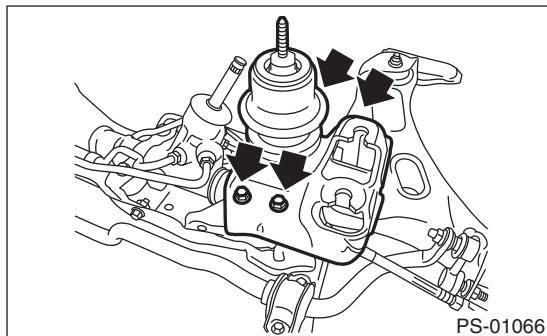


5. Steering Gearbox

A: REMOVAL

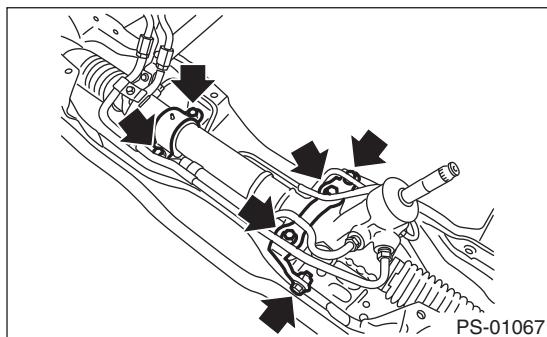
- 1) Remove the cradle. <Ref. to FS-15, REMOVAL, Cradle.>
- 2) Remove the bolt, and then remove the left and right main mounting bracket.



- 3) Remove the bolts and remove the steering gearbox.

CAUTION:

Be careful not to damage the steering boot.



B: INSTALLATION

- 1) Install in the reverse order of removal.

Tightening torque:

<Ref. to PS-4, COMPONENT, General Description.>

<Ref. to FS-3, COMPONENT, General Description.>

- 2) Inspect the wheel alignment and adjust if necessary.

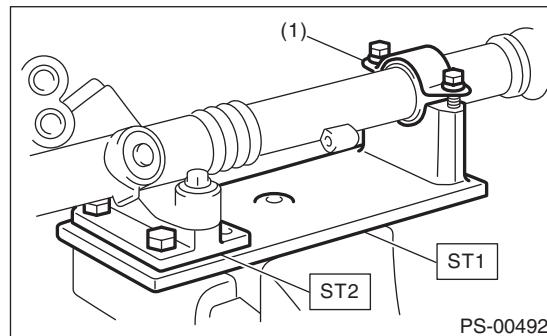
C: DISASSEMBLY

- 1) Disconnect the four pipes from steering body and control valve housing.
- 2) Secure the gearbox removed from vehicle in a vise using ST.

ST1 926200000 STAND
ST2 34199AG000 BOSS D

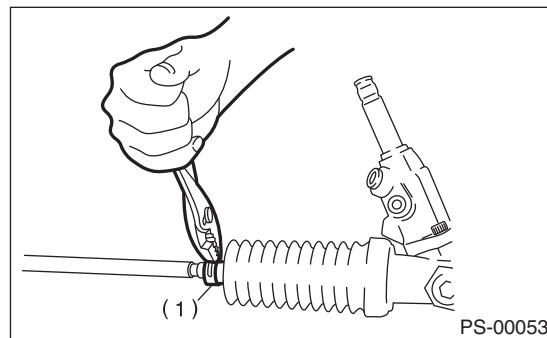
CAUTION:

Secure the gearbox assembly in a vise using ST as shown. Do not affix the gearbox to the vice without this ST.



(1) Clamp

- 3) Remove the tie-rod end and lock nut from gearbox.
- 4) Remove the clip of boot outside using the plier, and then slide the boot to the tie-rod end side.

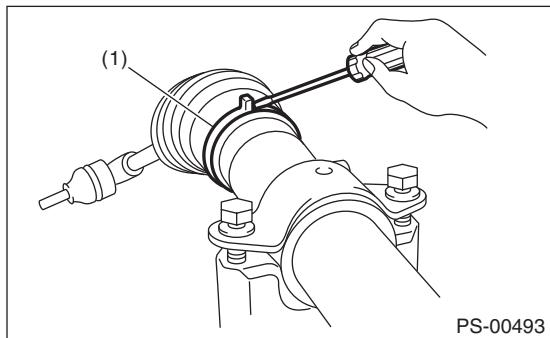


(1) Clip

- 5) Using a flat tip screwdriver, remove the band from boot.

NOTE:

Replace the boot if there is damage, cracks or deterioration.

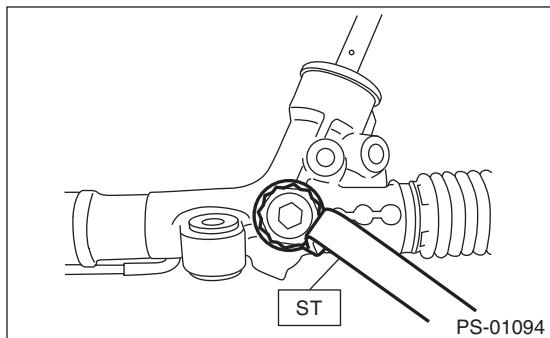


PS-00493

(1) Band

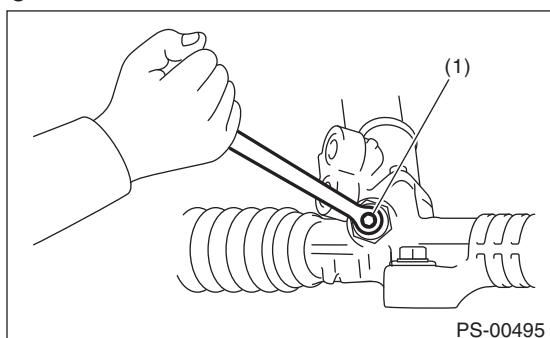
6) Using the ST, loosen the lock nut.

