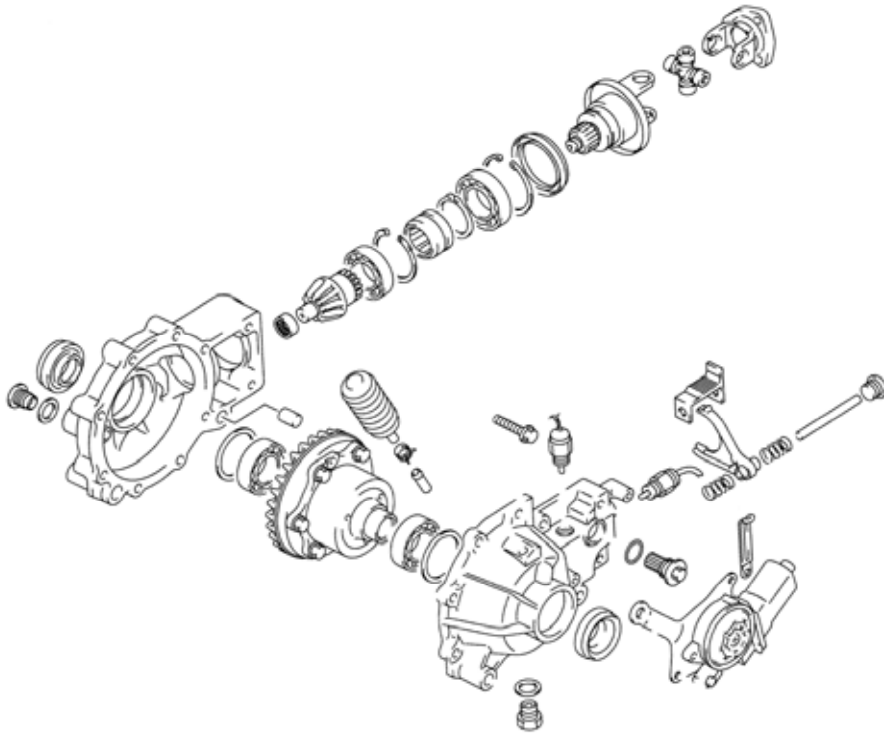

DRIVE TRAIN

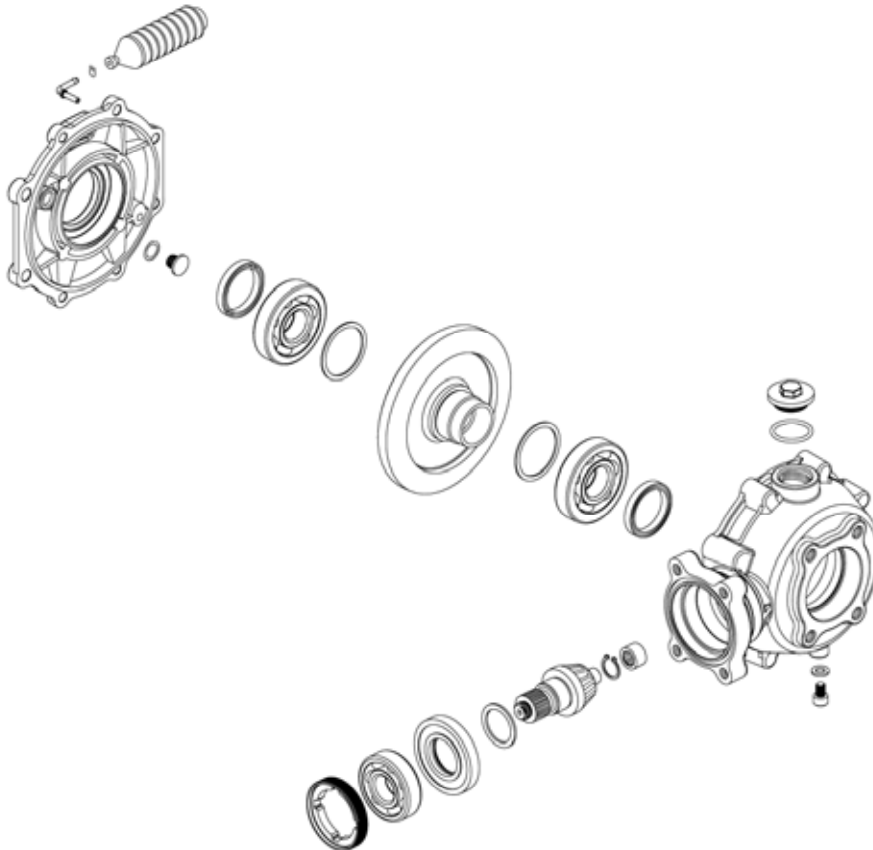
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13. DRIVE TRAIN

FRONT DRIVE



REAR DRIVE



13. DRIVE TRAIN

SERVICE INFORMATION

GENERAL INSTRUCTIONS

- Too little backlash is extremely destructive to the gear teeth. If a test ride following reassembly indicates this condition, stop riding immediately to minimize gear damage.
- Stop riding immediately if broken gear teeth are suspected. This condition could result in the shaft drive assembly locking up, causing loss of control of the machine and possible injury to the rider.
- An apparent oil leak on a new or nearly new machine may be the result of a rust-preventative coating or excessive seal lubrication.
- Always clean the machine and recheck the suspected location of an apparent leakage.

TORQUE VALUES

Front drive gear case mounting bolt	4 kgf-m (40 Nm, 29 lbf-ft)
Front propeller shaft bolt	4.5 kgf-m (45 N-m, 32.4 lbf-ft)
Shifting fork shaft plug	1.5 kgf-m (15 N-m, 11 lbf-ft) Apply threebond: 1215
Front drive gear case bolt	2.3 kgf-m (23 N-m, 16.5 lbf-ft) Apply threebond: 1215
2WD/4WD shift motor mounting bolt (M8)	2.3 kgf-m (23 N-m, 16.5 lbf-ft) Apply threebond: 1215
2WD/4WD shift motor mounting bolt (M6)	1.2 kgf-m (12 N-m, 8.5 lbf-ft)
Rear drive gear case mounting nut	5.5 kgf-m (55 Nm, 40 lbf-ft)
Rear drive gear case bolt (M10)	5 kgf-m (49 N-m, 36 lbf-ft) Apply threebond: 1215
Rear drive gear case bolt (M8)	2.5 kgf-m (25 N-m, 19 lbf-ft) Apply threebond: 1215

SPECIAL TOOLS

Oil seal & bearing installer	A120E00014
Bearing puller	A120E00037
Joint yoke remover	A120F00016
Drive shaft puller	A120F00017
Yoke bearing puller	A120F00018
Pinion puller set	A120F00021
Bearing lock nut wrench	A120F00020

TROUBLESHOOTING

- 1. A pronounced hesitation movement during acceleration, deceleration, or sustained speed. (This must not be confused with engine surging or transmission characteristics.)**
- 2. A “rolling rumble” noticeable at low speed; a high-pitched whine from front drive component or area.**
- 3. A locked-up condition of the shaft drive train mechanism, no power transmitted from the engine to the front and /or rear wheel.**
 - Bearing damage
 - Improper backlash
 - Gear tooth damage
 - Broken propeller shaft
 - Broken gear teeth
 - Seizure due to lack of lubrication
 - Small foreign objects lodged between the moving parts.

13. DRIVE TRAIN

FRONT DRIVE SHAFT REOMVAL/INSPECTION/ INSTALLATION

REMOVAL

Remove the steering knuckle (refer to the “**STEERING KNUCKLE REMOVAL/INSPECTION/INSTALLATION**” section in the chapter 14).

Remove the front drive shaft from front drive assembly.

★

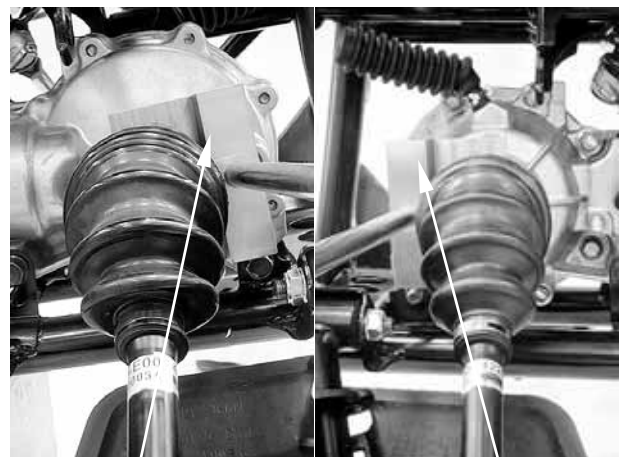
If it is difficult to remove the front drive shaft by hand, use the special tools.

Special tool:

Drive shaft remover A120F00017



Front Drive Shaft



Special Tool

Special Tool

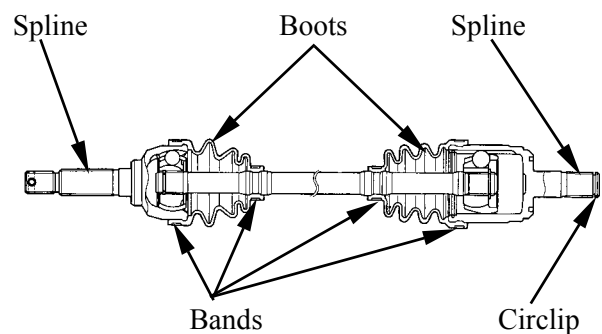
INSPECTION

Inspect the boots, circlip and boot bands for wear or damage.

If any damages are found, replace them with new ones.

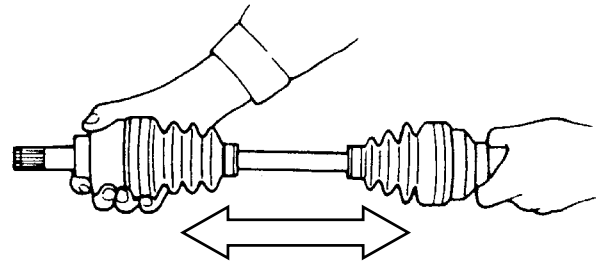
Inspect the double off-set joint spline for wear or damage.

If any damages are found, replace them with new ones.



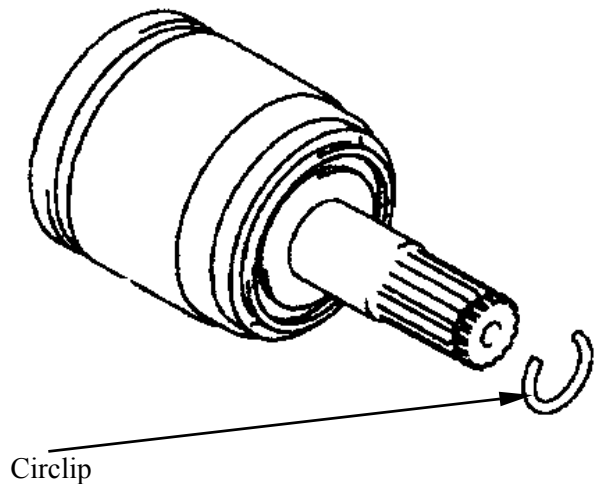
13. DRIVE TRAIN

Inspect the free play by using a push-and-pull motion (thrust movement).
Excessive play → Replace the joint assembly.



INSTALLATION

Install a new circlip into its groove in the splines.



Apply lightweight lithium-soap base grease to the splines of the drive shafts and install the drive shaft to the front drive gear case.

★

- Be careful not to damage the oil seal in the front drive gear case.
- After installing drive shaft, check the circlip is seated properly by pulling the case side joint lightly.



Case Side Joint

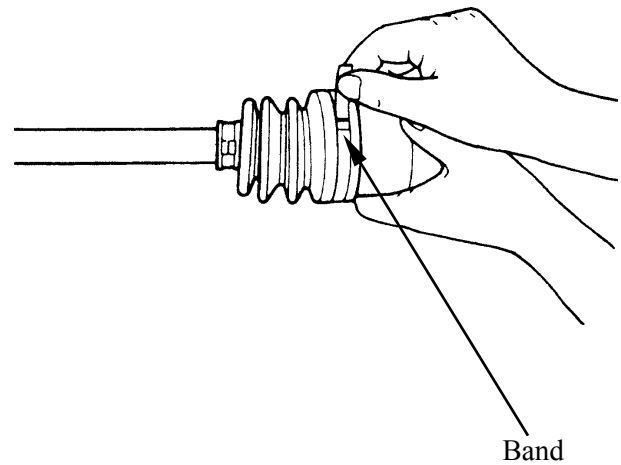
13. DRIVE TRAIN

FRONT DRIVE SHAFT DISASSEMBLY/INSPECTION/ ASSEMBLY

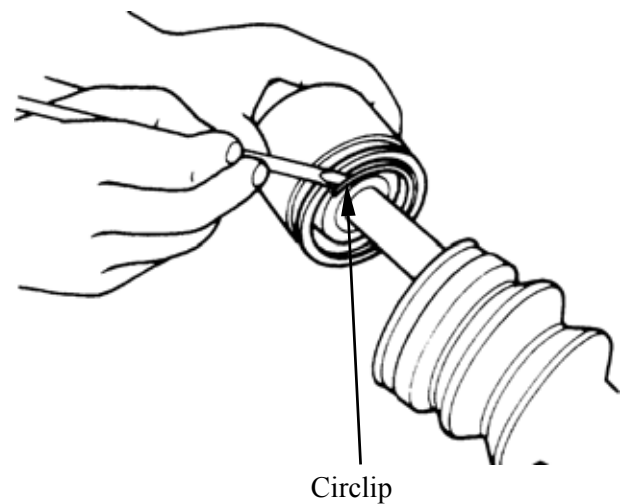
DISASSEMBLY

Remove the front drive shaft (refer to the “**FRONT DRIVE SHAFT REMOVAL/INSPECTION/INSTALLATION**” section in this chapter)

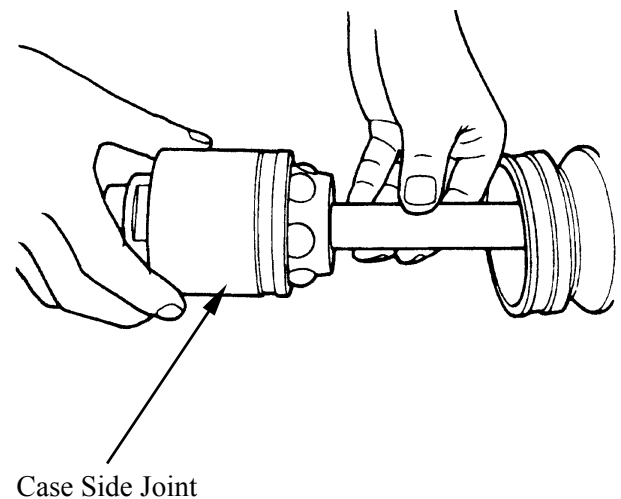
Remove the boot band of the case side joint.



Slide the boot toward the center of the front drive shaft and remove the circlip from the case side joint.

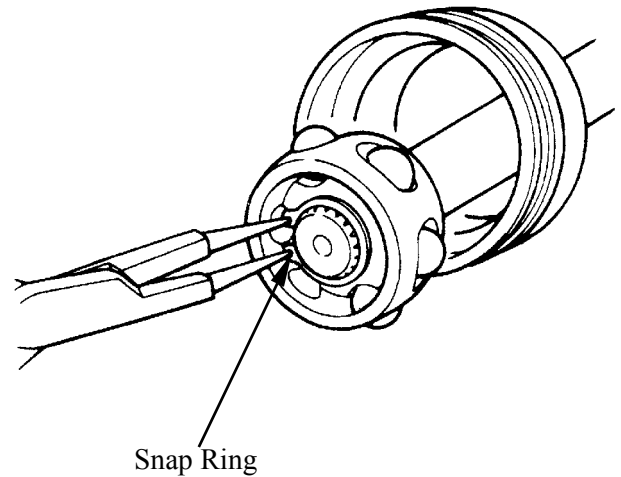


Separate the case side joint from the front drive shaft.



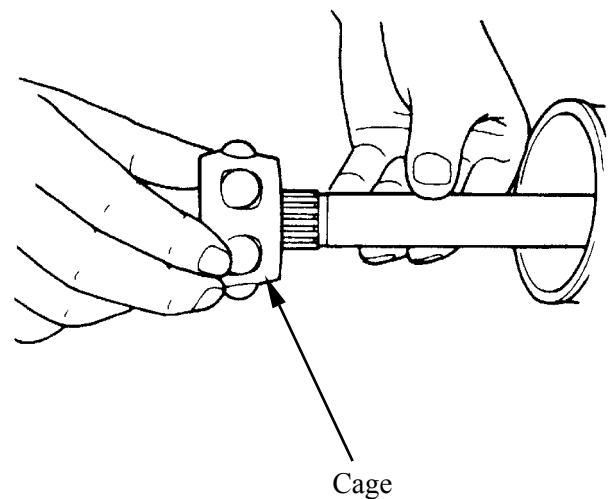
13. DRIVE TRAIN

Wipe off any grease and remove the snap ring from the groove on the front drive shaft.



