

STEERING

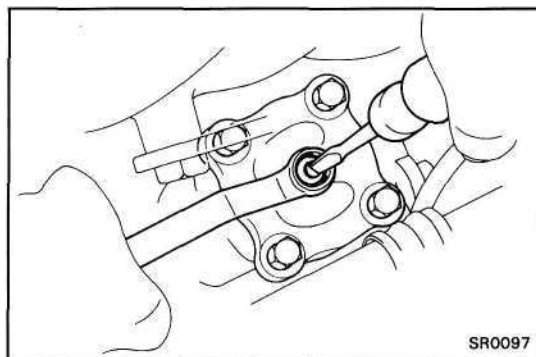
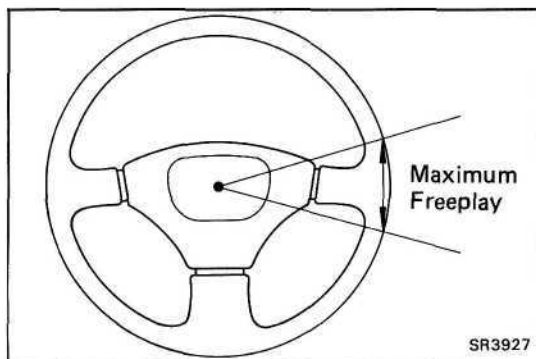
	Page
PRECAUTION	SR-2
TROUBLESHOOTING	SR-2
ON-VEHICLE INSPECTION	SR-3
STEERING COLUMN	SR-4
Non-Tilt Steering Column	SR-6
Tilt Steering Column	SR-10
MANUAL GEAR HOUSING	SR-19
POWER STEERING	SR-28
Description	SR-28
On-Vehicle Inspection	SR-32
Power Steering Pump	SR-38
Gear Housing	SR-54
Electronic Control System	SR-65
STEERING LINKAGE	SR-71

PRECAUTION

Care must be taken to replace parts properly because they may affect the performance of the steering system and result in a driving hazard.

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Hard steering	Tires improperly inflated	Inflate tires to proper pressure	A-14
	Insufficient lubricant	Lubricate suspension	
	Excessive caster	Check front wheel alignment	SA-3
	Steering system joints worn	Replace steering system joints	SR-19, 54
	Steering column binding	Inspect steering column	SR-4
	Steering gear out of adjustment or broken	Adjust or repair steering gear	SR-19, 54
	Power steering belt loose	Adjust belt	SR-32
	Fluid level in reservoir low	Check reservoir	SR-33
	Power steering unit faulty	Check power steering unit	SR-38, 54
	Solenoid valve faulty	Inspect solenoid valve	SR-69
	Electronic control faulty	Inspect electronic control	SR-65
Poor return	Tires improperly inflated	Inflate tires to proper pressure	A-14
	Insufficient lubricant	Lubricate suspension	
	Wheel alignment incorrect	Check front wheel alignment	SA-3
	Steering column binding	Inspect steering column	SR-4
	Steering gear out of adjustment or broken	Adjust or repair steering gear	SR-19, 54
Excessive play	Front wheel bearing worn	Replace front wheel bearing	SA-15
	Main shaft yoke or intermediate shaft yoke worn	Replace main shaft or intermediate shaft	SR-4
	Steering system joints worn	Replace steering system joints	SR-19, 54
	Steering gear out of adjustment or broken	Adjust or repair steering gear	SR-19, 54
Abnormal noise	Steering linkage loose	Tighten steering linkage	SR-71
	Steering system joints worn	Replace steering system joints	SR-19, 54
	Steering gear out of adjustment or broken	Adjust or repair steering gear	SR-19, 54



ON-VEHICLE INSPECTION

STEERING WHEEL FREEPLAY

1. CHECK THAT STEERING WHEEL FREEPLAY IS CORRECT

With the vehicle stopped and pointed straight ahead, rock the steering wheel gently back and forth with light finger pressure. Freeplay should not exceed the maximum limit.

Maximum **play**: 30 mm (1.18 in.)

If incorrect, adjust or repair as required.

2. POINT WHEELS STRAIGHT AHEAD

3. ADJUST STEERING GEAR HOUSING

- Loosen the lock nut.
- Turn the adjusting screw clockwise to decrease wheel freeplay and counterclockwise to increase it.

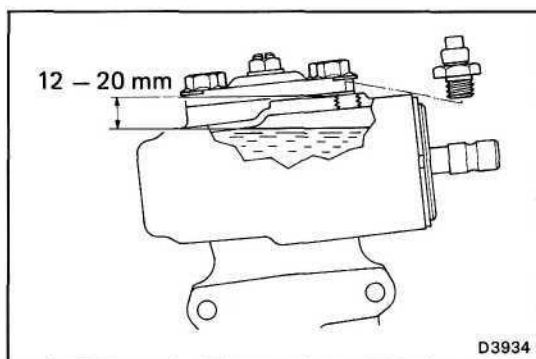
HINT: Turn the adjusting screw in small increments and check the wheel freeplay between each adjustment.

4. CHECK THAT STEERING DOES NOT BIND

Turn the steering wheel half way around in both directions.

Check that the freeplay is correct and steering is smooth and without rough spots.

5. HOLD ADJUSTING SCREW AND TIGHTEN LOCK NUT



OIL LEVEL

CHECK STEERING GEAR HOUSING OIL LEVEL

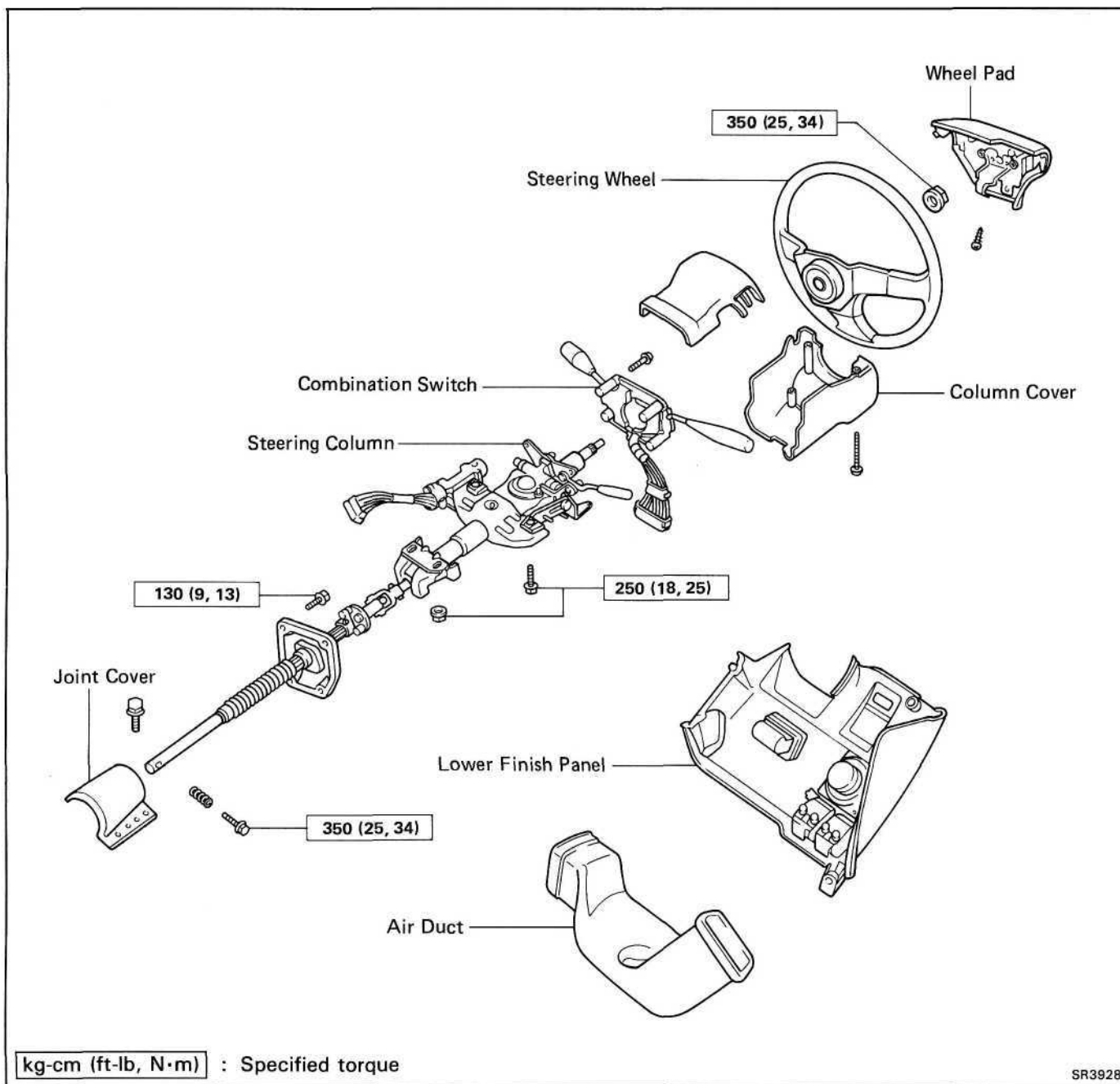
Oil level: 12 - 20 mm (0.47 - 0.79 in.)

If low, fill with gear oil and check for leakage.

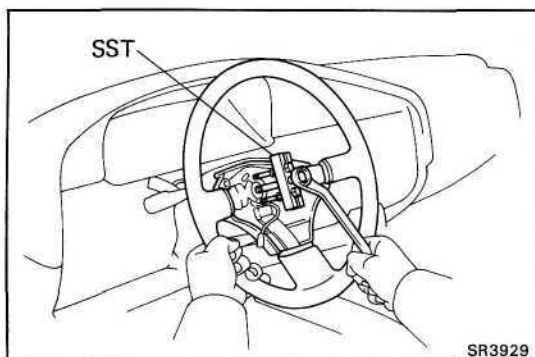
STEERING COLUMN

REMOVAL AND INSTALLATION OF STEERING COLUMN

Remove and install the parts as shown.



SR3928



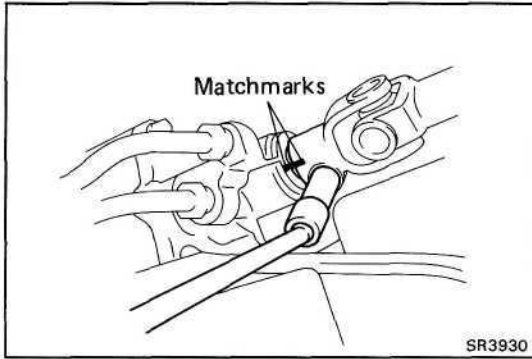
SR3929

(MAIN POINT OF REMOVAL)

1. REMOVE STEERING WHEEL

Using SST, remove the steering wheel.

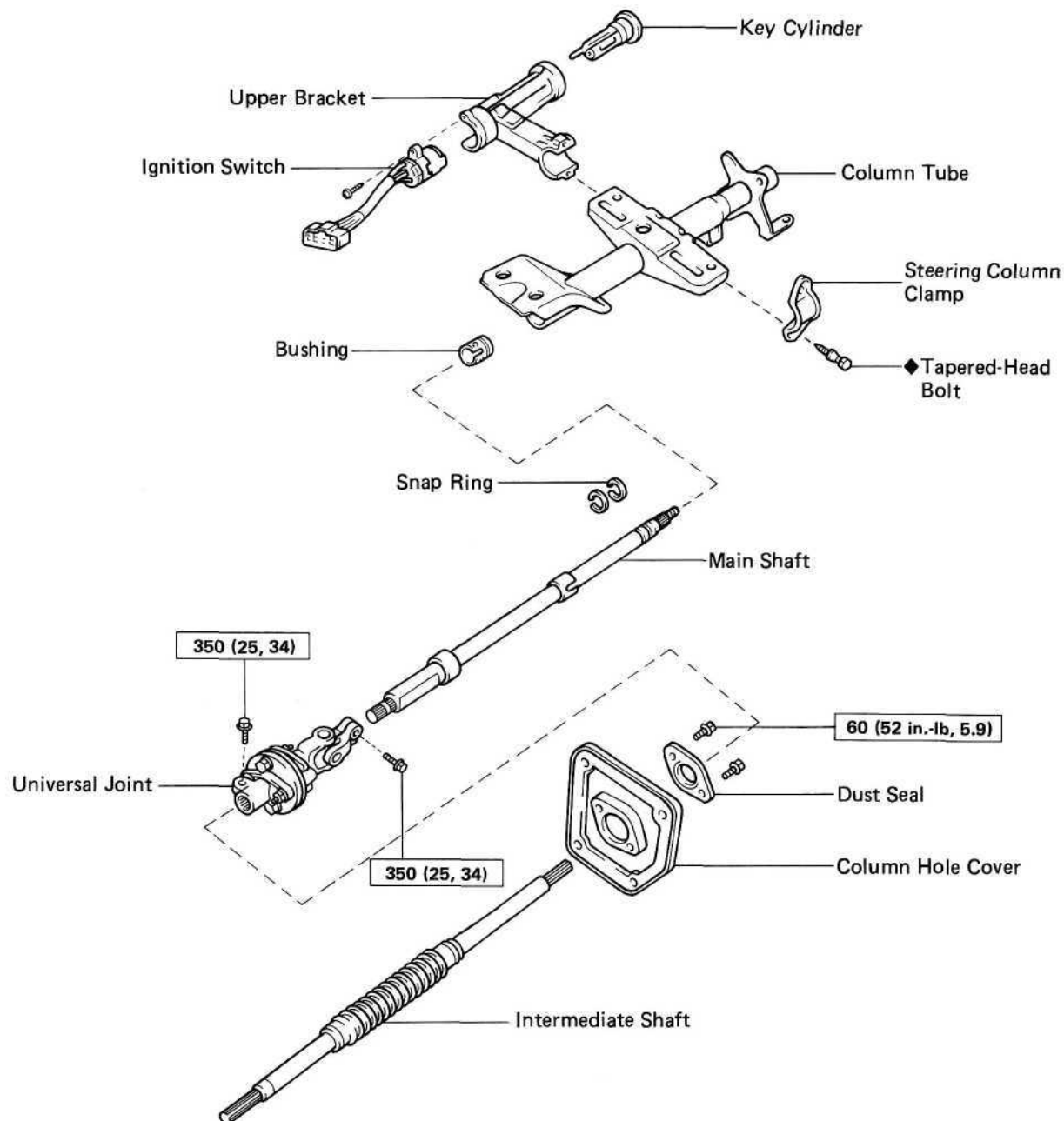
SST 09609-20011

**2. DISCONNECT MAIN SHAFT**

- (a) Place matchmarks on the worm shaft and main shaft.
- (b) Disconnect the main shaft from the worm shaft.

Non-Tilt Steering Column

COMPONENTS

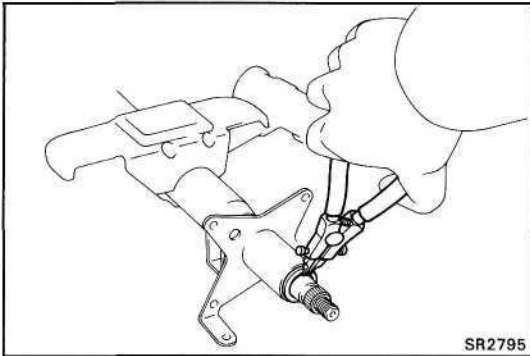


kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

DISASSEMBLY OF STEERING COLUMN

1. **DISCONNECT UNIVERSAL JOINT**
(See page SR-11)
2. **REMOVE COLUMN HOLE COVER**
(See page SR-11)

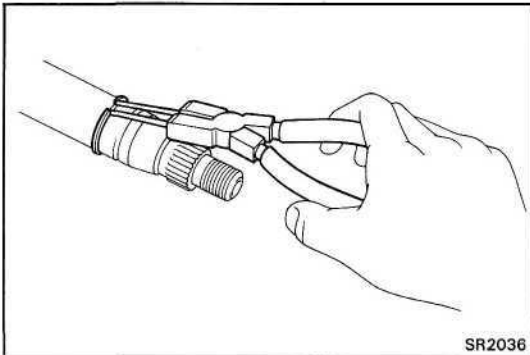


3. **PULL OUT MAIN SHAFT**

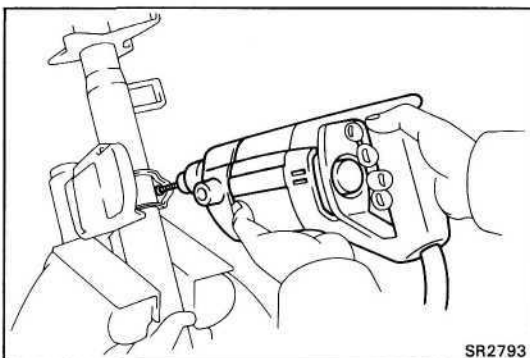
(a) Using snap ring pliers, remove the snap ring.

(b) Pull out main shaft from the upper tube.

HINT: Do not place the ignition key at the LOCK position.



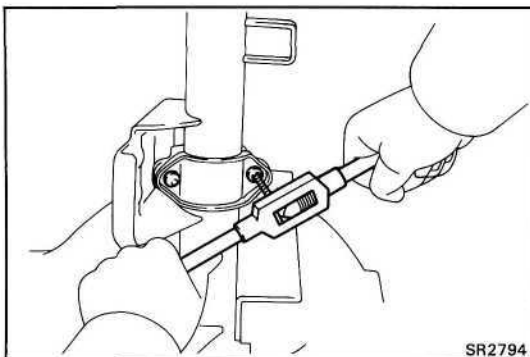
(c) Using snap ring pliers, remove the snap ring.



4. **REMOVE UPPER BRACKET**

(a) Using a centering punch, mark the center of the tapered-head bolts.

(b) Using a 3 - 4 mm (0.12 - 0.16 in.) drill, drill into the tapered-head bolts.

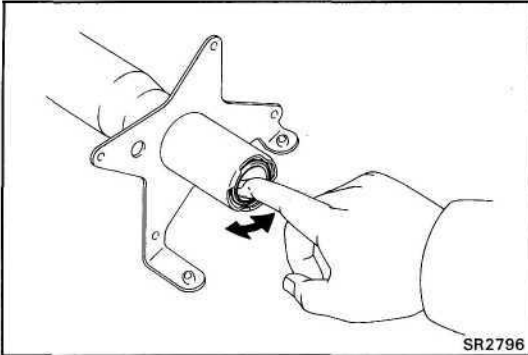


(c) Using a screw extractor, remove the tapered-head bolts.

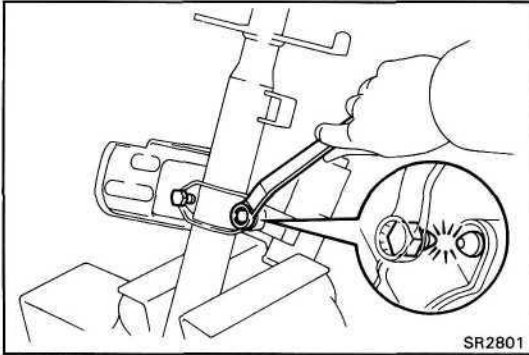
(d) Remove the two bolts and separate the upper bracket and column tube.

INSPECTION AND REPLACEMENT OF NON-TILT STEERING COLUMN

1. **INSPECT UPPER BRACKET**
(See page SR-14)
2. **IF NECESSARY, REPLACE IGNITION KEY CYLINDER**
(See page SR-14)



3. **INSPECT UPPER BEARING**
Check the upper bearing rotation condition and check for abnormal noise.
If the bearing is worn or damaged, replace the column tube assembly.
4. **IF NECESSARY, REPLACE BUSHING**
(See page SR-14)

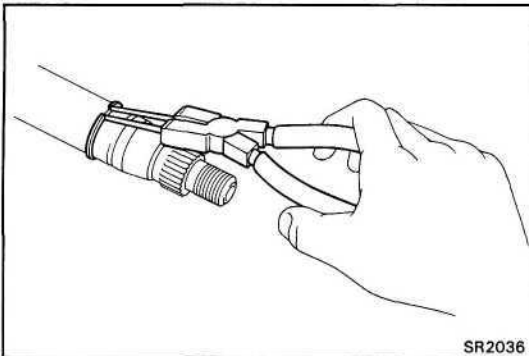


ASSEMBLY OF NON-TILT STEERING COLUMN

(See page SR-6)

1. INSTALL UPPER BRACKET TO COLUMN TUBE

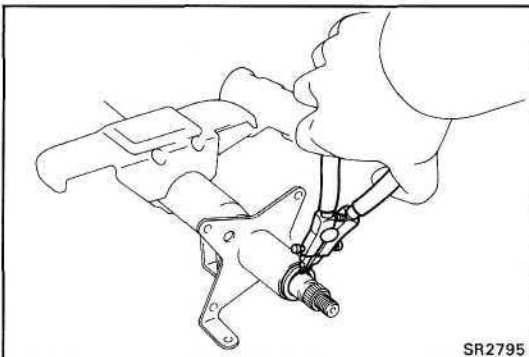
- (a) Install the upper bracket with new two tapered-head bolts.
- (b) Tighten the tapered-head bolts until the bolt heads break off.



2. INSTALL MAIN SHAFT TO COLUMN TUBE

- (a) Using snap ring pliers, install the snap ring in the lower groove of the main shaft.
- (b) Insert the main shaft in the column tube.

HINT: Do not place the ignition key at LOCK position.



- (c) Using snap ring pliers, install the upper snap ring.

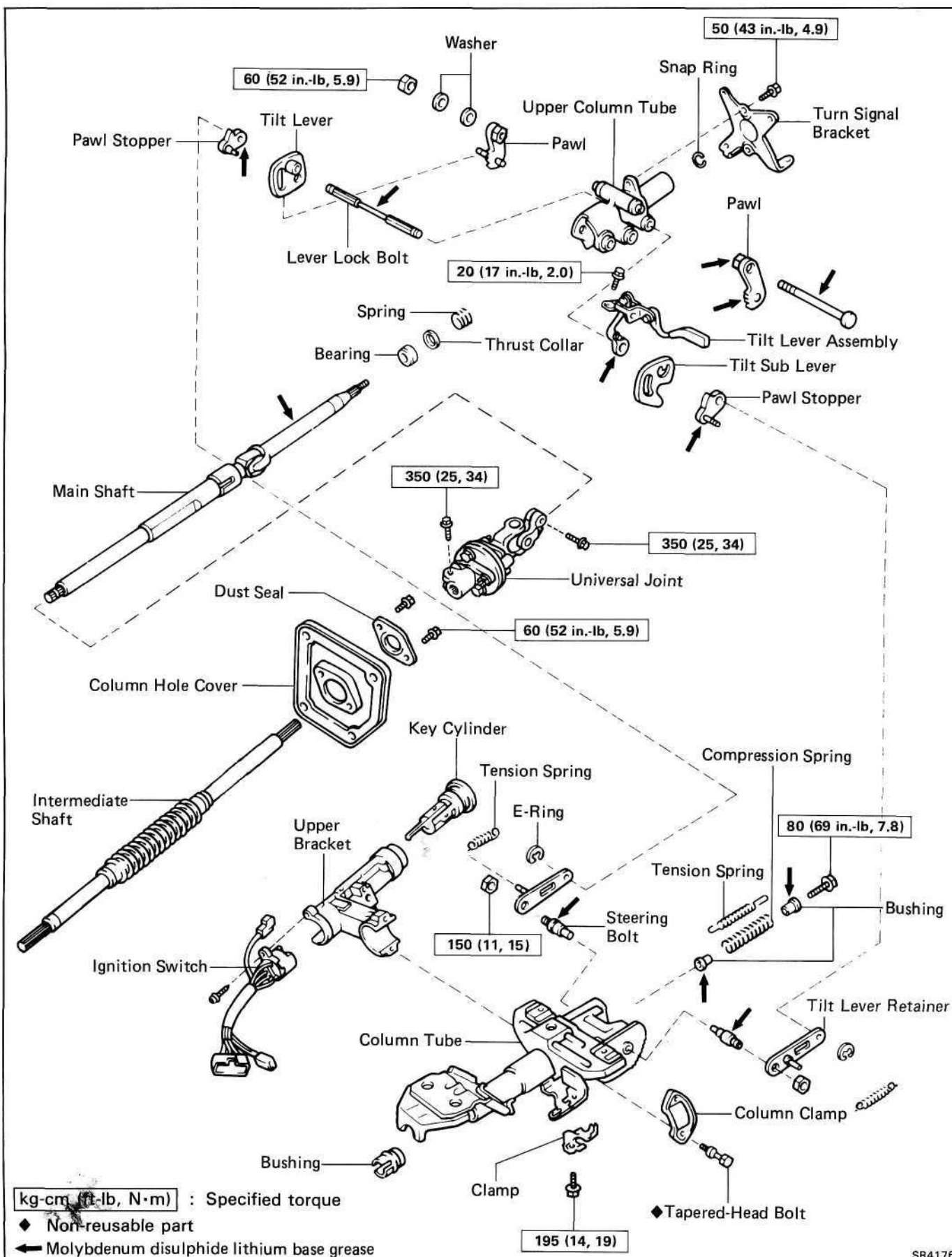
3. INSTALL COLUMN HOLE COVER

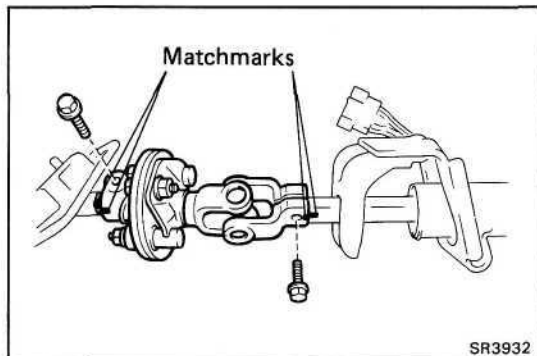
(See page SR-18)

4. CONNECT UNIVERSAL JOINT

(See page SR-18)

Tilt Steering Column COMPONENTS





DISASSEMBLY OF STEERING COLUMN

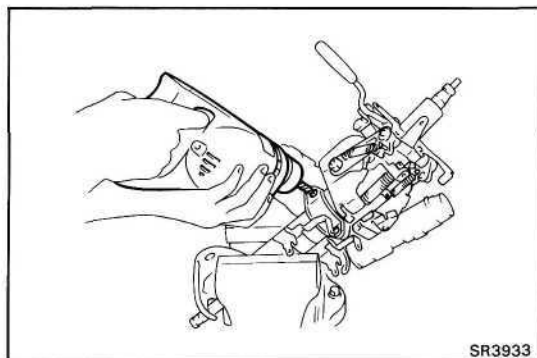
(See page SR-10)

1. DISCONNECT UNIVERSAL JOINT

Place matchmarks on the universal joint and the shaft, then remove the bolt and the universal joint.

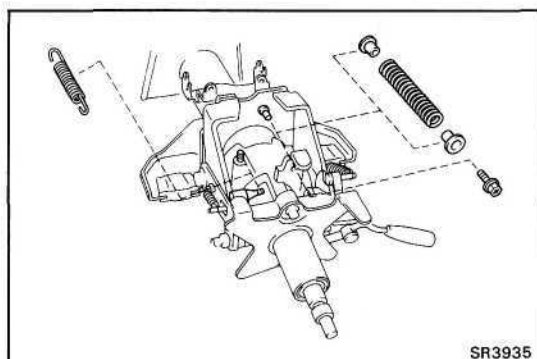
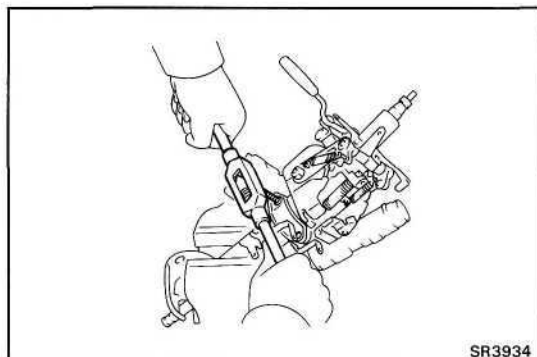
2. REMOVE COLUMN HOLE COVER

- Place matchmarks on the flexible coupling and the shaft, then remove the bolt and the shaft.
- Remove two bolts and the dust seal.
- Remove the column hole cover.



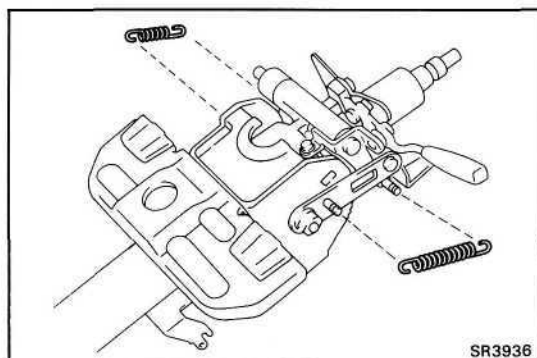
3. REMOVE UPPER BRACKET

- Using a centering punch, mark the center of the tapered-head bolt.
- Using a 3 - 4 mm (0.12 - 0.16 in.) drill, drill into the tapered-head bolt.
- Using a screw extractor, remove the tapered-head bolt.
- Remove the two bolts, and separate the upper bracket and the column tube.

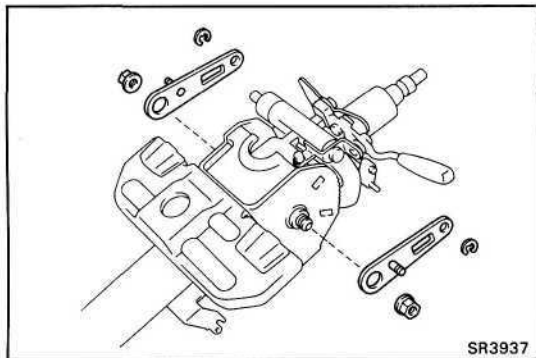


4. REMOVE COMPRESSION SPRING AND TENSION SPRING

- Remove the wire harness clamp.
- Remove the bolt with the compression spring.
- Remove the bushings from the spring.
- Remove the tension spring.

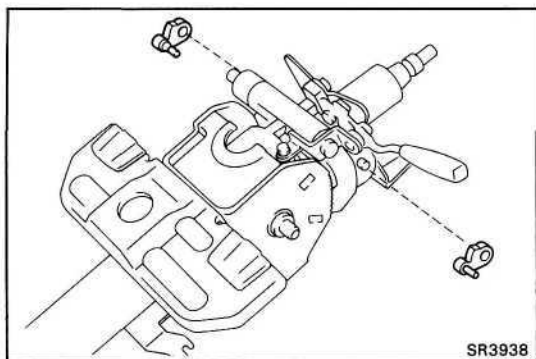


5. REMOVE TWO TENSION SPRINGS

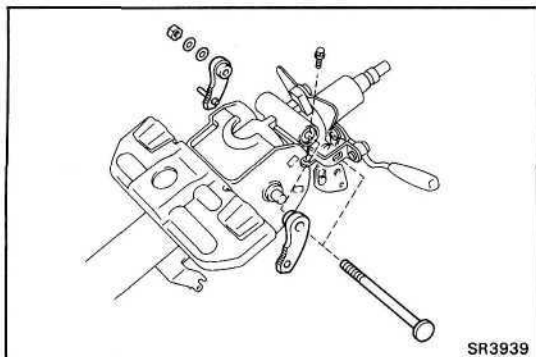


6. REMOVE TWO TILT LEVER RETAINERS

- (a) Remove the E-rings from the retainers.
- (b) Remove the retainers with the nuts.

