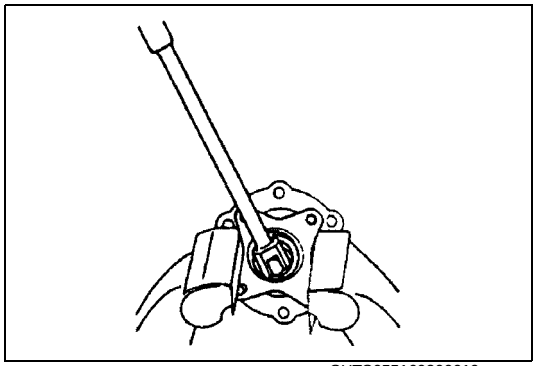
(1) Remove the bolts and then remove the hypoid pinion and the shims.

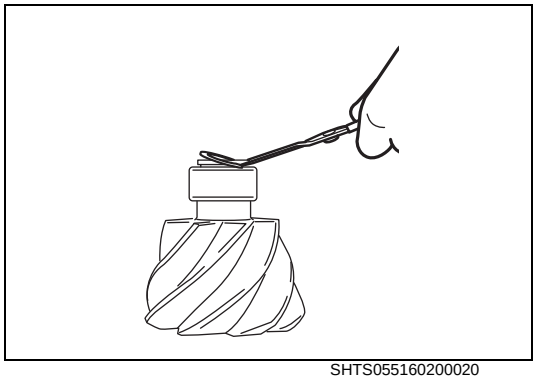

SHTS055160200017

(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.

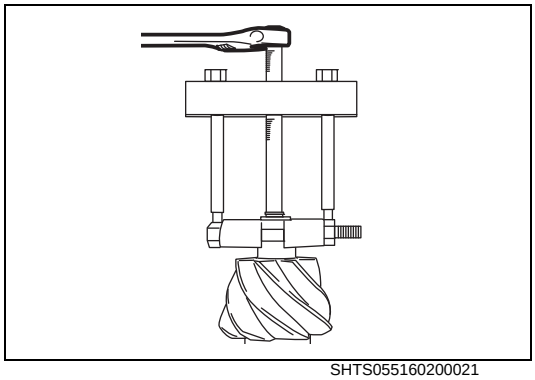

SHTS055160200018

4. BEARING CAGE
(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-96502)


SHTS055160200019

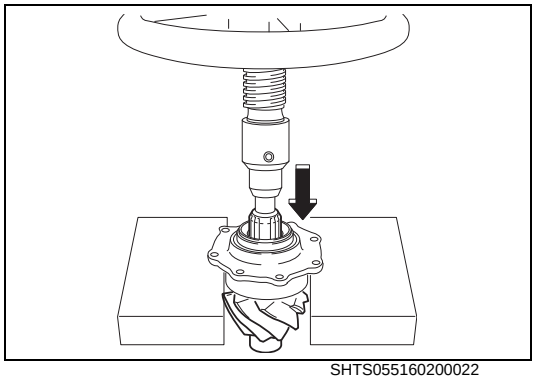

SHTS055160200020

(2) Remove the retainer ring.



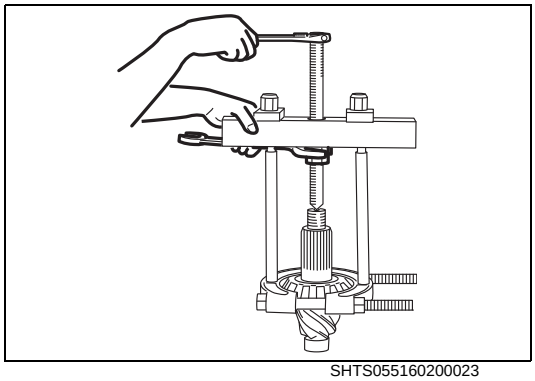
SHTS055160200021

(3) Using a puller, remove the cylindrical roller bearing inner race.



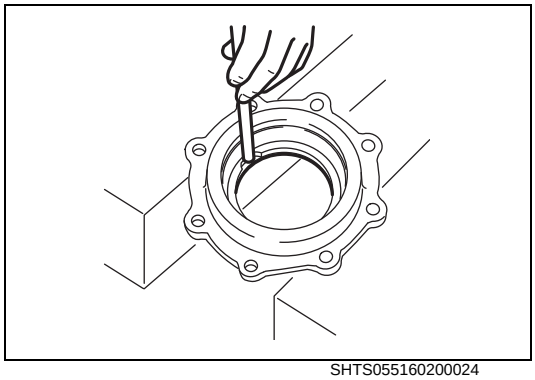
SHTS055160200022

(4) Using a press, remove the hypoid pinion.



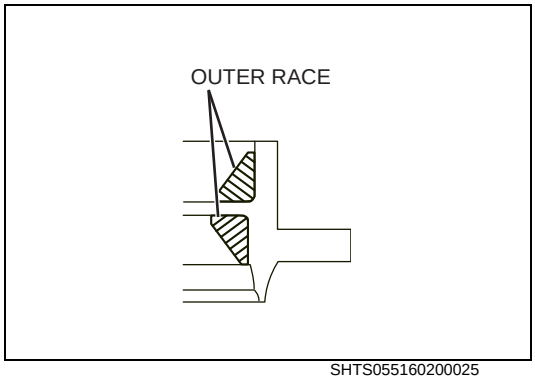
SHTS055160200023

(5) Using a puller, remove the taper roller bearing inner race.

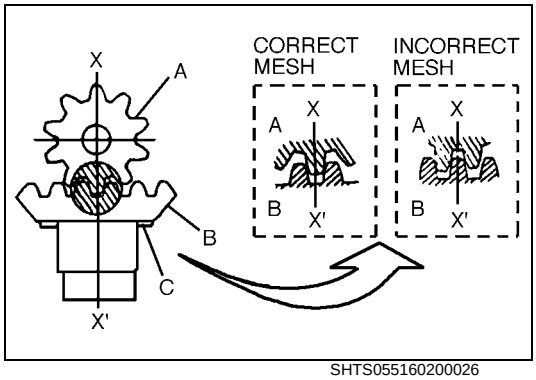


SHTS055160200024

(6) Using a brass bar and a hammer, knock through the taper roller bearing outer race.



SHTS055160200025



SHTS055160200026

IMPORTANT POINTS - ASSEMBLY

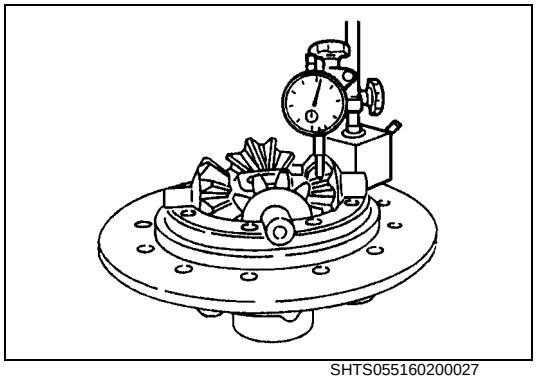
1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

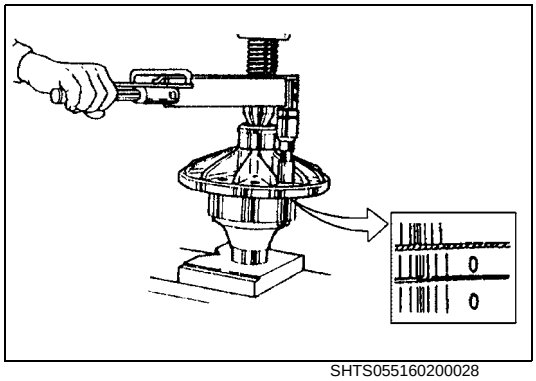
NOTICE

Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

- A: Pinion
- B: Side gear
- C: Thrust washer


SHTS055160200027

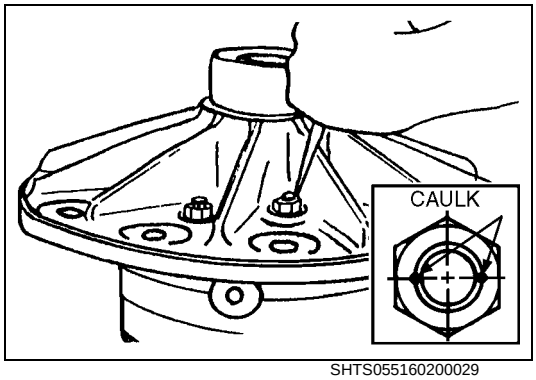
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service limit: 0.9 mm {0.0354 in.}


SHTS055160200028

(3) Assemble the differential case.

NOTICE

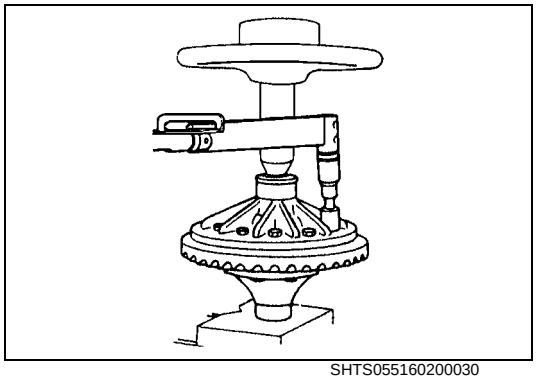
- **Align the aligning marks when assembling.**
- **Apply adhesive (ThreeBond 1360K or equivalent) on the bolt threads.**



SHTS055160200029

NOTICE

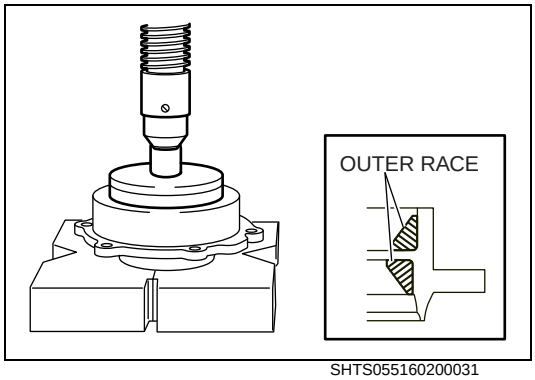
When adhesive is not applied, caulk the lock nut as shown in the figure.


SHTS055160200030

(4) Install the ring gear to the differential case and tighten it with bolts.

NOTICE

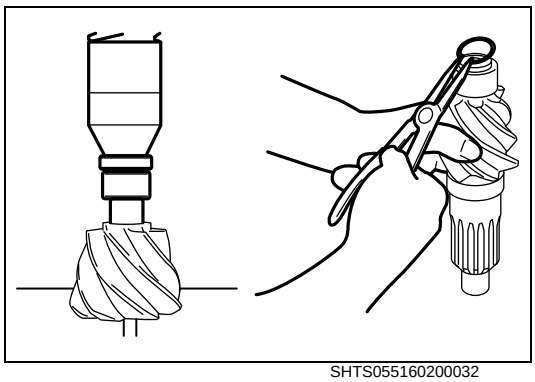
- **Apply adhesive (ThreeBond 1360K or equivalent) on the bolt threads.**
- **When adhesive is not applied, caulk the nut in the same manner as step (3).**



SHTS055160200031

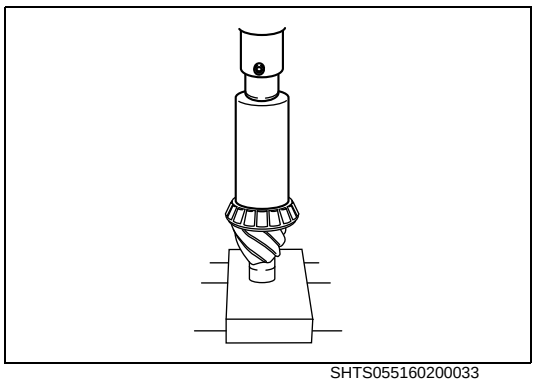
2. ASSEMBLY OF THE HYPOID PINION

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

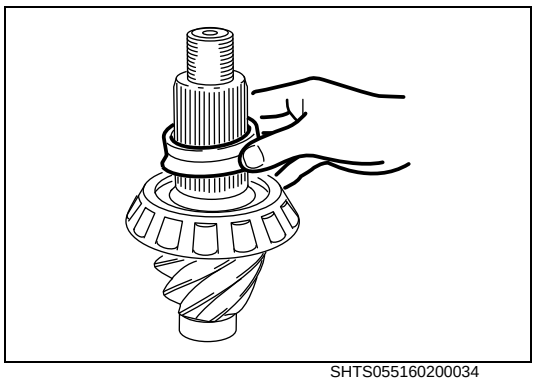

SHTS055160200032

(2) Installing the pilot bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

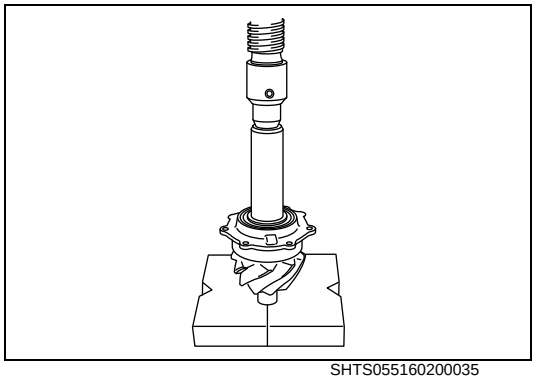
⚠ CAUTION
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS055160200033

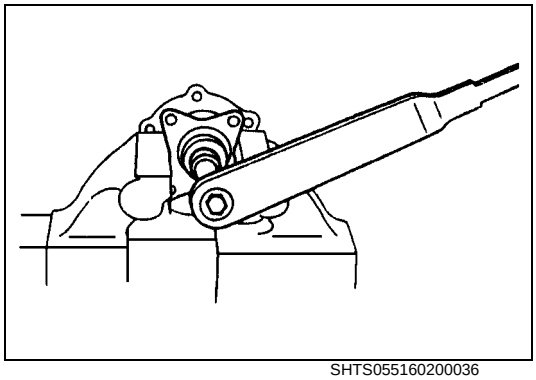
(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.


SHTS055160200034

   c. Install the spacer.


SHTS055160200035

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


SHTS055160200036

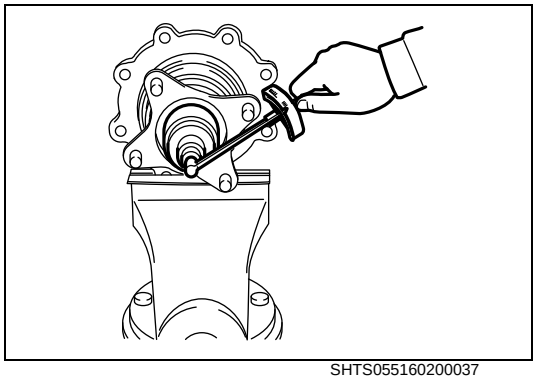
3. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-96502)


SHTS055160200037

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

Assembly standard: Turning torque Unit: N·m {kgf·cm, lbf·ft}

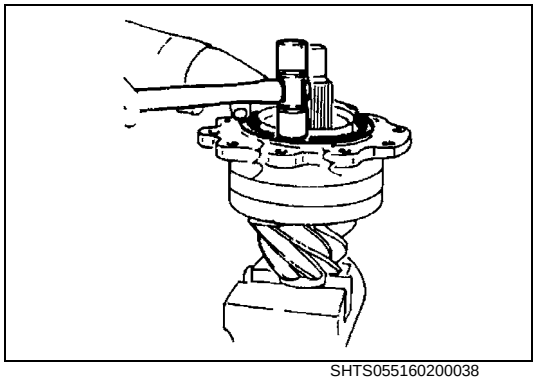
New bearing	Re-used bearing
2.46-2.74 {25-28, 1.9-2.0}	1.97-2.25 {20-23, 1.5-1.6}

Adjusting spacer thickness:

23 kinds of thicknesses ranging from 18.175 to 18.725 mm {0.715 to 0.737 in.} each differing 0.025 mm {0.001 in.}

NOTICE

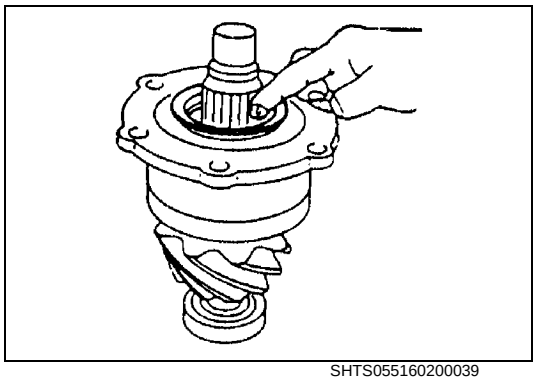
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.


SHTS055160200038

(3) After adjusting the preload, install the new oil seal.

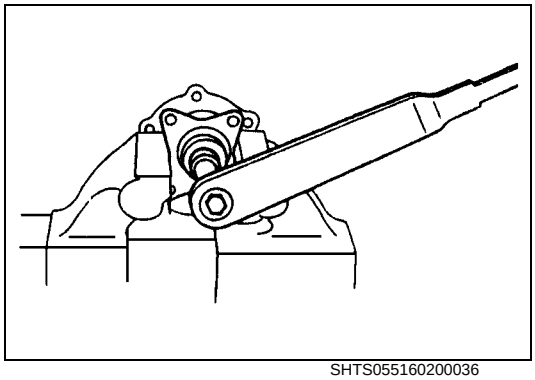
NOTICE

Tap the oil seal in small steps and evenly to prevent it from being at slant position.


SHTS055160200039

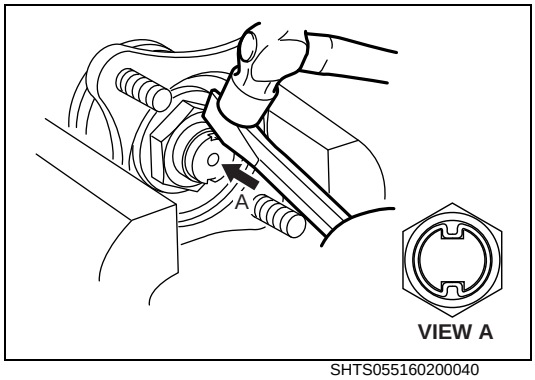
NOTICE

Apply wheel bearing grease on the oil seal lip part.



SHTS055160200036

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-96502)

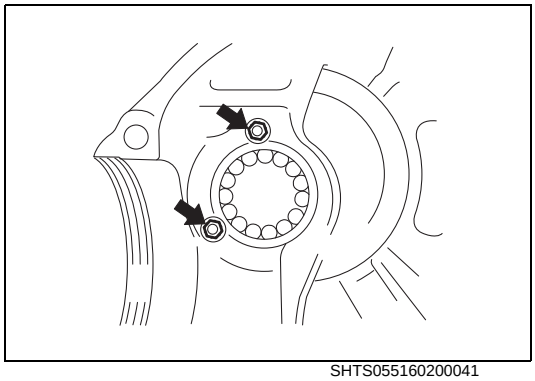


SHTS055160200040

(5) Caulk the lock nut.

NOTICE

- **Caulk the nut securely as shown.**
- **Make sure that there is no rift in the caulk position.**



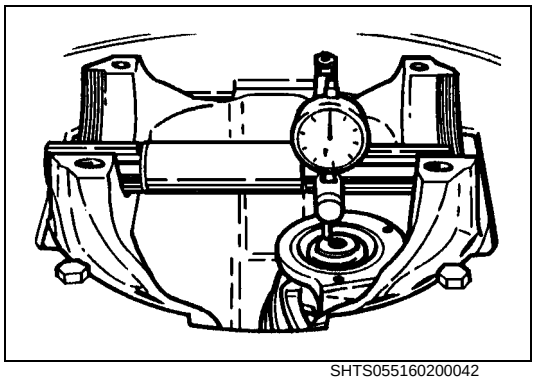
SHTS055160200041

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

NOTICE

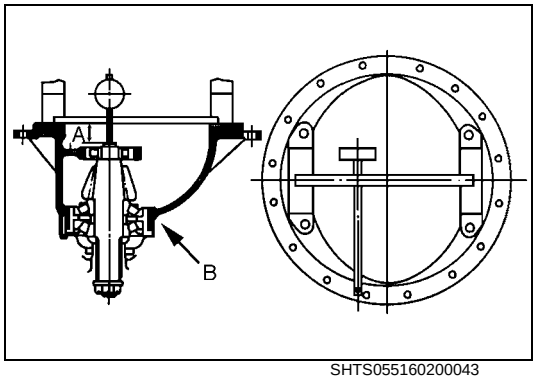
Apply adhesive (ThreeBond 1360K or equivalent) on the bolt threads.



SHTS055160200042

5. ADJUSTMENT OF THE PINION FITTING HEIGHT (CONICAL DISTANCE).

(1) Install the pinion cage assembly and adjust the height with shims.
SST: Gauge Assembly (S0964-01231)

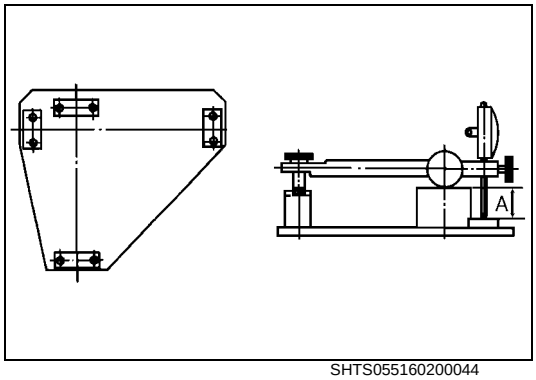


SHTS055160200043

A:

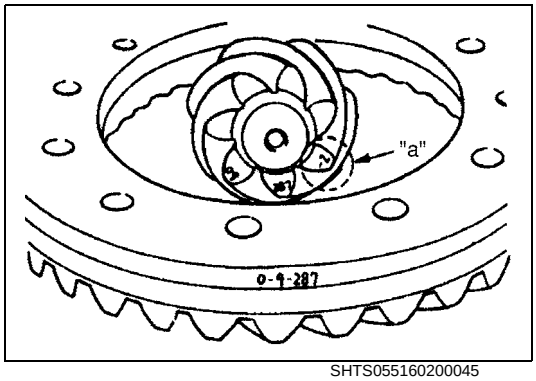
Standard	With manual differential lock
46 mm {1.811 in.}	43.5 mm {1.713 in.}

B: Adjusting shim
Thickness: 0.30 mm {0.0118 in.}
0.40 mm {0.0157 in.}
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}



SHTS055160200044

(2) How to use the pinion depth gauge: Set the pinion depth gauge.
A: 46 mm {1.811 in.}



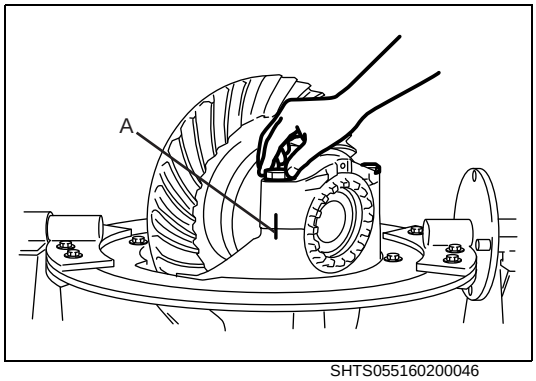
SHTS055160200045

EXAMPLE:

In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

Standard pinion height "A"				Measuring part (A')
46.0 mm	–	0.2 mm The engraved value "a"	=	45.8 mm

NOTICE
Upon completing the adjustment, remove the bearing cage assembly and apply liquid gasket (ThreeBond #1215, #1216 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.

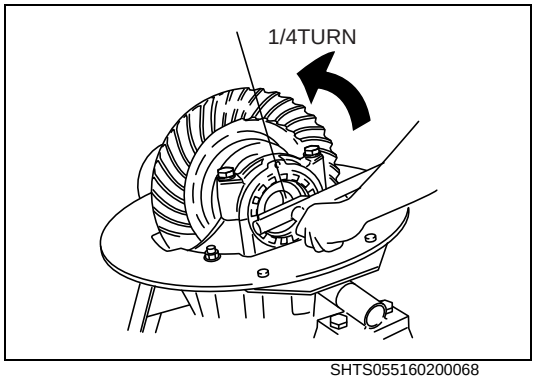


SHTS055160200046

6. ADJUSTMENT OF HYPOID RING GEAR BACKLASH

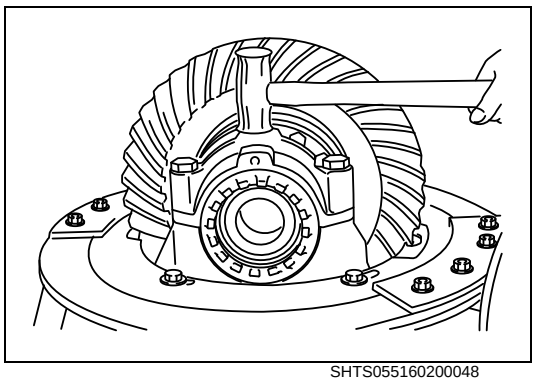
(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE
Align the aligning marks "A".

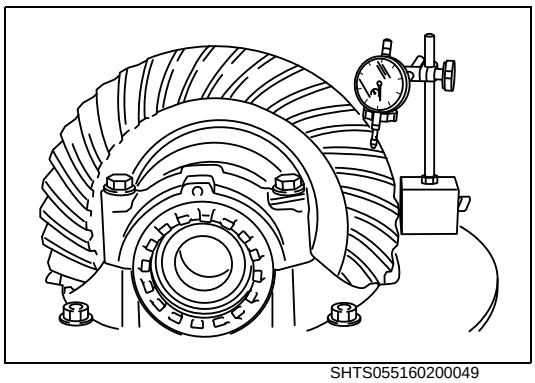


SHTS055160200068

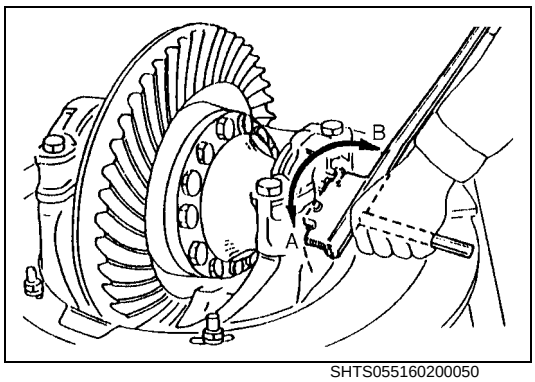
(2) Adjust the preload of the side bearing provisionally.
a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.
SST: Adjuster Tool (S0966-51180)


SHTS055160200048

b. Hit the bearing cap with a copper hammer.

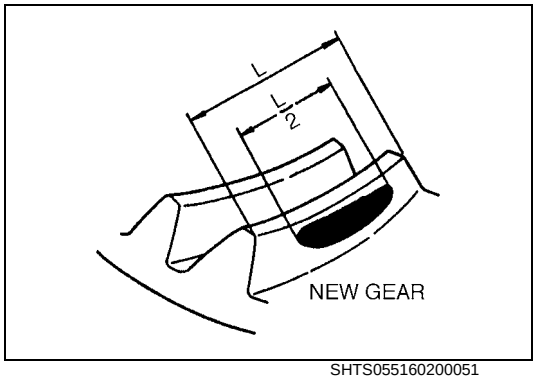

SHTS055160200049

(3) Measure the gear backlash at three or four points on the circumference of the gear.
Assembly standard:
0.30-0.41 mm {0.0119-0.0161 in.}



SHTS055160200050

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: A-Decrease B-Increase
SST: Adjuster Tool (S0966-51180)



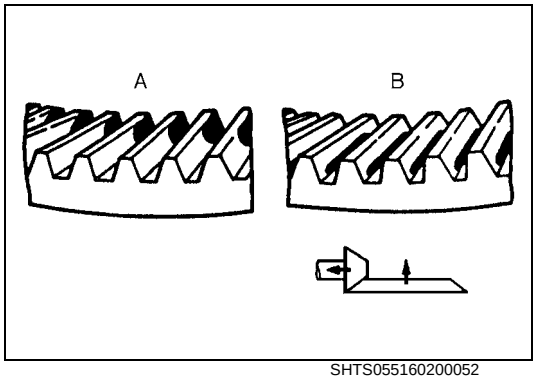
SHTS055160200051

7. INSPECTION AND ADJUSTMENT OF GEAR MESHING

(1) Satisfactory gear meshing.

NOTICE

New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.

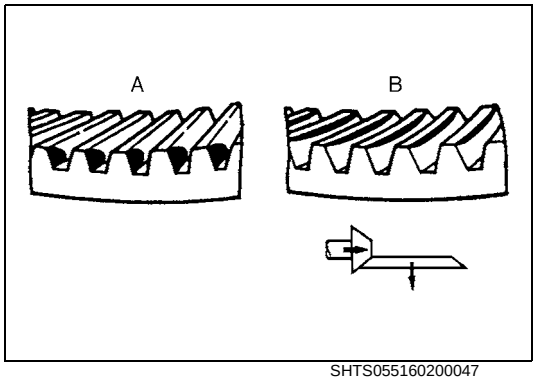


SHTS055160200052

(2) Example of the unsatisfactory engagement

a. Toe and flank contact

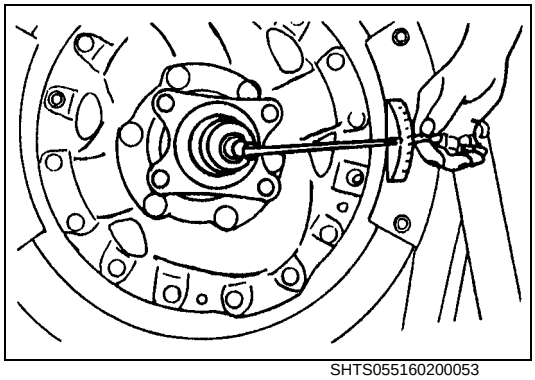
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



SHTS055160200047

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


SHTS055160200053

8. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING

(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

NOTICE

Total preload = Side bearing preload + Pinion bearing preload (refer to item 3).