Remove the cage and boot from the front drive shaft.

* Do not disassemble the wheel side joint. If any damages are found, replace the wheel side joint with a new one.



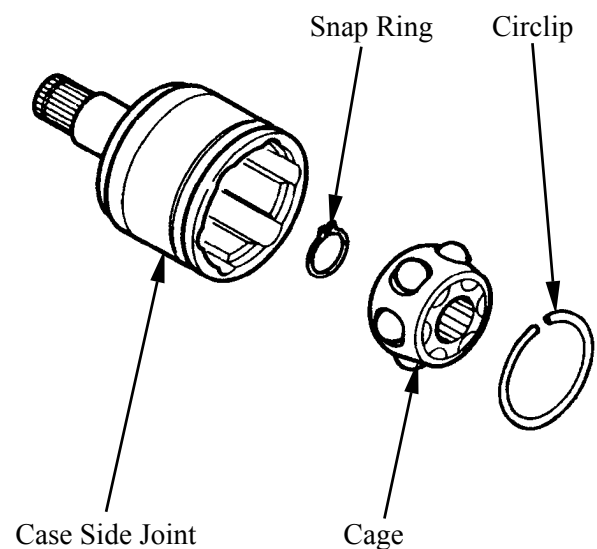
INSPECTION

Inspect the circlip and snap ring for wear or damage.

If any damages are found, replace them with new ones.

Inspect the cage and inner surface of case side joint for pitting, wear or damage.

If any damages are found, replace them with new ones.



13. DRIVE TRAIN

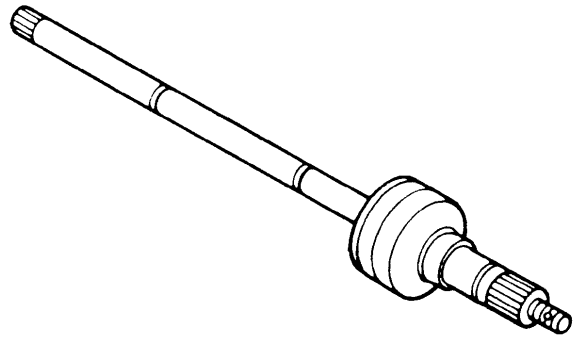
Inspect the front drive shaft spline for wear or damage.

If any damages are found, replace them with a new one.

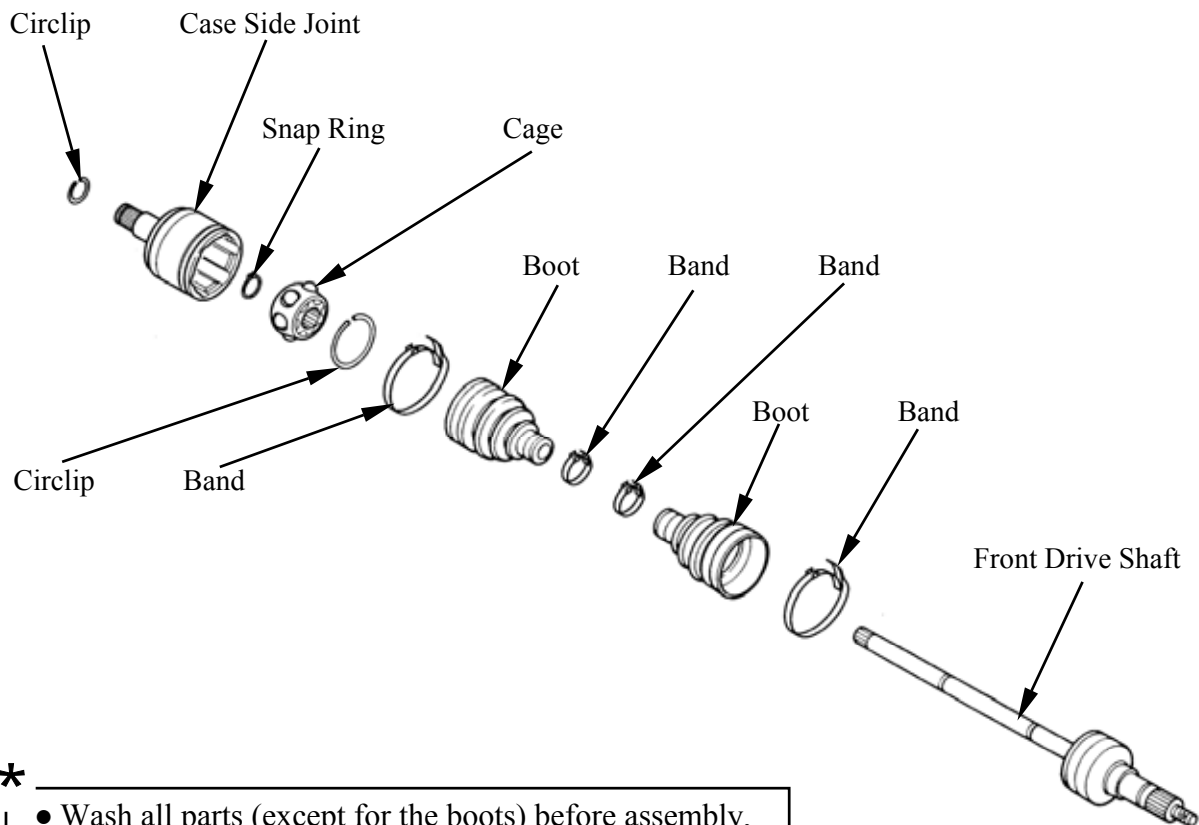
Inspect the front drive shaft for bends.

If any damages are found, replace them with a new one.

Do not attempt to straighten a bent shaft; this may dangerously weaken the shaft.



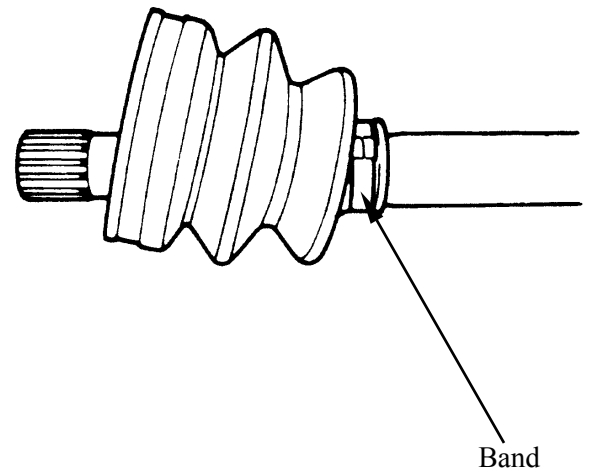
ASSEMBLY



- Wash all parts (except for the boots) before assembly, clean the inside and outside of the boot with a cloth.
- Do not wash the boots in any commercially available degreaser, such as gasoline or kerosene. Washing in a degreaser causes deterioration of the boot.

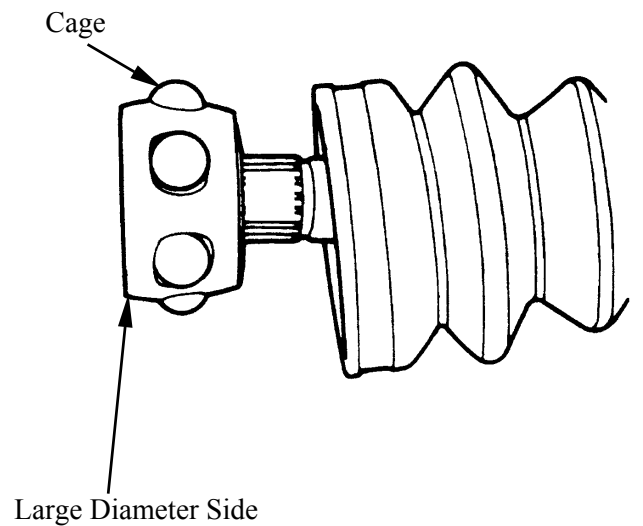
13. DRIVE TRAIN

Fit a boot on the drive shaft end, fitting the small diameter side of the boot to the shaft groove, fix its end with a new band.

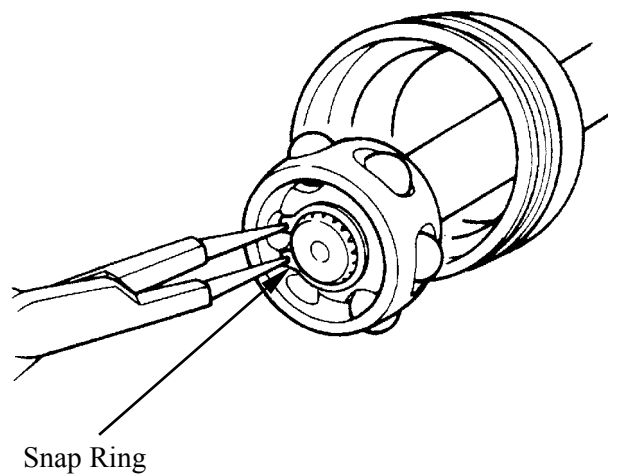


Install the cage on the shaft.

* Install the cage with the large diameter side facing the shaft end.



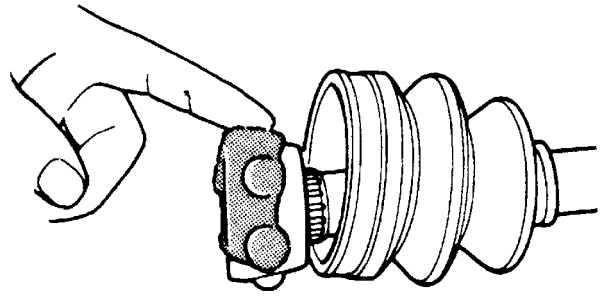
Install the snap ring to the groove on the drive shaft.



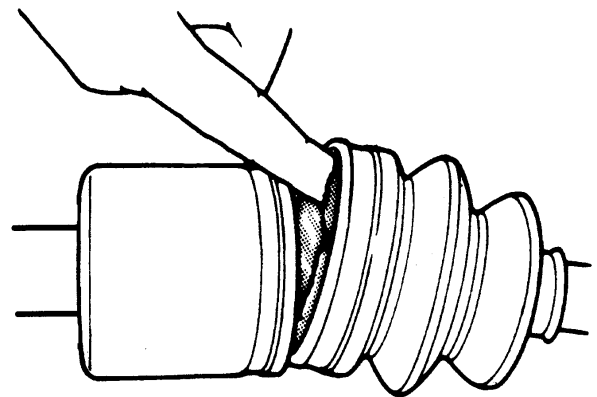
13. DRIVE TRAIN

Apply molybdenum disulfide grease to the entire surface of the cage and the inside of the case side joint/wheel side joint.

Position Grease	Case side joint	Wheel side joint
Quantity	85 g (2.8 oz)	45 g (1.5 oz)

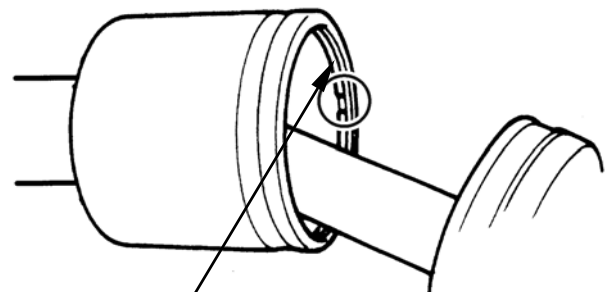


* The tube of joint molybdenum disulfide grease is included in the wheel side boot set or wheel side joint assembly of spare parts.



Insert the cage into the case side joint and fit a circlip in the groove of the case side joint.

* Locate the opening of the circlip so that the opening is not lined up with a ball.



Circlip

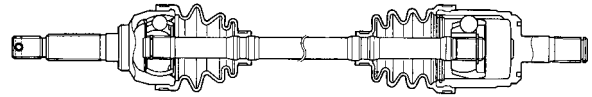
13. DRIVE TRAIN

After fitting the boot on the case side joint, insert a screw driver into the boot on the case side joint and allow air to enter the boot so that the air pressure in the boot becomes the same as the atmospheric pressure.

Fix the boot on the case side joint with a new boot band, taking care not distort the boot.

✱

The dust boots should be fastened with the boot bands at the grooves in the drive shaft.



13. DRIVE TRAIN

FRONT DRIVE REMOVAL/INSPECTION/ INSTALLATION

REMOVAL

Drain the front drive gear oil (refer to the “**FRONT DRIVE GEAR OIL**” in the chapter 3).

Remove the steering knuckle (refer to the “**STEERING KNUCKLE REMOVAL/INSPECTION/INSTALLATION**” section in the chapter 14).

Remove the front upper arms and front lower arms (refer to the “**FRONT ARMS INSPECTION/REMOVAL/INSTALLATION**” section in the chapter 14).

Remove the drive shafts (refer to the “**FRONT DRIVE SHAFT REOMVAL/INSPECTION/INSTALLATION**” section in this chapter).

Disconnect the following wire connectors

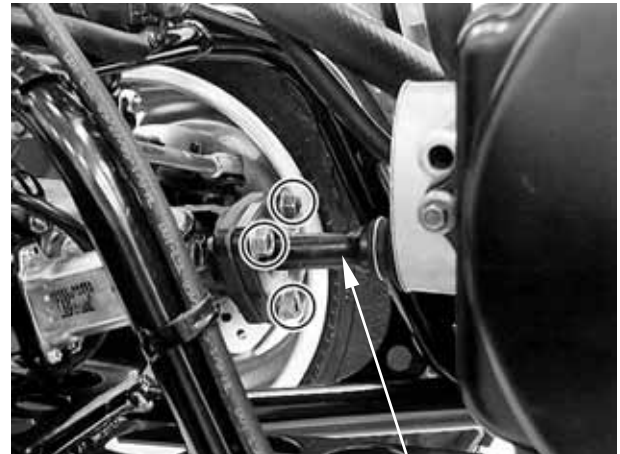
- 2WD indicator wire connector
- 2WD/4WD motor wire connector
- 4WD indicator wire connector

Then cut the wire rubber band.



13. DRIVE TRAIN

Remove the three bolts from front propeller shaft.



Front Propeller Shaft

Remove two front drive case mounting bolts/nuts from frame, then remove the case out of the frame.



INSPECTION

Check the breather rubber case for wear or damage. Also, check that the joint of the rubber case fits tightly.



13. DRIVE TRAIN

INSTALLATION

Install the front drive case into the frame.

Install and tighten the two mounting bolts/nuts to the specified torque.

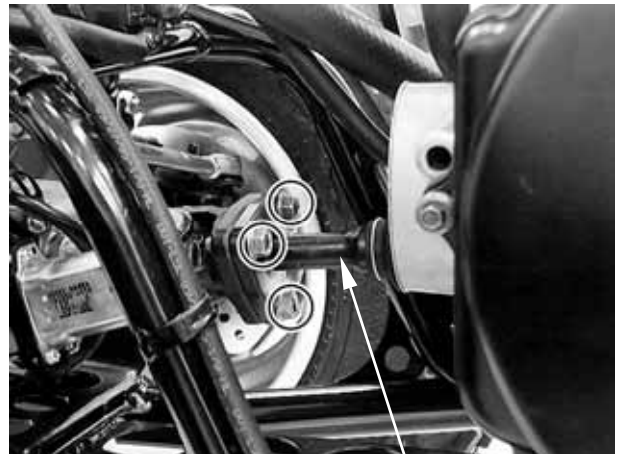
Torque: 4 kgf-m (40 N-m, 29 lbf-ft)



Install the front propeller shaft.
Install and tighten the three new bolts to specified torque.

* Always install the bolts with the new ones.

Torque: 4.5 kgf-m (45 N-m, 32.4 lbf-ft)



Front Propeller Shaft

Connect all wire connectors and then install a new rubber band.

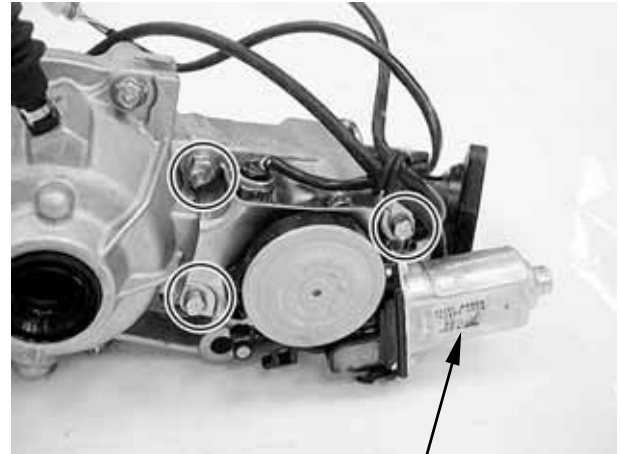


13. DRIVE TRAIN

FRONT DRIVE DISASSEMBLY/INSPECTION/ ASSEMBLY

Remove the front drive case assembly (refer to the “**FRONT DRIVE REMOVAL/INSPECTION/INSTALLATION**” section in this chapter).