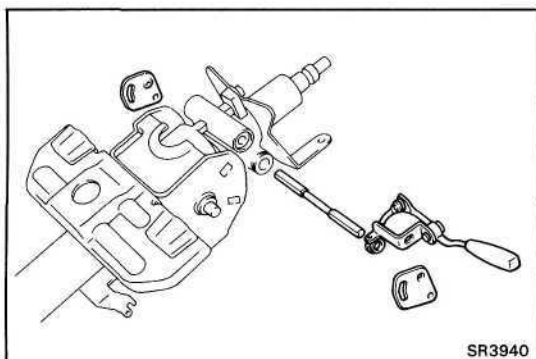


7. REMOVE TWO PAWL STOPPERS



8. REMOVE TWO TILT PAWLS

- (a) Remove the nut and bolt.
- (b) Remove the bolt from the tilt lever assembly.
- (c) Remove the two pawls with the collars.



9. REMOVE TILT LEVER ASSEMBLY. TILT LEVER, TILT SUB LEVER AND LEVER LOCK BOLT

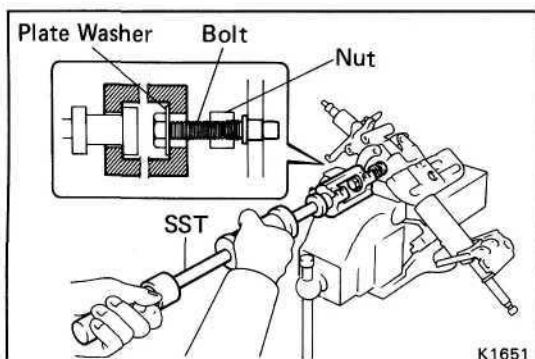
10. REMOVE UPPER COLUMN TUBE

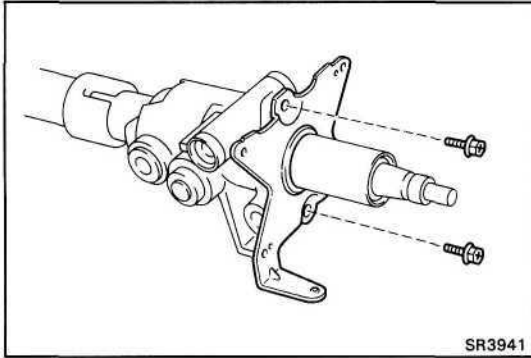
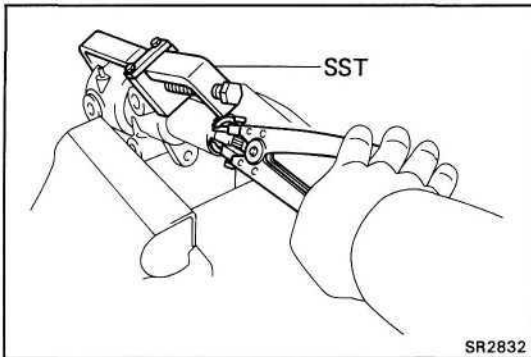
- (a) Set SST, the nut (10 mm nominal diameter, 1.25 mm pitch), plate washer (36 mm outer diameter) and bolt (10 mm nominal diameter, 1.25 mm pitch, 50 mm length) as shown. And then remove the two bolts.

SST 09910-0001 5 (09911-00011, 09912-00010)

(Reference)	Nut	90170-10004
	Plate washer	90201-10201
	Bolt	91111-51050

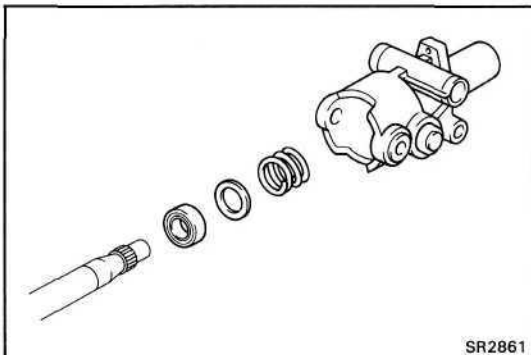
- (b) Remove the upper column tube from the lower column tube.
- (c) Remove the stopper.



**11. REMOVE TURN SIGNAL BRACKET****12. REMOVE MAIN SHAFT**

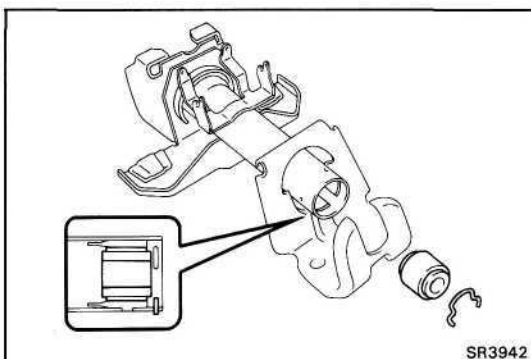
- (a) Using SST to hold the main shaft, remove the snap ring with snap ring pliers.

SST 09950-20017



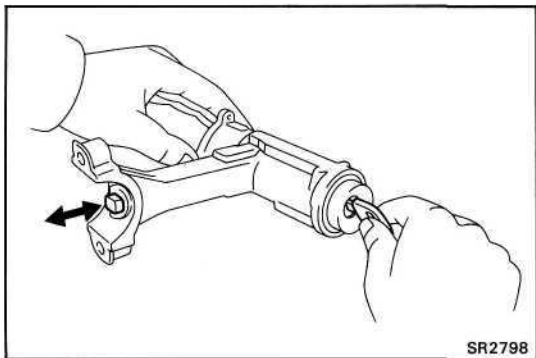
- (b) Remove the main shaft from the column tube.

- (c) Remove the spring, thrust collar and bearing.

**13. REMOVE MAIN SHAFT COLLAR**

- (a) Remove the snap ring from the lower column tube.

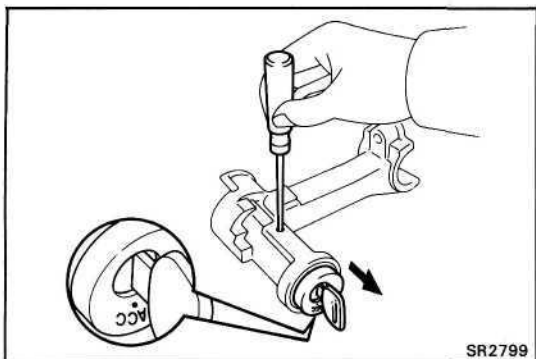
- (b) Remove the main shaft collar.



INSPECTION AND REPLACEMENT OF STEERING COLUMN

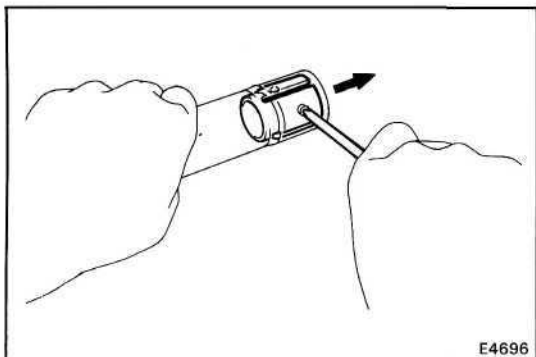
1. INSPECT KEY CYLINDER

Check that the steering lock mechanism operates properly.



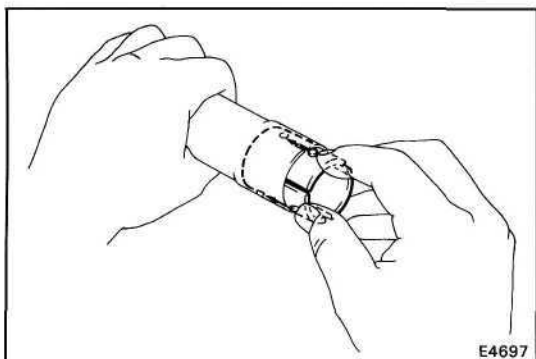
2. IF NECESSARY, REPLACE KEY CYLINDER

- Place the ignition key at the ACC position.
- Push down the stop key with a thin rod, and pull out the key cylinder.
- Make sure that the ignition key at the ACC position.
- Install a new key cylinder.



3. IF NECESSARY, REPLACE MAIN SHAFT BUSHING

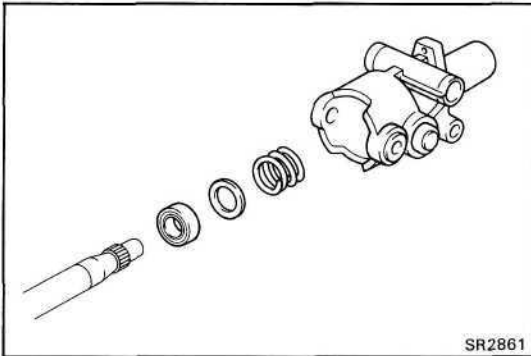
- Using a screwdriver, remove the bushing.
- Align the holes of the tube and the projections of a new bushing, and insert the bushing in the column tube.



ASSEMBLY OF TILT STEERING COLUMN

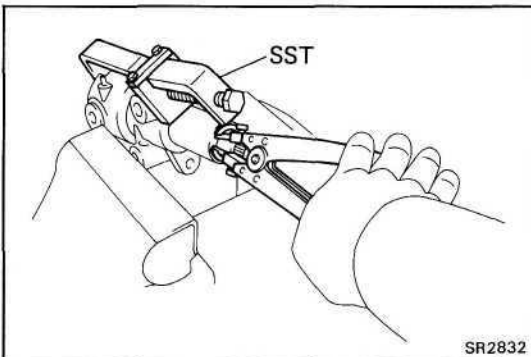
(See page SR-10)

1. **COAT MOLYBDENUM DISULPHID LITHIUM BASE GREASE ON FOLLOWING PARTS** (See page SR-10)



2. **INSTALL MAIN SHAFT**

- (a) Install the main shaft with the bearing, collar and spring.

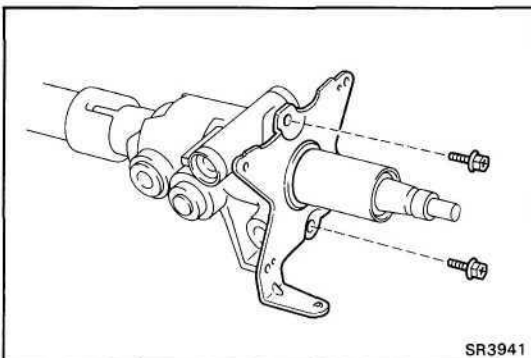


- (b) Using SST to hold the main shaft, install the snap ring with a snap ring pliers.

SST 09950-20017

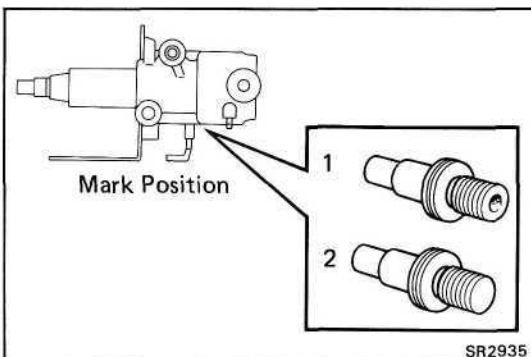
3. **INSTALL TURN SIGNAL BRACKET**

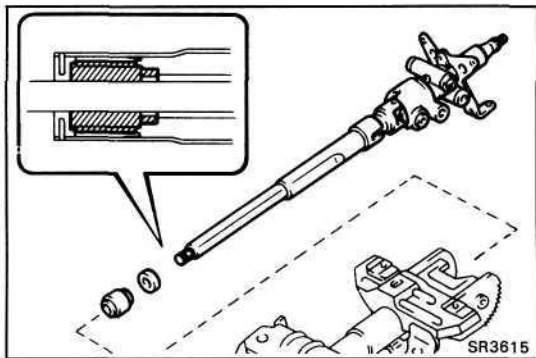
Install the two bolts.

Torque: 50 kg-cm (43 in.-lb, 4.9 Nm)

4. **SELECT STEERING BOLT AND UPPER COLUMN TUBE**

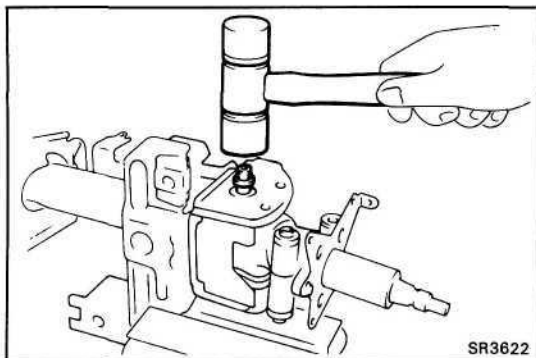
Select the bolt with center hole when the upper column tube mark is 1, and select the bolt without hole when the mark is 2.



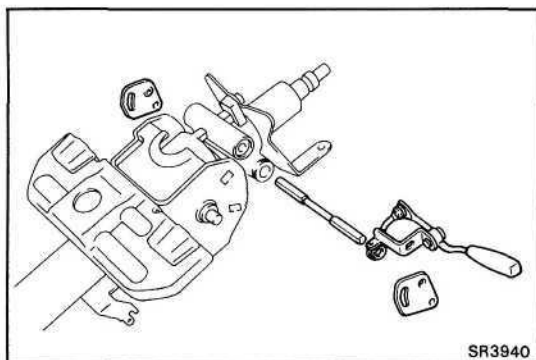


5. INSTALL MAIN SHAFT WITH UPPER COLUMN TUBE

- (a) Install the stopper and main shaft collar to the main shaft as shown.
- (b) Install the main shaft to the lower column tube.

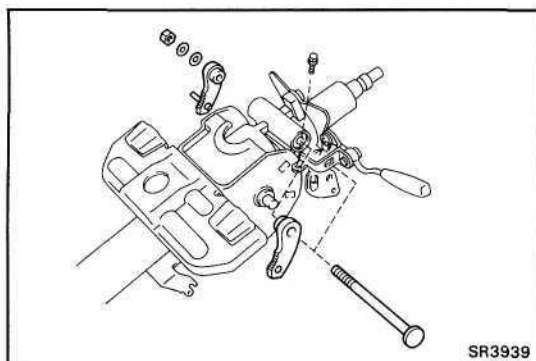


- (c) Using a plastic hammer, drive in the steering bolts.



6. INSTALL TILT LEVER LOCK BOLT, TILT LEVER ASSEMBLY, TILT LEVER AND TILT SUB LEVER

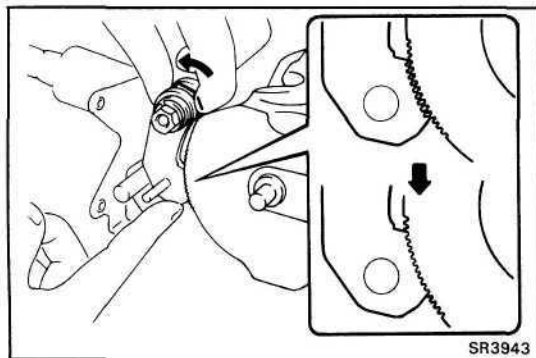
- (a) Install the tilt lever lock bolt to the upper column tube.
- (b) Install the tilt lever assembly.
- (c) Install the tilt lever and the tilt sub lever.



7. INSTALL TWO TILT PAWLS

- (a) Temporarily install the tilt pawls.
- (b) Install the bolt.

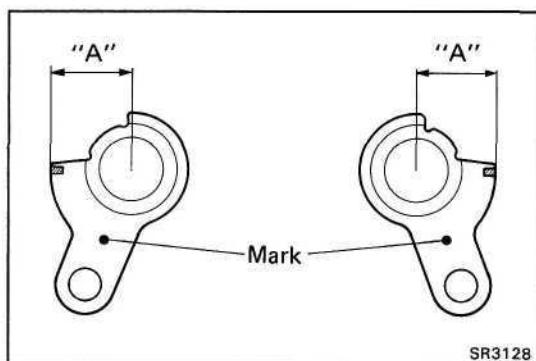
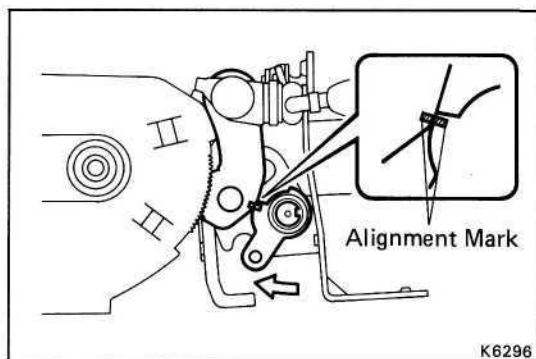
Torque: 20 kg-cm (17 in.-lb, 2.0 Nm)



8. ENGAGE AND ADJUST TILT PAWL

- (a) Engage the tilt sub lever side pawl to the center of the ratchet.
- (b) While turning the tilt lever side collar, engage the tilt lever side pawl to the ratchet completely.
- (c) Tighten the nut.

Torque: 60 kg-cm (52 in.-lb, 5.9 Nm)



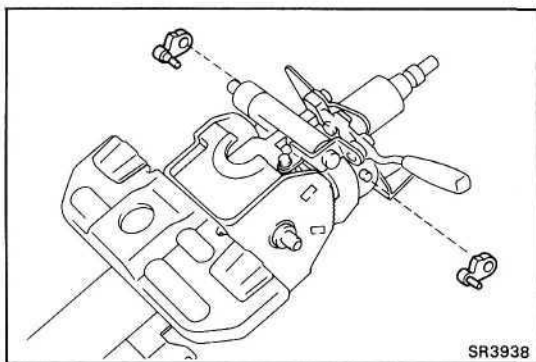
9. SELECT PAWL STOPPERS

- With the tilt pawl and ratchet engaged, install two pawl stoppers.
- Check that the alignment marks on the stopper and pawl align when the stopper is rotated to the pawl side.
- If the alignment marks do not align, select pawl stoppers according to the following table.

Tilt lever side	Tilt sub lever side	Dimension "A" mm (in.)
1	A	12.65 — 12.75 (0.4980 — 0.5020)
2	B	12.55 — 12.65 (0.4941 — 0.4980)
3	C	12.45 — 12.55 (0.4902 — 0.4941)
4	D	12.35 — 12.45 (0.4862 — 0.4902)
5	E	12.25 — 12.35 (0.4823 — 0.4862)

- After selecting the stoppers, check that on both sides the pawl and ratchet are fully engaged.

10. INSTALL TWO TILT PAWL STOPPERS

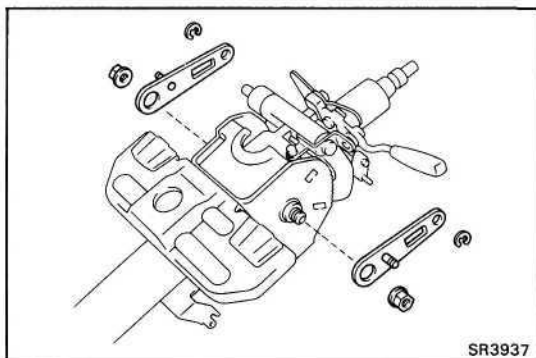


11. INSTALL TWO TILT LEVER RETAINERS

- Install the two tilt lever retainers and torque the nuts.

Torque: 150 kg-cm (11 ft-lb, 15 N-m)

- Install the E-rings.

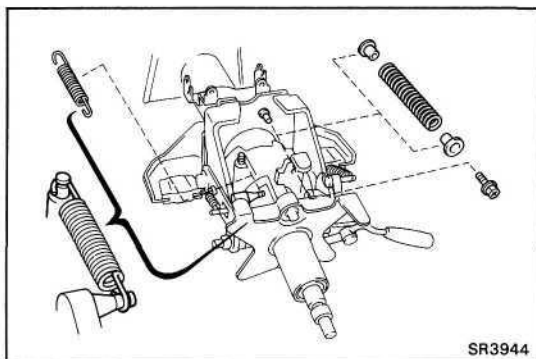


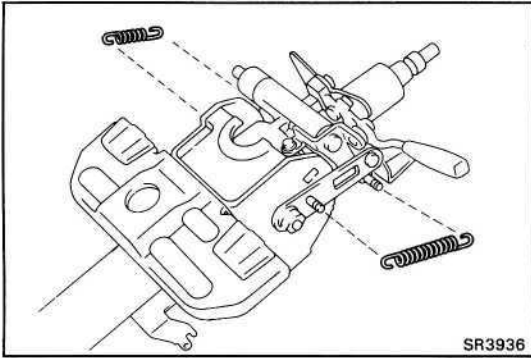
12. INSTALL COMPRESSION SPRING AND TENSION SPRING

- Install the bushings to the compression spring.
- Install the spring and bolt.

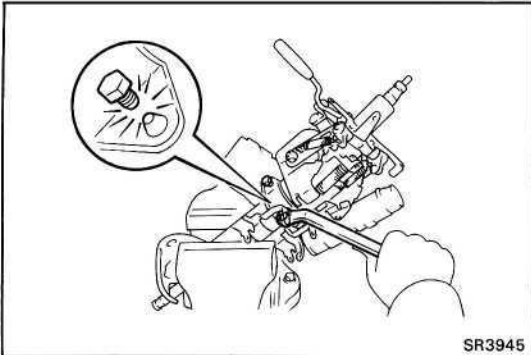
Torque: 80 kg-cm (69 in.-lb, 7.8 N-m)

- Install the tension spring.
- Install the wire harness clamp.



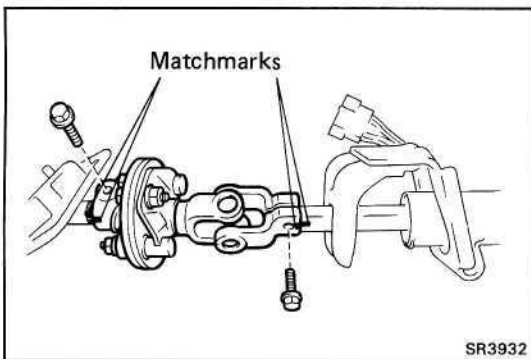


13. INSTALL TWO TENSION SPRINGS



14. INSTALL UPPER BRACKET

- (a) Install the upper bracket with two new tapered-head bolts.
- (b) Tighten the tapered-head bolts until the bolt heads break off.



15. INSTALL COLUMN HOLE COVER

- (a) Install the column hole cover.
 - (b) Install two bolts and the dust seal.
- Torque: 60 kg-cm (52 in.-lb, 5.9 Nm)
- (c) Align the matchmarks on the shaft and flexible coupling, then torque the bolt.

Torque: 350 kg-cm (25 ft-lb, 34 Nm)

16. CONNECT UNIVERSAL JOINT

Align the matchmarks on the universal joint and the shaft, then torque the bolt.

Torque: 350 kg-cm (25 ft-lb, 34 Nm)

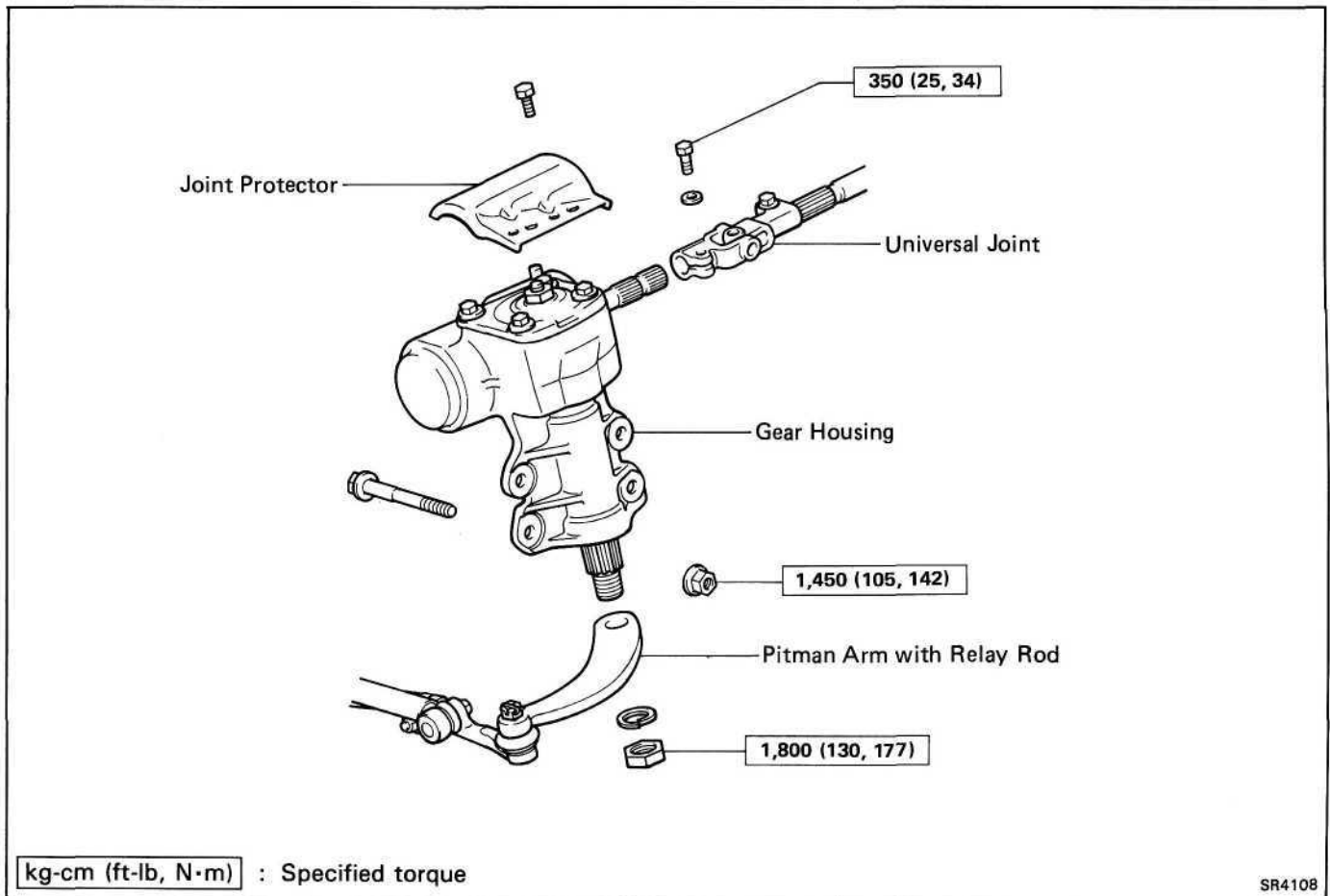
17. CHECK OPERATION OF TILT STEERING LEVER AND SUPPORT

- (a) Check that there is no axial play at the end of the main shaft.
- (b) With the main shaft in the neutral position, raise the tilt lever and check that the main shaft rises to the uppermost position.
- (c) Lower the main shaft, and check that it locks in the lowermost position.

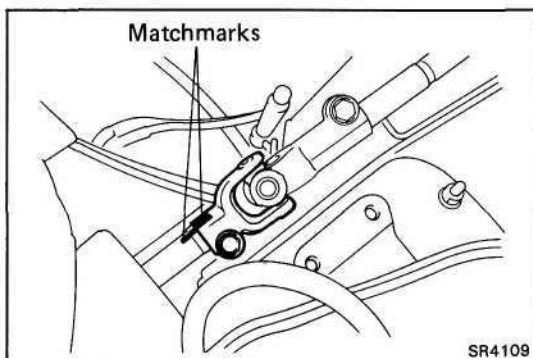
MANUAL GEAR HOUSING

REMOVAL AND INSTALLATION OF MANUAL GEAR HOUSING

Remove and install the parts as shown.



SR4108



SR4109

(MAIN POINT OF REMOVAL AND INSTALLATION)

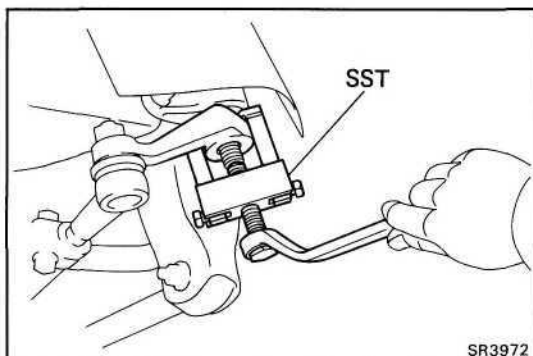
1. DISCONNECT UNIVERSAL JOINT

- Loosen the column side set bolt.
- Remove the gear side set bolt.
- Place matchmarks on the universal joint and worm shaft.
- Slide the shaft rearward to disconnect the shaft from the worm shaft.

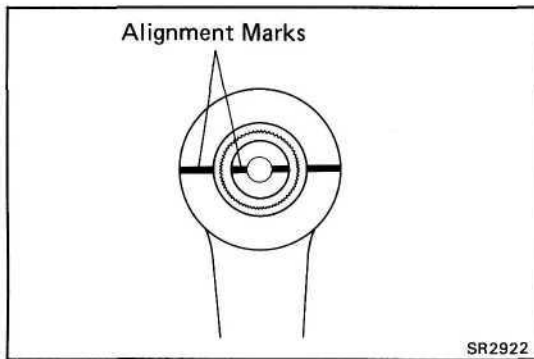
2. DISCONNECT PITMAN ARM FROM GEAR HOUSING

- Loosen the pitman arm nut.
- Using SST, disconnect pitman arm from the gear housing.

