2001-08 MANUAL TRANSMISSIONS

Overhaul - M15M-D 5-speed - Miata

APPLICATION

MANUAL TRANSMISSION APPLICATIONS

Application	Transmission Model
MX-5 Miata	M15M-D

MANUAL TRANSMISSION

GENERAL PROCEDURES (MANUAL TRANSMISSION)

Precaution Transmission Disassembly/Assembly

- Clean the transmission exterior thoroughly with a steam cleaner or cleaning solvent before disassembly.

WARNING:

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

- Clean the removed parts (except sealed bearings) and all sealing surfaces with cleaning solvent, and dry with compressed air. Clean out all holes and passages with compressed air, and verify that there are no obstructions.
- All O-rings and gaskets must be replaced with the new ones included in the overhaul kit.
- Before assembly, make sure all parts are completely clean.
- Assemble the parts within 10 minutes after applying sealant. Allow all sealant to cure at least 30 minutes after assembly before filling the transmission with transmission oil.

Clutch Hub

- For the synchronizer components, align the synchronizer ring grooves and synchronizer keys.
- The synchronizer rings can be distinguished as shown in the figure. The inner diameter of the 2nd synchronizer ring is larger than the 1st.

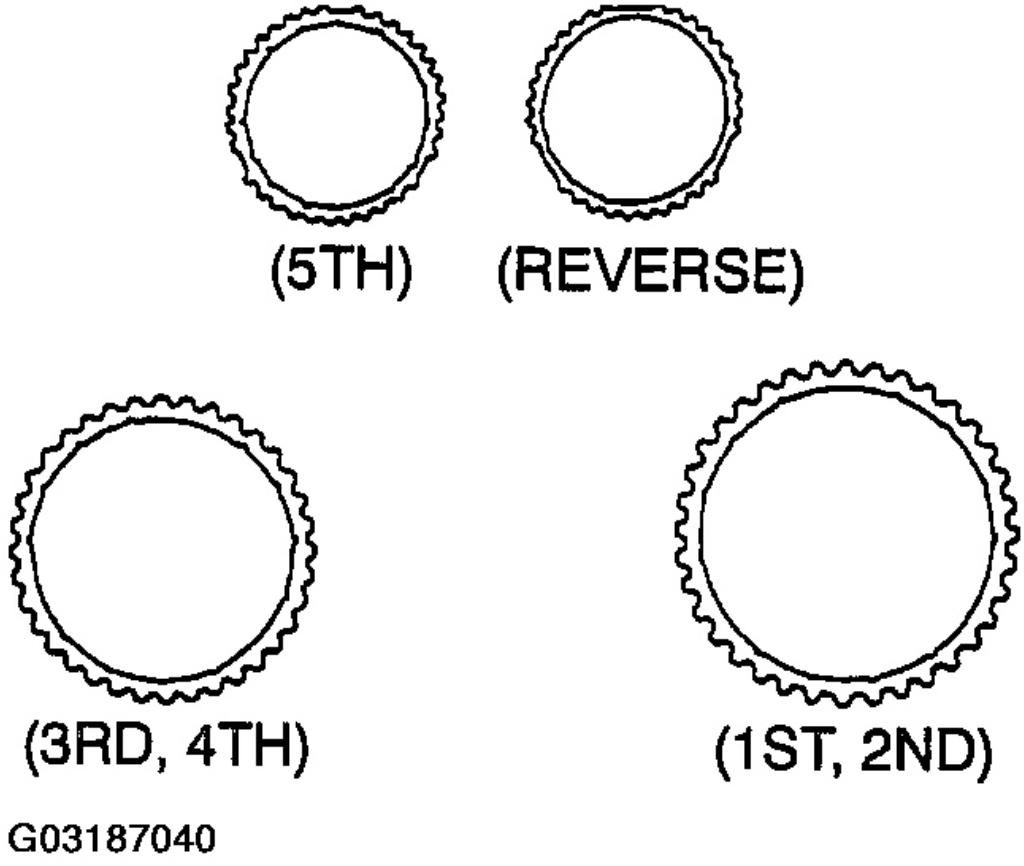


Fig. 1: Identifying Synchronizer Rings
Courtesy of MAZDA MOTORS CORP.

- When installing the gears and clutch hub components in the following procedure, make sure that they are installed in the direction shown in the figure.

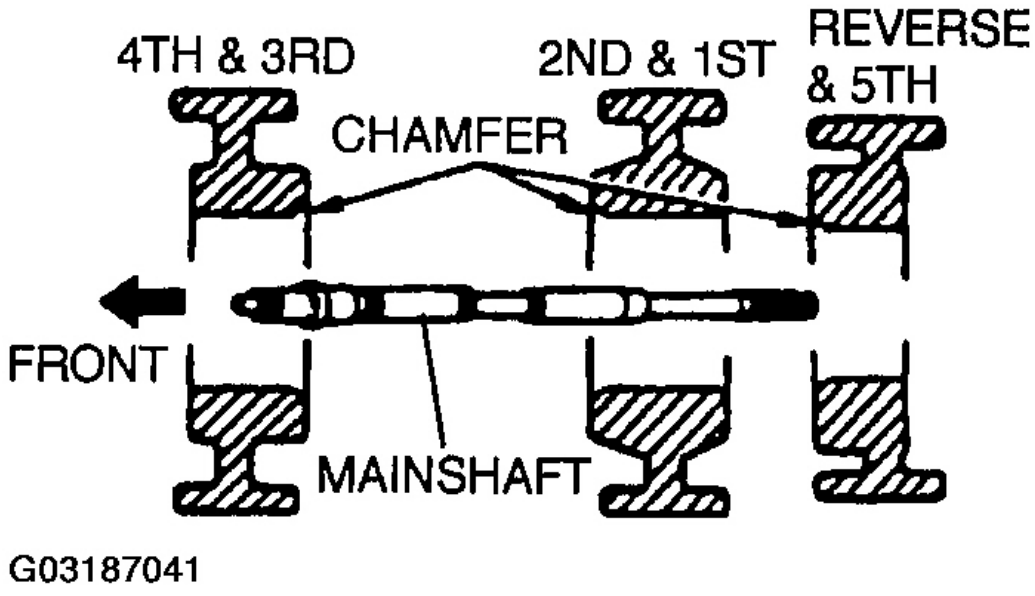


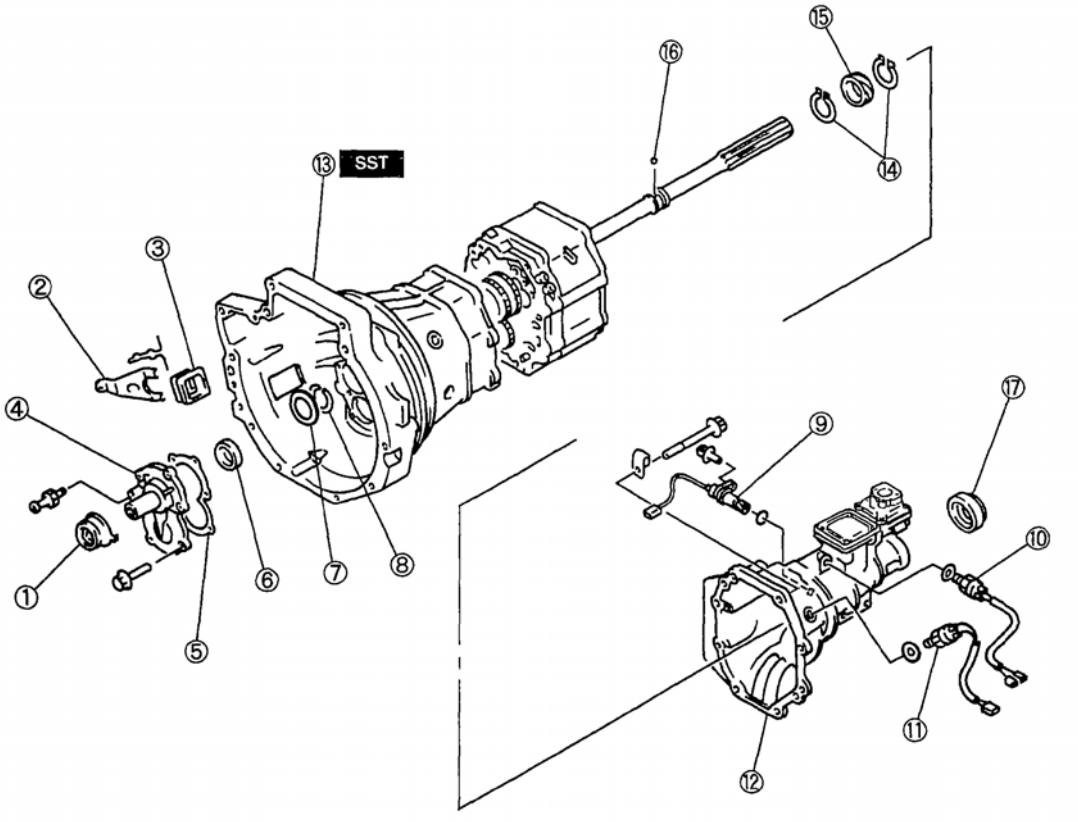
Fig. 2: Gear & Clutch Hub Component Installation Direction
Courtesy of MAZDA MOTORS CORP.

HOUSING COMPONENTS DISASSEMBLY

NOTE:

- **The front and rear oil seals do not need to be removed unless you are replacing them.**

- Disassemble in the order indicated in the figure.



1	Clutch release collar
2	Clutch release fork
3	Boot
4	Front cover
5	Gasket
6	Oil seal (front)
7	Adjustment shim
8	Snap ring
9	Speedometer sensor

10	Neutral switch
11	Back-up light switch
12	Extension housing
13	Transmission case (See TRANSMISSION CASE DISASSEMBLY NOTE)
14	Snap ring
15	Speedometer drive gear
16	Steel ball
17	Oil seal (rear)

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Fig. 3: Disassembling Transmission Housing
Courtesy of MAZDA MOTORS CORP.

Transmission Case Disassembly Note

- Remove the transmission case from the intermediate housing and gear component by using the **SST** .

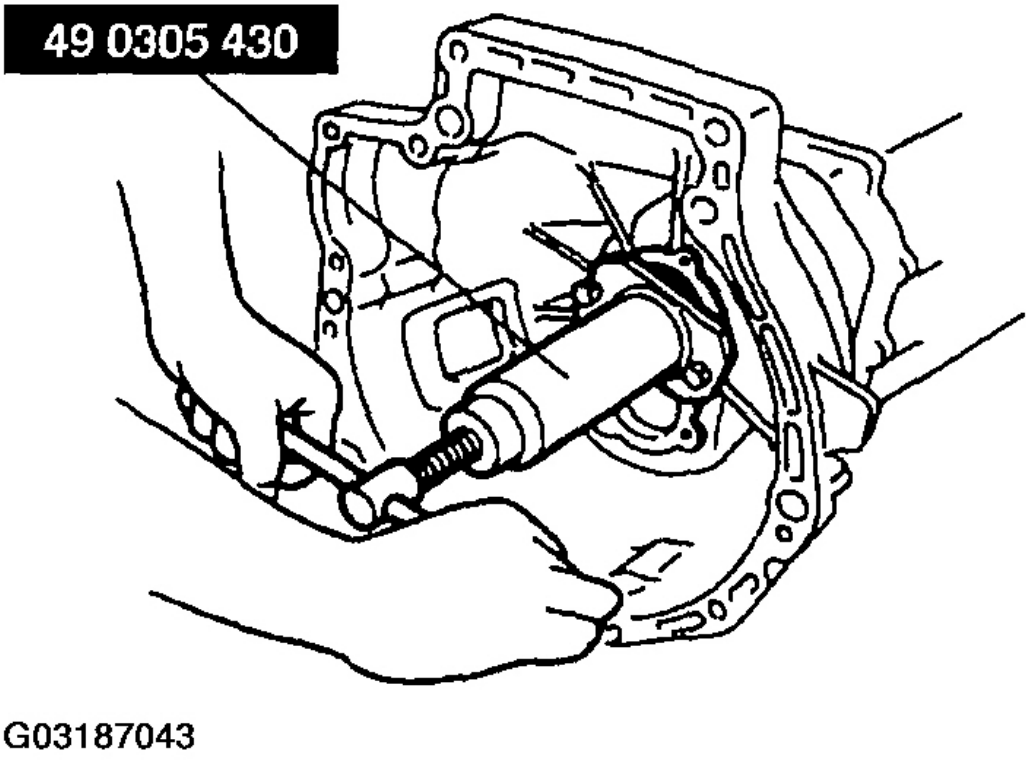
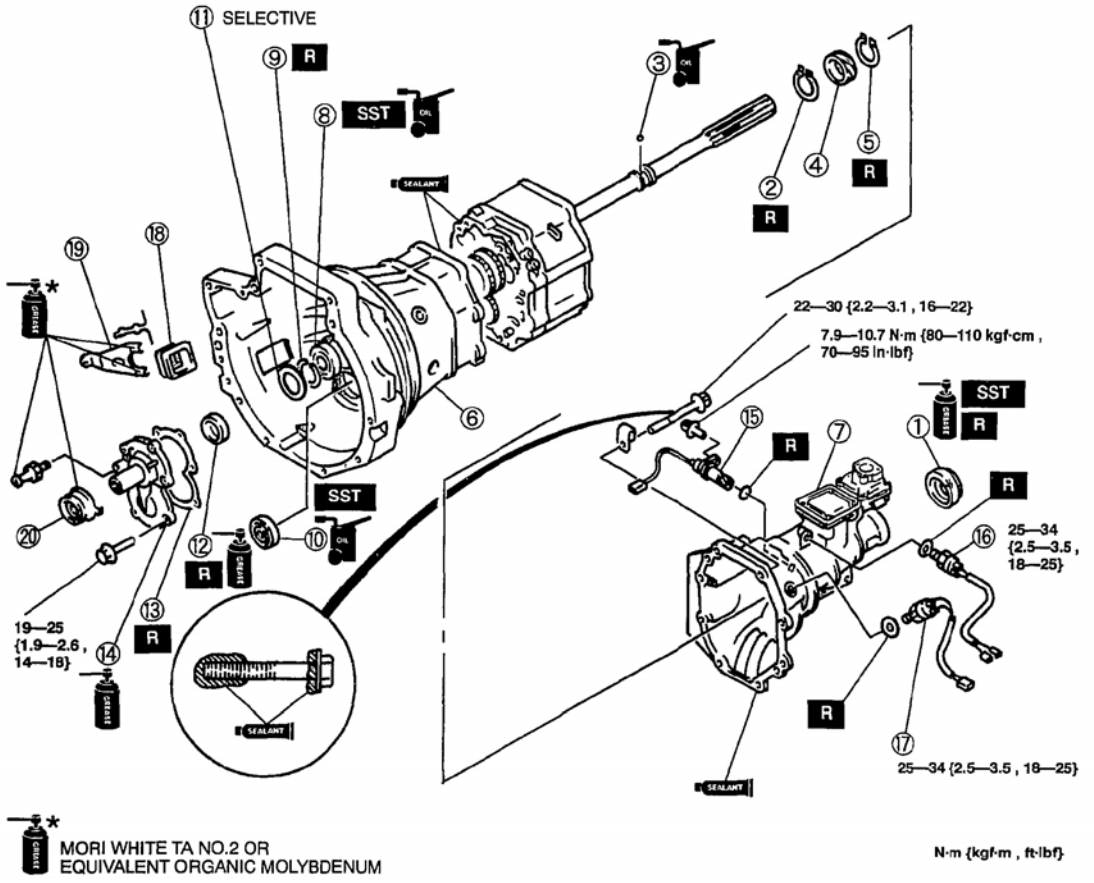


Fig. 4: Removing Transmission Case
Courtesy of MAZDA MOTORS CORP.

HOUSING COMPONENTS ASSEMBLY

1. Assemble in the order indicated in the figure.



1	Oil seal (rear) (See OIL SEAL ASSEMBLY NOTE)
2	Snap ring
3	Steel ball
4	Speedometer drive gear
5	Snap ring
6	Transmission case
7	Extension housing (See EXTENSION HOUSING ASSEMBLY NOTE)
8	Main drive gear bearing (See MAIN DRIVE GEAR BEARING ASSEMBLY NOTE)
9	Snap ring
10	Countershaft front bearing (See COUNTERSHAFT FRONT BEARING ASSEMBLY NOTE)

11	Adjustment shim (See ADJUSTMENT SHIM ASSEMBLY NOTE)
12	Oil seal (front)
13	Gasket
14	Front cover (See FRONT COVER ASSEMBLY NOTE)
15	Speedometer sensor
16	Neutral switch
17	Back-up light switch
18	Boot
19	Clutch release fork
20	Clutch release collar

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Fig. 5: Assembling Transmission Housing
Courtesy of MAZDA MOTORS CORP.

2. Inspect the gearshift lever operation.

Oil Seal (Rear) Assembly Note

1. Apply transmission oil to the outer periphery.
2. Install a new oil seal with the **SST** .

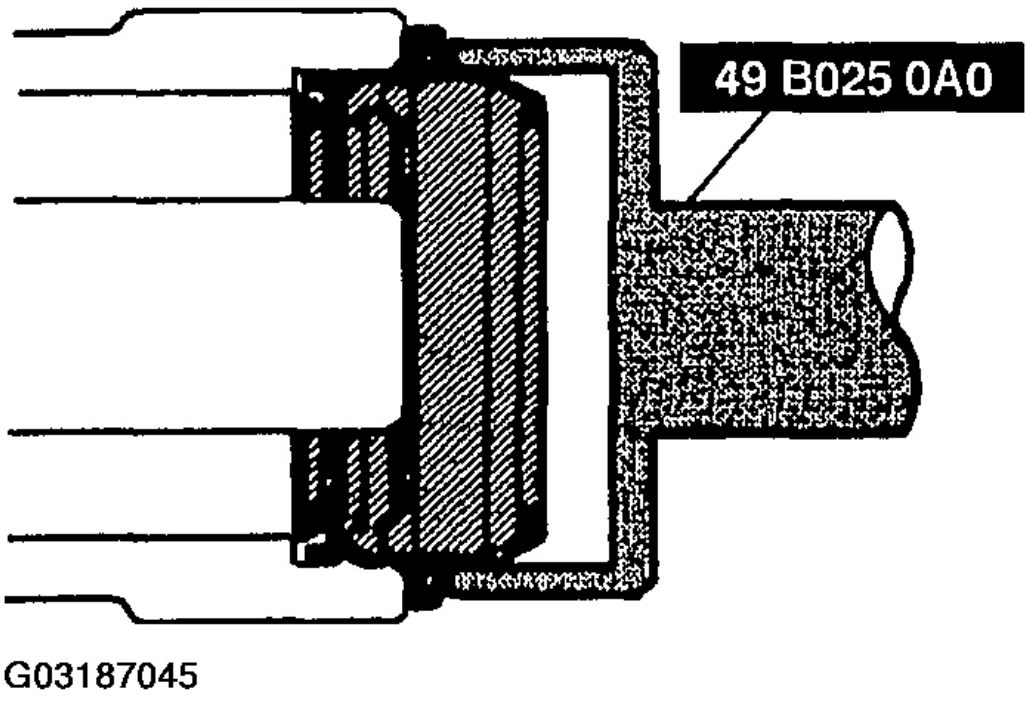

Fig. 6: Installing Oil Seal
Courtesy of MAZDA MOTORS CORP.

Extension Housing Assembly Note

1. Apply sealant to the contact surfaces of the bearing housing and extension housing.
2. Install the extension housing.
3. Apply sealant to the bolt threads, and install the bolts.

Tightening Torque

22-30 N.m {2.2-3.1 kgf.m, 16-22 ft.lbf}

Main Drive Gear Bearing Assembly Note

- Install the main drive gear bearing by using the **SST** , and secure it with a new snap ring.

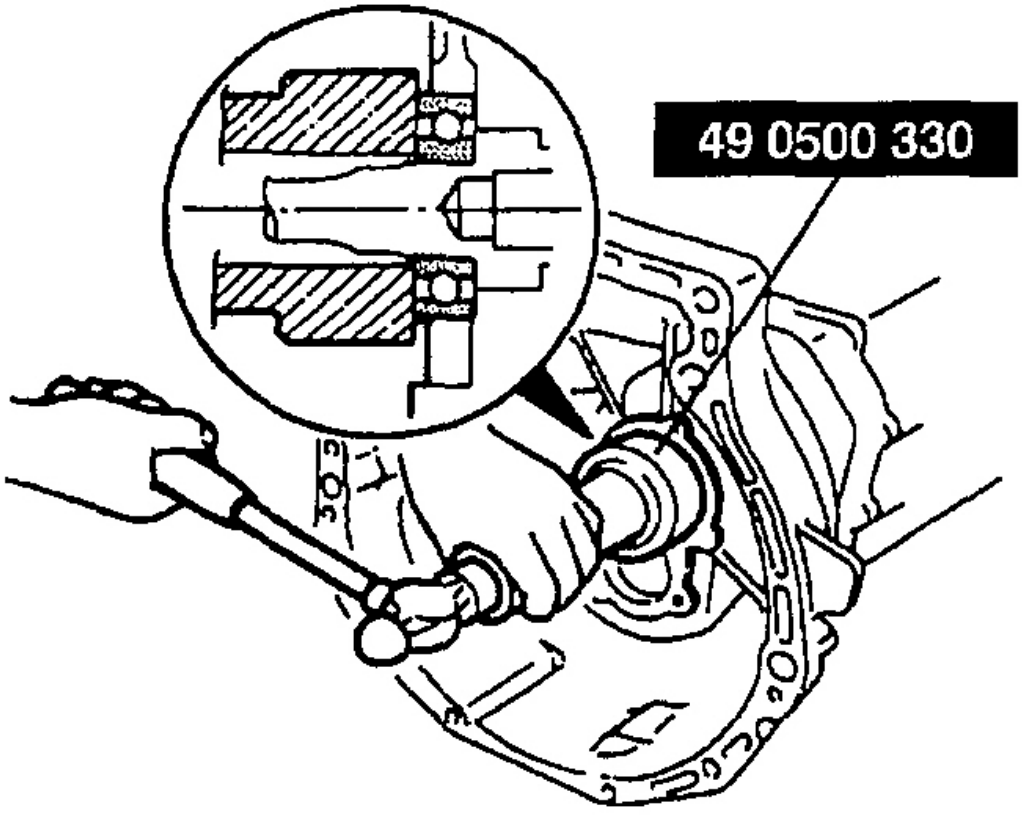

Fig. 7: Installing Main Drive Gear Bearing
Courtesy of MAZDA MOTORS CORP.

Countershaft Front Bearing Assembly Note

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

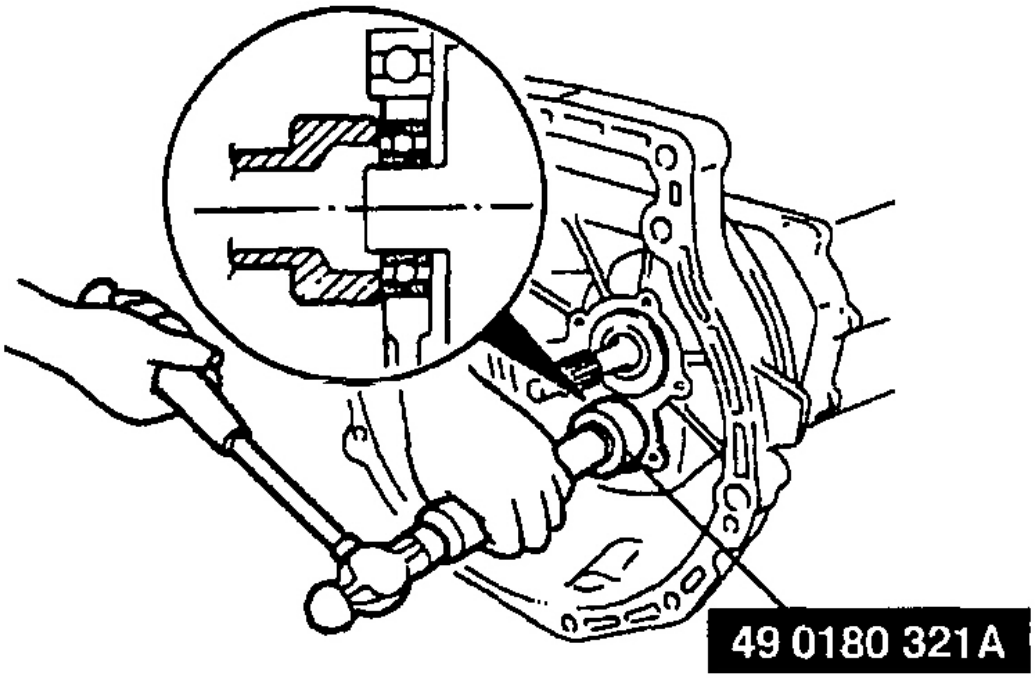

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Fig. 8: Installing Countershaft Front Bearing
Courtesy of MAZDA MOTORS CORP.

Adjustment Shim Assembly Note

- After measuring dimensions A and B show in the figure, use the adjustment shim(s) of the thickness corresponding to the value of A minus B, so that bearing end play will be within the specification.