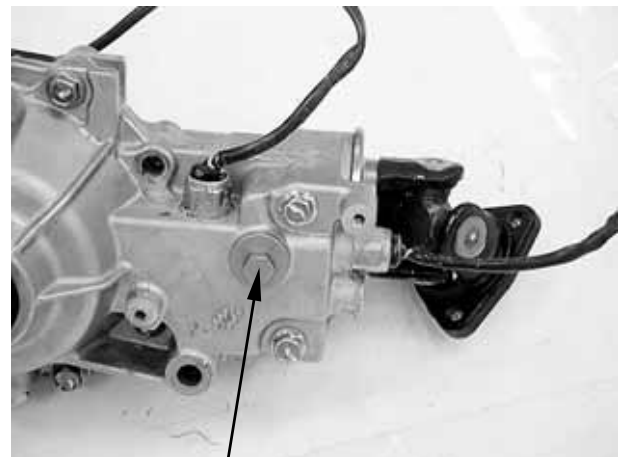
Remove the three bolts and then remove the 2WD/4WD shifting motor assembly.



Shifting Motor Assembly

Remove the 2WD/4WD shifting pinion and O-ring by hand.

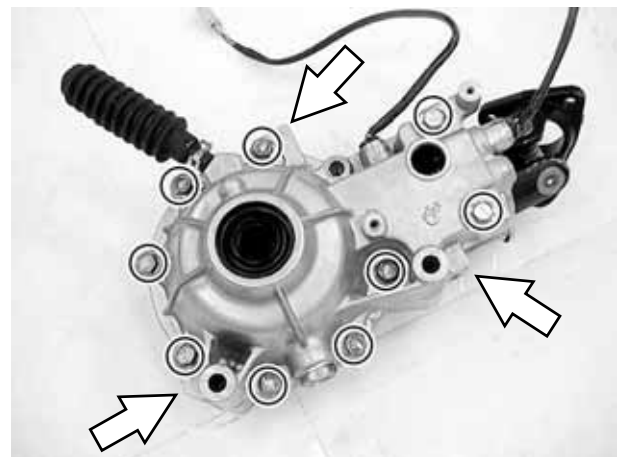
* The shifting pinion is not a bolt or screw, do not remove it with a wrench.



2WD/4WD shifting Pinion

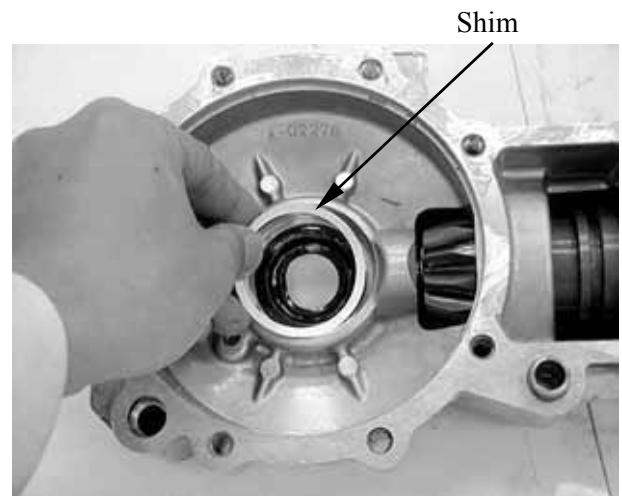
Remove the nine bolts from left gear case in a crisscross pattern.

Pry the case at the arrows as shown by using a screwdriver, then remove the right gear case.



13. DRIVE TRAIN

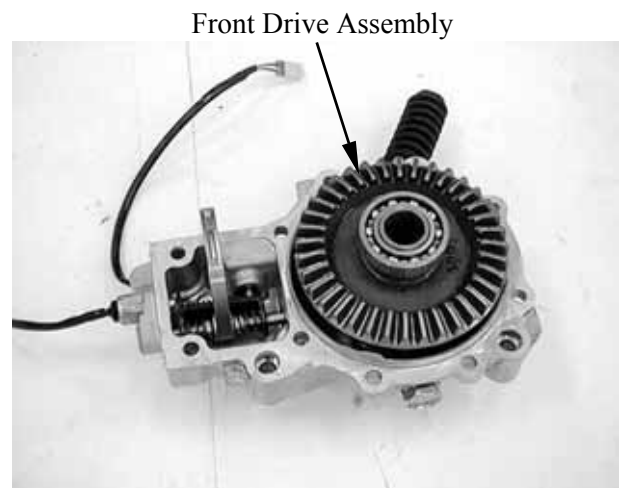
Remove the shim from right gear case.



Remove the front drive assembly from the left gear case.

★

- Do not attempt to disassemble the front drive assembly.
- The front drive is available only as an assembly.



Remove the shim from the left gear case.

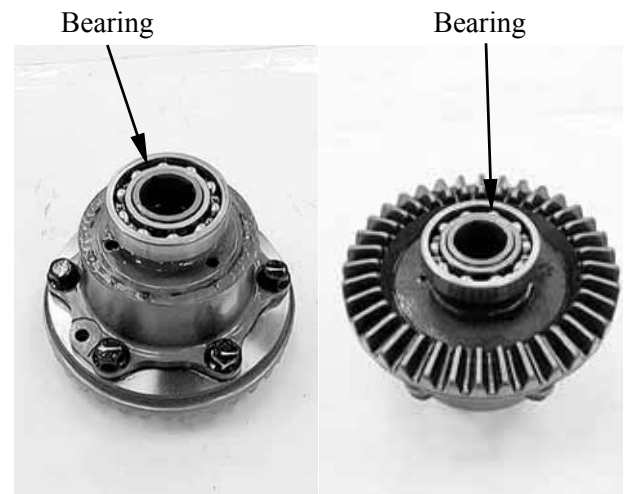


13. DRIVE TRAIN

Remove the bearings from the front drive assembly by using a commercially available bearing puller.

✱

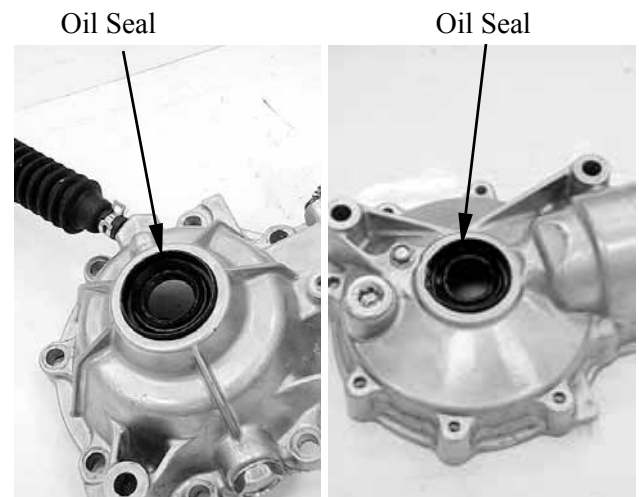
- If there is no abnormal condition, the bearing removal is not necessary
- The removed bearing must be replaced with a new one.



Remove the oil seals out of the gear case.

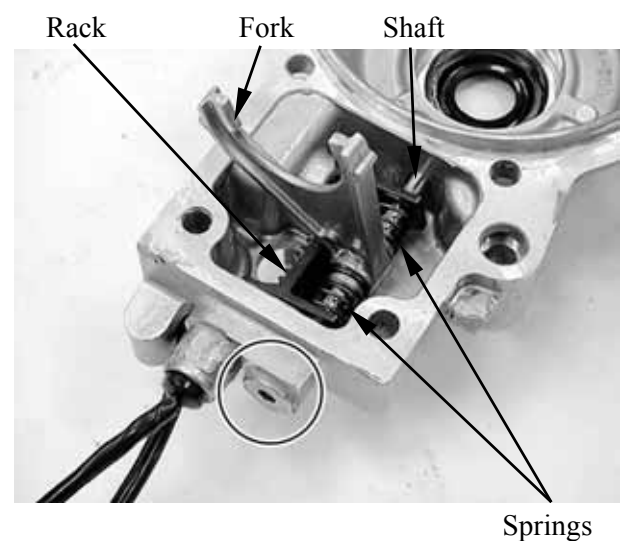
✱

- If there is no abnormal condition, the oil seal removal is not necessary
- The removed oil seal must be replaced with a new one.



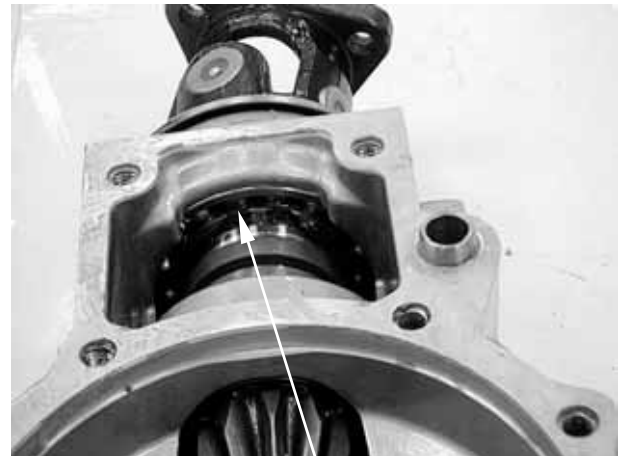
Remove the 2WD/4WD shifting fork shaft plug.

Remove the 2WD/4WD shifting fork, spring and shifting rack by removing shaft.



13. DRIVE TRAIN

Remove the snap ring out of its groove and slide it towards the shifting sleeve.



Snap Ring

Remove the universal joint yoke assembly by using the special tool.

Special tool:

Joint yoke remover A120F00016



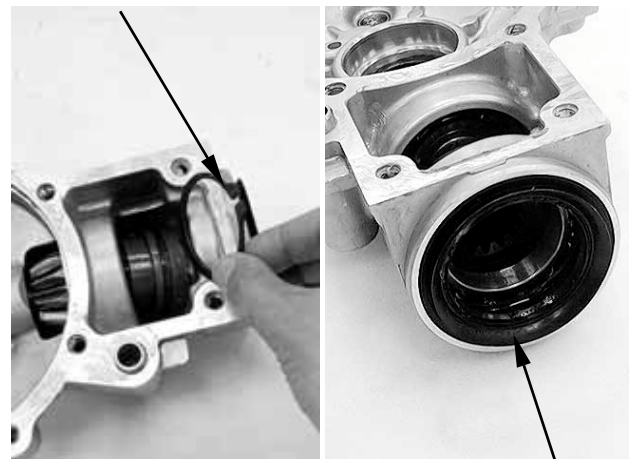
Remove the snap ring

Remove the oil seal out of the right gear case.

★

- If there is no abnormal condition, the oil seal removal is not necessary
- The removed oil seal must be replaced with a new one.

Snap Ring



Oil Seal

13. DRIVE TRAIN

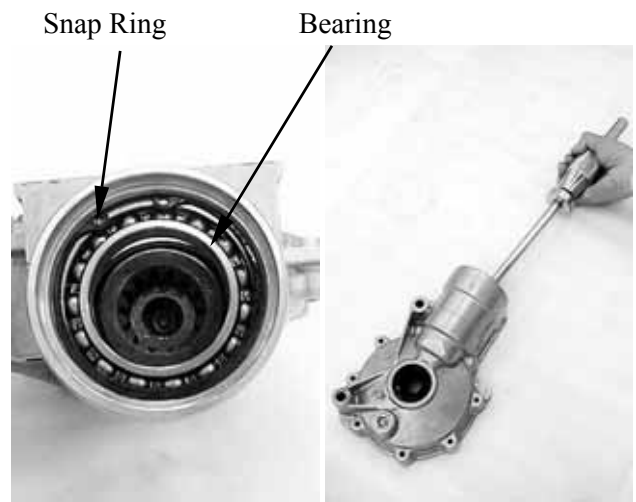
Remove the snap ring.

Remove the bearing by using the special tool.

Special tool:

* Yoke bearing puller A120F00018

- If there is no abnormal condition, the bearing removal is not necessary
- The removed bearing must be replaced with a new one.

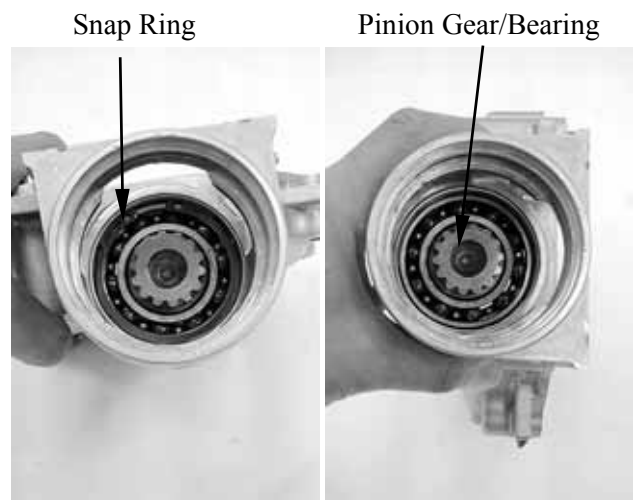


Remove the shifting sleeve.



Remove the snap ring.

Remove the pinion gear together with the bearing.



13. DRIVE TRAIN

Pull the pinion bearing from the shaft with a commercially available bearing puller.

★

- If there is no abnormal condition, the bearing removal is not necessary
- The removed bearing must be replaced with a new one.



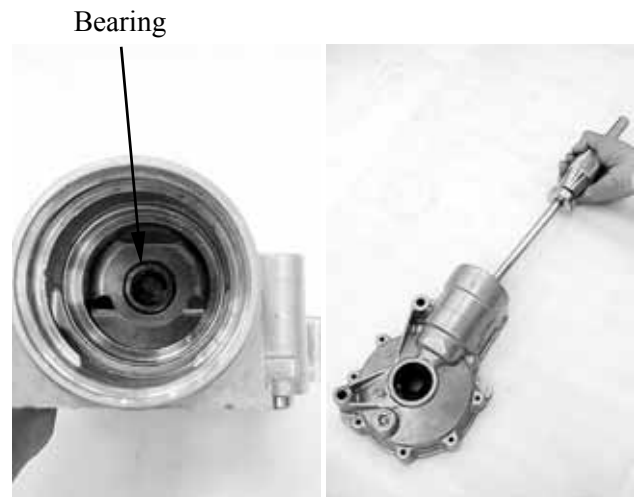
Remove the pinion gear pilot bearing by using the special tools.

Special tool:

Bearing puller A120E00037

★

- If there is no abnormal condition, the bearing removal is not necessary
- The removed bearing must be replaced with a new one.



Remove the C-rings from the universal joint by using the special tool.

★

Replace the removed C-ring with a new one.

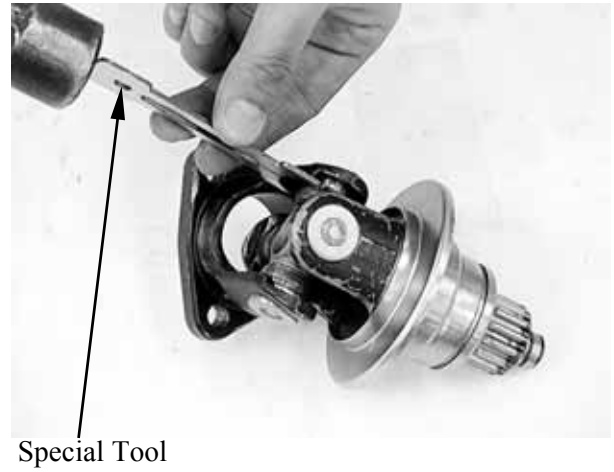
Special tool:

C-ring remover A120F00022



13. DRIVE TRAIN

- Tap the C-ring out by using the special tool.



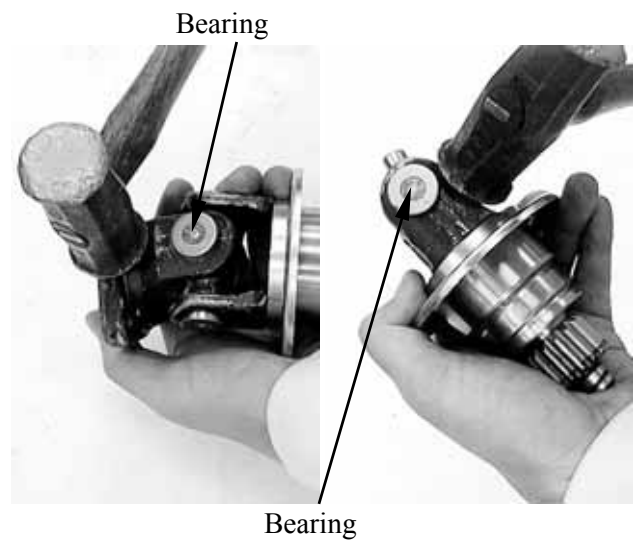
- Insert a screwdriver into the hole on the special tool, then pull it out.



Remove the bearings by tapping the universal joint with a copper hammer.