ST 34199AJ000 SPECIAL TOOL CPS LHD



PS-01094

7) Tighten the adjusting screw until it can no longer be tightened.



PS-00495

(1) Adjusting screw

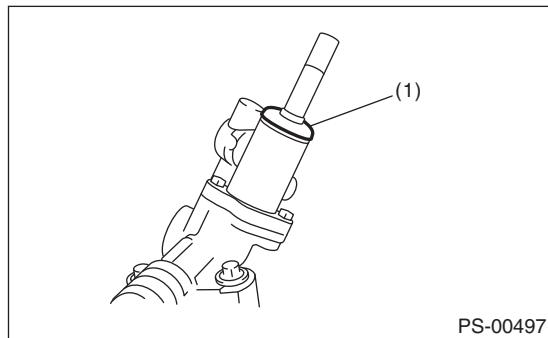
8) Remove the tie-rod.

9) Loosen the adjusting screw, and remove the spring and sleeve.

10) Clean any dirt adhered to the input shaft. Remove the dust cover, paying attention not to scratch the housing or input shaft and not to allow foreign matter to enter gearbox interior.

CAUTION:

Roll a vinyl tape around the input shaft spline to avoid scratching the dust cover.

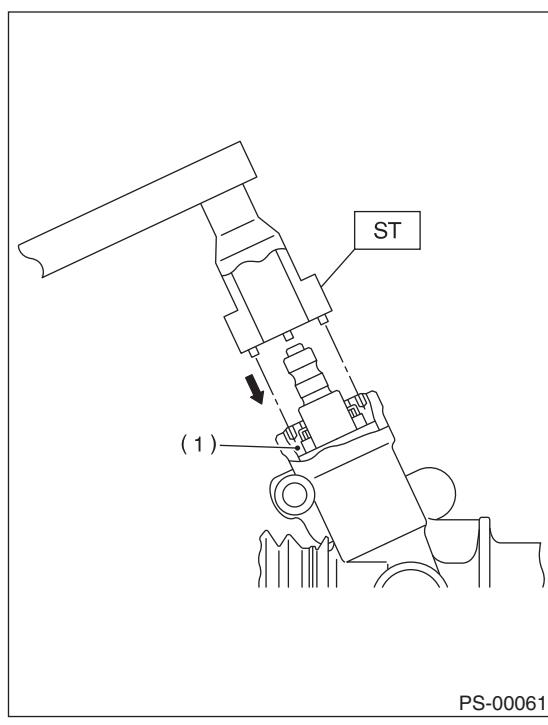


PS-00497

(1) Dust cover

11) Align the ST pin with plug hole to install. Rotate the ST counterclockwise to remove plug.

ST 34199AE090 PLUG WRENCH



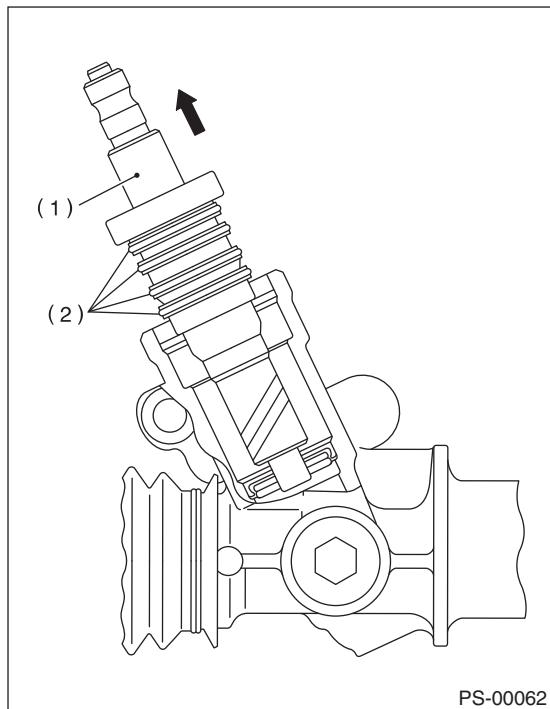
PS-00061

(1) PLUG

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

12) Remove the valve assembly paying attention not to scratch the seal ring or valve housing inner surfaces.

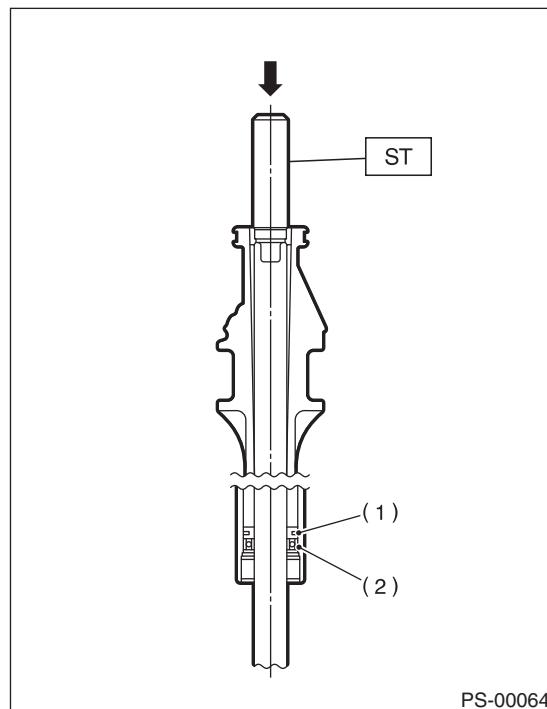


(1) Valve ASSY

(2) Seal ring

NOTE:

Block the pipe connection of steering body to prevent fluid from flowing out.