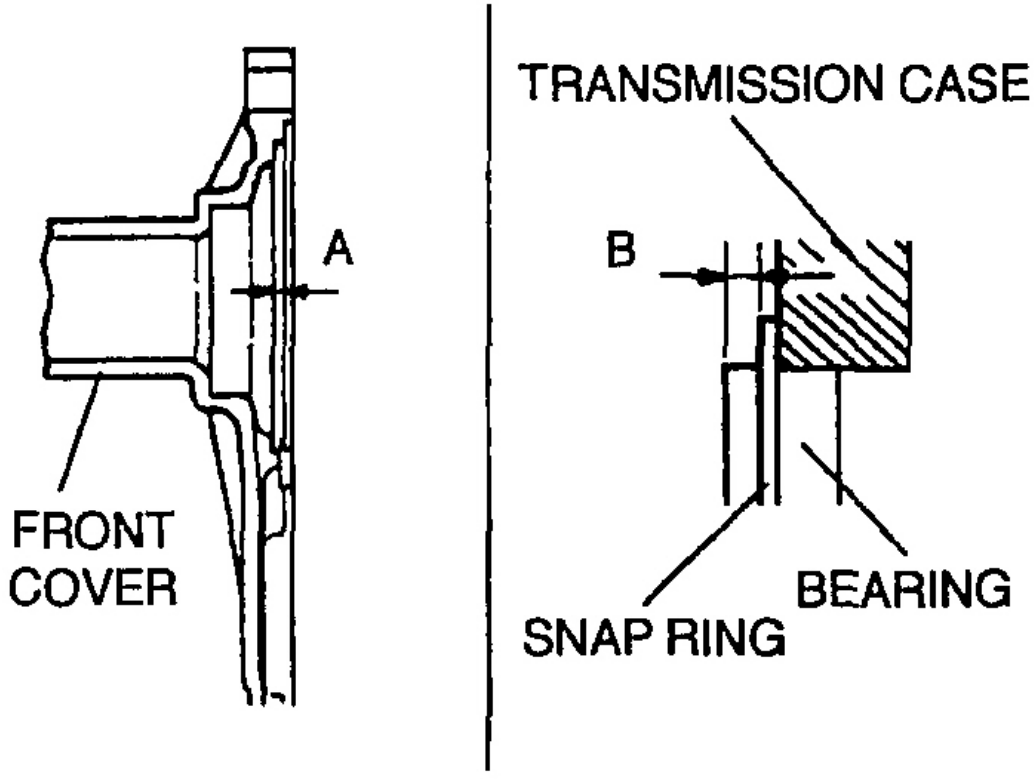


Fig. 9: Identifying Dimensions A & B
Courtesy of MAZDA MOTORS CORP.

Bearing End Play

0-0.1 mm {0-0.004 in}

Adjustment Shim Thickness

0.10 mm {0.004 in}, 0.30 mm {0.012 in}

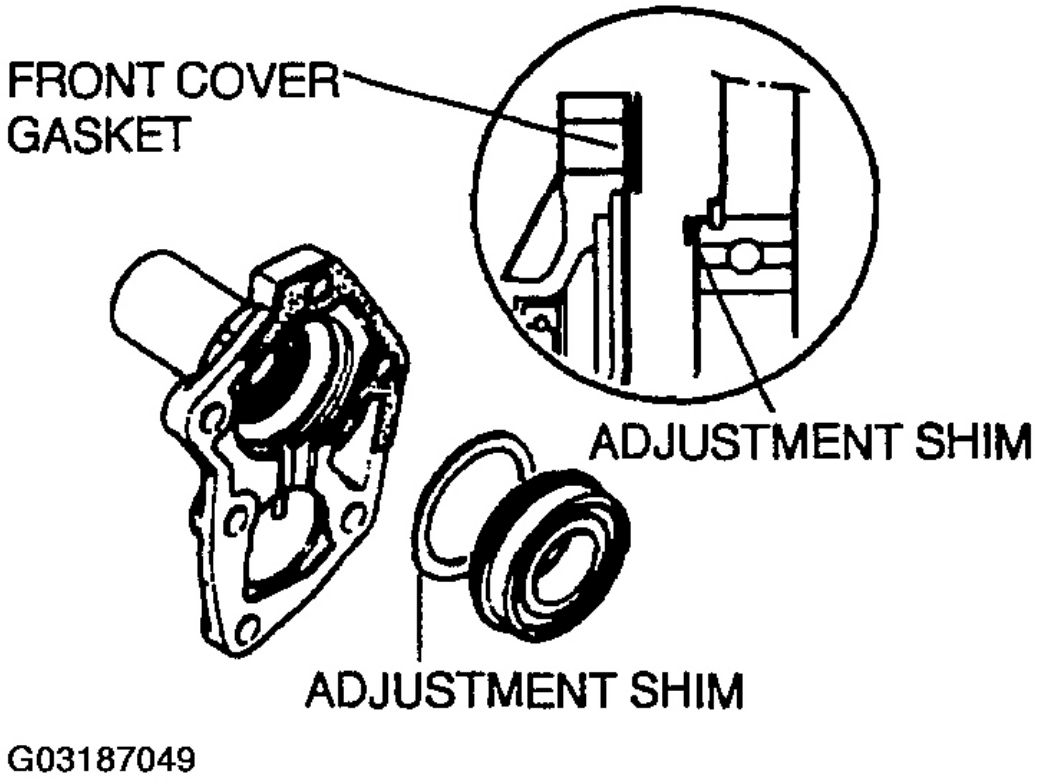


Fig. 10: Installing Adjustment Shim
Courtesy of MAZDA MOTORS CORP.

Front Cover Assembly Note

1. Install the oil seal (front) onto the front cover.
2. Apply grease to shaded area of the front cover.

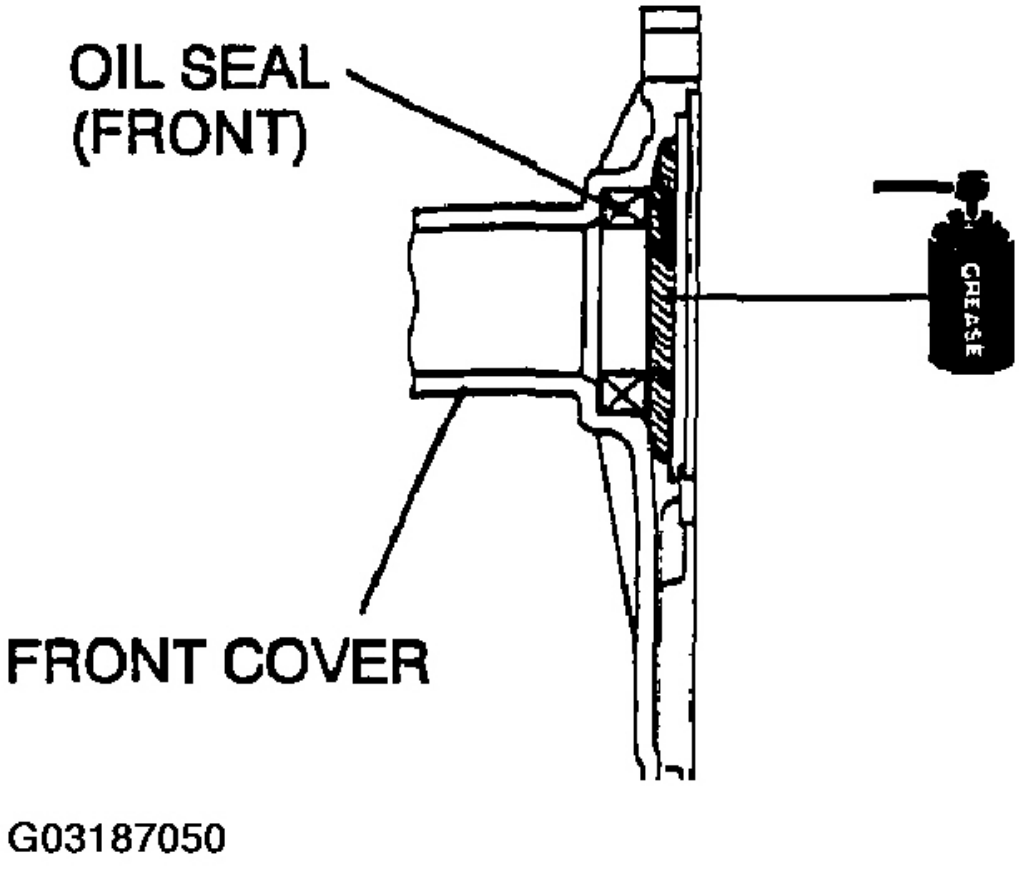
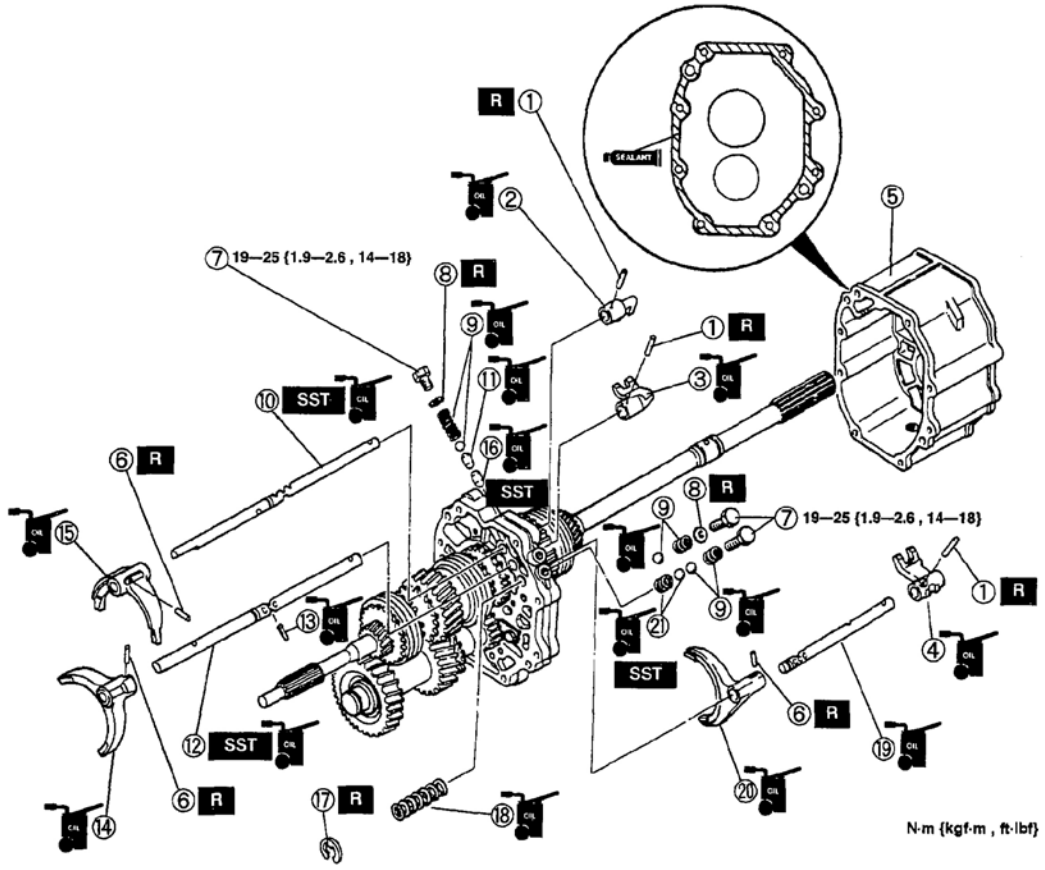


Fig. 11: Applying Grease To Shaded Area Of Front Cover
Courtesy of MAZDA MOTORS CORP.

3. Install the front cover.

SHIFT FORK AND SHIFT ROD PARTS DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the figure.



1	Roll pin
2	1st/2nd shift rod end
3	3rd/4th shift rod end
4	5ht/reverse shift rod end
5	Intermediate housing (See INTERMEDIATE HOUSING ASSEMBLY NOTE)
6	Roll pin
7	Cap plug
8	Washer
9	Spring and ball
10	1st/2nd shift rod (See 1ST/2ND SHIFT ROD ASSEMBLY NOTE)
11	Interlock pin (See INTERLOCK PIN ASSEMBLY NOTE)
12	3rd/4th shift rod (See 3RD/4TH SHIFT ROD ASSEMBLY NOTE)

13	Interlock pin
14	3rd/4th shift fork (See 3RD/4TH SHIFT FORK ASSEMBLY NOTE)
15	1st/2nd shift fork (See 1ST/2ND SHIFT FORK ASSEMBLY NOTE)
16	Interlock pin (See INTERLOCK PIN ASSEMBLY NOTE)
17	Clip (See CLIP DISASSEMBLY NOTE) (See CLIP ASSEMBLY NOTE)
18	Spring (See SPRING ASSEMBLY NOTE)
19	5th/reverse shift rod (See 5TH/REVERSE SHIFT ROD ASSEMBLY NOTE)
20	5th/reverse shift fork (See 5TH/REVERSE SHIFT FORK ASSEMBLY NOTE)
21	Spring and ball (See SPRING & BALL ASSEMBLY NOTE)

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Fig. 12: Disassembling/Assembling Shift Fork & Shift Rod Parts
Courtesy of MAZDA MOTORS CORP.

2. Assemble in the reverse order of disassembly.

Clip Disassembly Note

- Remove the clip and spring from the 5th/reverse shift rod.

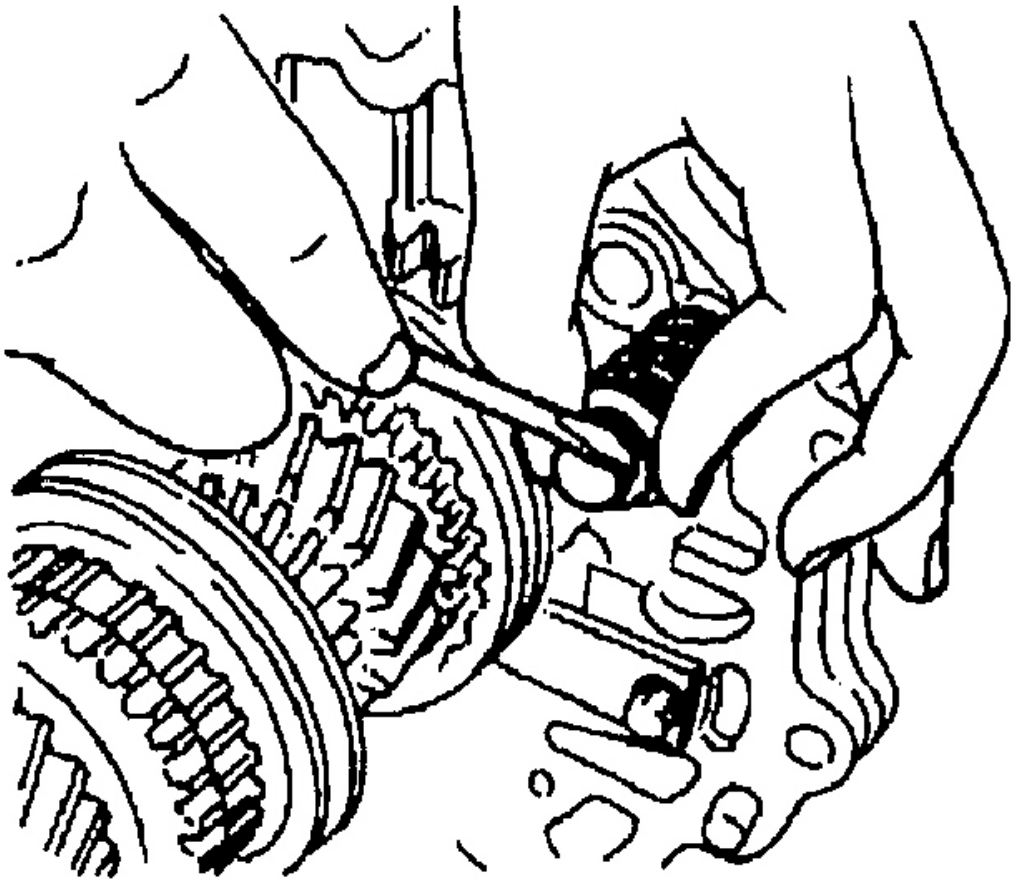

Fig. 13: Removing 5th/Reverse Shift Rod Clip
Courtesy of MAZDA MOTORS CORP.

Spring & Ball Assembly Note

1. Insert the spring and ball (5th/reverse) into the bearing housing.

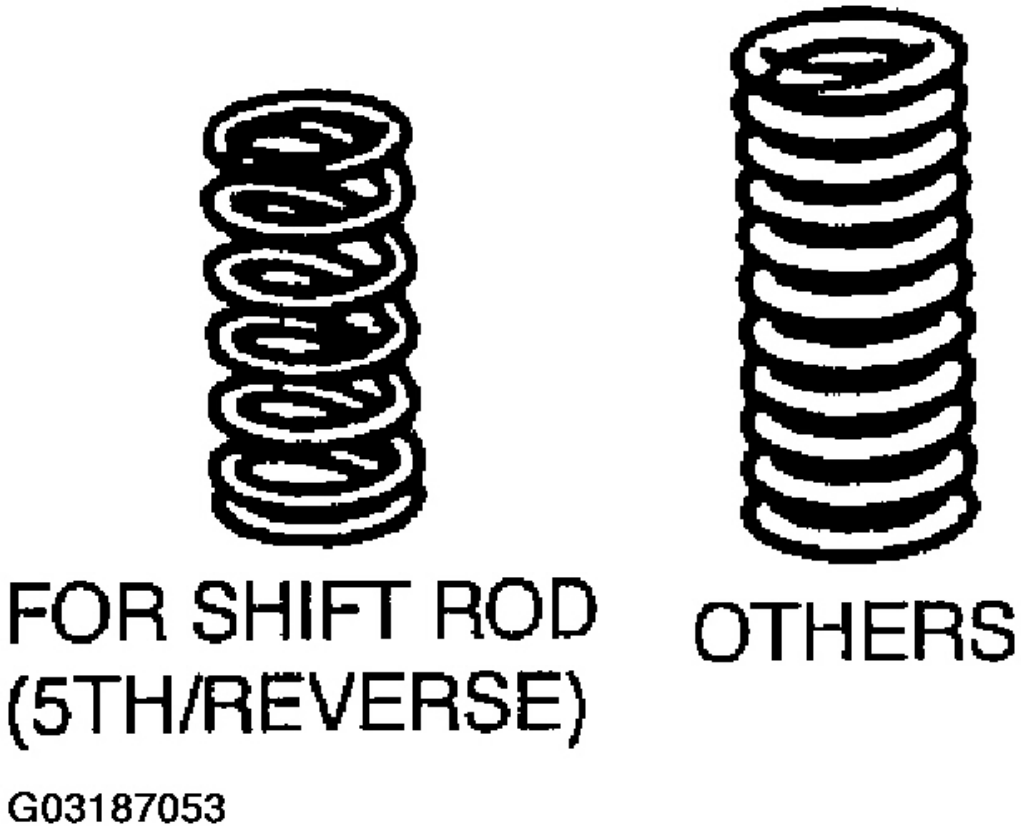

Fig. 14: Identifying 5th/Reverse Shift Rod Spring
Courtesy of MAZDA MOTORS CORP.

2. Press down the spring and ball (5th/reverse) by using the **SST** and a screwdriver, and install the shift rod.

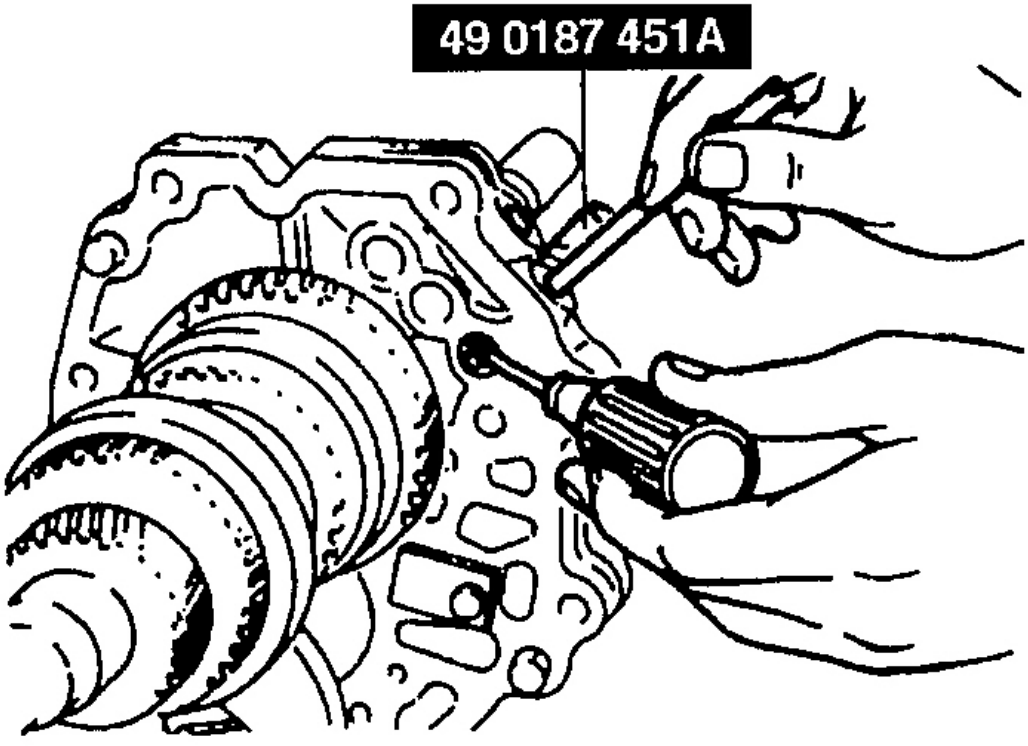

Fig. 15: Installing Shift Rod
Courtesy of MAZDA MOTORS CORP.

5th/Reverse Shift Fork & Rod Assembly Note

- Install the 5th/reverse shift fork and 5th/reverse shift rod into the bearing housing.

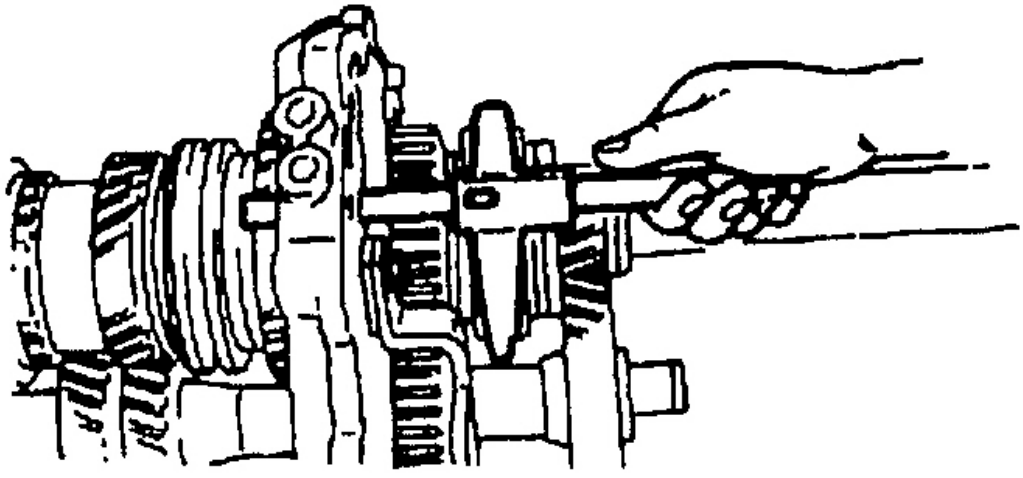

Fig. 16: Installing 5th/Reverse Shift Fork & 5th/Reverse Shift rod
Courtesy of MAZDA MOTORS CORP.

Spring, Clip Assembly Note

1. Slide the spring onto the 5th/reverse shift rod. While pressing the spring, install a new clip.

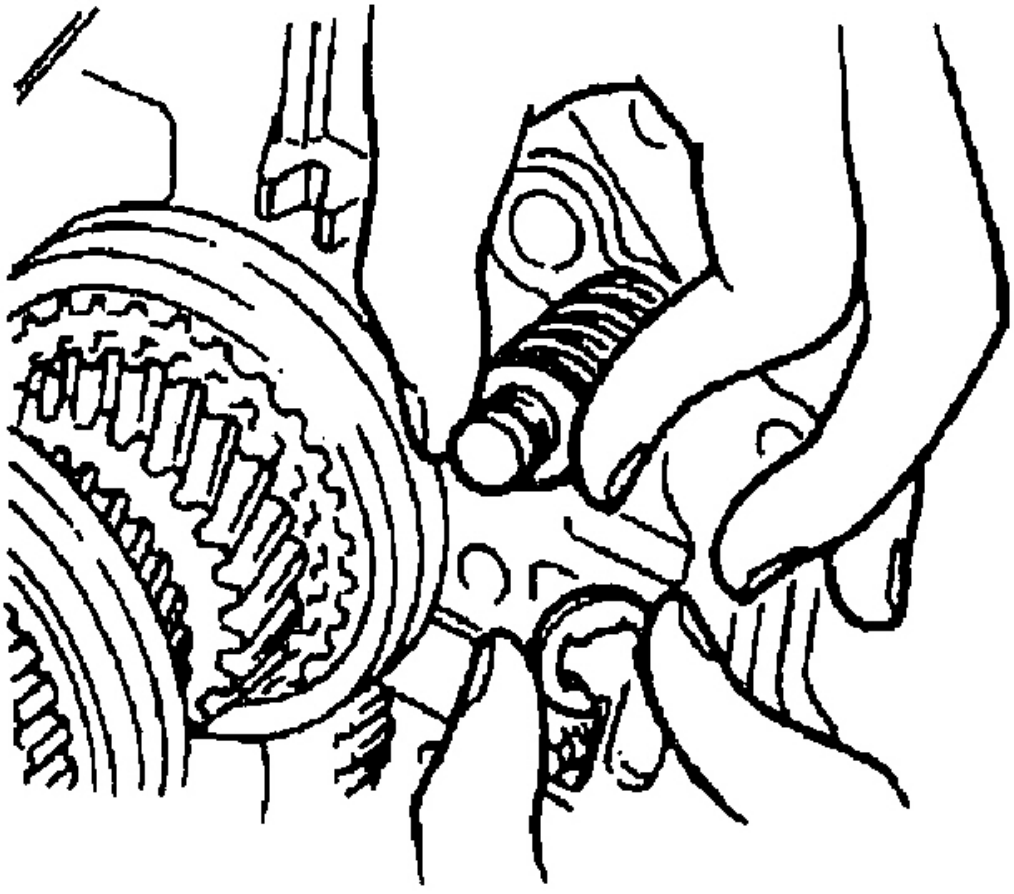

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Fig. 17: Installing 5th/Reverse Shift Rod Spring & Clip
Courtesy of MAZDA MOTORS CORP.