★

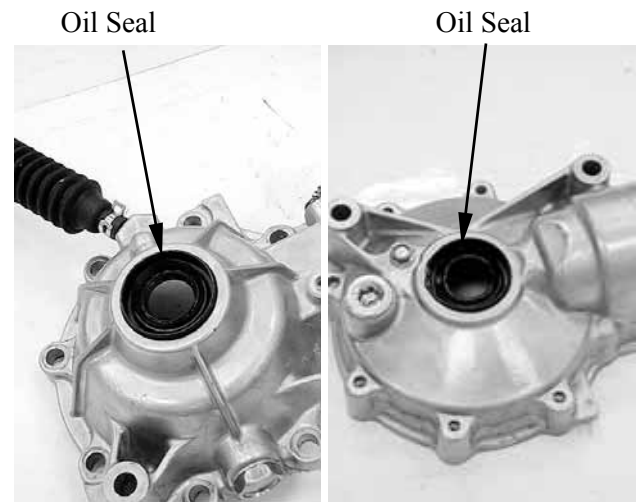
- If there is no abnormal condition, the bearing removal is not necessary
- The removed bearing must be replaced with a new one.



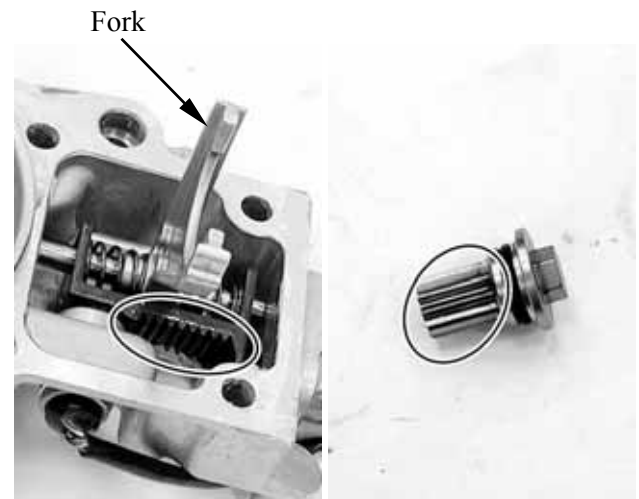
13. DRIVE TRAIN

INSPECTION

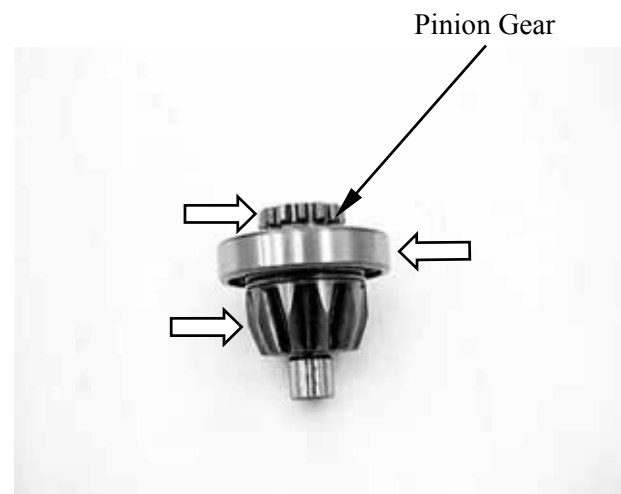
Inspect the gear case and oil seals for wear or damage.
 If any wear or damage is found, replace the oil seal with a new one.



Inspect the shifting fork and its rack-and-pinion for wear and damage.
 If any defects are found, replace the shifting fork and its rack-and-pinion with the new ones.
 If the shifting fork is damaged, inspect the groove of the shifting sleeve.



Check the outer race play and smooth rotation of the bearing by hand while it is on the pinion gear shaft.
 Inspect the pinion gear for wear or damage.
 If the pinion gear is damaged, inspect the ring gear.
 If any defects are found, replace the bearing and gear with the new ones



13. DRIVE TRAIN

Inspect the right gear case and oil seal for wear or damage.

If any wear or damage is found, replace the oil seal with a new one.



Check the right gear case bearing for wear or damage.

If any wear or damage is found, replace the bearing with a new one.



Check the outer race play and smooth rotation of the bearing by hand while it is on the front drive.

Inspect the ring gear for wear or damage.

If the ring gear is damaged, inspect the pinion gear also.

If any defects are found, replace the bearings and ring gear with the new ones.



13. DRIVE TRAIN

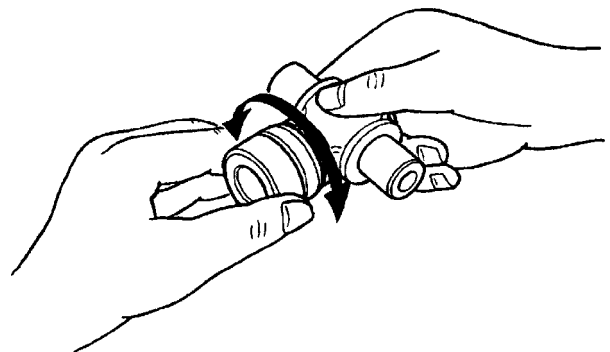
Inspect the splines of universal joint for wear or damage.
If any defects are found, replace the universal joint yoke with a new one.



Inspect the universal joint, wear and damage.
If any defects are found, replace the bearings and universal joint as a set.

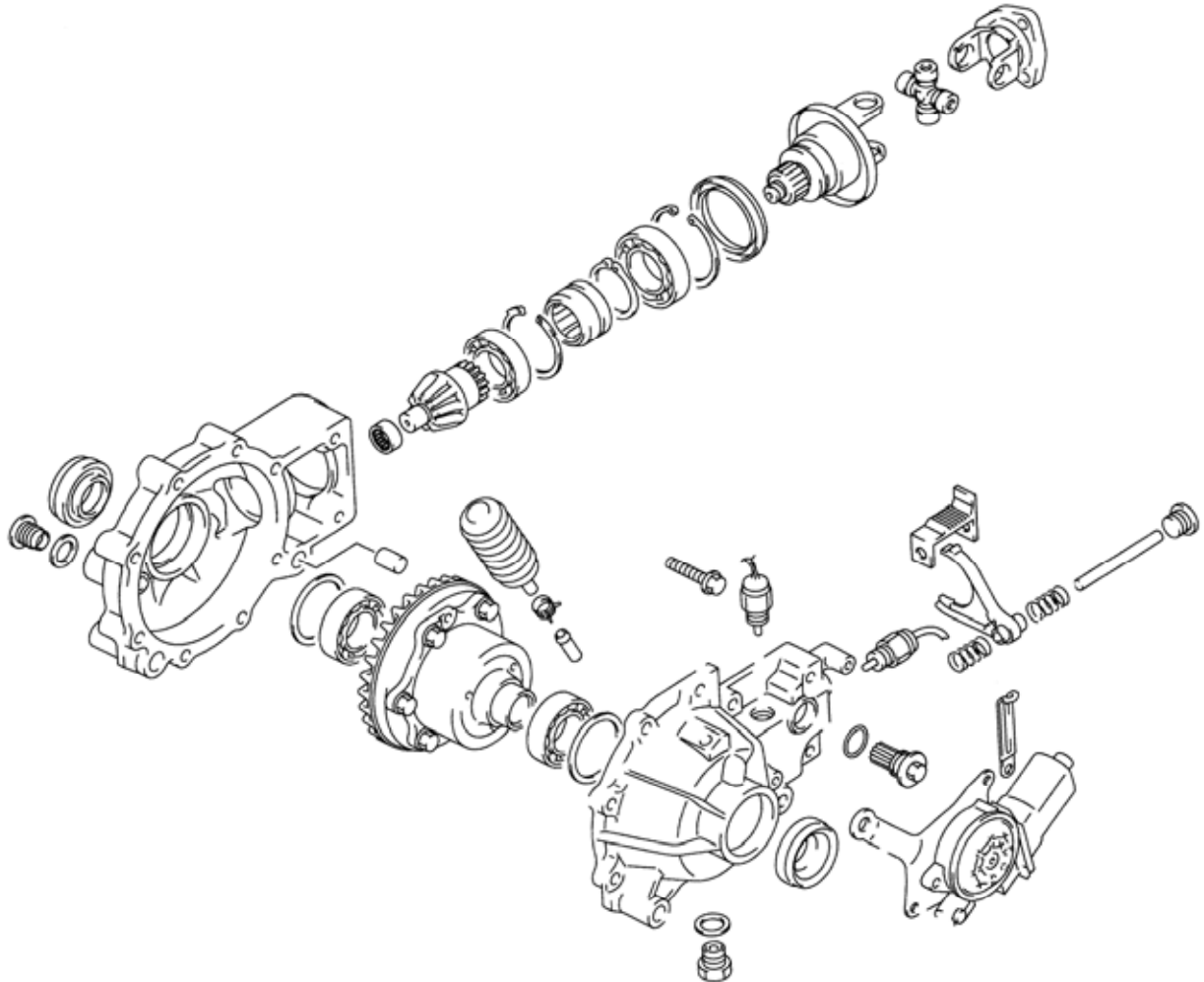


Insert the universal joint to the new bearing and check the play by turning the universal joint, as shown.
If excessive play is noted, replace the bearings and universal joint as a set.



13. DRIVE TRAIN

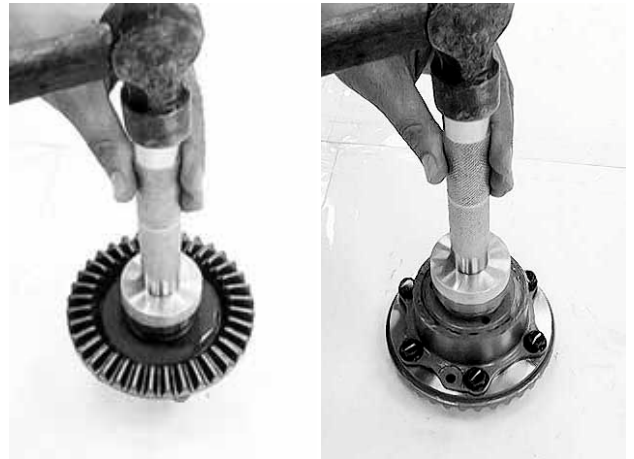
ASSEMBLY



* Before reassembly, thoroughly clean all parts in cleaning solvent.

13. DRIVE TRAIN

Install the new bearings to the front drive.

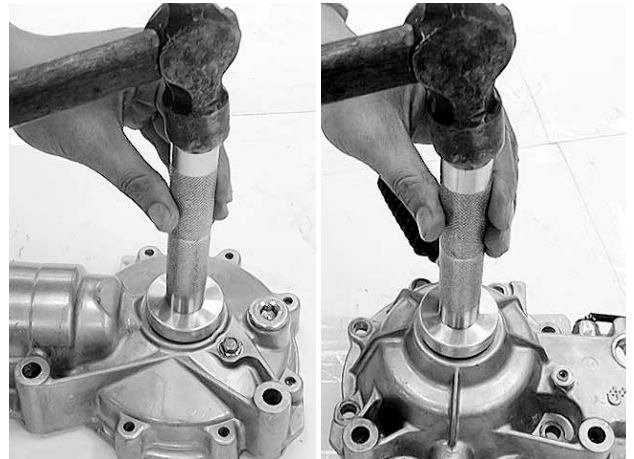


Apply lightweight lithium-soap base grease to the new oil seal lips.

Install the new oil seals into the gear cases by using the special tool.

Special tool:

Oil seal & bearing installer A120E00014

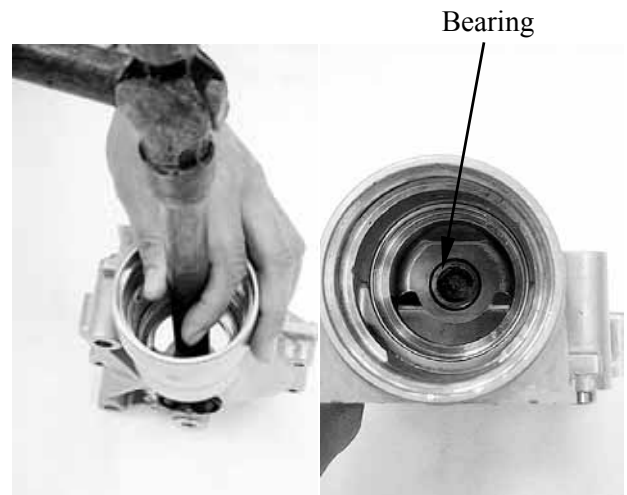


Install the new bearing onto the pinion shaft by using a proper pipe.

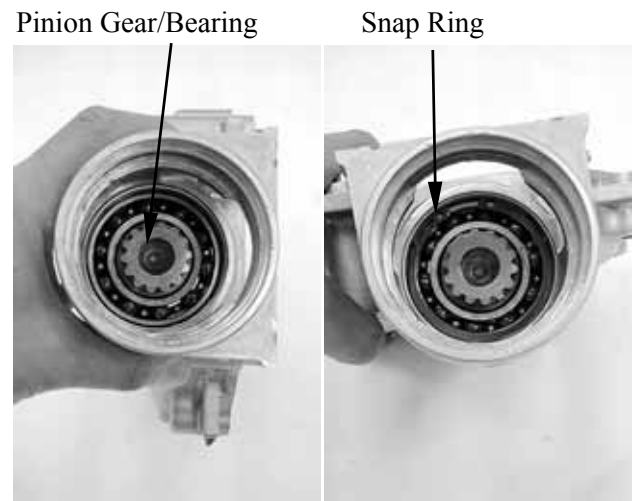


13. DRIVE TRAIN

Install the new bevel pinion gear pilot bearing into the right gear case by using a proper shaft.



Install the pinion gear assembly and fix the bearing race with the snap ring.



Install the shifting sleeve to the pinion gear shaft.

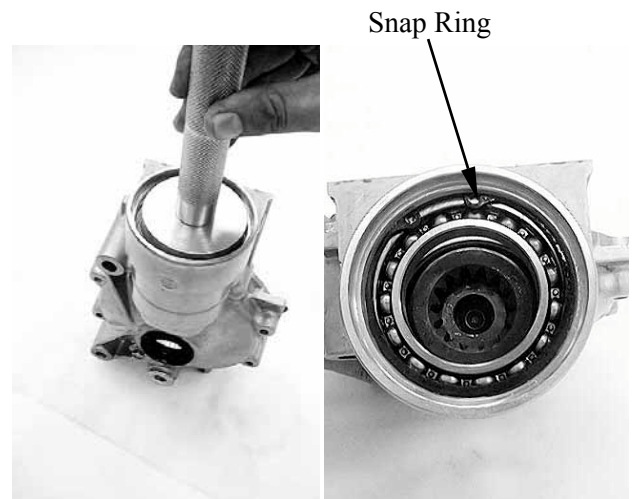


13. DRIVE TRAIN

Install the new bearing into the right gear case by using the special tool and fix it with the snap ring.

Special tool:

Oil seal & bearing installer A120E00014



Install the new oil seal into the right gear case.

Apply 4 – 5 g (0.13 – 0.17 oz) of lightweight lithium-soap base grease to the outside of seal lip groove.

Apply lightweight lithium-soap base grease to the bearing and dust seal lip



Apply grease to the new bearings.
Install the universal joint and new bearings.
Install the C-rings by tapping with a copper hammer.



13. DRIVE TRAIN

After reassembling the universal joint, check the joint movement smoothly. If a large resistance is felt to movement, tap the bearing with a plastic mallet lightly.



Before install the universal joint yoke assembly, place the snap ring between the shifting sleeve and splines of universal joint.



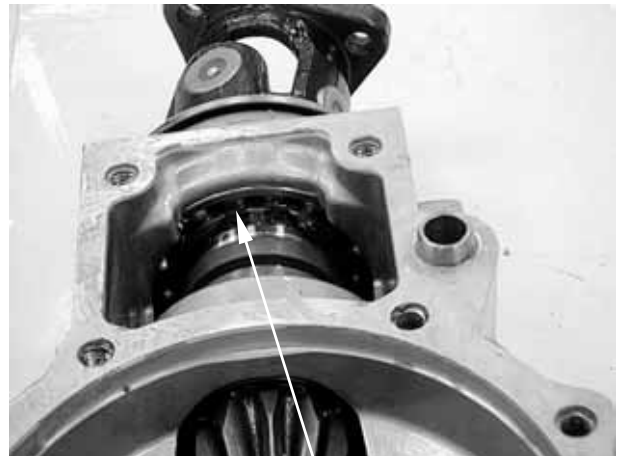
Snap Ring

Install the universal joint yoke assembly by tapping with a plastic mallet.



13. DRIVE TRAIN

Fix the universal joint yoke with the snap ring.