(1) Rack piston

(2) Outer side oil seal

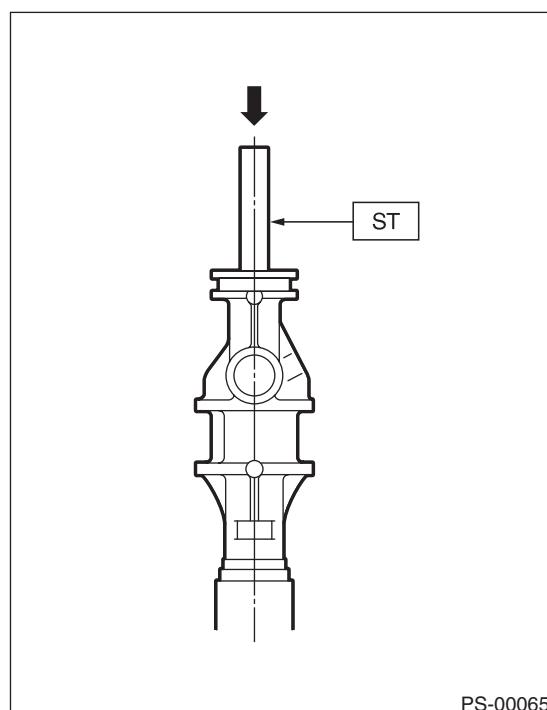
13) Remove the holder.

14) Attach the ST to the pinion housing side of the rack, and push out the rack together with the outer side oil seal.

ST 34199FE000 INSTALLER & REMOVER

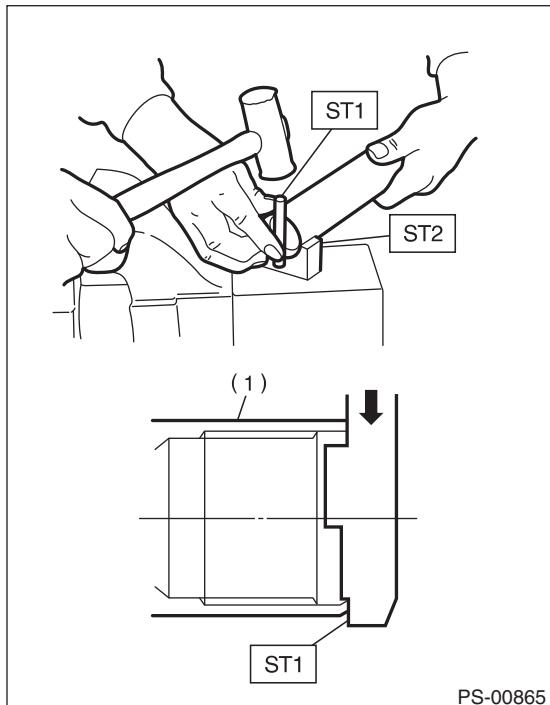
15) Insert the ST from the valve side and press the back-up ring and oil seal out.

ST 34199FE010 REMOVER



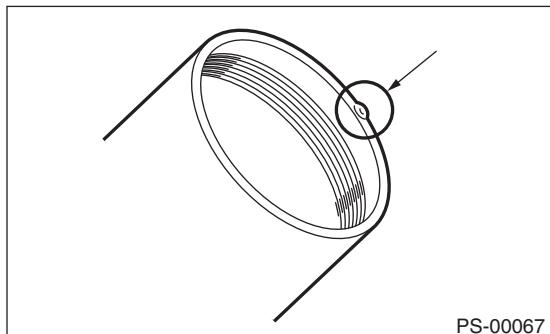
16) Using ST1 and ST2, repair the crimped portion of cylinder.

ST1 34099FA080 PUNCH
ST2 34199FE020 BASE



(1) Cylinder

17) If the cylinder edge is deformed in a convex shape, repair using an oil stone.

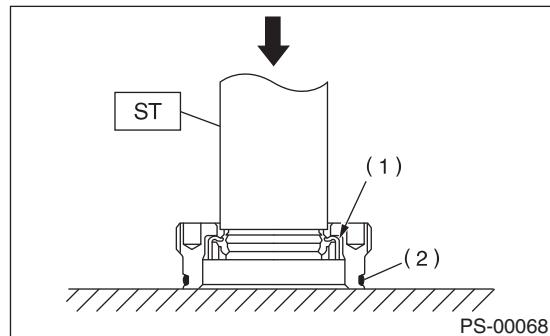


18) Using the ST, remove the oil seal and push out from the plug.

ST 34199AE100 OIL SEAL PLUG REMOVER

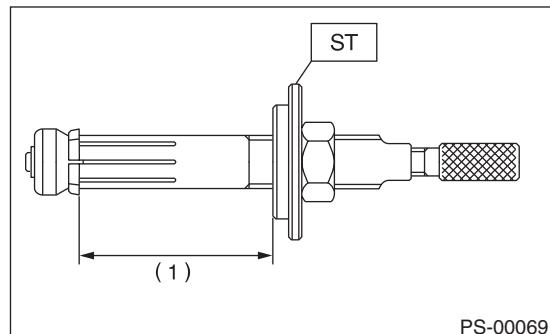
NOTE:

Do not apply force on the plug edge surface.



(1) Oil seal
(2) O-ring

19) Set the ST at a size shown in the figure.
ST 34199AE120 GEARBOX OIL SEAL REMOVER

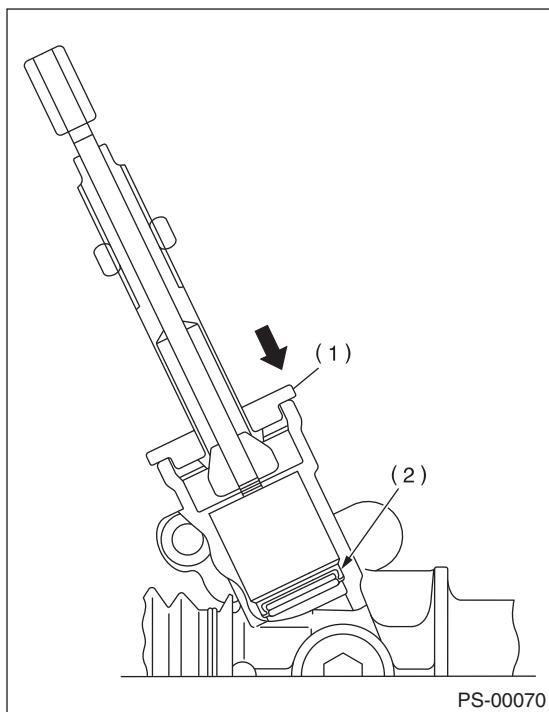


(1) 70 mm (2.76 in)