Interlock Pin Assembly Note

1. Position the interlock pin into the bearing housing by using the **SSTs** .

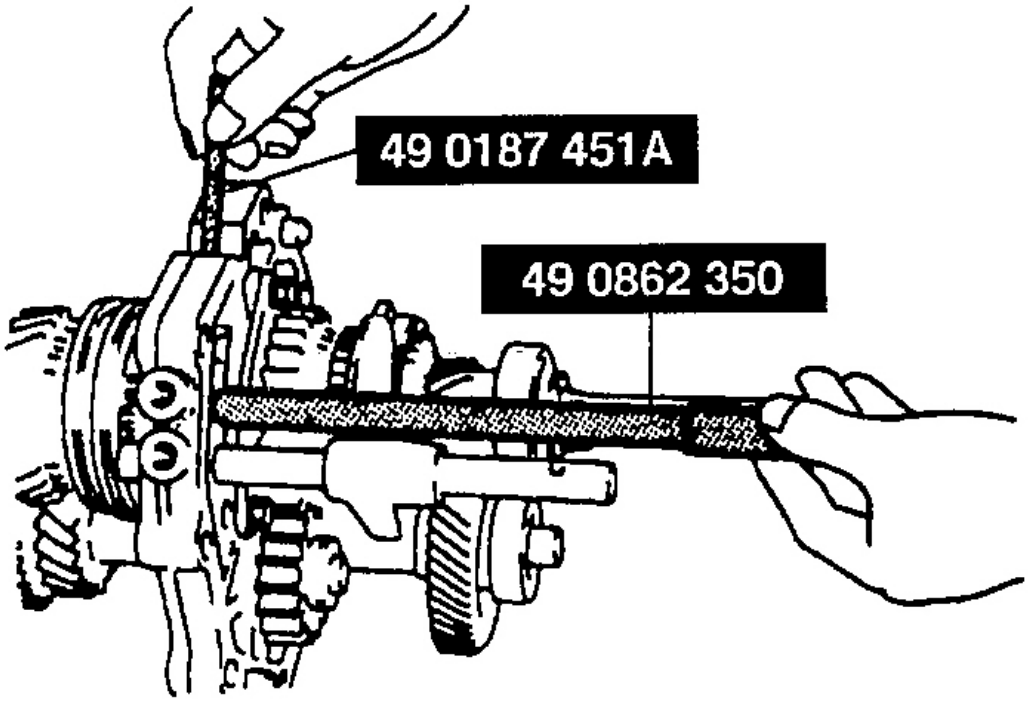


Fig. 18: Installing Interlock Pin
Courtesy of MAZDA MOTORS CORP.

2. Verify that the interlock pin is correctly installed.

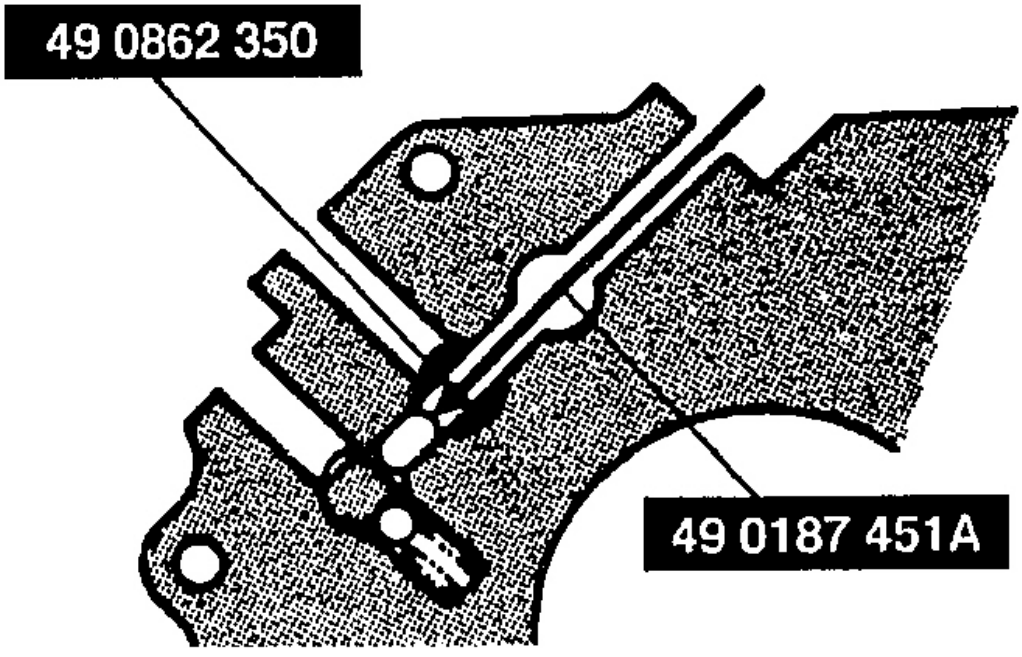


Fig. 19: Verifying Interlock Pin Correct Installation
Courtesy of MAZDA MOTORS CORP.

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

1. Set the 1st/2nd shift fork onto the 1st/2nd clutch hub component.
2. Install the 3rd/4th shift fork and 3rd/4th shift rod, and install the interlock pin into the bearing housing as described in the interlock pin assembly note. (Refer to **INTERLOCK PIN ASSEMBLY NOTE**.)

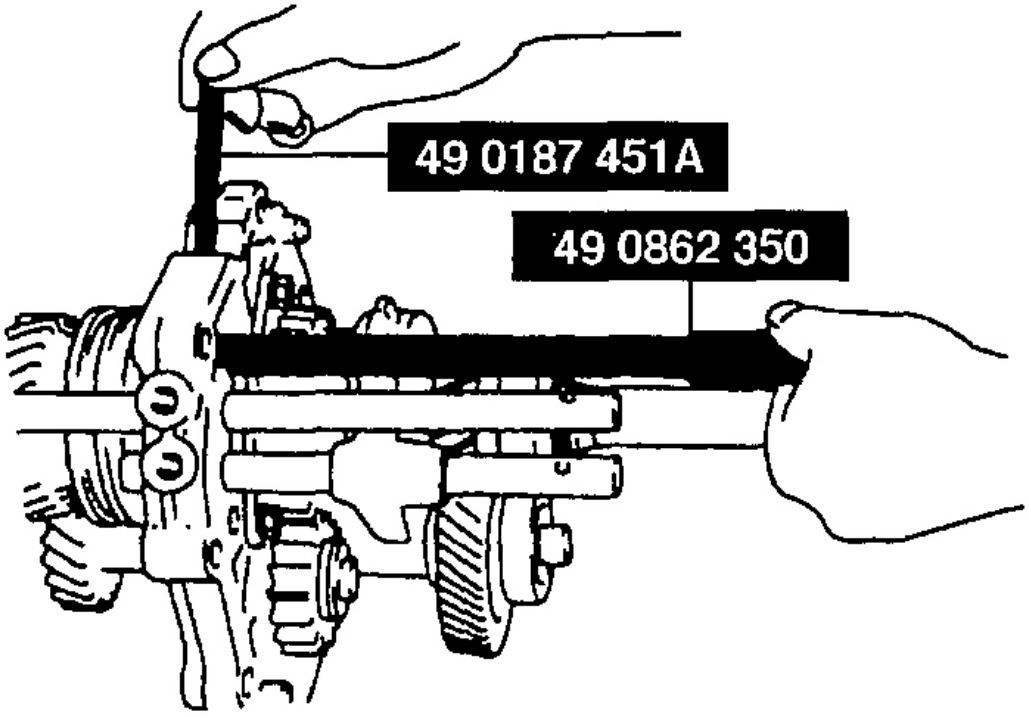


Fig. 20: Installing Interlock Pin Into Bearing Housing
Courtesy of MAZDA MOTORS CORP.

3. Install the spring, ball and new washer, then tighten the cap plug.

   Tightening Torque

   19-25 N.m {1.9-2.6 kgf.m, 14-18 ft.lbf}

4. Install the Roll pin.
5. Verify that the centers of the shift fork and clutch hub sleeve are aligned properly. If they are not, select the proper washer to install between 1st gear and the mainshaft front bearing, and between reverse gear and the mainshaft front bearing.

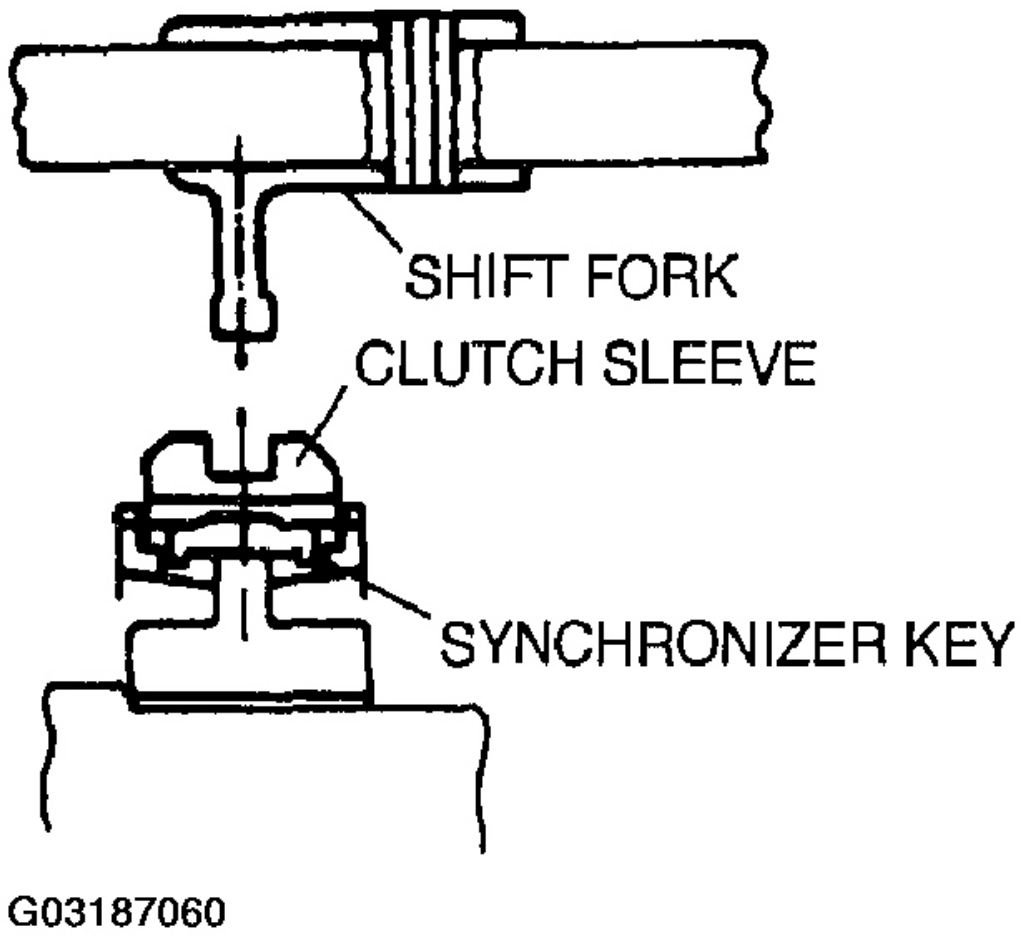


Fig. 21: Verifying Centers Of Shift Fork & Clutch Hub Sleeve Are Aligned Properly
Courtesy of MAZDA MOTORS CORP.

6. The following washer thicknesses are available. The total thickness of the front and rear washers should be as follows:

Total Thickness

5.9-6.0 mm {0.232-0.236 in}

Washer Thickness

2.2 mm {0.087 in}
2.7 mm {0.106 in}

3.0 mm {0.118 in}
3.2 mm {0.126 in}
3.7 mm {0.146 in}

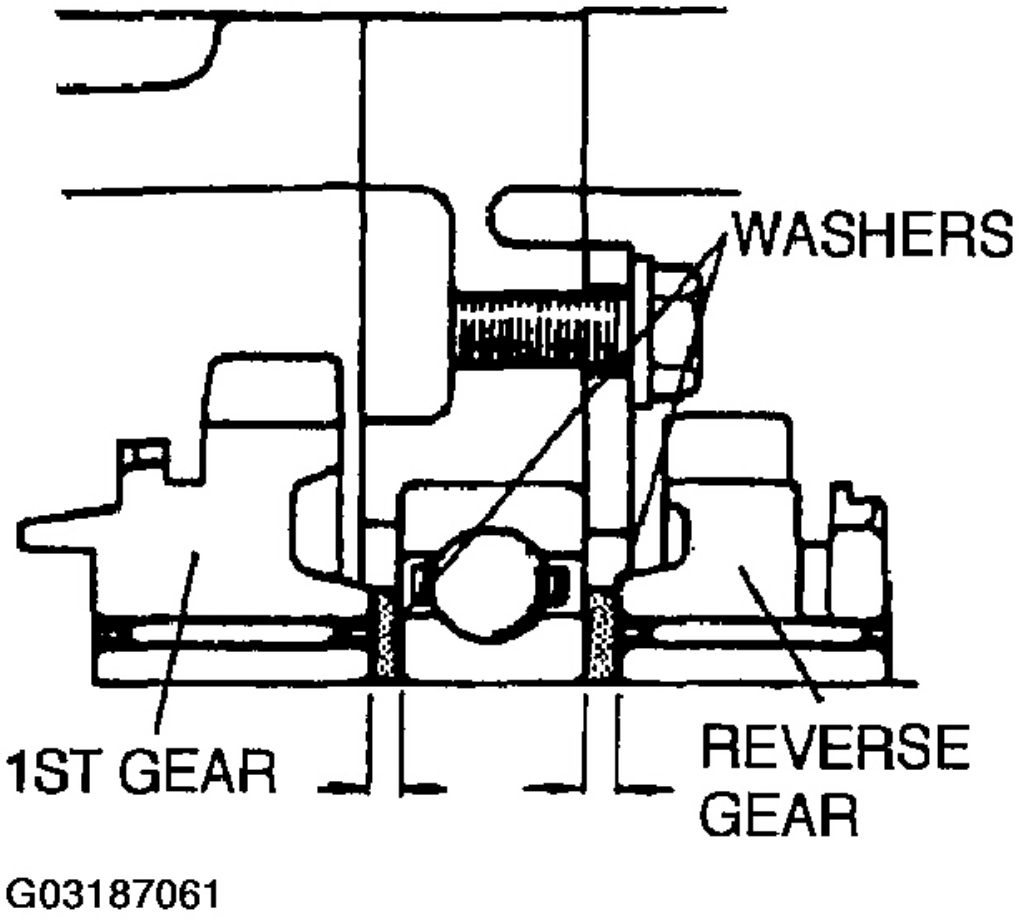


Fig. 22: Installing Spacer Washers
Courtesy of MAZDA MOTORS CORP.

Intermediate Housing Assembly Note

1. Apply sealant to the contact surfaces of the intermediate housing and bearing housing.
2. Mount the intermediate housing to the bearing housing by tapping it lightly with a plastic hammer.

SHIFT FORK AND SHIFT ROD PARTS INSPECTION

Springs Inspection

1. Measure the free length of the springs.

   Standard Free Length

   Shift Rod (5th/Reverse) Spring:
   76.5 mm {3.012 in}

   Detent Ball Spring (1st/2nd, 3rd/4th):
   22.5 mm {0.886 in}

   Detent Ball Spring (5th/Reverse):
   17.0 mm {0.669 in}

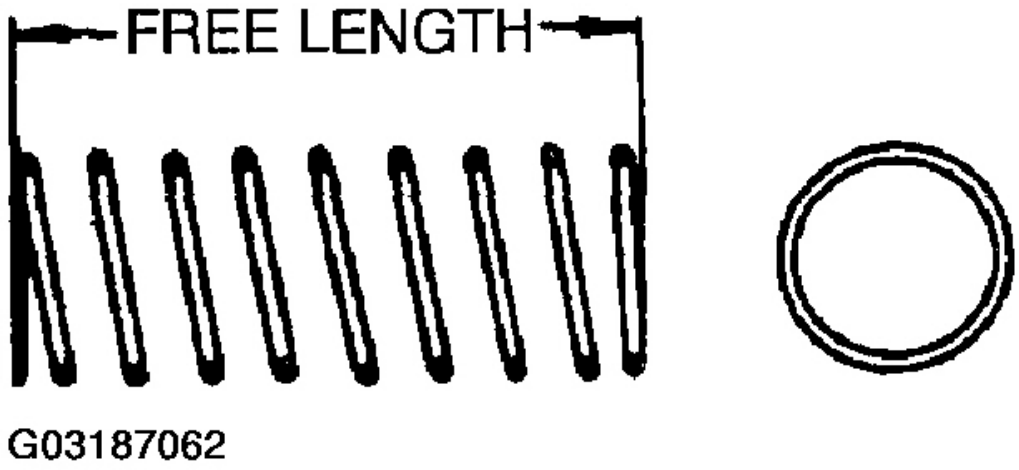


Fig. 23: Measuring Spring Free Length
Courtesy of MAZDA MOTORS CORP.

2. If not as specified, replace the springs.

Intermediate Housing Inspection

1. Measure the intermediate housing pin height.

   Standard Height
   9.0-10.0 mm {0.354-0.394 in}

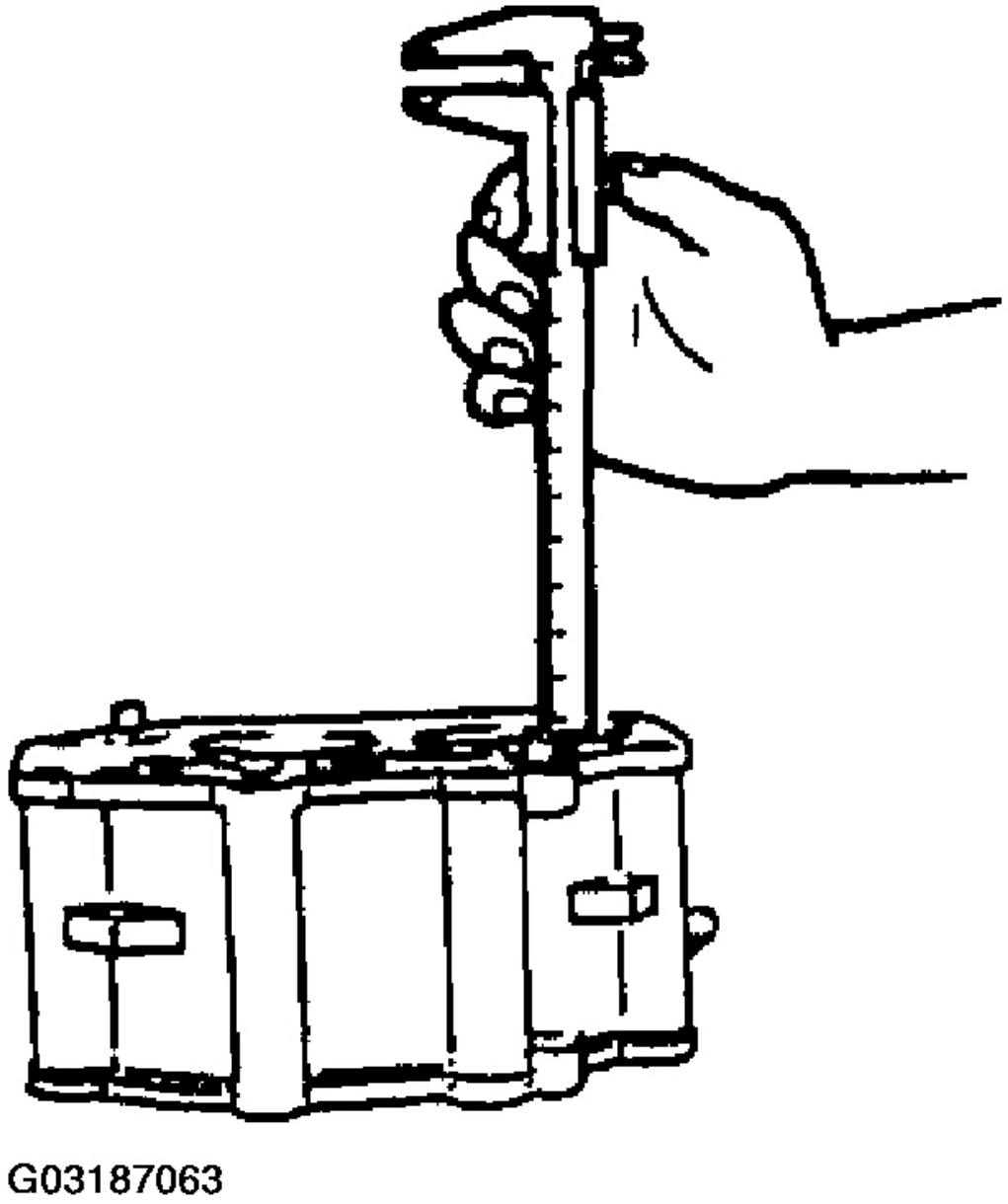


Fig. 24: Measuring Intermediate Housing Pin Height
Courtesy of MAZDA MOTORS CORP.

2. If not as specified, replace the intermediate housing.

1st/2nd, 3rd/4th & 5th/Reverse Shift Fork Inspection

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

Standard Clearance

0.2-0.3 mm {0.008-0.012 in}

Maximum

0.5 mm {0.020 in}

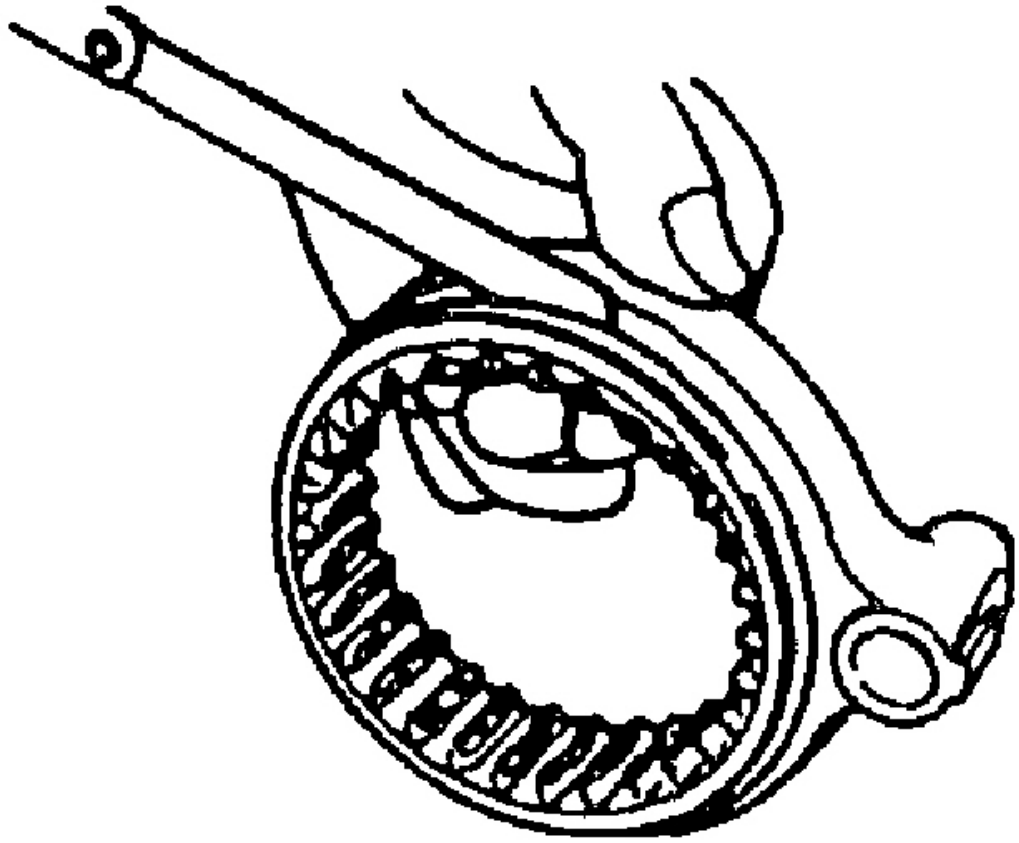
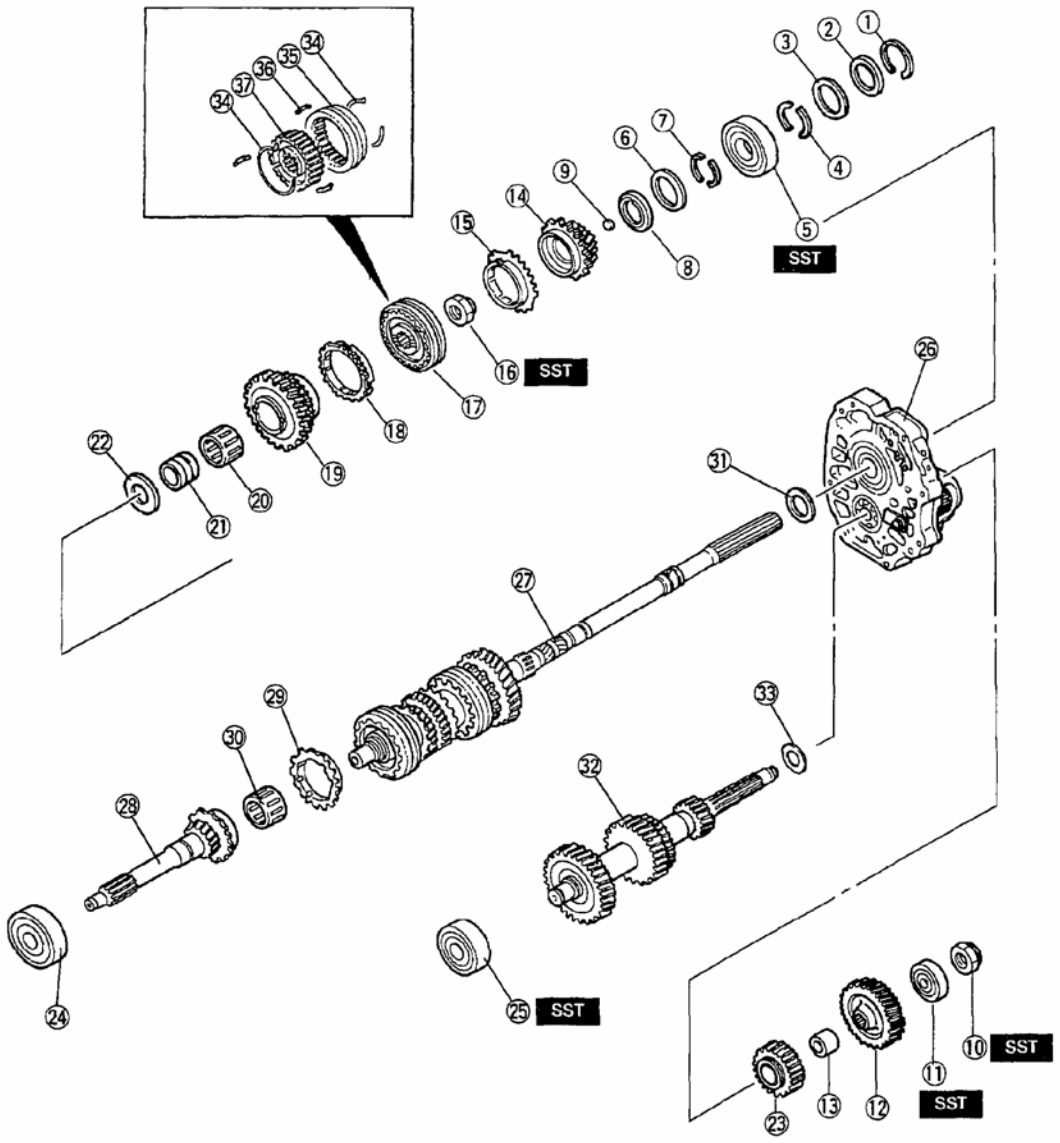


Fig. 25: Measuring Clearance Between Hub Sleeve & Shift Fork
Courtesy of MAZDA MOTORS CORP.