SST 09628-62011



SR3972

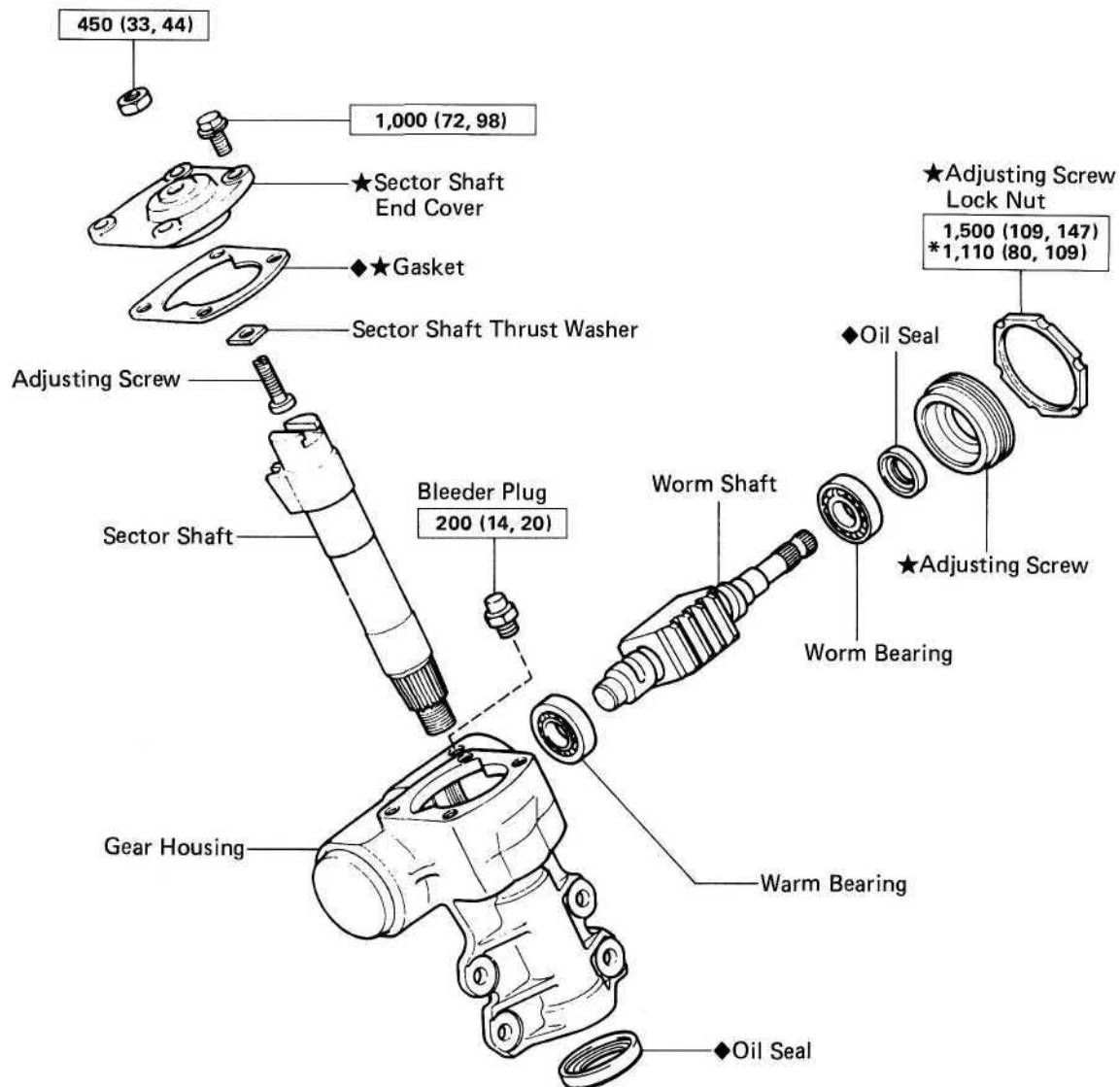


3. CONNECT PITMAN ARM TO GEAR HOUSING

- Align the alignment marks on the sector shaft and pitman arm and install the spring washer and arm.
- Tighten the pitman arm nut.

Torque: 1,800 kg-cm (130 ft-lb, 177 Nm)

COMPONENTS

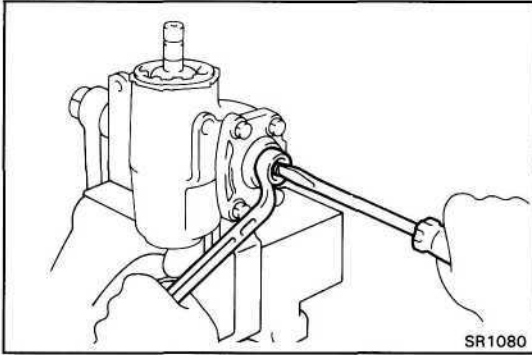


kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

★ Precoated part

* For use with SST



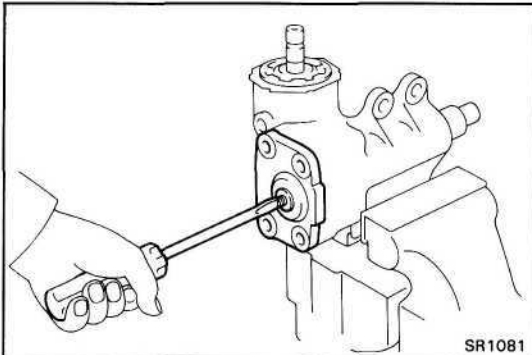
DISASSEMBLY OF MANUAL GEAR HOUSING

(See page SR-20)

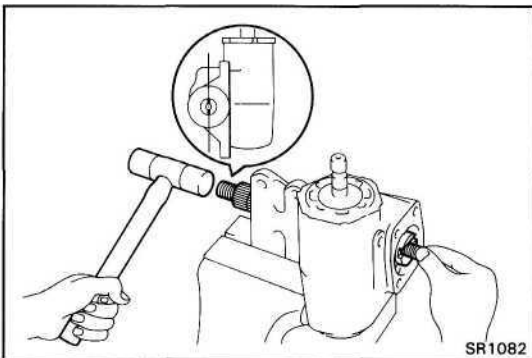
1. REMOVE BLEEDER PLUG AND DRAIN GEAR OIL

2. REMOVE END COVER AND SECTOR SHAFT

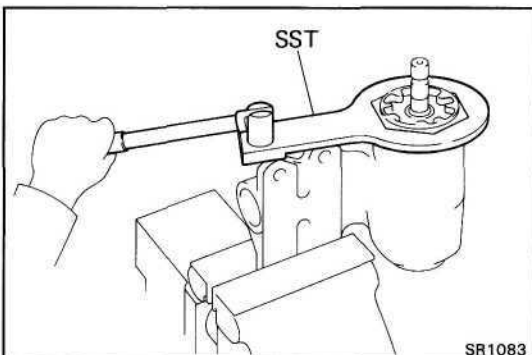
(a) Remove the adjusting screw lock nut and four bolts.



(b) Remove the end cover by turning the adjusting screw clockwise with a screwdriver.



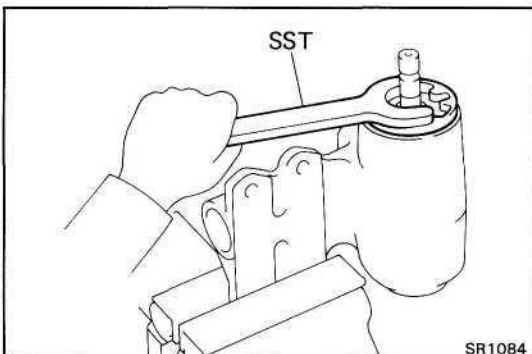
(c) Using a plastic hammer, tap out the sector shaft and adjusting screw from the gear housing.



3. REMOVE LOCK NUT

Using SST, remove the lock nut.

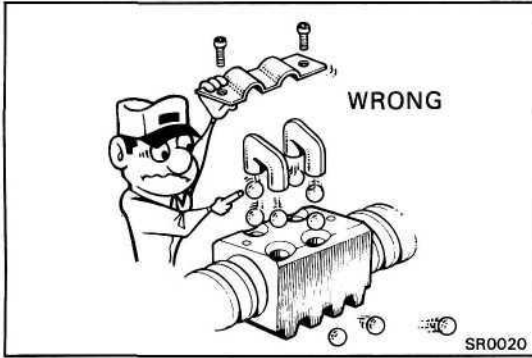
SST 09617-60010



4. REMOVE BEARING ADJUSTING SCREW

Using SST, remove the adjusting screw.

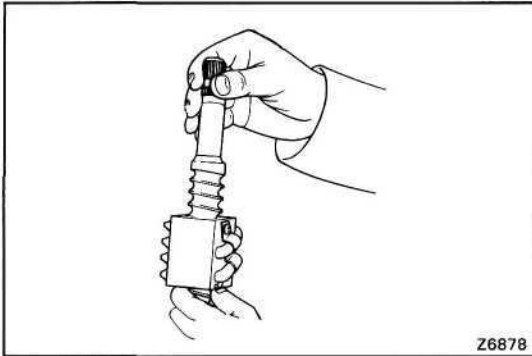
SST 09616-30020



5. REMOVE WORM SHAFT

Pull the worm shaft out of the gear housing.

NOTICE: Do not disassemble the ball nut from the steering worm shaft.

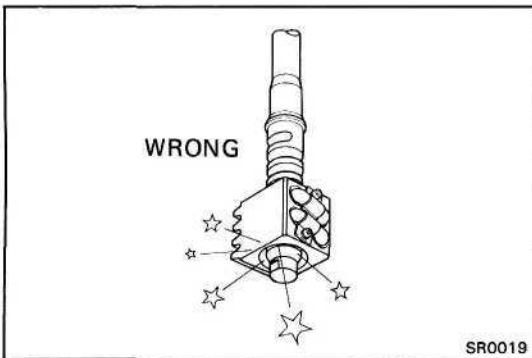


INSPECTION AND REPLACEMENT OF MANUAL GEAR HOUSING

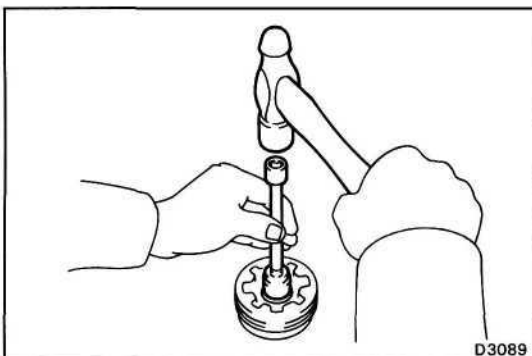
1. INSPECT WORM AND BALL NUT

- Check the worm and ball nut for wear or damage.
- Check that the nut rotates smoothly down the shaft by its own weight.

If a problem is found, repair or replace the worm.



NOTICE: Do not allow the ball nut to hit the end of the worm shaft.



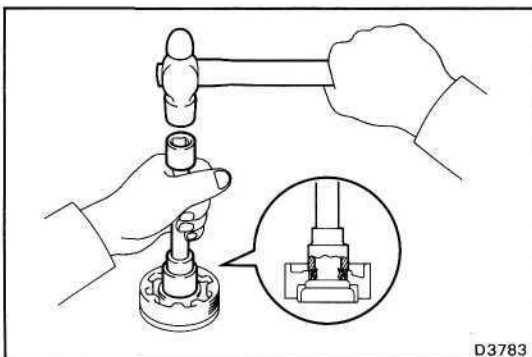
2. INSPECT WORM BEARINGS AND OIL SEAL

Check for wear or damage.

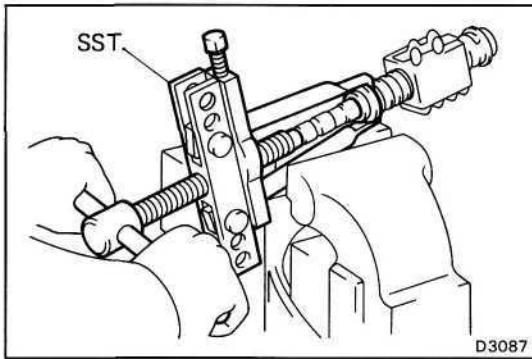
If a problem is found, replace the bearings, bearing races and oil seal.

3. IF NECESSARY, REPLACE OIL SEAL

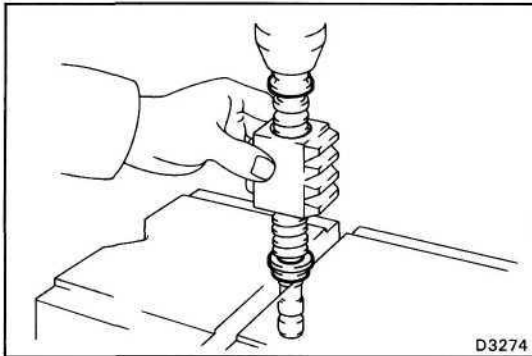
- Using a 19 mm socket wrench, drive out the oil seal.



- Using a 23 mm socket wrench, drive in the oil seal.

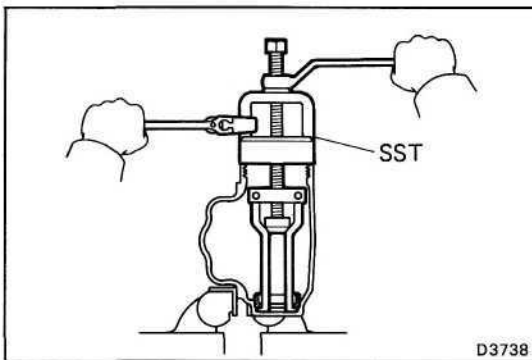
**4. IF NECESSARY, REPLACE WORM BEARINGS**

- (a) Using SST, remove the both side bearings.
SST 09950-2001 7



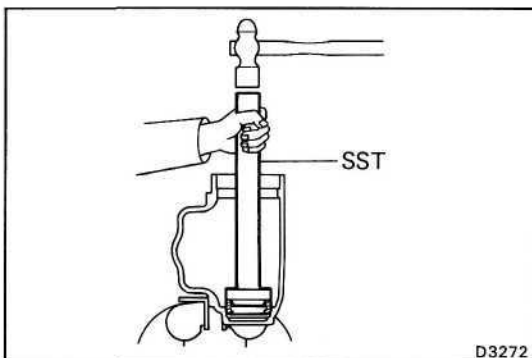
- (b) Using a press, install the both side bearings.

NOTICE: Be careful not to damage the ball nut while holding it by hand.



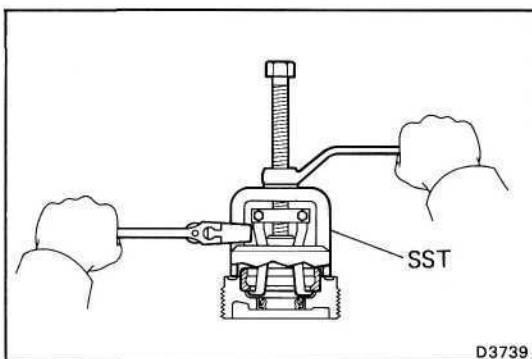
- (c) Using SST, remove the outer race from the gear housing.

SST 09612-65014 (09612-01030)



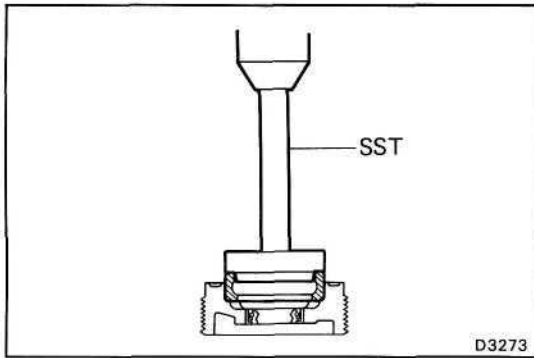
- (d) Using SST, drive in the outer race into the gear housing.

SST 09550-10012 (09552-10010, 09559-10010)



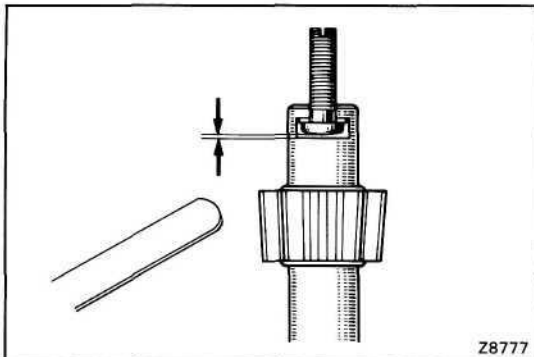
- (e) Using SST, remove the outer race from the adjusting screw.

SST 09612-65014 (09612-01040)



- (f) Using SST, press in the outer race into the adjusting screw.

SST 09550-10012 (09552-10010, 09559-10010)



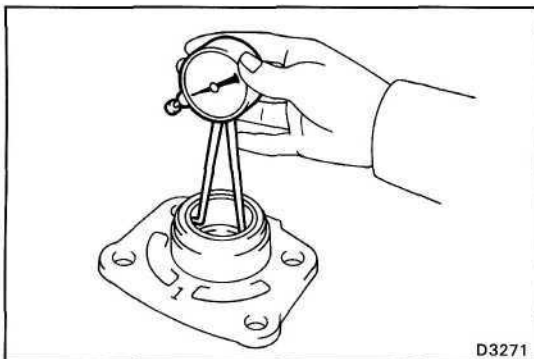
5. INSPECT SECTOR SHAFT

Measure shaft thrust clearance with a feeler gauge.

Maximum clearance: 0.05 mm (0.0020 in.) or less

If necessary, install a new thrust washer which will provide the minimum clearance between the sector shaft and the adjusting screw.

Thrust washer thickness		mm (in.)
1.95 (0.0768)	2.00 (0.0787)	2.05 (0.0807)



6. INSPECT SECTOR SHAFT END COVER

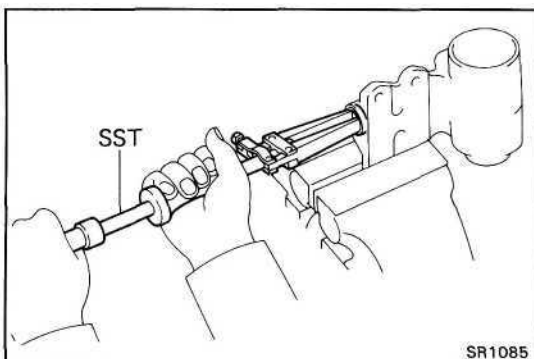
- (a) Check for damage.

- (b) Check the bushing for wear or damage.

If necessary, replace the end cover.

HINT: When replacing the end cover, replace with one bearing the same number.

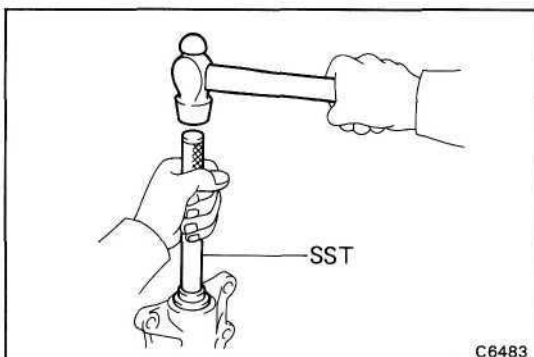
No.	Bushing inside diameter	mm (in.)
1	36.055 — 36.065 (1.4195 — 1.4199)	
2	36.045 — 36.055 (1.4191 — 1.4195)	
3	36.035 — 36.045 (1.4187 — 1.4191)	
4	36.025 — 36.035 (1.4183 — 1.4187)	



7. IF NECESSARY, REPLACE OIL SEAL

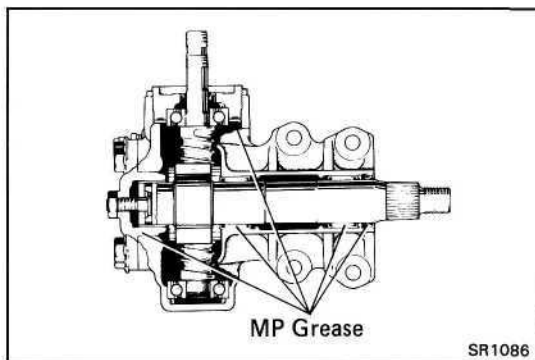
- (a) Using SST, remove the oil seal.

SST 09308-00010



- (b) Using SST, drive in the new oil seal.

SST 09550-10012 (09558-10010, 09552-10010)

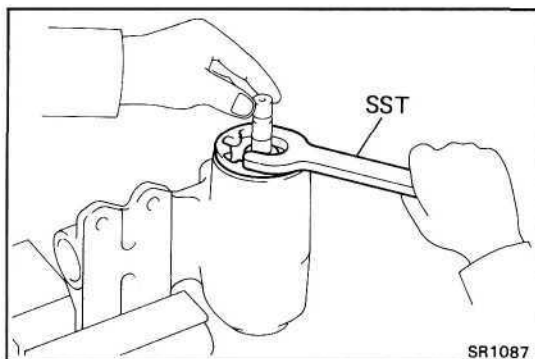


ASSEMBLY OF STEERING GEAR HOUSING

(See page SR-20)

1. **APPLY MP GREASE TO BUSHING, NEEDLE ROLLER BEARINGS AND OIL SEALS**
2. **INSERT WORM SHAFT INTO GEAR HOUSING**

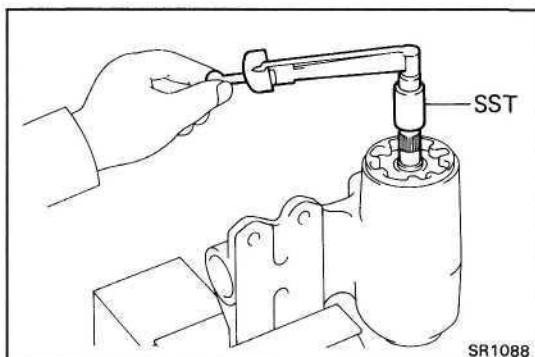
Place the worm bearings on the shaft and insert the shaft into the housing.



3. **INSTALL AND ADJUST BEARING ADJUSTING SCREW**

(a) Using SST, gradually tighten the adjusting screw until it is snug.

SST 09616-30020

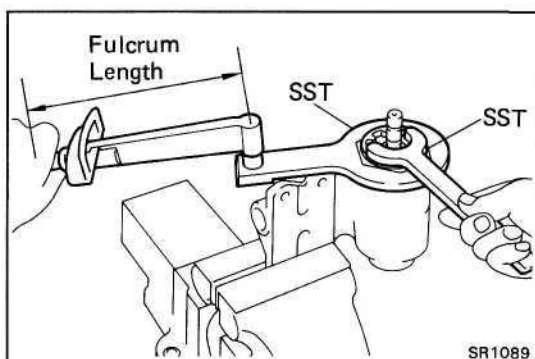


(b) Using a torque meter and SST, measure the bearing preload in both directions. Turn the adjusting screw until the preload is correct.

Preload (starting):

3.5 - 5 kg-cm (3.0 - 4.3 in.-lb, 0.34 - 0.49 Nm)

SST 09616-00010



(c) Apply sealant to the lock nut.

Sealant: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

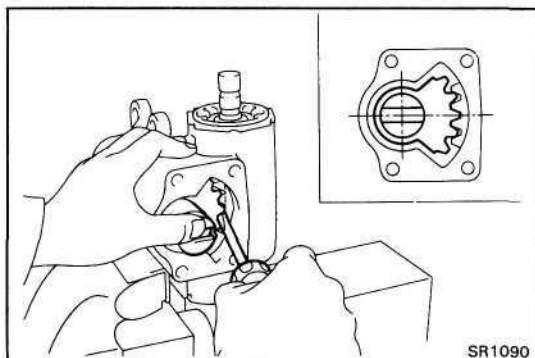
(d) Hold the adjusting screw in position with SST and tighten the lock nut with SST.

Torque: 1,110 kg-cm (80 ft-lb, 109 Nm)

SST 09616-30020, 09617-60010

HINT:

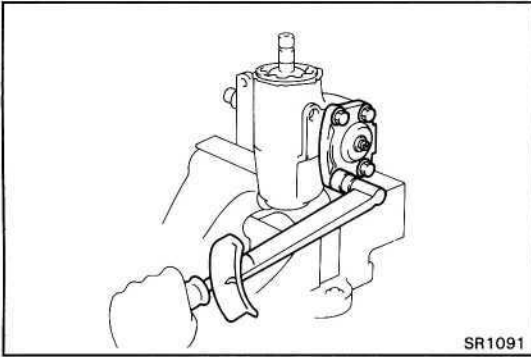
- Check that the bearing preload is still correct.
- Use a torque wrench with a fulcrum length of 425 mm (16.73 in.)



4. **INSTALL SECTOR SHAFT**

(a) Install the adjusting screw and thrust washer onto the sector shaft.

(b) Set the ball nut at the center of the worm shaft. Insert the sector shaft into the gear housing so that the center teeth mesh together.



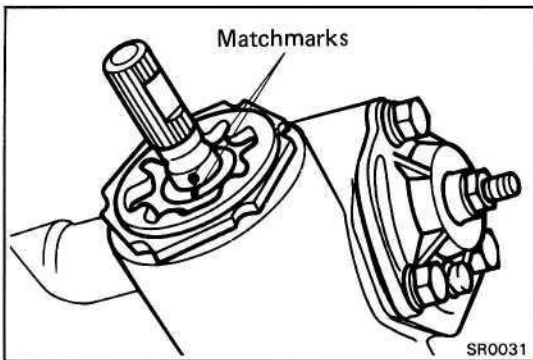
5. INSTALL END COVER

- (a) Apply sealant to the gasket.

Sealant: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

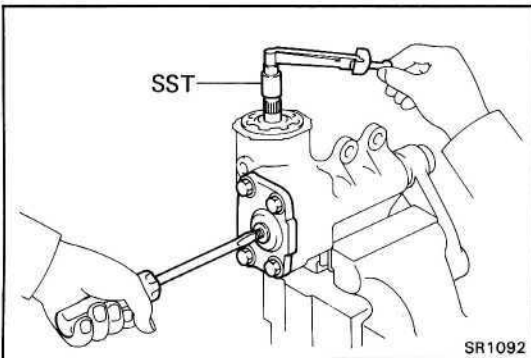
- (b) Install the end cover over the gasket.
 (c) Using a screwdriver, loosen the adjusting screw as far as possible.
 (d) Torque the four cover bolts.

Torque: 1,000 kg-cm (72 ft-lb, 98 Nm)



6. PLACE WORM SHAFT IN NEUTRAL POSITION

- (a) Count the total shaft rotations and turn the shaft back half of that number.
 (b) The worm shaft is now in neutral position.
 (c) Place matchmarks on the worm shaft and housing to show neutral position.



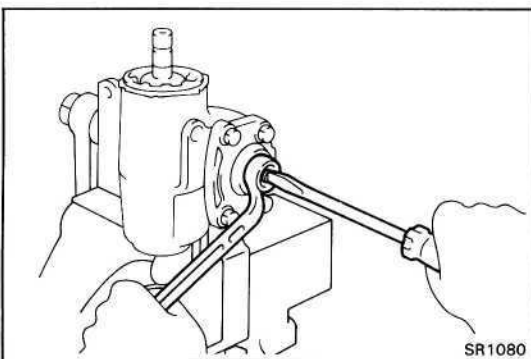
7. ADJUST TOTAL PRELOAD

Using a torque meter and SST, turn the adjusting screw while measuring the preload until it is correct.

HINT: Be sure that the worm shaft is in neutral position.

Preload (starting): 8 — 11 kg-cm
 (6.9 - 9.5 in.-lb, 0.78 - 1.08 Nm)

SST 09616-00010



8. TIGHTEN ADJUSTING SCREW LOCK NUT

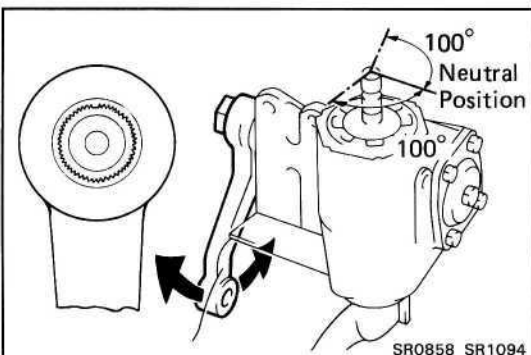
- (a) Apply sealant to the lock nut.

Sealant: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

- (b) Hold the screw with a screwdriver while tightening the lock nut.
 (c) Torque the lock nut.

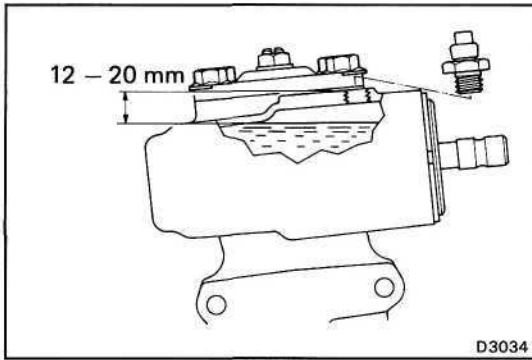
Torque: 450 kg-cm (33 ft-lb, 44 Nm)

HINT: Check that the preload is still correct.



9. MEASURE SECTOR SHAFT BACKLASH

- (a) Align the alignment marks on the pitman arm and sector shaft, and install the nut by hand.
 (b) Install a dial indicator. Check that the sector shaft has no backlash within 100 degrees of the left and right sides from neutral position.

**10. REPLENISH WITH GEAR OIL**

Oil type: API GL-4, SAE 90

Capacity (Minimum): 640 cc (39.1 cu in.)

Oil level: (at installation)

12 - 20 mm (0.47 - 0.79 in.) from top

11. INSTALL BLEEDER PLUG

Torque: 200 kg-cm (15 ft-lb, 20 Nm)

POWER STEERING

Description

Two types of power steering are the standard type and the PPS (progressive power steering) type. Both these types have a recirculating ball system and rotary type hydraulic control valve.

PPS TYPE

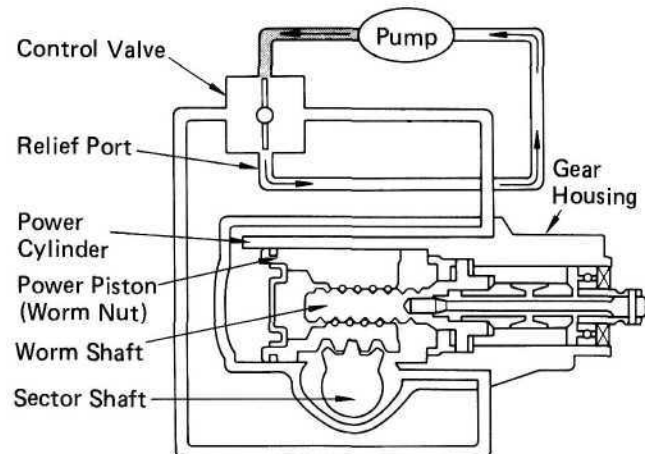
Vehicle speed is detected by a speed sensor and fluid pressure acting on the piston is varied accordingly. When the vehicle is stopped or when moving at low speed, fluid pressure is increased to lighten the force required for steering. At high speed, pressure is reduced to lessen the amount of assist and provide appropriate steering wheel response.

PRINCIPLES OF POWER STEERING

Power steering is one type of a hydraulic device for utilizing engine power as a steering effort. Consequently, the engine is used to drive a pump to develop fluid pressure, and this pressure acts on a piston within the gear box so that the worm shaft assists the ball nut effort. The amount of this assistance depends on the extent of pressure acting on the piston. Therefore, if more steering force is required, the pressure must be raised. The variation in the fluid pressure is accomplished by a control valve which is linked to the steering main shaft.

• NEUTRAL (STRAIGHT-AHEAD) POSITION

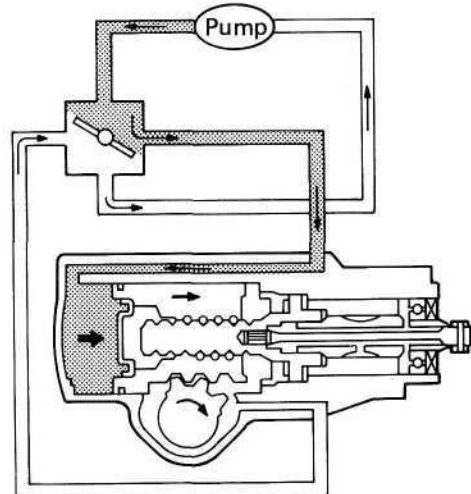
Fluid from the pump is sent to the control valve. If the control valve is in the neutral position, all the fluid will flow pass through the control valve into the relief port and back to the pump. At this time, hardly any pressure is created and because the pressure on the cylinder piston is equal on both sides, the piston will not move in either direction.