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

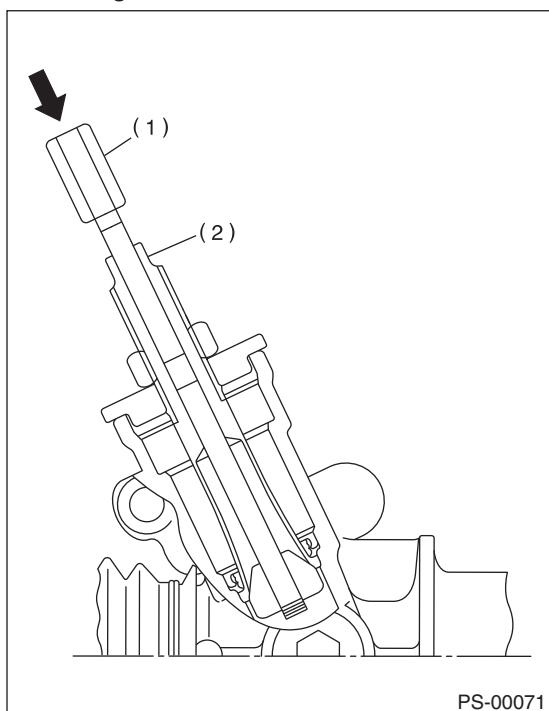
20) Set the stopper to gearbox, then insert the tip of the ST to the gearbox.



(1) STOPPER

(2) Oil seal

21) By fixing the 2-surface widths, press-in the rod while rotating it and catch the oil seal.



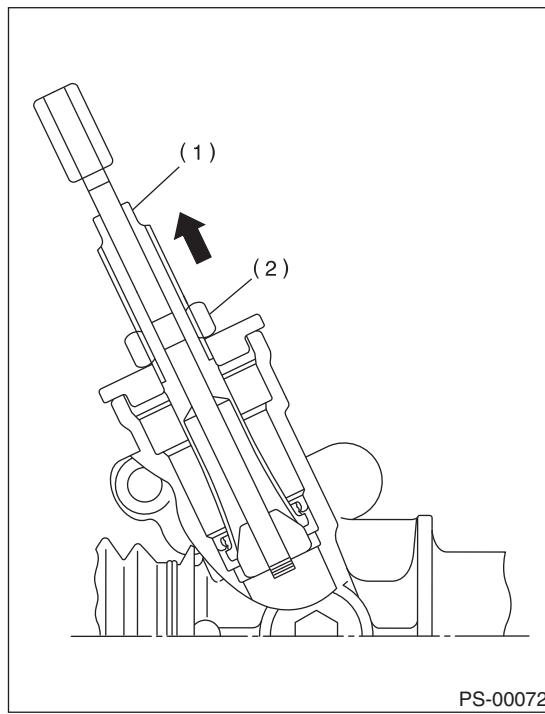
(1) Rod

(2) 2-surface widths

22) While fixing the 2-surface widths, pull out the oil seal by rotating nut.

CAUTION:

Take care not to scratch the gearbox inner surface.



(1) 2-surface widths

(2) Nut

D: ASSEMBLY

1) Apply a coat of grease to the inside and outside of the new oil seal.

Steering grease:

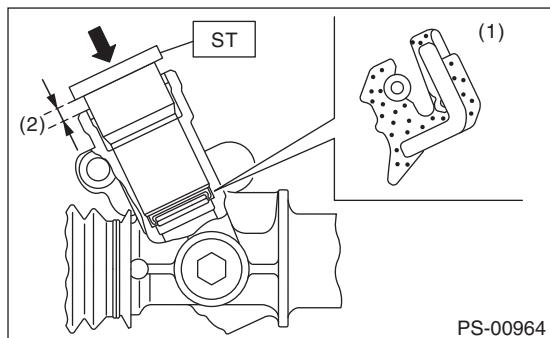
VALIANT GREASE M2

2) Verify the direction of the oil seal and installation position. Using the ST and a press, press-fit the oil seal into the gearbox.

CAUTION:

- Make sure to press fit the oil seal in all the way.
- The gap between the gearbox end face and the ST is to be approximately 4 mm (0.157 in) after press fitting.

ST 34199AE130 GEARBOX OIL SEAL INSTALLER



(1) Oil seal
(2) 4 mm (0.157 in)

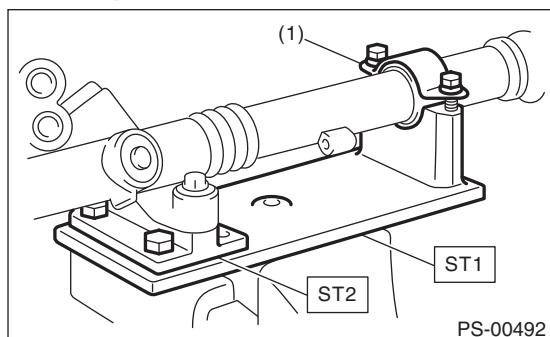
3) Attach the steering body to ST as shown in the figure. Apply a coat of grease to needle bearing.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

CAUTION:

Make sure the needle bearing is free from defects. If it is faulty, replace the steering body with a new part.



(1) Clamp

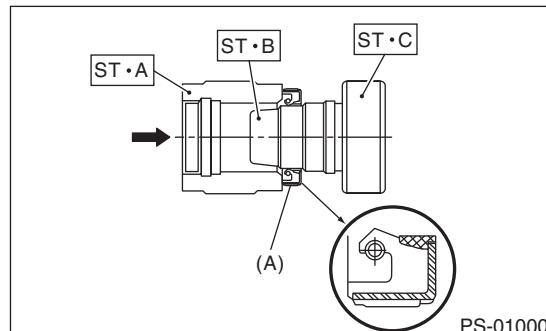
4) Using the ST A and ST B, attach the oil seal to ST C.