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

MAINSHAFT AND COUNTERSHAFT PARTS DISASSEMBLY

- Disassemble in the order indicated in the figure.



1	Snap ring
2	Washer
3	Retaining ring
4	C-washer
5	Mainshaft rear bearing (See MAINSHAFT REAR BEARING DISASSEMBLY NOTE)
6	Retaining ring
7	C-washer

8	Thrust lock washer
9	Steel ball
10	Locknut (countershaft) (See LOCKNUT DISASSEMBLY NOTE)
11	Countershaft rear bearing (See COUNTERSHAFT REAR BEARING DISASSEMBLY NOTE)
12	Counter 5th gear
13	Spacer

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Fig. 26: Disassembling Mainshaft & Countershaft (1 Of 2)
Courtesy of MAZDA MOTORS CORP.

14	5th gear
15	5th synchronizer ring
16	Locknut (Mainshaft) (See LOCKNUT DISASSEMBLY NOTE)
17	Clutch hub component (5th/reverse)
18	Reverse synchronizer ring
19	Reverse gear
20	Bearing
21	Bearing race
22	Washer
23	Counter reverse gear
24	Main drive gear bearing (See MAIN DRIVE GEAR BEARING DISASSEMBLY NOTE)
25	Countershaft front bearing (See COUNTERSHAFT FRONT BEARING DISASSEMBLY NOTE)
26	Bearing housing component (See BEARING HOUSING COMPONENT DISASSEMBLY NOTE)
27	Mainshaft gear component
28	Main drive gear
29	4th synchronizer ring
30	Bearing
31	Washer
32	Countershaft
33	Spacer
34	Synchronizer key spring
35	Clutch hub sleeve
36	Synchronizer key
37	Clutch hub

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Fig. 27: Disassembling Mainshaft & Countershaft - Legend Cont. (2 Of 2)
Courtesy of MAZDA MOTORS CORP.

Mainshaft Rear Bearing Disassembly Note

- Remove the mainshaft rear bearing by using the **SSTs** .

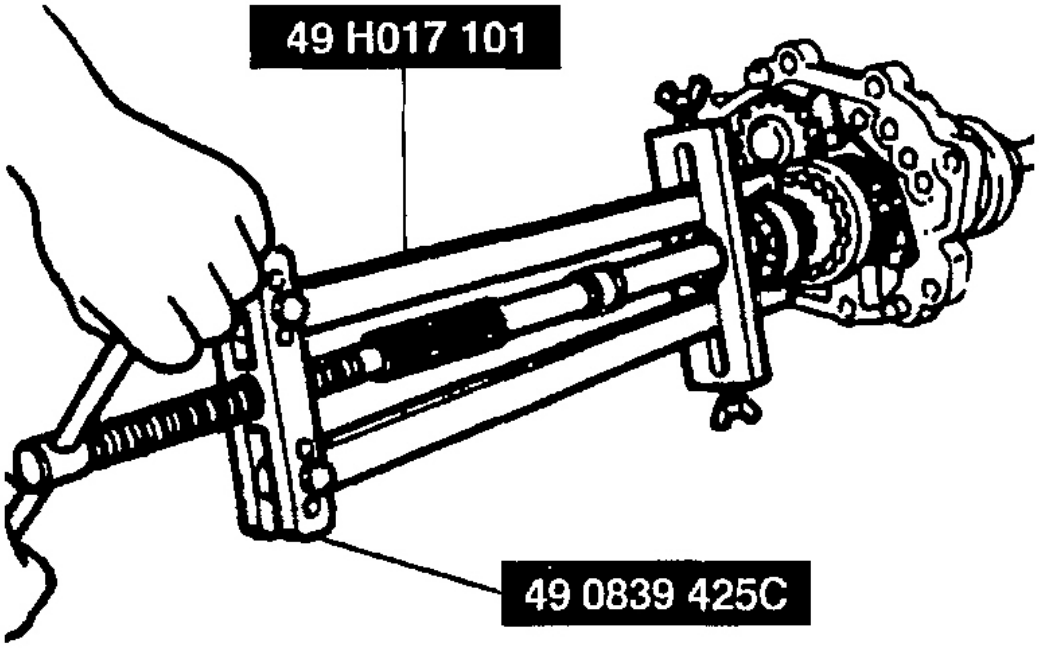

Fig. 28: Removing Mainshaft Rear Bearing
Courtesy of MAZDA MOTORS CORP.

Locknut (Countershaft) Disassembly Note

1. Shift the clutch hub sleeves into 1st and reverse gears to lock the rotation of the mainshaft.

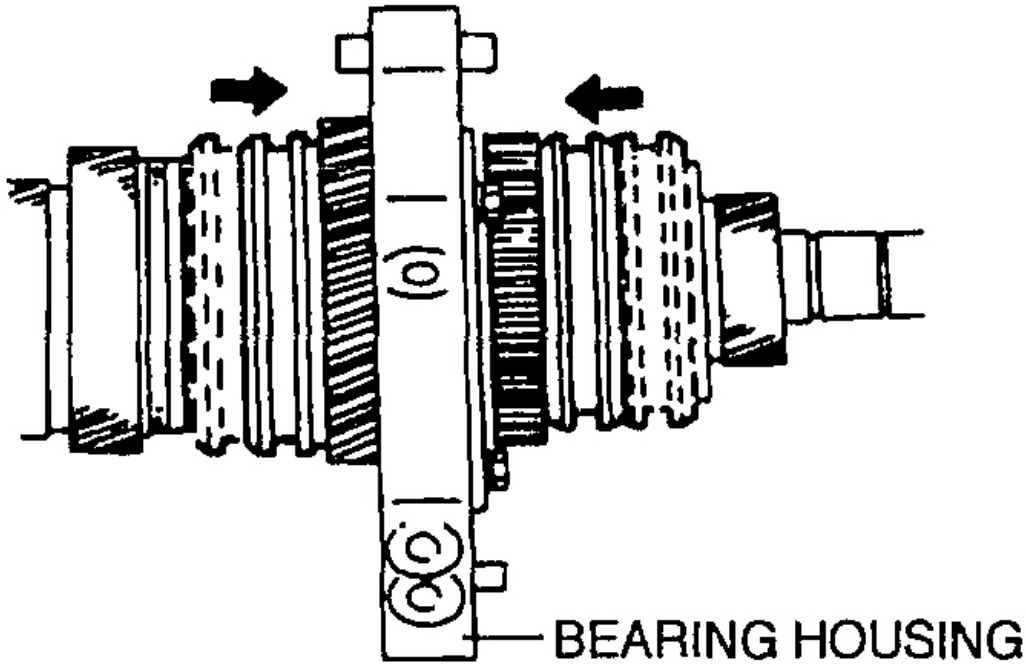

Fig. 29: Shifting Clutch Hub Sleeves Into 1st & Reverse Gears
Courtesy of MAZDA MOTORS CORP.

2. Use a suitable tool to uncrimp the tabs of the locknut.
3. Connect the **SST** to the mainshaft and secure it in a vise.

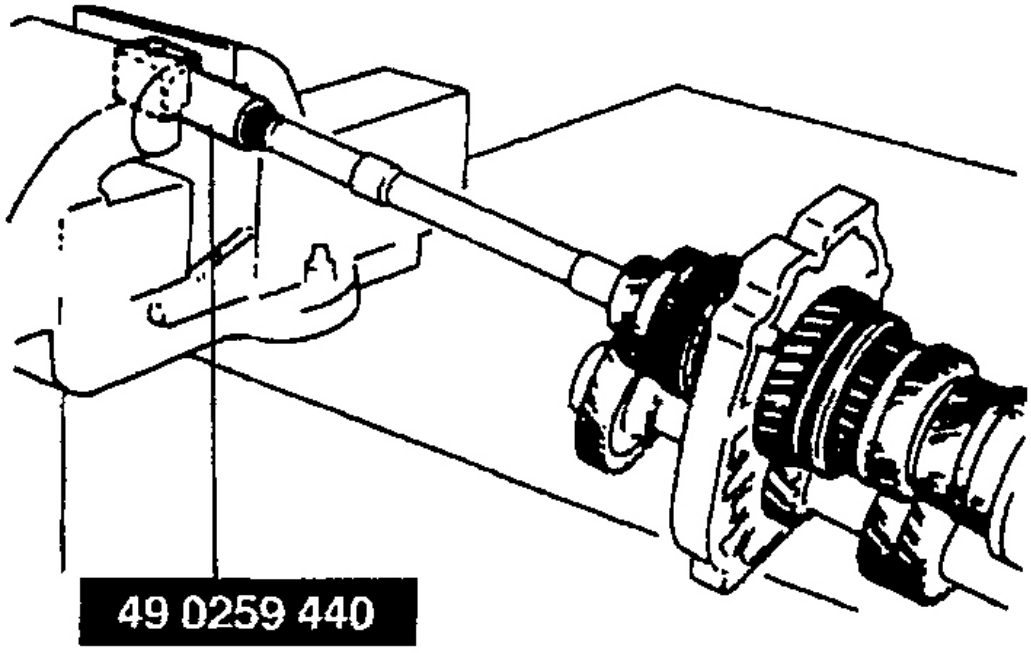

Fig. 30: Securing SST & Mainshaft In Vise
Courtesy of MAZDA MOTORS CORP.

4. Remove the locknut.

Countershaft Rear Bearing Disassembly Note

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

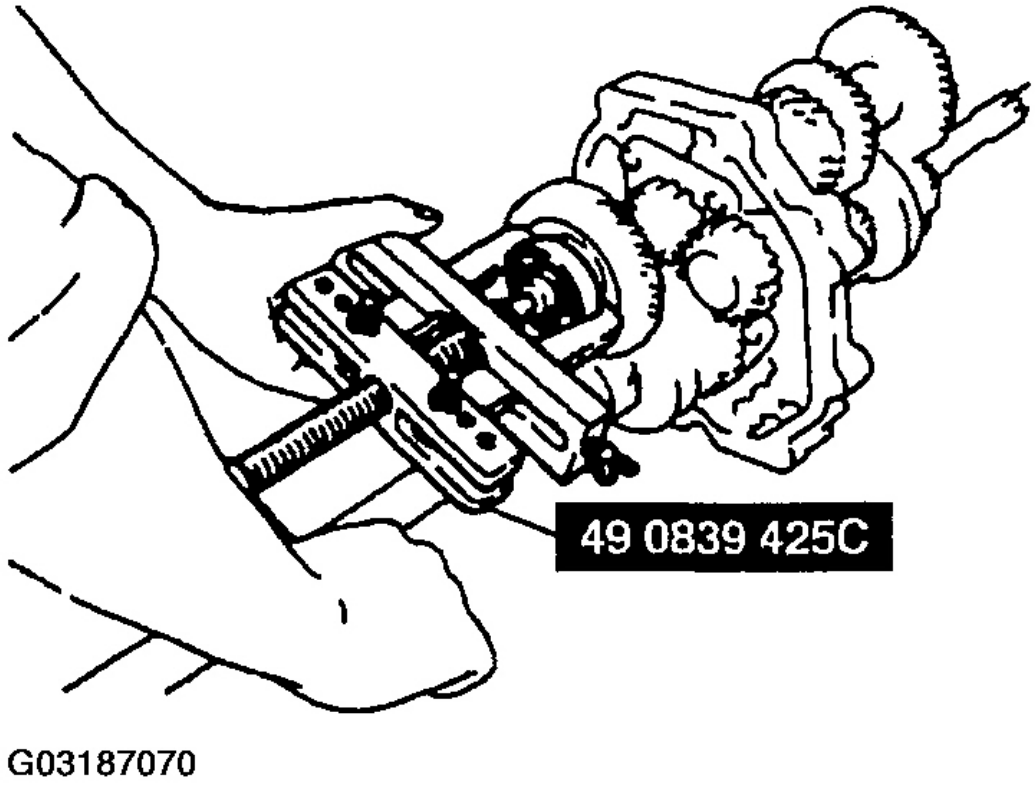

Fig. 31: Removing Countershaft Rear Bearing
Courtesy of MAZDA MOTORS CORP.

Locknut (Mainshaft) Disassembly Note

1. Shift the clutch hub sleeves into 1st and reverse gears to lock the rotation of the mainshaft.
2. Use a suitable tool to uncrimp the tabs of the locknut.
3. Secure the bearing housing in a vise.
4. Remove the locknut by using the **SST**

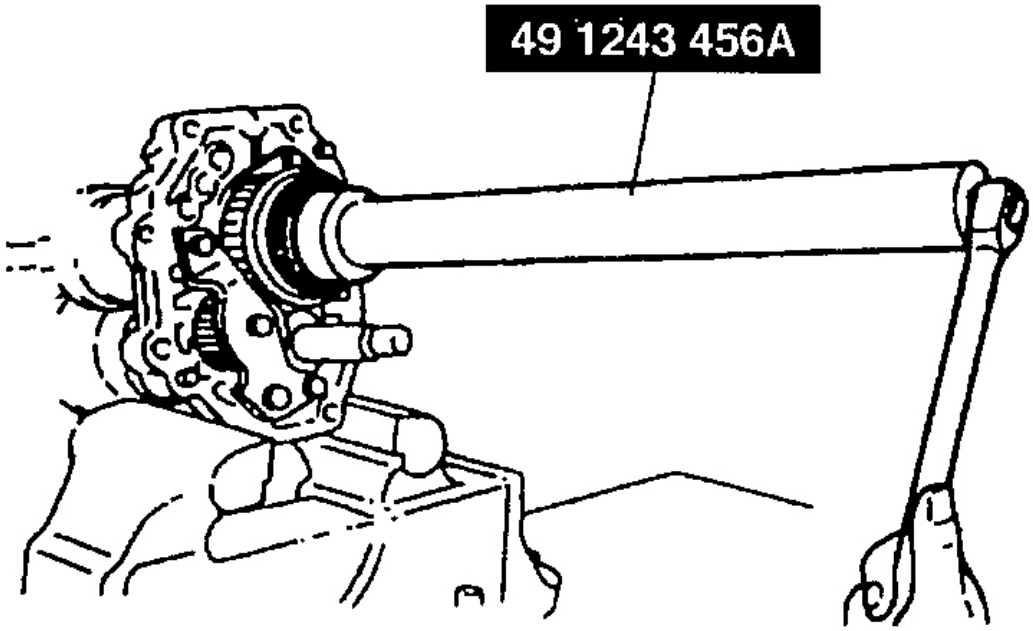

Fig. 32: Removing Mainshaft Locknut
Courtesy of MAZDA MOTORS CORP.

Main Drive Gear Bearing Disassembly Note

- Remove the main drive gear bearing with a pipe and a hammer.

Outer Diameter Of Pipe

70.0 mm {2.76 in}

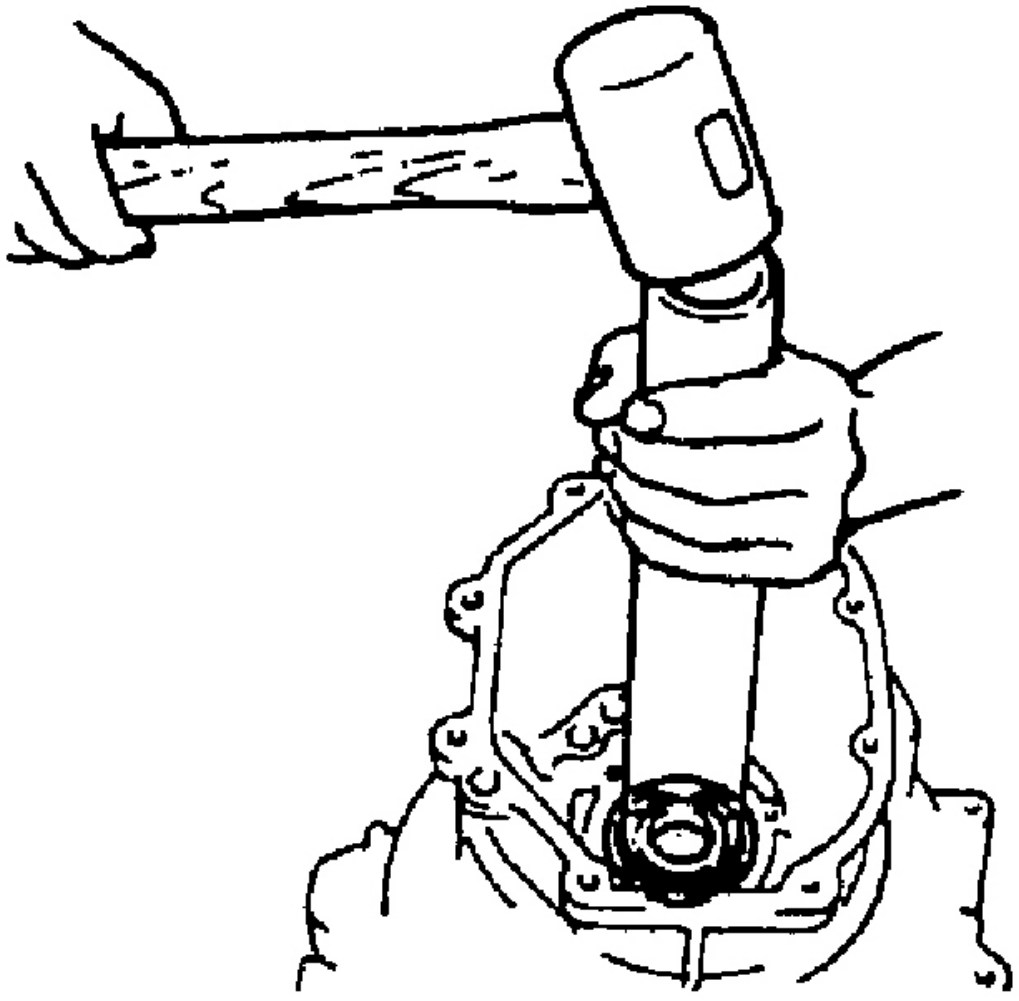

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Fig. 33: Removing Main Drive Gear Bearing
Courtesy of MAZDA MOTORS CORP.

Countershaft Front Bearing Disassembly Note

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

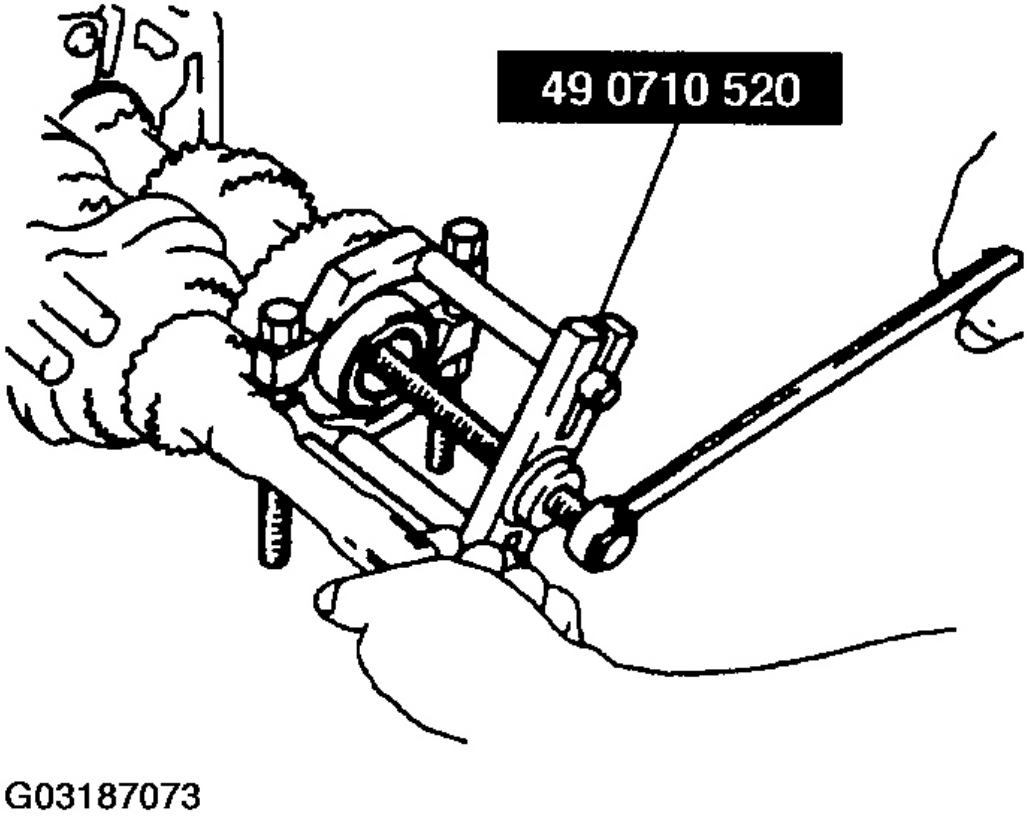


Fig. 34: Removing Countershaft Front Bearing
Courtesy of MAZDA MOTORS CORP.

Bearing Housing Component Disassembly Note

- Remove the bearing housing by lightly tapping the countershaft with a copper hammer.