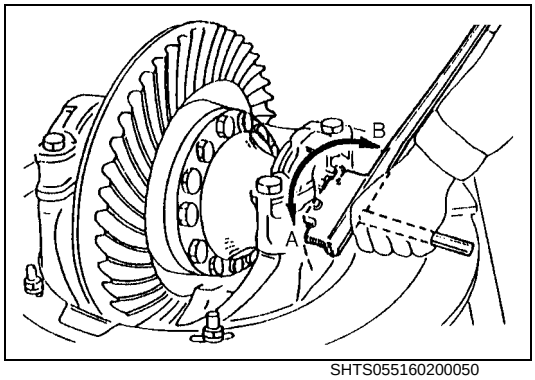
Assembly standard: Side bearing preload turning torque

Unit: N·m {kgf·cm, lbf·ft}

Gear ratio	3.900	4.333	4.555
New bearing	0.63-0.70 {6.5-7.1, 0.46-0.52}	0.57-0.63 {5.8-6.4, 0.42-0.46}	0.54-0.60 {5.5-6.1, 0.40-0.44}
Re-used bearing	0.51-0.57 {5.2-5.8, 0.38-0.42}	0.46-0.52 {4.7-5.3, 0.34-0.38}	0.44-0.49 {4.4-5.0, 0.32-0.36}

NOTICE

The gear ratio is indicated on the bearing cage.

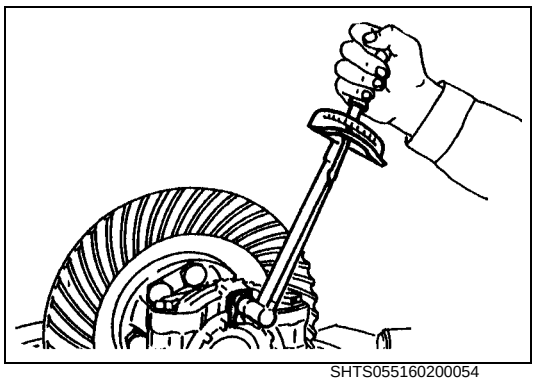


SHTS055160200050

(2) If necessary, adjust the side bearing preload with the adjusting nut.

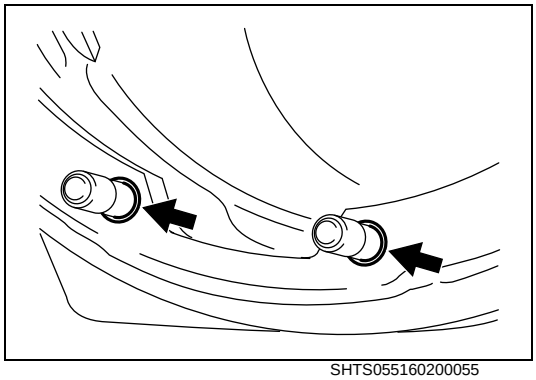
- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload

SST: Adjuster Tool (S0966-51180)


SHTS055160200054

(3) Tighten the bearing cap and install the lock plate.

SST: Socket Wrench (S0983-93003)

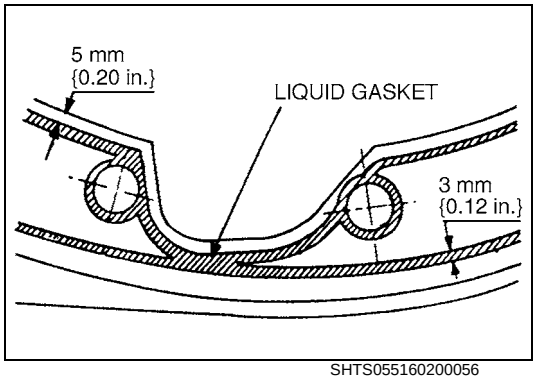

SHTS055160200055

IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.

(2) Install a new O-ring.

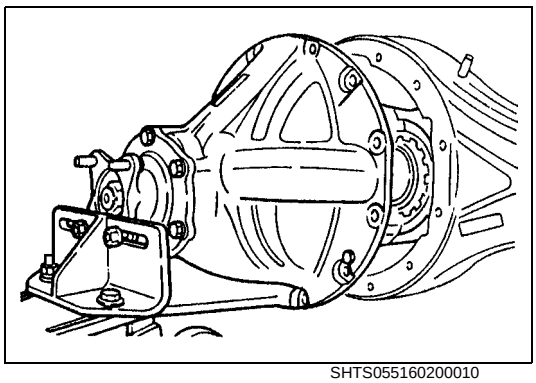


SHTS055160200056

(3) Apply liquid gasket on the face of the housing flange.

NOTICE

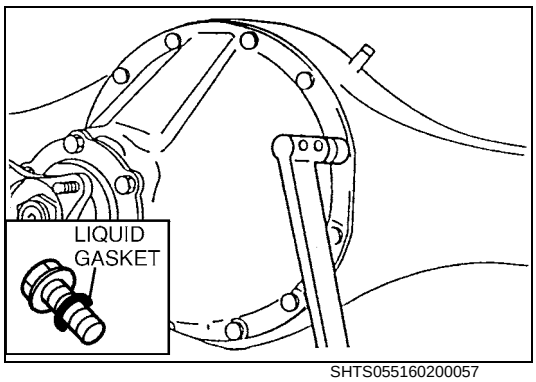
- **The liquid gasket must be ThreeBond #1215, #1216 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 5 mm {0.20 in.} away from the edge.**


SHTS055160200010

(4) Using a jack, install the differential carrier assembly to the axle housing.

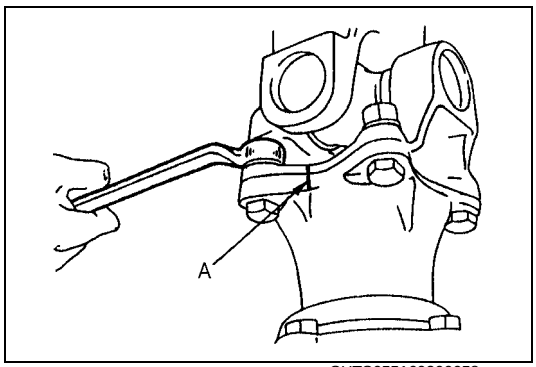
NOTICE

Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055160200057

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ16 bolts (12 pieces), install the bolts and tighten them regularly.



SHTS055160200058

(6) Connect the propeller shaft.

NOTICE

Align the aligning marks "A".

Tightening Torque:
ϕ14 bolt: 128-156 N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}
ϕ16 bolt: 167-225 N·m {1,700-2,300 kgf·cm, 123-166 lbf·ft}

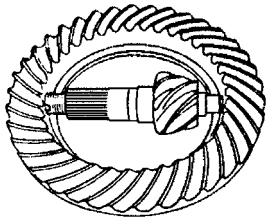
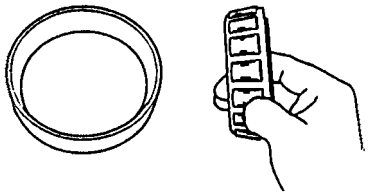
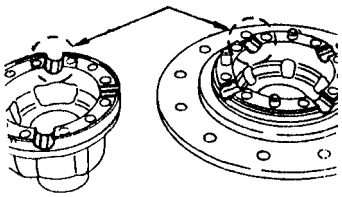
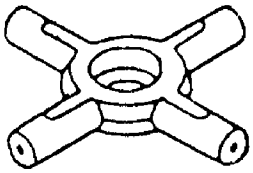
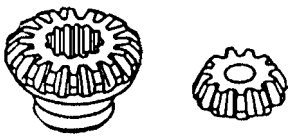
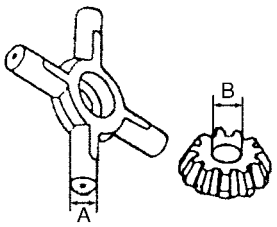
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

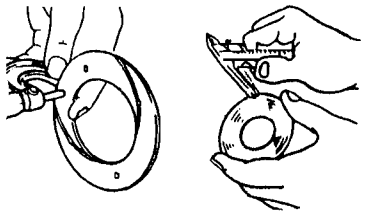
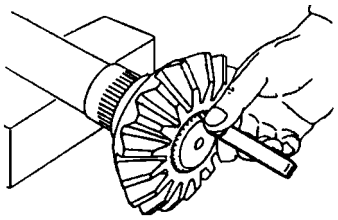
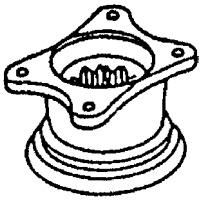
Gear oil:
Refer to the Owner's manual.

INSPECTION AND REPAIR

EN0551602H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 34 {1.338}** **B-A: 0.145-0.270 {0.006-0.011}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.9-2.1 {0.075-0.082}	**1.7 {0.067}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (THD17)

DF02-006

DIFFERENTIAL CARRIER (THD17)..... DF02-2

DATA AND SPECIFICATIONS..... DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING..... DF02-5
SPECIAL TOOL..... DF02-6
COMPONENT LOCATOR DF02-7
OVERHAUL DF02-10
INSPECTION AND REPAIR..... DF02-29

DIFFERENTIAL CARRIER (THD17)

DATA AND SPECIFICATIONS

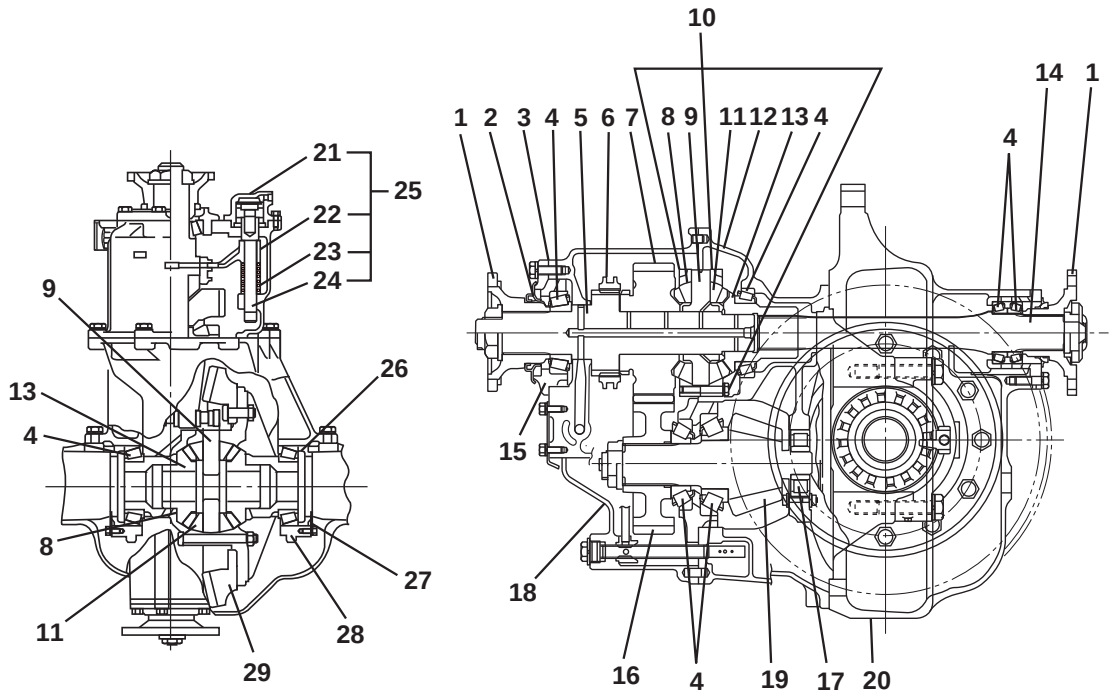
EN0551802I200001

Type	**Single-reduction, single-speed, by hypoid gearing with Inter-axle differential and transfer gear, used for the forward axle of tandem drive axles.**
Gear ratios	**4.100, 4.625, 4.875, 5.250, 5.428, 5.857, 6.428, 7.166**
Oil capacity	**13 L {3.43 U.S.gal, 2.86 Imp.gal}**

DESCRIPTION

EN0551802C100001

(EXAMPLE)

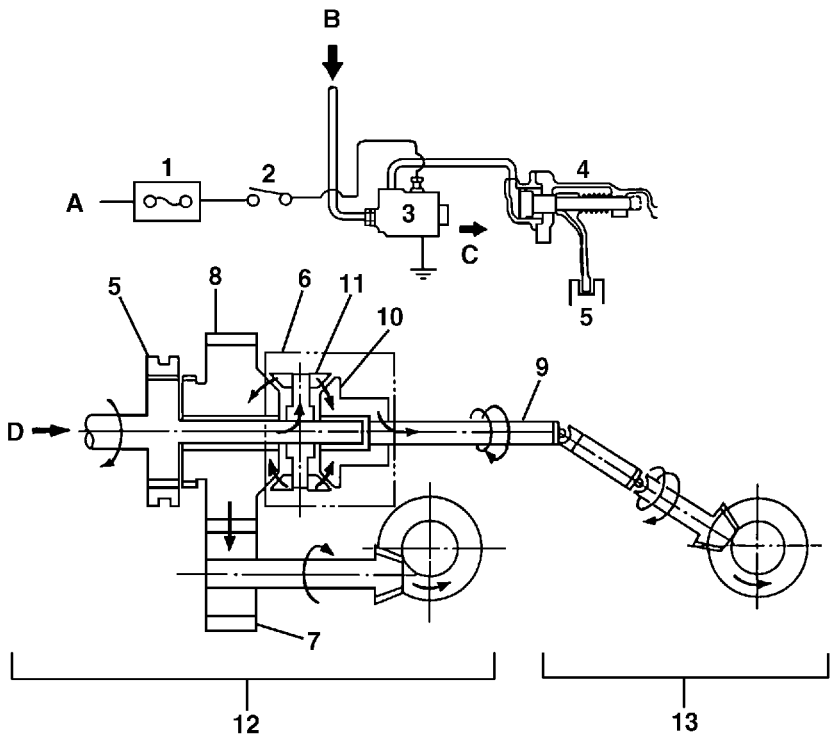


SHTS055180200001

1	**Flange**	**16**	**Pinion drive gear**
2	**Oil seal**	**17**	**Cylindrical roller bearing**
3	**Shim**	**18**	**Differential carrier cover**
4	**Taper roller bearing**	**19**	**Pinion gear**
5	**Drive shaft**	**20**	**Rear axle housing**
6	**Shifter sleeve**	**21**	**Case cover**
7	**Drive gear**	**22**	**Shift fork**
8	**Washer**	**23**	**Return spring**
9	**Spider**	**24**	**Piston**
10	**Inter-axle differential case sub-assembly**	**25**	**Air shift unit**
11	**Differential pinion**	**26**	**Adjusting nut**
12	**Differential carrier**	**27**	**Lock plate**
13	**Side gear**	**28**	**Bearing cap**
14	**Through shaft**	**29**	**Ring gear**
15	**Differential carrier cage**		

OPERATION OF INTER-AXLE DIFFERENTIAL GEAR

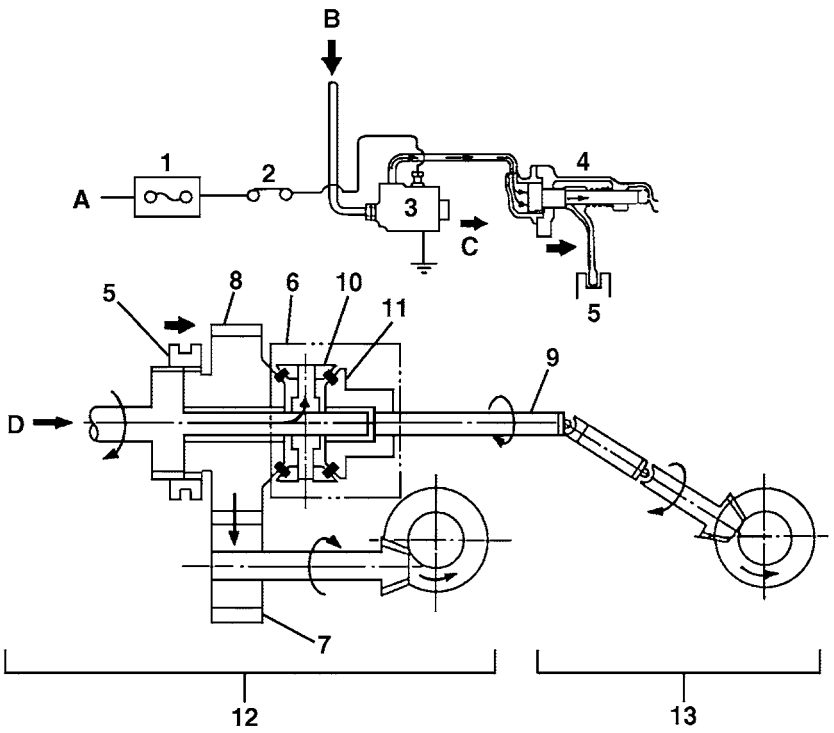
- Differential (Driving on paved roads) -



SHTS055180200002

1	Fuse	10	Rearward axle drive gear
2	Inter-axle differential lock switch	11	Inter-axle differential pinion
3	Magnetic valve	12	Forward axle
4	Air shift unit	13	Rearward axle
5	Shift sleeve	A	From battery
6	Inter-axle differential gear	B	From air tank
7	Forward axle drive gear	C	Exhaust
8	Drive gear	D	From propeller shaft
9	Through shaft		

- Lock (Driving on bad roads) -
NOTICE: Do not operate the switch while the vehicle is moving



SHTS055180200003

1	Fuse	10	Rearward axle drive gear
2	Inter-axle differential lock switch	11	Inter-axle differential pinion
3	Magnetic valve	12	Forward axle
4	Air shift unit	13	Rearward axle
5	Shift sleeve	A	From battery
6	Inter-axle differential gear	B	From air tank
7	Forward axle drive gear	C	Exhaust
8	Drive gear	D	From propeller shaft
9	Through shaft		

TROUBLESHOOTING

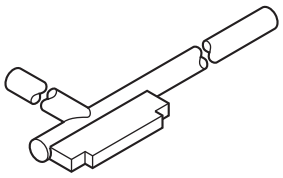
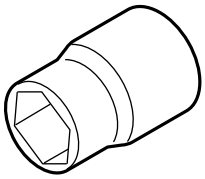
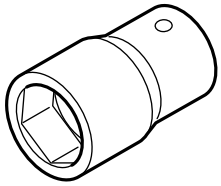
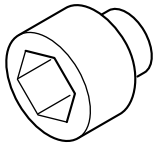
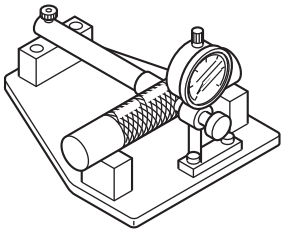
EN0551802F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
	Worn or damaged inter-axle differential gear	Replace
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil, check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

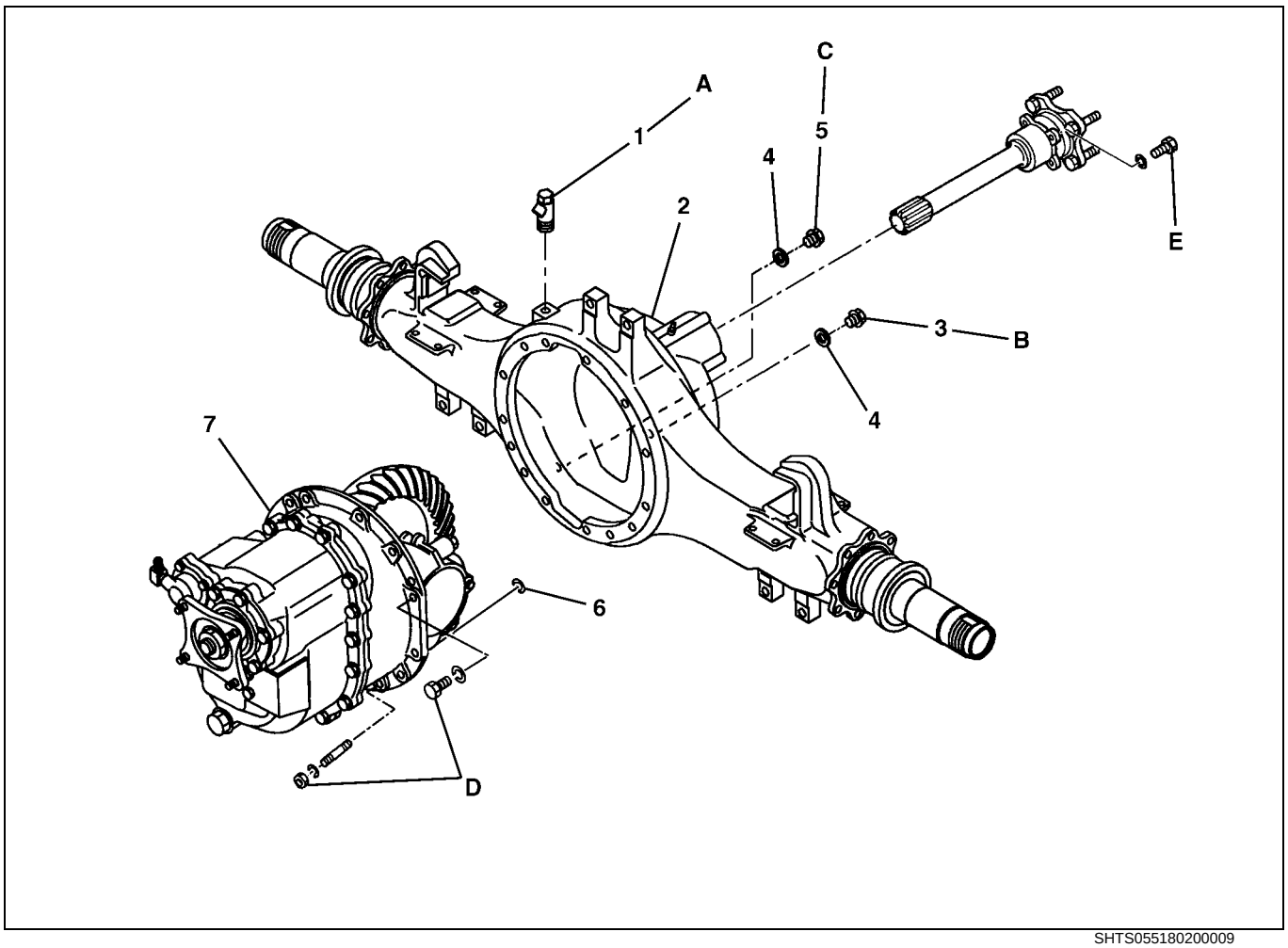
EN0551802K100001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51180	ADJUSTER TOOL	
	S0983-93003	SOCKET WRENCH	
	S0983-94601	SOCKET WRENCH	
	S0983-95501 S0983-96502	SOCKET WRENCH	
	S0964-01210	GAUGE ASSEMBLY	

COMPONENT LOCATOR

EN0551802D100001

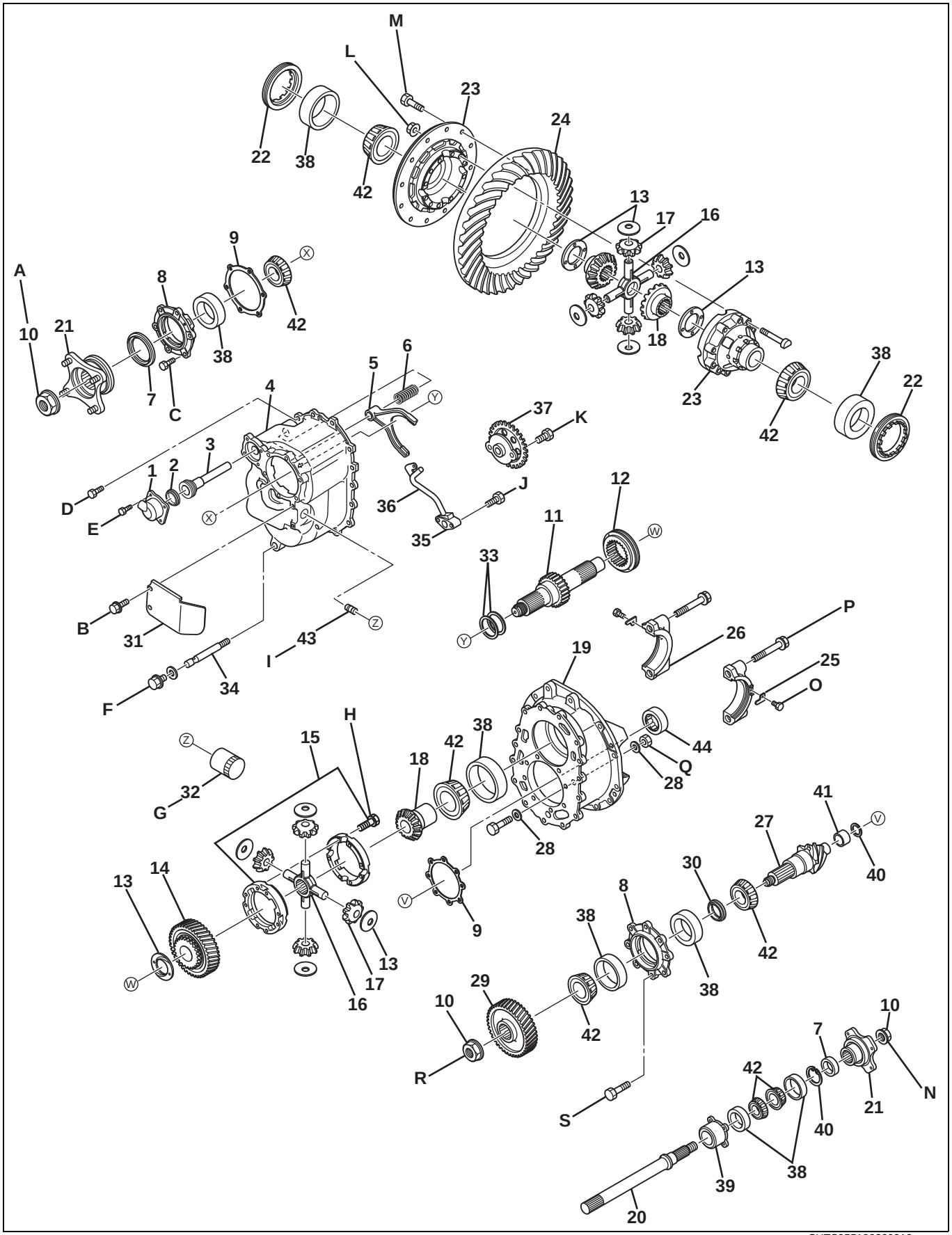


SHTS055180200009

1	Air breather	5	Oil drain plug
2	Axle housing assembly	6	O-ring
3	Oil filler plug	7	Differential carrier assembly
4	Gasket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	9.8-19.6 {100-200, 7.3-14.4}	D	167-213 {1,700-2,200, 123-159}
B	78.4-117.6 {800-1,200, 58-86}	E	64-84 {650-870, 47-63}
C	39.2-68.6 {400-700, 29-50}		


M
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SHTS055180200010

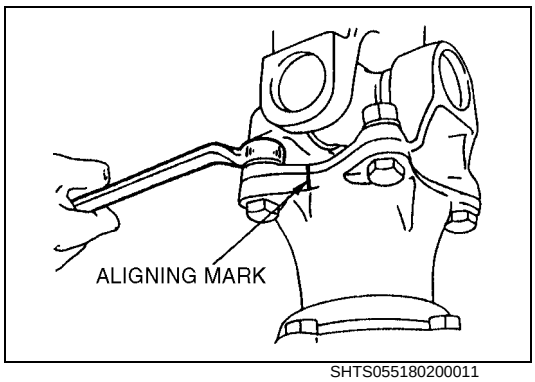
1	Case cover	16	Spider	31	Oil filter shield
2	Piston seal	17	Differential pinion	32	Oil filter element set
3	Piston	18	Side gear	33	Seal ring
4	Differential carrier cover	19	Differential carrier	34	Oil strainer
5	Shift fork	20	Through shaft	35	Elbow
6	Return spring	21	Flange	36	Oil pump pipe
7	Oil seal	22	Adjusting nut	37	Oil pump gear
8	Differential carrier cage	23	Differential gear case	38	Taper roller bearing outer race
9	Shim	24	Ring gear	39	Bearing cage
10	Lock nut	25	Lock plate	40	Retainer ring
11	Drive shaft	26	Bearing cap	41	Cylindrical roller bearing inner race
12	Shift sleeve	27	Pinion gear	42	Taper roller bearing inner race
13	Thrust washer	28	Lock washer	43	Joint
14	Drive gear	29	Pinion drive gear	44	Cylindrical roller bearing outer race
15	Inter axle differential case sub-assembly	30	Spacer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	589-781 {6,000-8,000, 434-578}	K	44.5-53.5 {450-550, 33-39}
B	44.5-53.5 {450-550, 33-39}	L	246-294 {2,500-3,000, 181-216}
C	113-147 {1,100-1,500, 80-108}	M	461-559 {4,700-5,700, 340-412}
D	113-147 {1,100-1,500, 80-108}	N	589-781 {6,000-8,000, 434-578}
E	37.5-48.5 {380-500, 28-36}	O	19-25 {190-260, 14-18}
F	78.5-117.5 {800-1,200, 58-86}	P	344-456 {3,500-4,700, 254-339}
G	12.0-15.5 {120-160, 9-11}	Q	19-25 {190-260, 14-18}
H	49-61 {500-630, 37-45}	R	589-781 {6,000-8,000, 434-578}
I	34.5-43.5 {350-450, 26-32}	S	167-223 {1,700-2,300, 123-166}
J	44.5-53.5 {450-550, 33-39}		

OVERHAUL

EN0551802H200001



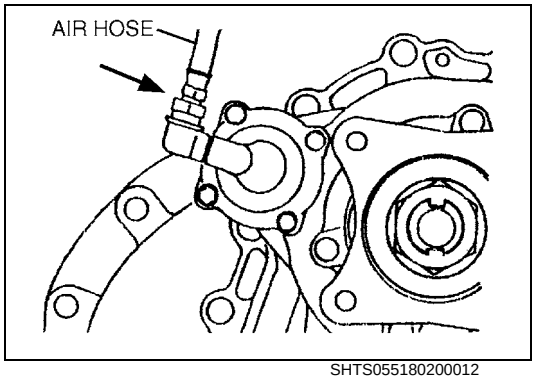
SHTS055180200011

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.