SR2452

• WHEN TURNING

When the steering main shaft is turned in either direction, the control valve also moves, closing one of the fluid passages. The other passage then opens wider, causing a change in fluid flow volume and, at the same time, pressure is created. Consequently, a pressure difference occurs between both sides of the piston and the piston moves in the direction of the lower pressure so that the fluid in that cylinder is forced back to the pump through the control valve.



SR2453

SERVICE HINT

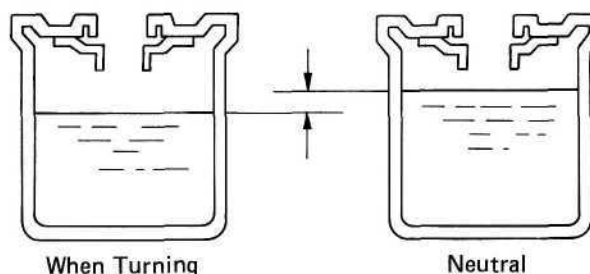
Troubles with the power steering system are usually concerned with hard steering due to the fact that there is no assist. In such case, before attempting to make repairs, it is necessary to determine whether the trouble lies with the pump or with the gear housing. To do this, an on-vehicle inspection can be made by using a pressure gauge.

ON-VEHICLE INSPECTION

Power steering is a hydraulic device and any problems are normally due to insufficient fluid pressure acting on the piston. This could be caused by either the pump not producing the specified fluid pressure or the control valve in the gear housing not functioning properly so that the proper amount of fluid pressure can not be obtained.

If the fault lies with the pump, the same symptoms will generally occur whether the steering wheel is turned fully to the right or left. On the other hand, if the fault lies with the control valve, there will generally be a difference between the amount of assist when the steering wheel is turned to the left and right, causing harder steering. However, if the piston seal of the power cylinder is worn, there will be a loss of fluid pressure whether the steering wheel is turned to the right or left and symptoms will be the same for both.

Before performing an on-vehicle inspection, a check must first be made to confirm that the power steering system is completely free of any air. If there is any air in the system, the volume of this air will change when the fluid pressure is raised, causing a fluctuation in the fluid pressure so that the power steering will not function properly. To determine if there is any air in the system, check to see if there is a change of fluid level in the reservoir tank when the steering wheel is turned fully to the right or left.



SR2392

SR2393

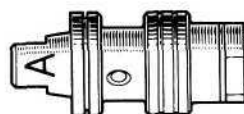
Also, air in the system will sometimes result in an abnormal noise occurring from the pump or gear housing when the steering wheel is fully turned in either direction. This on-vehicle inspection must always be performed to insure that the power steering system is working properly after overhauling or repairing the pump or gear housing.

VANE PUMP

The main component parts of the vane pump, such as the cam ring, rotor, vanes and flow control valve are highly precision parts and must be handled carefully. Also, because this pump produces a very high fluid pressure, O-rings are used for sealing each part. When reassembling the pump, always use new O-rings.

In the flow control valve, there is a relief valve which controls the maximum pressure of the pump. The amount of this maximum pressure is very important; if it is too low, there will be insufficient power steering assist and if too high, it will have an adverse effect on the pressure hoses, oil seals, etc. If the maximum pressure is either too high or too low due to a faulty relief valve, do not disassemble or adjust the relief valve, but replace the flow control valve as an assembly.

Flow Control Valve

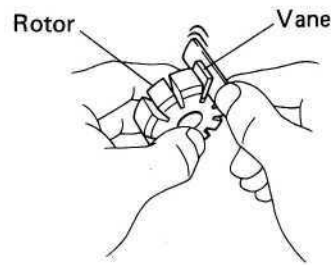


Pump Body

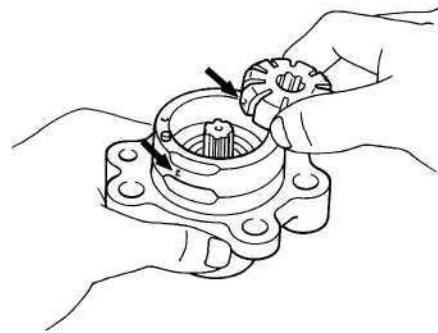


The clearance between the flow control valve and pump body installation hole is very important. When replacing the flow control valve, be sure to do so with one having the same mark in order to insure the proper clearance.

The function parts of the pump which produce fluid pressure are the cam ring, rotor and vanes, and these should be checked to wear. If the clearance between each is not within standard when reassembling, any worn parts should be replaced. In this case, the replaces cam ring and rotor should be of the same length (have the same mark), and the vanes should be replaced with those having a length corresponding to that mark, otherwise the proper thrust clearance cannot be obtained. If there is too much thrust clearance, there will be insufficient fluid pressure at low speeds. If there is too little thrust clearance, it may result seizure of the vanes.



SR2397

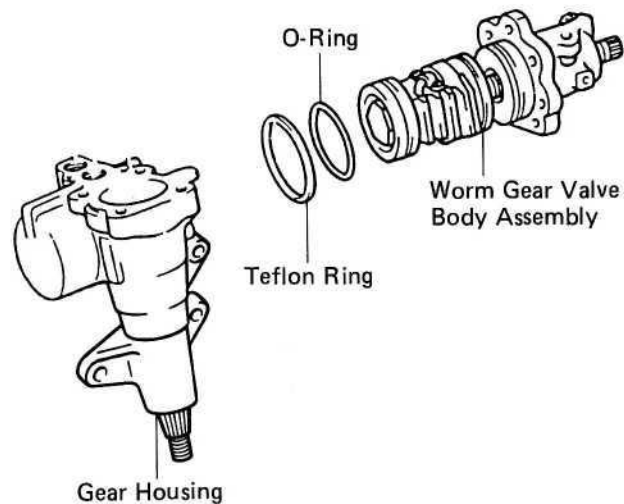


SR2398

GEAR HOUSING

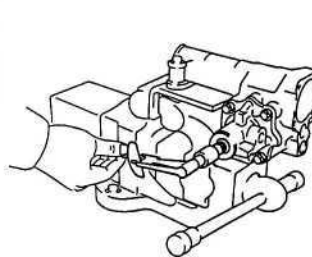
Because of the high pressure, even the slightest scratch will cause fluid leakage, resulting in an in-operative power steering system.

Teflon rings are used for the cross shaft, piston and control valve. These teflon rings are highly durable against wear, but if it is necessary to replace them, be careful not to stretch the new ones. After installing a teflon ring into its groove, snug it down into the groove before assembly of the cylinder or housing to prevent possible damage.

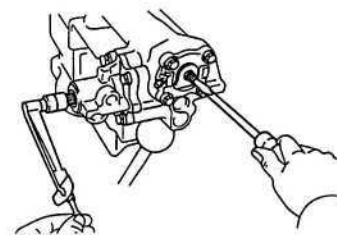


SR3616

As with the recirculating ball type steering, preload is very important. If the preload is not correct, it could result in such trouble as steering wheel play or lack of durability so always make sure that it is correct.



Check the worm gear preload



Adjust total preload

SR2455

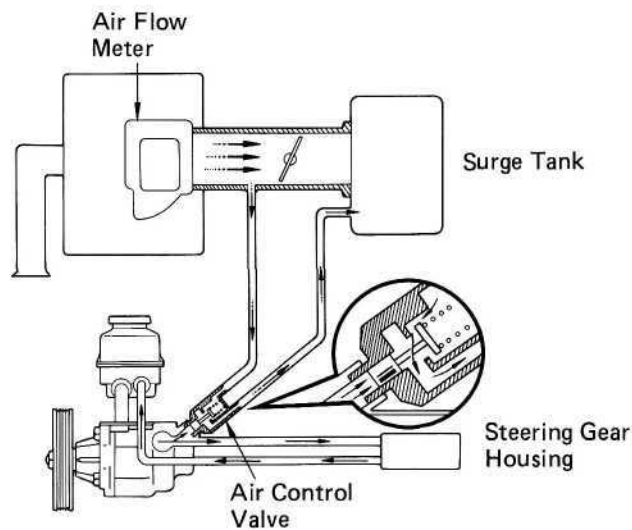
SR2456

IDLE-UP DEVICE

The pump produces the maximum fluid pressure when the steering wheel is turned fully to the right or left and, at this time, there is a maximum load on the pump which causes a decrease in engine idle rpm. To solve this problem, some vehicles are equipped with an idle-up device which acts to raise the engine idle rpm whenever there is a heavy load on the pump.

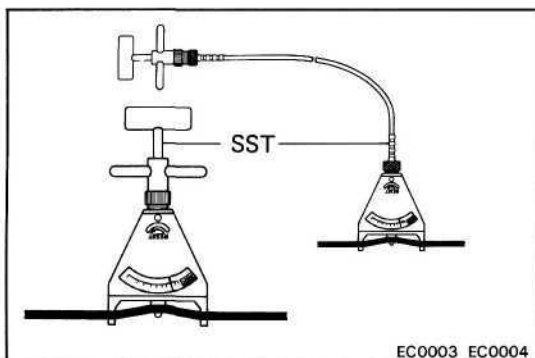
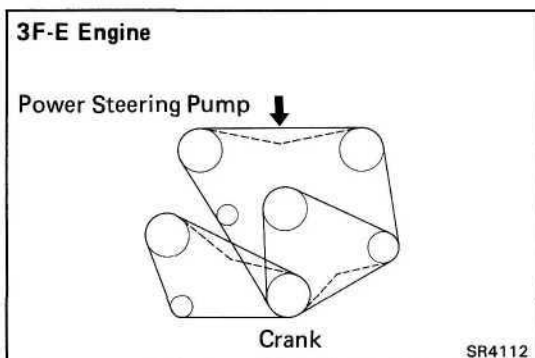
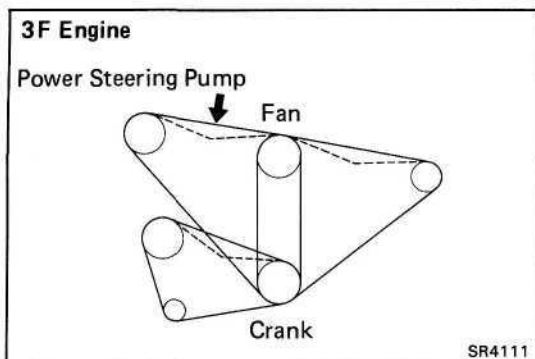
EFI ENGINES

On EFI engines, when the piston of the air control valve is pushed by fluid pressure, the air valve opens and the volume of air by-passing the throttle valve is increased to regulate engine rpm.



SR3154

The idle-up device functions to raise engine idle rpm when pump fluid pressure acts on the air control valve, installed to the pump body, to control the flow of air.



On-Vehicle Inspection

CHECK DRIVE BELT TENSION

Measure the drive belt tension.

Drive belt tension:

New belt: 7 - 9.5 mm (0.28 - 0.37 in.)

Used belt: 8 - 10 mm (0.32 - 0.39 in.)

HINT:

- "New belt" refers to a belt which has been less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.

(Reference)

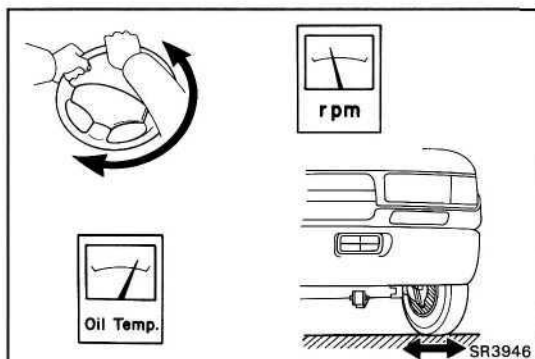
- Using SST, check the drive belt tension.

SST 09216-00020 and 09216-00030

Drive belt tension:

New belt: 45 - 55 kg

Used belt: 20 - 35 kg



FLUID LEVEL CHECK

1. KEEP VEHICLE LEVEL

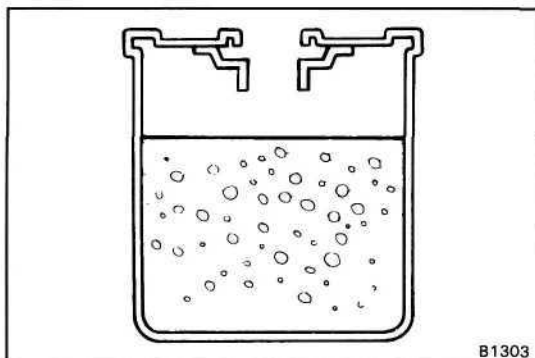
2. BOOST FLUID TEMPERATURE

With the engine idling at 1,000 rpm or less, turn the steering wheel from lock to lock several times to boost fluid temperature.

Fluid temperature: 80°C (176°F)

3. CHECK FOR FOAMING OR EMULSIFICATION

HINT: Foaming and emulsification indicate either the existence of air in the system or that the fluid level is too low.

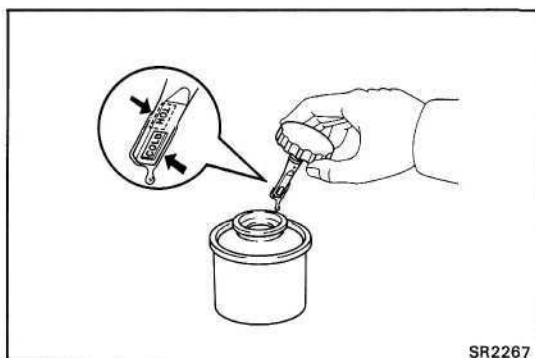


4. CHECK FLUID LEVEL IN RESERVOIR

Check the fluid level and add fluid if necessary.

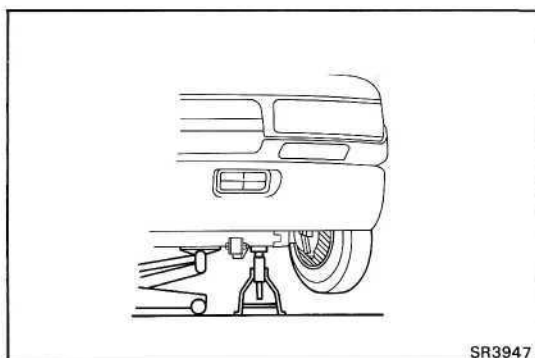
Fluid: ATFDEXRON®II

HINT: Check that the fluid level is within the HOT LEVEL of the dipstick. If the fluid is cold, check that it is within the COLD LEVEL of the dipstick.

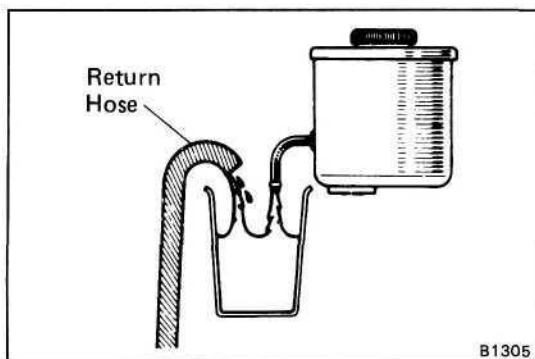


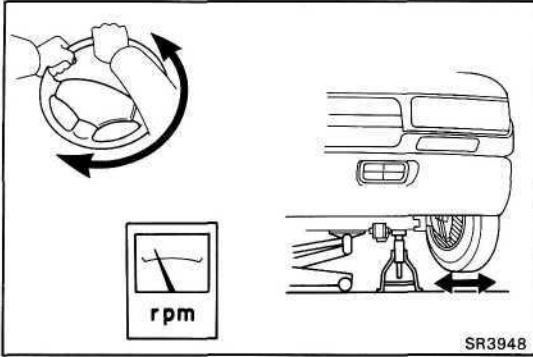
REPLACEMENT OF POWER STEERING FLUID

1. JACK UP FRONT OF VEHICLE AND SUPPORT IT WITH STANDS

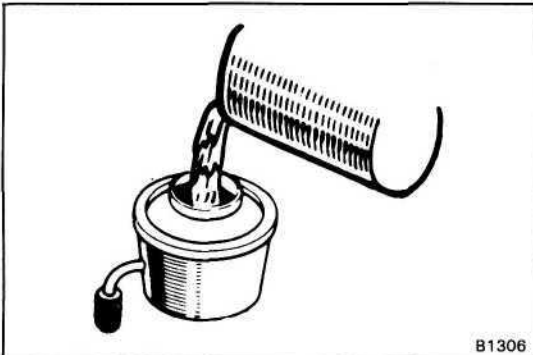


2. REMOVE FLUID RETURN HOSE FROM RESERVOIR TANK AND DRAIN FLUID INTO CONTAINER

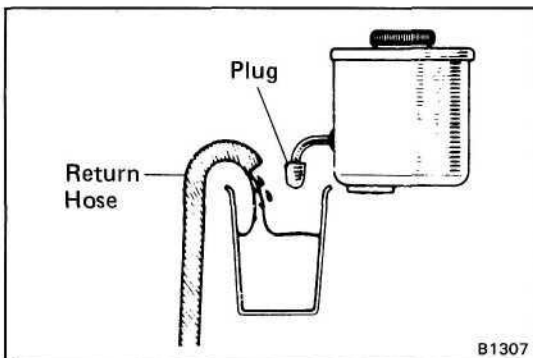




3. **TURN STEERING WHEEL FROM LOCK TO LOCK WHILE DRAINING FLUID**



4. **FILL RESERVOIR TANK WITH FRESH FLUID**
Fluid : ATF DEXRON® U



5. **START ENGINE AND RUN IT AT 1,000 RPM**
After 1 or 2 seconds, fluid will begin to discharge from the return hose. Stop the engine immediately at this time.
NOTICE: Take care that some fluid remains left in the reservoir tank.

6. **REPEAT STEPS 4 AND 5 FOUR OR FIVE TIMES UNTIL THERE IS NO MORE AIR IN FLUID**

7. **CONNECT RETURN HOSE TO RESERVOIR TANK**

8. **BLEED POWER STEERING SYSTEM**

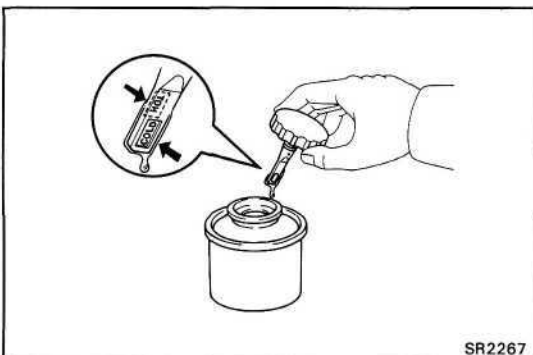
BLEEDING OF POWER STEERING SYSTEM

1. **CHECK FLUID LEVEL IN RESERVOIR TANK**

Check the fluid level and add fluid if necessary.

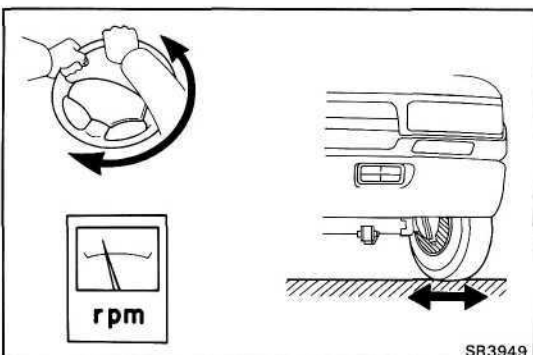
Fluid: ATF DEXRON® H

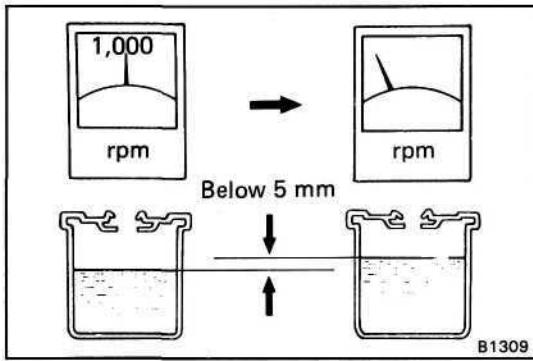
HINT: Check that the fluid level is within the HOT LEVEL of the dipstick. If the fluid is cold, check that it is within the COLD LEVEL of the dipstick.



2. **START ENGINE AND TURN STEERING WHEEL FROM LOCK TO LOCK THREE OR FOUR TIMES**

With the engine speed below 1,000 rpm, turn the steering wheel to left or right full lock and keep it there for 2 — 3 seconds, then turn the wheel to the reverse full lock and keep it there for 2 — 3 seconds.





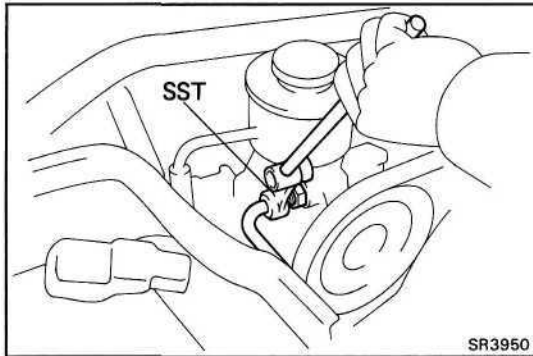
3. **CHECK THAT FLUID IN RESERVOIR IS NOT FOAMY OR CLOUDY AND DOES NOT RISE OVER MAXIMUM WHEN ENGINE IS STOPPED**

Measure the fluid level with the engine running. Stop the engine and measure the fluid level.

Maximum rise: 5 mm (0.20 in.)

If a problem is found, repeat steps 4 and 5 on page SR-34.

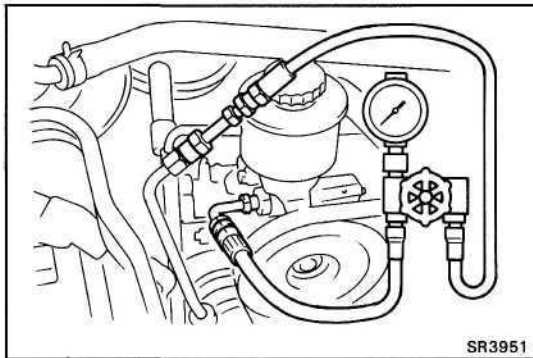
Repair the PS if the problem persists.



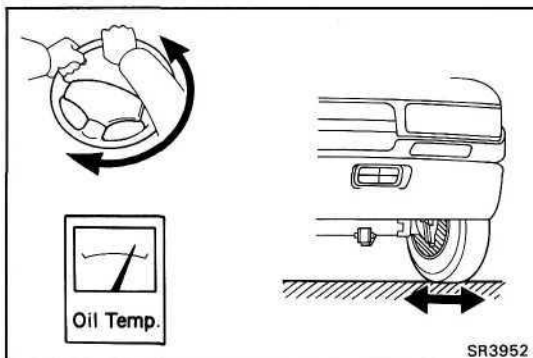
OIL PRESSURE CHECK

1. **CONNECT PRESSURE GAUGE**

(a) Using SST, disconnect the pressure line joint.
SST 09631-22020



- (b) Connect the gauge side of the pressure gauge to the PS pump side and the valve side to the pressure line side.
- (c) Bleed the system. Start the engine and turn the steering wheel from lock to lock two or three times.
- (d) Check that the fluid level is correct.



2. **CHECK THAT FLUID TEMPERATURE IS AT LEAST 80°C (176°F)**

3. **START ENGINE AND RUN IT AT IDLE**

4. **CHECK FLUID PRESSURE READING WITH VALVE CLOSED**

Close the pressure gauge valve and observe the reading on the gauge.

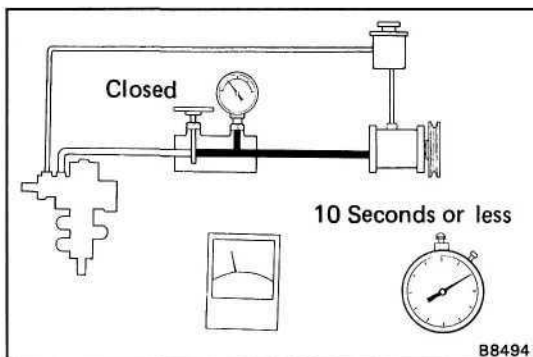
Minimum pressure:

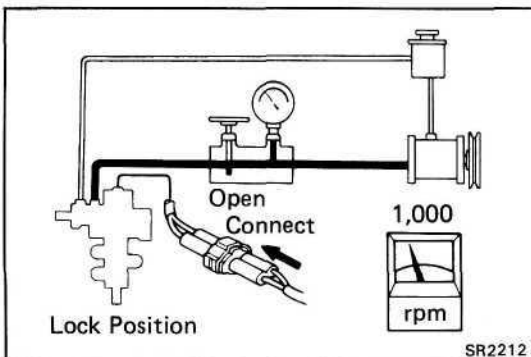
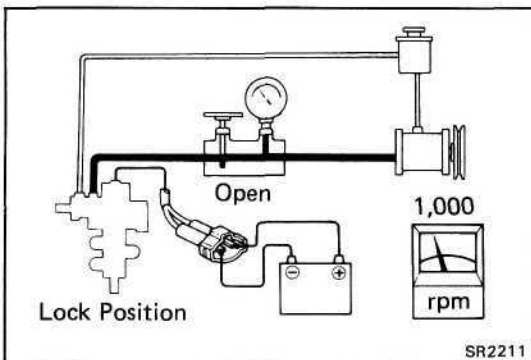
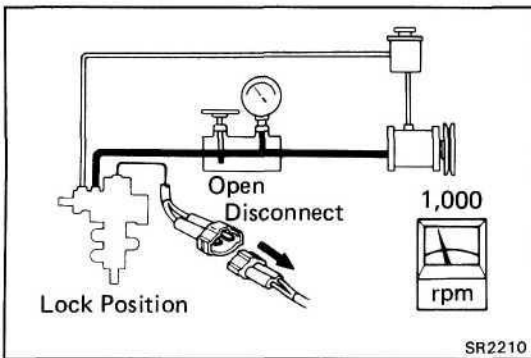
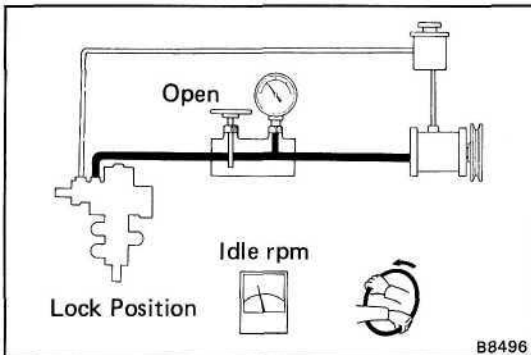
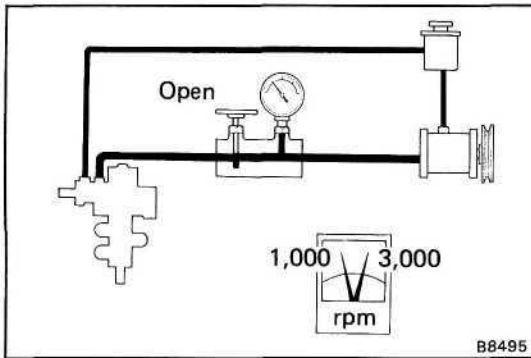
FJ series	80 kg/cm ² (1,138 psi, 7,845 kPa)
HZJ and HDJ series	85 kg/cm ² (1,209 psi, 8,336 kPa)

NOTICE:

- Do not keep the valve closed for more than 10 seconds.
- Do not let the fluid temperature become too high.

If pressure is low, repair or replace the PS pump.





5. OPEN VALVE FULLY

6. CHECK AND RECORD PRESSURE READING AT 1,000 RPM

7. CHECK AND RECORD PRESSURE READING AT 3,000 RPM

Check that there is 5 kg/cm² (71 psi, 490 kPa) or less difference in pressure between the 1,000 rpm and 3,000 rpm checks.

If the difference is excessive, repair or replace the flow control valve of the PS pump.

8. CHECK PRESSURE READING WITH STEERING WHEEL TURNED TO FULL LOCK

[Standard type power steering]

Be sure the pressure gauge valve is fully opened and the engine idling.

Minimum pressure:

FJ series 80 kg/cm²
(1,138 psi, 7,845 kPa)

HZJ and HDJ series 85 kg/cm²
(1,209 psi, 8,336 kPa)

If pressure is low, the gear housing has an internal leak and must be repaired or replaced.

[Progressive power steering]

- Turn the steering wheel to full lock position.
- Disconnect the solenoid connector.
- Be sure the pressure gauge valve is fully opened and the engine is running at 1,000 rpm.

Minimum pressure:

FJ series 80 kg/cm²
(1,138 psi, 7,845 kPa)

HDJ series 85 kg/cm²
(1,209 psi, 8,336 kPa)

If pressure is low, the gear housing has an internal leak or the solenoid is faulty.

- Apply battery voltage to the solenoid.

NOTICE:

- Do not apply voltage more than 30 seconds to avoid burning out the solenoid.
- If repeating this step, wait until the solenoid cools down enough that it can be touched by hand.

- Check the oil pressure.

(Reference)

Maximum pressure: Approx. 40 kg/cm²
(569 psi, 3,923 kPa)

If pressure is high, check the solenoid.

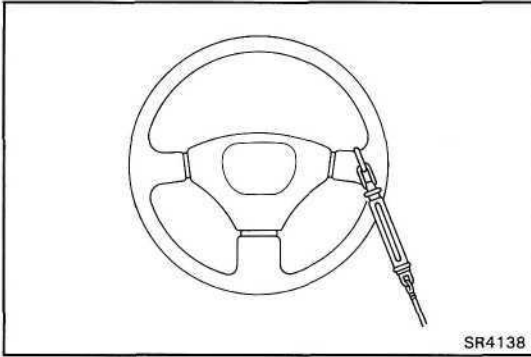
- Connect the solenoid connector and check the oil pressure.

Minimum pressure:

FJ series 80 kg/cm²
(1,138 psi, 7,845 kPa)

HDJ series 85 kg/cm²
(1,209 psi, 8,336 kPa)

If pressure is low, the progressive power steering system is faulty.



9. MEASURE STEERING EFFORT

[Standard type power steering]

- (a) Center the steering wheel and run the engine at idle.
- (b) Using a spring scale, measure the steering effort in both directions.

Maximum steering effort: 4 kg (8.8 lb, 39 N)

If steering effort is excessive, repair the power steering unit.

HINT: Be sure to consider tire type, pressure and contact surface before making your diagnosis.

[Progressive power steering]

- (a) Center the steering wheel and run the engine at idle.
- (b) Using a spring scale, measure the steering effort in both directions.

Maximum steering effort: 3 kg (6.6 lb, 29 N)

If steering effort is excessive, repair the power steering unit.

- (c) Apply battery voltage to the solenoid.

NOTICE:

- Do not apply voltage more than 30 seconds to avoid burning out the solenoid.
 - If repeating this step, wait until the solenoid cools down enough that it can be touched by hand.
- (d) Check that the steering effort is heavier than it was before battery voltage was applied to the solenoid.

(Reference)

Maximum steering effort: 12 kg (26 lb, 118 N)

- (e) If steering effort is not heavier, check the solenoid.