ST 34199FE040 INSTALLER A, B, C

- INSTALLER A: 34199FE070
- INSTALLER B: 34199FE080
- INSTALLER C: 34199FE090

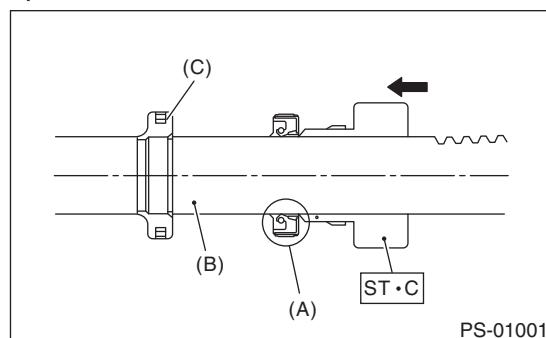
NOTE:

Face the oil seal in the direction as shown in the figure.



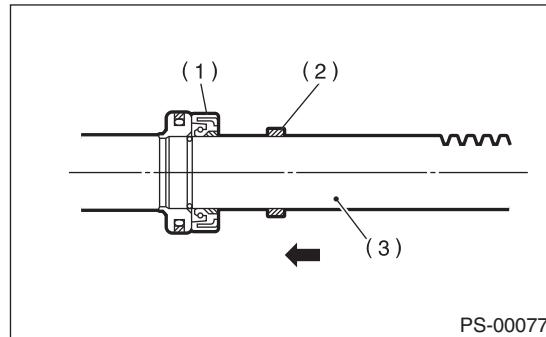
(A) Oil seal

5) Insert the ST C with oil seal assembled from the gear side of rack. Remove the oil seal from ST C near piston, and then remove the ST C from rack.



(A) Oil seal
(B) Rack
(C) Piston

6) Install the back-up washer from the gear side of rack.



(1) Oil seal
(2) Back-up washer
(3) Rack

Steering Gearbox

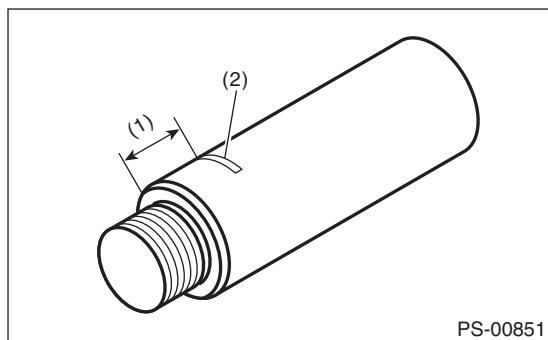
POWER ASSISTED SYSTEM (POWER STEERING)

7) Apply a coat of grease to the grooves in rack, sliding surface of sleeve and sealing surface of piston. Then insert the rack into steering body from cylinder side.

8) Temporarily tighten the holder to gearbox cylinder.

9) Put a mark on a location of 9 mm (0.35 in) from the ST end surface as shown in the figure.

ST 34199FE000 INSTALLER & REMOVER

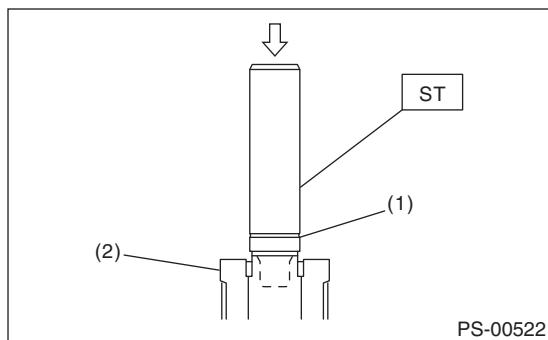


(1) 9 mm (0.35 in)
(2) Place a mark

10) Set the ST to the end of rack.

ST 34199FE000 INSTALLER & REMOVER

11) Using a press, press-fit until the mark on ST is aligned to the end surface of holder.



(1) Mark
(2) HOLDER

12) Remove the ST and holder.

13) Insert the outer side oil seal to the rack in the same procedure as step 4) to 5).

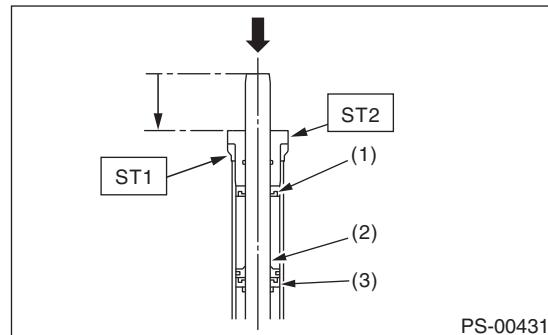
ST 34199FE040 INSTALLER A, B, C

- INSTALLER A: 34199FE070
- INSTALLER B: 34199FE080
- INSTALLER C: 34199FE090

14) Make the ST2 pass through the rack, and then press in the rack and ST2 using a press.

Press in the outer side oil seal until the ST1 and ST2 comes into contact with each other and the rack end surface is aligned to the end surface of the ST2.

ST1 34199FE050 GUIDE
ST2 34199FE060 INSTALLER



PS-00431

(1) Outer side oil seal
(2) Rack piston
(3) Inner side oil seal

15) Attach a new holder on the cylinder side of the steering body.

Tightening torque:

75 N·m (7.6 kgf-m, 55.3 ft-lb)

16) Using the ST, crimp one location less than 3 mm (0.12 in) from the holder.