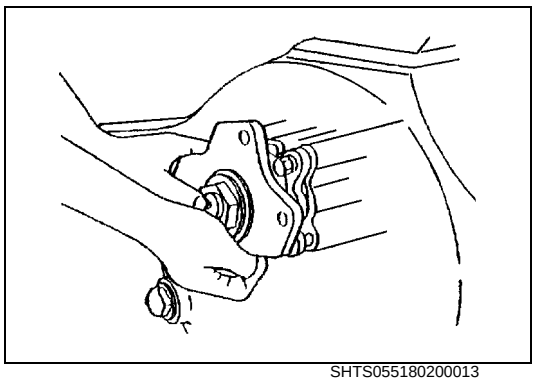


SHTS055180200012

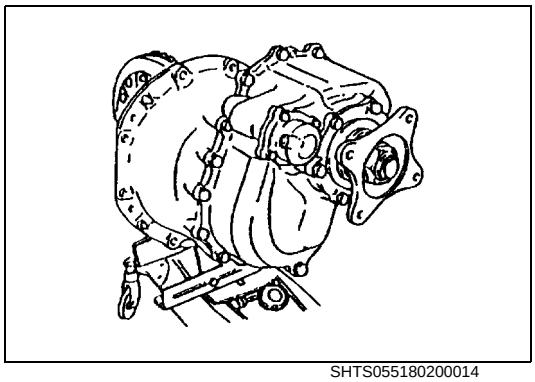
2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.

(1) Drain the gear oil and remove the axle shaft.

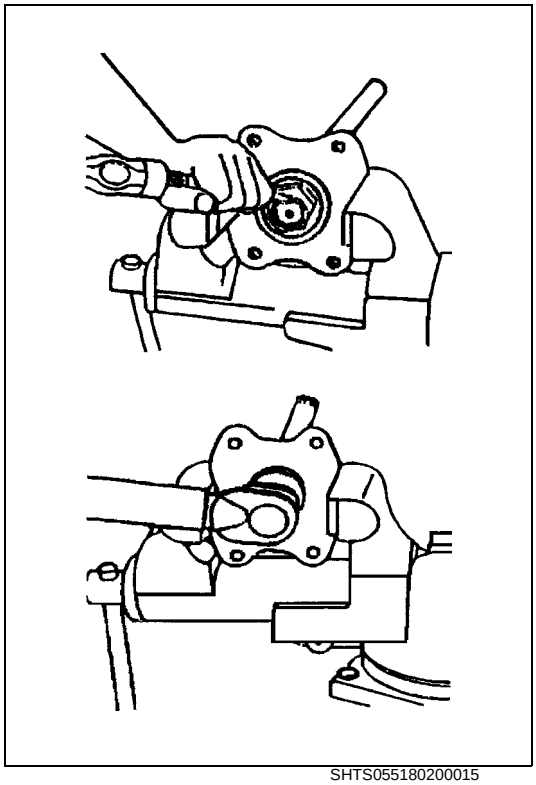
(2) Disconnect the air hose.


SHTS055180200013

(3) Remove the through shaft.


SHTS055180200014

(4) Using a jack, dismount the differential carrier assembly.

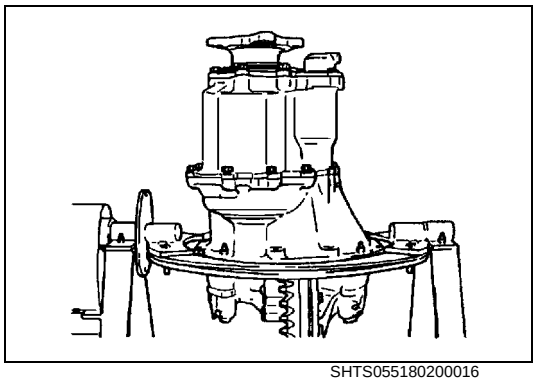


SHTS055180200015

IMPORTANT POINTS - DISASSEMBLY

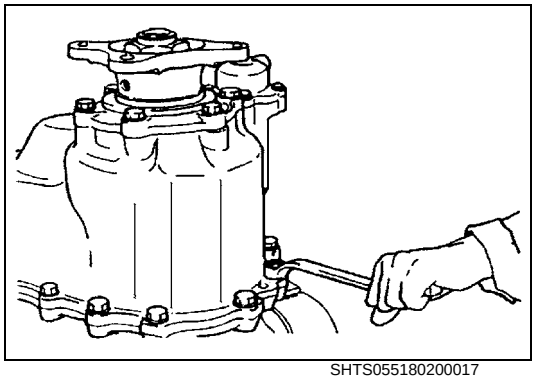
1. THROUGH SHAFT

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-94601)



SHTS055180200016

2. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON THE WORK STAND.

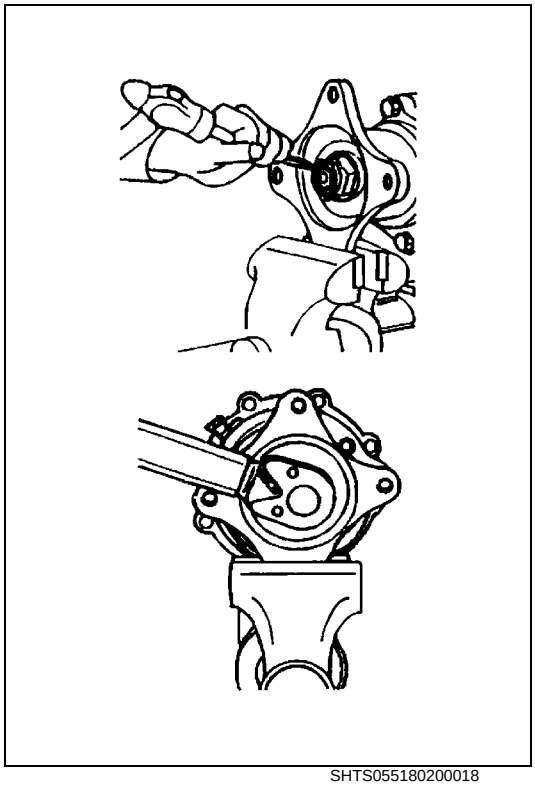

SHTS055180200017

3. DIFFERENTIAL CARRIER COVER ASSEMBLY

(1) Loosen the bolts and remove the differential carrier cover assembly from the differential carrier.

NOTICE

Lift the assembly vertically with a wire and chain block, and be careful not to drop the drive gear.

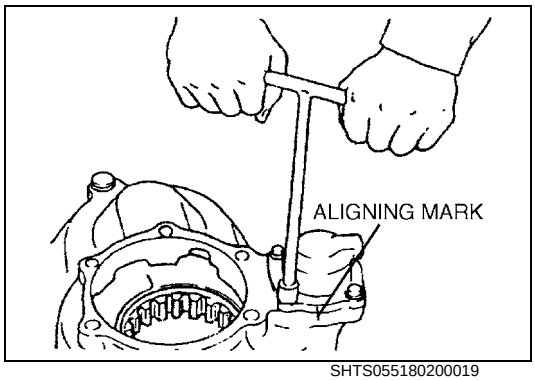

SHTS055180200018

(2) Loosen the bolts and remove the bearing cage with the drive shaft from the carrier cover.

(3) Uncaulk the lock nut, and remove the nut.
SST: Socket Wrench (S0983-96502)

NOTICE

Be careful not to drop the shift sleeve.

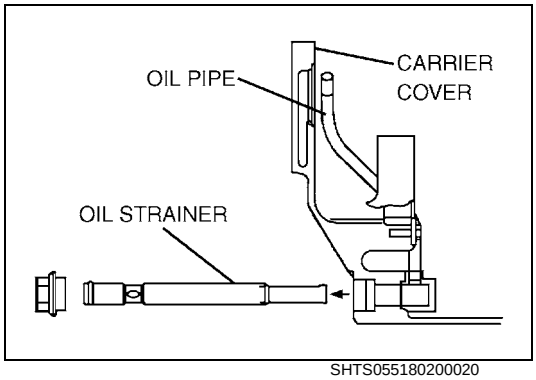


SHTS055180200019

(4) Loosen the bolts and remove the case cover from the carrier cover, then remove the piston, shift fork and return spring.

NOTICE

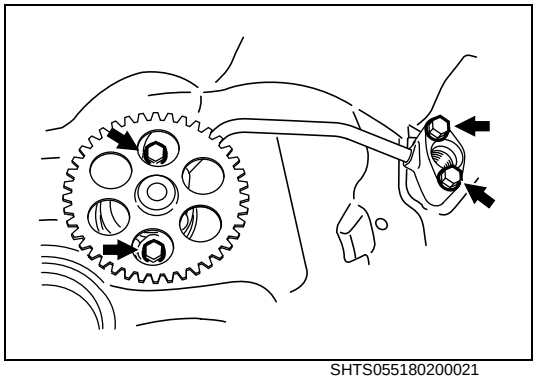
Before removing the case make aligning mark on the case cover and differential carrier cover.



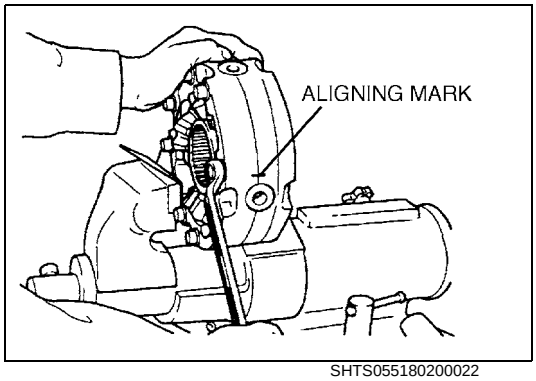
SHTS055180200020

4. OIL PUMP

(1) Remove the oil strainer from the carrier cover.


SHTS055180200021

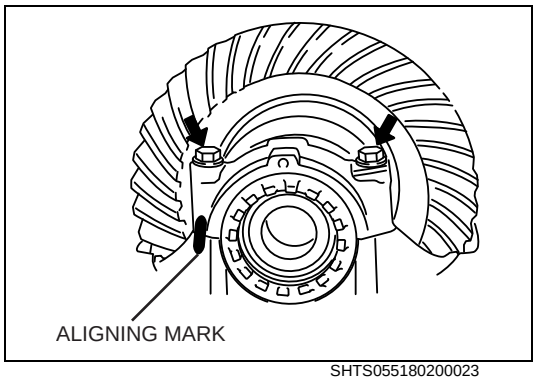
(2) Loosen the bolts and remove the oil pump assembly and the oil pipe from the carrier cover.



SHTS055180200022

5. INTER-AXLE DIFFERENTIAL GEAR

(1) Check for the aligning marks for the differential gear case then loosen the bolts and separate it.



SHTS055180200023

6. DIFFERENTIAL CARRIER

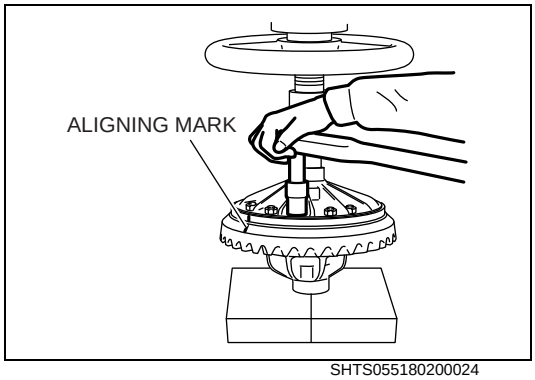
(1) Remove the bearing cap, then remove the differential case assembly with a wire and a chain block.

NOTICE

Make aligning mark before disassembling.

SST: Socket Wrench (S0983-93003)

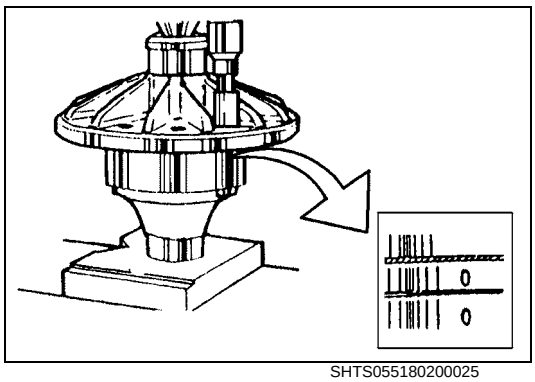
(2) Using a puller, remove the taper roller bearings.



SHTS055180200024

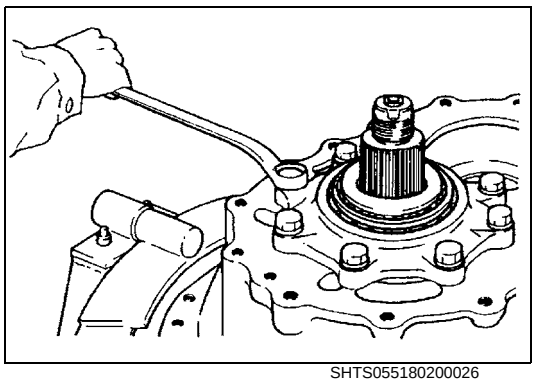
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055180200025

(4) Disassembly the differential case.

NOTICE
Be sure to check the matching marks on the differential case before disassembly. Remove the bolts and nuts so that the case separates.

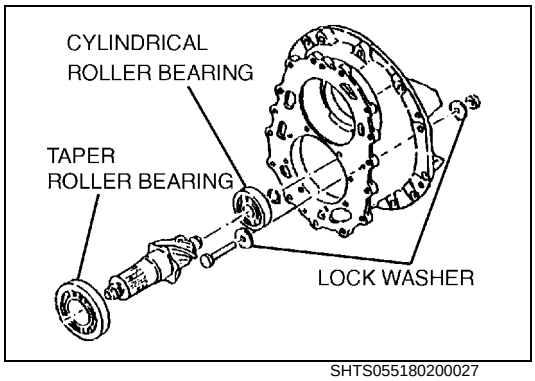

SHTS055180200026

7. DIFFERENTIAL CARRIER CAGE

(1) Uncaulk the lock nut and remove the lock nut.
SST: Socket Wrench (S0983-95501)

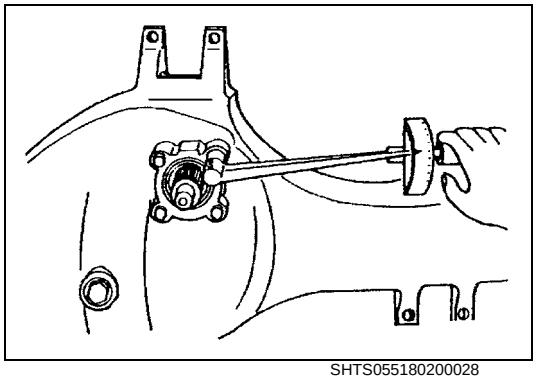
(2) Remove the pinion drive gear.
(3) Loosen the bolts, then remove the pinion assembly.

NOTICE
Fit the gear and lock nut back to remove the pinion assembly.



SHTS055180200027

(4) Loosen the bolt and nut then remove the cylindrical roller bearing lock washer.
(5) Using a puller, remove the taper roller bearing inner race and the cylindrical roller bearing inner race.


SHTS055180200028

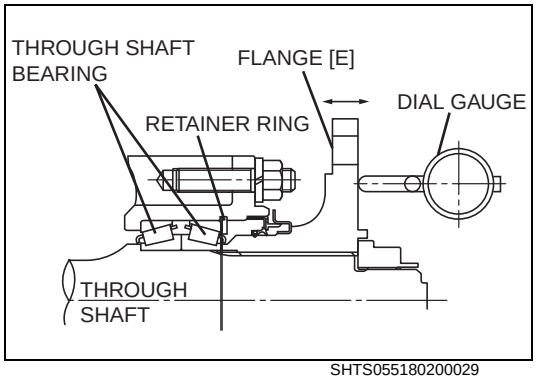
IMPORTANT POINTS - ASSEMBLY

1. ADJUSTMENT OF THE THROUGH SHAFT THRUST PLAY

(1) Install the through shaft with taper roller bearings and outer bearing race then install the retainer ring and bearing cage.

NOTICE

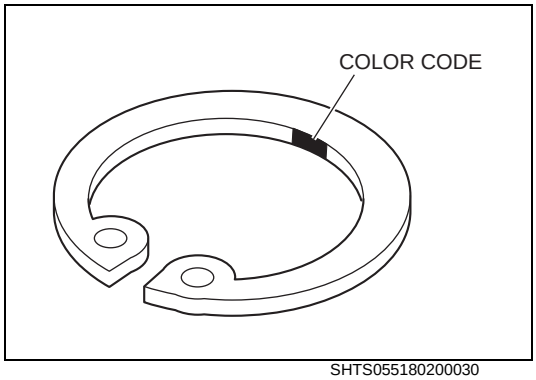
- **During installation, rotate (approx. 30 degrees) the retainer ring to check for proper installation in the groove.**
- **Be sure to use a new retainer ring, and discard the previously installed ring.**
- **Set the oil seal in the bearing cage after measurement of the thrust play.**



SHTS055180200029

(2) Select a retainer ring with appropriate thickness. Without the oil seal in place, adjust the thrust play between the through shaft bearing and retainer ring. To measure the thrust play, place a dial gauge on the end surface of the flange and move the flange [E].
Assembly Standard: 0.025-0.125 mm {0.0010-0.0049 in.}

NOTICE
Retainer rings are color-coded according to thickness.



SHTS055180200030

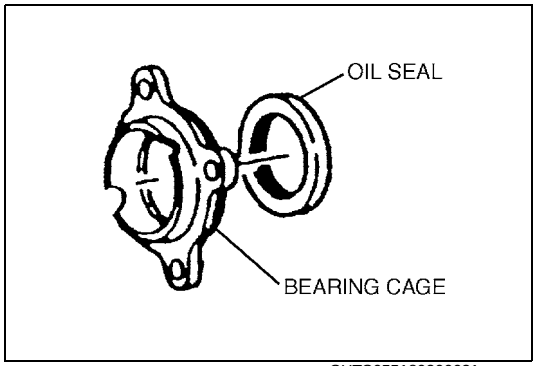
Thickness of retainer ring	Color code
2.8 mm {0.110 in.}	Non color
2.9 mm {0.114 in.}	Blue
3.0 mm {0.118 in.}	Yellow
3.1 mm {0.122 in.}	Red
3.2 mm {0.126 in.}	Sky blue
3.3 mm {0.130 in.}	Brown
3.4 mm {0.134 in.}	Green
3.5 mm {0.138 in.}	White
3.6 mm {0.142 in.}	Orange

(3) Remove the through shaft assembly from the housing, and remove the flange and the bearing cage from the shaft.

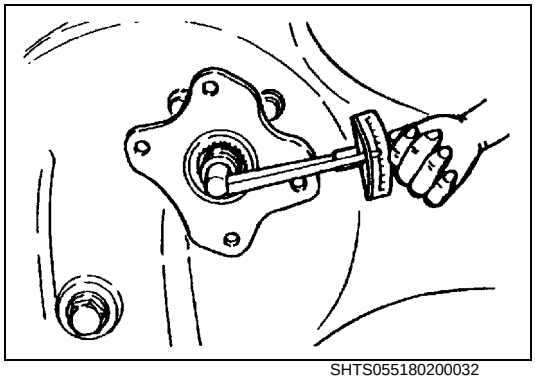
(4) Install the oil seal to the bearing cage.

NOTICE

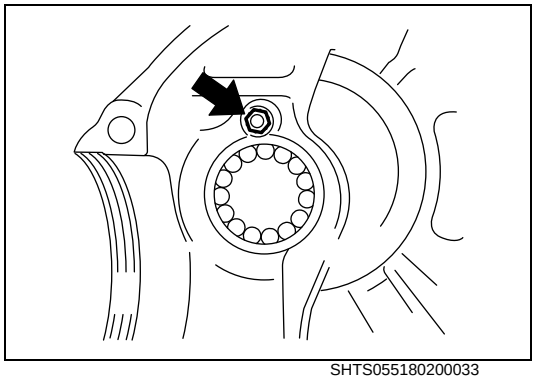
- **Apply bearing grease on the oil seal lip part.**
- **Before installation of the flange, heat the flange to a temperature between 80-100°C {176-212°F} in hot water or oil. After the flange is installed, leave it for approximately 10 minutes.**
- **Heating parts to a high temperature causes a substantial decrease in strength and durability. Do not heat parts above 120°C {248°F}**



SHTS055180200031


SHTS055180200032

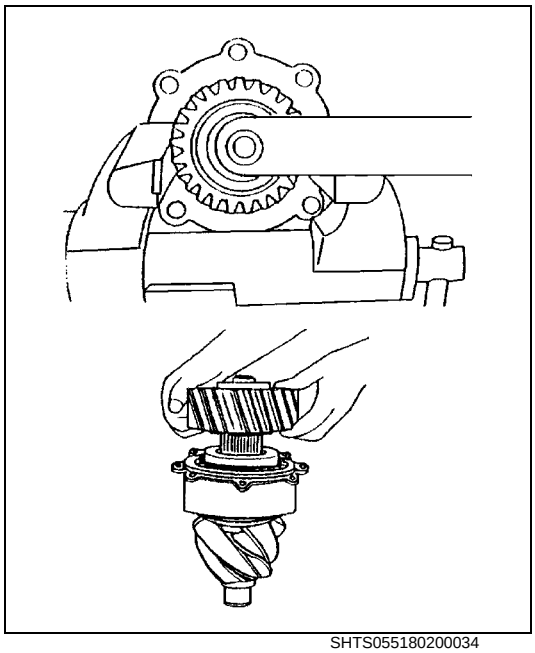
(5) After assembly, tighten it to the specified torque.
SST: Socket Wrench (S0983-94601)


SHTS055180200033

2. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

NOTICE
Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.

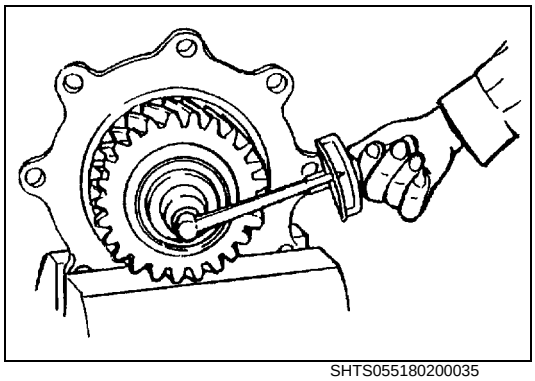

SHTS055180200034

3. ADJUSTMENT OF THE PINION ASSEMBLY PRELOAD

(1) Assemble the differential carrier cage and initially tighten the pinion drive gear.

NOTICE
Apply gear oil to the bearings.

SST: Socket Wrench (S0983-95501)

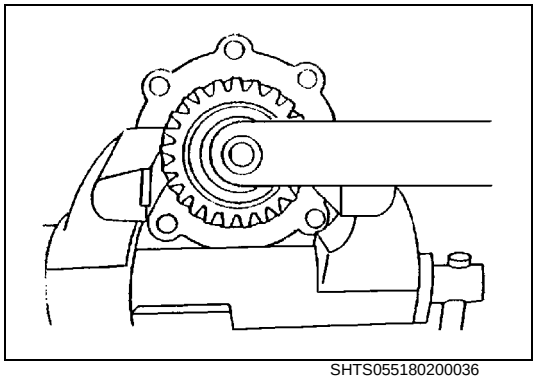

SHTS055180200035

(2) Using the torque wrench, measure the preload of the bearing and if the preload is not within the specific value shown below, adjust with spacer.

Assembly Standard: Turning torque **Unit: N·m {kgf·cm, lbf·ft}**

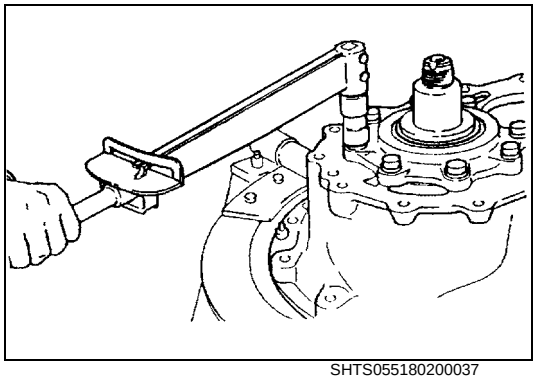
New bearing	Re-used bearing
1.97-2.45 {20-25, 1.4-1.8}	1.47-1.96 {15-20, 1.1-1.4}

Adjusting spacer thickness:
23 kinds of thicknesses ranging from 16.250 to 16.800 mm {0.640 to 0.661 in.} each differing 0.025 mm {0.001 in.}

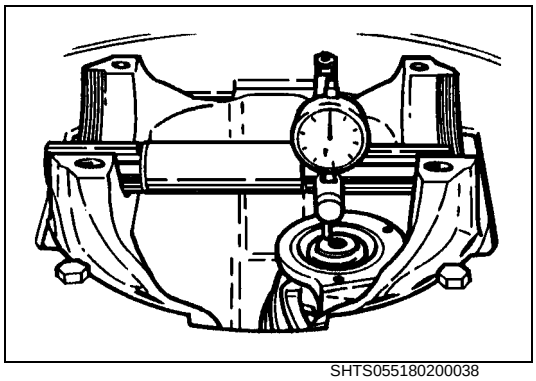

SHTS055180200036

(3) After completing the adjustment, loosen the lock nut.
SST: Socket Wrench (S0983-95501)

(4) Remove the lock nut and the pinion drive gear.

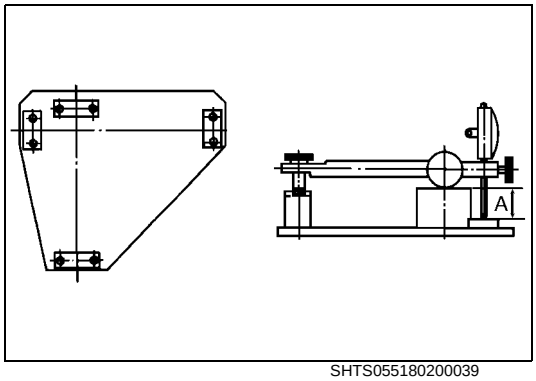

SHTS055180200037

(5) Install the pinion assembly and tighten the bolts.
(6) Install the pinion drive gear and tighten the lock nut with specified torque.
SST: Socket Wrench (S0983-95501)


SHTS055180200038

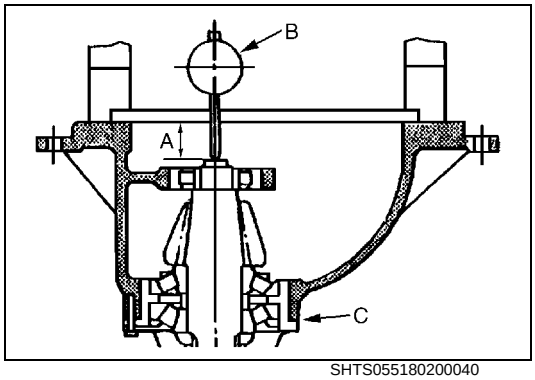
4. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE)

(1) Adjust the pinion fitting height with the shims.
Standard Pinion Fitting height: 34 mm {1.339 in.}
Adjusting shims Thicknesses:
0.3 mm {0.0118 in.} 0.45 mm {0.0177 in.}
0.4 mm {0.0157 in.} 0.50 mm {0.0197 in.}
SST: Gauge Assembly (S0964-01210)



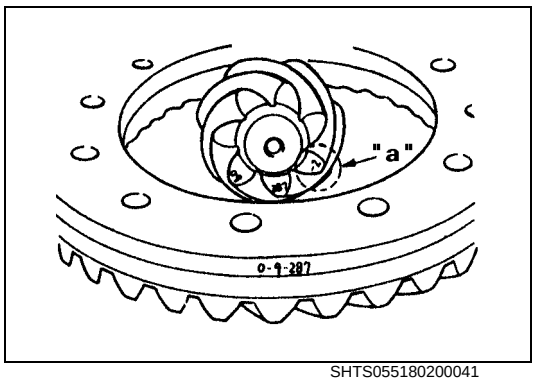
SHTS055180200039

(2) How to use the pinion depth gauge:
Set the pinion depth gauge.
A: 34 mm {1.339 in.}



SHTS055180200040

(3) Measure the pinion fitting height (Conical distance), adjust by using the proper shim.
A: Measuring part (Pinion height)
B: Pinion depth gauge
C: Adjusting shim

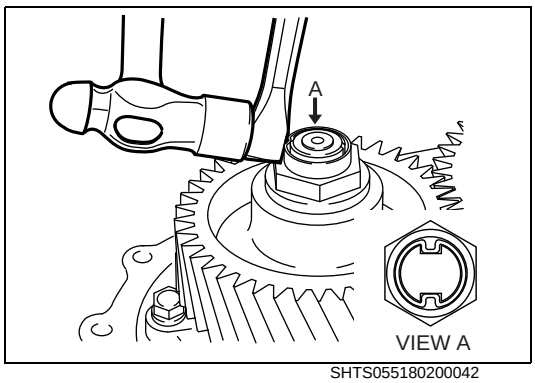


SHTS055180200041

EXAMPLE:

In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

Standard pinion height "A"				Measuring part (A')
34.0 mm	–	0.2 mm The engraved value "a"	=	33.8 mm

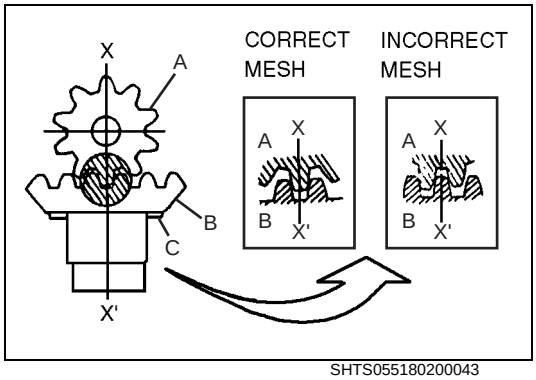


SHTS055180200042

(4) Caulk the pinion drive gear lock nut.