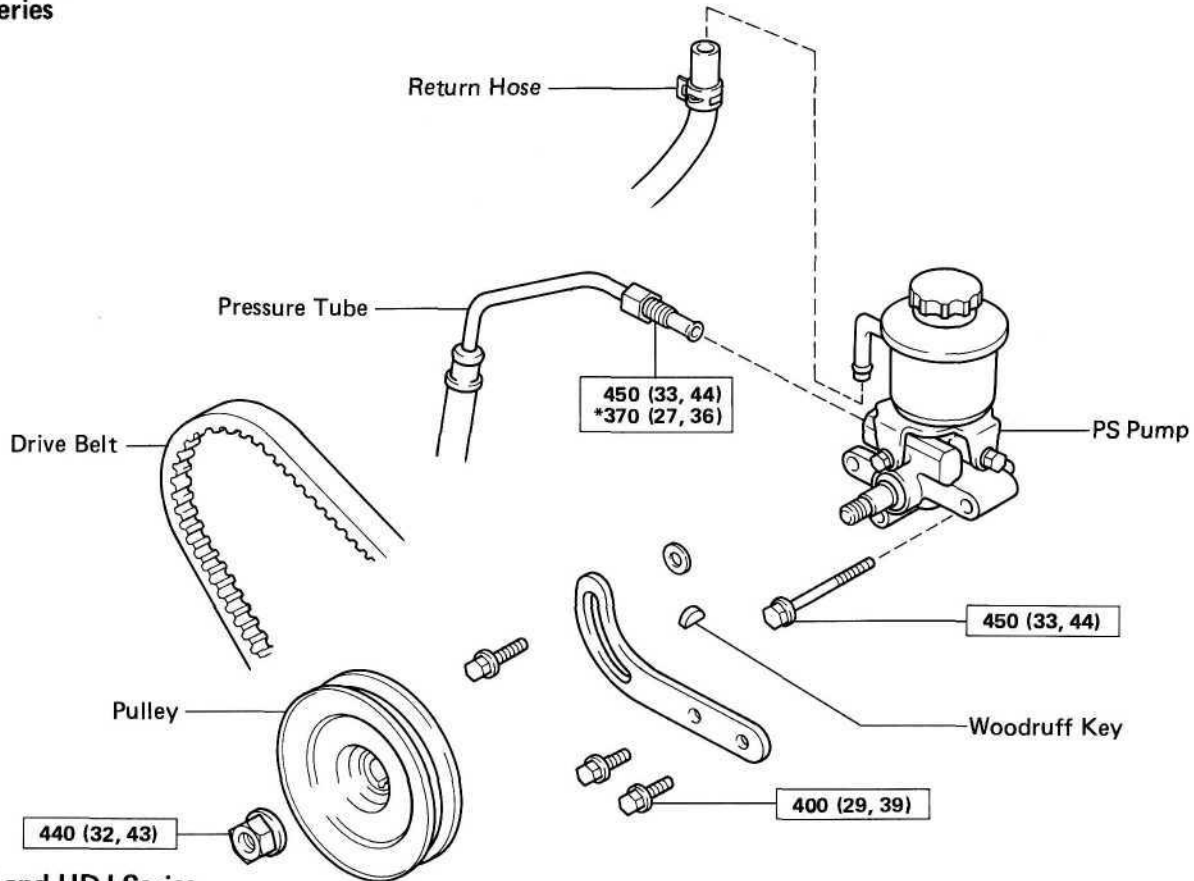
HINT: Be sure to consider tire type, pressure and contact surface before making your diagnosis.

Power Steering Pump

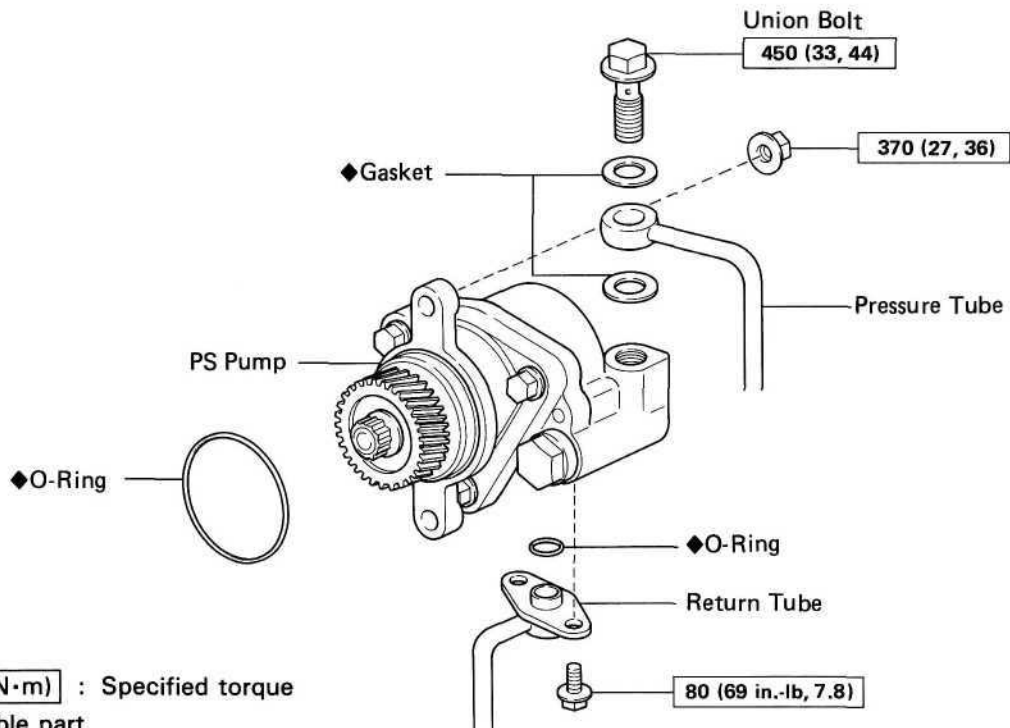
REMOVAL AND INSTALLATION OF POWER STEERING PUMP

Remove and install the parts as shown.

FJ Series



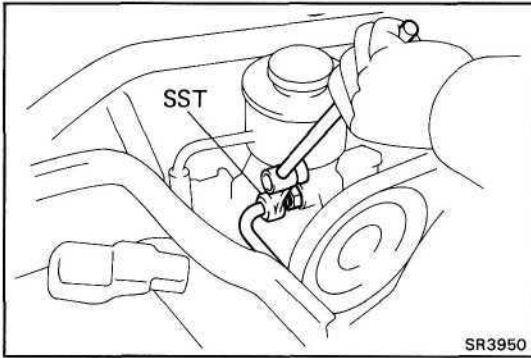
HZJ and HDJ Series



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

* For use of SST



(MAIN POINT OF REMOVAL AND INSTALLATION)

1. (FJ Series)

DISCONNECT AND CONNECT PRESSURE TUBE

Using SST, disconnect and connect the pressure tube from/to the PS pump.

SST 09631-22020

Torque: 370 kg-cm (27 ft-lb, 36 Nm)

HINT: Use a torque wrench with a fulcrum length of 300 mm (11.81 in.).

2. (FJ Series)

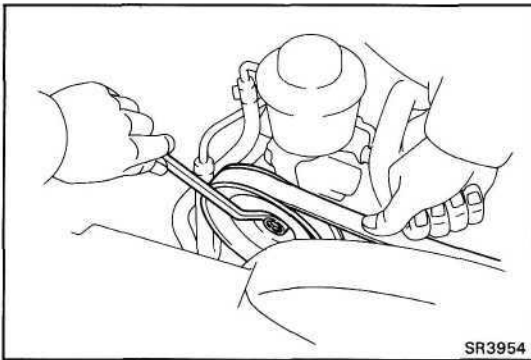
LOOSEN PULLEY NUT

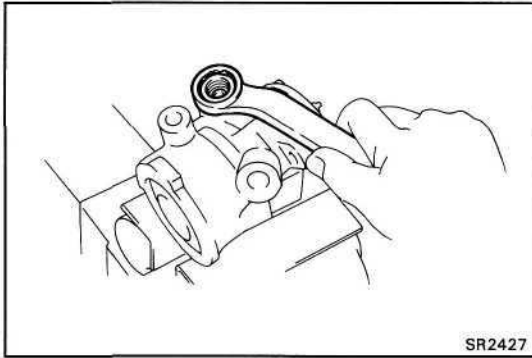
Push on the drive belt with your hand to hold the pulley in place and loosen the pulley nut.

3. (FJ Series)

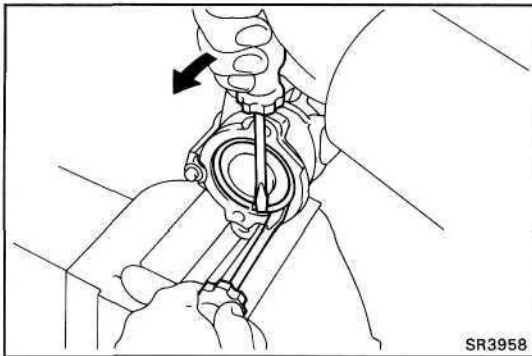
ADJUST DRIVE BELT TENSION AFTER INSTALLING PS PUMP

(See page SR-32)

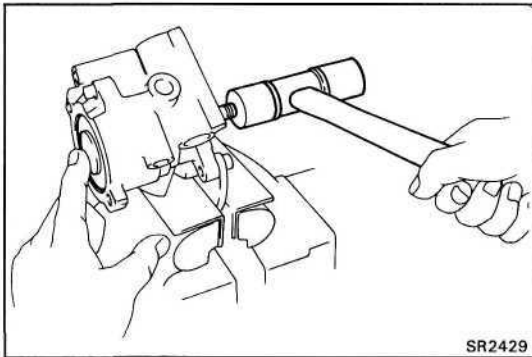


**3. REMOVE PRESSURE PORT UNION AND FLOW CONTROL VALVE**

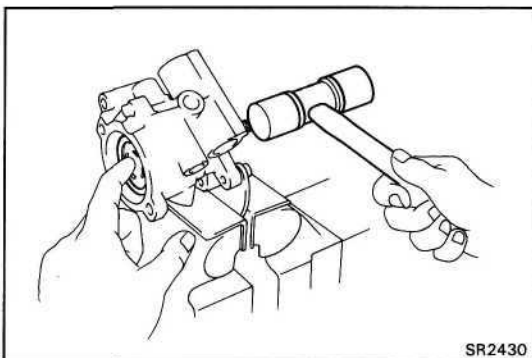
- (a) Remove the pressure port union.
- (b) Remove the O-ring from the pressure port union.
- (c) Remove the flow control valve and spring.

**4. REMOVE REAR HOUSING**

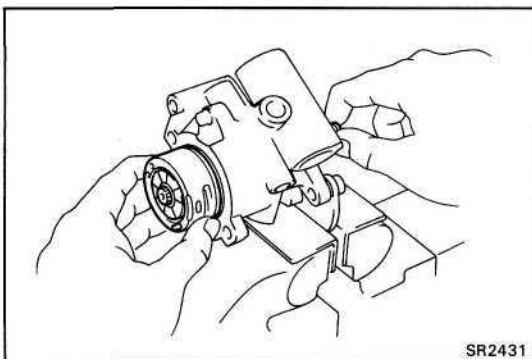
- (a) Using two screwdrivers, remove the snap ring.



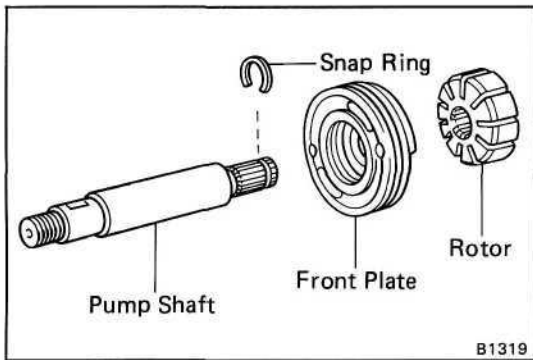
- (b) Using a plastic hammer, tap out the rear housing and wave washer.
- (c) Remove the O-ring from the rear housing.

**5. REMOVE REAR PLATE**

- (a) Using a plastic hammer, tap the shaft end and remove the rear plate.
- (b) Remove the O-ring from the rear plate.

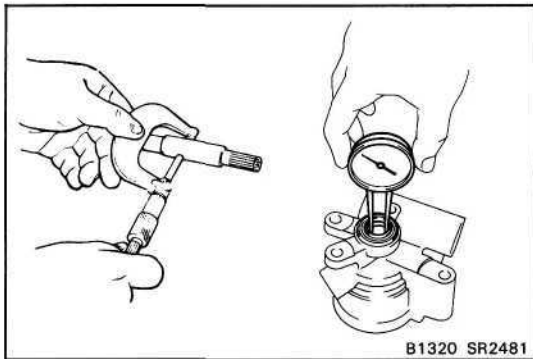
**6. REMOVE PUMP SHAFT, CAM RING AND VANE PLATES**

- (a) Remove the pump shaft with the camring, vane plates from the front housing.
- (b) Remove the cam ring and ten vane plates from the pump shaft.
- (c) Remove the longer straight pin from the front housing.



7. REMOVE ROTOR AND FRONT PLATE

- Using a screwdriver, remove the snap ring.
- Remove the rotor and front plate from the pump shaft.
- Remove the two O-rings from the front plate.
- Remove the straight pin from the front plate.



INSPECTION OF POWER STEERING PUMP

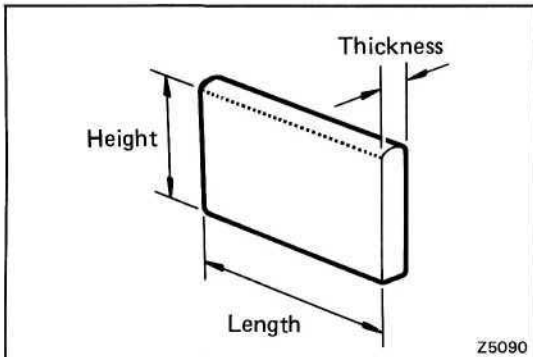
1. CHECK OIL CLEARANCE OF SHAFT AND BUSHING

Using a micrometer and calipers, check the oil clearance.

Standard clearance: 0.01 — 0.03 mm
(0.0004 - 0.0012 in.)

Maximum clearance: 0.07 mm (0.0028 in.)

If more than maximum, replace the entire PS pump.



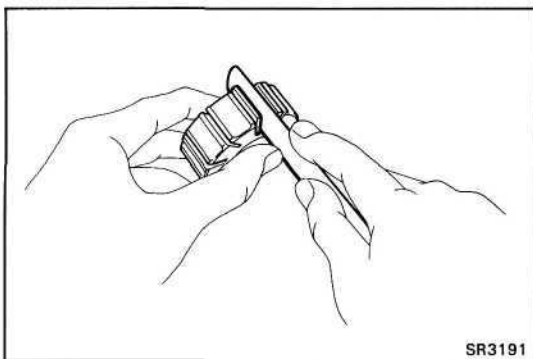
2. INSPECT ROTOR AND VANE PLATES

- Using a micrometer, measure the height, thickness and length of the vane plate.

Minimum height: 8.1 mm (0.319 in.)

Minimum thickness: 1.797 mm (0.0707 in.)

Minimum length: 14.988 mm (0.5901 in.)



- Using a feeler gauge, measure the clearance between the rotor groove and vane plate.

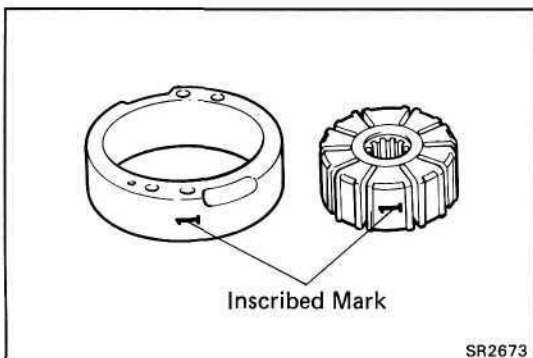
Maximum clearance: 0.028 mm (0.0011 in.)

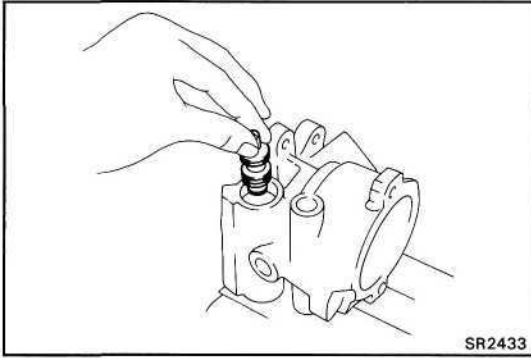
If more than maximum, replace the pump plate and/or rotor with one having the same mark stamped on the cam ring.

Inscribed mark: 1, 2, 3, 4 or None

HINT: There are five vane lengths with the following rotor and cam ring marks:

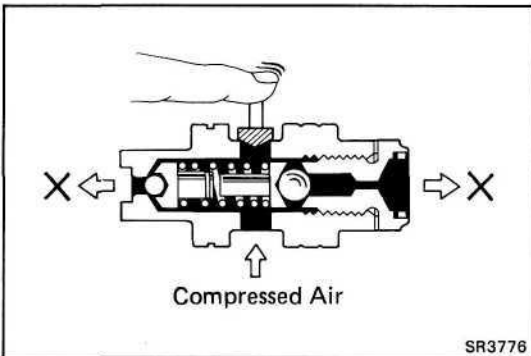
Rotor and cam ring mark	Vane length mm (in.)
None	14.996 — 14.998 (0.5904 — 0.5905)
1	14.994 — 14.996 (0.5903 — 0.5904)
2	14.992 — 14.994 (0.5902 — 0.5903)
3	14.990 — 14.992 (0.59016 — 0.59024)
4	14.988 — 14.990 (0.5901 — 0.5902)





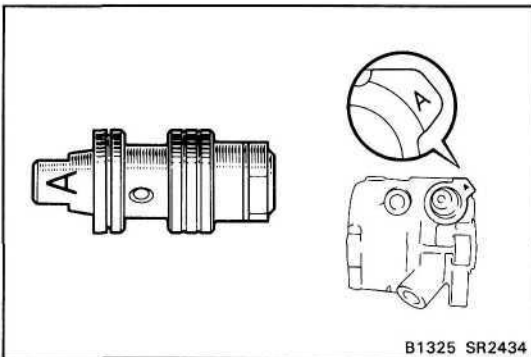
3. INSPECT FLOW CONTROL VALVE

- (a) Coat the valve with power steering fluid and check that it falls smoothly into the valve hole by its own weight.



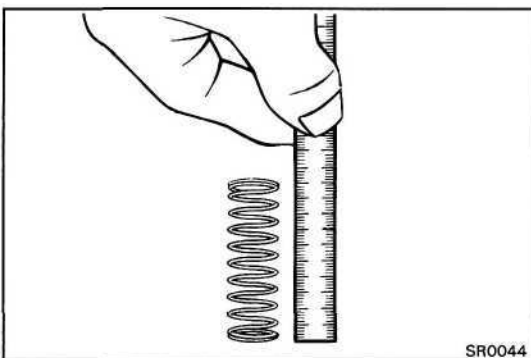
- (b) Check the flow control valve for leakage.

Close one of the holes and apply compressed air [4 or 5 kg/cm² (57 or 71 psi, 392 or 490 kPa)] into the opposite side, and confirm that air does not come out from the end hole.



If necessary, replace the valve with one having the same letter as inscribed on the front housing.

Inscribed mark: A, B, C, D, E or F

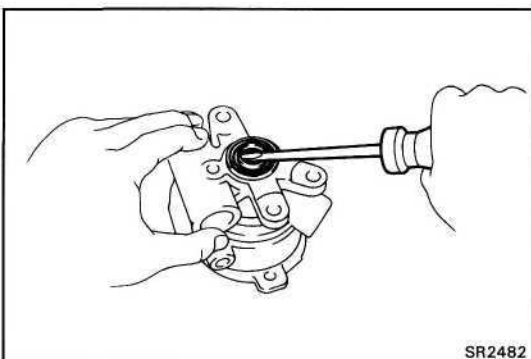


4. INSPECT FLOW CONTROL SPRING

Using a scale, measure the free length of the spring.

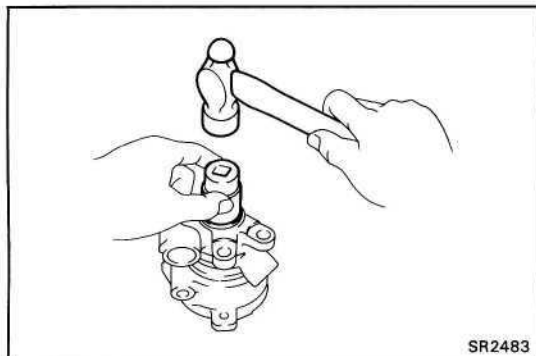
Spring length: 35 — 37 mm (1.38 — 1.46 in.)

If not within specification, replace the spring.



5. IF NECESSARY, REPLACE OIL SEAL

- (a) Using a screwdriver, pry out the oil seal.

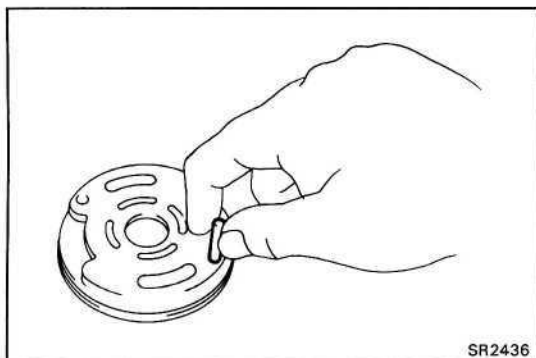


- (b) Using a socket wrench and hammer, drive in a new oil seal.

ASSEMBLY OF POWER STEERING PUMP

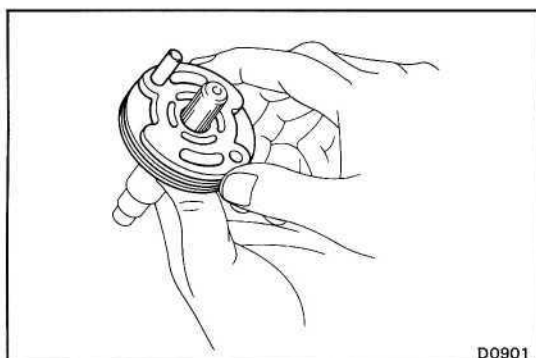
(See page SR-40)

1. COAT ALL SLIDING SURFACES WITH POWER STEERING FLUID BEFORE ASSEMBLY

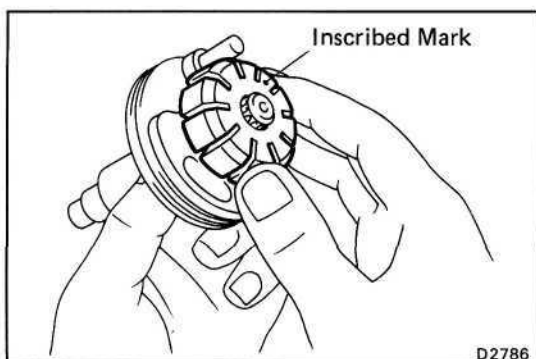


2. INSTALL FRONT PLATE AND ROTOR TO PUMP SHAFT

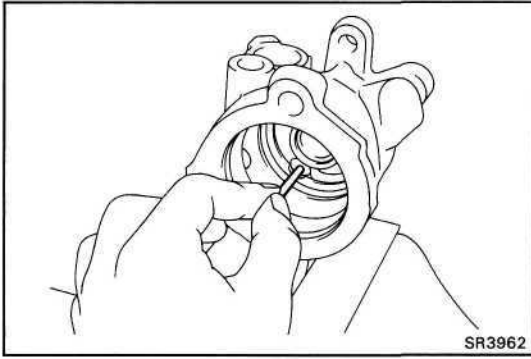
- (a) Install the shorter straight pin to the front plate.



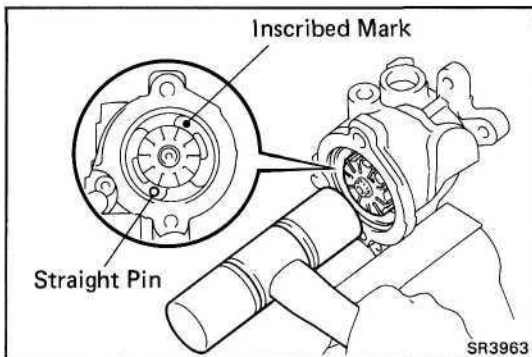
- (b) Install two new O-rings to the front plate.
(c) Install the front plate to the pump shaft.



- (d) Install the rotor to the pump shaft with the inscribed mark facing outward.
(e) Install the snap ring.

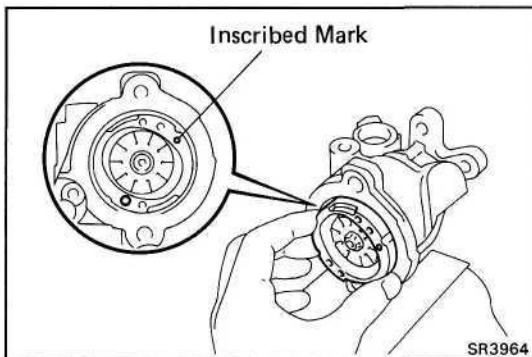
**3. INSTALL PUMP SHAFT TO FRONT HOUSING**

- (a) Coat the oil seal lip with MP grease.
- (b) Install the longer straight pin to the front housing.

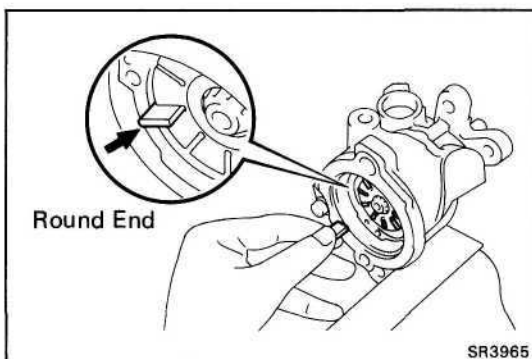


- (c) Align the hole of the front plate and straight pin and tap in the pump shaft with a plastic hammer.

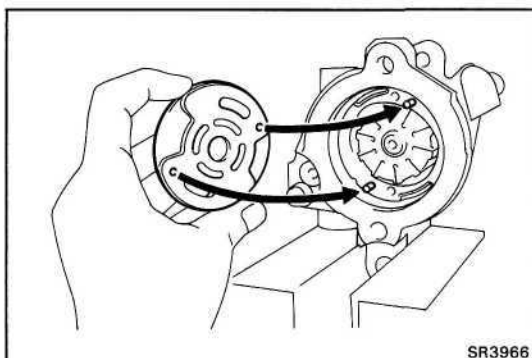
HINT: Be careful not to damage the oil seal and O-rings.

**4. INSTALL CAM RING**

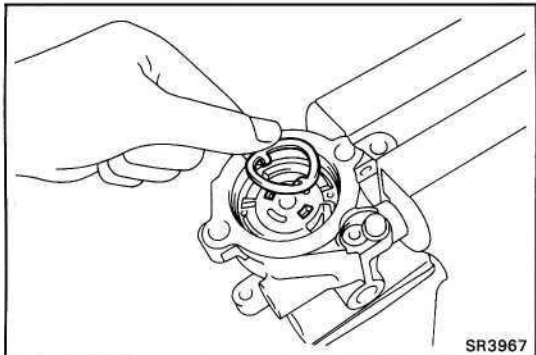
Align the oval hole of the cam ring and longer straight pin, and insert the cam ring with the inscribed mark facing outward.

**5. INSTALL VANE PLATES**

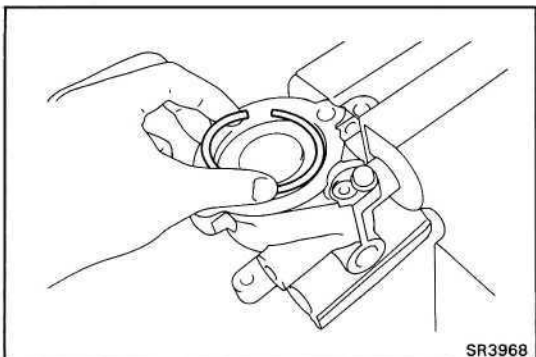
Install the ten vane plates with the round end facing outward.

**6. INSTALL REAR PLATE**

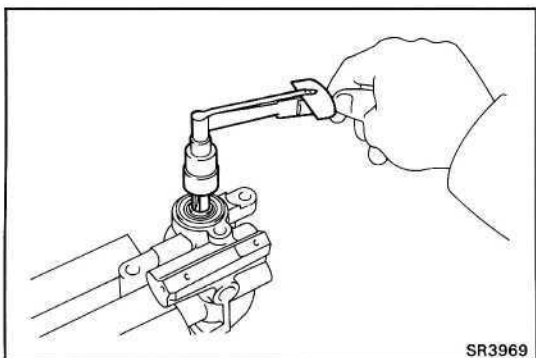
- (a) Install a new O-ring to the rear plate.
- (b) Align the holes of the rear plate with the pins, and install the plate.

**7. INSTALL REAR HOUSING**

- (a) Install the wave washer.
- (b) Install a new O-ring to the rear housing.
- (c) Using a plastic hammer, tap in the rear housing.

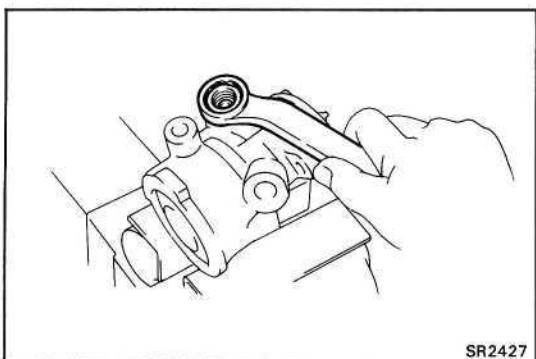


- (d) Install the snap ring.

**8. CHECK PUMP SHAFT PRELOAD**

- (a) Check that the shaft rotates smoothly without abnormal noise.
- (b) Temporarily install the pulley nut and check the rotating torque.