Steering Gearbox

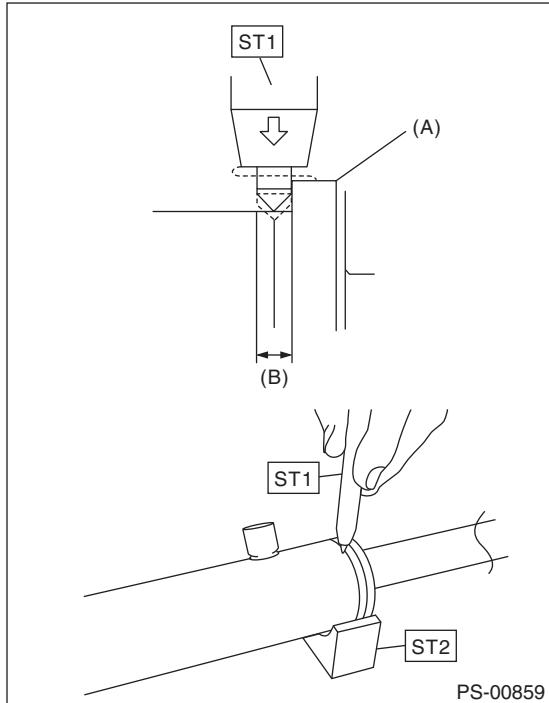
POWER ASSISTED SYSTEM (POWER STEERING)

CAUTION:

Be careful not to deform the holder.

ST1 34099FA060 PUNCH HOLDER

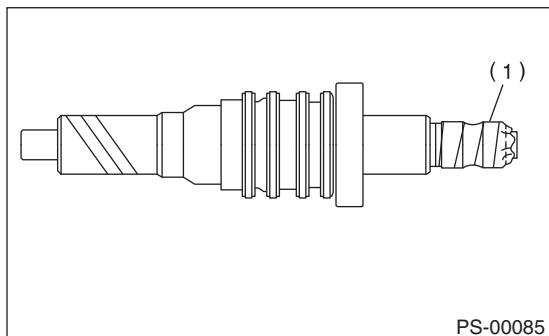
ST2 34199FE020 BASE



(A) HOLDER

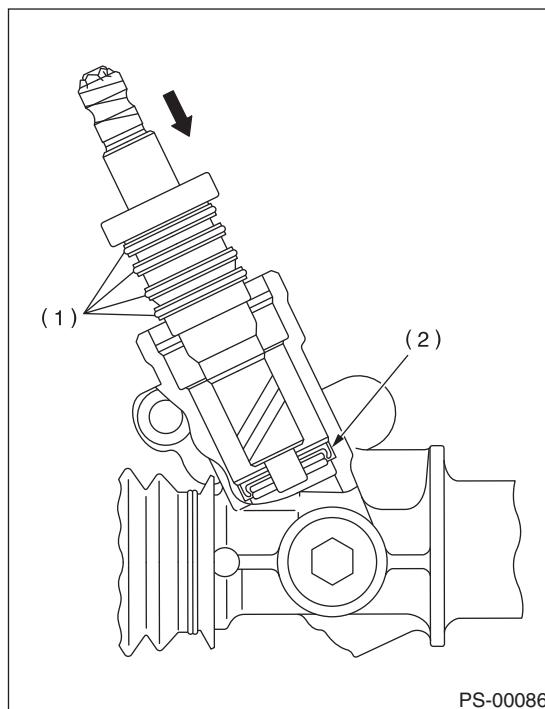
(B) 3 mm (0.12 in)

17) Roll a vinyl tape on the serration portion of valve assembly, and then apply grease on the tape surface.



(1) Vinyl tape

18) Apply a coat of grease on the gear teeth of the valve assembly, and then attach the valve assembly taking care not to scratch oil seal and seal ring.



(1) Seal ring

(2) Oil seal

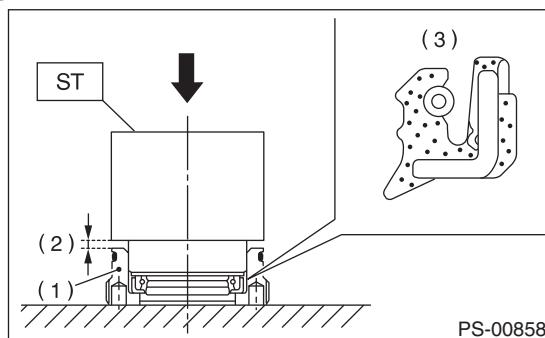
19) Replace the O-rings of plug circumference with new O-rings.

20) Apply grease on the oil seal circumference, and then press it into the plug using ST and a press.

ST 34199AE110 OIL SEAL PLUG INSTALLER

CAUTION:

- Install the oil seal paying attention to correct direction.
- Make sure to press fit the oil seal in all the way.
- The gap between the plug and the ST is to be approximately 1 mm (0.039 in) after press fitting.



(1) PLUG

(2) 1 mm (0.039 in)