NOTICE

- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**



SHTS055180200043

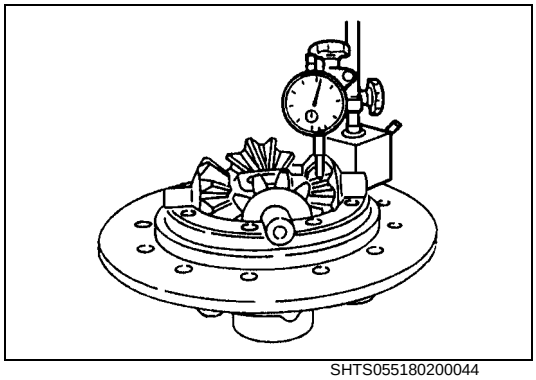
5. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

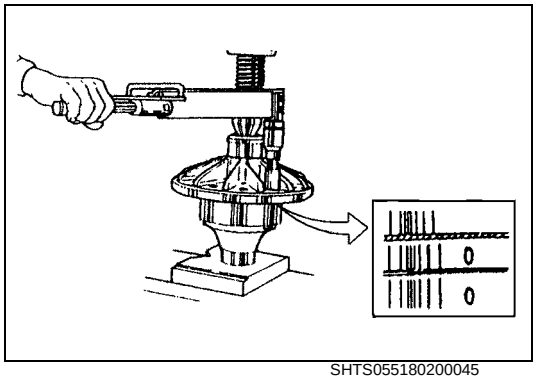
NOTICE

Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

A: Pinion
B: Side gear
C: Thrust washer


SHTS055180200044

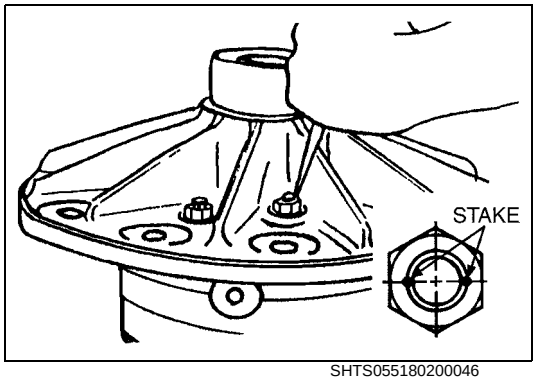
(2) If the backlash is more than service limit, replace the thrust washer for the side gear and/or for the pinion.
Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}


SHTS055180200045

(3) Assemble the differential case.

NOTICE

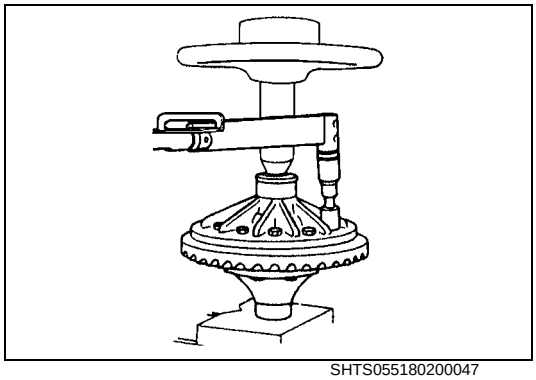
- **Align the aligning marks when assembling.**
- **Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.**



SHTS055180200046

NOTICE

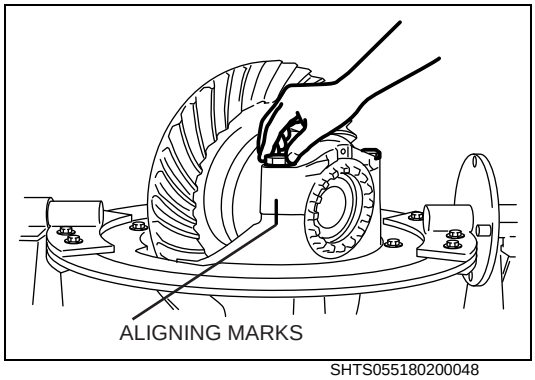
When lock agent is not applied, stake the lock nut as shown in the figure.


SHTS055180200047

(4) Install the ring gear to the differential case and tighten the bolts.

NOTICE

- **Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.**
- **When lock agent is not applied, stake the nut in the same manner as step (3).**
- **Align the aligning marks when assembling.**

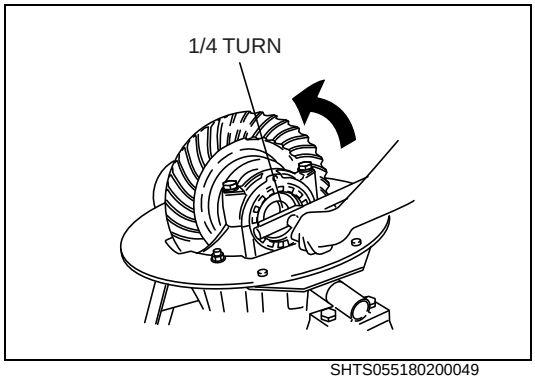


SHTS055180200048

6. ADJUSTMENT OF PINION DRIVE GEAR AND RING GEAR BACKLASH

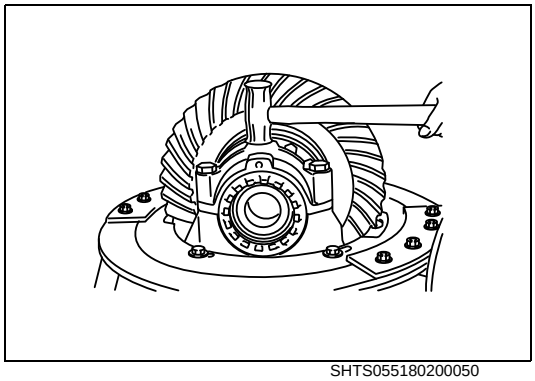
(1) Set the differential case assembly on the differential carrier and install the adjusting nut and bearing cap.

NOTICE
Align the aligning marks.

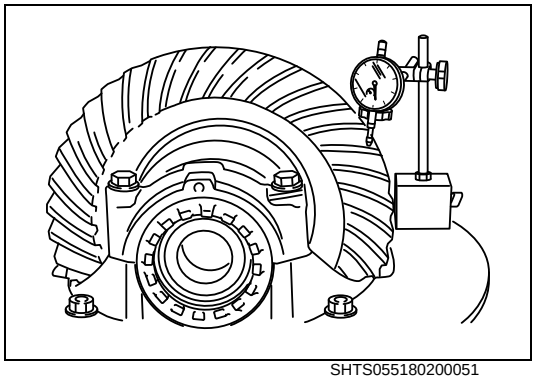


SHTS055180200049

(2) Adjust the preload of the side bearing provisionally.
a. Tightening the adjusting nut fully then loosen the adjusting nut by 1/4 turn +1 notch.
SST: Adjuster Tool (S0966-51180)

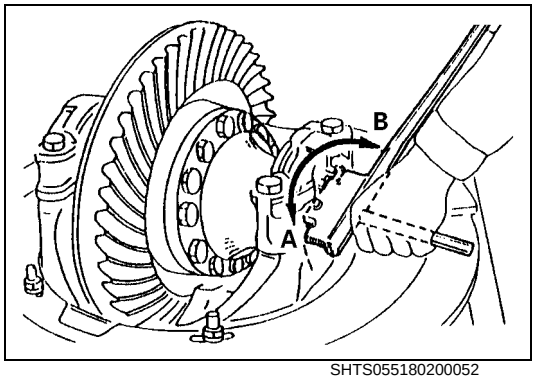

SHTS055180200050

b. Hit the bearing cap with a copper hammer.


SHTS055180200051

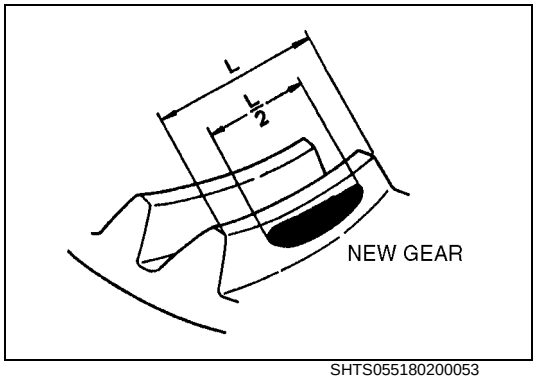
(3) Measure the gear backlash at three or four points on the circumference of the gear.
Assembly standard:

Gear ratio	Backlash
Except 6.428	0.30-0.41 mm {0.012-0.016 in.}
6.428	0.25-0.33 mm {0.010-0.013 in.}



SHTS055180200052

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: "A" - Decrease "B" - Increase
SST: Adjuster Tool (S0966-51180)



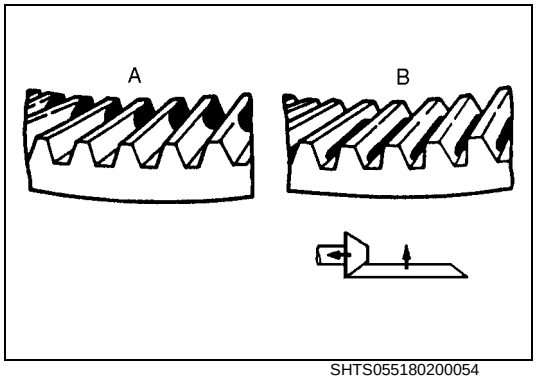
SHTS055180200053

7. INSPECTION AND ADJUSTMENT OF GEAR MESHING

(1) Satisfactory gear meshing.

NOTICE

New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.

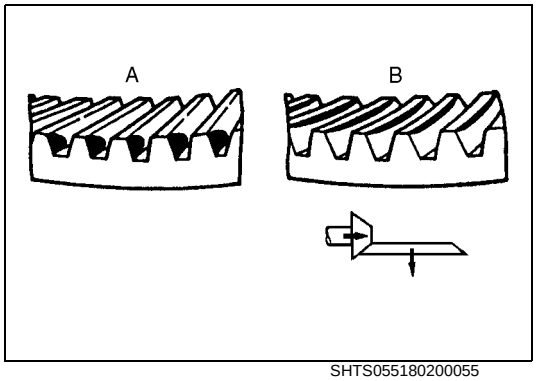


SHTS055180200054

(2) Example of the unsatisfactory engagement.

a. Toe and flank contact

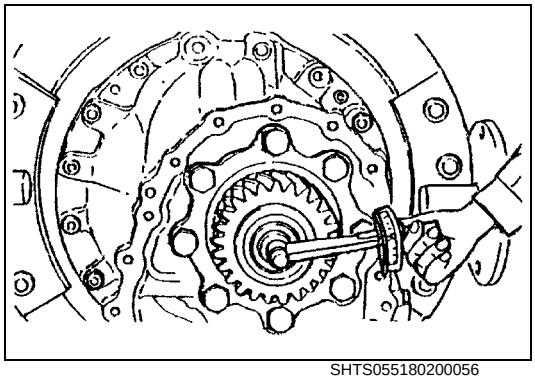
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



SHTS055180200055

b. Heel and face contact.

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


SHTS055180200056

8. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING

(1) Measure and adjust the total preload at the differential carrier bearings using a torque wrench.

NOTICE

Total preload = Side bearing preload + Pinion bearing preload (refer to item 3).

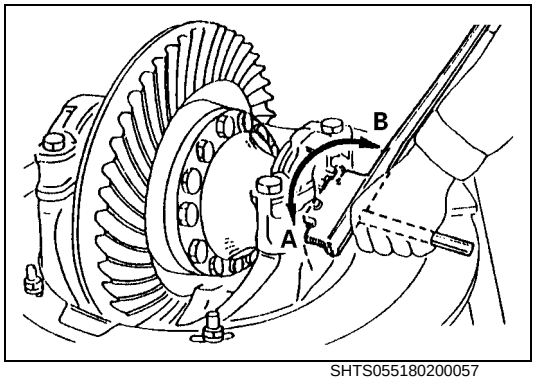
Assembly standard: Side bearing preload turning torque

Unit: N·m {kgf·cm, lbf·ft}

Gear ratio	4.100	4.625	4.875	5.250	5.428	5.857	6.428	7.166
New bearing	0.48-0.59 {4.9-6.0, 0.36-0.44}	0.43-0.53 {4.4-5.4, 0.32-0.39}	0.41-0.50 {4.2-5.1, 0.30-0.36}	0.38-0.46 {3.9-4.7, 0.28-0.34}	0.37-0.45 {3.8-4.5, 0.28-0.32}	0.34-0.41 {3.5-4.2, 0.25-0.30}	0.31-0.37 {3.2-3.8, 0.23-0.27}	0.28-0.34 {2.8-3.4, 0.21-0.25}
Re-used bearing	0.36-0.47 {3.7-4.8, 0.27-0.35}	0.32-0.42 {3.3-4.3, 0.24-0.31}	0.31-0.40 {3.1-4.1, 0.23-0.29}	0.29-0.37 {2.9-3.8, 0.22-0.27}	0.28-0.36 {2.9-3.7, 0.20-0.26}	0.26-0.33 {2.6-3.4, 0.19-0.24}	0.23-0.30 {2.4-3.1, 0.17-0.22}	0.21-0.27 {2.1-2.7, 0.15-0.20}

NOTICE

The gear ratio is indicated on the bearing cage.

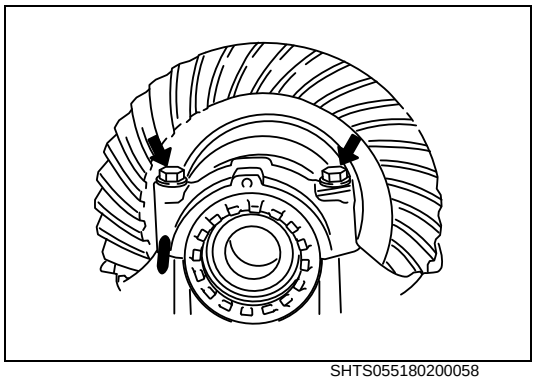


SHTS055180200057

(2) If necessary, adjust the side bearing preload with the adjusting nut.

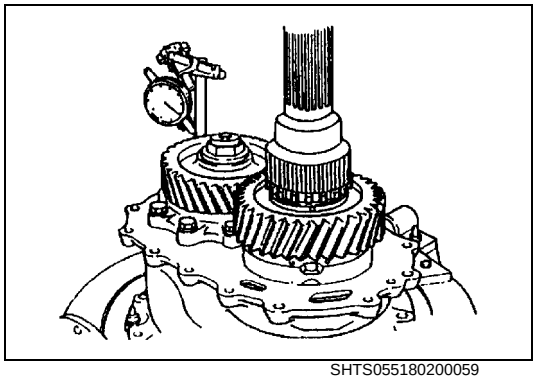
- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload

SST: Adjuster Tool (S0966-51180)


SHTS055180200058

(3) Tighten the bearing cap and install the lock plate.

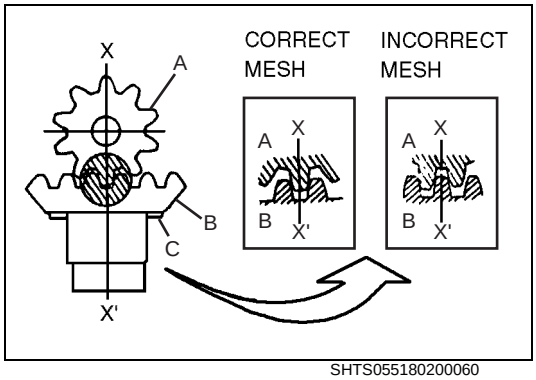
SST: Socket Wrench (S0983-93003)



SHTS055180200059

9. DRIVE GEAR AND PINION DRIVE GEAR

(1) Measure the drive gear and pinion drive gear backlash.
Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}
Service Limit: 0.4 mm {0.0157 in.}



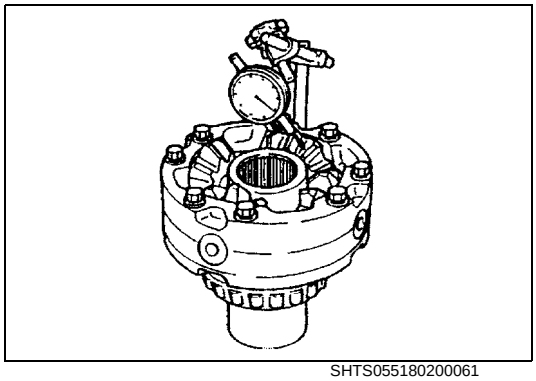
SHTS055180200060

10. INTER-AXLE DIFFERENTIAL GEAR

(1) Measure the pinion backlash.

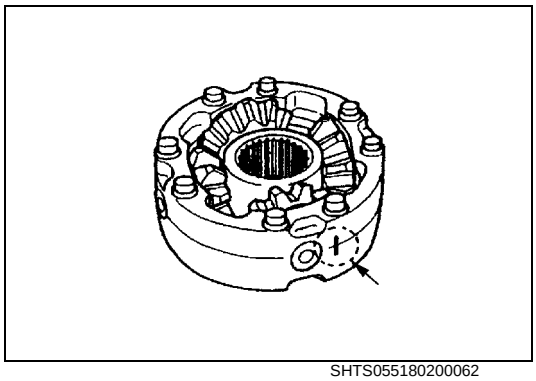
NOTICE
Apply molybdenum grease to the pinion gear and spider.

A: Pinion
B: Side gear
C: Thrust washer



SHTS055180200061

(2) If the backlash is more than service limit, replace the thrust washer for the side gear and/or for the pinion.
Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}



SHTS055180200062

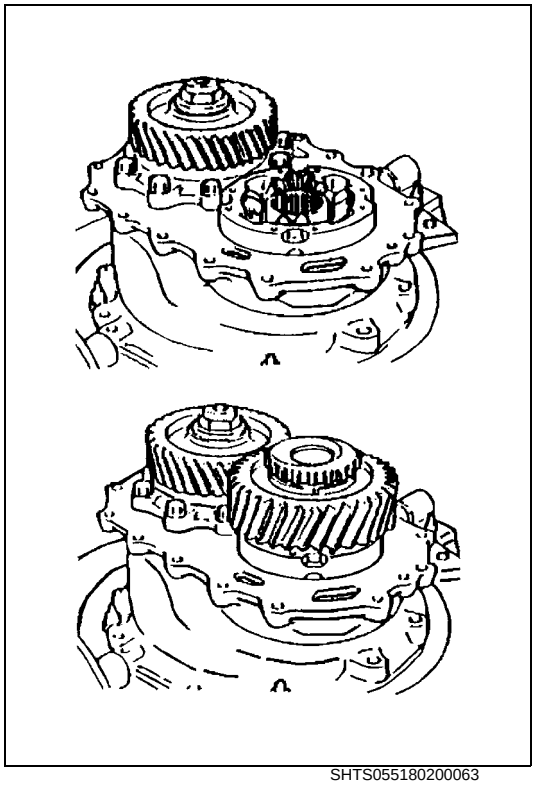
(3) Assemble the differential case.

NOTICE

- **Align the aligning marks when assembling.**
- **Apply molybdenum grease on all inner parts.**

(4) Tighten the bolts.

NOTICE
Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.

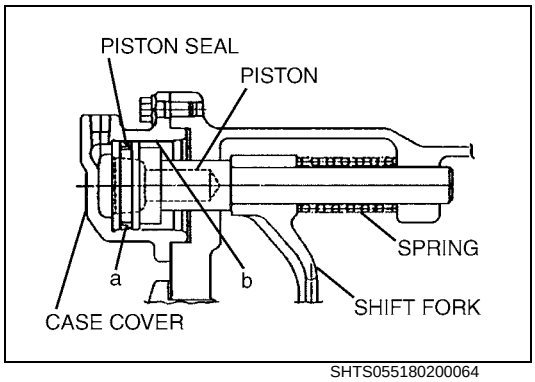


SHTS055180200063

(5) Place the inter-axle differential gear and the drive gear as shown in figure.

NOTICE

The bolts of the differential case should point downward when assembling.



SHTS055180200064

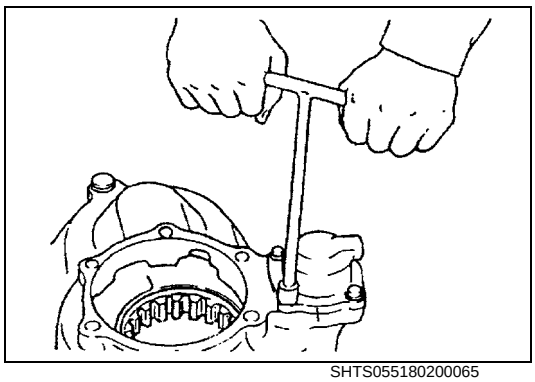
11. DIFFERENTIAL CARRIER COVER ASSEMBLY

(1) Set the piston seal as shown in the figure.

(2) Place the spring and the shift fork in the differential carrier cover, then insert the piston.

NOTICE

- **Coat the piston seal with silicon grease "a".**
- **Coat the piston and case cover inner surface with gear oil "b".**

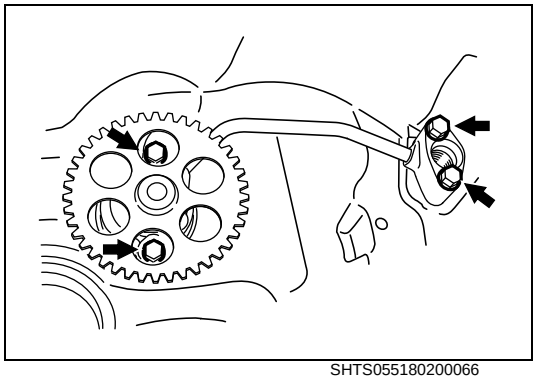


SHTS055180200065

(3) Install the case cover on the differential carrier cover.

NOTICE

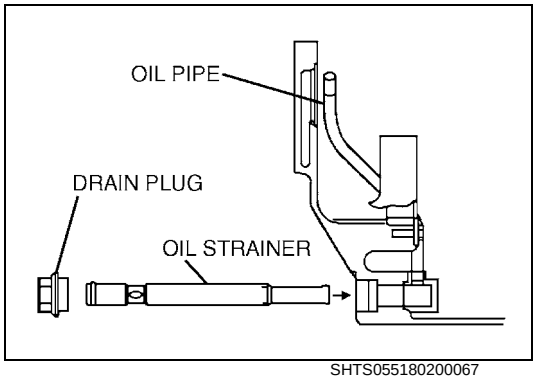
- **Apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surfaces of the case cover and differential carrier cover.**
- **Align the aligning marks on the case cover and the differential carrier cover.**


SHTS055180200066

(4) Install the oil pipe and oil pump assembly to the differential carrier cover.

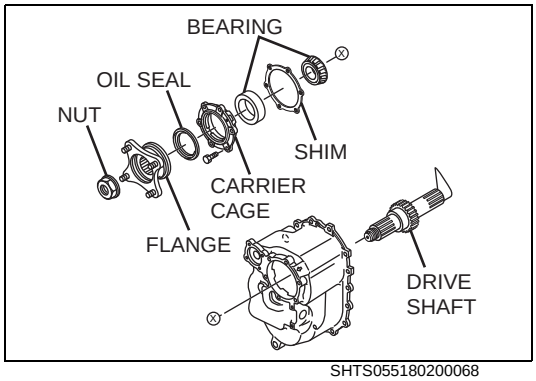
NOTICE

Be careful not to damage the O-ring when installing the oil pipe.



SHTS055180200067

(5) Install the oil strainer to the differential carrier cover.



SHTS055180200068

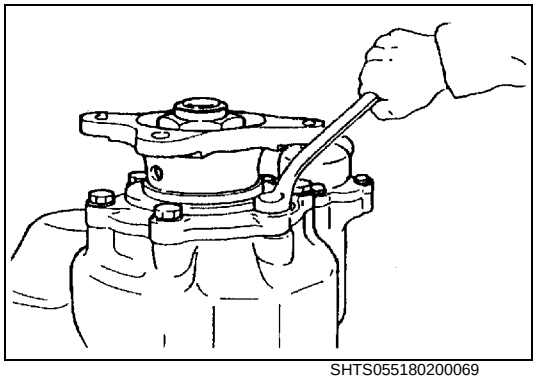
(6) Install the bearing on the drive shaft.

(7) Install the oil seal to the carrier cage and then install the carrier cage with the shim to the drive shaft.

NOTICE

Apply bearing grease on the oil seal lip parts.

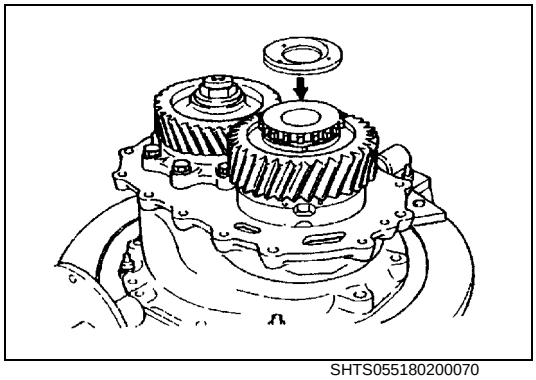
(8) Install the flange yoke coupling and tighten the nut.
SST: Socket Wrench (S0983-96502)


SHTS055180200069

(9) Place the shift sleeve in the shift fork, then install the drive shaft and the carrier cage assembly to the differential carrier cover.

NOTICE

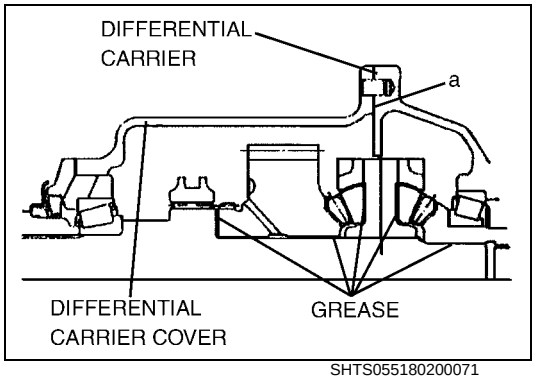
- **Apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surfaces of carrier cage and carrier cover.**
- **Align the spline of the sleeve and the drive shaft.**


SHTS055180200070

(10) Place the thrust washer on the drive gear.

NOTICE

Apply molybdenum grease to the both sides of the thrust washer.

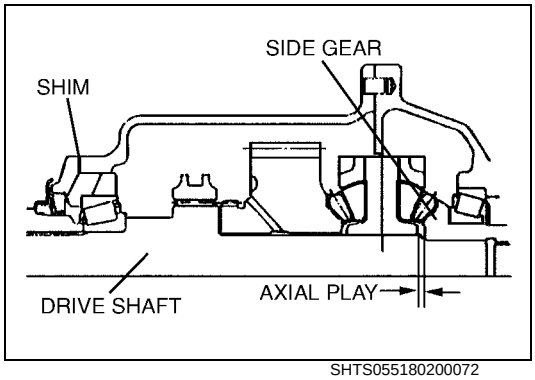


SHTS055180200071

(11) Initially install the differential carrier cover assembly to the differential carrier.

NOTICE

- **Apply molybdenum grease to the sliding surface.**
- **Apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surface of differential carrier cover and differential carrier "a".**

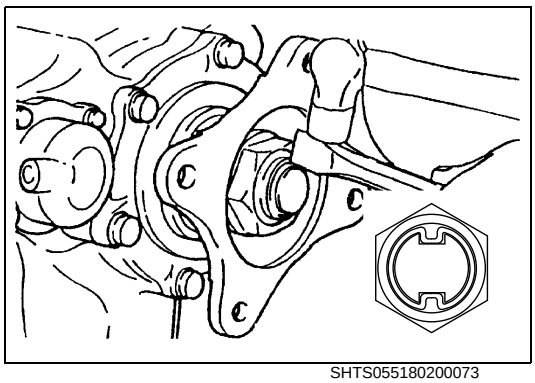


SHTS055180200072

(12) Measure the drive shaft axial play and adjust the side gear and drive shaft axial play with shims.
Assembly Standard: 0.05-0.10 mm {0.0020-0.0039 in.}
Adjusting shims Thicknesses:
0.30 mm {0.0118 in.}, 0.45 mm {0.0177 in.}
0.40 mm {0.0157 in.}, 0.50 mm {0.0197 in.}

NOTICE

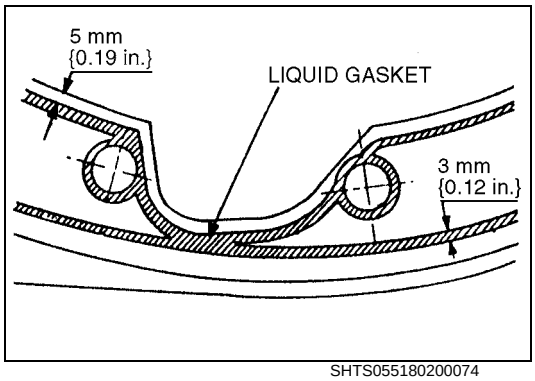
After adjusting shims, apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surface of differential carrier cover and differential carrier cage.


SHTS055180200073

(13) Caulk the lock nut.

NOTICE

- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**



SHTS055180200074

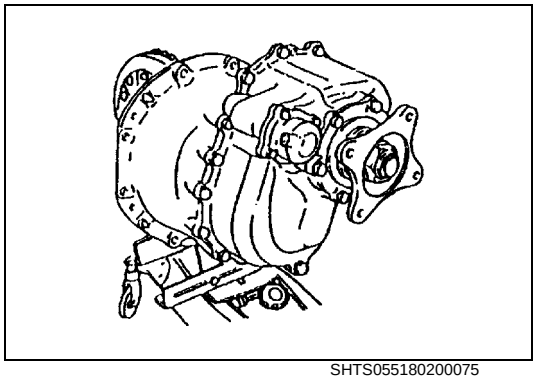
IMPORTANT POINTS - MOUNTING

1. DIFFERENTIAL CARRIER ASSEMBLY

(1) Apply liquid gasket on the face of the housing flange.

NOTICE

- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 5 mm {0.19 in.} away from the edge.**

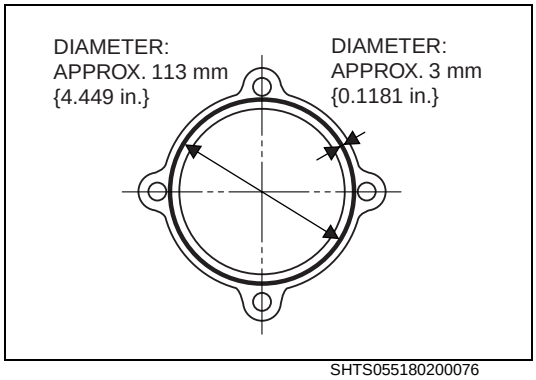


SHTS055180200075

(2) Using a jack, install the differential carrier assembly to the axle housing.

NOTICE

Fit the O-ring to the stud bolt.