Rotating torque: 2.8 kg-cm (2.4 in.-lb, 0.3 lM-m) or less

**9. INSTALL SPRING, FLOW CONTROL VALVE AND PRESSURE PORT UNION**

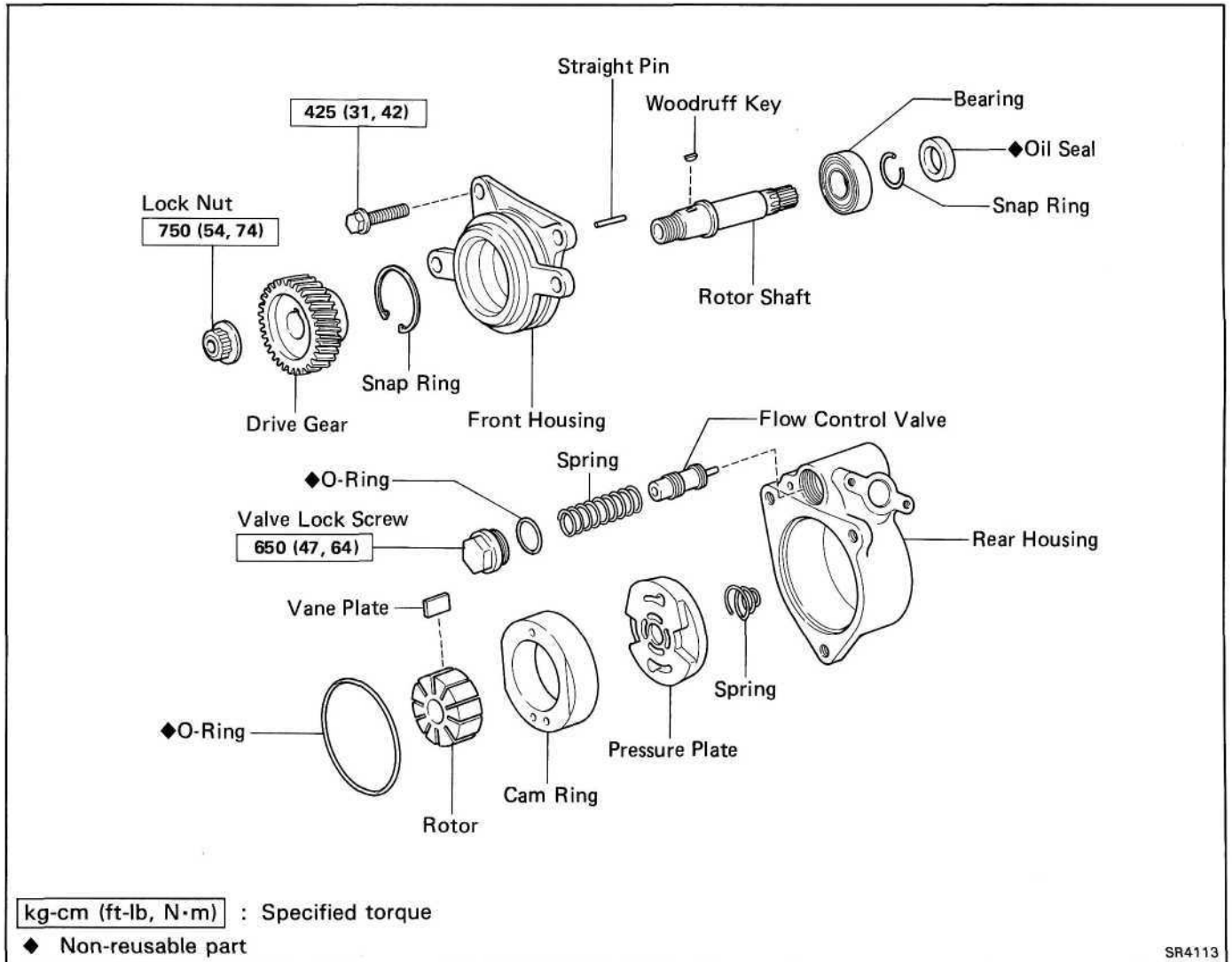
- (a) Install the spring and the valve into the housing.
- (b) Install a new O-ring in the groove of the pressure port union.
- (c) Install and torque the pressure port union.

Torque: 700 kg-cm (51 ft-lb, 69 Nm)

10. INSTALL RESERVOIR TANK

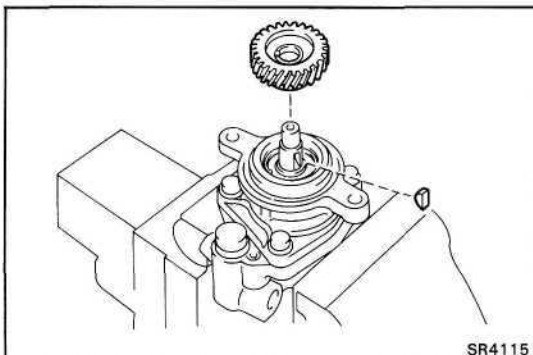
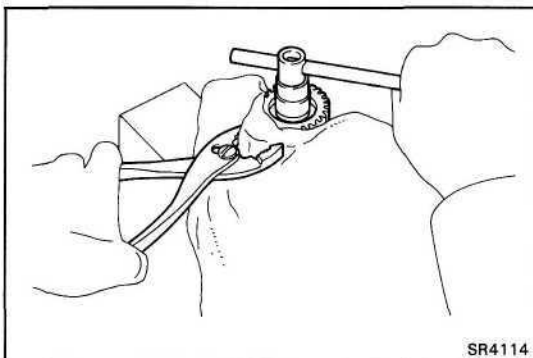
- (a) Install a new O-ring to the reservoir tank.
- (b) Install the reservoir tank to the housing and torque the three bolts.

Torque: 12 mm bolt 130 kg-cm (9 ft-lb, 13 Nm)
14 mm bolt 420 kg-cm (30 ft-lb, 41 Nm)

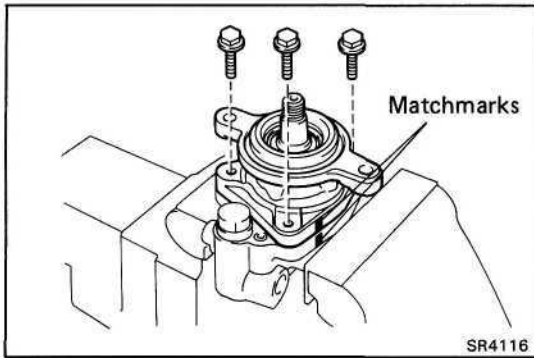
COMPONENTS (HZJ and HDJ series)**DISASSEMBLY OF POWER STEERING PUMP****1. REMOVE DRIVE GEAR**

- (a) While holding the driver gear with pliers, remove the lock nut.

HINT: Place the workshop rag over the gear to prevent damaging it.

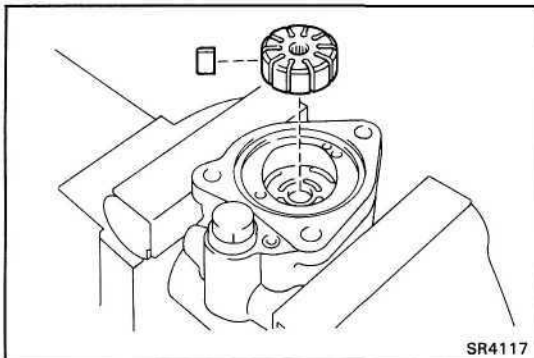


- (b) Remove the gear and woodruff key.



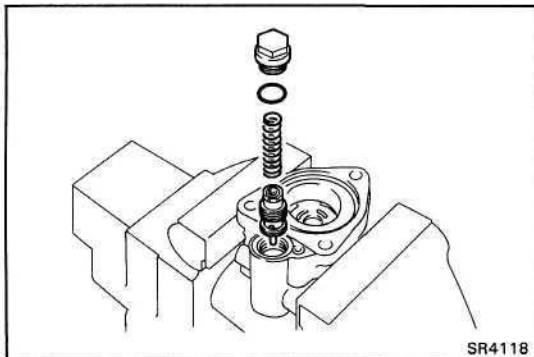
2. REMOVE FRONT HOUSING

- Place matchmarks on the front and rear housing.
- Remove three bolts and the front housing.
- Remove the O-ring from the front housing.



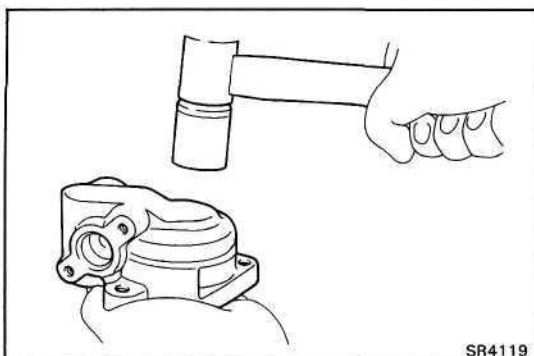
3. REMOVE ROTOR AND VANE PLATE

NOTICE: Be careful that the vane plates and rotor do not fall out.



4. REMOVE VALVE LOCK SCREW, SPRING AND FLOW CONTROL VALVE

- Remove the valve lock screw, spring and control valve.
- Remove the O-ring from the valve lock screw.

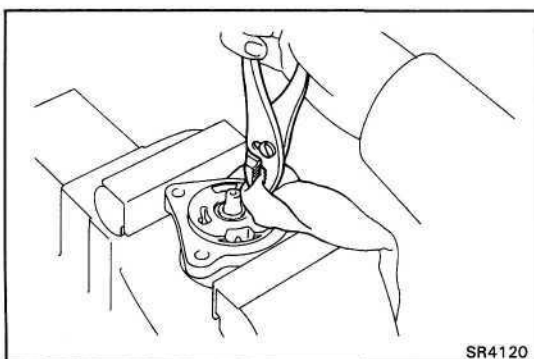


5. REMOVE CAM RING, PRESSURE PLATE AND SPRING

- Using a plastic hammer, tap the bottom end of the rear housing, and remove the pressure plate and spring.

NOTICE: Be careful not to scratch the front side of the pressure plate.

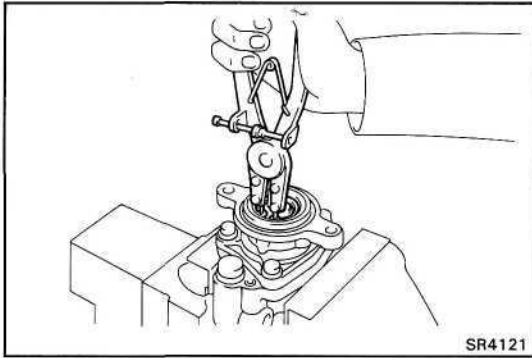
- Remove the O-ring from the pressure plate.



6. REMOVE STRAIGHT PIN

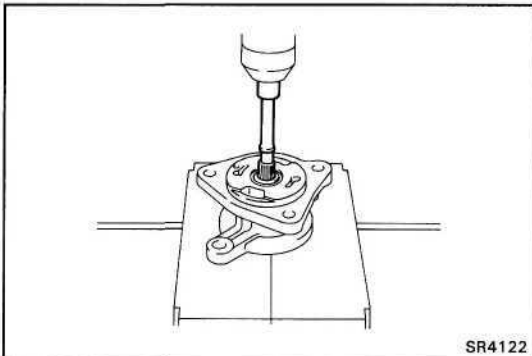
Using pliers, remove the straight pin.

HINT: Place a workshop rag over the pin to prevent damaging it.

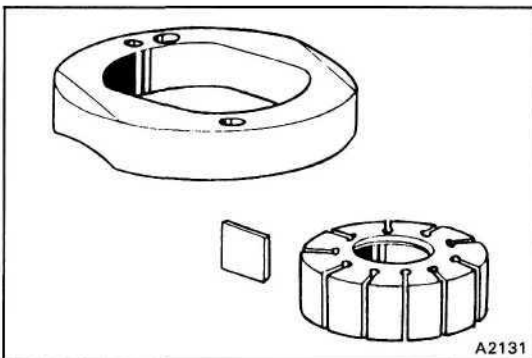


7. REMOVE ROTOR SHAFT

- (a) Using snap ring pliers, remove the snap ring.



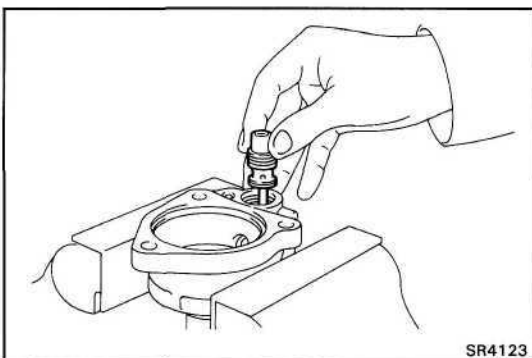
- (b) Using a extension bar and press, press out the rotor shaft with bearing.



INSPECTION OF POWER STEERING PUMP

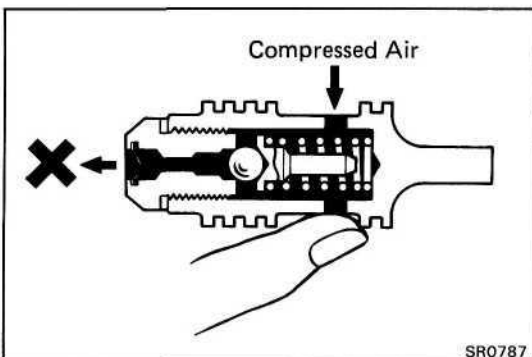
1. INSPECT ROTOR, CAM RING AND VANE PLATES

Check the cam ring for wear or scratches. If necessary, replace the cam ring with the rotor and the vane plates.

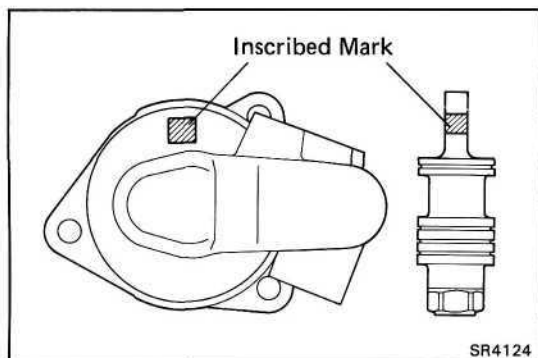


2. INSPECT FLOW CONTROL VALVE

- (a) Check the flow control valve for wear or damage.
- (b) Apply fluid to the valve and check that it falls smoothly into the valve hole by its own weight.

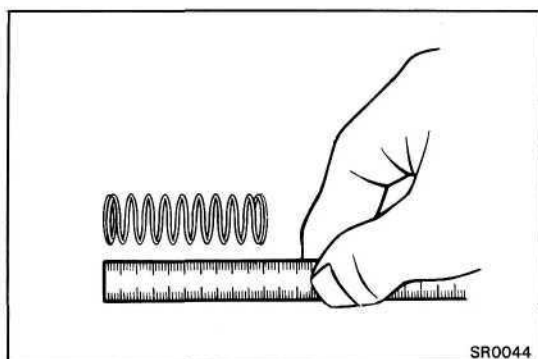


- (c) Check the flow control valve for leakage. Close one of the holes and apply compressed air [4 or 5 kg/cm² (57 or 71 psi, 392 or 490 kPa)] into the opposite side, and confirm that air does not come out from the end hole.



- (d) If necessary, replace the valve with one having the letter as inscribed on the rear housing.

Pump housing number	Valve cutter mark
0	II
1	I
2	None

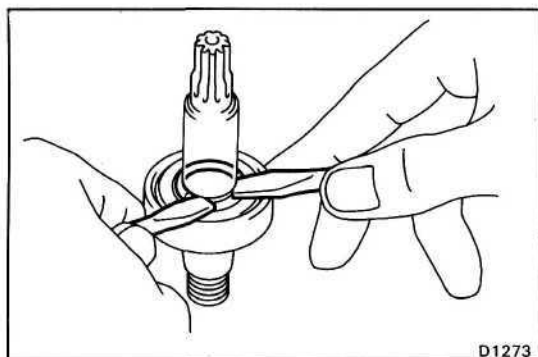


3. INSPECT FLOW CONTROL VALVE SPRING

Check that the spring length is within specification.

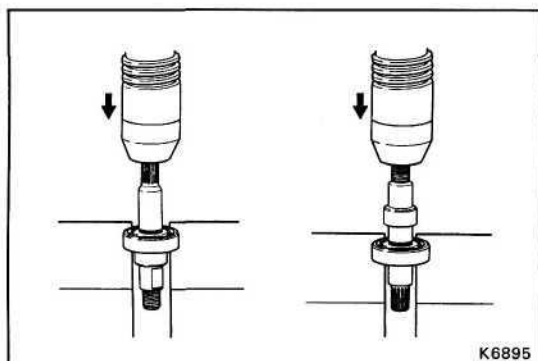
Spring length: 50 — 55 mm (1.97 — 2.17 in.)

If the spring is not within specification, replace it.



4. IF NECESSARY, REPLACE ROTOR SHAFT BEARING

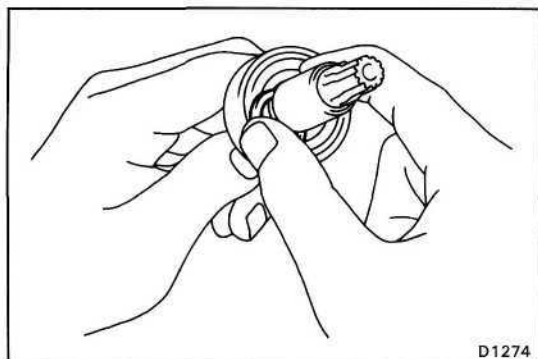
- (a) Using two screwdrivers, remove the snap ring.



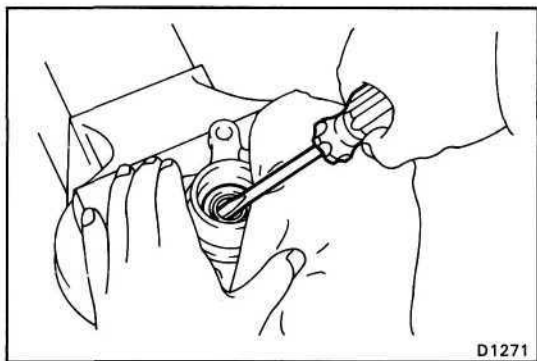
- (b) Using a press, press out the bearing.

- (c) Using a press, press in a new bearing.

NOTICE: Be careful not to scratch the rotor shaft contact surface with oil seal and bearing.



- (d) Install the snap ring.

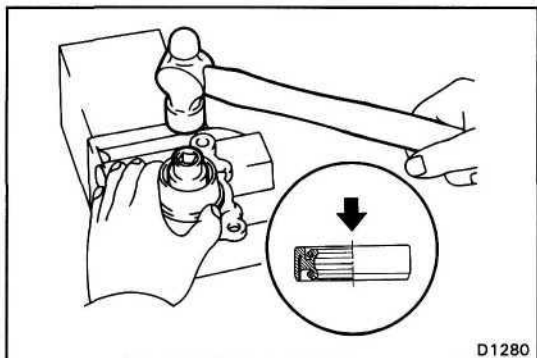
**5. IF NECESSARY, REPLACE OIL SEAL**

(a) Clamp the front housing in a vise.

NOTICE: Do not tighten the vise too tight.

(b) Using a screwdriver, remove the oil seal.

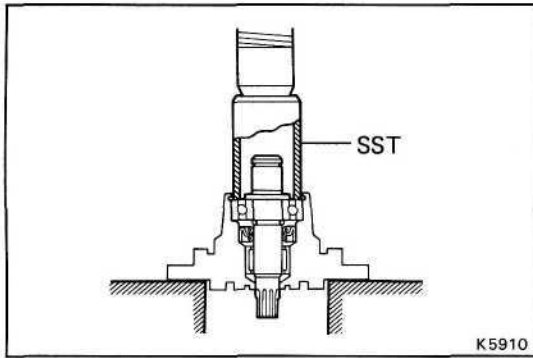
NOTICE: Be careful not to scratch the housing with a screwdriver.



(c) Apply MP grease to the oil seal lip.

(d) Using 23 mm socket wrench, install a new oil seal.

NOTICE: Be careful not to scratch the frictional surface of the rotor.



ASSEMBLY OF POWER STEERING PUMP

(See page SR-47)

1. COAT POWER STEERING FLUID ON EACH PARTS

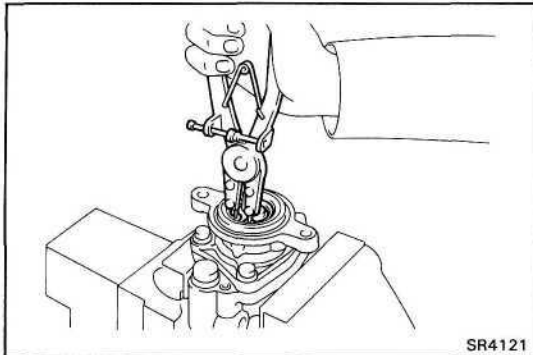
2. INSTALL ROTOR SHAFT

- (a) Using SST and a press, press in the rotor shaft to the front housing.

SST 09632-36010

NOTICE: Be careful not to scratch the oil seal lip and the rotor frictional surface.

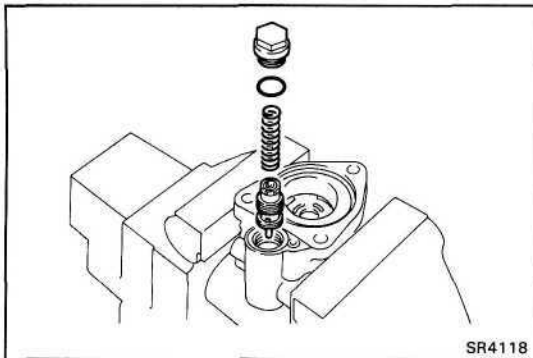
- (b) Using snap ring pliers, install the snap ring.



3. INSTALL VALVE LOCK SCREW, SPRING AND FLOW CONTROL VALVE

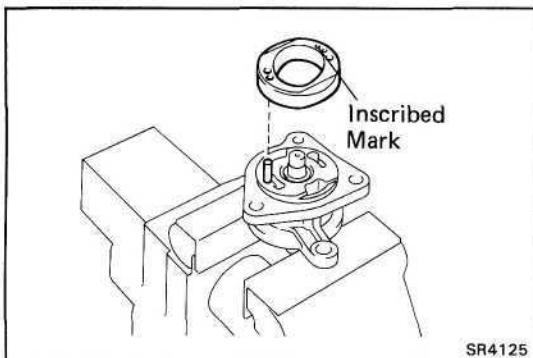
- (a) Coat power steering fluid to new O-ring.
 (b) Install the O-ring to the valve lock screw.
 (c) Install the flow control valve and the spring.
 (d) Install the valve lock screw.

Torque: 650 kg-cm (47 ft-lb, 64 N·m)



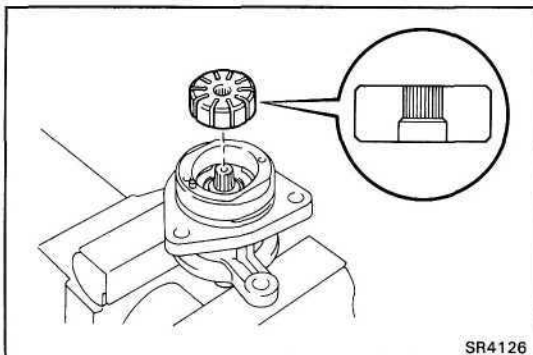
4. INSTALL CAM RING

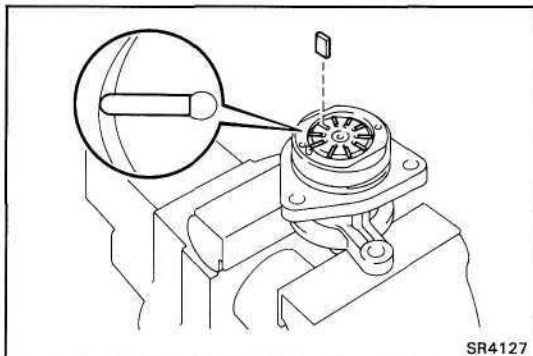
- (a) Install the straight pin to the front housing.
 (b) Install the cam ring with the inscribed mark facing upper side.



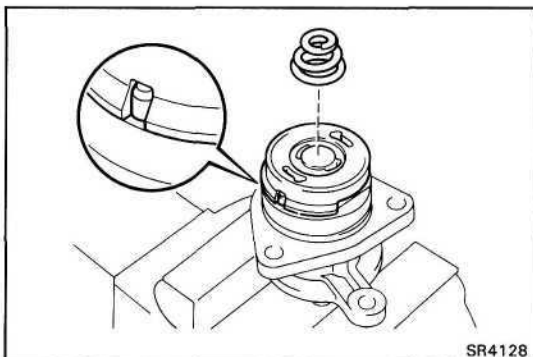
5. INSTALL ROTOR

Install the rotor as shown.

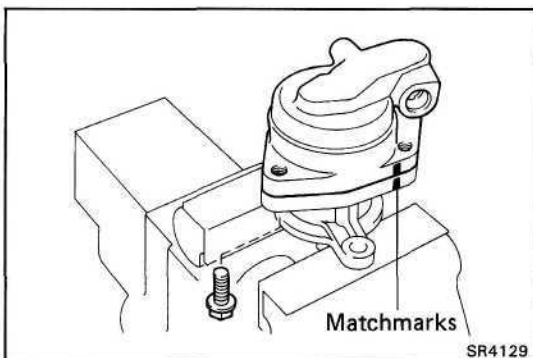


**6. INSTALL VANE PLATES**

Install the vane plates with the round end facing outward.

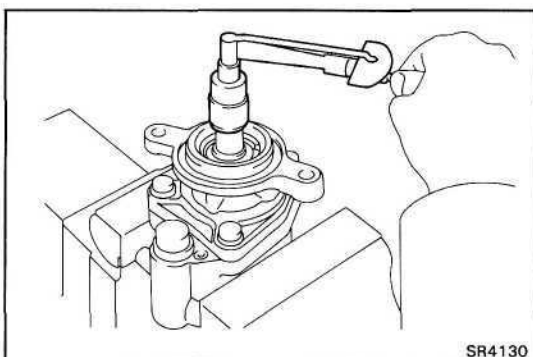
**7. INSTALL PRESSURE PLATE AND SPRING**

- (a) Align the cut portion of the pressure plate to the straight pin and install it.
- (b) Place the spring on the pressure plate.

**8. INSTALL REAR HOUSING**

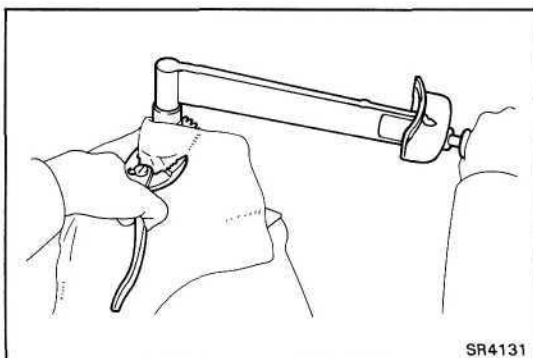
- (a) Coat a new O-ring with power steering fluid.
- (b) Install the O-ring to the rear housing.
- (c) Align the matchmarks on the front and rear housing and assemble them.
- (d) Torque the three bolts.

Torque: 425 kg-cm (31 ft-lb, 42 N-m)

**9. CHECK ROTOR SHAFT ROTATION CONDITION**

- (a) Check that the rotor shaft rotates smoothly without abnormal noise.
- (b) Temporarily install the gear lock nut and check the rotation torque.

Rotation torque: 2.8 kg-cm (2.4 in.-lb, 0.3 N-m) or less

**10. INSTALL DRIVE GEAR**

- (a) Install the gear and woodruff key.
- (b) While holding the gear with pliers, install the lock nut.

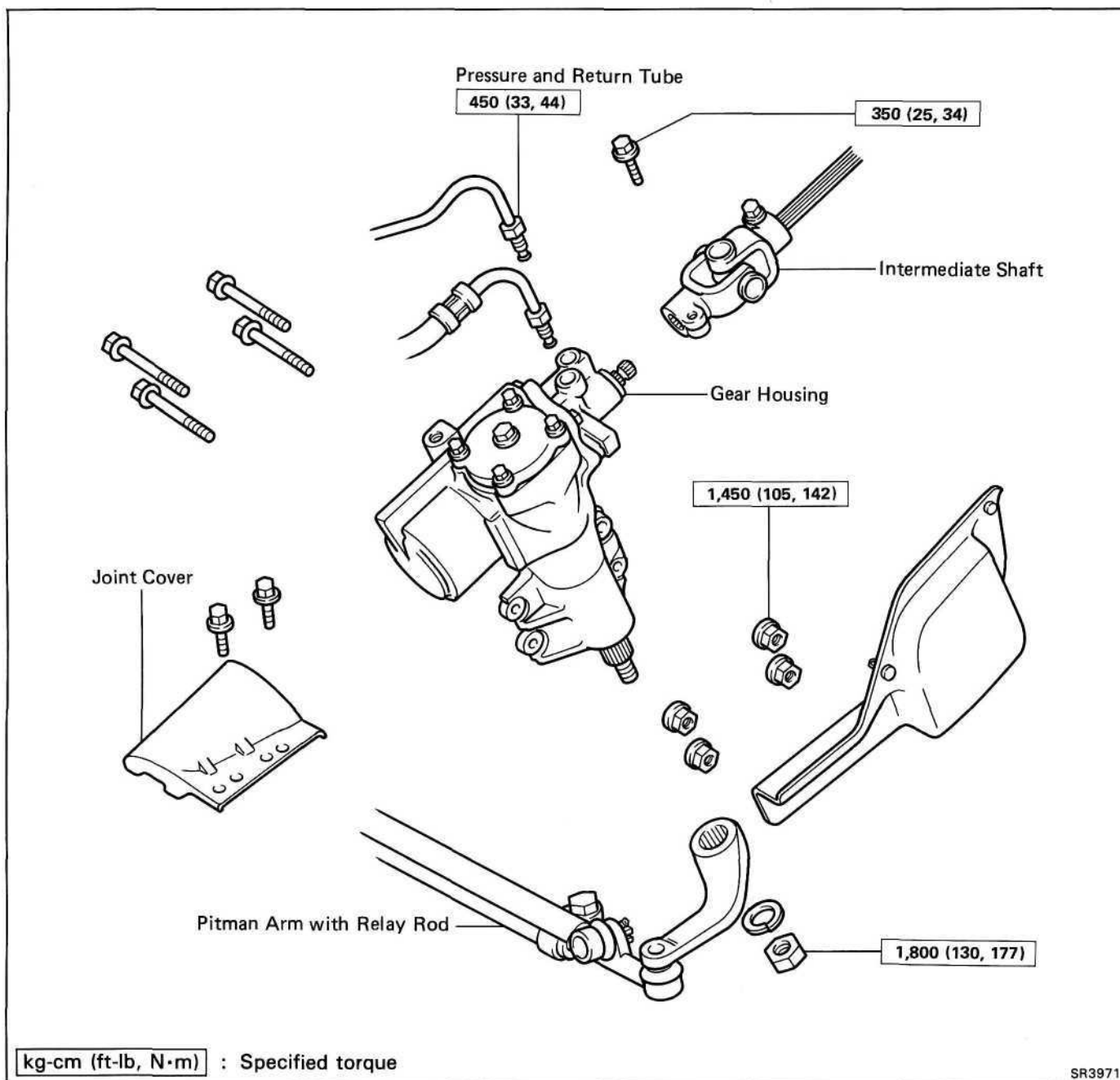
HINT: Place the workshop rag over the gear to prevent damaging it.

Torque: 750 kg-cm (54 ft-lb, 74 N-m)

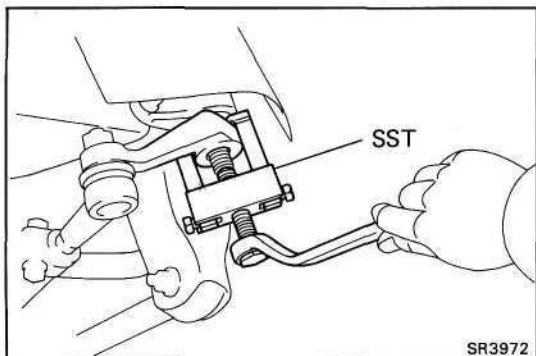
Gear Housing

REMOVAL AND INSTALLATION OF GEAR HOUSING

Remove and install the parts as shown.