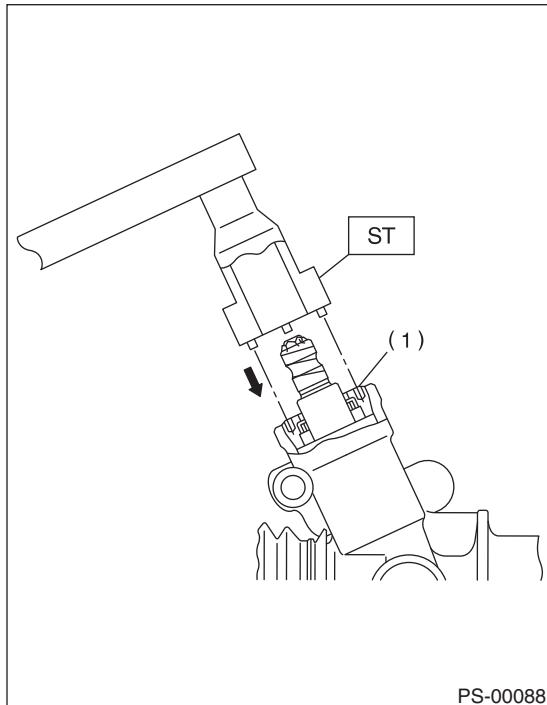
(3) Oil seal

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

21) Attach the plug using ST.
ST 34199AE090 PLUG WRENCH

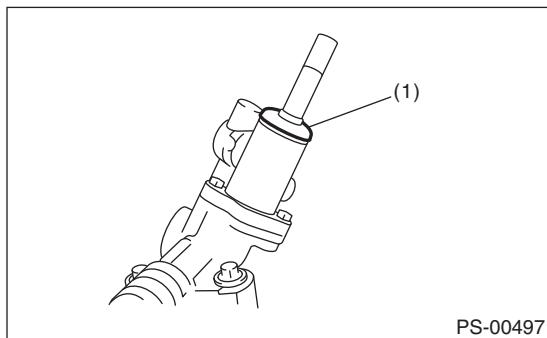
Tightening torque:
64 N·m (6.5 kgf-m, 47.2 ft-lb)



PS-00088

(1) PLUG

22) Install the dust cover, and remove the vinyl tape.



PS-00497

(1) Dust cover

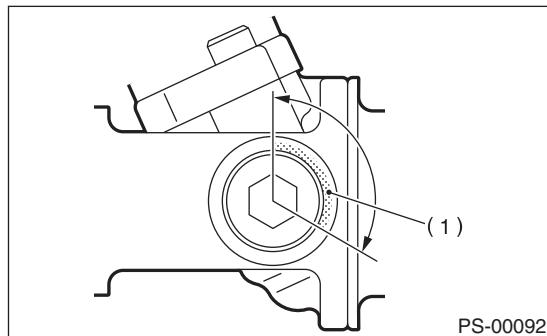
23) Temporarily tighten the tie-rod to the rack end, and then operate the rack from lock to lock for two or three times to make it fit in.

CAUTION:

If operating the rack from lock to lock without installing tie-rods, it may damage the oil seal. Always install the tie-rods LH and RH.

24) Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

Liquid gasket:
THREE BOND 1141 (Part No. 004403006)

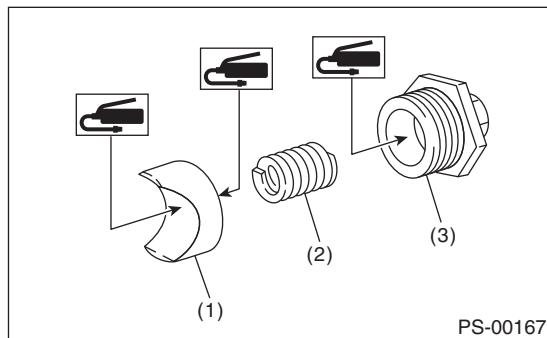


PS-00092

(1) Apply liquid gasket to 1/3 or more of the entire perimeter.

25) Apply a coat of grease to the sliding surface of sleeve and seating surface of spring, and then insert the sleeve into steering body.

Charge the adjusting screw with grease, and then insert the spring into adjusting screw. Then install on the steering body.



PS-00167

(1) Sleeve
(2) Spring
(3) Adjusting screw

26) Tighten the adjusting screw to the specified torque, then loosen it.

Tightening torque:
9.8 N·m (1.0 kgf-m, 7.2 ft-lb)

27) Tighten the adjusting screw to the specified torque, then loosen it.

Tightening torque:
4.9 N·m (0.5 kgf-m, 3.6 ft-lb)

28) Tighten the adjusting screw to the specified torque, then loosen it approx. 30°.

CAUTION:

Do not loosen by 37° or more.

Tightening torque:
4.9 N·m (0.5 kgf-m, 3.6 ft-lb)

29) Remove the tie-rod.

30) Check that play and looseness are within specifications. <Ref. to PS-34, SERVICE LIMIT, INSPECTION, Steering Gearbox.>

31) Install the lock nut. While holding the adjusting screw with wrench, tighten the lock nut using ST. ST 34199AJ000 SPECIAL TOOL CPS LHD

Tightening torque (lock nut):
39 N·m (4.0 kgf-m, 28.9 ft-lb)

NOTE:
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

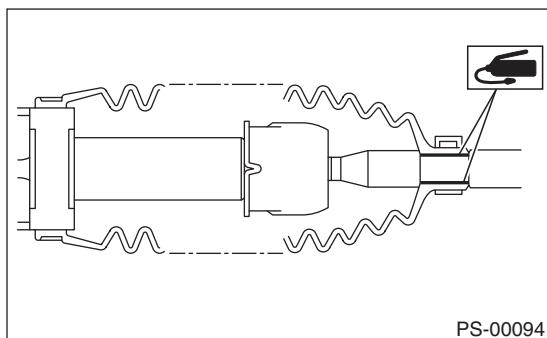
32) Install the tie-rod into rack.

Tightening torque:
90 N·m (9.1 kgf-m, 66.4 ft-lb)

NOTE:
Check the mating face of rack and tie-rod for foreign matter such as dust etc.

33) Apply a coat of grease to the tie-rod groove, and then install the boot to the housing.

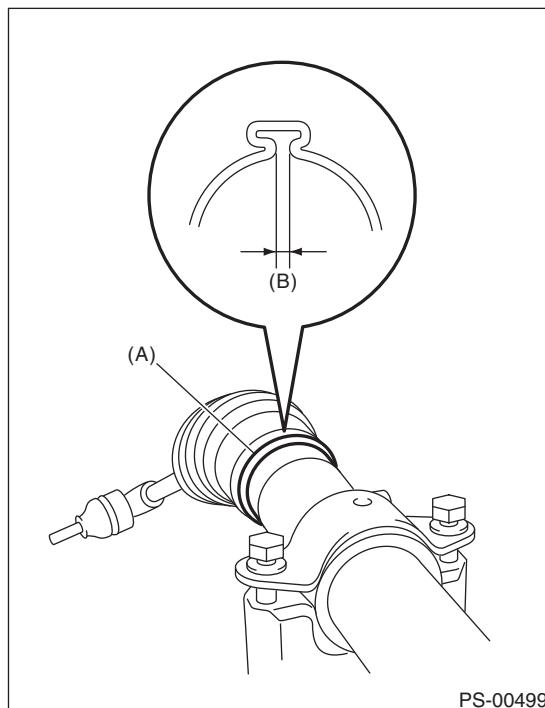
NOTE:
Make sure that the boot is installed without unusual inflation or deflation.