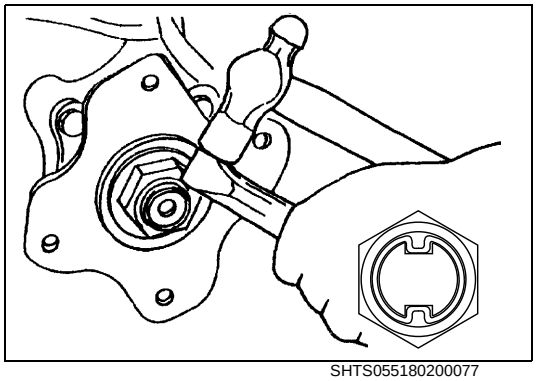
SHTS055180200076

2. THROUGH SHAFT ASSEMBLY

(1) Apply liquid gasket on face of the housing flange and insert the through shaft.

NOTICE

- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**



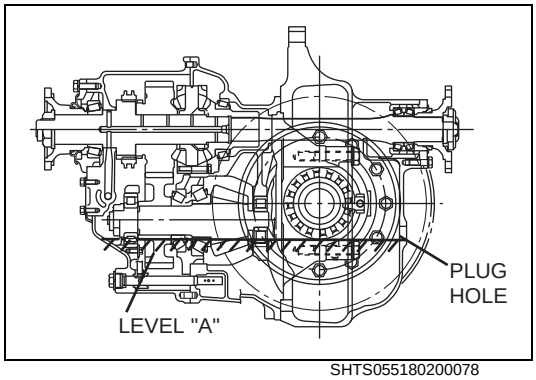
SHTS055180200077

(2) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-94601)

(3) Caulk the lock nut.

NOTICE

- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**

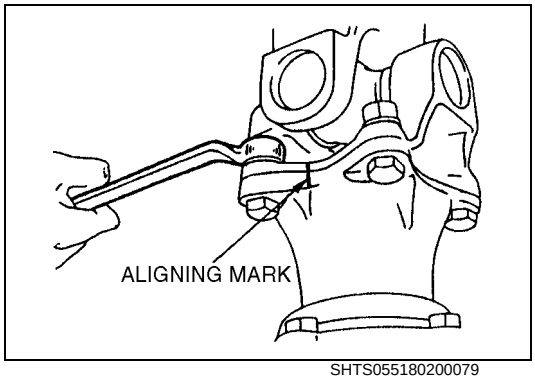


SHTS055180200078

3. GEAR OIL

(1) Fill the gear oil using plug hole to level "A" and tighten the plug.

Gear oil:
Refer to the owner's manual.



SHTS055180200079

4. PROPELLER SHAFT

(1) Install the propeller shafts.

NOTICE

Align the aligning marks.

Tightening Torque:

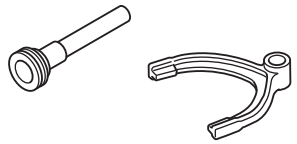
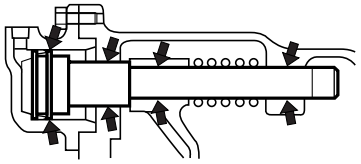
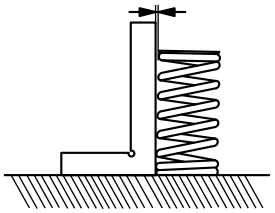
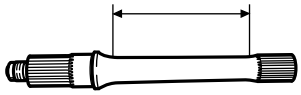
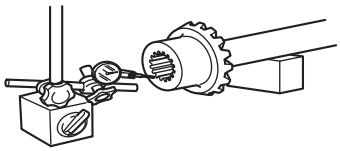
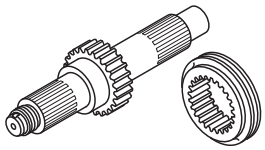
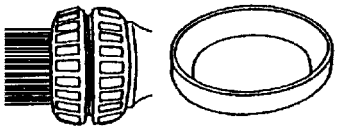
ϕ14 bolt: 127.5-156.9 N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}

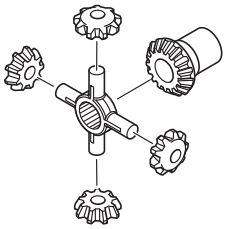
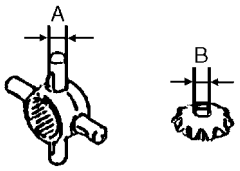
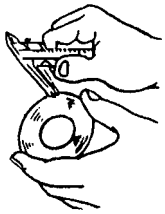
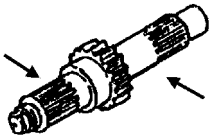
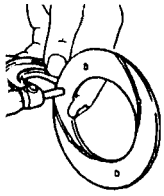
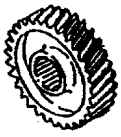
ϕ16 bolt: 166.8-225.4 N·m {1,700-2,300 kgf·cm, 123-166 lbf·ft}

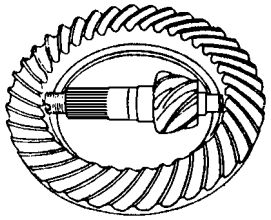
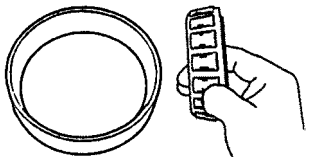
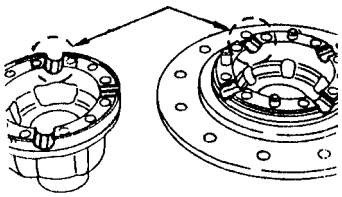
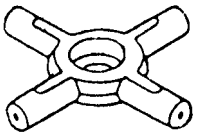
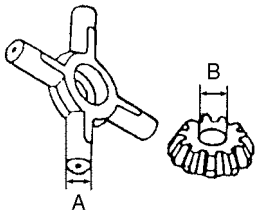
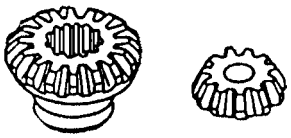
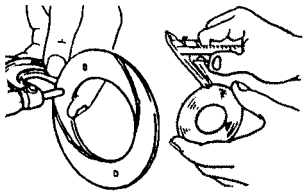
INSPECTION AND REPAIR

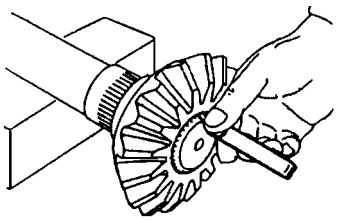
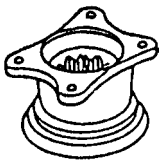
EN0551802H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Shift fork and piston: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Shift fork and piston case sliding surface: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Return spring: Squareness	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Through shaft: Bend	**0.1 {0.0039}**	**—**	**Replace.**	**Measure** 
Inter-axle side gear and through shaft: Spline backlash	**0.132-0.210 {0.006-0.008}**	**0.5 {0.020}**	**Replace.**	**Measure** 
Drive shaft and shift sleeve: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Through shaft bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Taper roller bearing: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check**

Inspection item	Standard	Limit	Remedy	Inspection procedure
Inter axle differential gear teeth: Wear and damage	—	—	Replace, if necessary.	Visual check 
Inter axle differential side gear spline: Wear and damage	—	—	Replace, if necessary.	
Inter axle differential spider: Wear and damage	—	—	Replace, if necessary.	
Inter axle differential spider and pinion: Clearance	A: 28 {1.102} B-A: 0.140-0.261 {0.006-0.010}	0.4 {0.016}	Replace.	Measure 
Inter axle differential thrust washers thickness	1.7-1.9 {0.006-0.010}	1.3 {0.051}	Replace.	Measure 
Inter axle differential drive shift sliding surface, spline; Wear and damage	—	—	Replace, if necessary.	Visual check 
Drive gear: Wear and damage	—	—	Replace, if necessary.	Visual check
Drive gear: Thrust washer thickness	1.9-2.1 {0.075-0.082}	1.7 {0.067}	Replace.	Measure 
Pinion drive gear: Wear and damage	—	—	Replace, if necessary.	Visual check 
Cylindrical roller bearing: Burns and damage	—	—	Replace, if necessary.	Visual check

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 32 {1.260}** **B-A: 0.145-0.190 {0.0058-0.0074}**	**0.4 {0.016}**	**Replace.**	**Measure** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Thrust washers thickness	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.7-1.9 {0.067-0.074}	**1.3 {0.051}**		

Inspection item	Standard	Limit	Remedy	Inspection procedure
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.020}**	**Replace.**	**Measure** 
Flange coupling spline: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SS12)

DF02-007

DIFFERENTIAL CARRIER (SS12) DF02-2

DATA AND SPECIFICATIONS..... DF02-2
DESCRIPTION DF02-3
TROUBLESHOOTING..... DF02-4
SPECIAL TOOL..... DF02-4
COMPONENT LOCATOR DF02-5
OVERHAUL DF02-7
INSPECTION AND REPAIR..... DF02-19

DIFFERENTIAL CARRIER (SS12)

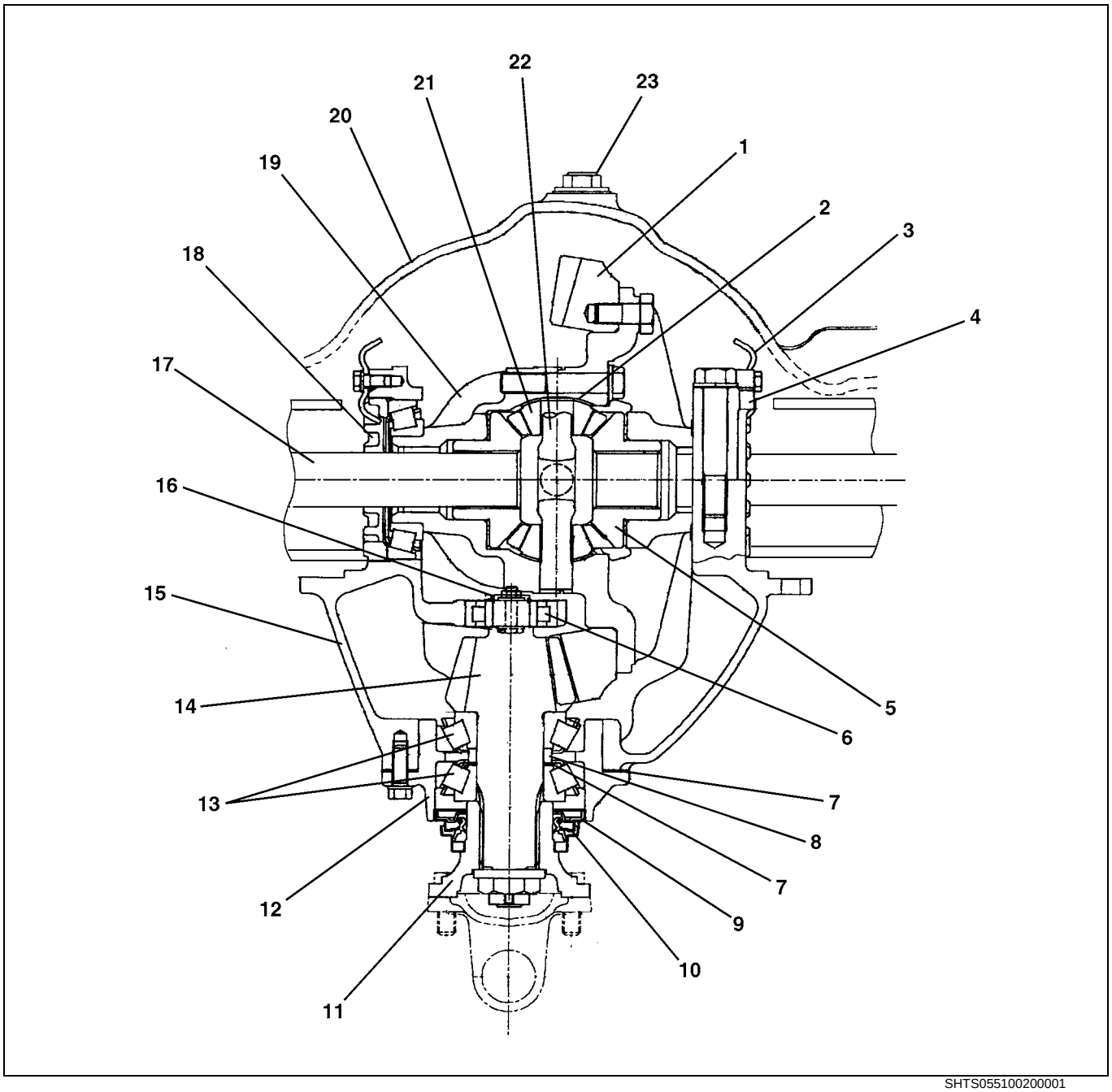
DATA AND SPECIFICATIONS

EN0551002I200001

Type	**Single-reduction, single-speed, by Spiral bevel gearing**
Gear ratio	**5.142**
Oil capacity	**3.5 L {0.77 lmp gal. / 0.92 U.S. gal.}**

DESCRIPTION

EN0551002C100001



SHTS055100200001

1	Ring gear	9	Oil seal	17	Axle shaft
2	Thrust washer	10	Dust deflector	18	Adjusting nut
3	Lock plate	11	Flange yoke coupling	19	Differential case
4	Bearing cap	12	Bearing cage	20	Axle housing
5	Differential side gear	13	Taper roller bearing	21	Differential pinion gear
6	Cylindrical roller bearing	14	Drive pinion	22	Spider
7	Adjusting shim	15	Differential carrier case	23	Oil filler plug
8	Spacer	16	Retainer ring		

TROUBLESHOOTING

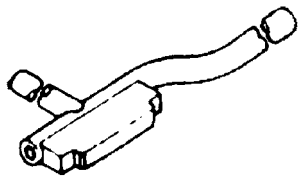
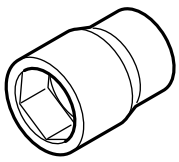
EN0551002F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Front axle system)	Worn front axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil; check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

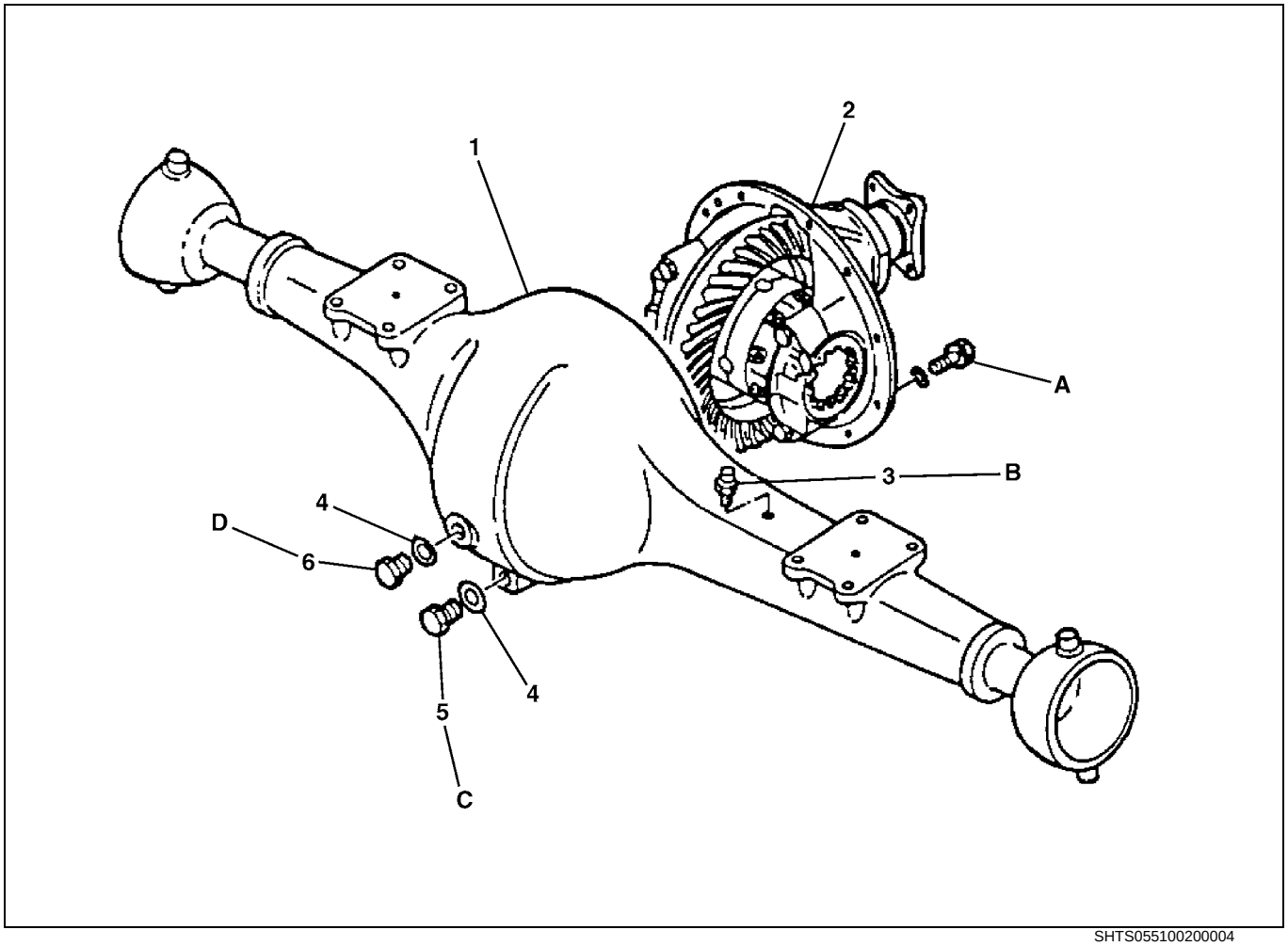
EN0551002K100001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51190	ADJUSTER TOOL	
	S0983-93606	SOCKET WRENCH	

COMPONENT LOCATOR

EN0551002D100001

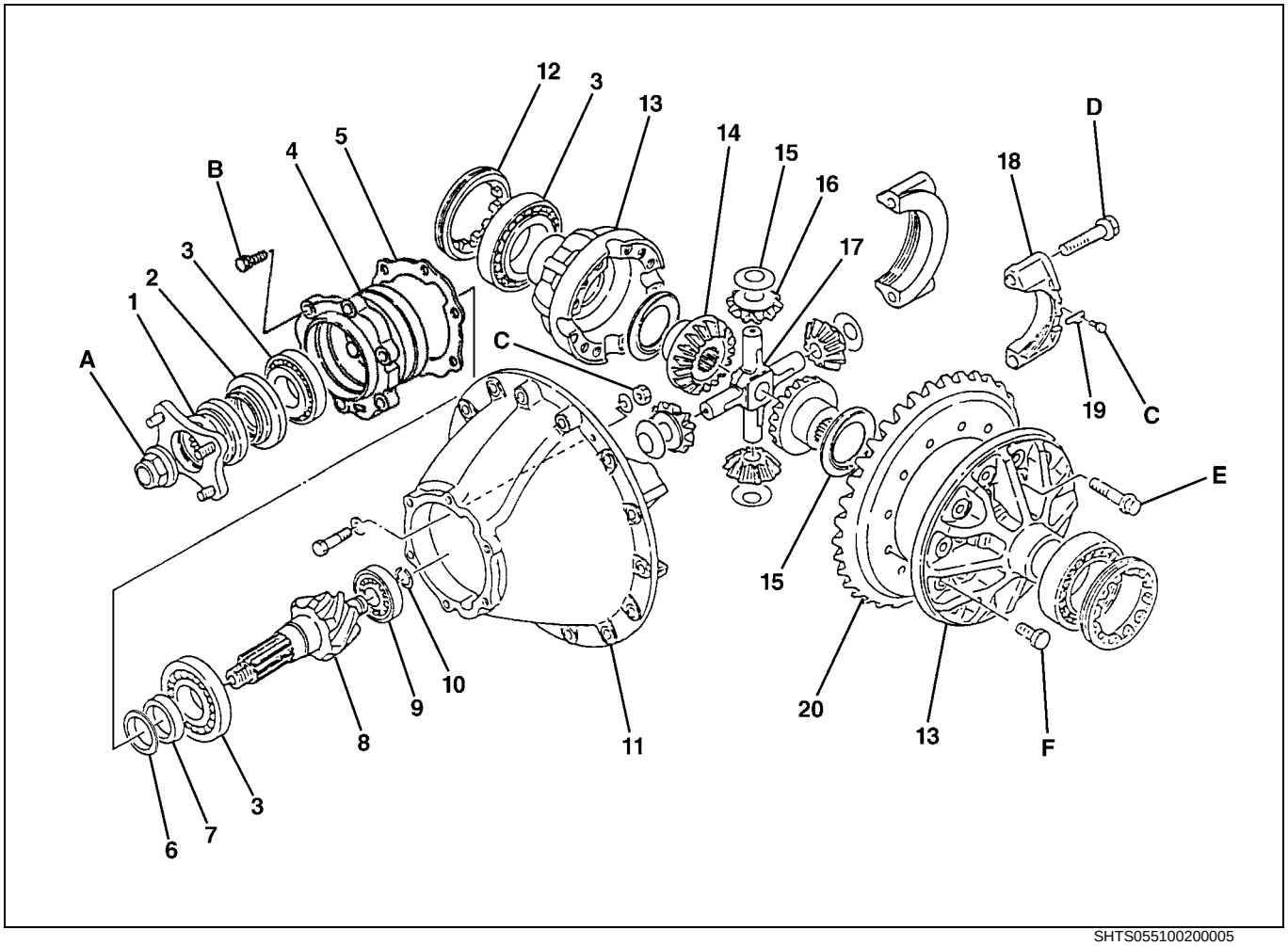


SHTS055100200004

1	Axle housing assembly	4	Gasket
2	Differential carrier assembly	5	Oil drain plug
3	Air breather	6	Oil filler plug

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	85.4-107.8 {870-1,100, 63-79}	C	39.2-68.6 {400-700, 29-50}
B	9.8-19.6 {100-200, 7-14}	D	78.4-117.6 {800-1,200, 58-86}



SHTS055100200005

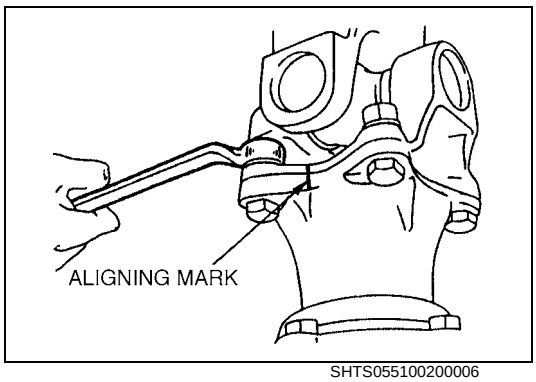
1	Flange yoke coupling	11	Differential carrier case
2	Oil seal	12	Adjusting nut
3	Taper roller bearing	13	Differential case
4	Bearing cage	14	Differential side gear
5	Adjusting shim	15	Thrust washer
6	Adjusting shim	16	Differential pinion gear
7	Spacer	17	Spider
8	Drive pinion	18	Bearing cap
9	Cylindrical roller bearing	19	Lock plate
10	Retainer ring	20	Ring gear

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	247-313 {2,500-3,200, 181-231}	D	167-223 {1,700-2,270, 123-164}
B	38-49 {380-500, 28-36}	E	167-213 {1,700-2,170, 123-157}
C	19-25 {190-260, 14-18}	F	166-214 {1,690-2,180, 123-157}

OVERHAUL

EN0551002H200001



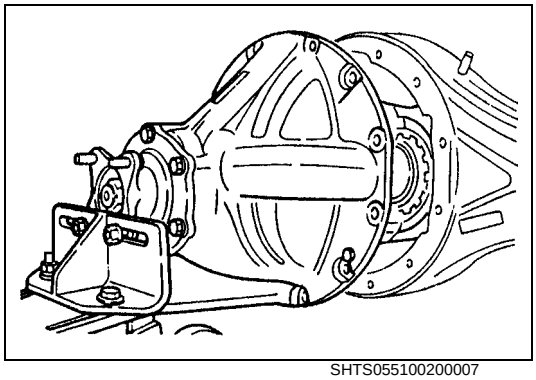
SHTS055100200006

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.


SHTS055100200007

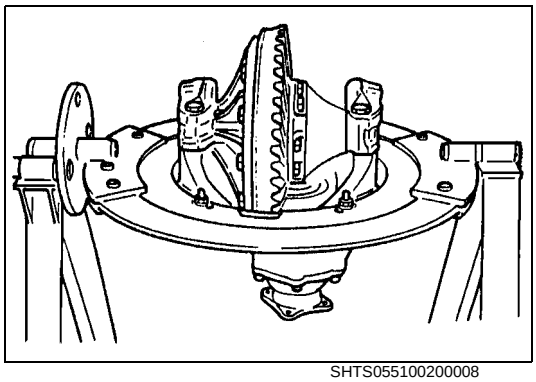
2. DISMOUNTING OF THE DIFFERENTIAL CARRIER ASSEMBLY

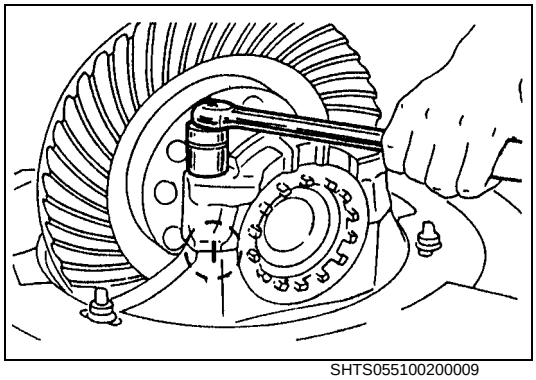
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.

IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.


SHTS055100200008


SHTS055100200009

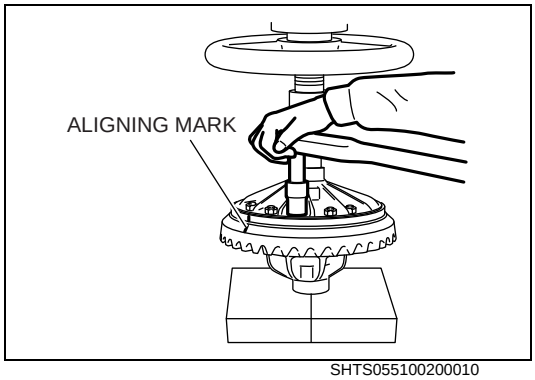
2. DIFFERENTIAL CASE

(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

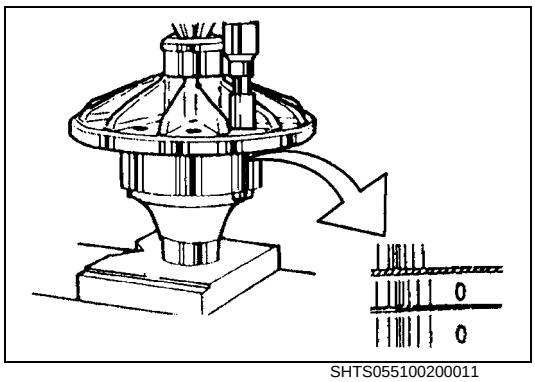
(2) Using a puller, remove the taper roller bearing.



SHTS055100200010

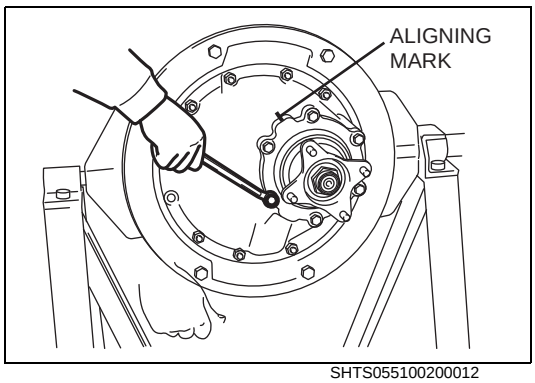
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts and then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055100200011

(4) Disassemble the differential case.

NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.

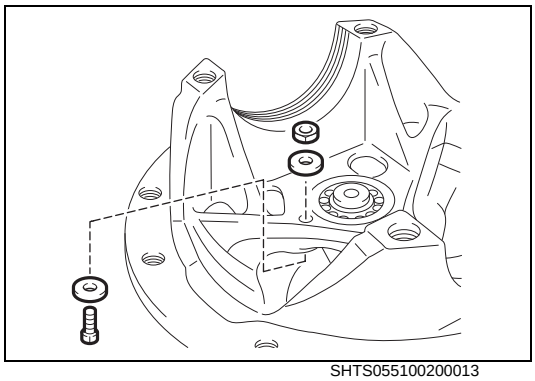


SHTS055100200012

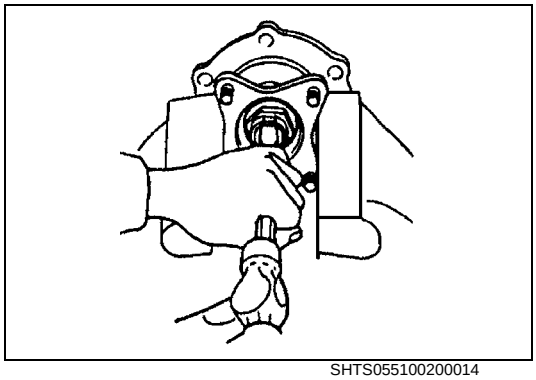
3. DRIVE PINION

(1) Remove the bolts and then dismount the drive pinion and the shims.

NOTICE
Make aligning mark the differential cage and differential carrier.