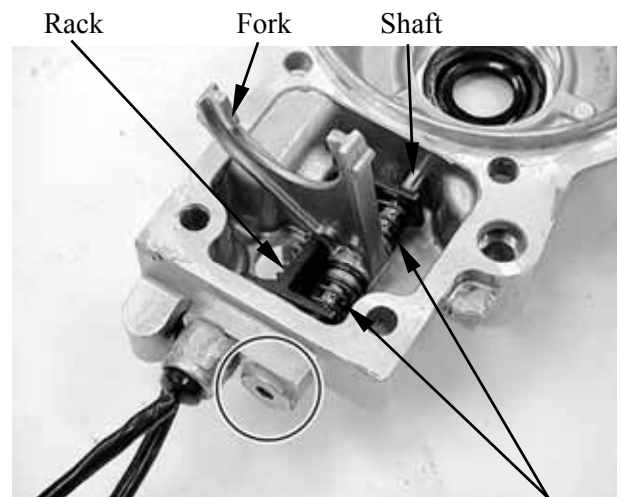


Snap Ring

Install the 2WD/4WD shifting fork, springs and shifting rack as shown.

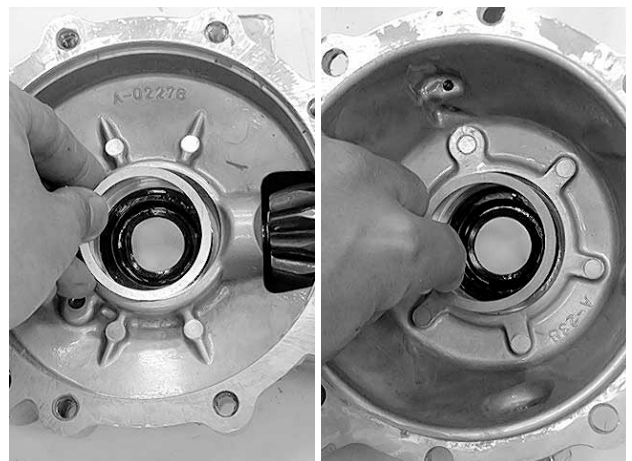
Apply sealant (three bond: 1215) to the shifting fork shaft plug and tighten it to the specified torque.

Torque: 1.5 kgf-m (15 N-m, 11 lbf-ft)



Springs

Install the removed shims to the gear case and its case.



13. DRIVE TRAIN

Install the front drive to the right gear case.
 Install the dowel pin and apply a sealant (threebond: 1215) to the mating surface of the case.

* After the backlash and tooth contact have been checked or adjusted, apply a sealant to the mating surface of the case.

Front Drive Assembly



When installing the left gear case, align the shifting fork with its groove.



Apply three bond: 1215 to the case bolts and tighten them to the specified torque in a crisscross pattern in 2 or 3 steps.

Torque: 2.3 kgf-m (23 N-m, 16.5 lbf-ft)

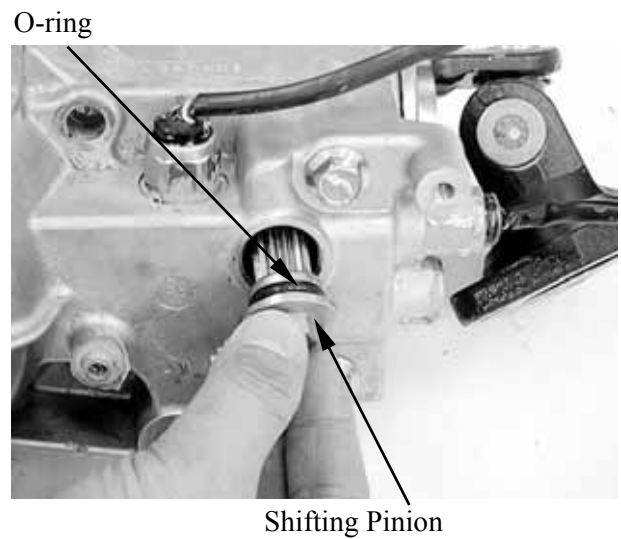
*

- After the backlash and tooth contact have been checked or adjusted, apply three bond: 1215 to the case bolts.
- It is important to turn the pinion while tightening the bolts. If the ring gear shim is too thick, the gears will lock after only light tightening.



13. DRIVE TRAIN

Coat a new O-ring with lightweight lithium-soap base grease and install the 2WD/4WD shifting pinion.

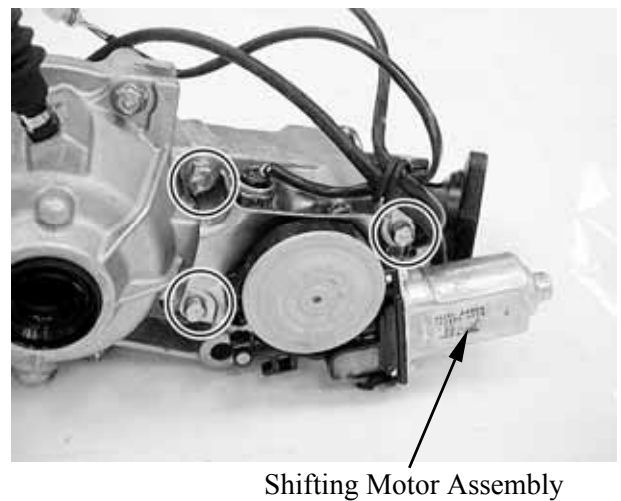


Apply three bond: 1215 to the M8 bolt. Install the 2D/4WD shifting motor and tighten its mounting bolts to the specified torque.

Torque:

M8: 2.3 kgf-m (23 N-m, 16.5 lbf-ft)

M6: 1.2 kgf-m (12 N-m, 8.5 lbf-ft)



13. DRIVE TRAIN

FRONT DRIVE SHIM ADJUSTMENT

BACKLASH

Install the removed left and right side shims and front drive assembly.

Assemble the gear case (refer to the “**FRONT DRIVE DISASSEMBLY/INSPECTION/ASSEMBLY**” section in this chapter).

★

At this time, it is not necessary to apply a sealant to the mating surface of the gear case.

Remove the oil filler cap and measure the backlash of the drive ring gear using the horizontal type dial gauge and proper size of wooden piece or plastic piece, as shown. Take backlash readings at three places while turning the ring gear slightly in each direction and securely holding the pinion gear by using commercially tool.

Read the total backlash on the dial gauge.

Remove the dial gauge and turn the ring gear 120°, then measure the backlash. Repeat this procedure once more and compare the difference of the three measurements.

If the backlash is not within specification, the shim must be changed and the backlash should be re-checked until correct.

Refer to the chart at the right for the appropriate shim thickness.

Stand backlash:

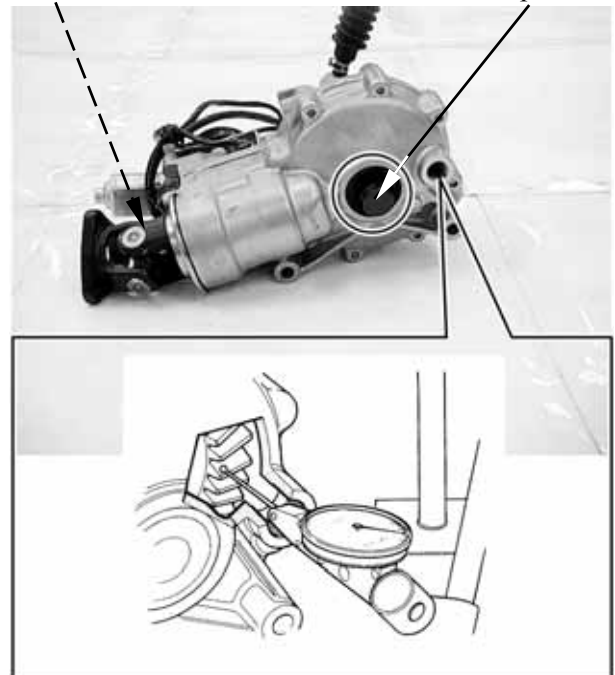
0.05 – 0.1 mm (0.002 – 0.004 in)

★

Adjust the backlash by referring to the chart at the right and using the thickness of the removed shims as a guide.

Backlash	Shim adjustment
Under 0.05 mm (0.002 in)	Increase shim thickness
0.05 – 0.1 mm (0.002 – 0.004 mm)	Correct
Over 0.1 mm (0.004 in)	Decrease shim thickness

Pinion Gear Wooden Piece or Plastic piece



Shim thickness
0.7 mm (0.0276 in)
0.75 mm (0.0295 in)
0.8 mm (0.0315 in)
0.85 mm (0.0335 in)
0.9 mm (0.0354 in)
0.95 mm (0.0374 in)
1 mm (0.0394 in)
1.05 (0.0413 in)
1.1 mm (0.0433 in)
1.15 mm (0.0453 in)
1.2 mm (0.0472 in)
1.25 mm (0.0492 in)
1.3 mm (0.0512 in)
1.35 mm (0.0531 in)
1.4 mm (0.0551 in)
1.45 mm (0.0571 in)

13. DRIVE TRAIN

If the backlash is too small, replace the right side shim(s) with a thicker one.

If the backlash is too large, replace the right side shim(s) with a thinner one.

If the right side shim was changed with a 0.1 mm thicker shim, replace the left side shim with one that is 0.1 mm thinner.

LEFT SIDE SHIM SELECTION

Install the removed right side shim(s) and front drive assembly.

Put a few pieces of solder (O.D.: 1.2 –2.5 mm/L: 6 mm) on the bearing outer race, as shown.

✱

- Do not install the left side shim(s) at this time.
- Apply a small quantity of grease to the solder to prevent them from falling



Assemble the gear case and tighten its bolts to the specified torque in a crisscross pattern in 2 or 3 steps.

✱

- Do not apply a sealant to the mating surface of the gear case.
- Do not apply a sealant to the case bolts.

Torque: 2.3 kgf-m (23 N-m, 16.5 lbf-ft)

✱

It is important to turn the pinion while tightening the bolts. If the ring gear shim is too thick, the gears will lock after only light tightening.



13. DRIVE TRAIN

Remove the gear case.
 Measure the thickness of compressed solder with the micrometer.



Select the proper size of shim(s) from the right chart, according as the compressed solder thickness.

After selecting the proper size of shim(s), check or adjust the backlash and tooth contact.

Shim thickness
0.7 mm (0.0276 in)
0.75 mm (0.0295 in)
0.8 mm (0.0315 in)
0.85 mm (0.0335 in)
0.9 mm (0.0354 in)
0.95 mm (0.0374 in)
1 mm (0.0394 in)
1.05 (0.0413 in)
1.1 mm (0.0433 in)
1.15 mm (0.0453 in)
1.2 mm (0.0472 in)
1.25 mm (0.0492 in)
1.3 mm (0.0512 in)
1.35 mm (0.0531 in)
1.4 mm (0.0551 in)
1.45 mm (0.0571 in)

13. DRIVE TRAIN

TOOTH CONTACT

After backlash adjustment and left side shim selection are carried out, the tooth contact must be checked. Pay attention to the following points:

- Remove the drive ring gear.
- Clean and degrease several teeth on the ring gear and pinion gear, and then apply a coating of machinist's layout dye or paste to several teeth of the pinion gear.
- Install the removed left and right side shims and front drive assembly.
- Assemble the gear case.

★

- Do not apply a sealant to the mating surface of the gear case.
- Do not apply a sealant to the case bolts.

Torque:

Gear case bolts:

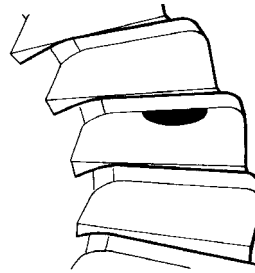
2.3 kgf-m (23 N-m, 16.5 lbf-ft)

- Rotate the drive ring gear several turns in each direction. This will provide a contact pattern on the coated teeth of ring gear.
- Remove the drive ring gear and compare the coated teeth to the examples shown in (1), (2) and (3).
- If tooth contact is found to be correct (example (2)), go to the "**FRONT DRIVE DISASSEMBLY/INSPECTION/ASSEMBLY**" section in this chapter) to complete installation.
- If tooth contact is found to be incorrect (example (1) and (3)), the shim must be changed and the tooth contact should be rechecked until correct.

★

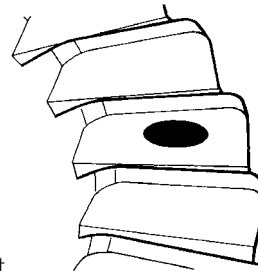
Make sure to check the backlash and shim thickness after the tooth contact has been adjusted, since it may have changed. Adjust the tooth contact and backlash until they are both within specification. If the correct tooth contact cannot be maintained when adjusting the backlash, replace the pinion gear and ring gear as a set.

(1)



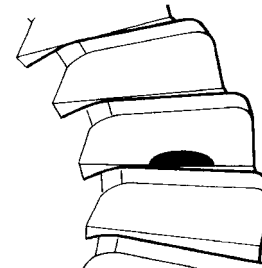
Incorrect: Contact at tooth top

(2)



Correct

(3)



Incorrect: Contact at tooth root

13. DRIVE TRAIN

REAR DRIVE REMOVAL/INSPECTION/ INSTALLATION

REMOVAL

Remove the left rear axle housing (refer to the “**REAR AXLE HOUSING REMOVAL/INSPECTION/INSTALLATION**” section in the chapter 15).

Remove the four mounting nuts from the right rear axle housing.

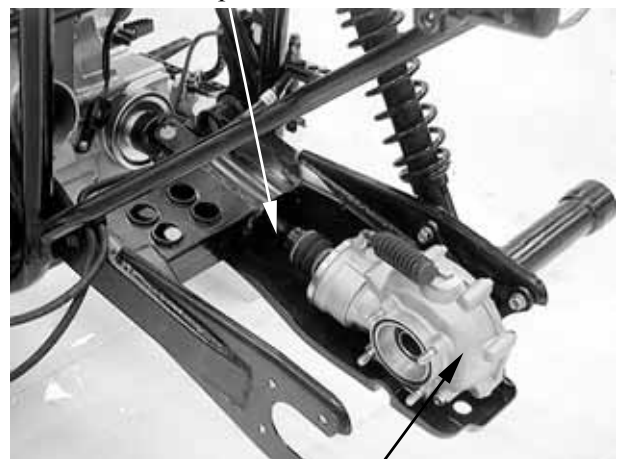
Remove the rear drive assembly and rear propeller shaft together.

Remove the rear propeller shaft from the rear drive assembly.

* Do not lose the compression spring.



Rear Propeller Shaft



Rear Drive Assembly

Rear Propeller Shaft



Compression Spring

13. DRIVE TRAIN

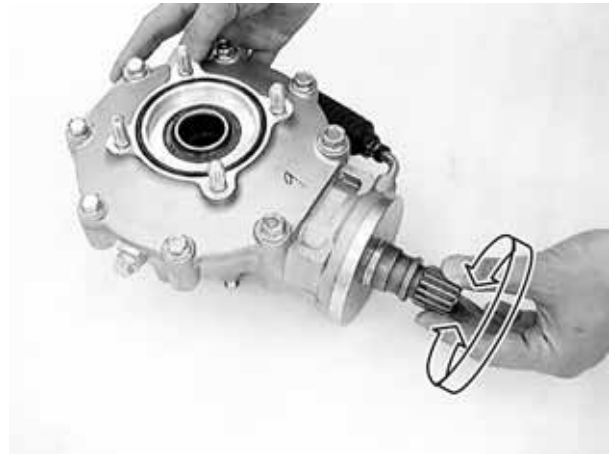
INSPECTION

Check the breather rubber case for wear or damage. Also, check that the joint of the rubber case fits tightly.



Turn the pinion gear and check that the gear turns smoothly and quietly without binding.

If the gears do not turn smoothly or quietly, the gears and/or bearing may be damaged or faulty. Replace the final gear case assembly if necessary.



INSTALLATION

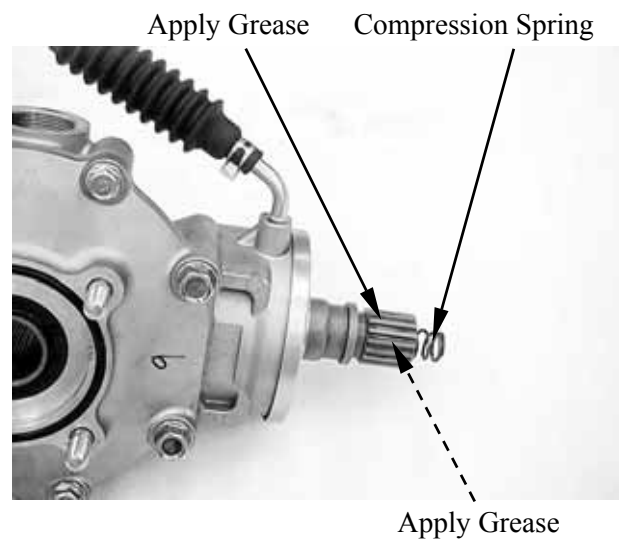
Apply lightweight lithium-soap base grease to the rear propeller shaft splines.



13. DRIVE TRAIN

Install the compression spring into the pinion gear.

Apply lightweight lithium-soap base grease to the pinion gear splines and inner.