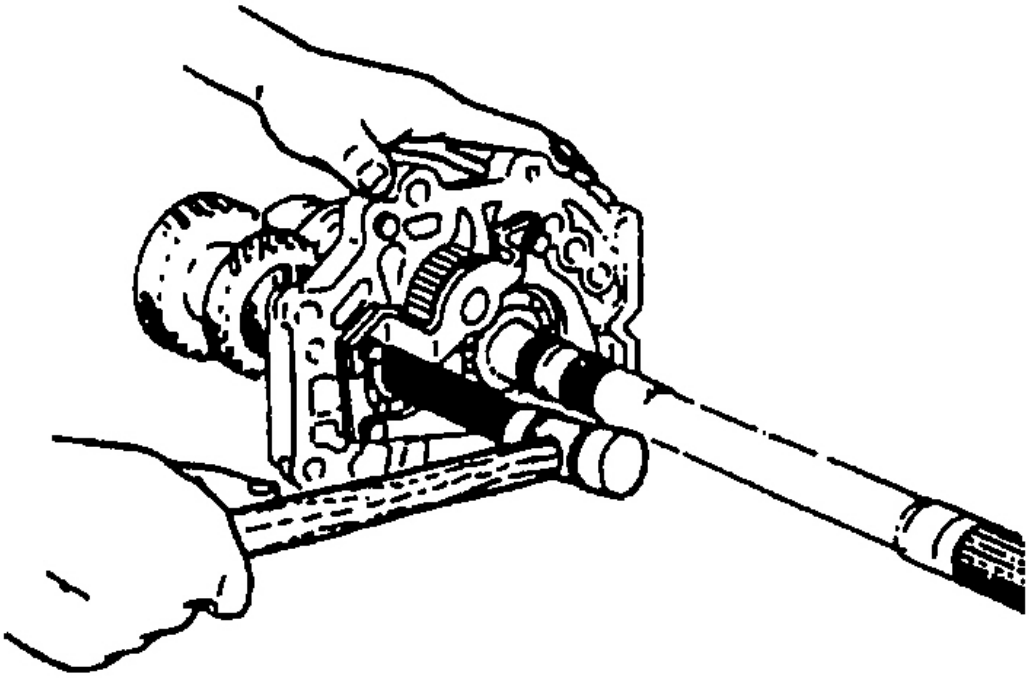
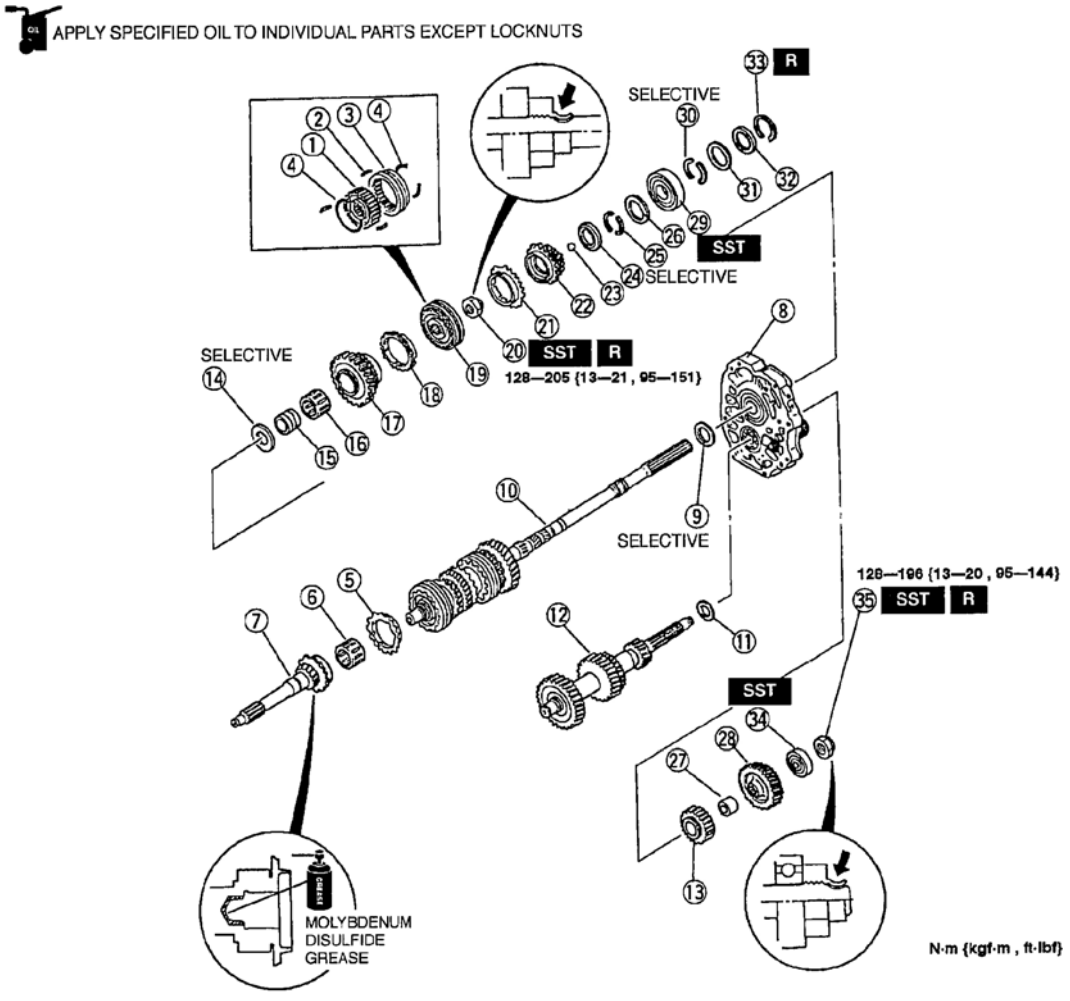


Fig. 35: Removing Bearing Housing
Courtesy of MAZDA MOTORS CORP.

MAINSHAFT AND COUNTERSHAFT PARTS ASSEMBLY

- Assemble in the order indicated in the figure.



1	Clutch hub
2	Synchronizer key
3	Clutch hub sleeve
4	Synchronizer key springs
5	4th synchronizer ring
6	Bearing
7	Main drive gear
8	Bearing housing component
9	Washer (See SHIFT FORK AND SHIFT ROD PARTS DISASSEMBLY / ASSEMBLY, 1st/2nd Shift Fork and Rod, 3rd/4th Shift Fork and Rod, and Interlock Pin Assembly Note)

10	Mainshaft gear component (See MAINSHAFT GEAR COMPONENT ASSEMBLY NOTE)
11	Spacer
12	Countershaft (See COUNTERSHAFT ASSEMBLY NOTE)
13	Counter reverse gear
14	Washer (See SHIFT FORK AND SHIFT ROD PARTS DISASSEMBLY / ASSEMBLY, 1st/2nd Shift Fork and Rod, 3rd/4th Shift Fork and Rod, and Interlock Pin Assembly Note)
15	Bearing race
16	Bearing
17	Reverse gear

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Fig. 36: Assembling Mainshaft & Countershaft (1 Of 2)
Courtesy of MAZDA MOTORS CORP.

18	Reverse synchronizer ring
19	Clutch hub component (5th/reverse)
20	Locknut (Mainshaft) (See LOCKNUT (MAINSHAFT) ASSEMBLY NOTE)
21	5th synchronizer ring
22	5th gear
23	Steel ball
24	Thrust lock washer (See THRUST LOCK WASHER ASSEMBLY NOTE)
25	C-washer
26	Retaining ring
27	Spacer
28	Counter 5th gear
29	Mainshaft rear bearing (See MAINSHAFT REAR BEARING ASSEMBLY NOTE)
30	C-washer
31	Retaining ring
32	Washer
33	Snap ring
34	Countershaft rear bearing (See COUNTERSHAFT REAR BEARING ASSEMBLY NOTE)
35	Locknut (Countershaft) (See LOCKNUT (COUNTERSHAFT) ASSEMBLY NOTE)

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Fig. 37: Assembling Mainshaft & Countershaft - Legend Cont. (2 Of 2)
Courtesy of MAZDA MOTORS CORP.

Mainshaft Gear Component & Countershaft Assembly Note

1. Place the mainshaft gear component and the countershaft on the bearing housing.
2. Use a bar to press in the countershaft.

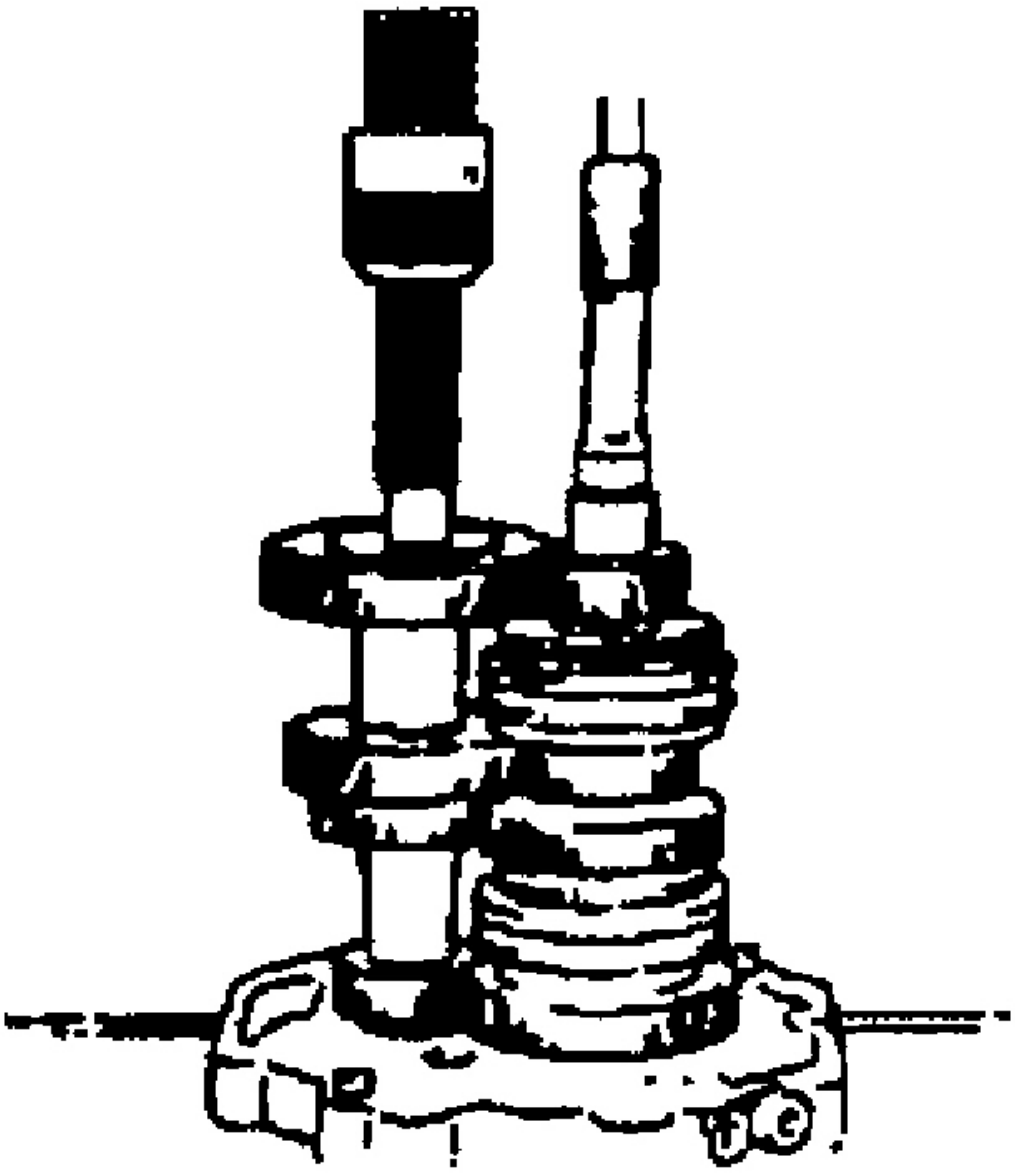

Fig. 38: Installing Countershaft On Bearing Housing
Courtesy of MAZDA MOTORS CORP.

Locknut (Mainshaft) Assembly Note

1. Secure the bearing housing component in a vise.
2. Shift the clutch hub sleeves into 1st and reverse gears to lock the rotation of the mainshaft.

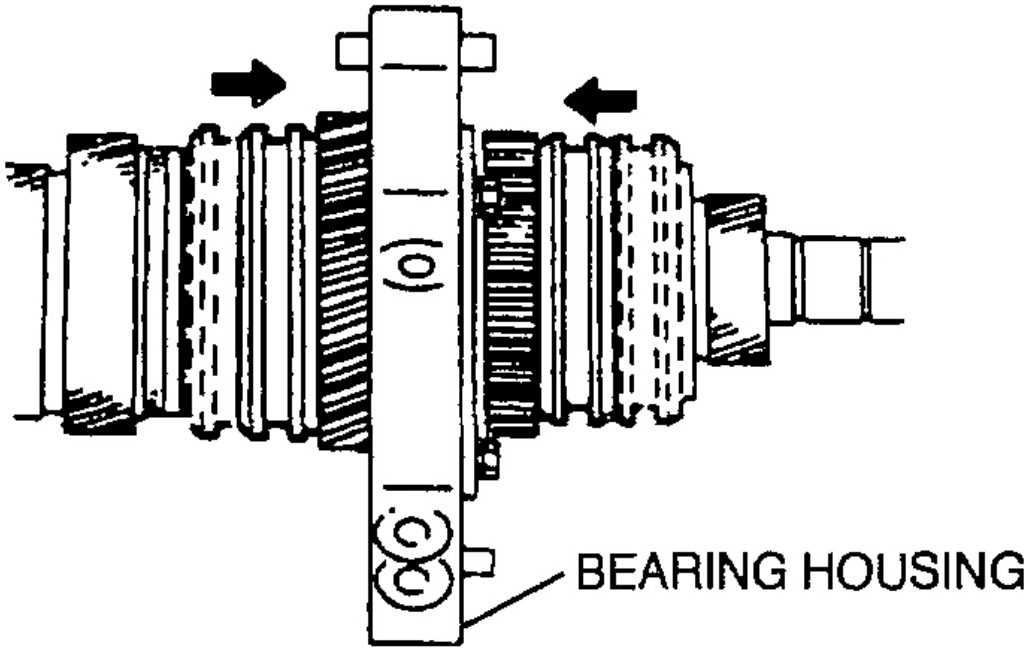

Fig. 39: Shifting Clutch Hub Sleeves Into 1st & Reverse Gears
Courtesy of MAZDA MOTORS CORP.

3. Install a new locknut and tighten it by using the **SST** .

Tightening Torque

128-205 N.m {13-21 kgf.m, 95-151 ft.lbf}

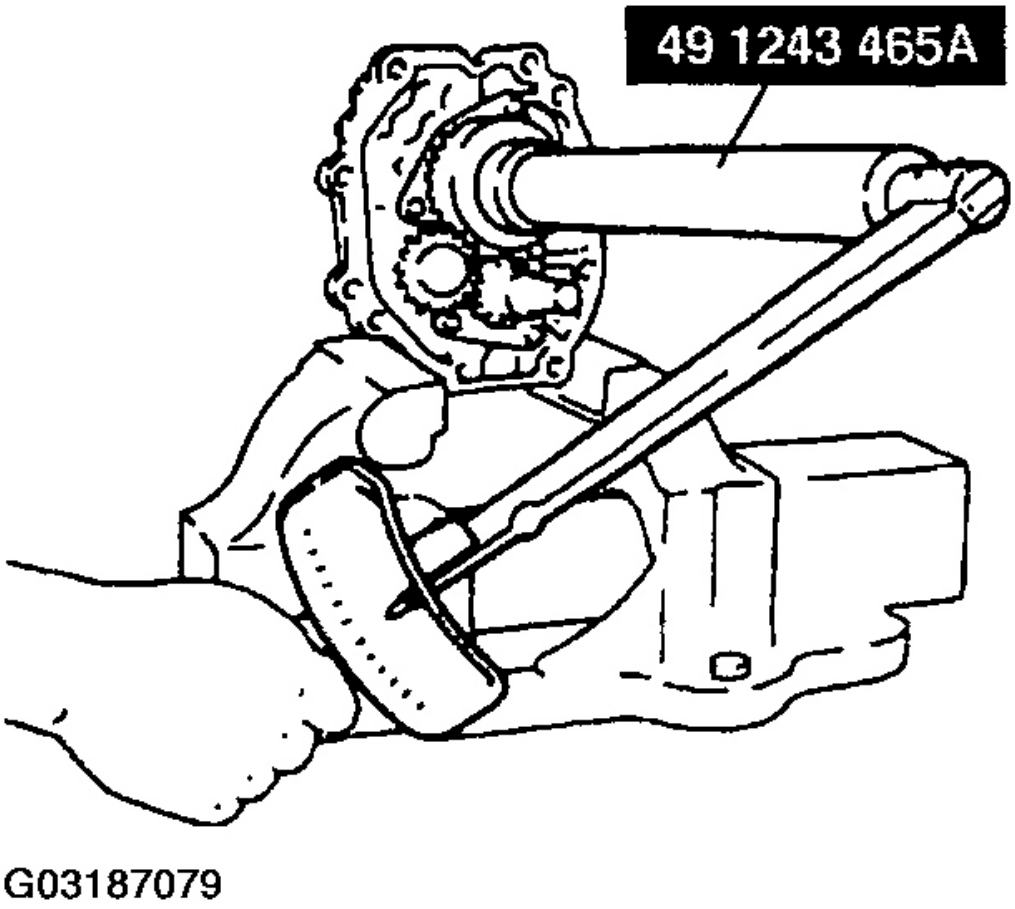

Fig. 40: Tightening Locknut
Courtesy of MAZDA MOTORS CORP.

4. Use a chisel to stake the locknut.

Thrust Lock Washer Assembly Note

1. Install the synchronizer ring and 5th gear.
2. Insert the steel ball and thrust lock washer.
3. Install two **3.0 mm {0.118 in}** thick C-washers in the front mainshaft groove.
4. Push the C-washers fully toward 5th gear and measure the clearance between the thrust lock washer and C-washers. If the clearance in not as specified, select the proper thrust lock washer.

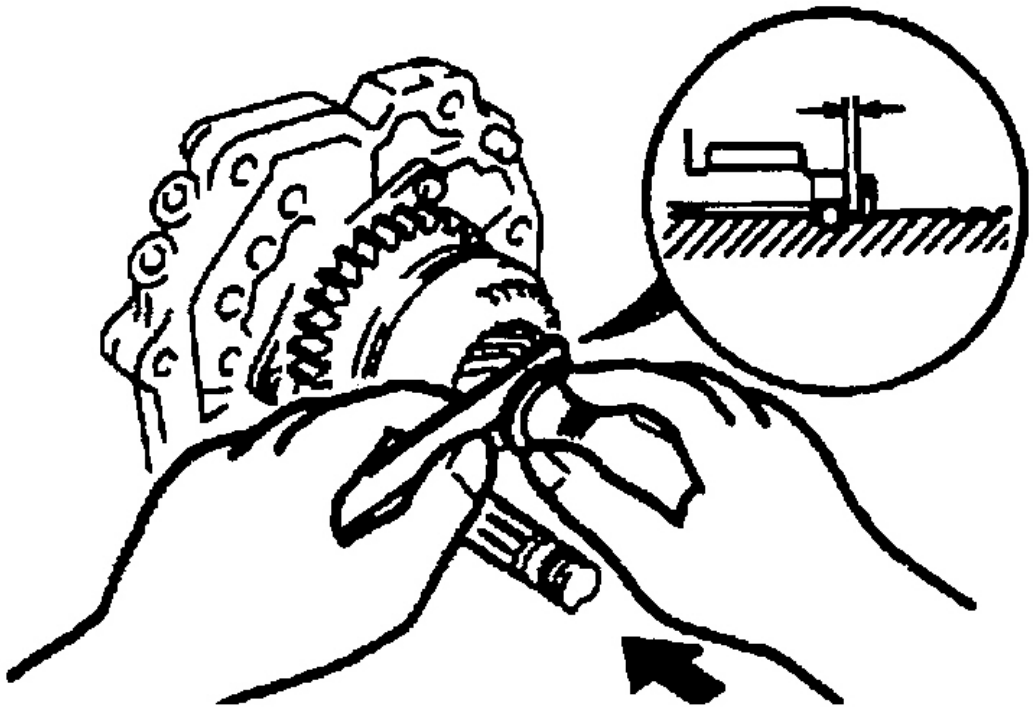

Fig. 41: Measuring Clearance Between Thrust Lock Washer & C-Washers
Courtesy of MAZDA MOTORS CORP.

Standard Clearance

0.1-0.3 mm {0.004-0.012 in}

Thrust Lock Washer Thickness

6.2 mm {0.244 in}
6.4 mm {0.252 in}
6.5 mm {0.256 in}
6.6 mm {0.260 in}

5. Install the retaining ring.

Mainshaft Rear Bearing Assembly Note

1. Install the mainshaft rear bearing by using the **SST** , and fully seat it against the front C-washers.

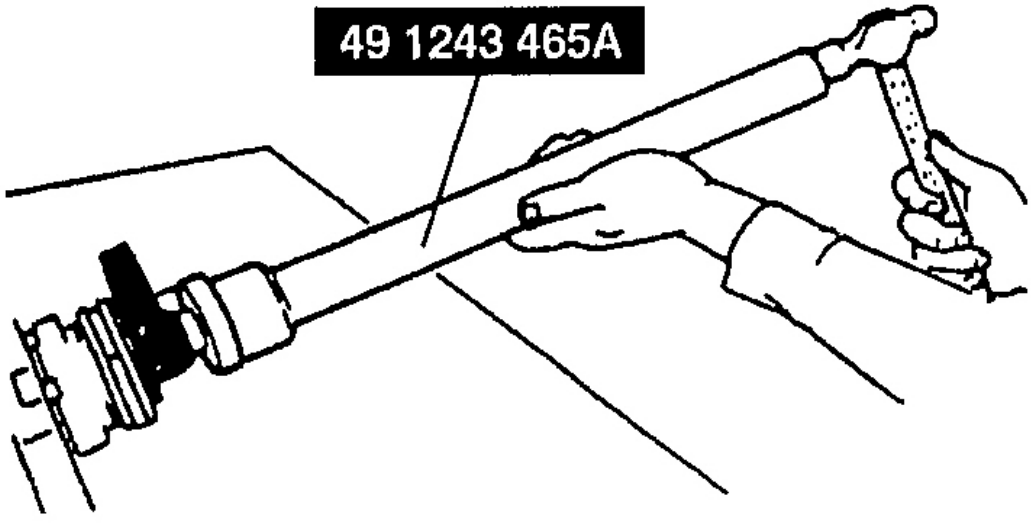

Fig. 42: Installing Mainshaft Rear Bearing
Courtesy of MAZDA MOTORS CORP.

2. Install the original C-washers and hold them with the retaining ring.
3. Install the washer and new snap ring.
4. If the C-washers do not fit into the rear mainshaft groove, select the proper thickness C-washers.
5. Verify that C-washers installed at one position are of the same thickness.
6. With points A through C pressed tightly together, measure the clearance between the washer and snap ring. If the clearance is not as specified, select the proper C-washers.

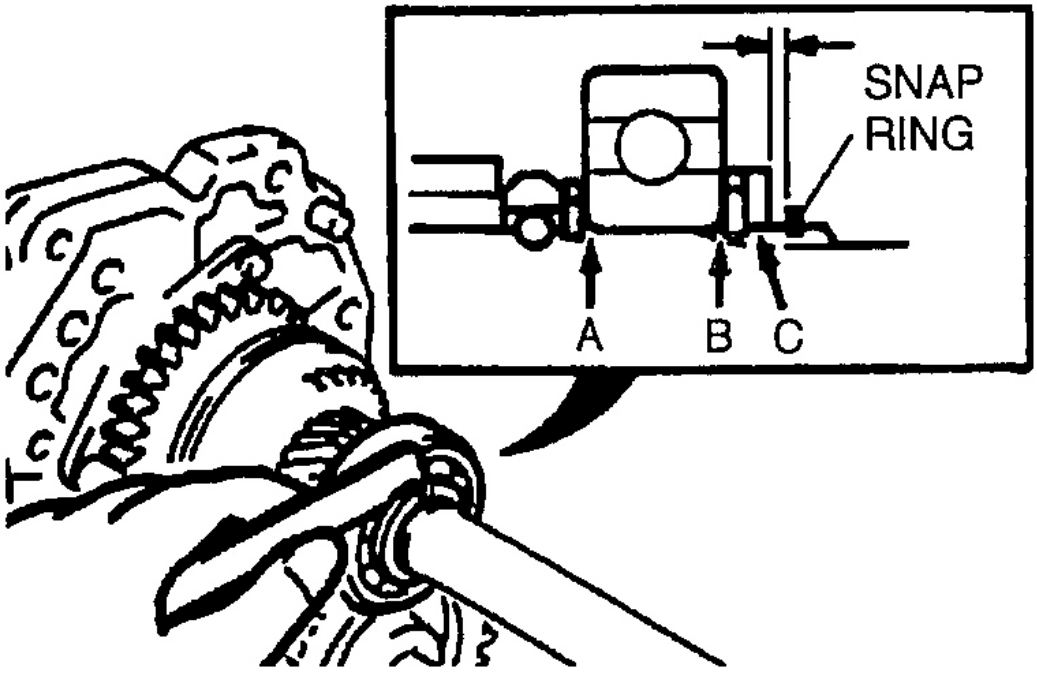

Fig. 43: Measuring Clearance Between Washer & Snap Ring
Courtesy of MAZDA MOTORS CORP.

Standard Clearance

0-0.1 mm {0-0.004 in}

C-Washer Thickness

2.9 mm {0.114 in}
3.0 mm {0.118 in}
3.1 mm {0.122 in}
3.2 mm {0.126 in}

Countershaft Rear Bearing Assembly Note

- Install the countershaft rear bearing onto the countershaft by using the **SST** .

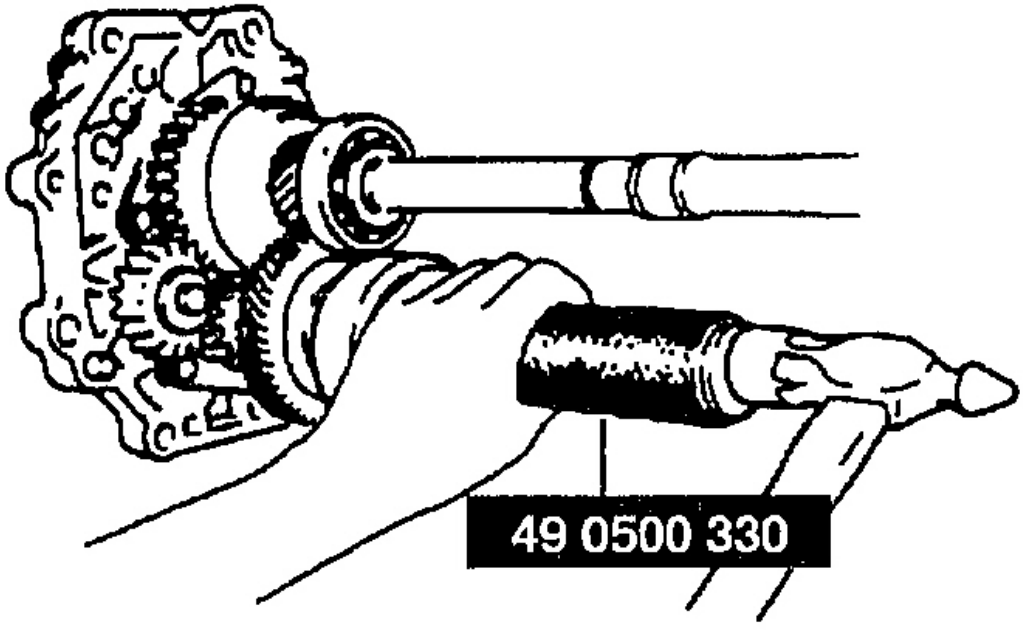

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Fig. 44: Installing Countershaft Rear Bearing
Courtesy of MAZDA MOTORS CORP.