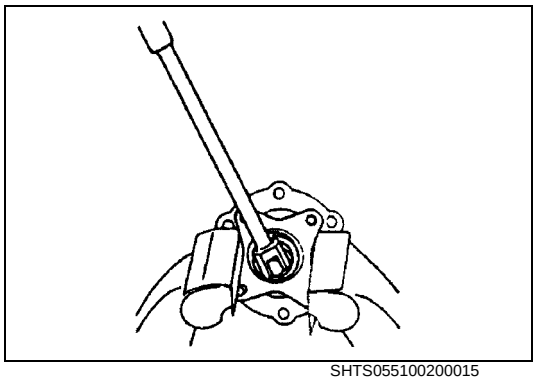

SHTS055100200013

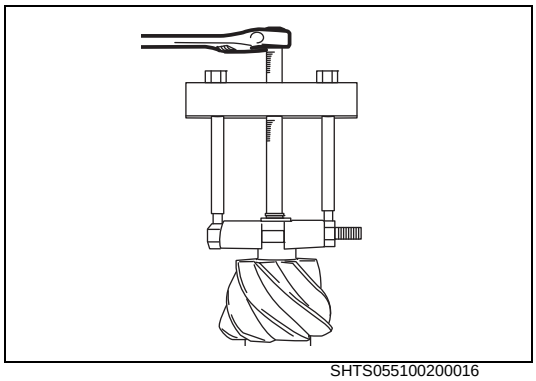
(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


SHTS055100200014

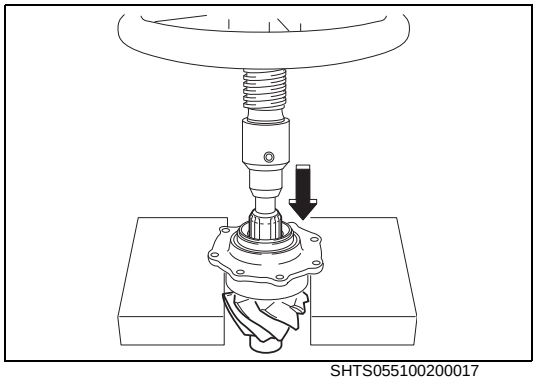
4. BEARING CAGE

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-93606)

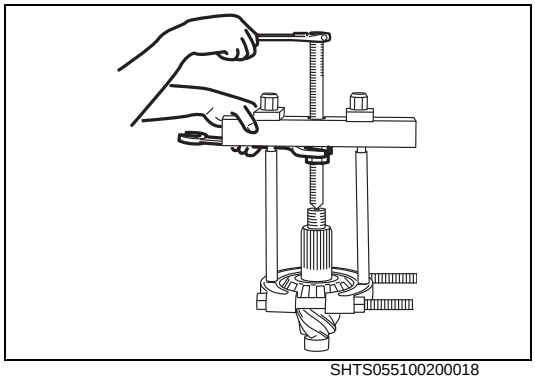

SHTS055100200015


SHTS055100200016

(2) Using a puller, remove the cylindrical roller bearing inner race.


SHTS055100200017

(3) Using a press, remove the drive pinion.


SHTS055100200018

(4) Using a puller, remove the taper roller bearing inner race.

IMPORTANT POINTS - ASSEMBLY

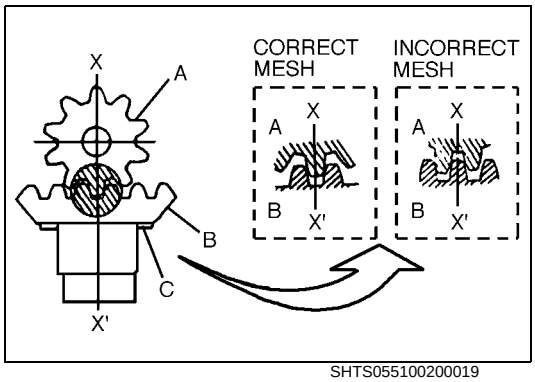
1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

NOTICE

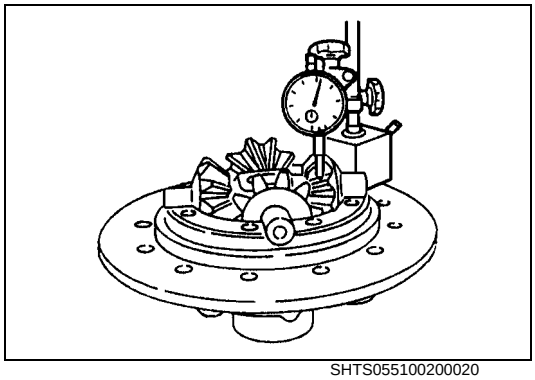
Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

- A: Pinion
- B: Side gear
- C: Thrust washer



SHTS055100200019

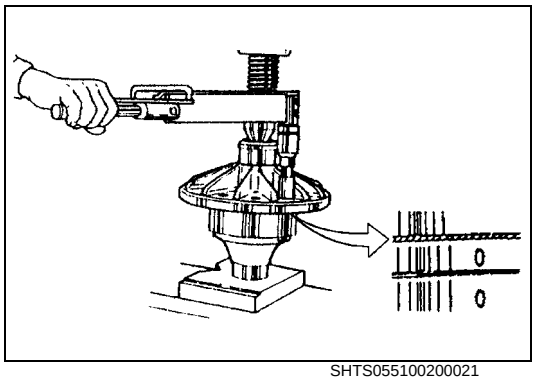
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}

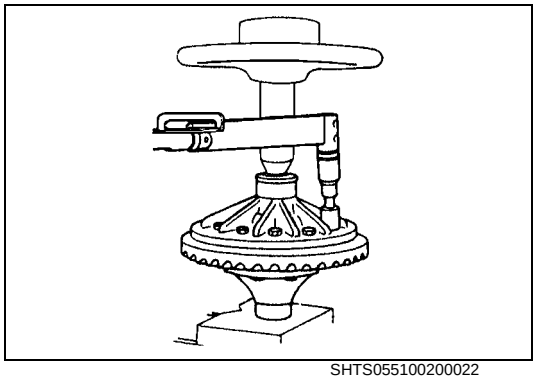

SHTS055100200020

(3) Assemble the differential case.

NOTICE

- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

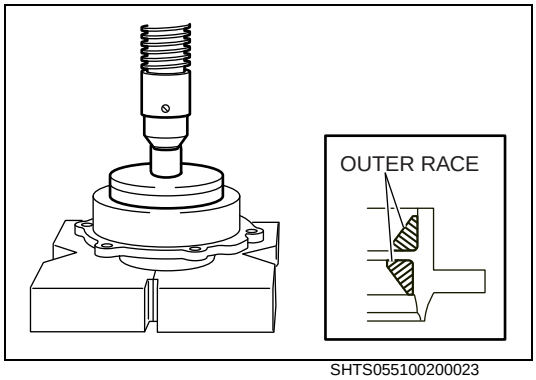

SHTS055100200021


SHTS055100200022

(4) Install the ring gear to the differential case and tighten it with bolts and nuts.

NOTICE

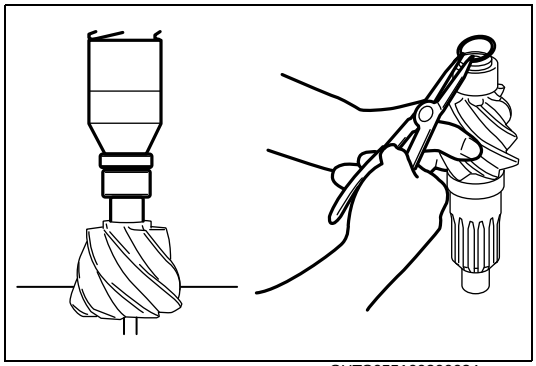
Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.



SHTS055100200023

2. DRIVE PINION

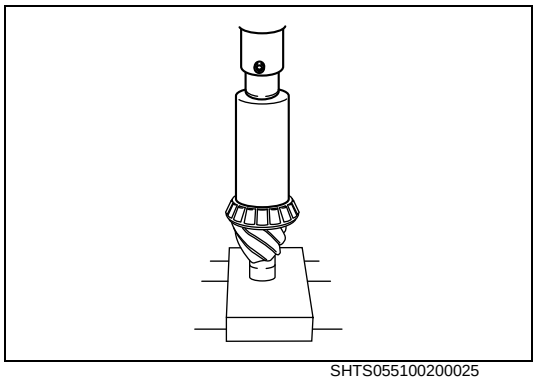
(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.


SHTS055100200024

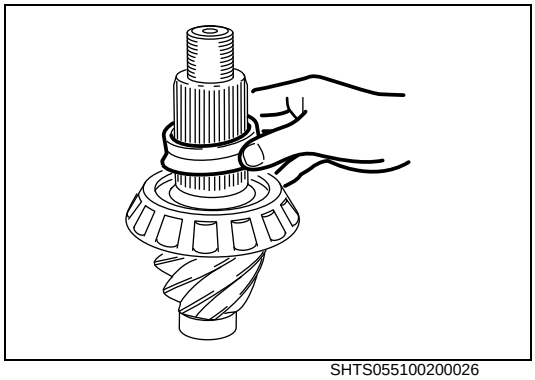
(2) Installing the cylindrical roller bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

⚠ CAUTION

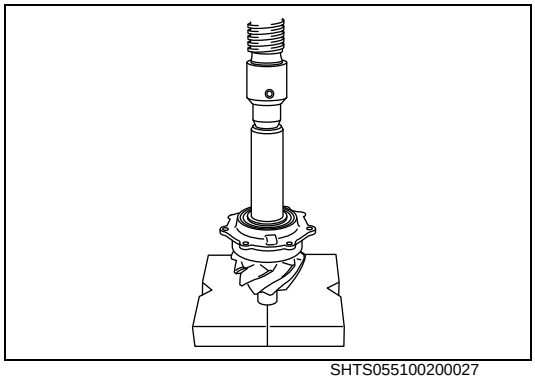
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS055100200025

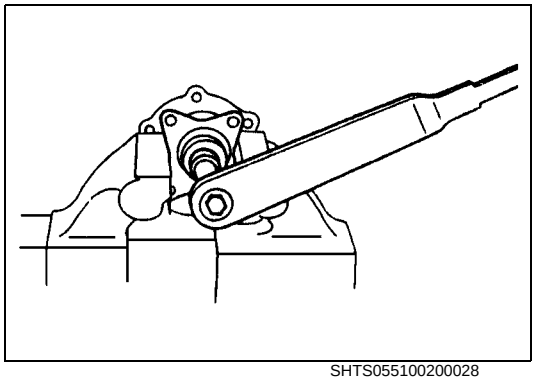
(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.


SHTS055100200026

c. Install the spacer.


SHTS055100200027

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


SHTS055100200028

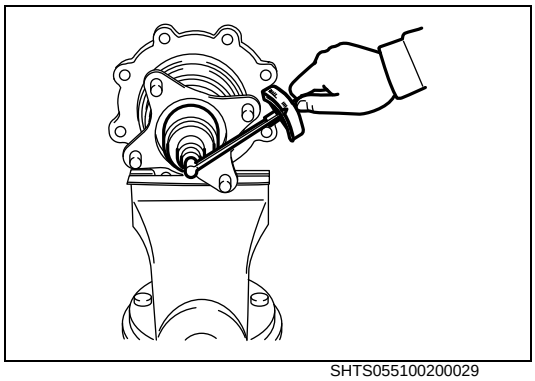
3. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-93606)


SHTS055100200029

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with adjusting shims.

Assembly Standard: Turning torque Unit: N·m {kgf·cm, lbf·ft}

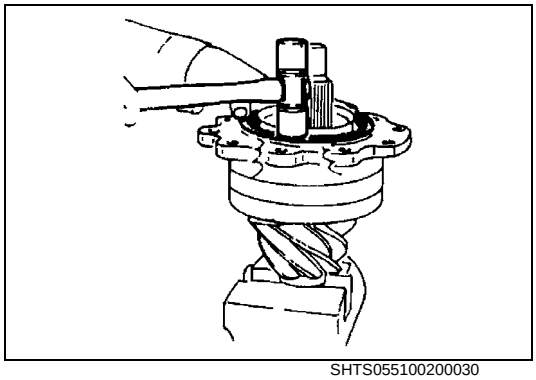
New bearing	Re-used bearing
1.47-1.96 {15-20, 1.1-1.4}	0.98-1.47 {10-15, 0.8-1.0}

Adjusting shim

Thickness: 0.40 mm {0.0157 in.]
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}

NOTICE

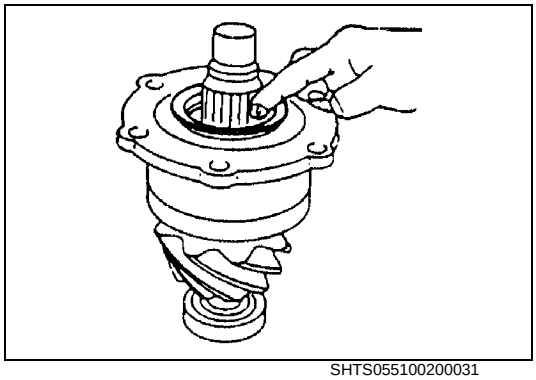
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.


SHTS055100200030

(3) After adjusting the preload, install the new oil seal.

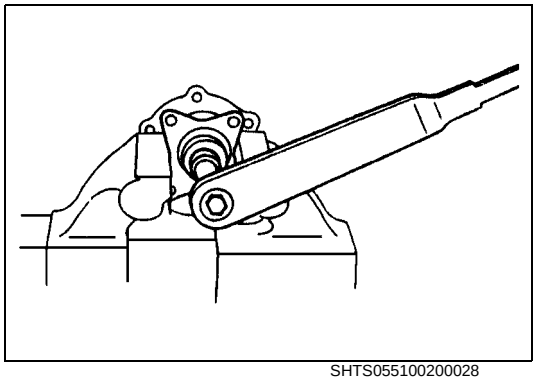
NOTICE

Tap the oil seal with small steps to make even the oil seal.

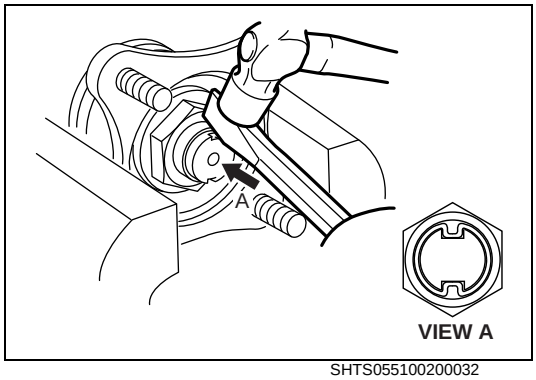

SHTS055100200031

NOTICE

Apply wheel bearing grease on the oil seal lip part.


SHTS055100200028

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-93606)

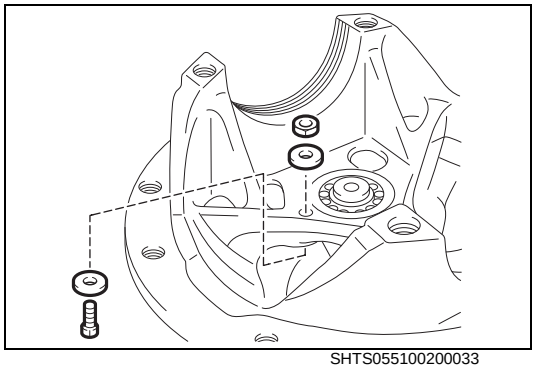


SHTS055100200032

(5) Using a chisel and a hammer, caulk the lock nut.

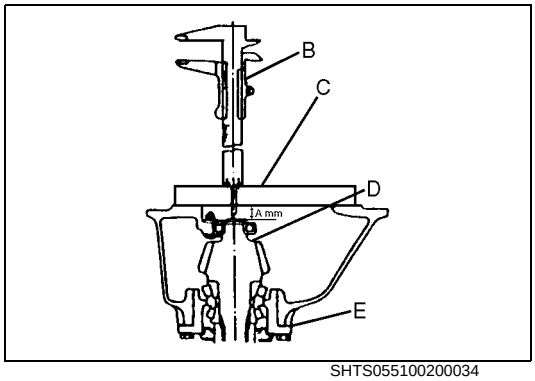
NOTICE

- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulked position.**


SHTS055100200033

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.



SHTS055100200034

5. ADJUSTMENT OF THE PINION FITTING HEIGHT (CONICAL DISTANCE)

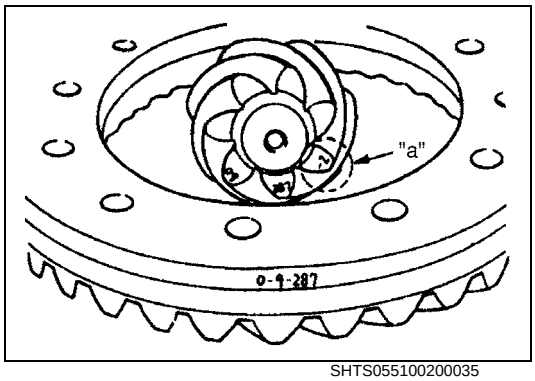
(1) Install the bearing cage assembly and adjust the height "A" by shims "E".
Standard pinion height: 24.5 mm {0.965 in.}

A: Pinion height
B: Vernier calipers
C: Straight edge
D: Engraved value for gear pinion fitting height adjustment
E: Adjusting shims

Adjusting shim
Thickness: 0.30 mm {0.0118 in.]
0.40 mm {0.0157 in.}
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}

EXAMPLE:
In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

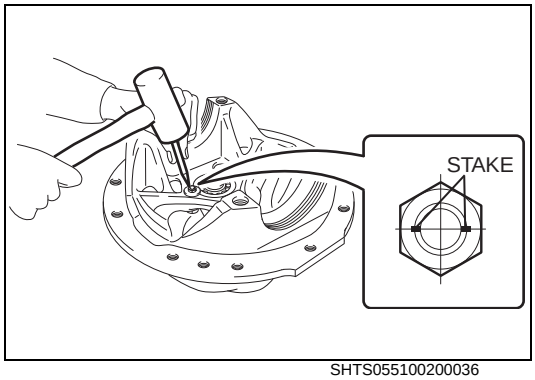
Standard pinion height "A"				Measuring part (A')
24.5 mm	–	0.2 mm	=	24.3 mm
		The engraved value "a"		



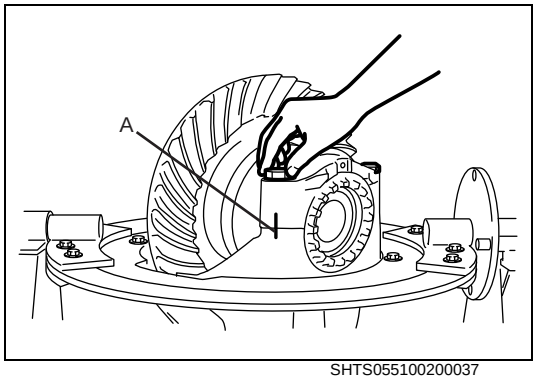
SHTS055100200035

NOTICE
Upon completing the adjustment, remove the bearing cage assembly and apply liquid gasket (ThreeBond 1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.

(2) Stake the lock nut securely as shown in the figure.



SHTS055100200036



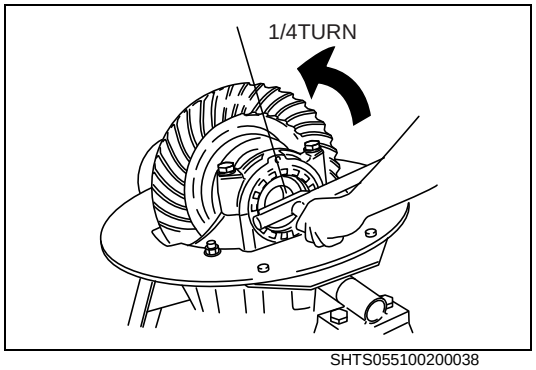
SHTS055100200037

6. ADJUSTMENT OF THE RING GEAR BACKLASH

(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE

Align the aligning marks "A".

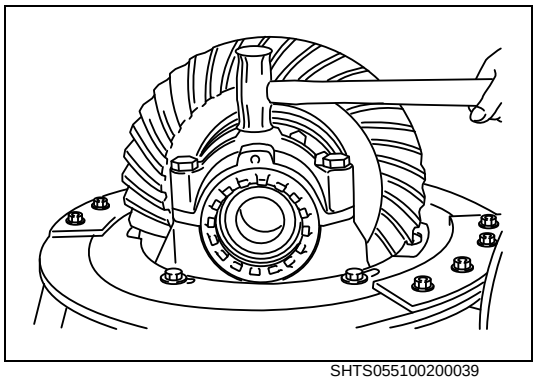


SHTS055100200038

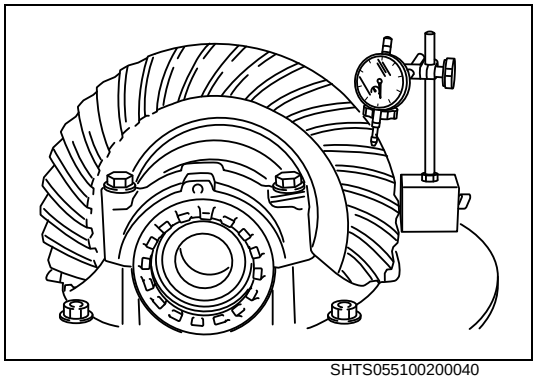
(2) Adjust the preload of the side bearing provisionally.

a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.

SST: Adjuster Tool (S0966-51190)

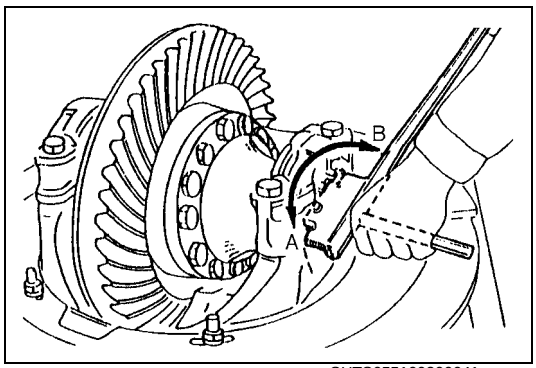

SHTS055100200039

b. Hit the bearing cap with a copper hammer.


SHTS055100200040

(3) Measure the gear backlash at three or four points on the circumference of the gear.

Assembly Standard: 0.20-0.28 mm {0.0079-0.0110 in.}

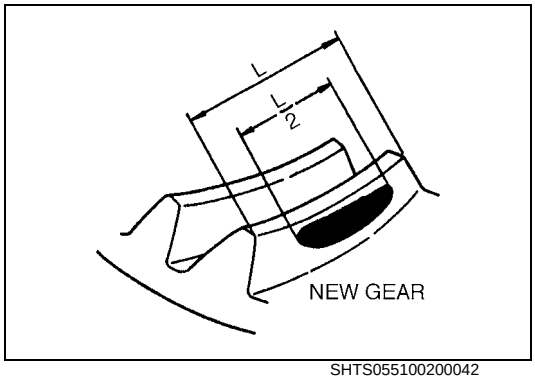


SHTS055100200041

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.

BACKLASH: "A"-Decrease "B"-Increase

SST: Adjuster Tool (S0966-51190)



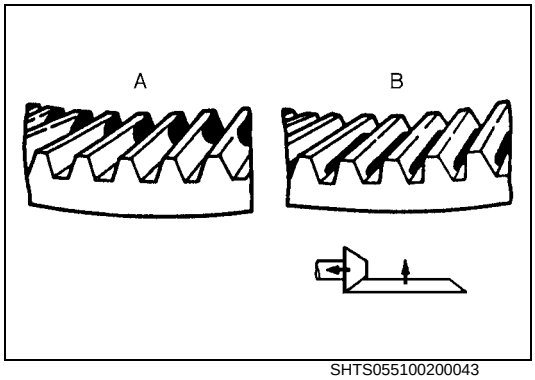
SHTS055100200042

7. INSPECTION AND ADJUSTMENT OF GEAR MESHING

(1) Satisfactory gear meshing.

NOTICE

New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.

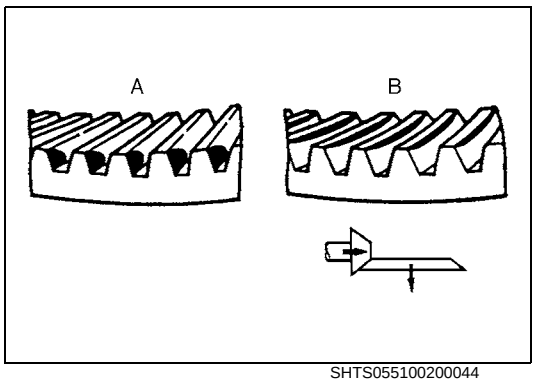


SHTS055100200043

(2) Example of the unsatisfactory engagement

a. Toe and flank contact

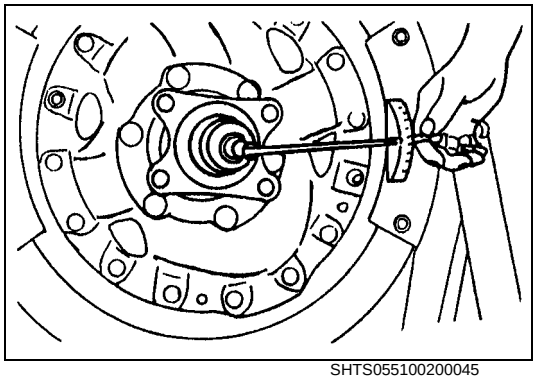
A: Toe contact -	Unadjust, replace the pinion and ring gear as a set.
B: Flank contact -	Adjust



SHTS055100200044

b. Heel and face contact

A: Heel contact -	Unadjust, replace the pinion and ring gear as a set.
B: Face contact -	Adjust


SHTS055100200045

8. MEASUREMENT AND ADJUSTMENT OF THE SIDE BEARING

(1) Measure the total preload using a torque wrench at the flange coupling.

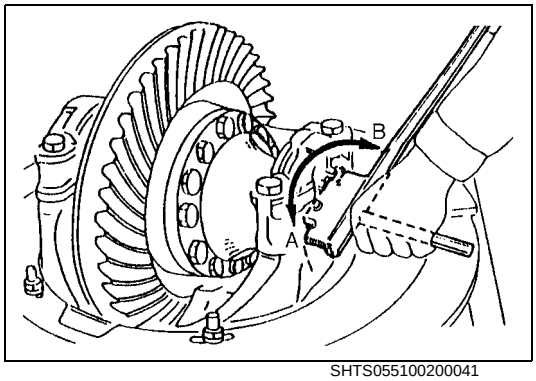
NOTICE

Total preload = Side bearing preload + Pinion bearing preload (refer to item 3).

Assembly standard:

Side bearing preload turning torque **Unit: N·m {kgf·cm, lbf·ft}**

New bearing	Re-used bearing
0.30-0.37 {3.0-3.8, 0.22-0.27}	0.20-0.28 {2.0-2.9, 0.15-0.20}

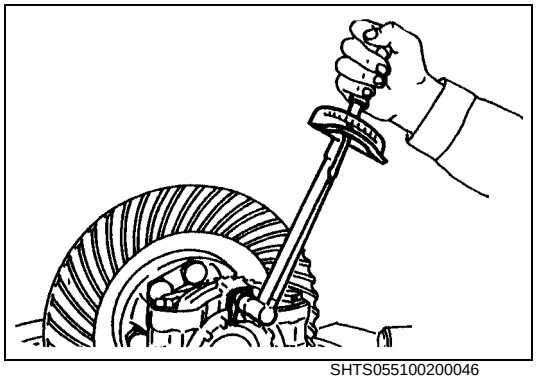


SHTS055100200041

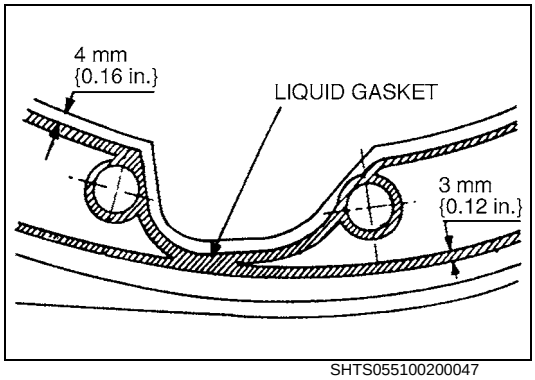
(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload

SST: Adjuster Tool (S0966-51190)


SHTS055100200046

(3) Tighten the bearing cap and install the lock plate.



SHTS055100200047

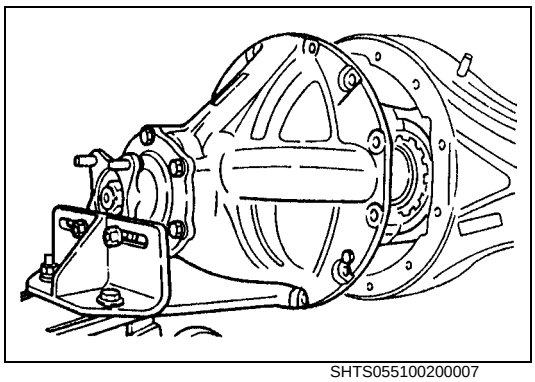
IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Apply liquid gasket on the face of the housing flange.

NOTICE

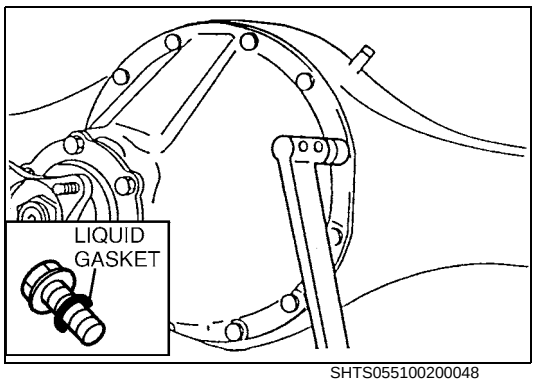
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 4 mm {0.16 in.} away from the edge.**


SHTS055100200007

(2) Using a jack, install the differential carrier assembly to the axle housing.

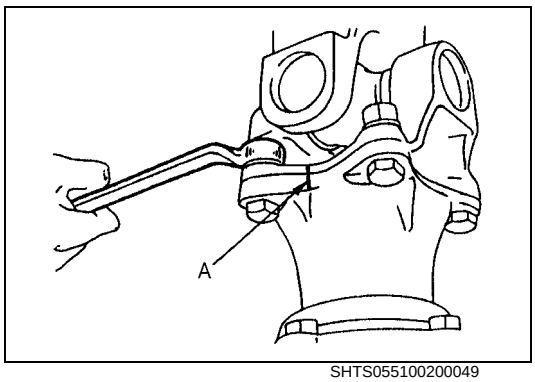
NOTICE

Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055100200048

(3) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ12 bolts (10 pieces), install the bolts and tighten them regularly.



SHTS055100200049

(4) Connect the propeller shaft.

NOTICE

Align the aligning marks "A".