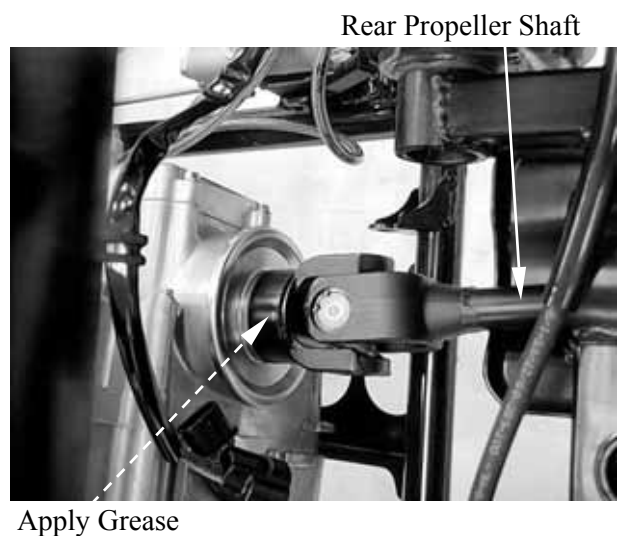


Install the rear propeller shaft to the rear drive assembly.



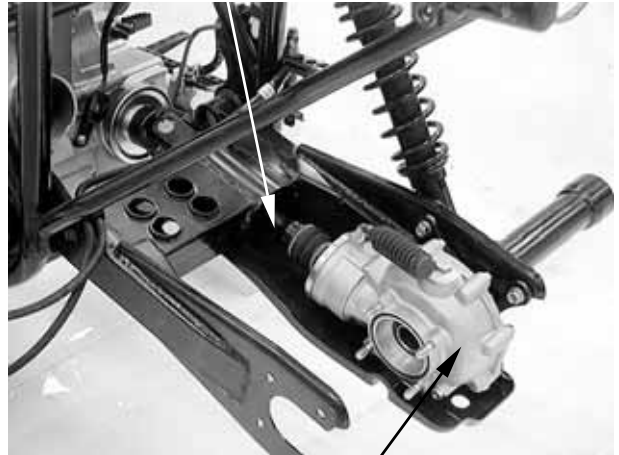
Install the rear propeller shaft and rear drive assembly to the engine and right rear axle housing.

* Apply lightweight lithium-soap base grease to the rear output shaft splines.



13. DRIVE TRAIN

Rear Propeller Shaft



Rear Drive Assembly

Install and tighten the four mounting nuts to the specified torque in a crisscross pattern in 2 or 3 steps.

Torque: 5.5 kgf-m (55 Nm, 40 lbf-ft)



13. DRIVE TRAIN

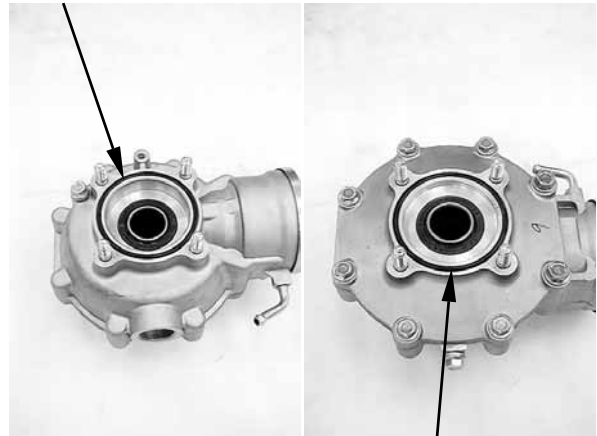
REAR DRIVE DISASSEMBLY/INSPECTION/ ASSEMBLY

DISASSEMBLY

Remove the rear drive assembly (refer to the “**REAR DRIVE REMOVAL/INSPECTION/INSTALLATION**” section in this chapter).

Remove the O-rings from the gear case and cover grooves.

O-ring (Case)



O-ring (Cover)

Remove the eight cover bolts in a crisscross pattern in several steps.



Pry the cover at the prying point using a screwdriver.

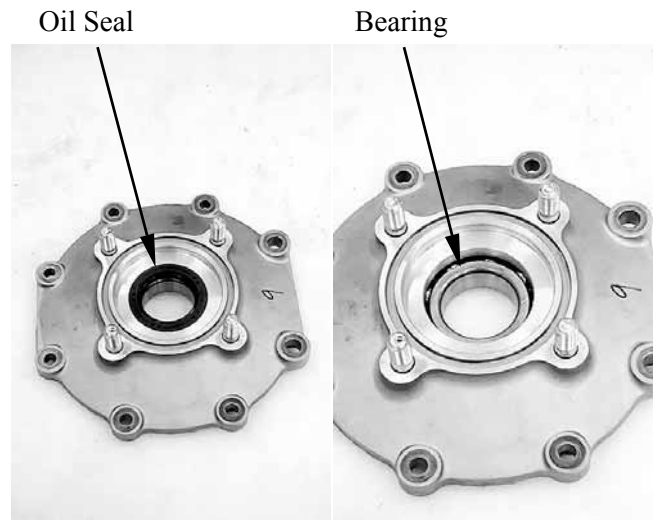


13. DRIVE TRAIN

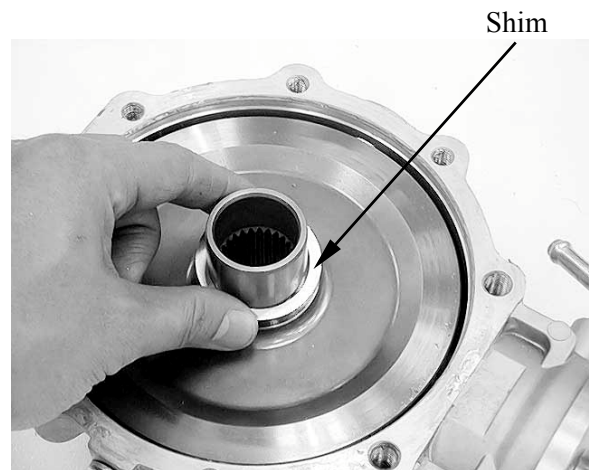
Remove the oil seal, then remove the bearing from the cover by using a proper pipe.

✱

- If there is no abnormal condition, the oil seal or bearing removal is not necessary
- The removed oil seal and bearing must be replaced with new ones.



Remove the right ring gear shim.

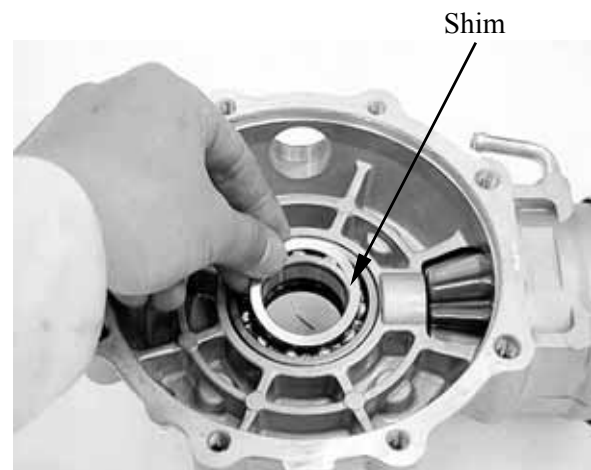


Remove the ring gear.



13. DRIVE TRAIN

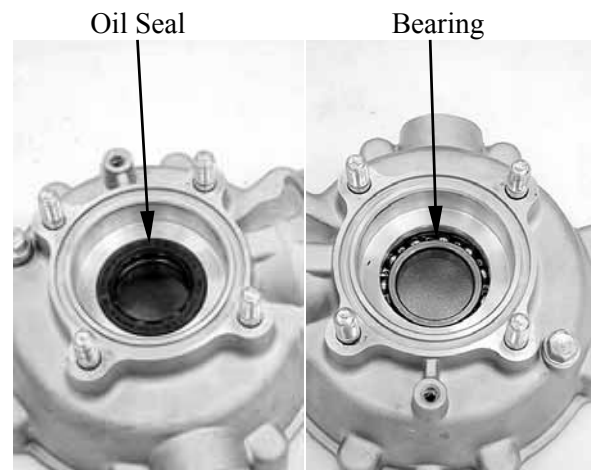
Remove the left ring gear shim.



Remove the oil seal, then remove the bearing from the case by using a proper pipe.

✱

- If there is no abnormal condition, the oil seal or bearing removal is not necessary
- The removed oil seal and bearing must be replaced with new ones.



Remove the water proof plate by using a commercially available puller.

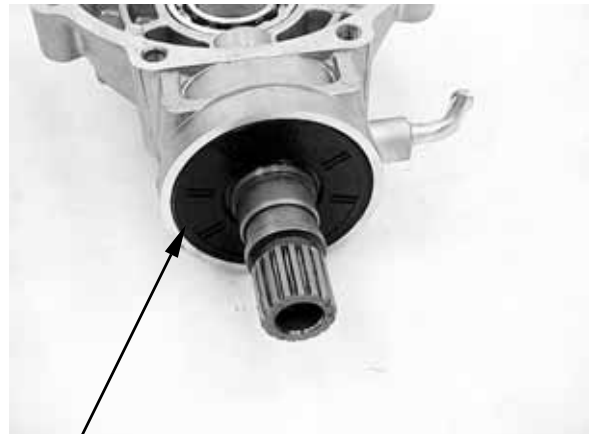


13. DRIVE TRAIN

Remove the oil seal.

✳

- If there is no abnormal condition, the oil seal removal is not necessary
- The removed oil seal must be replaced with a new one.

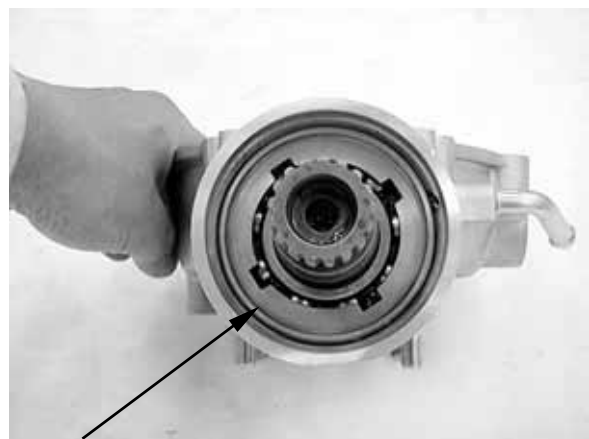


Oil Seal

Remove the bearing lock nut by using special tool.

Special tool:

Bearing lock nut wrench A120F00020



Bearing Lock Nut

Install the special tool onto the pinion gear shaft and gear case.

Special tool:

Pinion puller set A120F00021

Pull the pinion assembly out from the case.



13. DRIVE TRAIN

Remove the snap ring.
Remove the pinion gear pilot bearing by using the special tools.

Special tool:

Bearing puller A120E00037

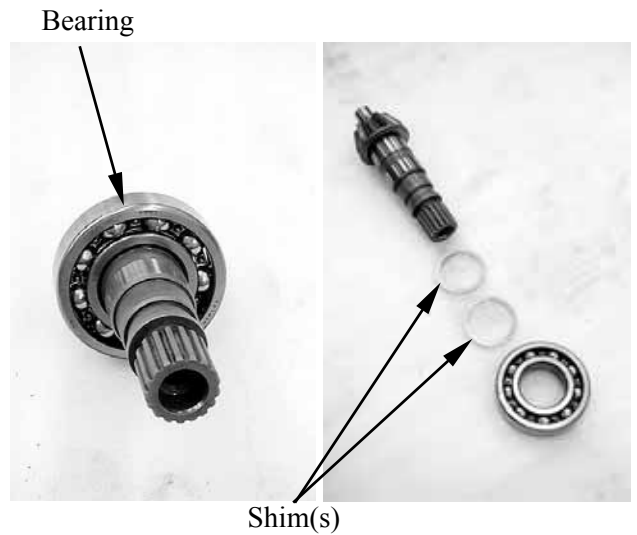


Pull the pinion bearing from the shaft with a commercially available bearing puller.

★

- If there is no abnormal condition, the bearing removal is not necessary.
- The removed bearing must be replaced with a new one.

Remove the pinion shim(s).

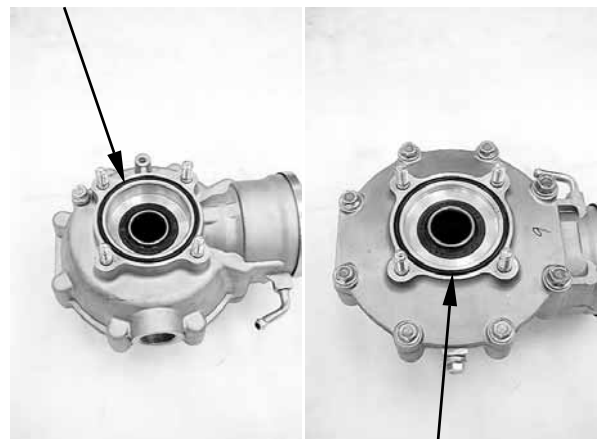


INSPECTION

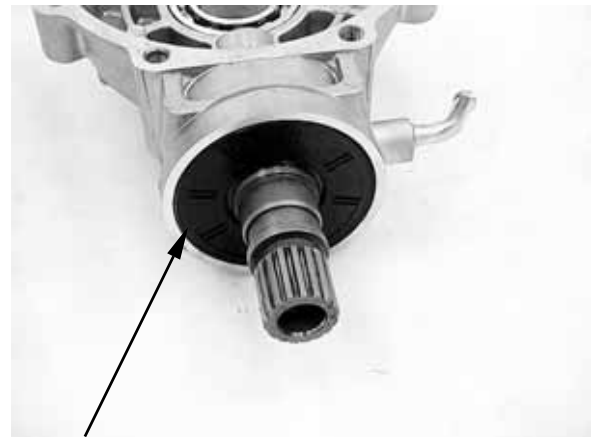
Inspect the gear case, cover and oil seals for wear or damage.

If any wear or damage is found, replace the oil seal with a new one.

O-ring (Case)



O-ring (Cover)



Oil Seal

Check the outer race play and smooth rotation of the bearing by hand while it is on the pinion gear shaft.

Inspect the pinion gear for wear or damage.

If the pinion gear is damaged, inspect the ring gear.

If any defects are found, replace the bearing and gear with the new ones

Inspect the splines of pinion gear shaft for wear or damage.

If any defects are found, replace the pinion gear shaft with a new one.

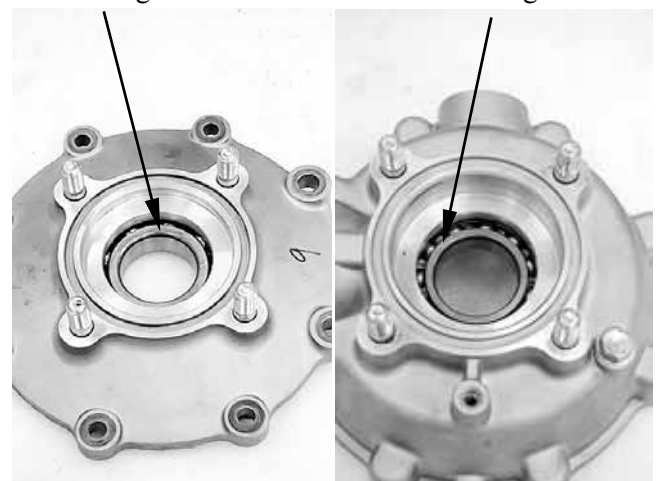


Bearing

Bearing

Check the cover and case bearings for wear or damage.

If any wear or damage is found, replace the bearing with a new one.