Locknut (Countershaft) Assembly Note

1. Shift the clutch hub sleeves into 1st and reverse gears to lock the rotation of the mainshaft.

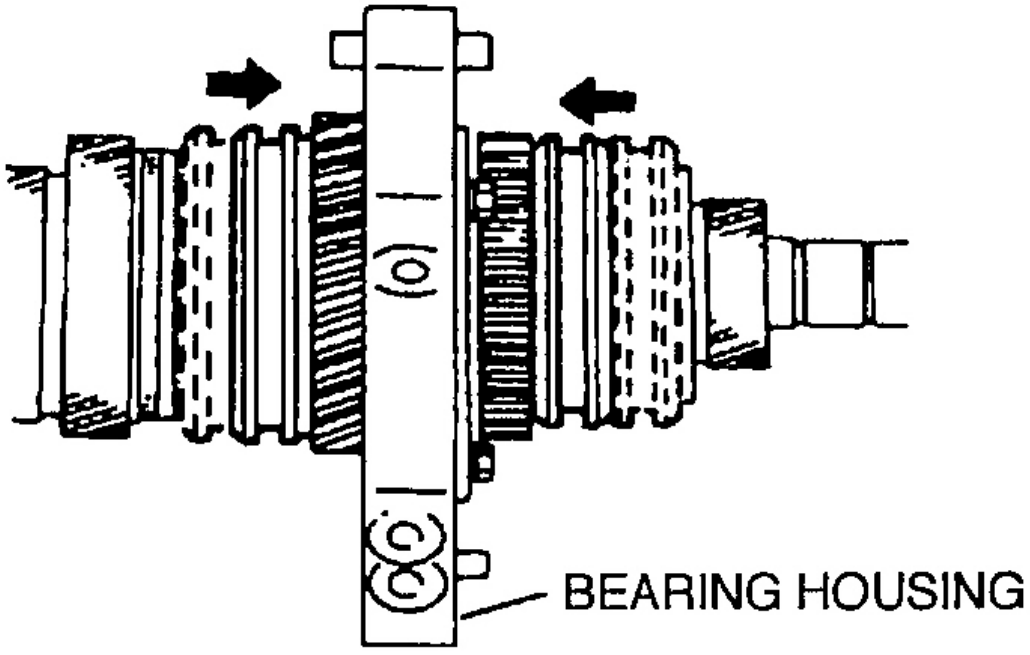

Fig. 45: Shifting Clutch Hub Sleeves Into 1st & Reverse Gears
Courtesy of MAZDA MOTORS CORP.

2. Connect the **SST** to the mainshaft and secure it in a vise.
3. Install a new locknut and tighten it.

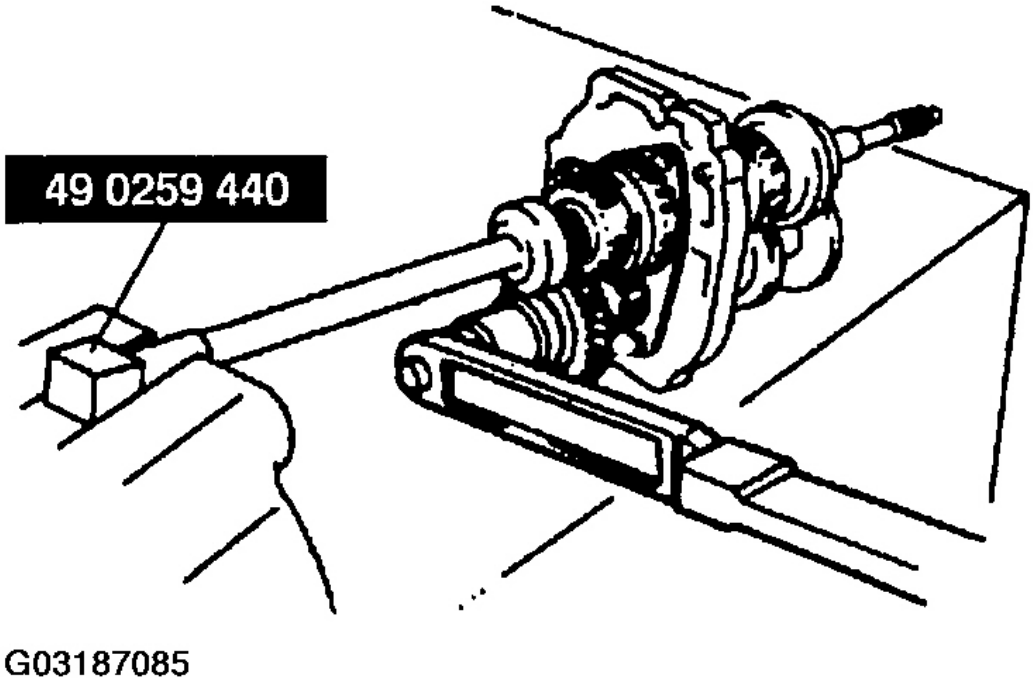

Fig. 46: Tightening Locknut
Courtesy of MAZDA MOTORS CORP.

Tightening Torque

128-196 N.m {13-20 kgf.m, 95-144 ft.lbf}

4. Use a chisel to stake the locknut.

MAINSHAFT AND COUNTERSHAFT PARTS INSPECTION

Bearing Inspection

- Inspect for damage and rough rotation.

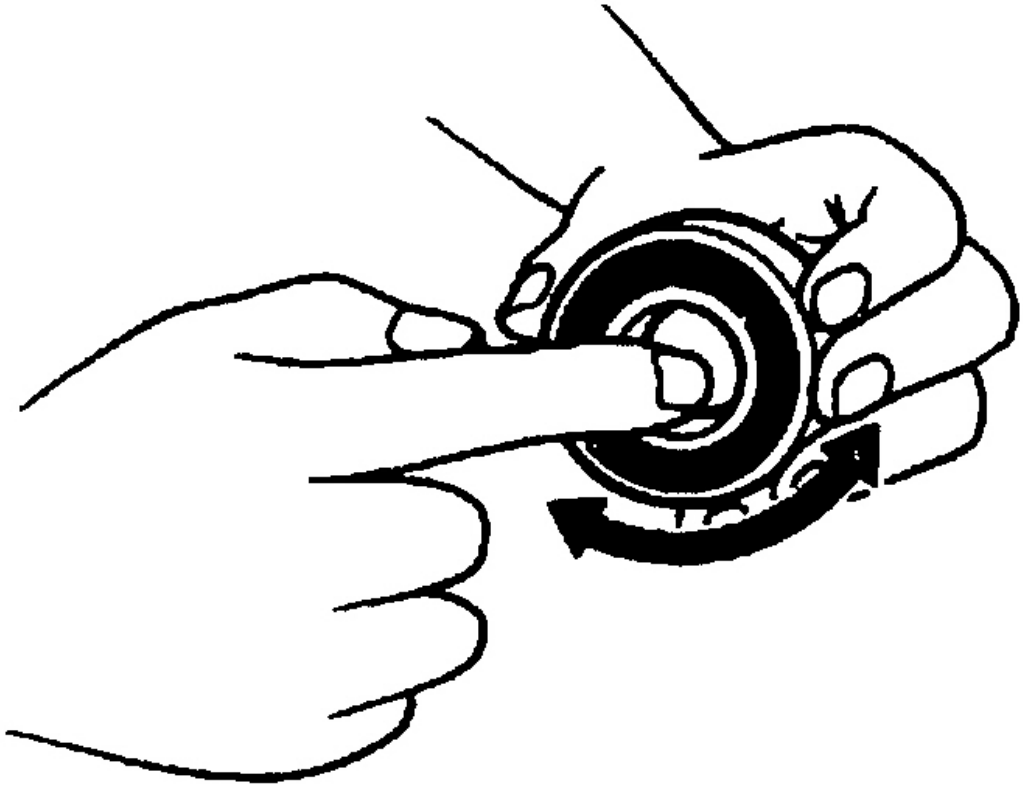

Fig. 47: Inspecting Bearing For Damage & Rough Rotation
Courtesy of MAZDA MOTORS CORP.

Each Gear and Main Drive Gear Inspection

- Inspect the following, and replace the each gear and main drive gear as necessary:
  1. Synchronizer cones for wear.
  2. Individual gear teeth for damage, wear, and cracks.
  3. Synchronizer ring matching teeth for damage and wear.
  4. Main drive gear splines for damage and wear.

Clutch Hub Component Inspection

- Inspect the following, and replace the clutch hub component as necessary:
  1. Clutch hub sleeve and hub operation.

2. Individual gear teeth for damage, wear, and cracks.
3. Synchronizer keys for damage, wear, and cracks.

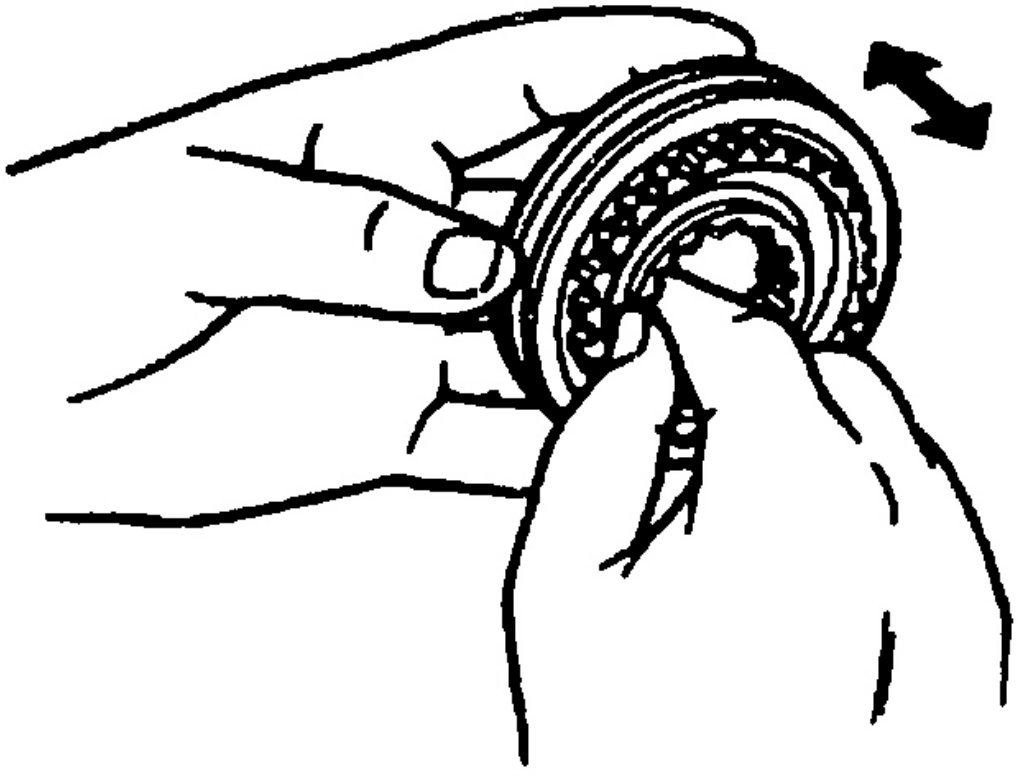

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Fig. 48: Inspecting Clutch Hub Component
Courtesy of MAZDA MOTORS CORP.

Synchronizer Ring Inspection

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

Standard Clearance

1.5 mm {0.059 in}

Minimum

0.8 mm {0.031 in}

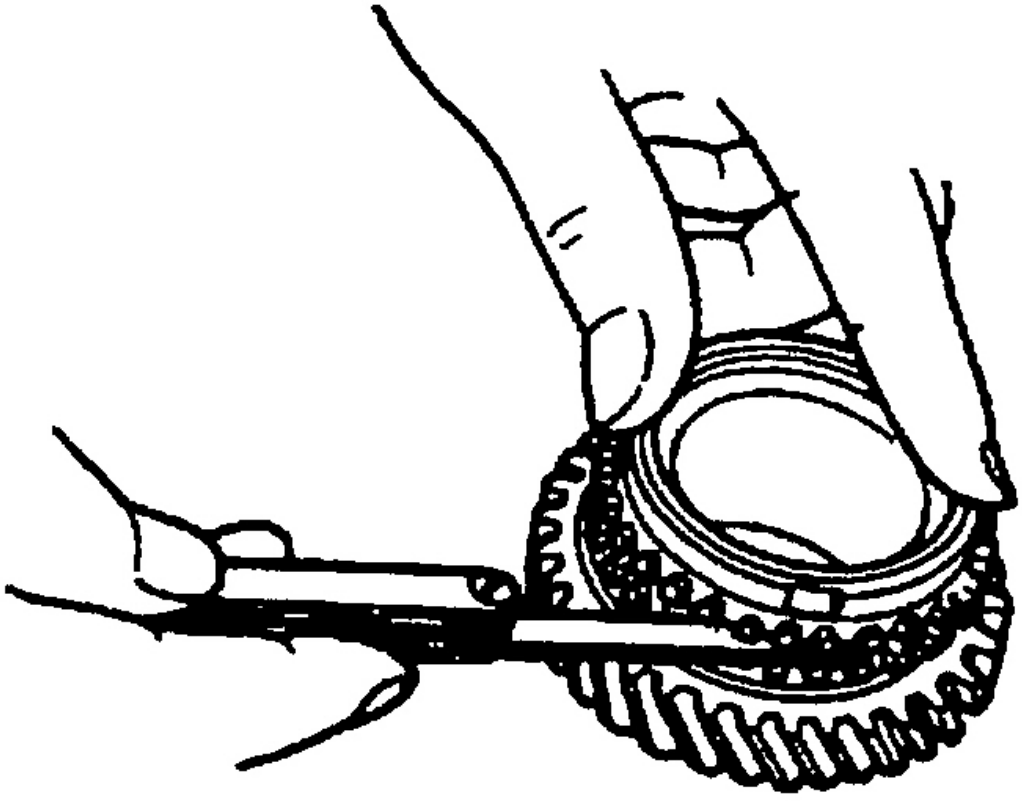


Fig. 49: Measuring Clearance Between Synchronizer Ring & Flank Surface Of Gear
Courtesy of MAZDA MOTORS CORP.

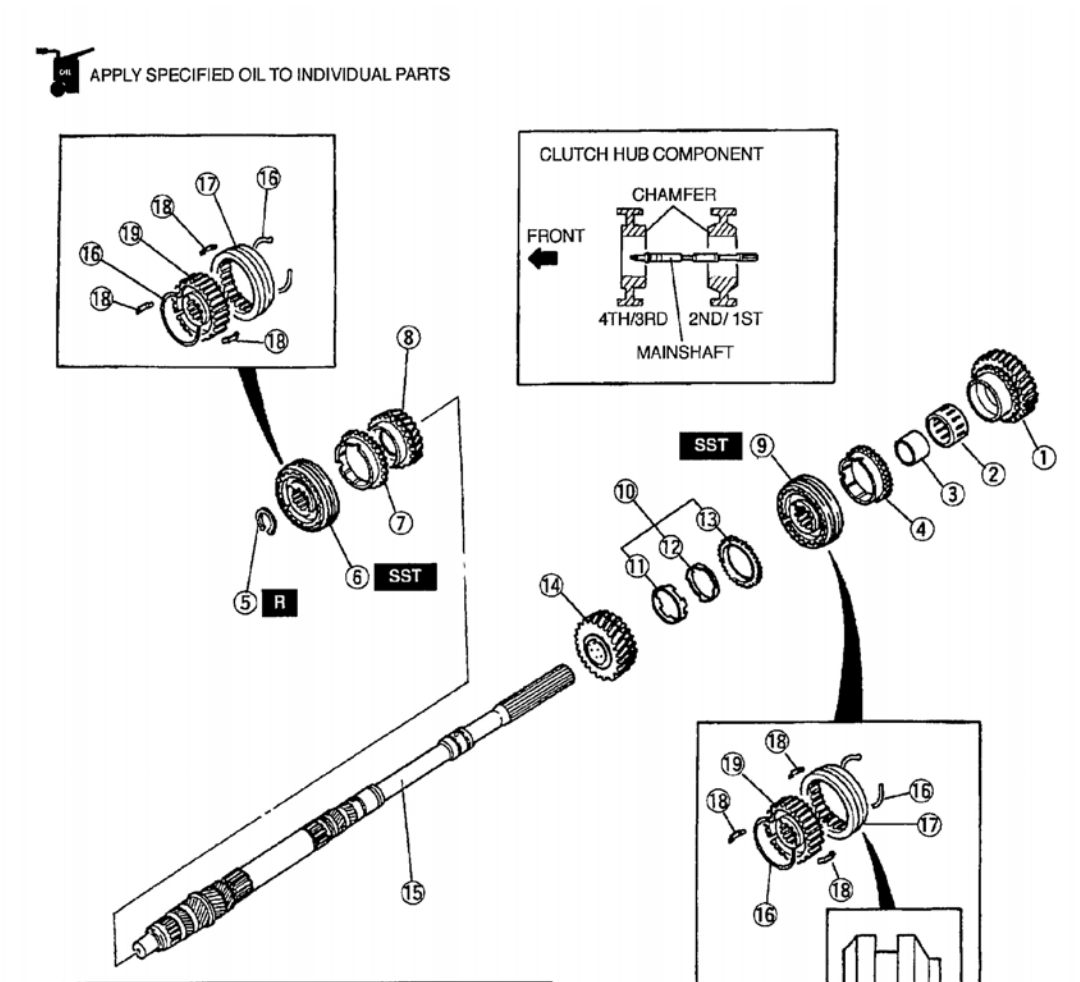
4. If not as specified, replace the synchronizer ring.

Countershaft Inspection

- Inspect the following, and replace the countershaft as necessary.
    1. Gear teeth for damage, wear, and cracks.

MAINSHAFT PARTS DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the figure.



1	1st gear
2	Bearing
3	Bearing race
4	1st synchronizer ring
5	Snap ring
6	3rd/4th clutch hub component (See 3RD/4TH CLUTCH HUB COMPONENT DISASSEMBLY NOTE) (See 3RD/4TH CLUTCH HUB COMPONENT ASSEMBLY NOTE)
7	3rd synchronizer ring
8	3rd gear
9	1st/2nd clutch hub component (See 1ST/2ND CLUTCH HUB COMPONENT DISASSEMBLY NOTE) (See 1ST/2ND CLUTCH HUB COMPONENT ASSEMBLY NOTE)

10	2nd synchronizer component
11	Inner cone
12	Double cone
13	2nd synchronizer ring
14	2nd gear
15	Mainshaft
16	Synchronizer key springs
17	Clutch hub sleeve
18	Synchronizer key
19	Clutch hub

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Fig. 50: Disassembling/Assembling Mainshaft
Courtesy of MAZDA MOTORS CORP.

2. Assemble in the reverse order of disassembly.

3rd/4th Clutch Hub Component Disassembly Note

1. Position the **SST** between 2nd and 3rd gears, and hold the mainshaft from underneath.

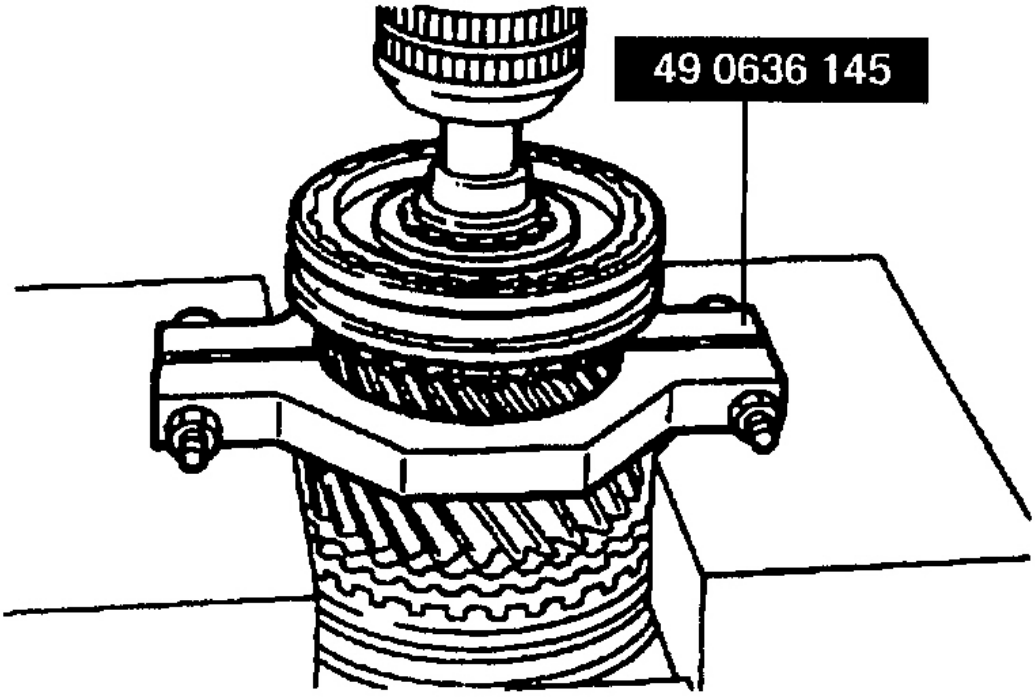


Fig. 51: Installing SST Between 2nd & 3rd Gears
Courtesy of MAZDA MOTORS CORP.

2. Press the mainshaft out of the 3rd/4th clutch hub component and 3rd gear.

1st/2nd Clutch Hub Component Disassembly Note

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

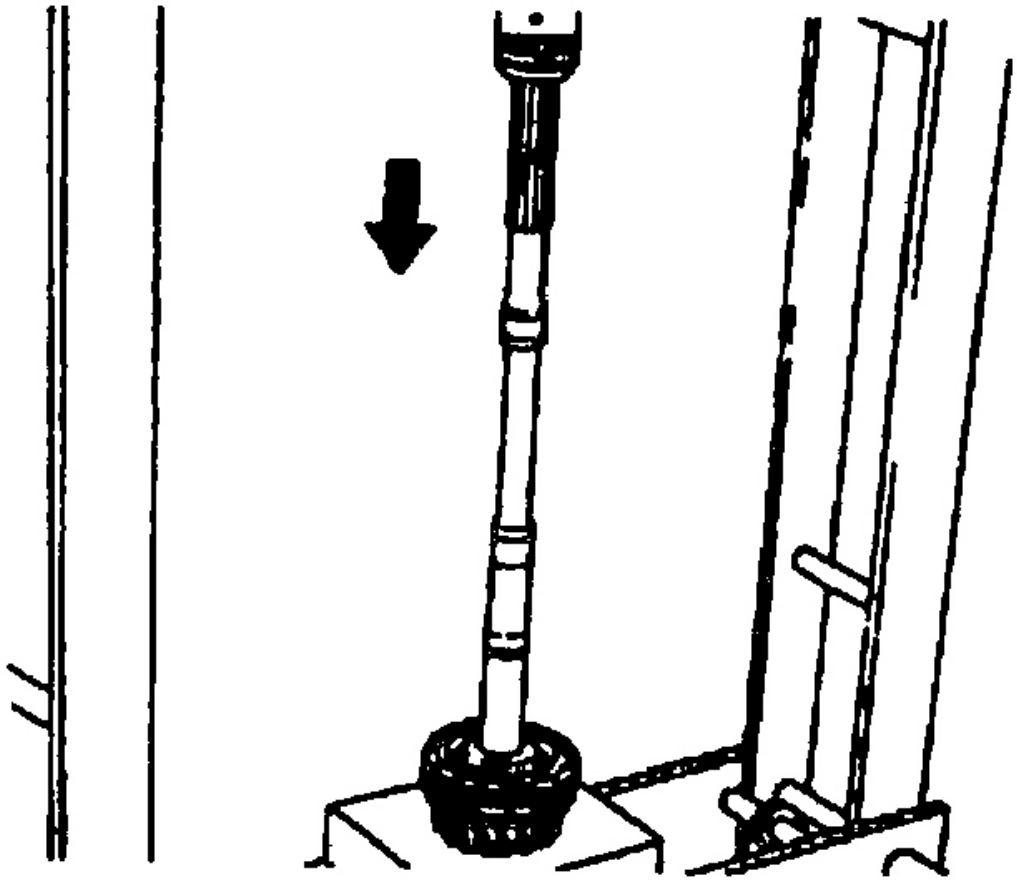


Fig. 52: Removing 1st/2nd Clutch Hub Component, 2nd Synchronizer Component & 2nd Gear
Courtesy of MAZDA MOTORS CORP.

1st/2nd & 3rd/4th Clutch Hub Component Assembly Note

1. Set the 2nd gear, 2nd synchronizer component, and 1st/2nd clutch hub component on the mainshaft, then press in the mainshaft.
2. Set the 3rd gear, 3rd synchronizer ring, and 3rd/4th clutch hub component on the mainshaft, then press them onto the mainshaft by using the **SST** .

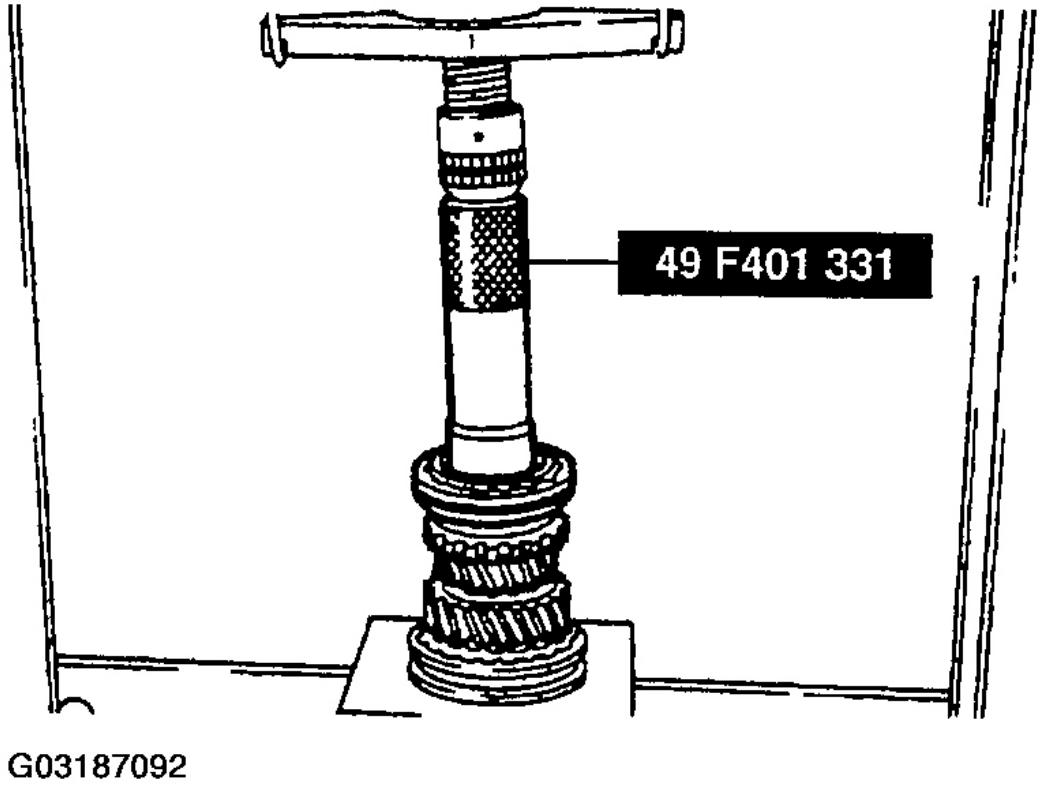


Fig. 53: Installing 2nd Gear, 2nd Synchronizer, 1st/2nd Clutch Hub, 3rd Gear/Synchronizer Ring & 3rd/4th Clutch Hub
Courtesy of MAZDA MOTORS CORP.