Tightening Torque:
61-91 N·m {623-927 kgf·cm, 45-67 lbf·ft}

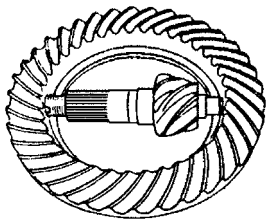
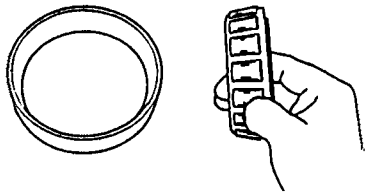
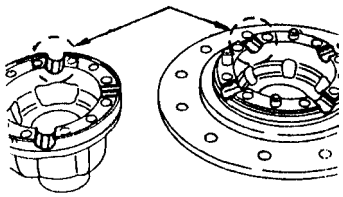
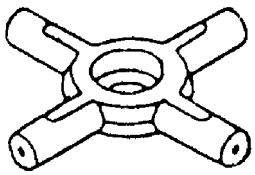
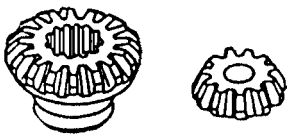
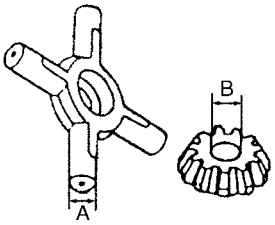
(5) Fill the axle housing with specified gear oil up to the filler plug hole.

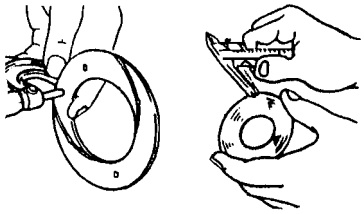
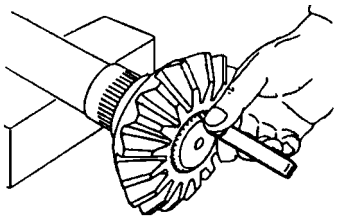
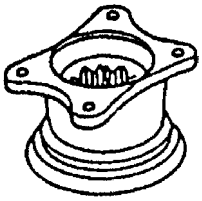
Gear oil:
Refer to the owner's manual.

INSPECTION AND REPAIR

EN0551002H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 22 {0.866} B-A: 0.140-0.261 {0.0056-0.0103}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.9-2.1 {0.075-0.082}**	**1.7 {0.067}**	**Replace.**	**Measure** 
	Pinion gear: 1.5-1.7 {0.060-0.066}	**1.3 {0.051}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

DIFFERENTIAL CARRIER (SS15)

DF02-008

DIFFERENTIAL CARRIER (SS15) DF02-2

DATA AND SPECIFICATIONS..... DF02-2
DESCRIPTION DF02-2
TROUBLESHOOTING..... DF02-3
SPECIAL TOOL..... DF02-3
COMPONENT LOCATOR DF02-4
OVERHAUL DF02-6
INSPECTION AND REPAIR..... DF02-18

DIFFERENTIAL CARRIER (SS15)

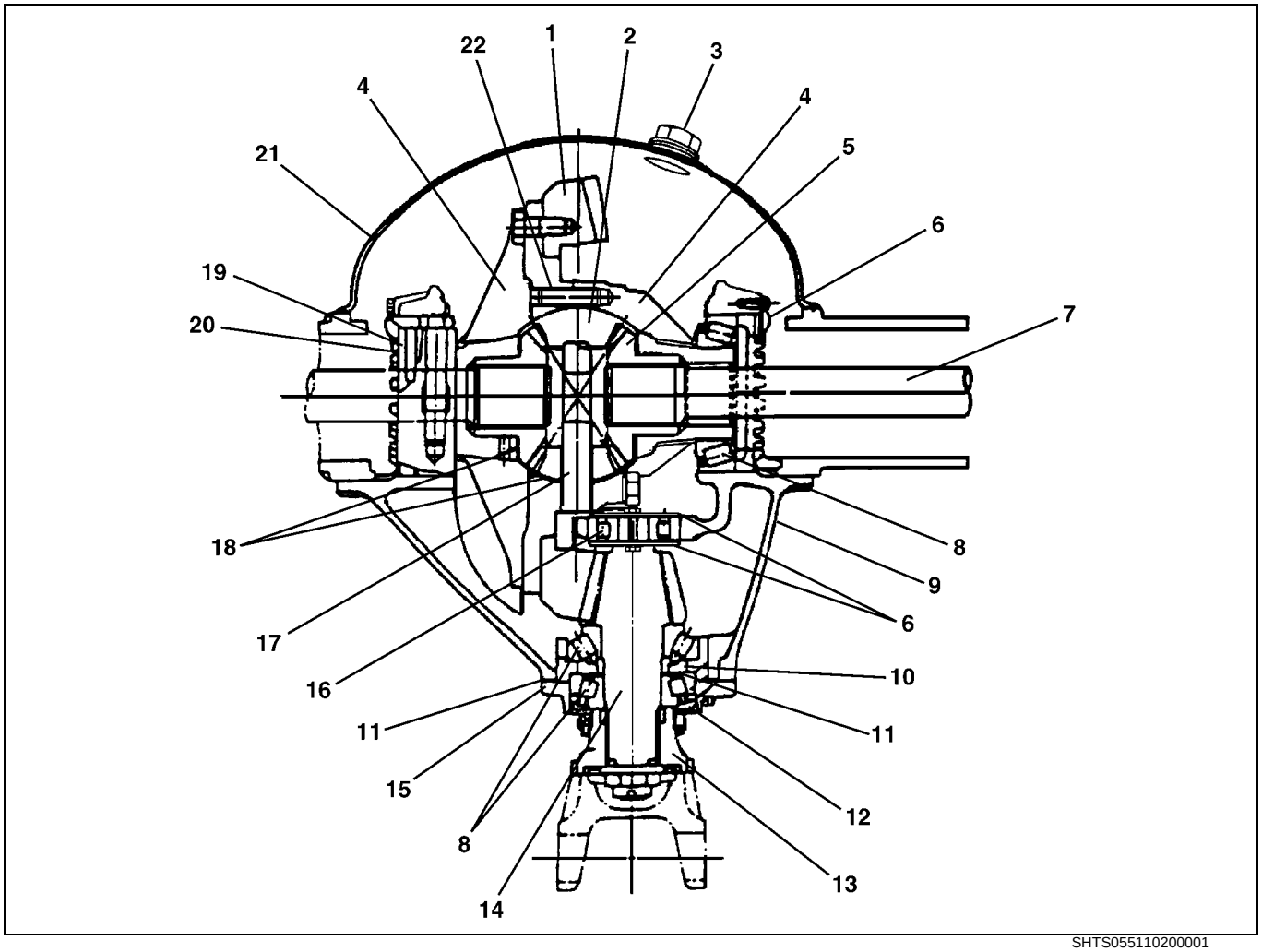
DATA AND SPECIFICATIONS

EN0551102I200001

Type	**Single-reduction, single-speed, by Spiral bevel gearing**
Gear ratio	**5.428**
Oil capacity	**7 L {1.54 lmp gal. / 1.85 U.S. gal.}**

DESCRIPTION

EN0551102C100001



SHTS055110200001

1	Ring gear	9	Differential carrier case	17	Spider
2	Differential pinion gear	10	Spacer	18	Thrust washer
3	Oil filler plug	11	Adjusting shim	19	Bearing cap
4	Differential case	12	Oil seal	20	Adjusting nut
5	Differential side gear	13	Flange yoke coupling	21	Axle housing
6	Lock plate	14	Drive pinion	22	Straight pin
7	Axle shaft	15	Bearing cage		
8	Taper roller bearing	16	Cylindrical roller bearing		

TROUBLESHOOTING

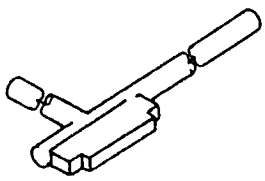
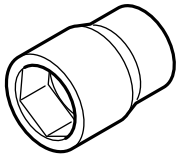
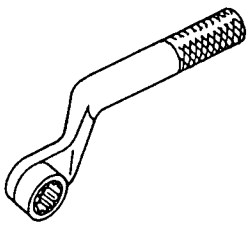
EN0551102F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Front axle system)	Worn front axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil; check for leakage.
	Poor oil quality	Change oil.
	Abnormal propeller shaft noise	Refer to the chapter **"PROPELLER SHAFT"**.

SPECIAL TOOL

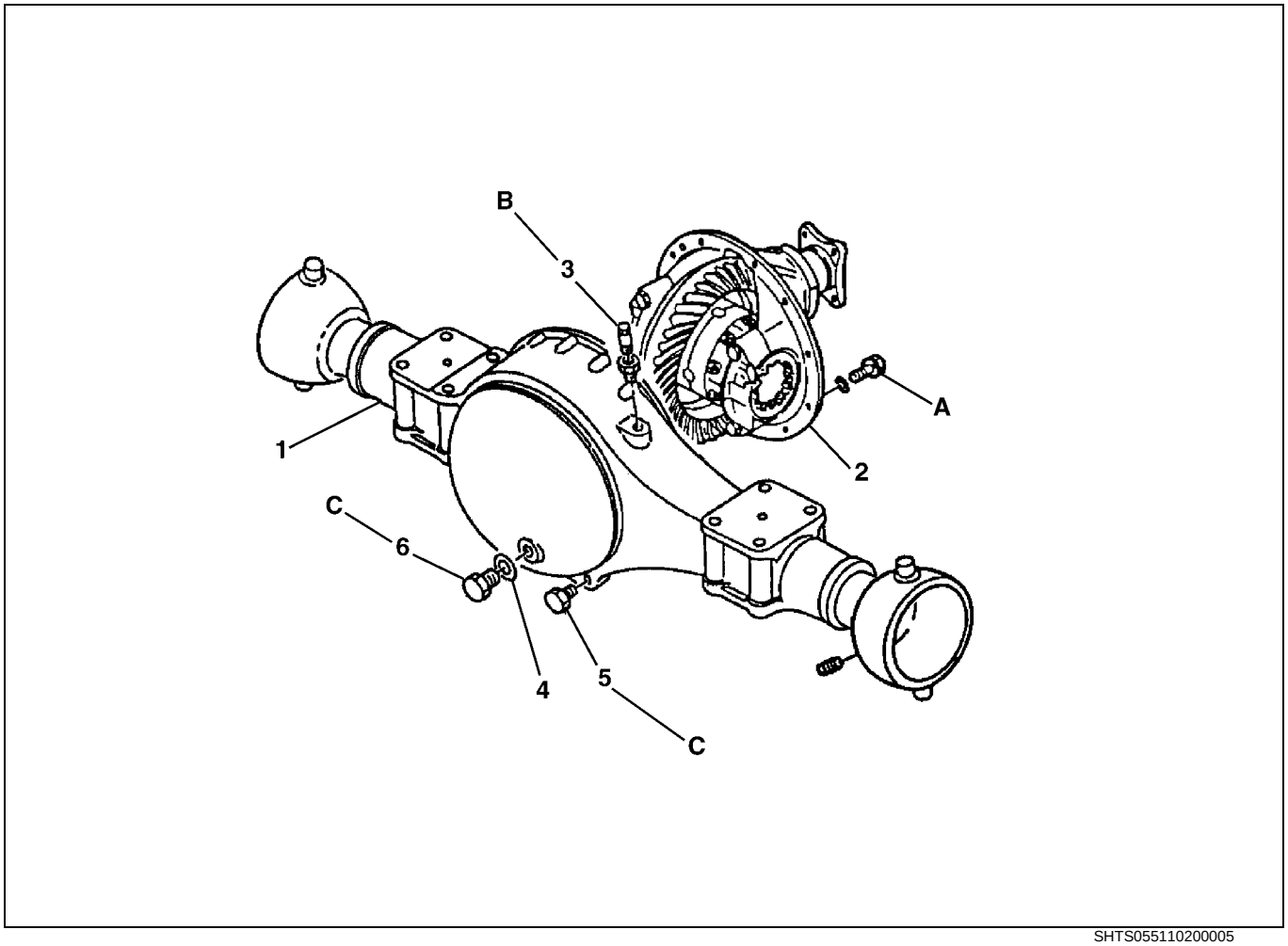
EN0551102K100001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0966-51040	ADJUSTER TOOL	
	S0983-94104	SOCKET WRENCH	
	S0960-31150	SOCKET WRENCH	

COMPONENT LOCATOR

EN0551102D100001

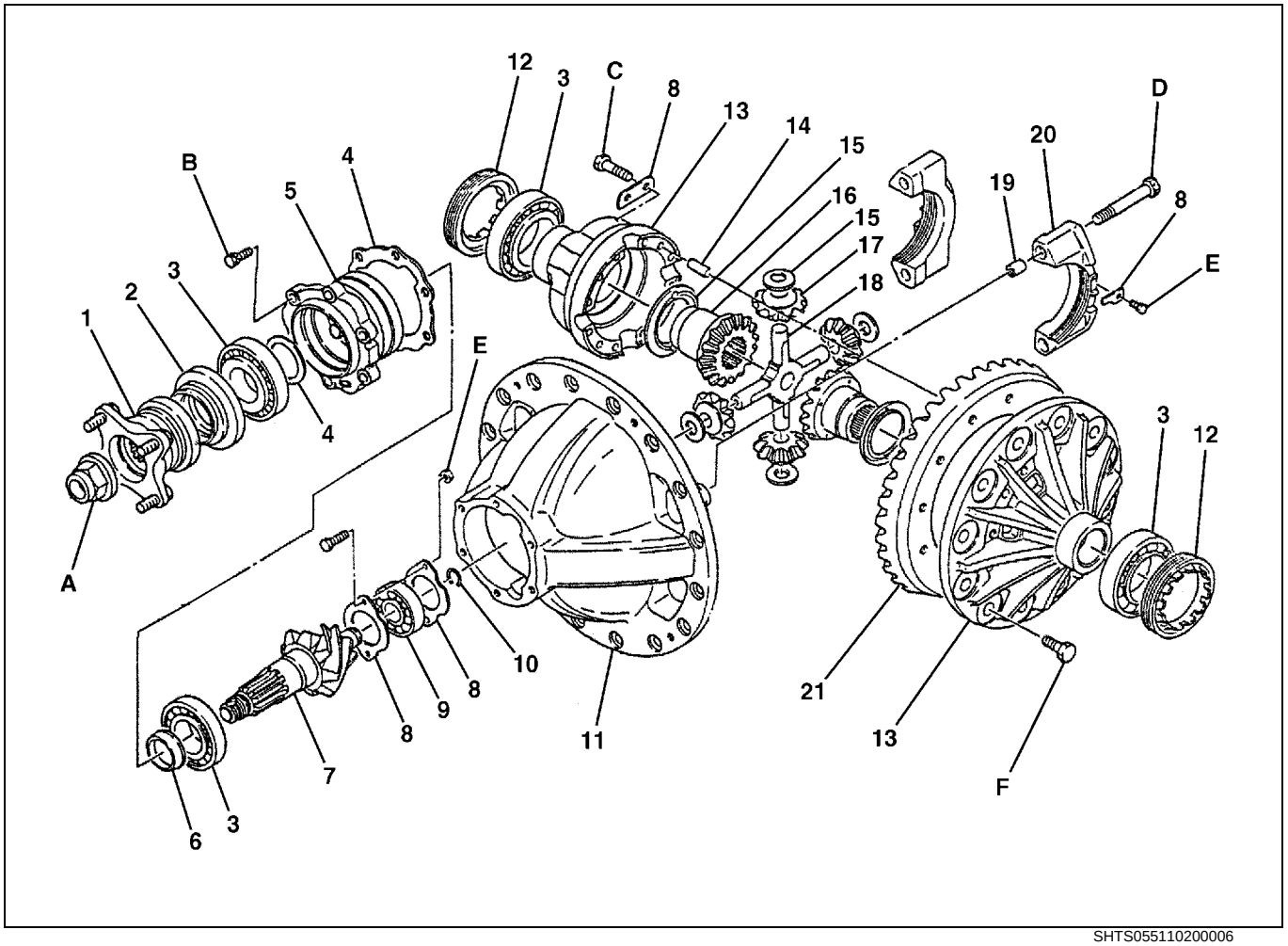


SHTS055110200005

1	Axle housing assembly	4	Gasket
2	Differential carrier assembly	5	Oil drain plug
3	Air breather	6	Oil filler plug

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	85.4-107.8 {870-1,100, 63-79}	C	78.5-117.5 {800-1,200, 58-86}
B	9.8-19.6 {100-200, 7.3-14.4}		



SHTS055110200006

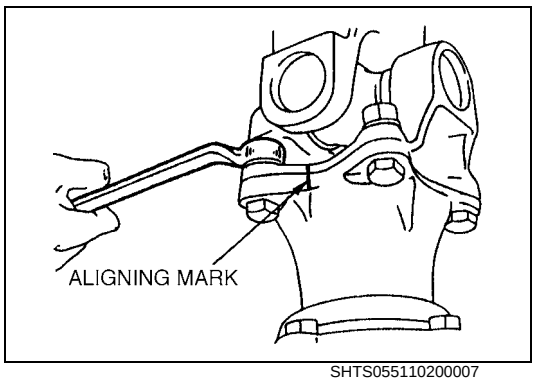
1	Flange yoke coupling	12	Adjusting nut
2	Oil seal	13	Differential case
3	Taper roller bearing	14	Straight pin
4	Adjusting shim	15	Thrust washer
5	Bearing cage	16	Differential side gear
6	Spacer	17	Differential pinion gear
7	Drive pinion	18	Spider
8	Lock plate	19	Collar
9	Cylindrical roller bearing	20	Bearing cap
10	Retainer ring	21	Ring gear
11	Differential carrier case		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	589-781 {6,000-7,965, 434-576}	D	277-353 {2,825-3,600, 204-260}
B	113-147 {1,152-1,500, 83-108}	E	19-25 {194-255, 14-18}
C	19-25 {194-255, 14-18}	F	368-422 {3,753-4,303, 272-311}

OVERHAUL

EN0551102H200001



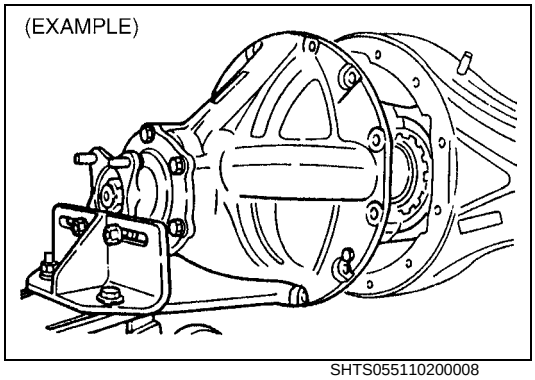
SHTS055110200007

IMPORTANT POINTS - DISMOUNTING

1. DISCONNECT THE PROPELLER SHAFT.

NOTICE

Make aligning marks before disassembling.

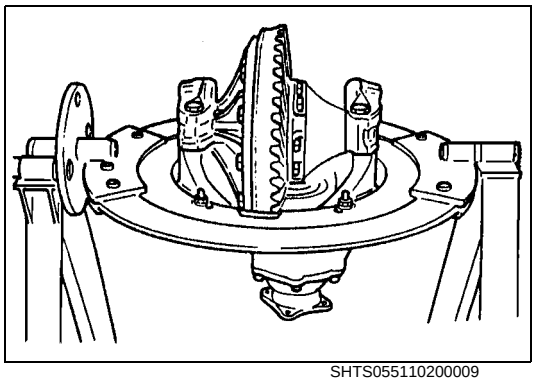


SHTS055110200008

2. DISMOUNTING OF THE DIFFERENTIAL CARRIER ASSEMBLY

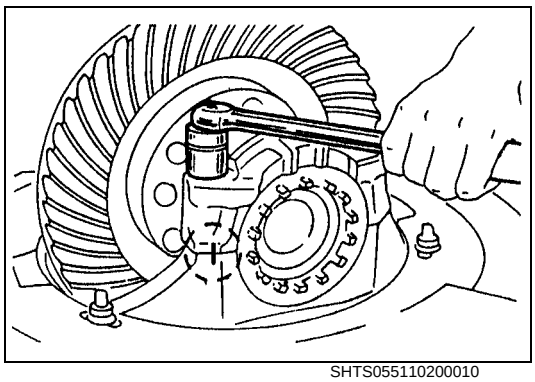
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


SHTS055110200009

IMPORTANT POINTS - DISASSEMBLY

1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.


SHTS055110200010

2. DIFFERENTIAL CASE

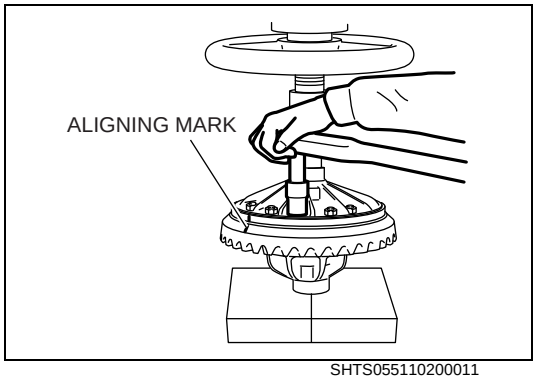
(1) Remove the bearing cap.

NOTICE

Make aligning marks before disassembling.

SST: Socket wrench (S0960-31150)

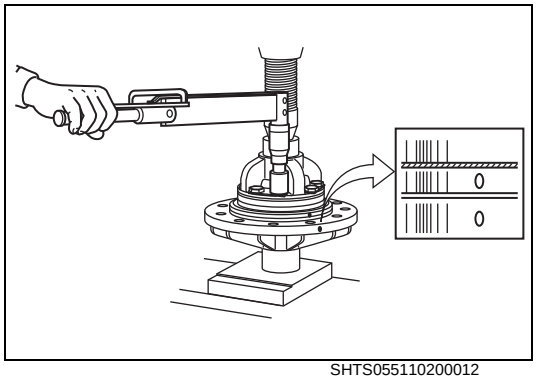
(2) Using a puller, remove the taper roller bearing.



SHTS055110200011

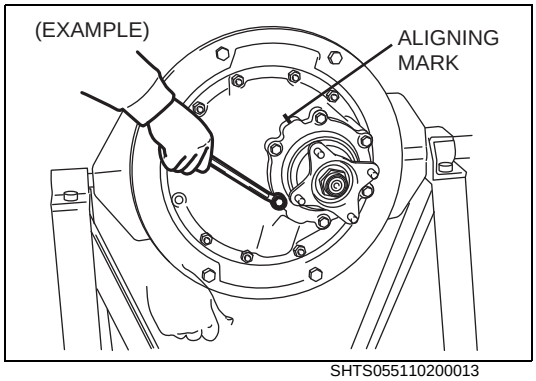
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts and then ring gear.

NOTICE
Be careful not to drop the ring gear.


SHTS055110200012

(4) Disassemble the differential case.

NOTICE
Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.

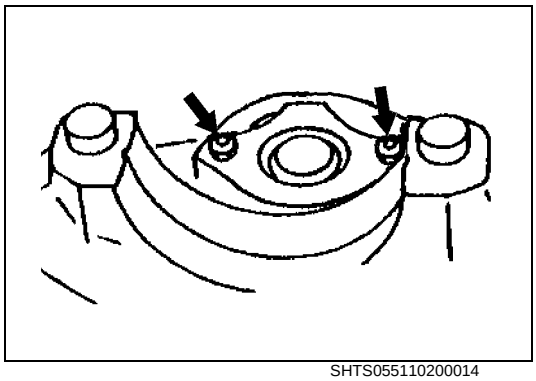


SHTS055110200013

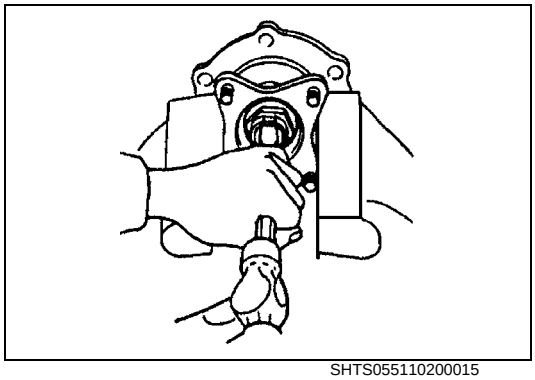
3. DRIVE PINION

(1) Remove the bolts and then dismount the drive pinion and the shims.

NOTICE
Make aligning mark the differential cage and differential carrier.

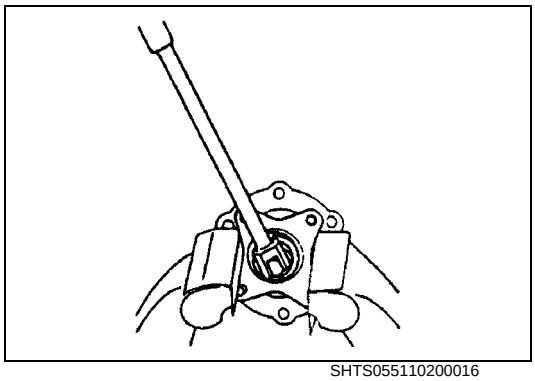

SHTS055110200014

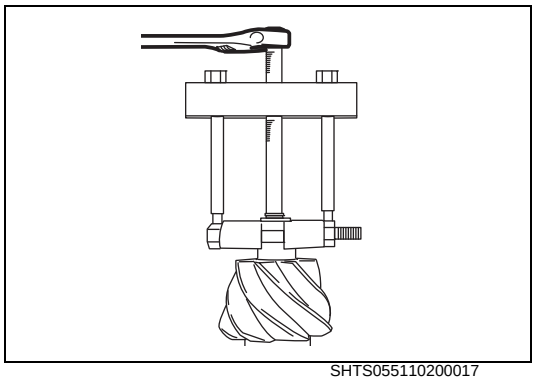
(2) Remove the bolts, nuts, and lock plates.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


SHTS055110200015

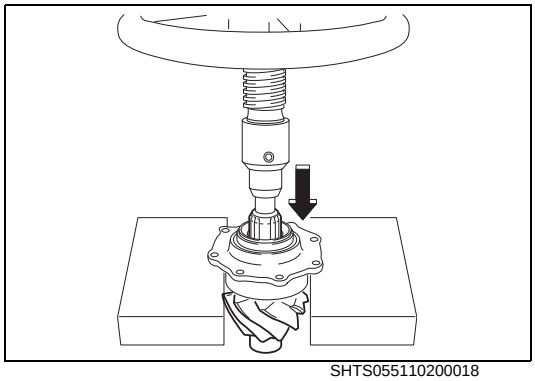
4. BEARING CAGE

(1) Uncaulk the lock nut and remove the nut.
SST: Socket Wrench (S0983-94104)

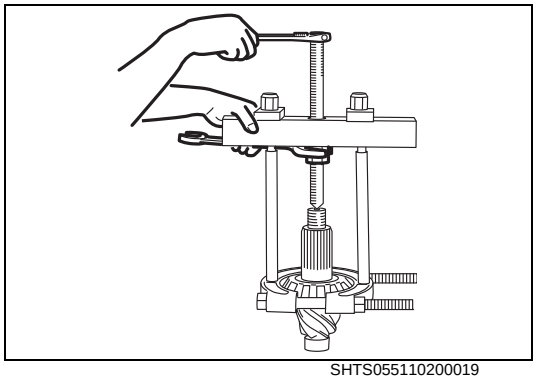

SHTS055110200016


SHTS055110200017

(2) Using a puller, remove the cylindrical roller bearing inner race.


SHTS055110200018

(3) Using a press, remove the drive pinion.


SHTS055110200019

(4) Using a puller, remove the taper roller bearing inner race.

IMPORTANT POINTS - ASSEMBLY

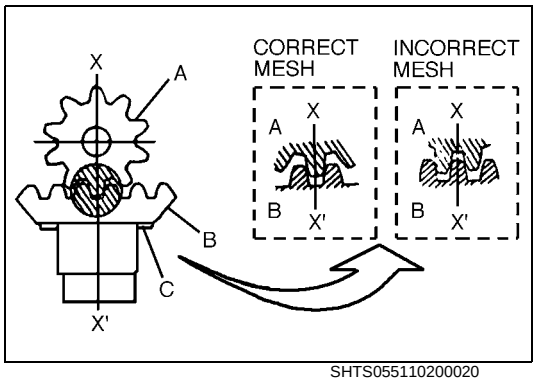
1. DIFFERENTIAL CASE

(1) Measure the pinion backlash.

NOTICE

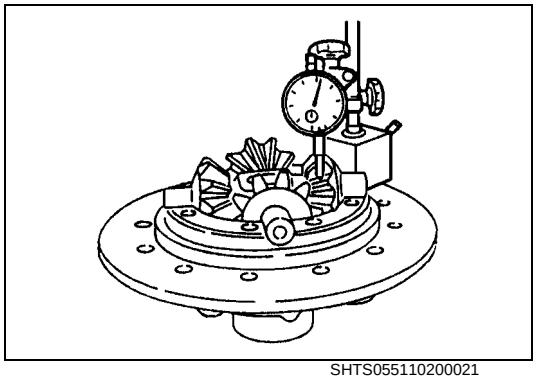
Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.

- A: Pinion
- B: Side gear
- C: Thrust washer



SHTS055110200020

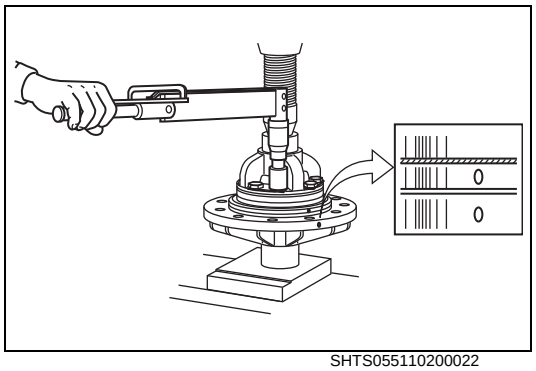
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
Assembly standard: 0.20-0.60 mm {0.0079-0.0236 in.}
Service Limit: 0.9 mm {0.0354 in.}

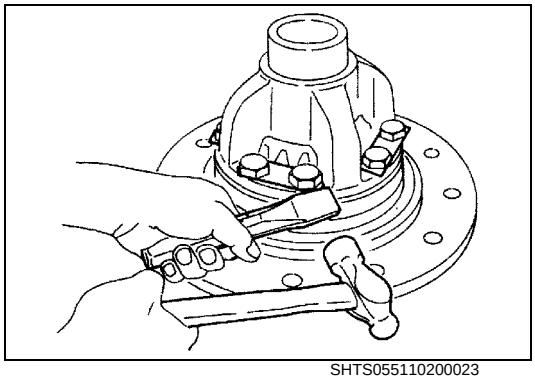

SHTS055110200021

(3) Assemble the differential case.