SR3971



SR3972

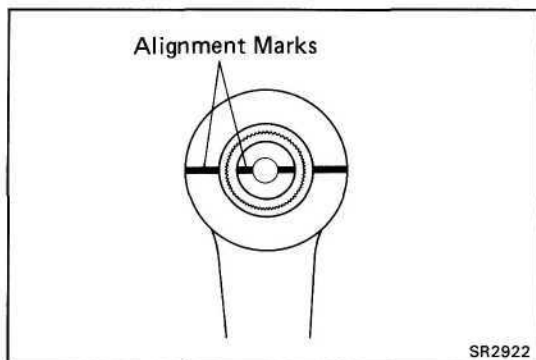
(MAIN POINTS OF REMOVAL AND INSTALLATION)

1. DISCONNECT PITMAN ARM

- Loosen the pitman arm nut.
- Using SST, disconnect the pitman arm from the sector shaft.

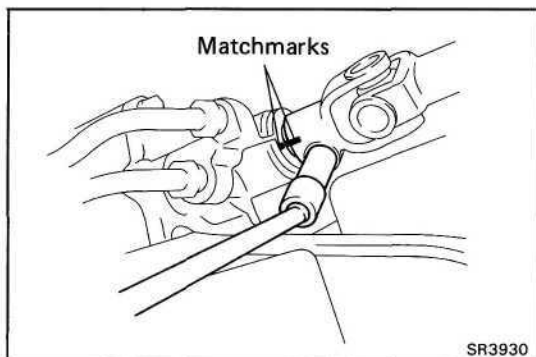
SST 09628-62011

- Remove the nut, the spring washer and the arm.



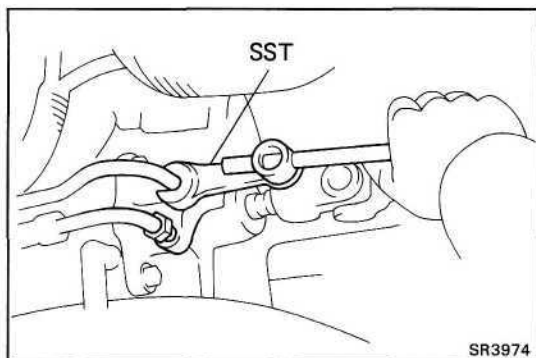
- (d) When connecting the pitman arm, align alignment marks on the pitman arm and the sector shaft, and install the spring washer and nut.

Torque: 1,800 kg-cm (130 ft-lb, 177 Nm)



2. DISCONNECT UNIVERSAL JOINT FROM GEAR HOUSING

- (a) Place matchmarks on the universal joint and the worm shaft.
- (b) Loosen the universal joint upper bolt.
- (c) Remove the universal joint lower bolt.
- (d) Slide the joint backward to disconnect the joint from the worm shaft.

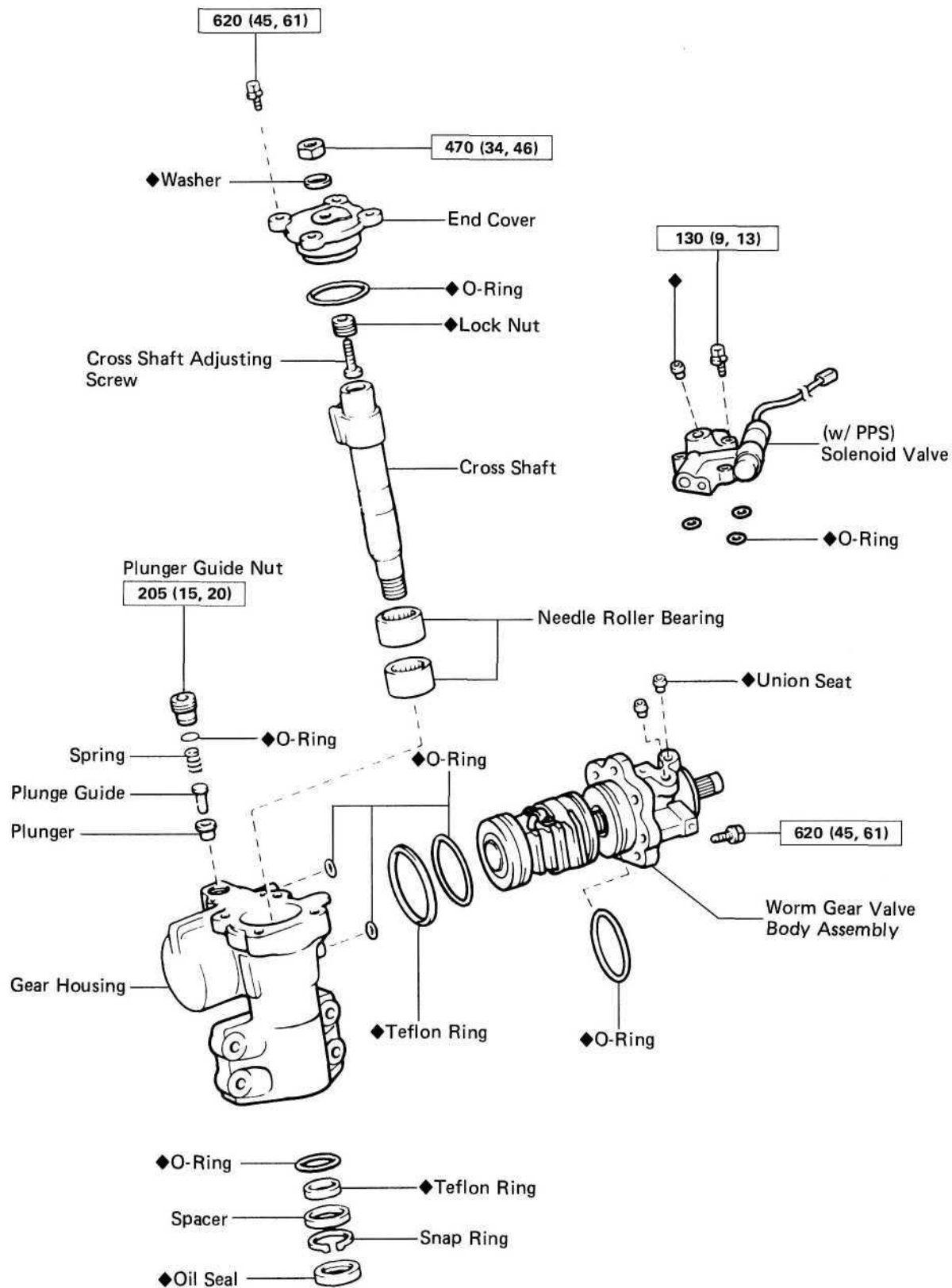


3. DISCONNECT PRESSURE AND RETURN TUBES

Using SST, disconnect the pressure and return tubes from the gear housing.

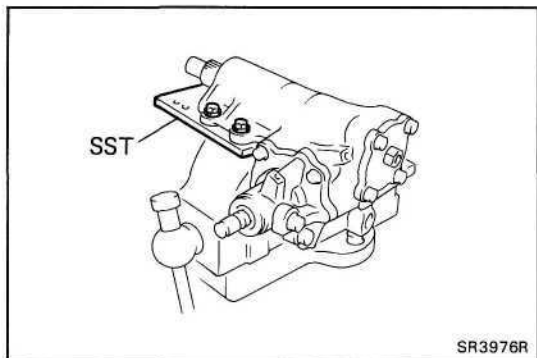
SST 09631-22022

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part



DISASSEMBLY OF GEAR HOUSING

(See page SR-56)

1. MOUNT HOUSING ON STAND

Mount the gear housing on SST and clamp SST in a vise.
SST 09630-00012 (09631-00140)

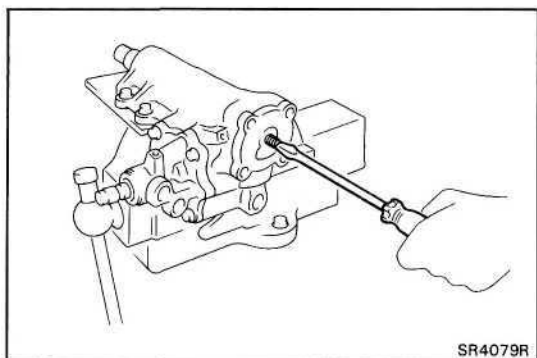
2. (w/ PPS)

REMOVE SOLENOID VALVE

- (a) Remove three bolts and the valve.
- (b) Remove the O-rings.

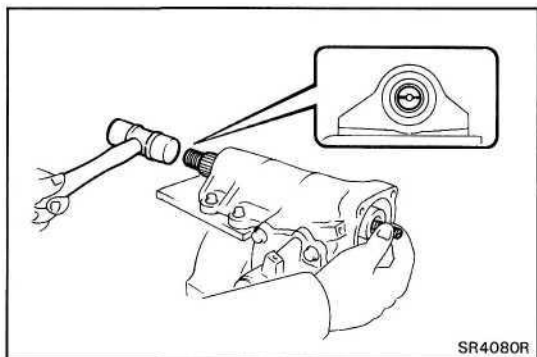
3. REMOVE END COVER

- (a) Remove the adjusting screw lock nut.
- (b) Remove the four bolts.
- (c) Screw in the adjusting screw until the cover comes off.



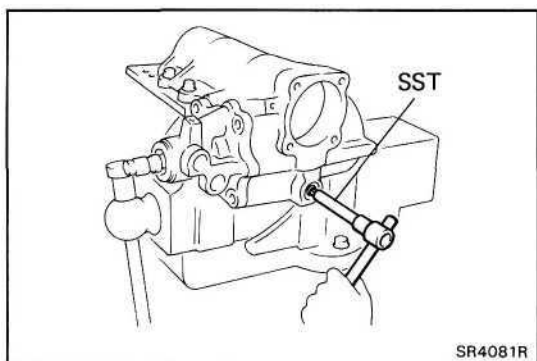
4. REMOVE CROSS SHAFT

Using a plastic hammer, tap on the cross shaft end and pull out the shaft.



5. REMOVE PLUNGER GUIDE NUT

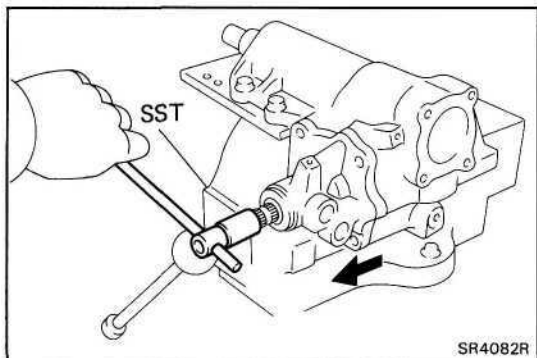
- (a) Using SST, remove the plunger guide nut.
SST 09043-38100
- (b) Remove the spring, plunger and plunger guide.
- (c) Remove the O-ring.

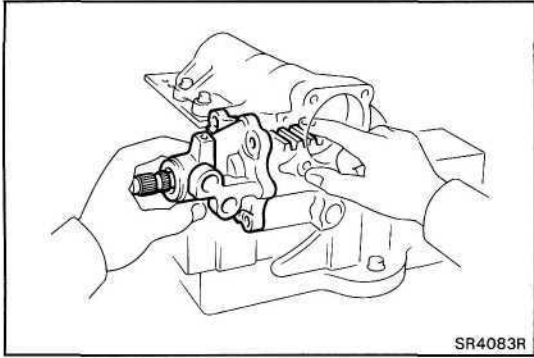


6. REMOVE WORM GEAR VALVE BODY ASSEMBLY

- (a) Remove the four cap bolts from the housing.
- (b) Using SST, turn the shaft clockwise to disconnect the worm gear valve body assembly from gear housing.

SST 09616-00010

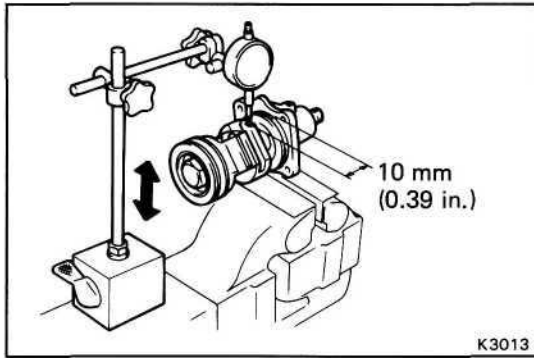




- (c) Hold the power piston nut with your thumb so it cannot move, then withdraw the valve body and power piston assembly.

NOTICE: Ensure that the power piston nut does not come off the worm shaft.

- (d) Remove the O-ring.



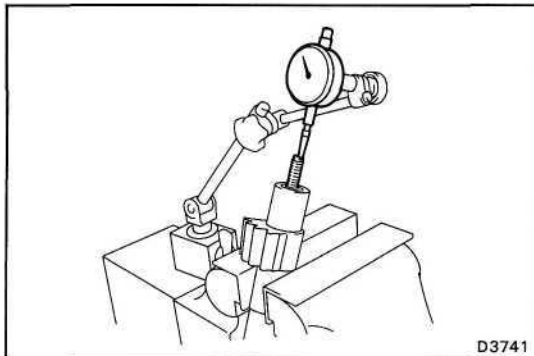
INSPECTION AND REPLACEMENT OF GEAR HOUSING

1. CHECK BALL CLEARANCE

- Mount the valve body in a vise.
- Using a dial indicator, check the ball clearance. Move the worm gear up and down.

Maximum ball clearance: 0.15 mm (0.0059 in.)

If clearance is excessive, the power control valve assembly must be replaced.

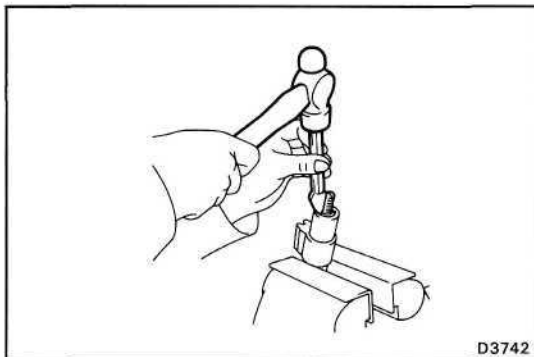


2. INSPECT CROSS SHAFT ADJUSTING SCREW THRUST CLEARANCE

- Clamp the cross shaft in a vise.
- Using a dial indicator, measure the thrust clearance.

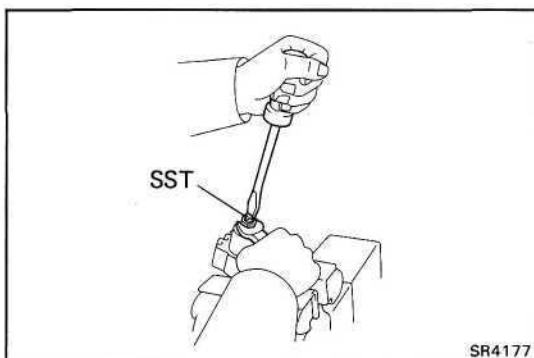
**Thrust clearance: 0.03 — 0.05 mm
(0.0012 - 0.0020 in.)**

If thrust clearance is not correct, adjust the thrust clearance.



3. IF NECESSARY, ADJUST THRUST CLEARANCE

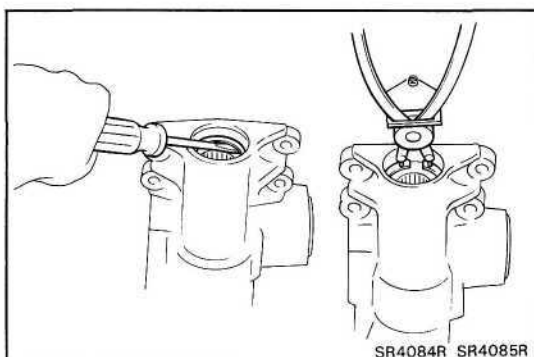
- Using a chisel and hammer, remove the lock nut stake.



- Using SST, remove the lock nut.

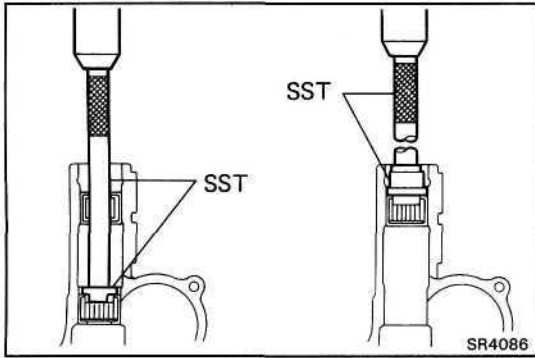
SST 09630-00012 (09631-00050)

- Adjust the adjusting screw for correct thrust clearance and tighten a new lock nut.
- Stake the lock nut.



4. IF NECESSARY, REPLACE NEEDLE ROLLER BEARING

- Using a screwdriver, pry out the oil seal.
- Using snap ring pliers, remove the snap ring.
- Remove the metal spacer, teflon ring and O-ring.

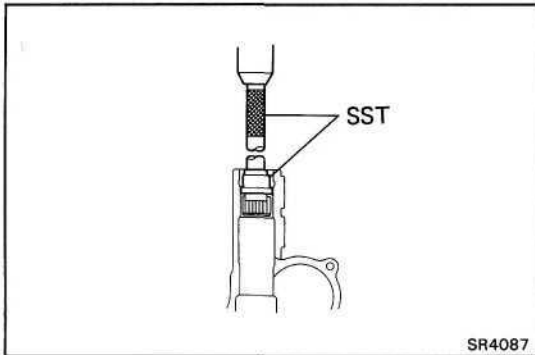


(d) Using SST, press out the upper bearing.

SST 09630-00012 (09631-00020, 09631-00070)

(e) Using SST, press out the lower bearing.

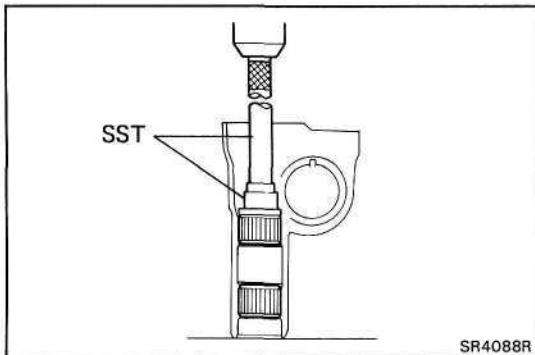
SST 09630-00012 (09631-00020, 09631-00090)



(f) Using SST, press in a new lower bearing.

SST 09630-00012 (09631-00020, 09631-00090)

HINT: Install the lower bearing so that it is positioned 23.1 mm (0.909 in.) away from the housing inner end surface.

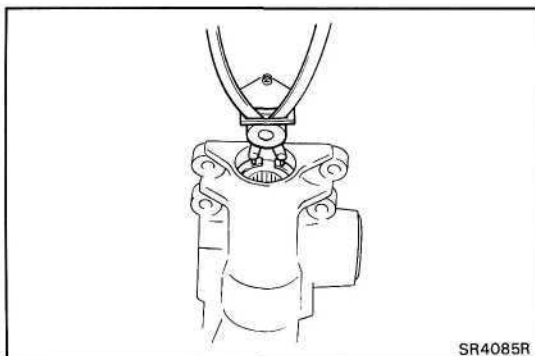


(g) Using SST, press in a new upper bearing.

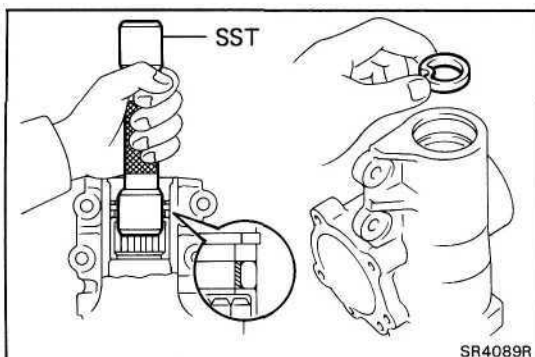
SST 09630-00012 (09631-00020, 09631-00090)

HINT: The bearing's top end should be installed so that it aligns with the housing end surface.

(h) Install a new O-ring and metal spacer.



(i) Using snap ring pliers, install the snap ring.

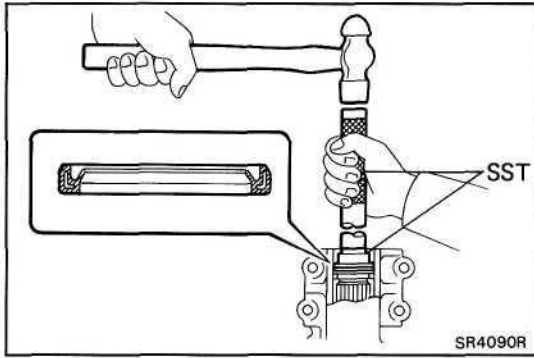


(j) Form a new teflon ring into a heart shape and install it with hand.

(k) Using SST, form the teflon ring.

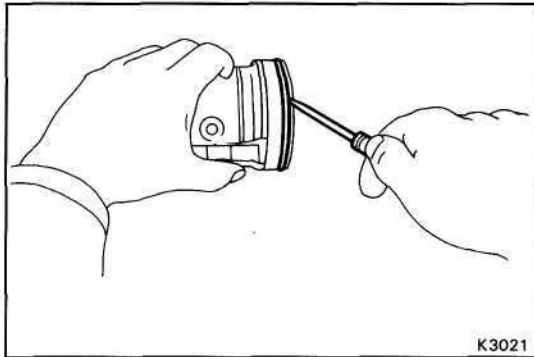
NOTICE: The teflon ring must be squeezed before inserting the sector shaft or damage will result.

SST 09630-00012 (09631-00120)



- (l) Using SST, drive a new oil seal into the gear housing.

SST 09630-00012 (09631-00020, 09631-00090)



5. IF NECESSARY, REPLACE CONTROL VALVE TEFLON RING

- (a) Using a screwdriver, remove the teflon ring and O-ring.

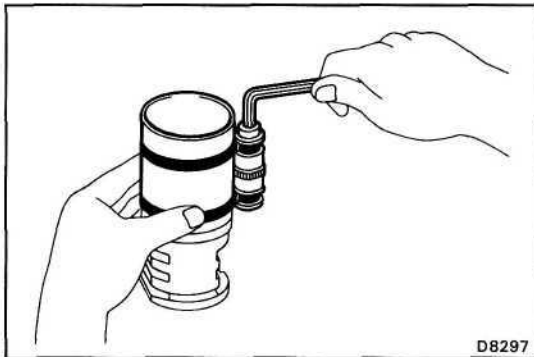
NOTICE: Be careful not to damage the control valve.

- (b) Install a new O-ring.

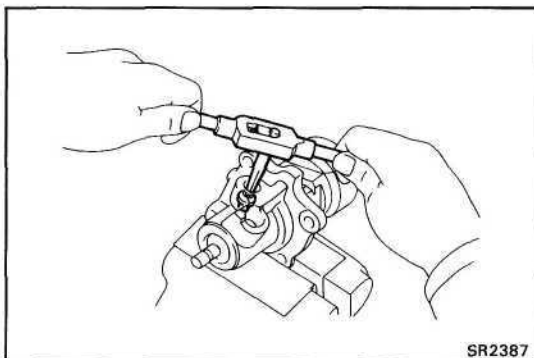
- (c) Expand a new teflon ring with your fingers.

NOTICE: Be careful not to over-expand the teflon ring.

- (d) Install a new teflon ring.

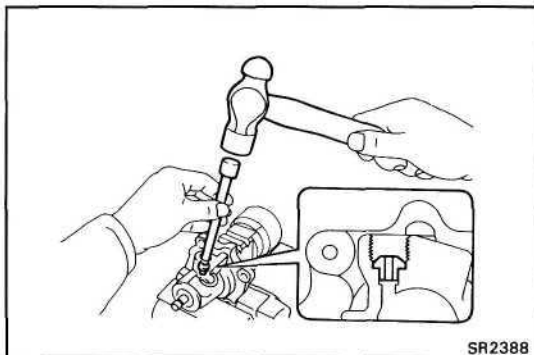


- (e) Coat the teflon ring with power steering fluid and snug it down with piston ring compressor for 5 — 7 minutes.

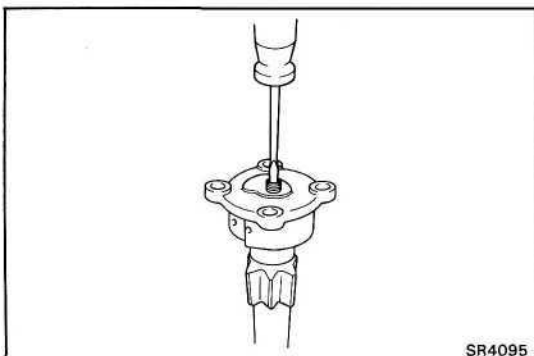
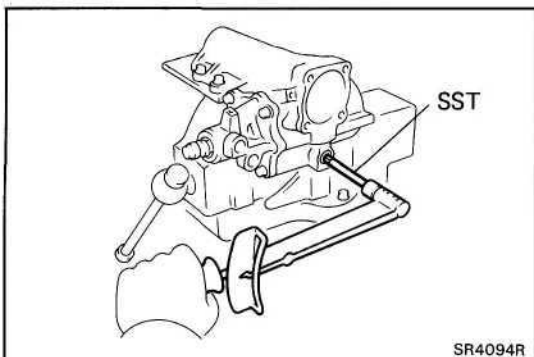
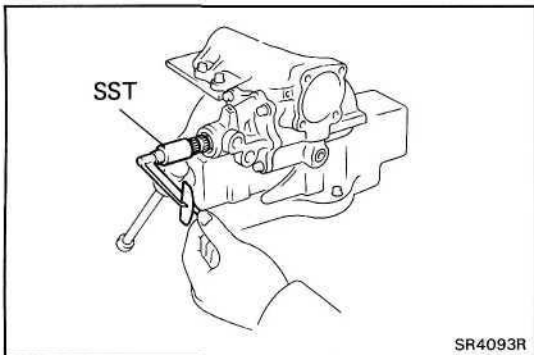
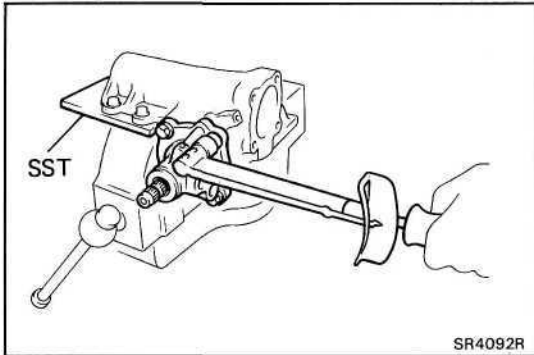
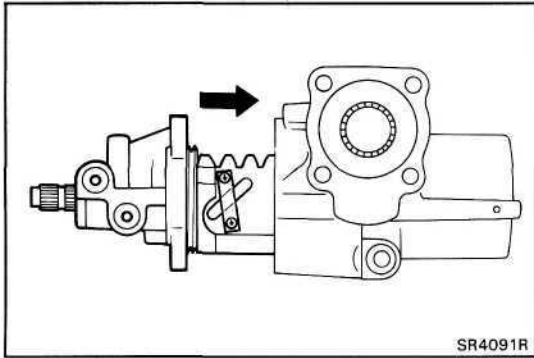


6. IF NECESSARY, REPLACE UNION SEAT

- (a) Using a screw extractor, remove the union seat.



- (b) Using a plastic hammer and extension bar, tap in a new union seat.



ASSEMBLY OF GEAR HOUSING

(See page SR-56)

1. INSTALL WORM GEAR VALVE BODY ASSEMBLY

- Install the three O-rings to the gear housing and valve body.
- Mount the gear housing on SST and clamp SST in vise.

SST 09630-00012 (09631-00140)

- Insert the worm gear valve body assembly to the gear housing as shown.
- Install and torque the four bolts.

Torque: 620 kg-cm (45 ft-lb, 61 Nm)

NOTICE: Be careful not to damage the teflon ring.

- Using SST, check the worm gear preload.

SST 09616-00010

Preload: (at starting)

3 - 5.5 kg-cm (2.6 - 4.8 in.-lb, 0.3 - 0.5 Nm)

HINT: Hold the power piston nut to prevent it from turning.

If preload is not correct, replace the worm gear assembly.

2. INSTALL PLUNGER GUIDE NUT

- Install the plunger, plunger guide and spring.
- Install a new O-ring to the plunger guide nut and install the plunger guide nut with SST.

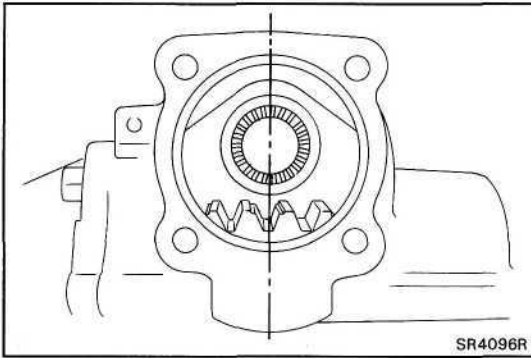
SST 09043-38100

Torque: 205 kg-cm (15 ft-lb, 20 Nm)

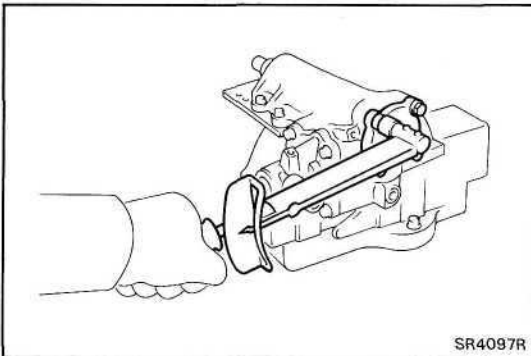
3. INSTALL CROSS SHAFT AND END COVER

- Install a new O-ring on the end cover.
- Using a screwdriver, assemble the cross shaft to the end cover.

HINT: Fully loosen the adjusting screw.

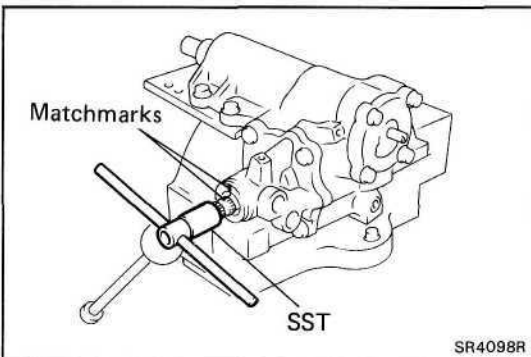


- (c) Set the worm gear at the center of the gear housing.
- (d) Insert and push the cross shaft into the gear housing so that the center teeth mesh together.



- (e) Install the four cap bolts. Torque the bolts in a diagonal pattern.