3. Install a new snap ring on the front of the mainshaft.
4. Install the bearing race, bearing, and 1st gear.

MAINSHAFT PARTS INSPECTION

Each Gear Inspection

- Inspect the following, and replace each gear as necessary:
    1. Synchronizer cones for wear.
    2. Individual gear teeth for damage, wear, and cracks.
    3. Synchronizer ring matching teeth for damage and wear.
    4. Main drive gear splines for damage and wear.

Synchronizer Ring Inspection

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

Standard Clearance

1.5 mm {0.059 in}

Minimum

0.8 mm {0.031 in}

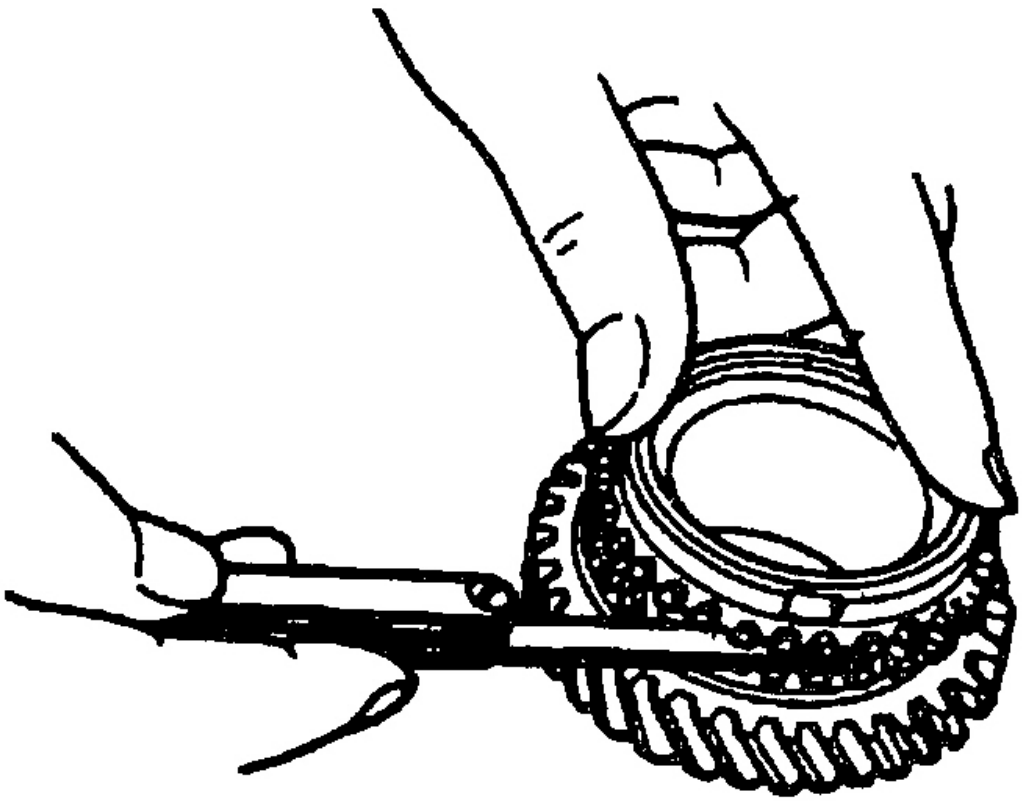


Fig. 54: Measuring Clearance Between Synchronizer Ring & Flank Surface Of Gear
Courtesy of MAZDA MOTORS CORP.

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

Clutch Hub Component Inspection

- Inspect the following, and replace the clutch hub component as necessary:
  1. Clutch hub operation.
  2. Individual gear teeth for damage, wear, and cracks.

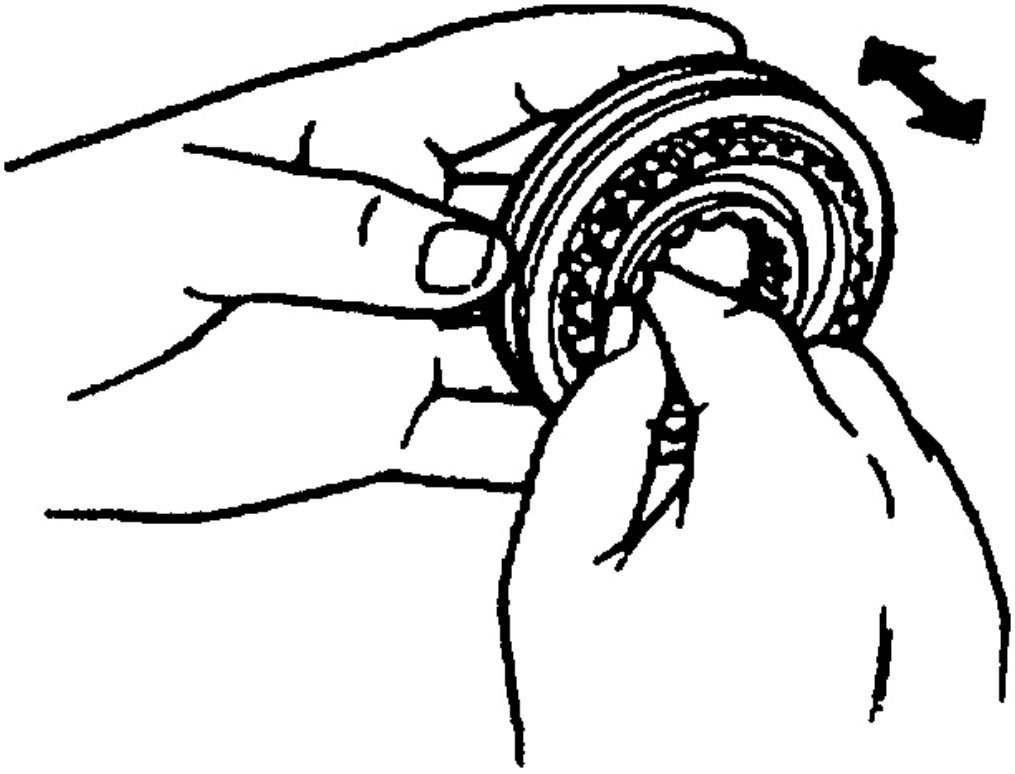


Fig. 55: Inspecting Clutch Hub Operation
Courtesy of MAZDA MOTORS CORP.

Synchronizer Component (2nd) Inspection

1. Inspect individual synchronizer ring gear teeth for damage, wear, and cracks. Replace the synchronizer component if any such damage is found.
2. Inspect for wear and damage to the tapered surfaces of the inner cone, double cone, and synchronizer

ring. Replace the synchronizer component if any such damage is found.

3. Set the synchronizer ring squarely in the gear.
4. Measure the clearance between the synchronizer ring and the flank surface of gear all around the circumference.

Clearance

1.5 mm {0.059 in}

Minimum

0.8 mm {0.031 in}

Mainshaft Inspection

1. Measure the mainshaft runout as shown.

Maximum runout

0.03 mm {0.0012 in}

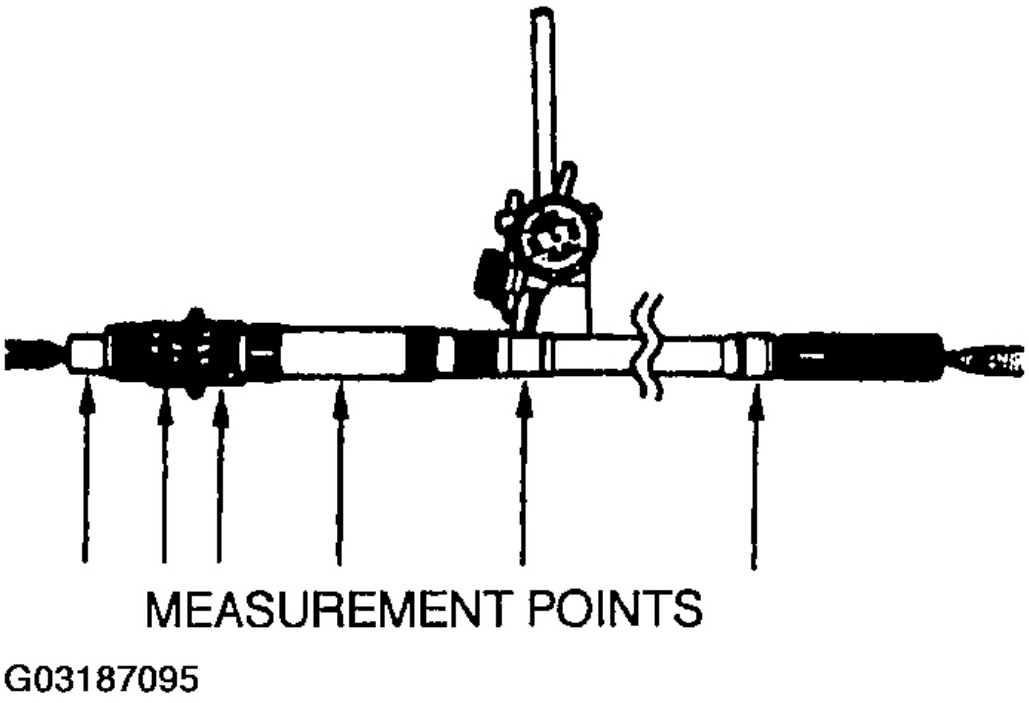


Fig. 56: Measuring Mainshaft Runout
Courtesy of MAZDA MOTORS CORP.

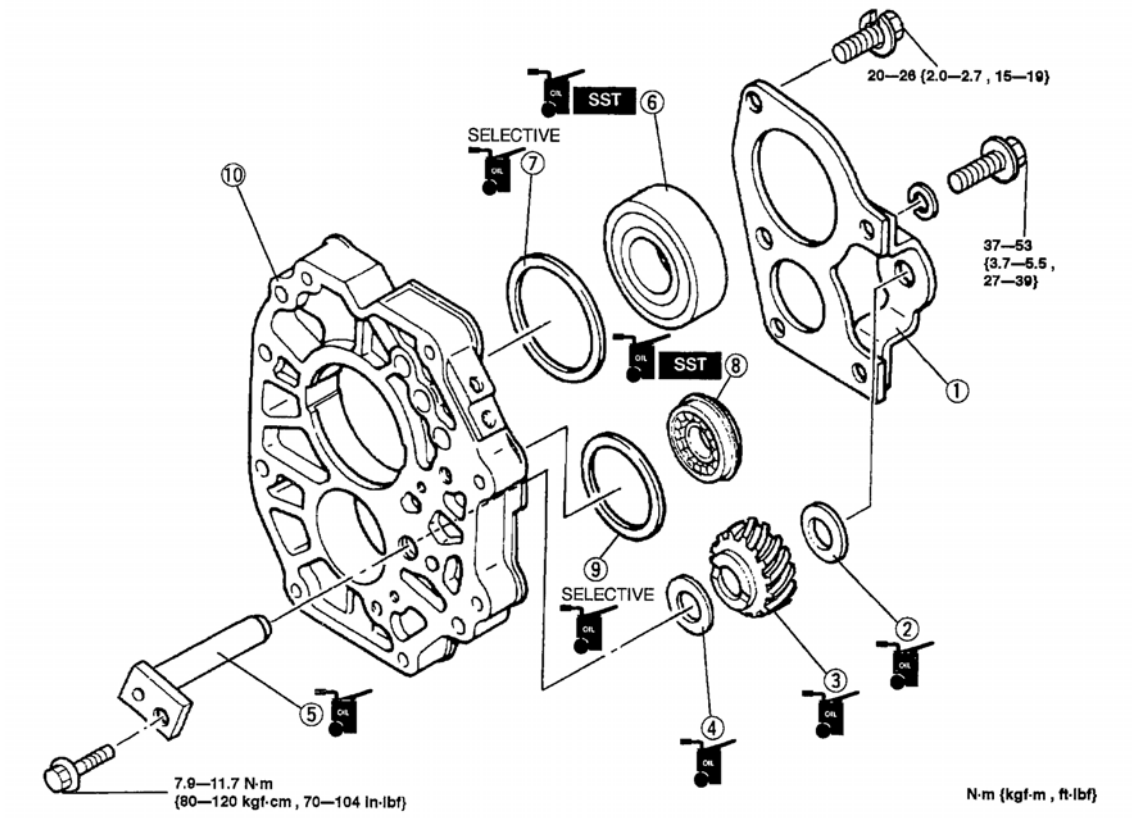
2. If not as specified, replace the mainshaft.
3. Inspect splines for damage or wear. Replace the main shaft if any such damage is found.
4. Measure the clearance between mainshaft and gear (or bushing).

Maximum Clearance
0.15 mm {0.006 in}

5. If not as specified, replace the mainshaft

BEARING HOUSING COMPONENT DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the figure.



1	Bearing cover
2	Washer
3	Reverse idler gear (See REVERSE IDLER GEAR ASSEMBLY NOTE)
4	Washer
5	Reverse idler gear shaft (See REVERSE IDLER GEAR SHAFT DISASSEMBLY NOTE) (See REVERSE IDLER GEAR SHAFT ASSEMBLY ASSEMBLY NOTE)
6	Mainshaft front bearing (See MAINSHAFT FRONT BEARING DISASSEMBLY NOTE) (See MAINSHAFT FRONT BEARING ASSEMBLY NOTE)

7	Mainshaft front bearing adjustment shim (See MAINSHAFT FRONT BEARING ADJUSTMENT SHIM ASSEMBLY NOTE)
8	Countershaft center bearing (See COUNTER-SHAFT CENTER BEARING DISASSEMBLY NOTE) (See COUNTERSHAFT CENTER BEARING ASSEMBLY NOTE)
9	Countershaft center bearing adjustment shim (See COUNTERSHAFT CENTER BEARING ADJUSTMENT SHIM ASSEMBLING NOTE)
10	Bearing housing

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Fig. 57: Disassembling/Assembling Bearing Housing
Courtesy of MAZDA MOTORS CORP.

2. Assemble in the reverse order of disassembly.

Reverse Idler Gear Shaft Disassembly Note

1. Remove the reverse idler gear shaft installation bolt.
2. Support the reverse idler gear shaft, and press it out from the bearing housing.

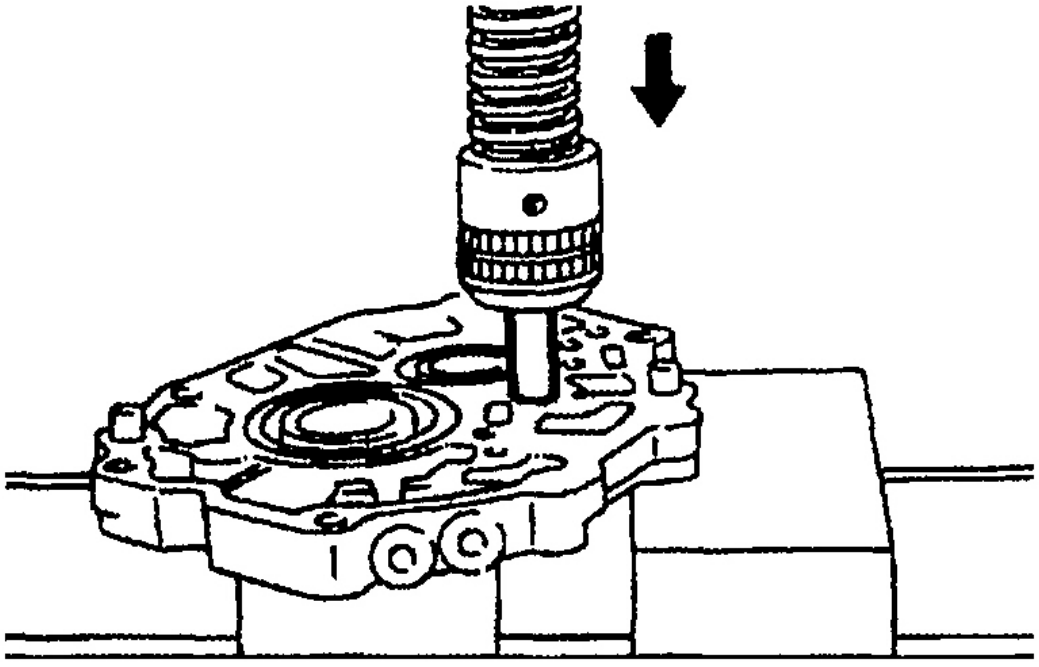

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Fig. 58: Removing Reverse Idler Gear Shaft
Courtesy of MAZDA MOTORS CORP.

Mainshaft Front Bearing Disassembly Note

- Support the mainshaft front bearing, and press it out from the bearing housing by using the **SST** .

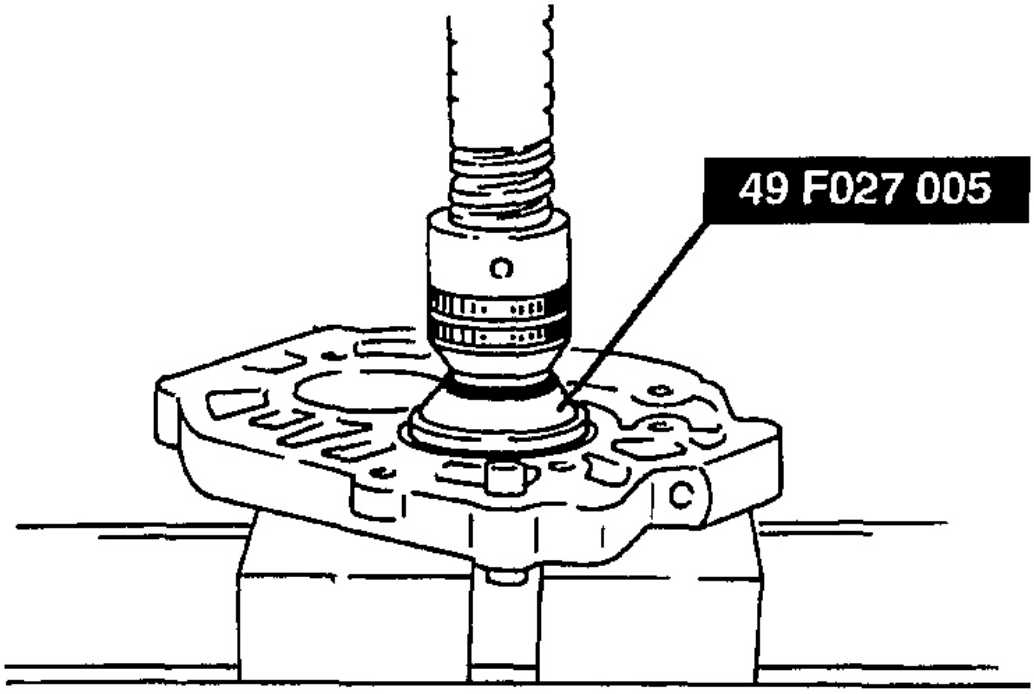


Fig. 59: Removing Mainshaft Front Bearing
Courtesy of MAZDA MOTORS CORP.

Countershaft Center Bearing Disassembly Note

NOTE:

- **If countershaft center bearing is replaced, replace the spacer also.**

- Support the countershaft center bearing, and press it out from the bearing housing by using the SST.

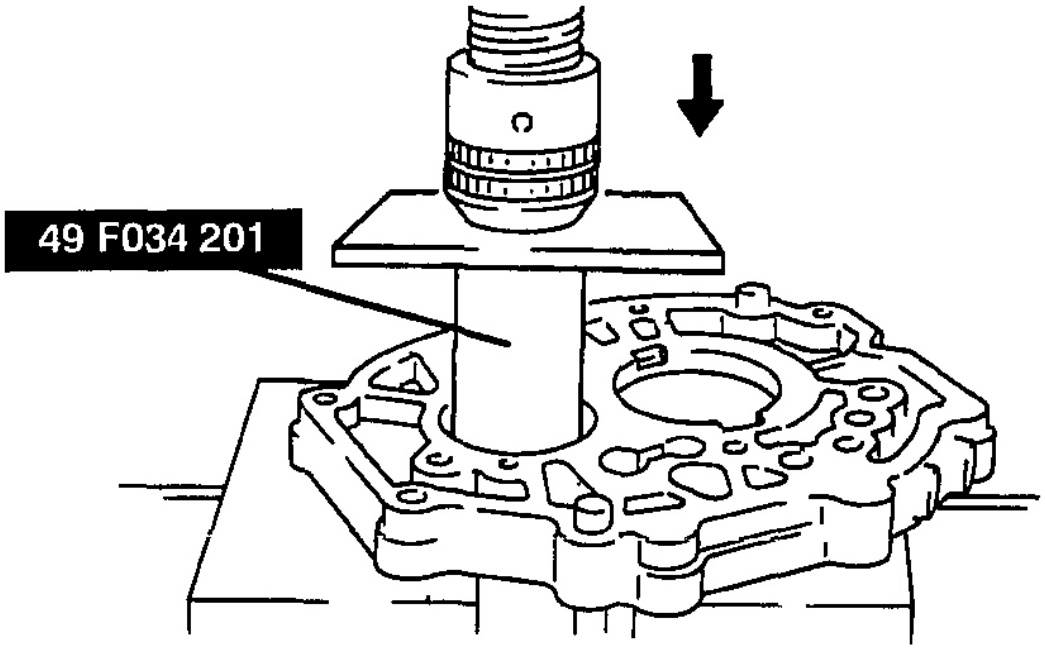


Fig. 60: Removing Countershaft Center Bearing
Courtesy of MAZDA MOTORS CORP.

Countershaft Center Bearing Adjustment Shim Assembly Note

- Measure the clearance between the countershaft center bearing and the bearing housing. If not within the specification, adjust the clearance by installing the correct adjustment shim(s)

  Standard Clearance

  0-0.1 mm {0-0.004 in}

  Adjustment Shim

  0.1 mm {0.004 in}, 0.3 mm {0.012 in}

Countershaft Center Bearing Assembly Note

- Press the countershaft center bearing into the bearing housing by using the **SST** .

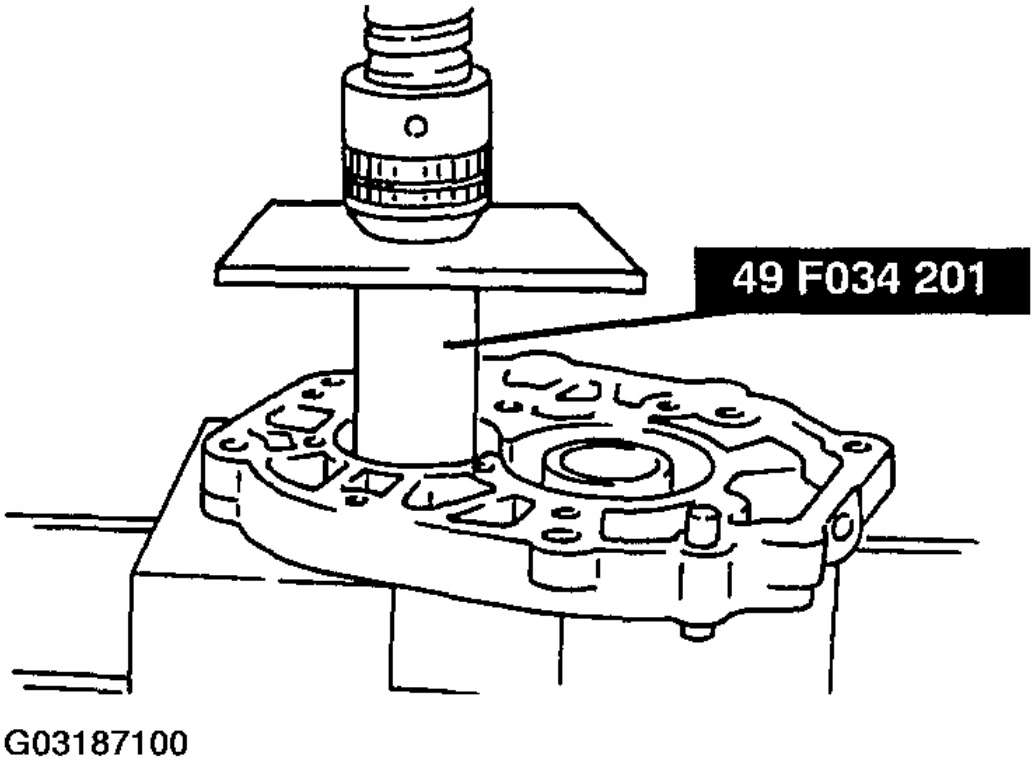


Fig. 61: Installing Countershaft Center Bearing
Courtesy of MAZDA MOTORS CORP.

Mainshaft Front Bearing Adjustment Shim Assembly Note

- Measure the clearance between the mainshaft front bearing and the bearing housing. If not within the specification, adjust the clearance by installing the correct adjustment shim(s).