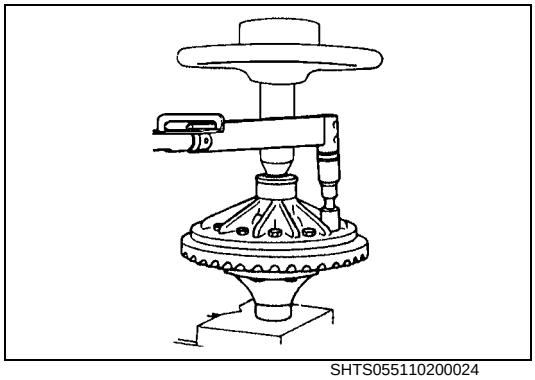
NOTICE

Align the aligning marks when assembling.


SHTS055110200022


SHTS055110200023

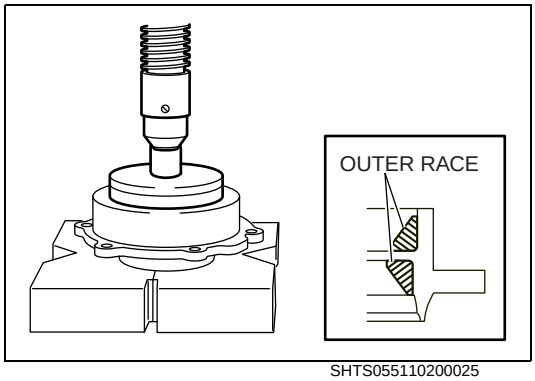
(4) Bend the lock plates.


SHTS055110200024

(5) Install the ring gear to the differential case and tighten it with bolts and nuts.

NOTICE

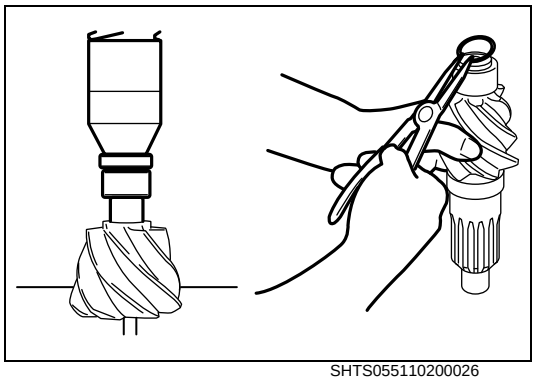
Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.



SHTS055110200025

2. DRIVE PINION

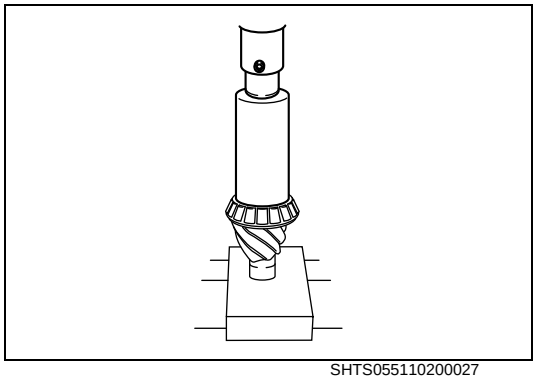
(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.


SHTS055110200026

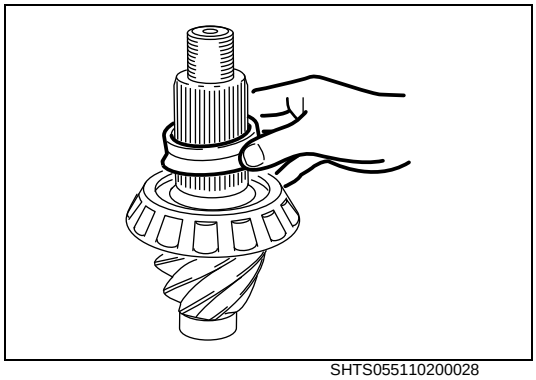
(2) Installing the cylindrical roller bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

⚠ CAUTION

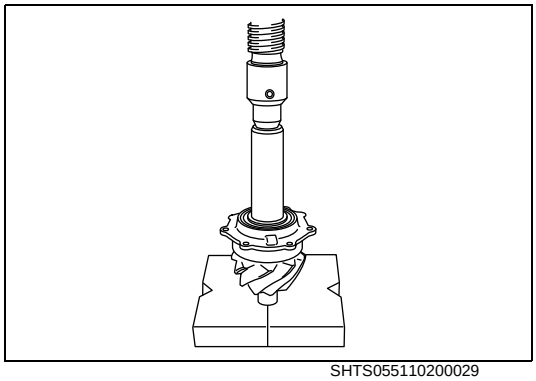
The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.


SHTS055110200027

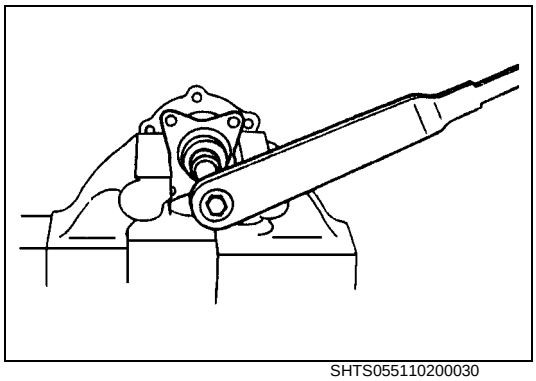
(3) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.


SHTS055110200028

   c. Install the spacer.


SHTS055110200029

(4) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the differential cage and outer taper roller bearing inner race.


SHTS055110200030

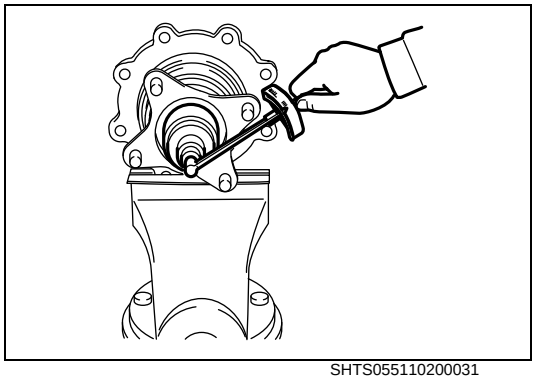
3. ADJUSTMENT OF THE PINION BEARING PRELOAD.

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

NOTICE

The oil seal must be installed in the bearing cage after measurement of the preload.

SST: Socket Wrench (S0983-94104)


SHTS055110200031

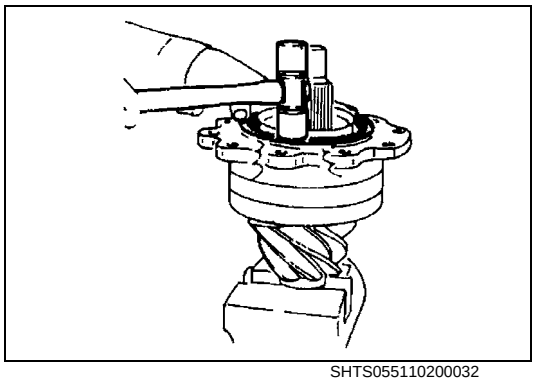
(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with adjusting shims.

Assembly Standard: Turning torque **Unit: N·m {kgf·cm, lbf·ft}**

New bearing	Re-used bearing
1.97-2.94 {20-30, 1.5-2.1}	1.47-2.45 {15-25, 1.1-1.8}

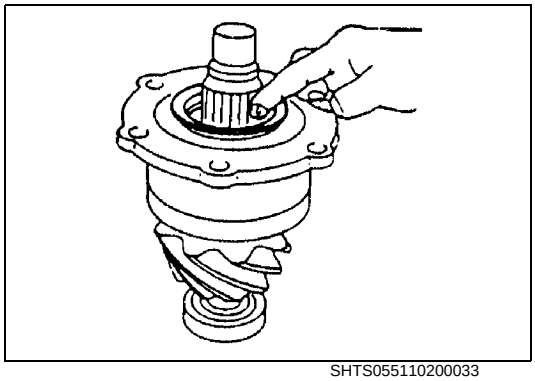
Adjusting shim
Thickness: 0.40 mm {0.0157 in.]
0.45 mm {0.0177 in.}
0.50 mm {0.0197 in.}

NOTICE
Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.

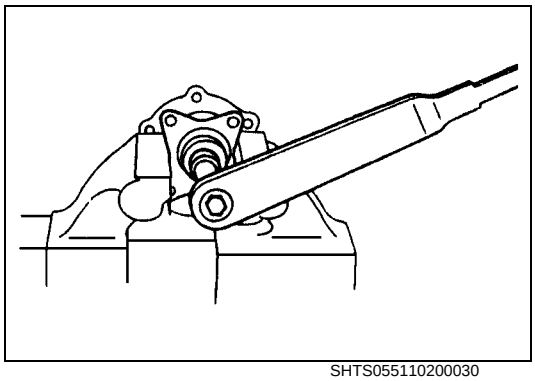

SHTS055110200032

(3) After adjusting the preload, install the new oil seal.

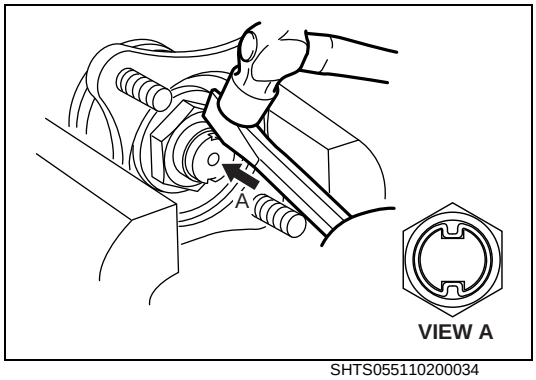
NOTICE
Tap the oil seal in small steps and evenly to prevent it from being at slant position.


SHTS055110200033

NOTICE
Apply wheel bearing grease on the oil seal lip part.


SHTS055110200030

(4) Install the flange yoke coupling and tighten the lock nut.
SST: Socket Wrench (S0983-94104)

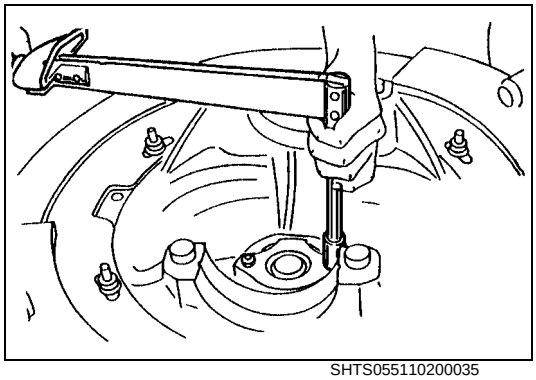


SHTS055110200034

(5) Using a chisel and a hammer, caulk the lock nut.

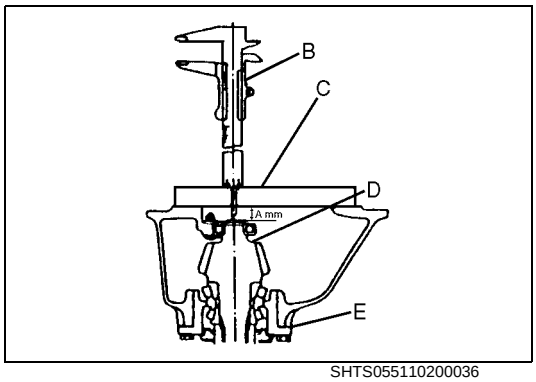
NOTICE

- **Caulk the nut securely as shown the figure.**
- **Make sure that there is no rift in the caulked position.**


SHTS055110200035

4. INSTALLATION OF THE CYLINDRICAL ROLLER BEARING OUTER RACE

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race.
(3) Install the bearing lock plates and tighten the nuts and bolts.



SHTS055110200036

5. ADJUSTMENT OF THE PINION FITTING HEIGHT (CONICAL DISTANCE)

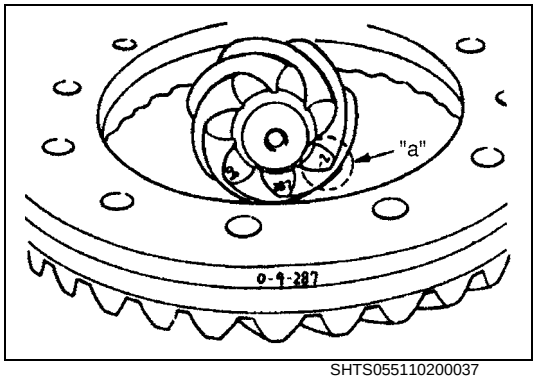
(1) Install the bearing cage assembly and adjust the height "A" by shims "E".
Standard pinion height: 35 mm {1.378 in.}

A: Pinion height
B: Vernier calipers
C: Straight edge
D: Engraved value for gear tooting adjustment
E: Adjusting shims

Adjusting shim
Thickness: 0.30 mm {0.0118 in.]
0.40 mm {0.0157 in.}
0.50 mm {0.0197 in.}

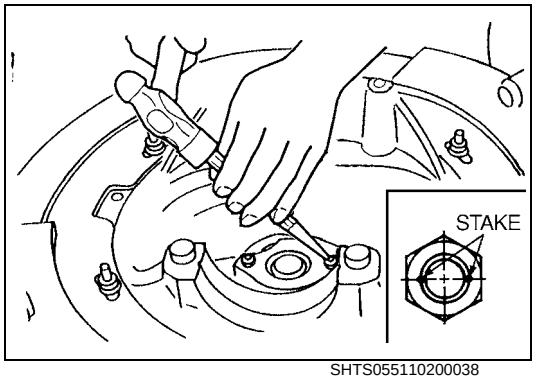
EXAMPLE:
In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):

Standard pinion height "A"		The engraved value "a"		Measuring part (A')
35.0 mm	–	0.2 mm	=	34.8 mm



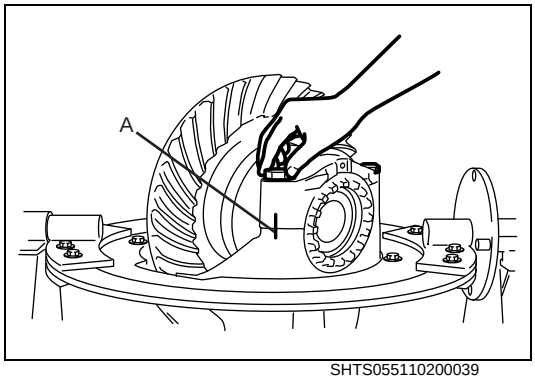
SHTS055110200037

NOTICE
Upon completing the adjustment, remove the bearing cage assembly and apply liquid gasket (ThreeBond 1102 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.



SHTS055110200038

(2) Stake the lock nut securely as shown in the figure.

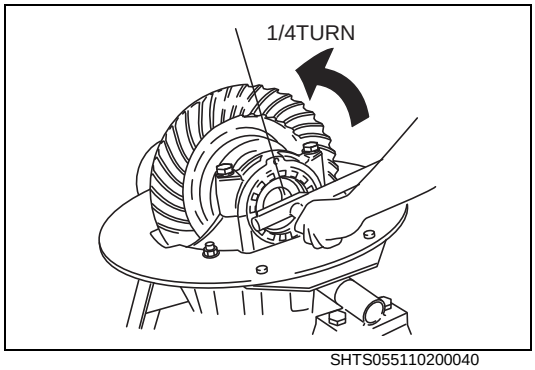


SHTS055110200039

6. ADJUSTMENT OF THE RING GEAR BACKLASH

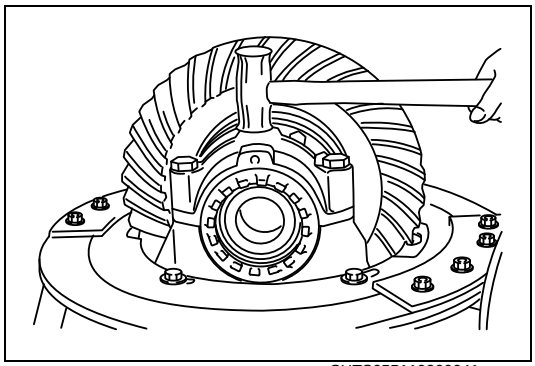
(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

NOTICE
Align the aligning marks "A".

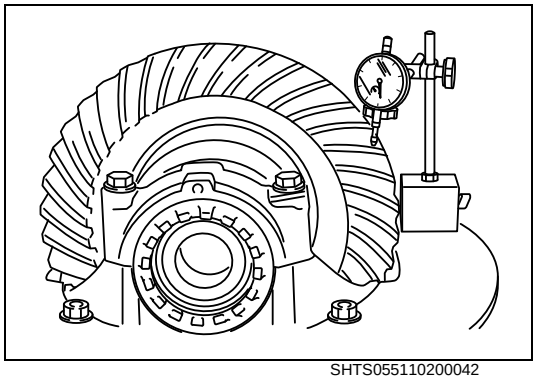


SHTS055110200040

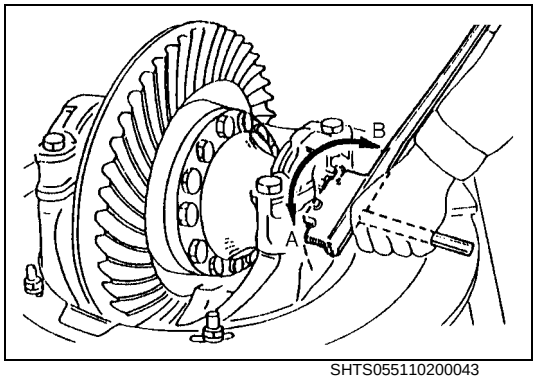
(2) Adjust the preload of the side bearing provisionally.
   a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.
   SST: Adjuster Tool (S0966-51040)


SHTS055110200041

   b. Hit the bearing cap with a copper hammer.

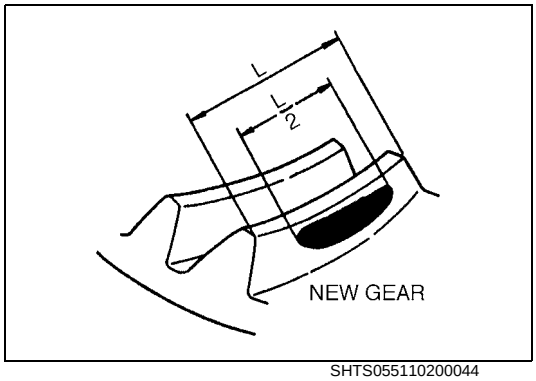

SHTS055110200042

(3) Measure the gear backlash at three or four points on the circumference of the gear.
Assembly Standard: 0.20-0.28 mm {0.0079-0.0110 in.}



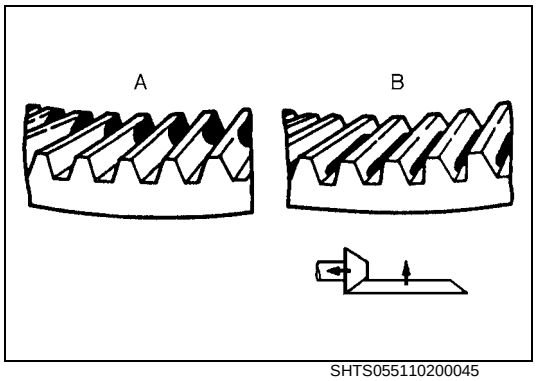
SHTS055110200043

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: "A" -Decrease "B" -Increase
SST: Adjuster Tool (S0966-51040)



SHTS055110200044

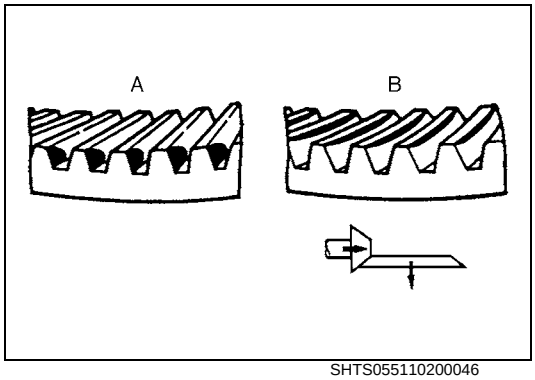
7. INSPECTION AND ADJUSTMENT OF GEAR MESHING
(1) Satisfactory gear meshing.
NOTICE
New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.



SHTS055110200045

(2) Example of the unsatisfactory engagement
a. Toe and flank contact

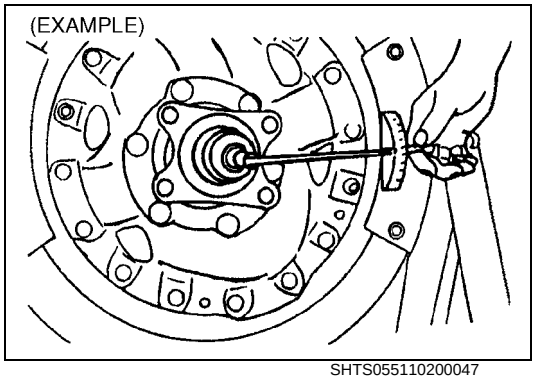
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact- Adjust



SHTS055110200046

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust



SHTS055110200047

8. MEASUREMENT AND ADJUSTMENT OF THE SIDE BEARING

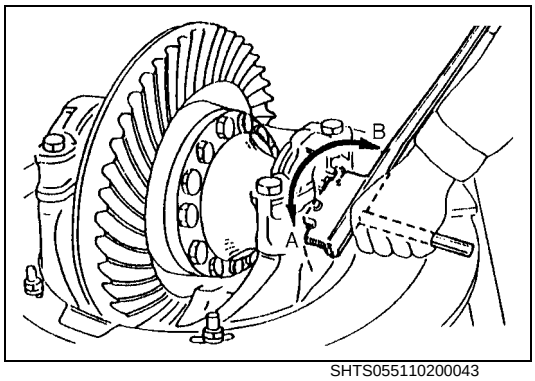
(1) Measure the total preload using a torque wrench at the flange coupling.

NOTICE
Total preload = Side bearing preload + Pinion bearing preload (refer to item 3).

Assembly standard:
Side bearing preload turning torque **Unit: N·m {kgf·cm, lbf·ft}**

New bearing	Re-used bearing
0.37-0.54 {3.7-5.5, 0.28-0.38}	0.28-0.45 {2.8-4.6, 0.21-0.33}

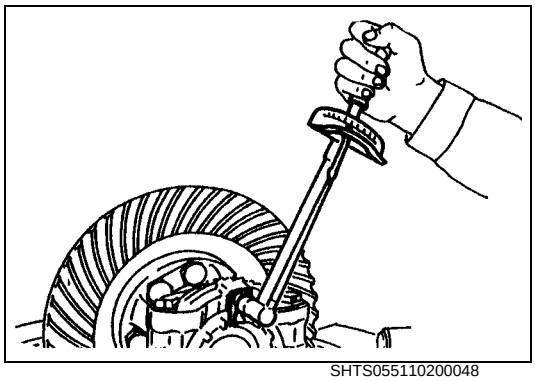
NOTICE
The gear ratio is indicated on the bearing cage.



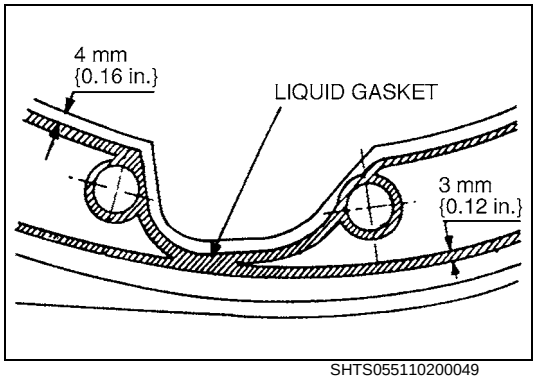
SHTS055110200043

(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload
  SST: Adjuster Tool (S0966-51040)


SHTS055110200048

(3) Tighten the bearing cap and install the lock plate.



SHTS055110200049

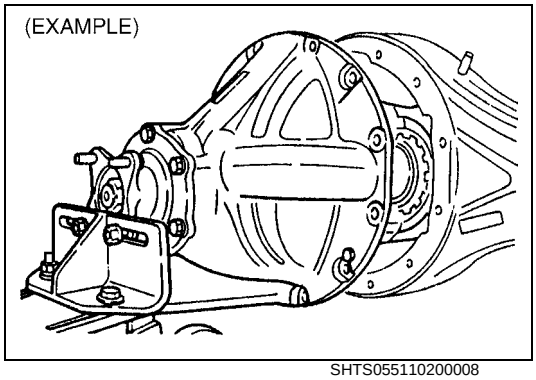
IMPORTANT POINT - MOUNTING

1. MOUNTING

(1) Apply liquid gasket on the face of the housing flange.

NOTICE

- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 4 mm {0.16 in.} away from the edge.**

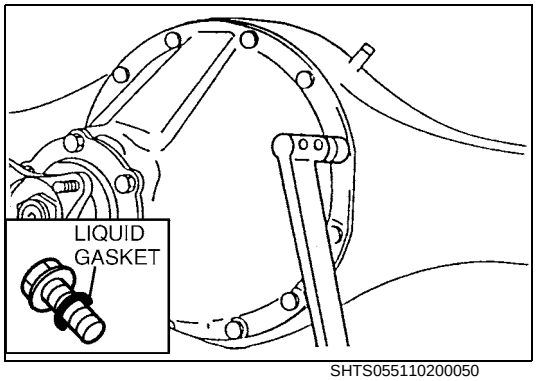


SHTS055110200008

(2) Using a jack, install the differential carrier assembly to the axle housing.

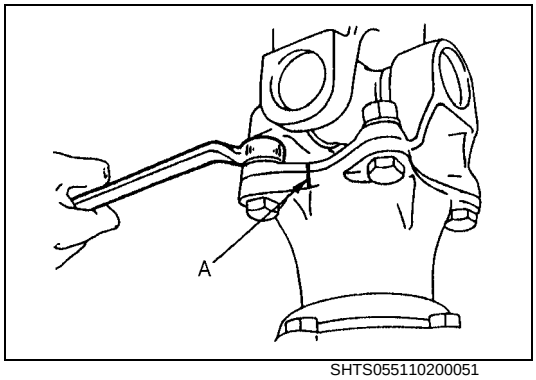
NOTICE

Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.



SHTS055110200050

(3) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ14 bolts (16 pieces), install the bolts and tighten them regularly.



SHTS055110200051

(4) Connect the propeller shaft.

NOTICE

Align the aligning marks "A".

Tightening Torque:
61-91 N·m {623-927 kgf·cm, 45-67 lbf·ft}

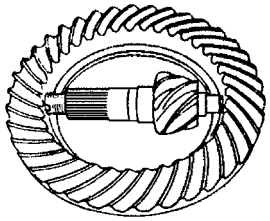
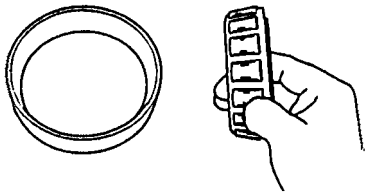
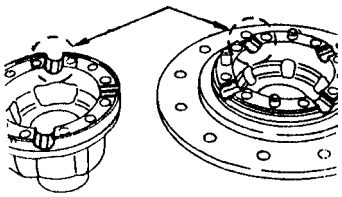
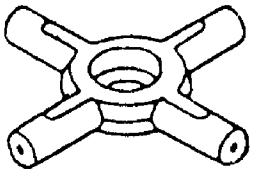
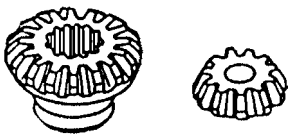
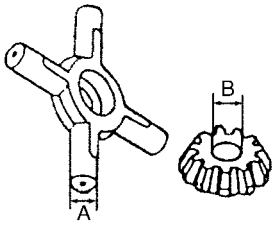
(5) Fill the axle housing with specified gear oil up to the filler plug hole.

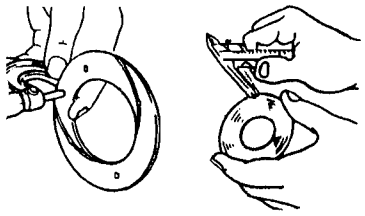
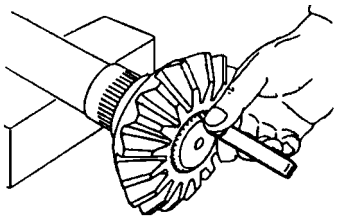
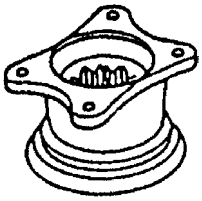
Gear oil:
Refer to the owner's manual.

INSPECTION AND REPAIR

EN0551102H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Pinion and ring gear: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Bearing and race: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential case spider holes: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Differential side gear and pinion: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Spider and pinion: Clearance	**A: 26 {1.024} B-A: 0.140-0.201 {0.0055-0.0079}**	**0.4 {0.016}**	**Replace.**	**Measure** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Thrust washers thickness (Side gear and pinion gear)	**Side gear: 1.5-1.7 {0.059-0.066}**	**1.3 {0.051}**	**Replace.**	**Measure** 
	Pinion gear: 1.45-1.75 {0.057-0.068}	**1.3 {0.051}**		
Differential side gear and axle shaft: Spline backlash	**0.054-0.148 {0.0021-0.0058}**	**0.5 {0.0196}**	**Replace.**	**Measure** 
Flange coupling: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

Hino Motors, Ltd.

Pub. No. **S1-YFCE18A ’06-9**
S1-YFCE18B ’06-11
S1-YFCE18C ’07-3
S1-YFCE18D ’07-8
S1-YFCE18E ’07-12
S1-YFCE18F 1/3 ’08-3
S1-YFCE18G 1/3 ’08-5
S1-YFCE18H 1/3 ’08-7
S1-YFCE18I 1/3 ’09-2
S1-YFCE18J 1/3 ’10-2
S1-YFCE18K 1/3 ’10-4