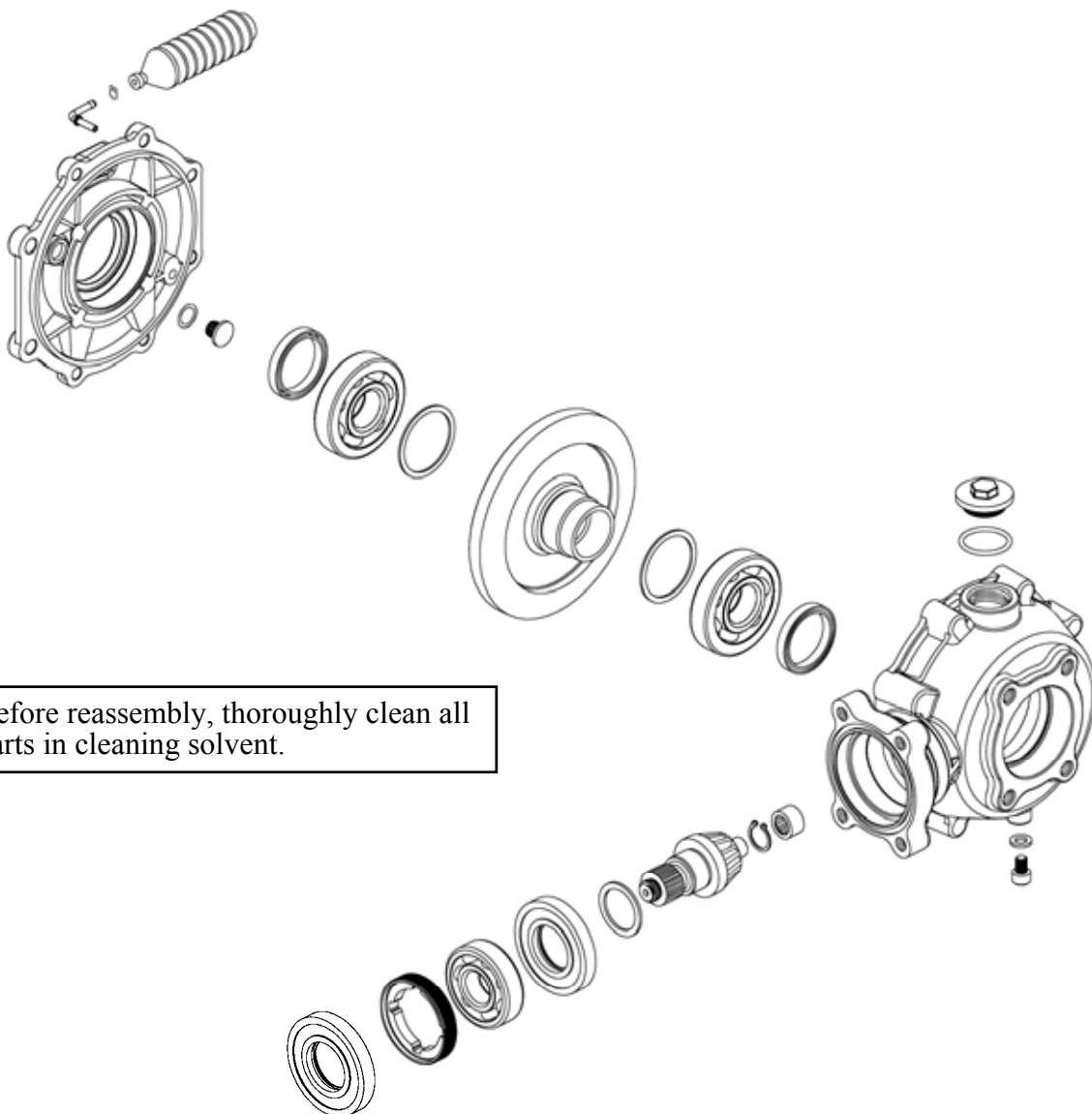


13. DRIVE TRAIN

Inspect the ring gear for wear or damage.
If the ring gear is damaged, inspect the pinion gear also.
If any defects are found, replace the bearings and ring gear with the new ones.



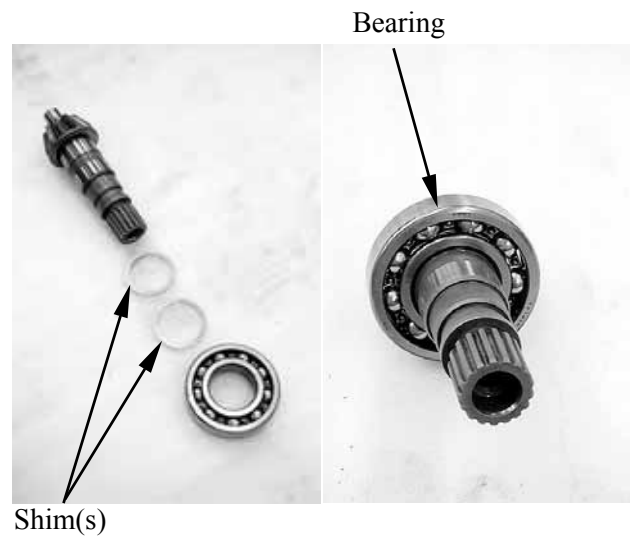
ASSEMBLY



* Before reassembly, thoroughly clean all parts in cleaning solvent.

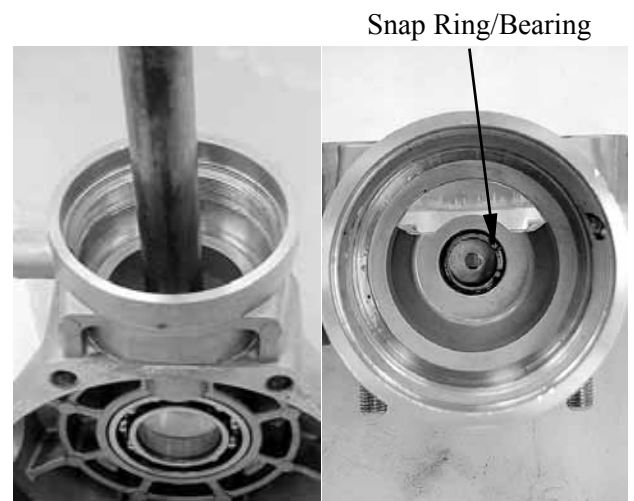
13. DRIVE TRAIN

Install the shim(s) onto the pinion gear shaft, then install the new bearing onto the pinion shaft by using a proper pipe.



Install the new bevel pinion gear pilot bearing into the gear case by using a proper shaft.

Install the snap ring.

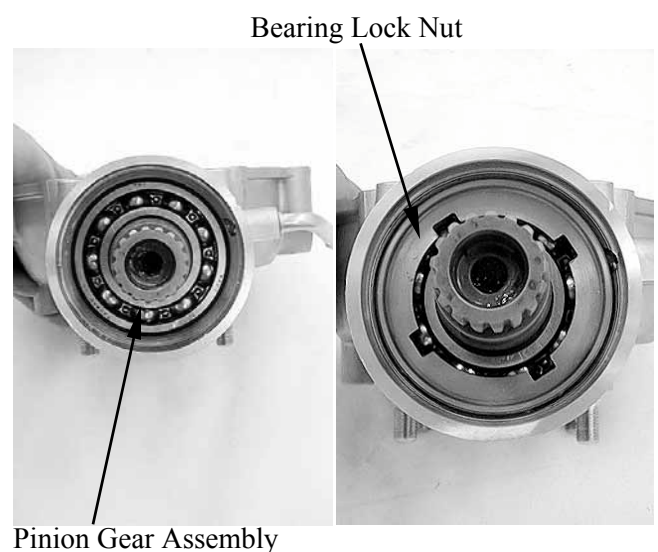


Install the pinion gear assembly by using a proper pipe.

Install the bearing lock nut by using the special tool.

Special tool:

Bearing lock nut wrench A120F00020

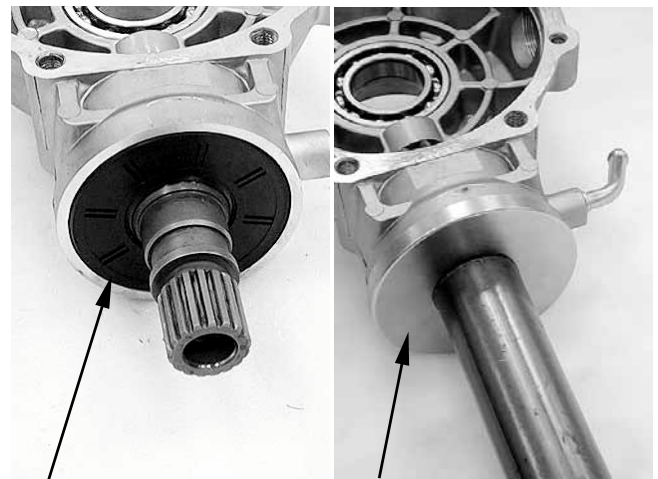


13. DRIVE TRAIN

Apply lightweight lithium-soap base grease to the new oil seal lips.

Install the new oil seal into the gear case by using a proper pipe.

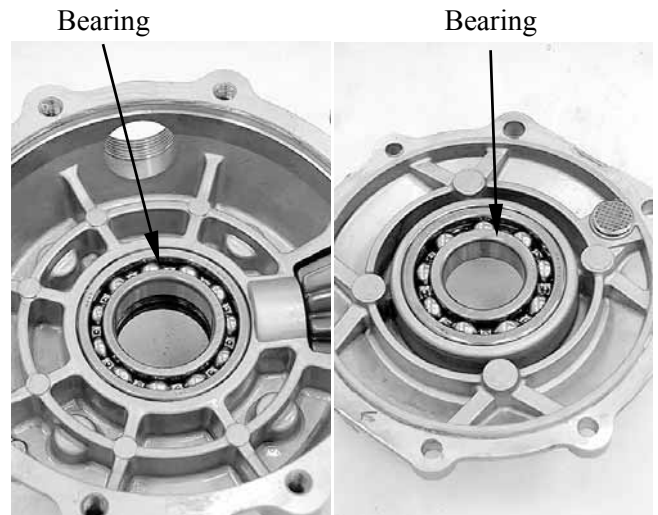
Install the new water proof plate by using a proper pipe.



Oil Seal

Water Proof Plate

Install the new bearings into the gear case and cover by using a proper pipe.



Bearing

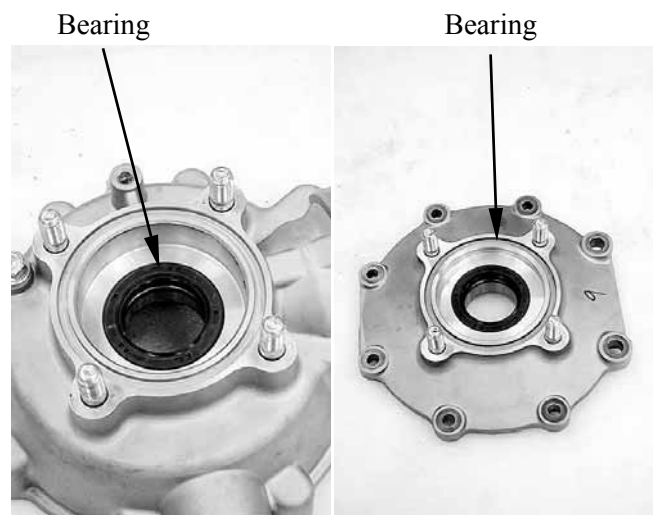
Bearing

Apply lightweight lithium-soap base grease to the new oil seal lips.

Install the new oil seals into the gear case and cover by using the special tool.

Special tool:

Oil seal & bearing installer A120E00014

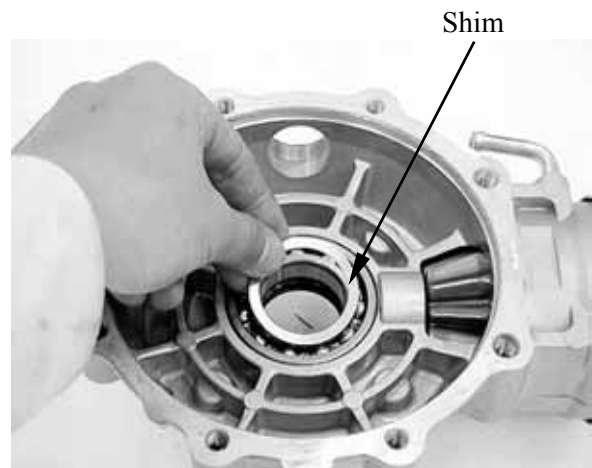


Bearing

Bearing

13. DRIVE TRAIN

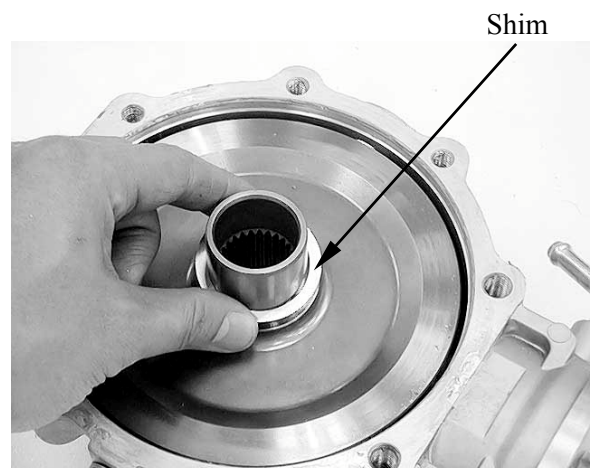
Install the removed left shim to the gear case.



Install ring gear to the gear case.



Install the removed right shim to the ring gear.



13. DRIVE TRAIN

Apply a sealant (three bond: 1215) to the mating surface of the case, then install the gear cover.

★

After the backlash and tooth contact have been checked or adjusted, apply a sealant to the mating surface of the case.

Apply three bond: 1215 to the case bolts and tighten them to the specified torque in a crisscross pattern in 2 or 3 steps.

Torque:

10-mm bolt: 5 kgf-m (49 N-m, 36 lbf-ft)

8-mm bolt: 2.5 kgf-m (25 N-m, 19 lbf-ft)

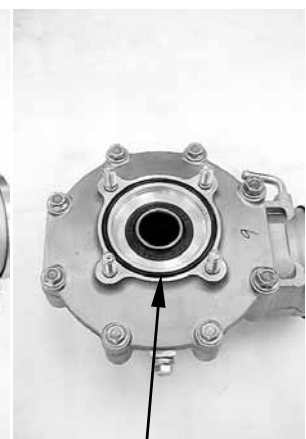
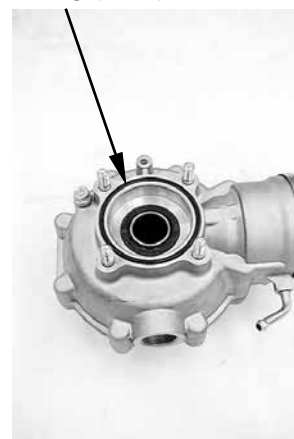
★

- After the backlash and tooth contact have been checked or adjusted, apply three bond: 1215 to the case bolts.
- It is important to turn the pinion while tightening the bolts. If the ring gear shim is too thick, the gears will lock after only light tightening.



Apply lightweight lithium-soap base grease to the new oil rings.
 Install the new oil rings into the gear case and cover.

O-ring (Case)



O-ring (Cover)

13. DRIVE TRAIN

REAR DRIVE SHIM ADJUSTMENT

BACKLASH

Install the removed left and right side shims and rear drive assembly.

Assemble the gear case (refer to the “**REAR DRIVE DISASSEMBLY/INSPECTION/ASSEMBLY**” section in this chapter).

★

At this time, it is not necessary to apply a sealant to the mating surface of the gear case.

Remove the oil filler cap and measure the backlash of the drive ring gear using the horizontal type dial gauge and proper size of wooden piece or plastic piece, as shown. Take backlash readings at three places while turning the ring gear slightly in each direction and securely holding the pinion gear by using commercially tool.

Read the total backlash on the dial gauge.

Standard:

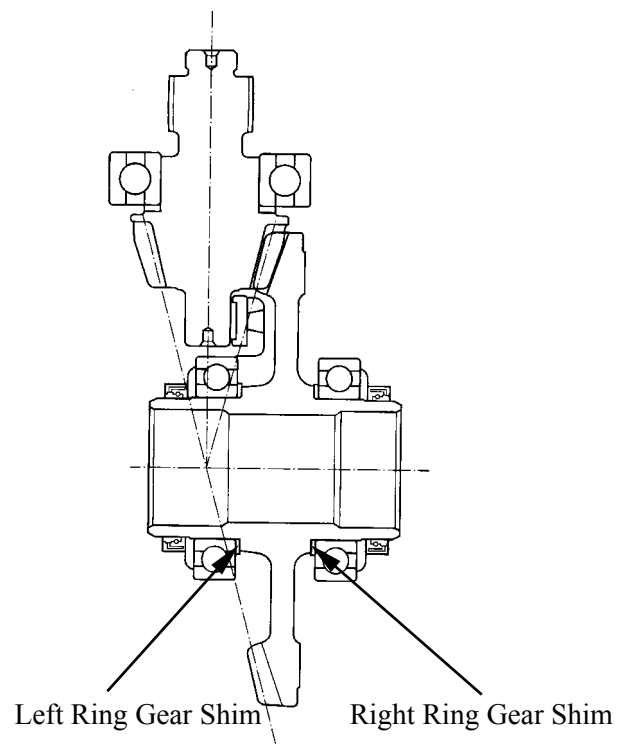
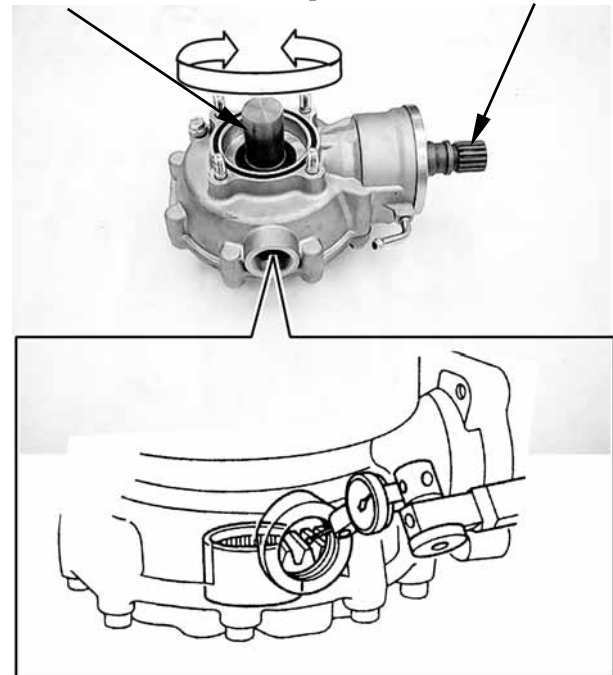
0.05 – 0.25 mm (0.002 – 0.01 in)

Service limit: 0.4 mm (0.16 in)

Remove the dial gauge and turn the ring gear 120°, then measure the backlash. Repeat this procedure once more and compare the difference of the three measurements.