Standard Clearance

0-0.1 mm {0-0.004 in}

Adjustment Shim

0.1 mm {0.004 in}, 0.3 mm {0.012 in}

Mainshaft Front Bearing Assembly Note

- Press the mainshaft front bearing into the bearing housing by using the **SST** .

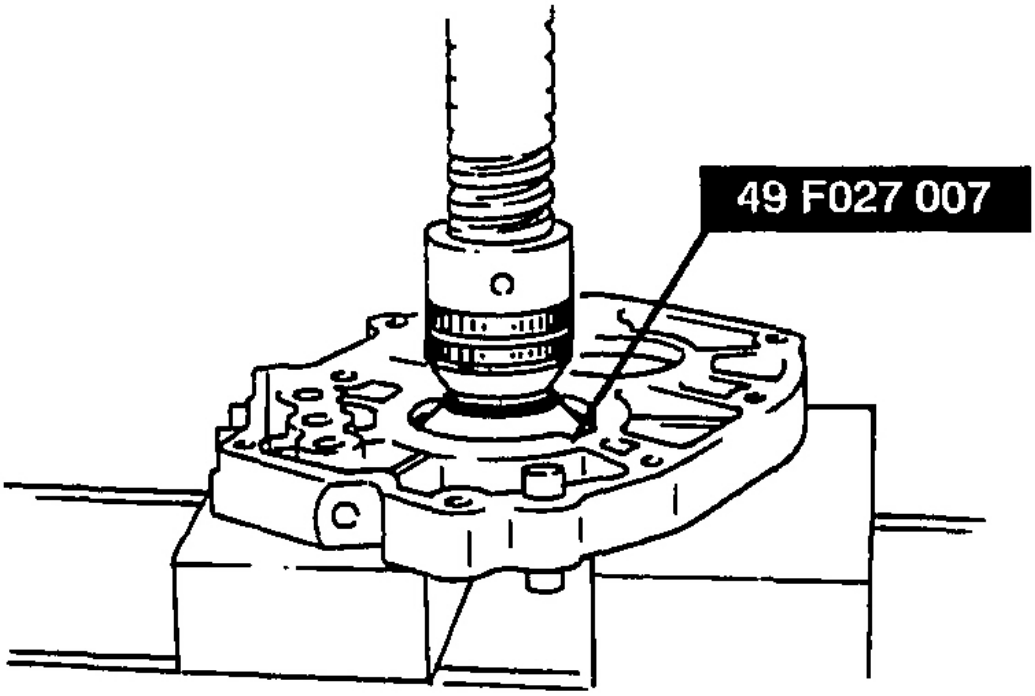


Fig. 62: Installing Mainshaft Front Bearing
Courtesy of MAZDA MOTORS CORP.

Reverse Idler Gear Shaft Assembly Note

1. Press the reverse idler gear shaft into the bearing housing.
2. Install and tighten the reverse idler gear shaft installation bolt.

Tightening Torque

7.9-11.7 N.m {80-120 kgf.cm, 70-104 in.lbf}

Reverse Idler Gear Assembly Note

1. Install the reverse idler gear, end washer, and bearing cover.
2. Tighten the bearing cover installation bolts.

Tightening Torque

A: 20-26 N.m {2.0-2.7 kgf.m, 15-19 ft.lbf}

B: 37-53 N.m {3.7-5.5 kgf.m, 27-39 ft.lbf}

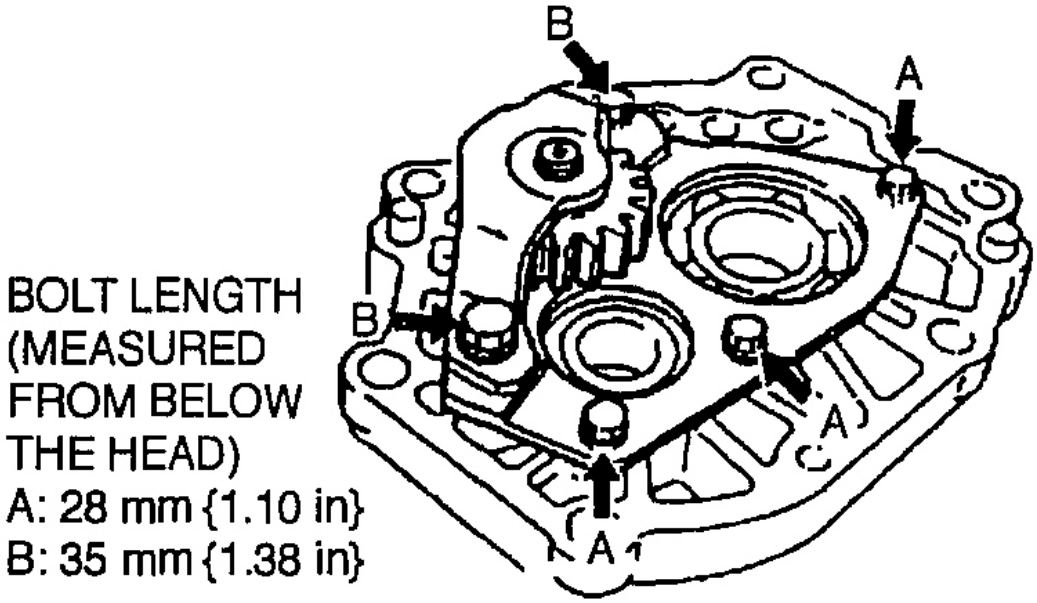


Fig. 63: Identifying Bearing Cover Installation Bolts
Courtesy of MAZDA MOTORS CORP.

BEARING HOUSING COMPONENT INSPECTION

Reverse Idler Gear & Shaft Inspection

1. Inspect gear teeth for wear and cracks. Replace the reverse idler gear as necessary.
2. Measure the clearance between the reverse idler gear bushing and shaft.

Standard Clearance

0.02-0.05 mm {0.0008-0.0020 in}

Maximum

0.15 mm {0.006 in}

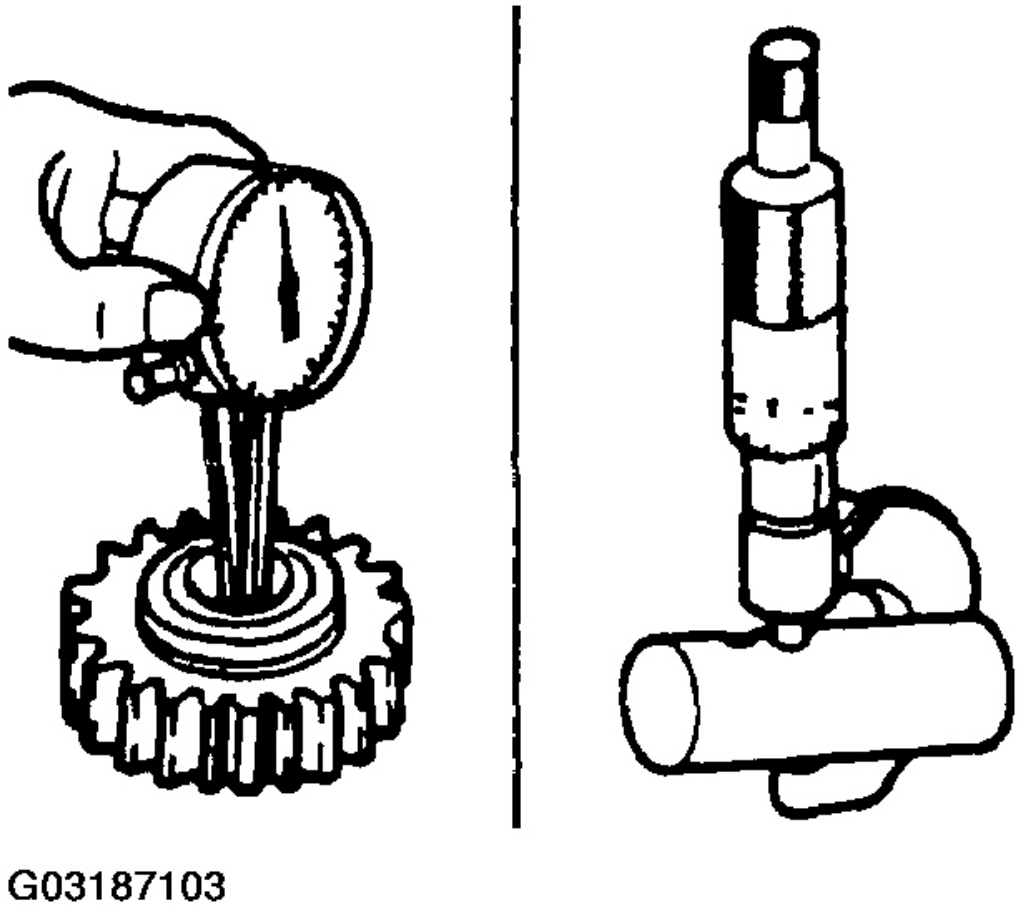


Fig. 64: Measuring Clearance Between Reverse Idler Gear Bushing & Shaft
Courtesy of MAZDA MOTORS CORP.

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

Bearing Inspection

- Inspect for damage and rough rotation. Replace the bearing as necessary.

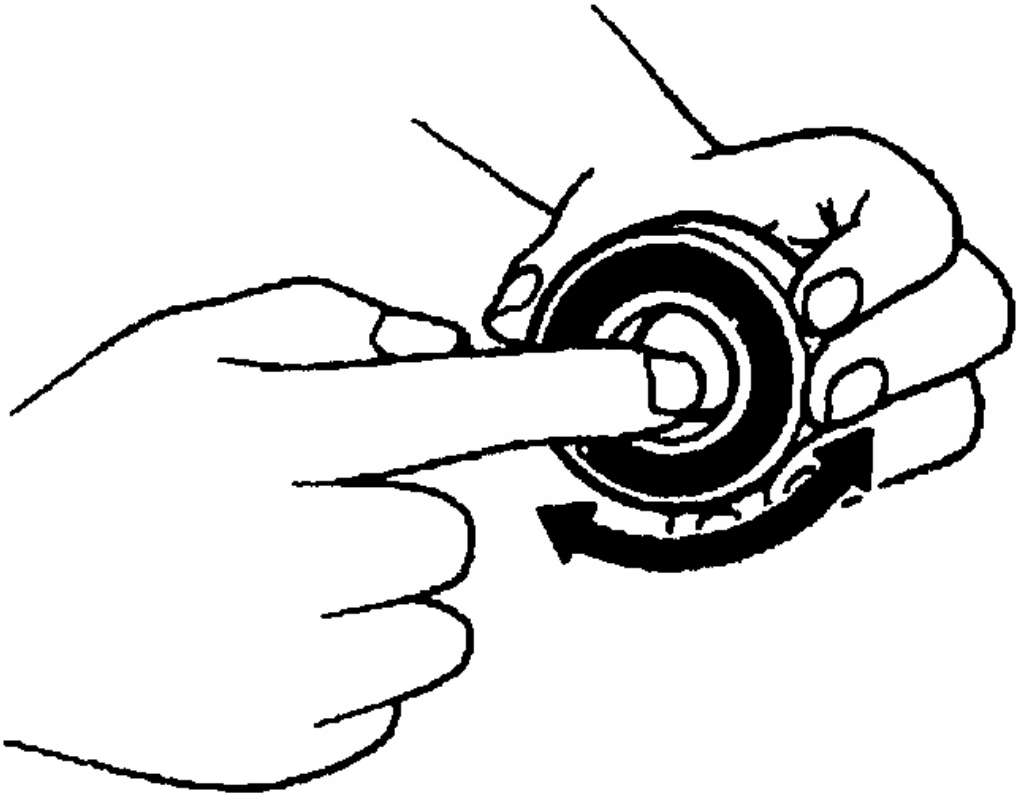
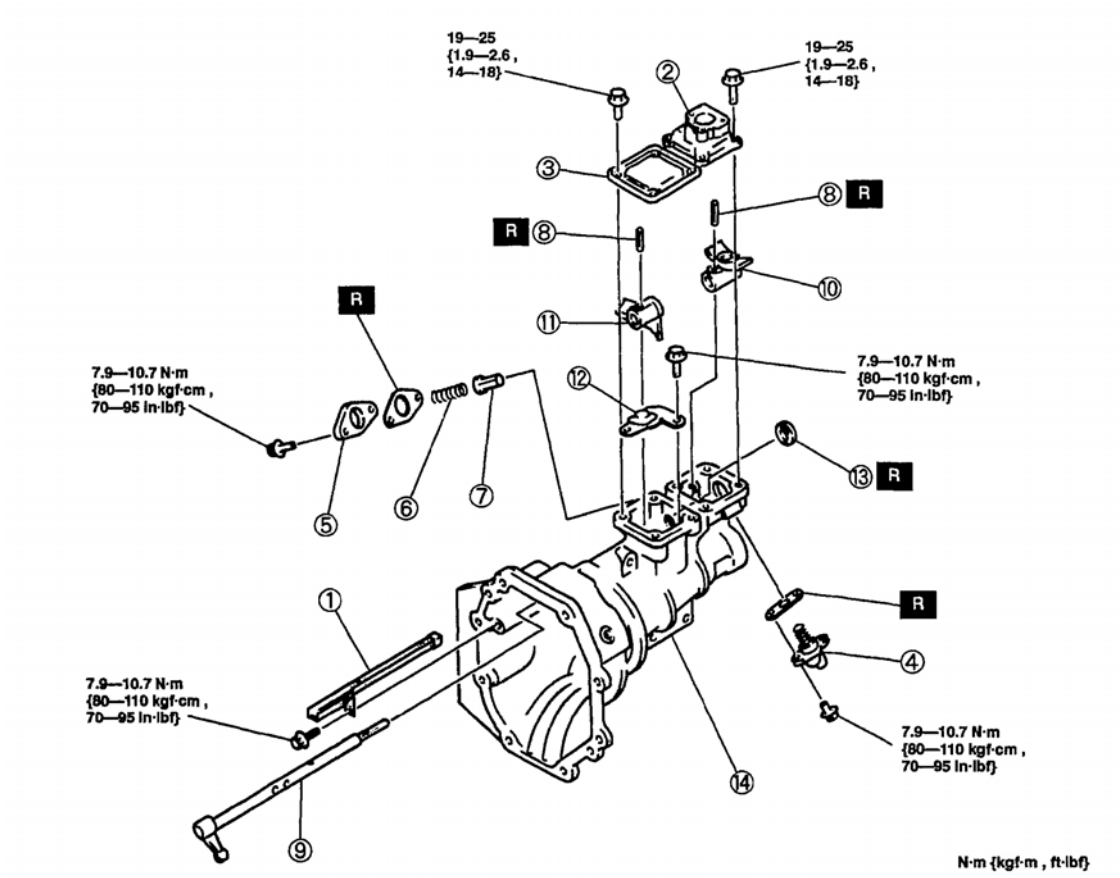


Fig. 65: Inspecting Bearing For Damage & Rough Rotation
Courtesy of MAZDA MOTORS CORP.

EXTENSION HOUSING PARTS DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the figure.



1	Oil guide
2	Control case
3	Blind cover
4	Select spindle component
5	Spring cap
6	Select lock spindle spring
7	Select lock spindle

8	Roll pin (See ROLL PIN DISASSEMBLY NOTE)
9	Control rod
10	Control rod end
11	Selector
12	Shift guide component
13	Oil seal
14	Extension housing

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Fig. 66: Disassembling/Assembling Extension Housing
Courtesy of MAZDA MOTORS CORP.

2. Assemble in the reverse order of disassembly.

Roll Pin Disassembly Note

1. Slide the control rod end to the point where the roll pin is directly above the recess in the extension housing.
2. Disassemble the roll pin from the control rod end by using a pin punch and a hammer.

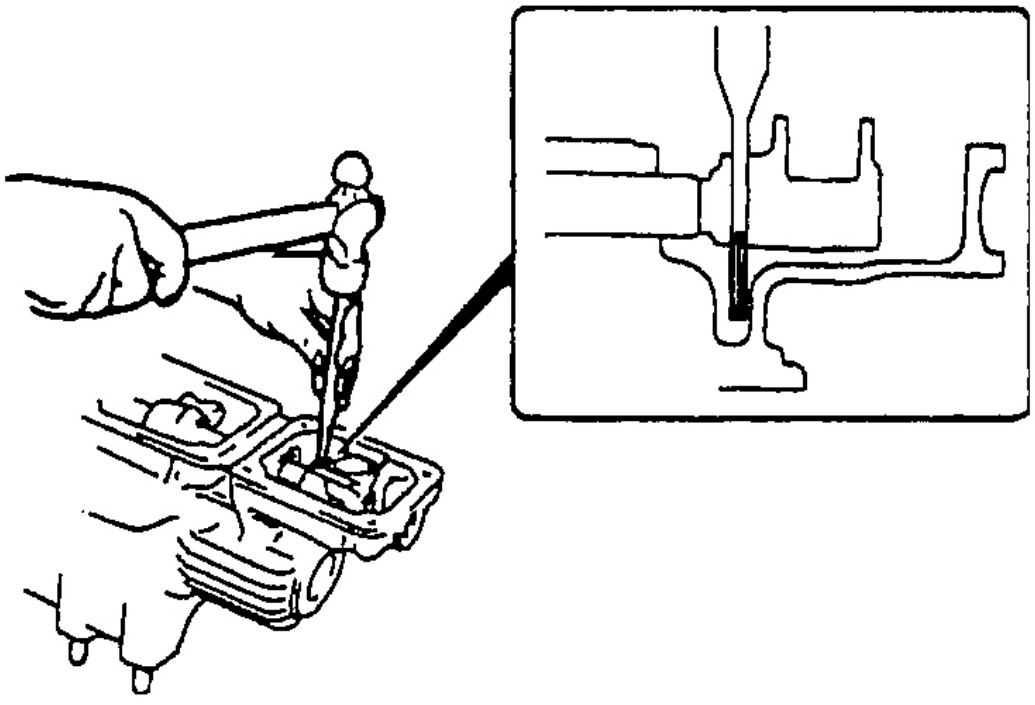


Fig. 67: Removing Control Rod End Roll Pin
Courtesy of MAZDA MOTORS CORP.

3. Remove the roll pin from the selector by using a pin punch and a hammer.

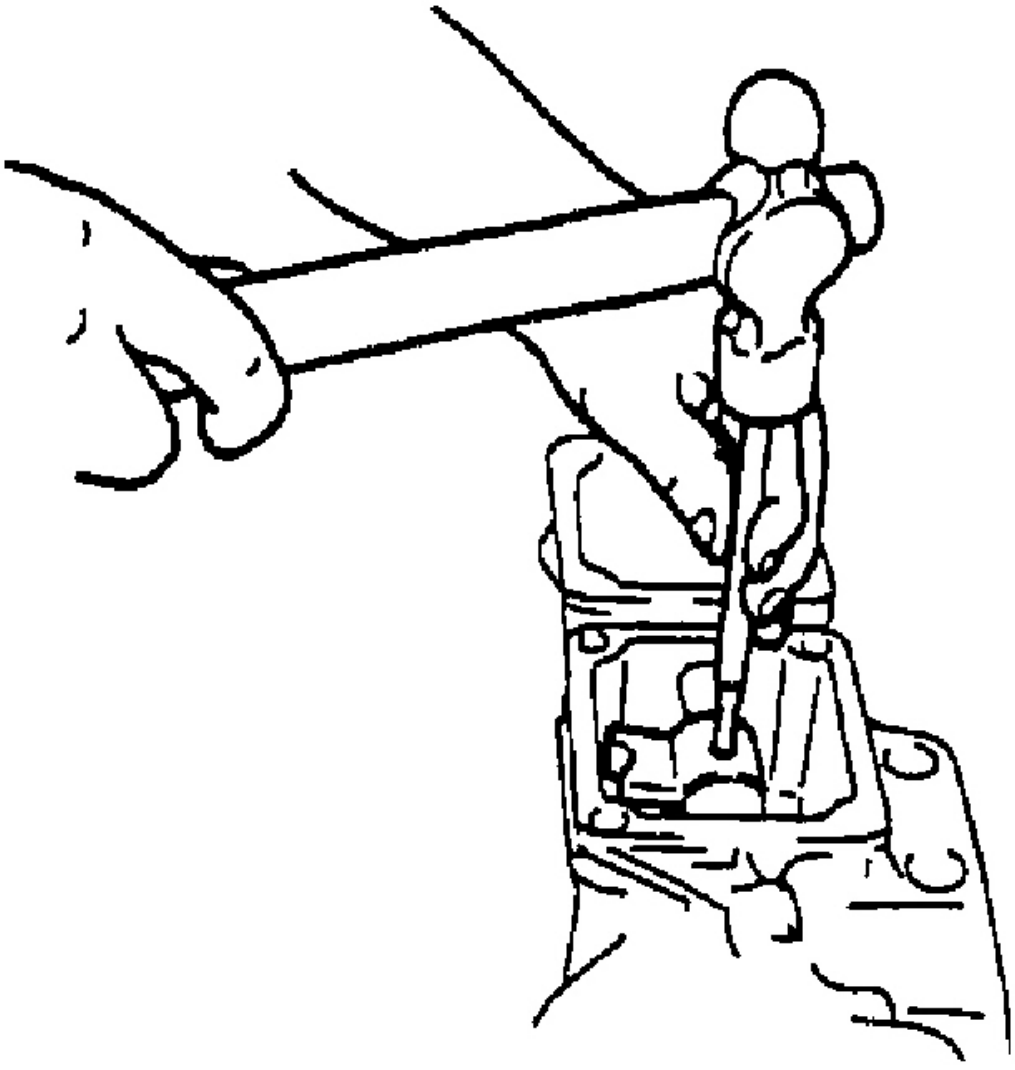


Fig. 68: Removing Selector Roll Pin
Courtesy of MAZDA MOTORS CORP.

TECHNICAL DATA

TRANSMISSION/TRANSAXLE TECHNICAL DATA

TECHNICAL DATA

Item		Specification
Transmission Type		M15M-D
Shift Fork & Shift Rod		
Clearance Between Shift Fork & Clutch Sleeve (mm {in})		
Standard		0.2-0.3 {0.008-0.012}
Wear Limit	0.5 {0.020}	
Shift Rod (5th/Reverse) Spring Free Length (mm {in})	76.5 {3.012}	
Detent Ball Spring (1st/2nd, 3rd/4th) Free Length (mm {in})	22.5 {0.886}	
Detent Ball Spring (5th/Reverse) Free Length (mm {in})	17.0 {0.669}	
Clearance Between Thrust Lock Washer & C-Washer (mm {in})		0.1--0.3 {0.004--0.012}
Thrust Lock Washer Thickness (mm {in})		6.2 {0.244}, 6.4 {0.252} 6.5 {0.256}, 6.6 {0.260}
Clearance Between Washer & Snap Ring (mm {in})	0-0.1 {0-0.004}	
C-Washer Thickness (mm {in})		2.9 {0.114}, 3.0 {0.118} 3.1 {0.122}, 3.2 {0.126}
Mainshaft Runout (mm {in})		
Maximum		0.03 {0.0012}
Clearance Between Mainshaft & Gear (or Bushing) (mm {in})		
Wear Limit		0.15 {0.006}
Clearance Between Countershaft Center Bearing & Bearing Housing (mm {in})		0-0.1 {0-0.004}
Countershaft Center Bearing Adjustment Shim Thickness (mm {in})		0.1 {0.004}, 0.3 {0.012}
Clearance Between Mainshaft Front Bearing & Bearing Housing (mm {in})		0-0.1 {0-0.004}
Mainshaft & Countershaft		
Mainshaft Front Bearing Adjustment Shim Thickness (mm {in})		0.1 {0.004}, 0.3 {0.012}
Synchronizer Ring		
Clearance Between Synchronizer Ring & Side Of Gear When Fitted (mm {in})		

Standard		1.5 {0.059}
Wear Limit	0.8 {0.031}	
Reverse Idler Gear		
Clearance Between Reverse Idler Gear Bush & Shaft (mm {in})		
Standard		0.02-0.05 {0.0008-0.0020}
Wear Limit	0.15 {0.006}	

SERVICE TOOLS

TRANSMISSION/TRANSAXLE SST

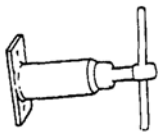
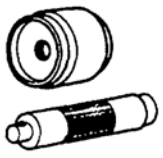
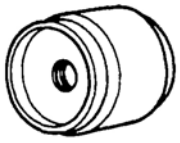
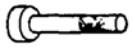
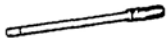
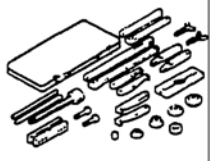
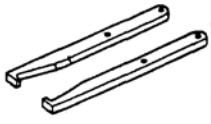
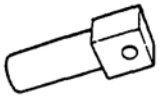
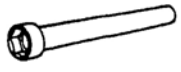
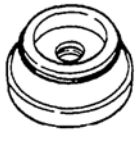
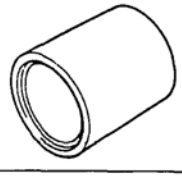
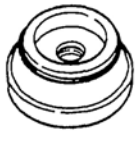
49 0305 430 Main drive shaft pusher 	49 B025 0A0 Oil seal installer 	49 G030 797 Handle (Part of 49 B025 0A0) 
49 B025 001 Body (Part of 49 B025 0A0) 	49 0500 330 Bearing installer 	49 0180 321A Bearing installer 
49 0187 451A Interlock pin guide 	49 0862 350 Shift fork guide 	49 0839 425C Bearing puller set 
49 H017 101 Hook 	49 0259 440 Mainshaft holder 	49 1243 465A Mainshaft locknut wrench 
49 0710 520 Bearing puller 	49 0636 145 Fan pulley boss puller 	49 F401 330B Bearing installer set 
49 F401 331 Body (Part of 49 F401 330B) 	49 F027 005 Attachment ϕ62 	49 F034 201 Dust boot installer 
49 F027 007 Attachment ϕ72 	—	—

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Fig. 69: Identifying Transmission/Transaxle SSTs
Courtesy of MAZDA MOTORS CORP.