Torque: 620 kg-cm (45 ft-lb, 61 N-m)

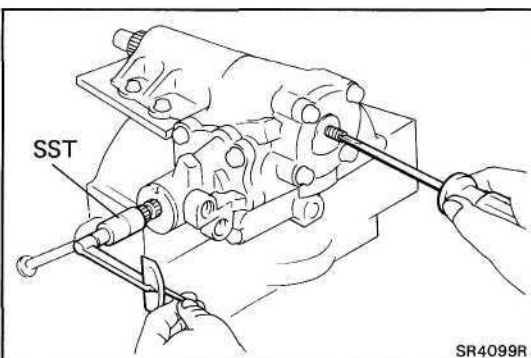


4. DETERMINE CENTER POSITION OF GEAR HOUSING

- (a) Using SST, turn the worm shaft so full lock in both directions and determine the exact center.

SST 09616-00010

- (b) Place matchmarks on the worm shaft and housing to show neutral position.



5. ADJUST CROSS SHAFT ADJUSTING SCREW

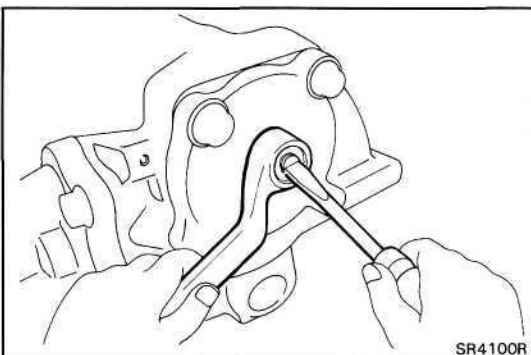
- (a) Install SST with a torque meter on the worm shaft.

SST 09616-00010

- (b) Turn the adjusting screw while measuring the preload until it is correct.

Total preload: (at starting)

7.5 - 11 kg-cm (6.5 - 9.6 in.-lb, 0.74 - 9.6 N-m)



6. INSTALL NEW WASHER

7. INSTALL AND TIGHTEN LOCK NUT

Torque the lock nut while holding the adjusting screw.

Torque: 470 kg-cm (34 ft-lb, 46 N-m)

8. CHECK TOTAL PRELOAD

9. (w/ PPS)**INSTALL SOLENOID VALVE**

- (a) Install new O-rings to the solenoid valve.
- (b) Install the three bolts and the valve.

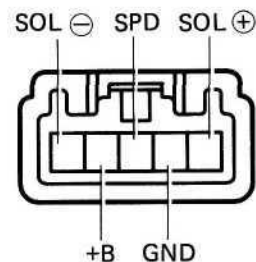
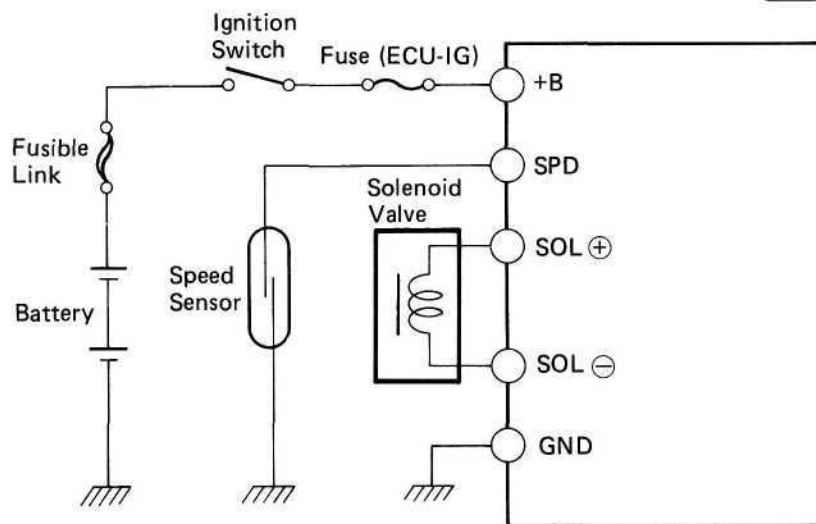
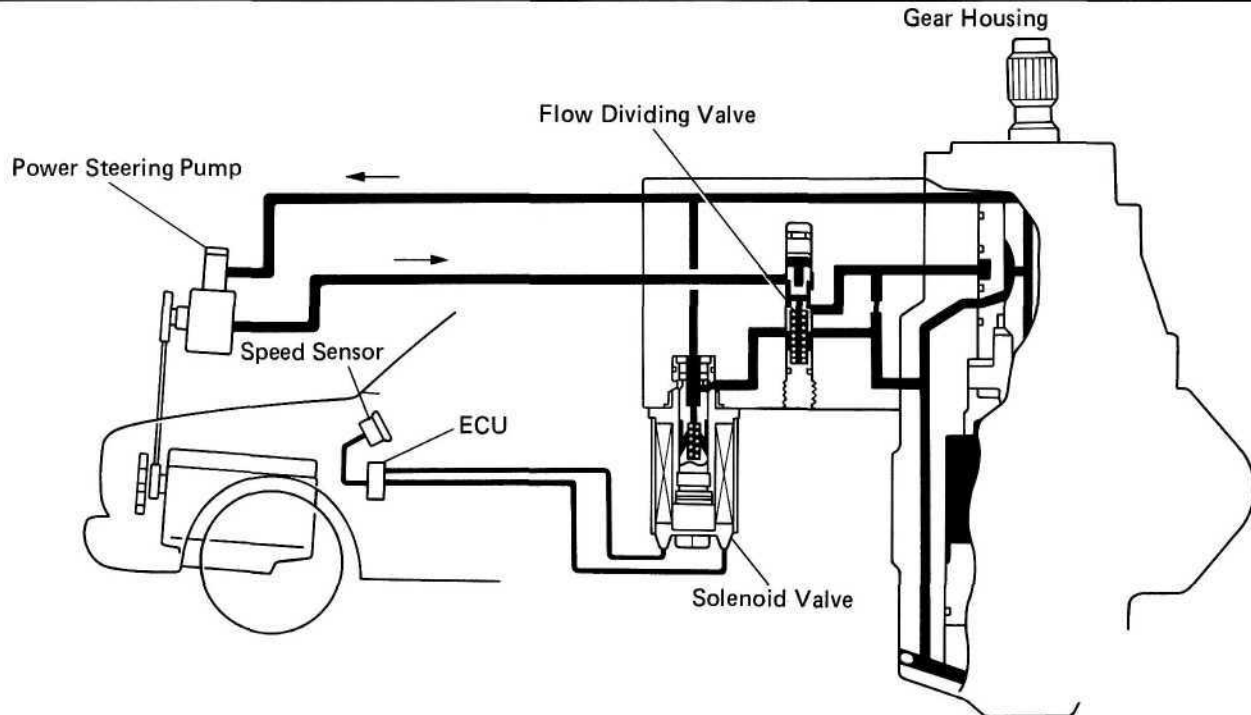
Torque: 130 kg-cm (9 ft-lb, 13 N·m)

Electronic Control System

PRECAUTION

Do not open the cover or the case of the ECU and various computers unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)

ELECTRONIC CIRCUIT



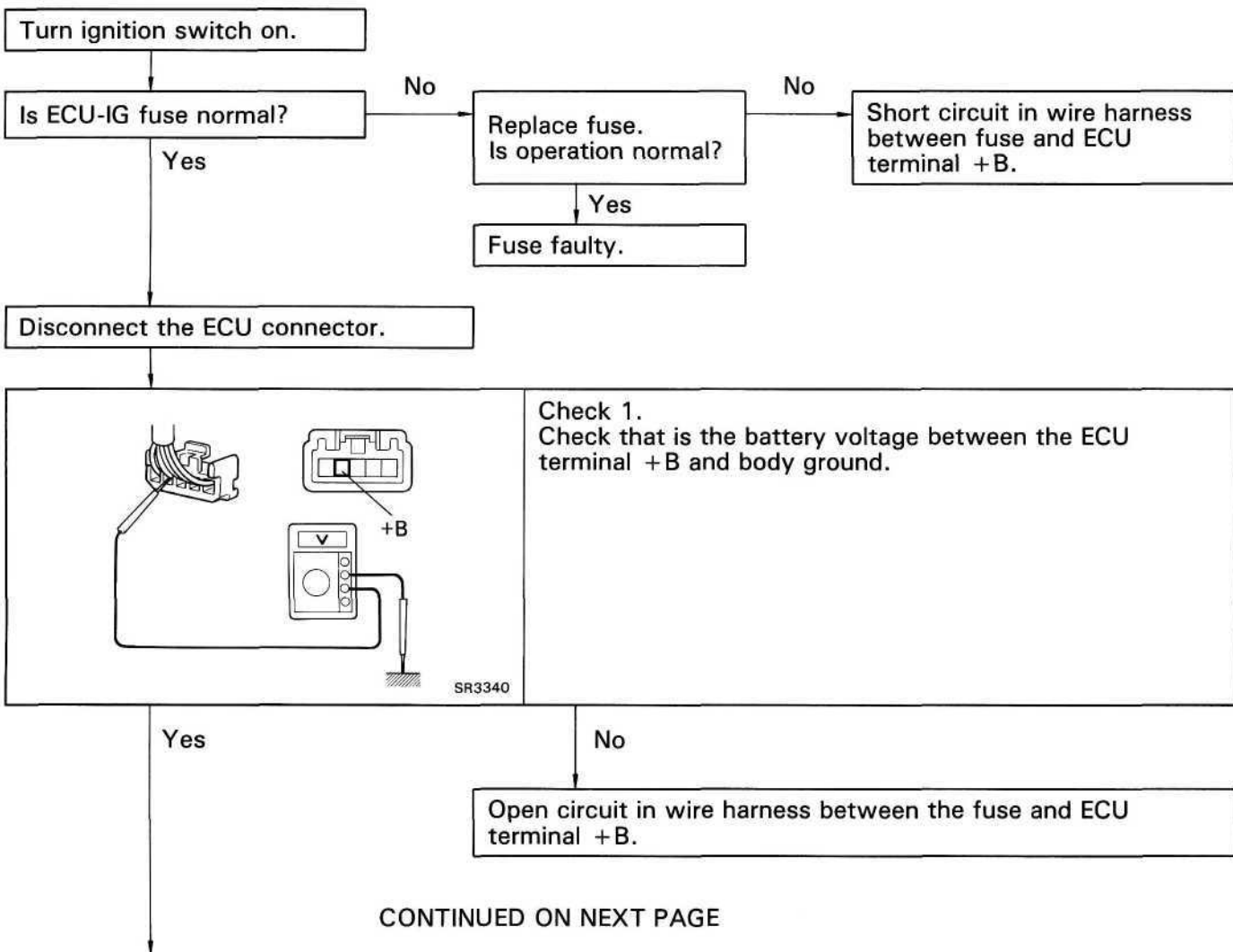
TROUBLESHOOTING FLOW-CHART

Trouble

- Hard steering at idle or low-speed driving.
- Steering too sensitive during high-speed driving.

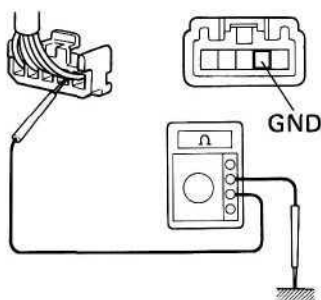
Preliminary Check

- Check tire pressure.
- Check lubrication of suspension and steering linkage.
- Check front wheel alignment.
- Check steering system joint and suspension arm ball joint.
- Check for bent steering column.
- Check that all connectors are secure.
- Check PS pump fluid pressure. (See page SR-35)



Yes

CONTINUED FROM PREVIOUS PAGE



SR3341

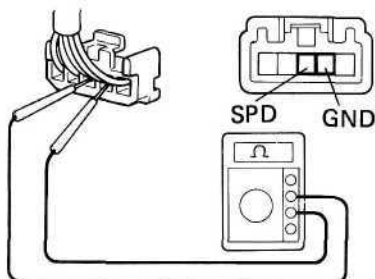
Check 2.

Check that there is continuity between the ECU terminal GND and body ground.

Yes

No

- Open circuit in wire harness between the ECU terminal GND and body ground.
- Body ground faulty.



SR3560

Check 3.

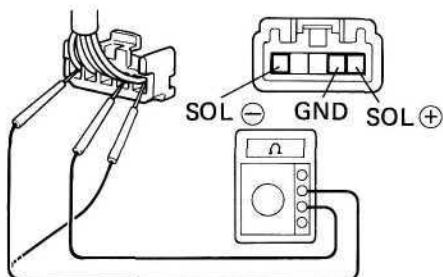
- Jack up the vehicle and support it on stands.
- Connect an ohmmeter between the ECU connector terminals SPD and GND.
- Spin the wheels and check the resistance.

Resistance (Ω) $0 \Omega \rightarrow \infty \rightarrow 0 \Omega$

Yes

No

- Open or short circuit in wire harness between the ECU terminal SPD and speed sensor.
- Speed sensor faulty (See page BE-55).



SR3371

Check 4.

Check that there is no continuity between terminals SOL \oplus or SOL \ominus and GND.

Yes

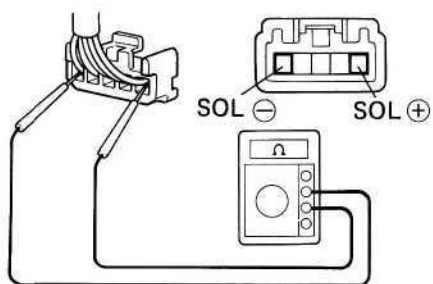
No

- Short circuit in wire harness between the terminals SOL \oplus and SOL \ominus .
- Solenoid valve faulty.

CONTINUED ON NEXT PAGE

Yes

CONTINUED FROM PREVIOUS PAGE



SR3343

Check 5.
Measure the resistance between terminals SOL \oplus and SOL \ominus .
Standard resistance: 6.0 — 11.0 Ω

Yes

No

- Open circuit in wire harness between the terminals SOL \oplus and SOL \ominus .
- Solenoid valve faulty.

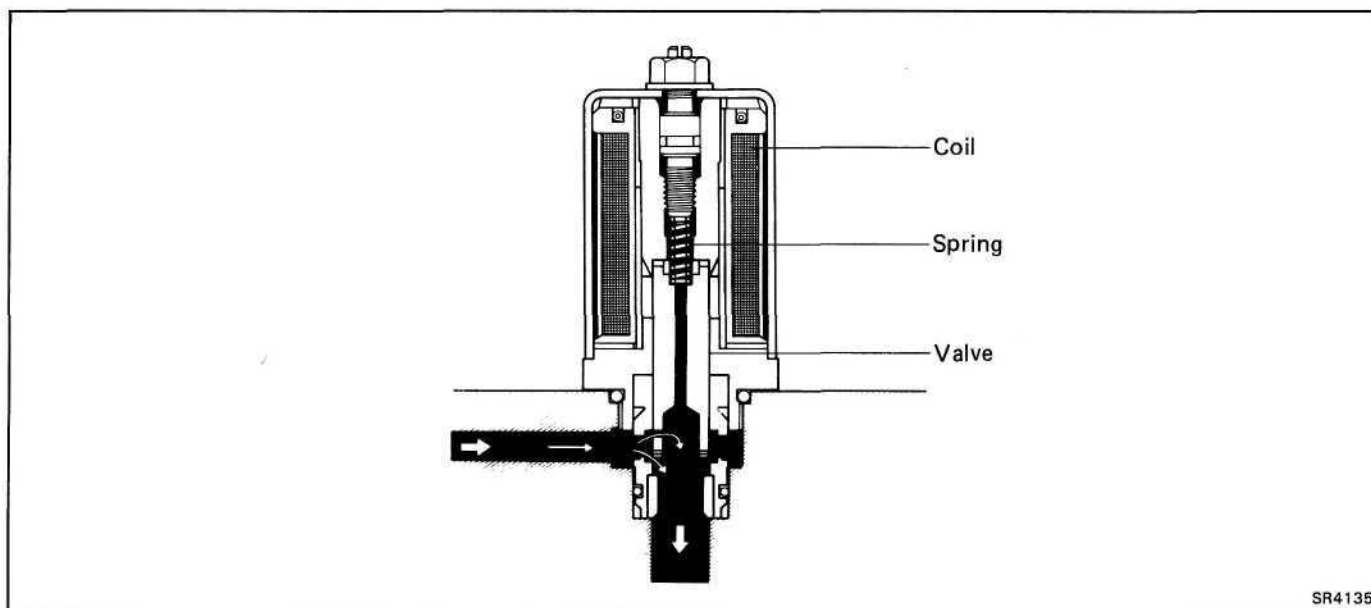
Check 6.
Inspect ECU.

Bad

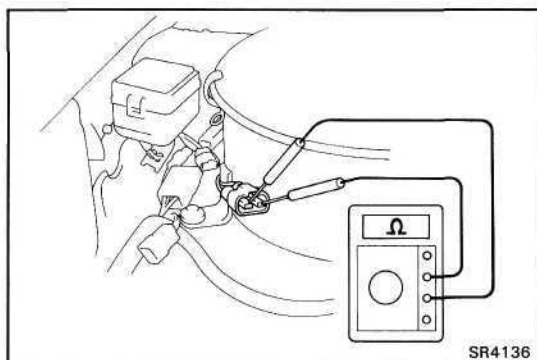
Replace ECU.

INSPECTION OF ELECTRONIC CONTROL COMPONENTS

Solenoid Valve



SR4135



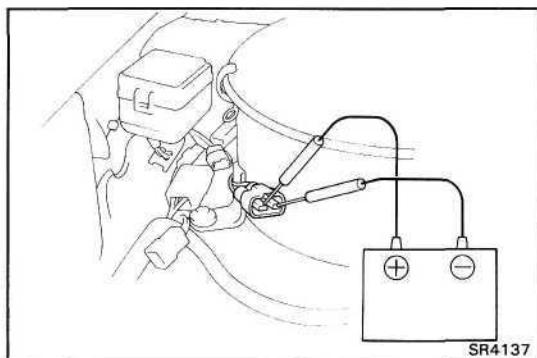
SR4136

1. DISCONNECT WIRING CONNECTOR

2. MEASURE RESISTANCE

Measure the resistance between SOL 0 and SOL 0 .

Resistance: 6 — 11 Ω



SR4137

3. CHECK SOLENOID OPERATION

- Connect the battery positive terminal to the solenoid terminal SOL 0 .
- Connect the battery negative terminal to the solenoid terminal SOL 0 .
- Check that the solenoid is clicked.

If faulty, replace the pressure control valve with the solenoid valve.

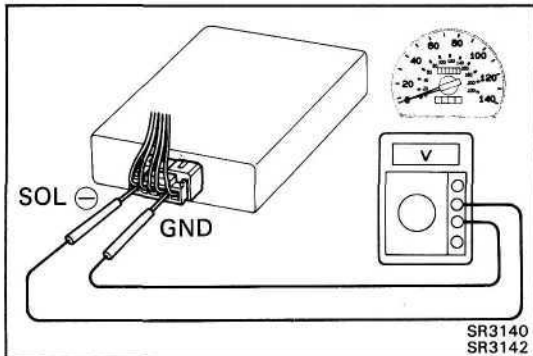
NOTICE:

- Do not apply voltage for more than 30 seconds to avoid burning out the solenoid.
- If repeating this step, wait until the solenoid cools down enough that it can be touched by hand.

4. CONNECT WIRING CONNECTOR

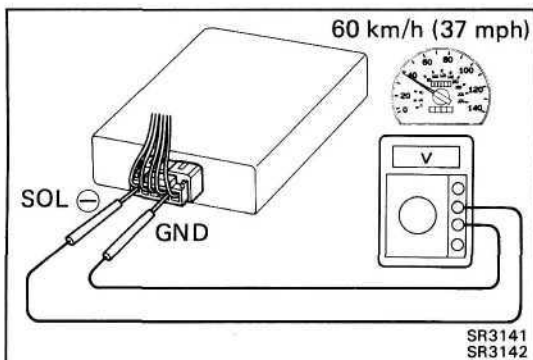
Power Steering ECU**1. JACK UP VEHICLE AND SUPPORT IT ON STANDS****2. REMOVE LH COWL SIDE TRIM**

HINT: Do not disconnect the ECU connector.

**3. START ENGINE****4. MEASURE VOLTAGE OF ECU**

- (a) Using a voltmeter, measure the voltage between ECU terminals GND and SOL 0 while the engine is idling.

Standard voltage: 0.28 - 0.38 V



- (b) Place the transmission in gear and while traveling at about 60 km/h (37 mph), measure the voltage between ECU terminals GND and SOL 0.

Standard voltage: Voltage measure in (a) above, minus 0.13 - 0.21 V

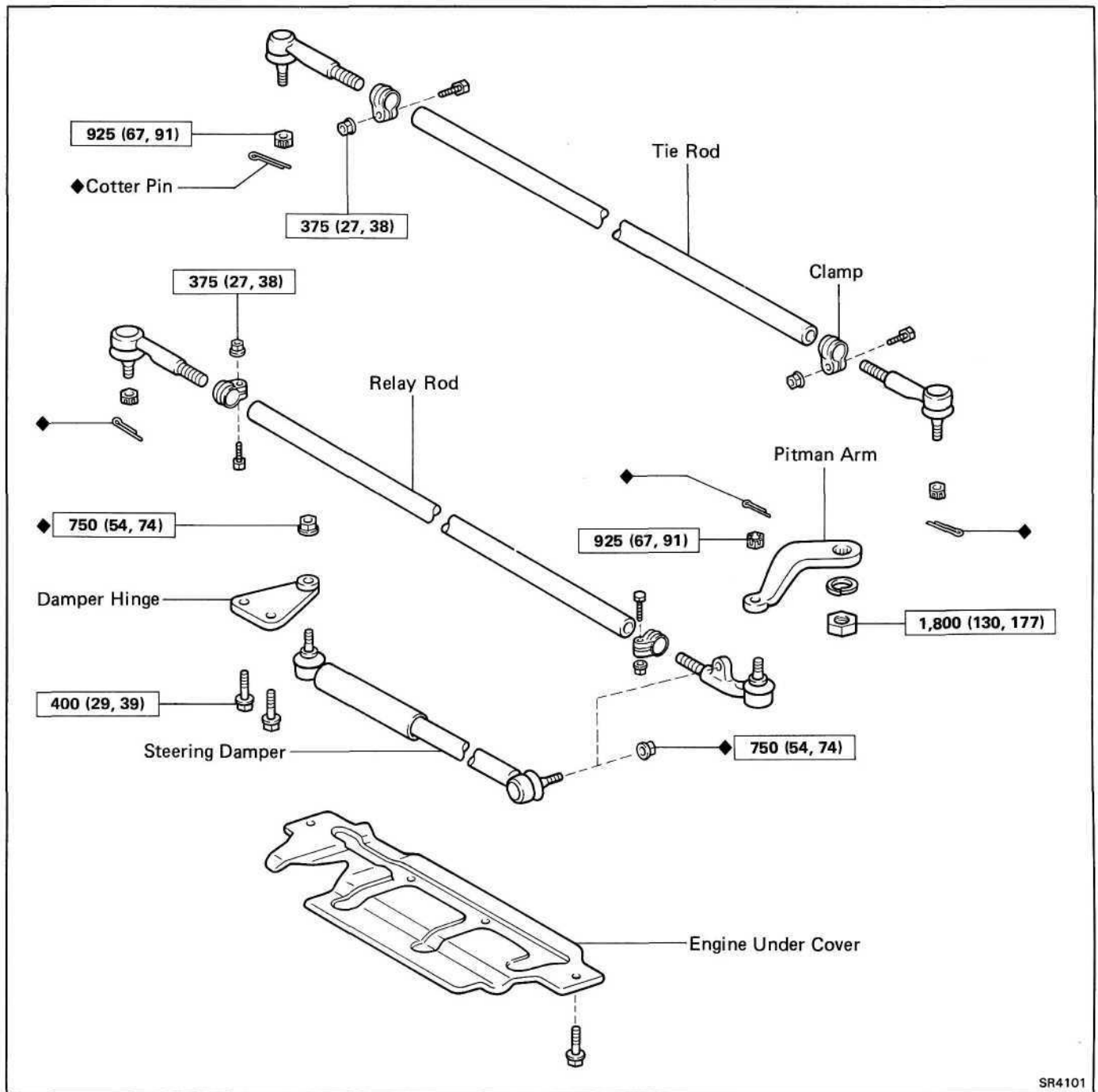
If no voltage, try another ECU.

5. INSTALL LH COWL SIDE TRIM**6. LOWER VEHICLE**

STEERING LINKAGE

REMOVAL AND INSTALLATION OF STEERING LINKAGE

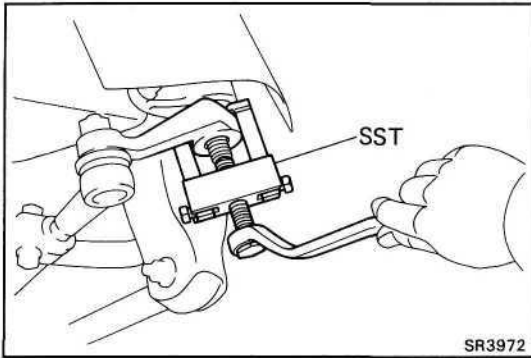
Remove and install the parts as shown.



SR4101

HINT:

- When connecting the ball stud to the arm or rod, remove the grease on the joint surfaces.
- After torquing the ball stud nut to specified torque, advance the nut just enough to insert the cotter pin.
- After installing any of the steering linkage components, check the front wheel alignment and side slip. (See page SA-3)



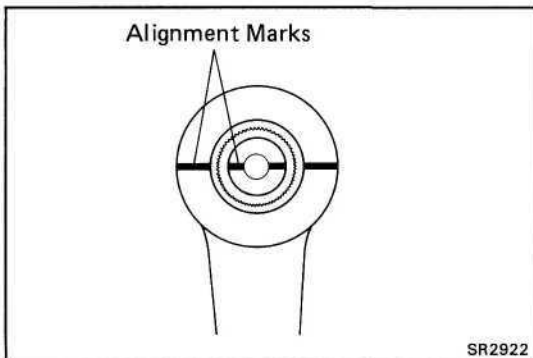
(MAIN POINTS OF REMOVAL AND INSTALLATION)

1. DISCONNECT AND CONNECT PITMAN ARM FROM/TO SECTOR SHAFT

- Loosen the pitman arm nut.
- Using SST, disconnect pitman arm from sector shaft.

SST 09628-62011

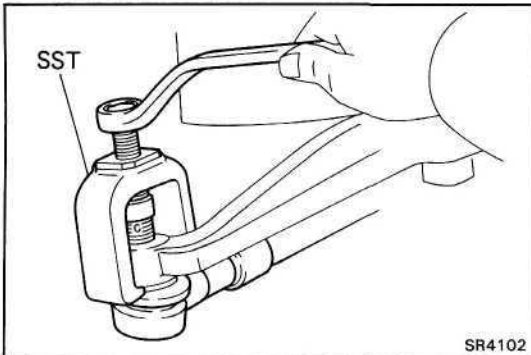
- When connecting, align the alignment marks on the pitman arm and the sector shaft, and install the spring washer and nut.



2. DISCONNECT RELAY ROD FROM PITMAN ARM

Using SST, disconnect the pitman arm from the relay rod.

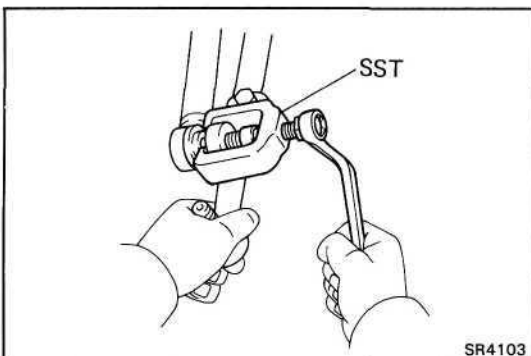
SST 09611-22012



3. DISCONNECT STEERING DAMPER FROM RELAY ROD

Using SST, disconnect the steering damper from the relay rod.

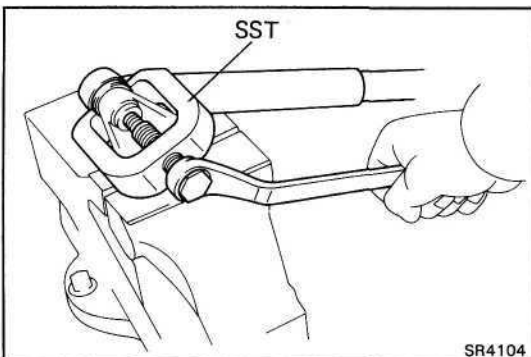
SST 09611-22012

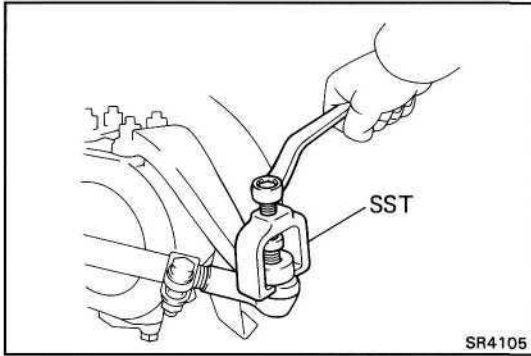


4. DISCONNECT STEERING DAMPER FROM DAMPER HINGE

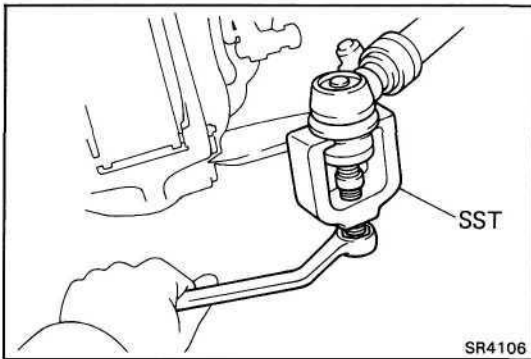
- Remove the damper with hinge.
- Using SST, disconnect the damper from the hinge.

SST 09610-55012

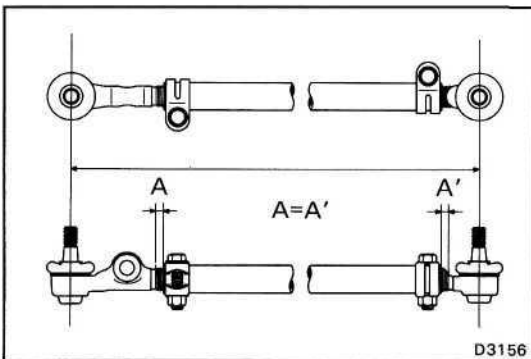




- 5. DISCONNECT RELAY ROD FROM KNUCKLE ARM**
Using SST, disconnect relay rod from knuckle arm.
SST 09611-22012



- 6. DISCONNECT TIE ROD FROM KNUCKLE ARM**
Using SST, disconnect tie rod from knuckle arm.
SST 09611-22012



- 7. IF NECESSARY, REPLACE TIE OR RELAY ROD END**
- (a) Loosen the tie or relay rod end clamp and remove the tie rod end.
 - (b) Turn the rod ends equal amounts into the rod tube. Tie rods should be approximately 1,207 mm (47.51 in.). Relay rods should be approximately 1,076 mm (42.34 in.).
 - (c) The remaining length of threads on both tie rod ends should be equal.
 - (d) Temporarily tighten the tie rod end clamp.