Service limit: 0.2 mm (0.08 in)

Wooden Piece or Plastic piece Pinion Gear



13. DRIVE TRAIN

If the backlash is not within specification, the shim must be changed and the backlash should be re-checked until correct.

Refer to the chart at the right for the appropriate shim thickness.

★

Adjust the backlash by referring to the chart at the right and using the thickness of the removed shims as a guide.

Backlash	Shim adjustment
Under 0.05 mm (0.002 in)	Increase shim thickness
0.05 – 0.25 mm (0.002 – 0.01 mm)	Correct
Over 0.25 mm (0.01 in)	Decrease shim thickness

Right/Left Shim thickness	
A	1.55 mm (0.062 in)
B	1.5 mm (0.06 in)
C	1.45 mm (0.058 in)

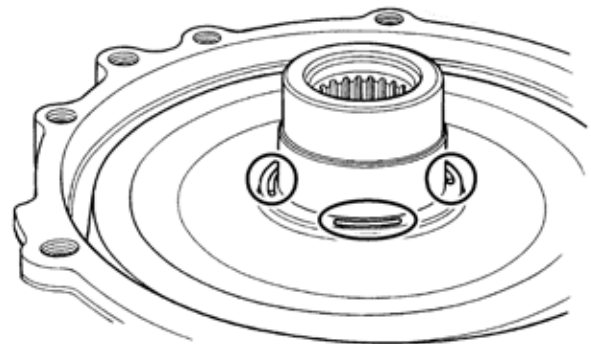
RIGHT SIDE SHIM SELECTION

Install the removed left side shim(s) and ring gear.

Put a few pieces of solder (O.D.: 2 – 2.5 mm/L: 6 mm) on the ring gear back side, as shown.

★

- Do not install the right side shim(s) at this time.
- Apply a small quantity of grease to the solder to prevent them from falling



Install the gear case cover.

★

At this time, it is not necessary to apply a sealant to the mating surface of the gear case.

13. DRIVE TRAIN

Install and tighten its bolts to the specified torque in a crisscross pattern in 2 or 3 steps.

Torque:

10-mm bolt: 5 kgf-m (49 N-m, 36 lbf-ft)

8-mm bolt: 2.5 kgf-m (25 N-m, 19 lbf-ft)



- Do not apply a sealant to the case bolts.
- It is important to turn the pinion while tightening the bolts. If the ring gear shim is too thick, the gears will lock after only light tightening.
- Do not install the new O-ring to the gear case cover.

Remove the gear case cover.

Measure the thickness of compressed solder with the micrometer.



Select the proper size of shim(s) from the right chart, according as the compressed solder thickness.

After selecting the proper size of shim(s), install it on the ring back side.

Right/Left Ring Gear Shim thickness	
A	1.55 mm (0.062 in)
B	1.5 mm (0.06 in)
C	1.45 mm (0.058 in)

13. DRIVE TRAIN

TOOTH CONTACT

After backlash adjustment and right side shim selection are carried out, the tooth contact must be checked. Pay attention to the following points:

- Remove the ring gear.
- Clean and degrease several teeth on the ring gear and pinion gear, and then apply a coating of machinist's layout dye or paste to several teeth of the pinion gear.
- Install the ring gear with the shims in place.
- Install the gear case cover, and then tighten the bolts to the specified torque in a crisscross pattern in 2 or 3 steps.

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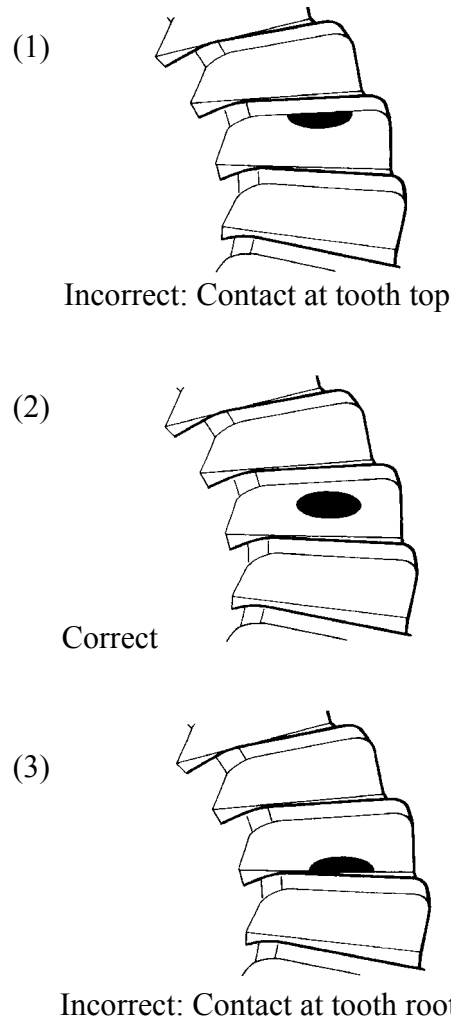
- Do not apply a sealant to the mating surface of the gear case.
- Do not apply a sealant to the case bolts.
- It is important to turn the pinion while tightening the bolts. If the ring gear shim is too thick, the gears will lock after only light tightening
- At this time, it is not necessary to install the gear case cover's O-ring.

Torque:

- 10-mm bolt:** 5 kgf-m (49 N-m, 36 lbf-ft)
- 8-mm bolt:** 2.5 kgf-m (25 N-m, 19 lbf-ft)

- Rotate the ring gear several turns in each direction. This will provide a contact pattern on the coated teeth of ring gear.
- Remove the ring gear and compare the coated teeth to the examples shown in (1), (2) and (3).
- If tooth contact is found to be correct (example (2)), go to the "**REAR DRIVE DISASSEMBLY/INSPECTION/ASSEMBLY**" section in this chapter) to complete installation.

If tooth contact is found to be incorrect (example (1) and (3)), the shim between the pinion gear bearing and pinion gear must be changed and tooth contact re-checked until correct.



Tooth contact	Shim adjustment
Contact at tooth top (1)	Decrease shim thickness
Contact at tooth root (3)	Increase shim thickness

13. DRIVE TRAIN

*

Make sure to check the backlash and shim thickness after the tooth contact has been adjusted, since it may have changed. Adjust the tooth contact and backlash until they are both within specification. If the correct tooth contact cannot be maintained when adjusting the backlash, replace the pinion gear and ring gear as a set.

Pinion Gear Shim thickness	
A	2.05 mm (0.081 in)
B	2 mm (0.079 in)
C	1.95 mm (0.077 in)

13. DRIVE TRAIN

FRONT PROPELLER SHAFT DISASSEMBLY/INSPECTION/ ASSEMBLY

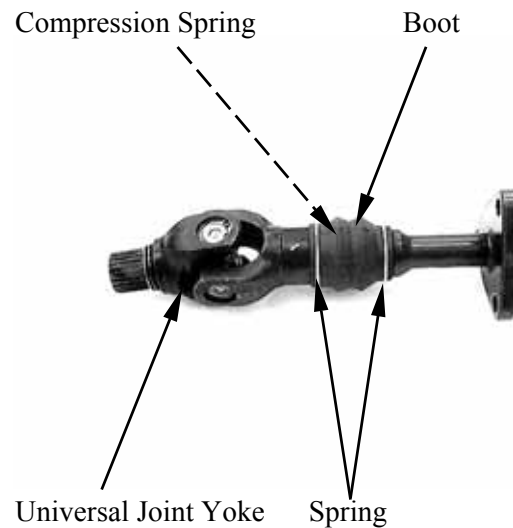
DISASSEMBLY

Remove the front propeller shaft (refer to the “**FRONT DRIVE REMOVAL/INSPECTION/INSTALLATION**” section in this chapter).



Front Propeller Shaft

Slide the spring rings back, then remove the boot, universal joint yoke, shaft and compression spring.



Remove the snap rings from the universal joint.



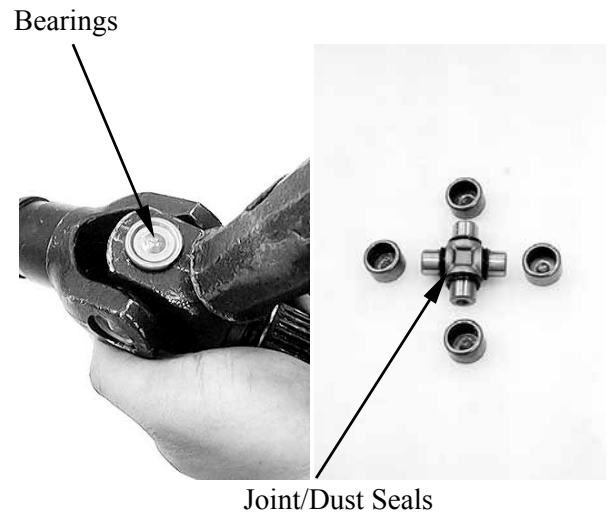
13. DRIVE TRAIN

Remove the bearings by tapping the universal joint with a copper hammer.

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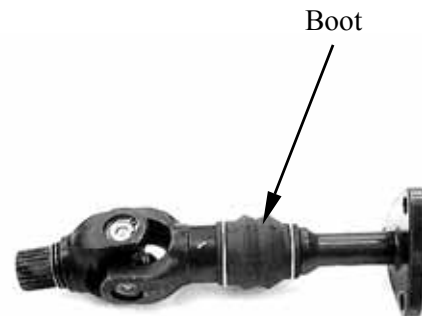
- If there is no abnormal condition, the dust seal or bearing removal is not necessary.
- The removed dust seal and bearing must be replaced with new ones.

Remove the universal joint/dust seals.



INSPECTION

Check the boot for holes or tears.
If any damage is found, replace the boot with a new one.



Inspect the splines of universal joint for wear or damage.
If any defects are found, replace the universal joint yoke with a new one.



13. DRIVE TRAIN

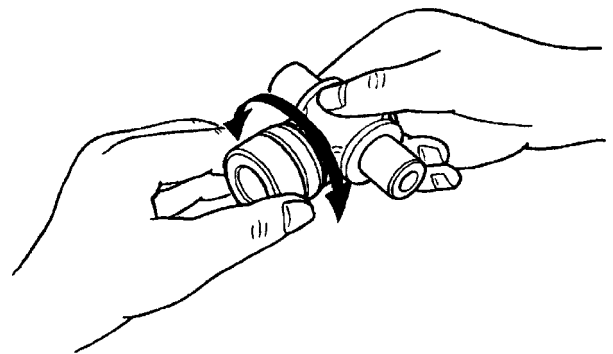
Inspect the universal joint, wear and damage.

If any defects are found, replace the bearings, dust seal and universal joint as a set.



Insert the universal joint to the new bearing and check the play by turning the universal joint, as shown.

If excessive play is noted, replace the bearings, dust seal and universal joint as a set.



Inspect the splines of shaft for wear or damage.

If any defects are found, replace the shaft with a new one.



13. DRIVE TRAIN

ASSEMBLY

Install the universal joint, new dust seal and new bearings.

Install the snap rings.



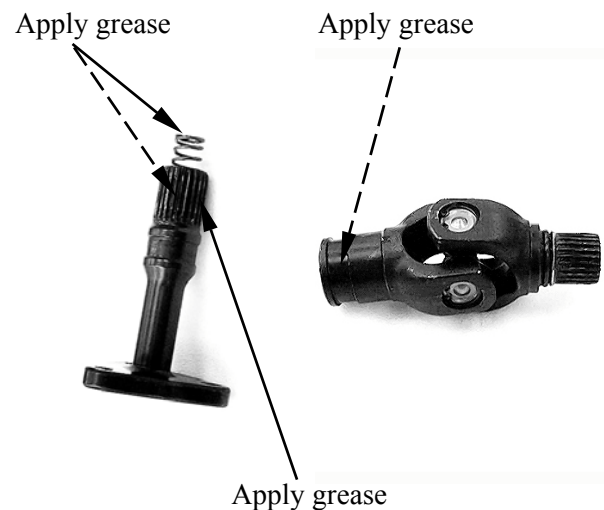
After reassembling the universal joint, check the joint movement smoothly. If a large resistance is felt to movement, tap the bearing with a plastic mallet lightly.



Apply lightweight lithium-soap base grease to the shaft splines and inner.

Apply lightweight lithium-soap base grease to the compression spring.

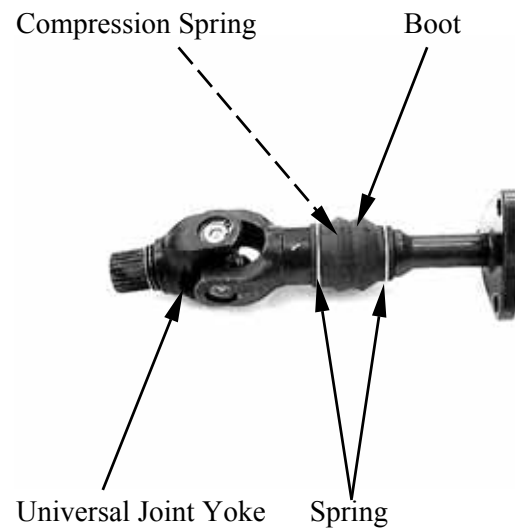
Apply lightweight lithium-soap base grease to the universal joint inner.



13. DRIVE TRAIN

Fix the boot and spring ring, taking care not to distort the boot.

The dust boot should be fastened with the spring ring at the grooves in the propeller shaft.



13. DRIVE TRAIN

REAR PROPELLER SHAFT DISASSEMBLY/INSPECTION/ ASSEMBLY

DISASSEMBLY

Remove the front propeller shaft (refer to the “**REAR DRIVE REMOVAL/INSPECTION/INSTALLATION**” section in this chapter).

Slide the spring ring back, then remove the boot.



Remove the snap rings from the universal joint.



13. DRIVE TRAIN

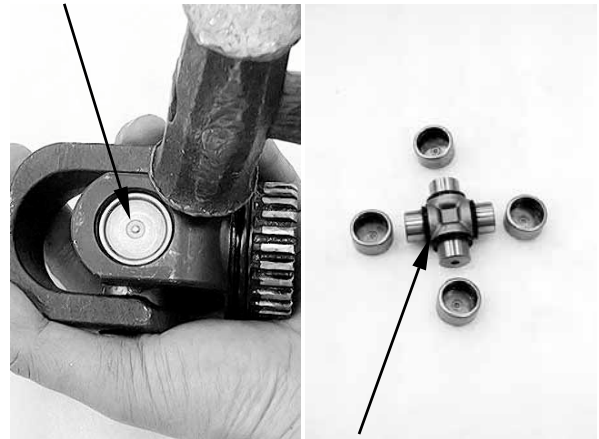
Remove the bearings by tapping the universal joint with a copper hammer.

✱

- If there is no abnormal condition, the dust seal or bearing removal is not necessary.
- The removed dust seal and bearing must be replaced with new ones.

Remove the universal joint/dust seals.

Bearings



Joint/Dust Seals

INSPECTION

Check the boot for holes or tears.

If any damage is found, replace the boot with a new one.

Boot



Inspect the splines of universal joint for wear or damage.

If any defects are found, replace the universal joint yoke with a new one.



13. DRIVE TRAIN

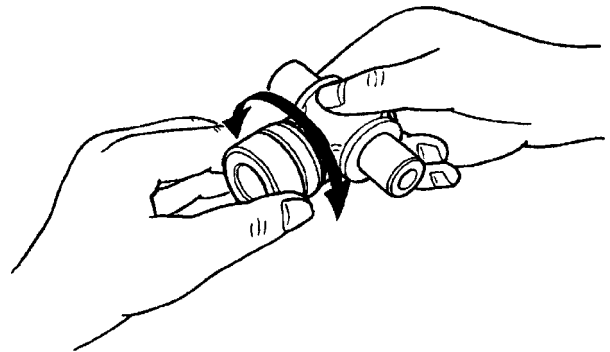
Inspect the universal joint, wear and damage.

If any defects are found, replace the bearings, dust seals and universal joint as a set.



Insert the universal joint to the new bearing and check the play by turning the universal joint, as shown.

If excessive play is noted, replace the bearings, dust seals and universal joint as a set.



ASSEMBLY

Install the universal joint, new dust seal and new bearings.

Install the snap rings.



13. DRIVE TRAIN

After reassembling the universal joint, check the joint movement smoothly. If a large resistance is felt to movement, tap the bearing with a plastic mallet lightly.



Fix the boot and spring ring, taking care not to distort the boot.

The dust boot should be fastened with the spring ring at the groove in the propeller shaft.