PS-00094

34) Using boot clamp pliers, crimp it so that the clearance of the boot band crimping section becomes 2 mm (0.08 in) or less.

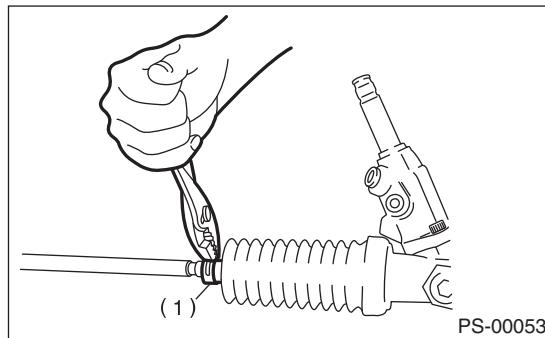
NOTE:
Use a new boot band.



PS-00499

(A) Boot band
(B) 2 mm (0.08 in) or less

35) Fix the boot end with small clip.



PS-00053

(1) Clip

36) After installing, check that the boot end is installed to the groove of the tie-rod.

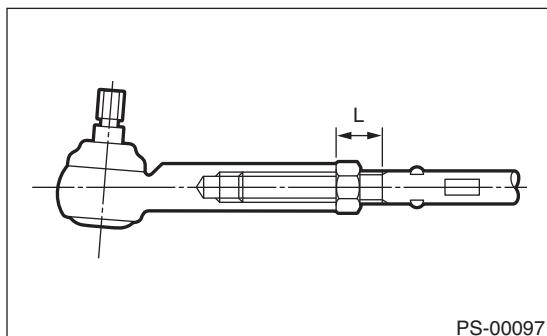
37) If the tie-rod end has been removed, screw in lock nut and tie-rod end to the screwed portion of tie-rod, and tighten the lock nut temporarily in a position as shown in the figure.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

Installed tie-rod length L:

24 mm (0.9 in)

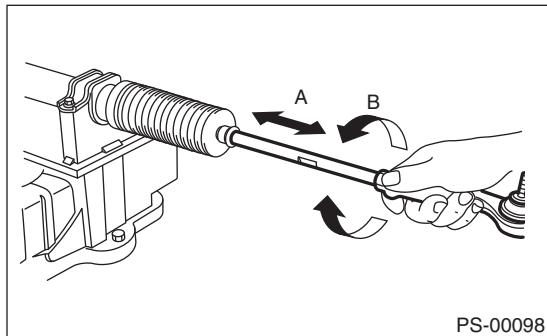


38) Inspect the gearbox as follows:

“A” Holding the tie-rod end, repeat lock to lock several times as quickly as possible.

“B” Holding the tie-rod end, turn it slowly at a radius several times as large as possible.

Finally, make sure that the boot is installed in the specified position without inflating.



39) Remove the gearbox from ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

40) Attach the 4 pipes to the steering body and control valve housing.

E: INSPECTION

1. BASIC INSPECTION

1) Clean all the disassembled parts, and check for wear, damage or any other faults, then repair or replace as necessary.

2) When disassembling, check the inside of gearbox for water. If any water is found, carefully check the boot for damage, input shaft dust seal, adjusting screw and boot clips for poor sealing. If faulty, replace with new parts.

No.	Parts	INSPECTION	Corrective action
1	Input shaft	(1) Bent input shaft (2) Damage on serration	If the bend or damage is excessive, replace the entire gearbox.
2	Dust seal	(1) Crack or damage (2) Wear	If the outer wall slips, the lip is worn out or damage is found, replace it with a new part.
3	Rack & pinion	Poor mating of rack with pinion	(1) Adjust the backlash properly. By measuring the turning torque of the gearbox and sliding resistance of rack, check if the rack & pinion engage uniformly and smoothly with each other. (Refer to "Service limit".) (2) Pull out the entire rack to allow viewing of the teeth, and check for damage. When abnormality is found in either (1) or (2), replace the entire gearbox.
4	Gearbox unit	(1) Bending of the rack shaft (2) Bending of the cylinder portion (3) Crack or damage on the cast iron portion	Replace the gearbox with a new part.
		(4) Wear or damage on rack bushing	If the free play of rack shaft in radial direction is out of the specified range, replace the gearbox with new part. (Refer to "Service limit".)
		(5) Wear on input shaft bearing	If the free play of input shaft in radial and axial direction is out of the specified range, replace the gearbox with a new part. (Refer to "Service limit".)
5	Boot	Crack, damage or deterioration	Replace.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration of dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipe	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

2. SERVICE LIMIT

Make a measurements as follows. If it exceeds the specified service limits, adjust or replace.

NOTE:

When making a measurement, vise the gearbox using ST. Never vise the gearbox by inserting aluminum plates etc. between vise and gearbox.

ST1 926200000 STAND
ST2 34199AG000 BOSS D

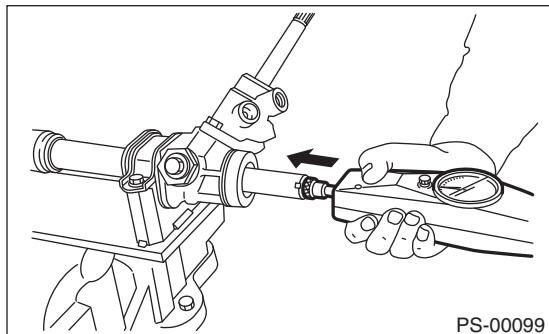
Sliding resistance of rack shaft:

Service limit

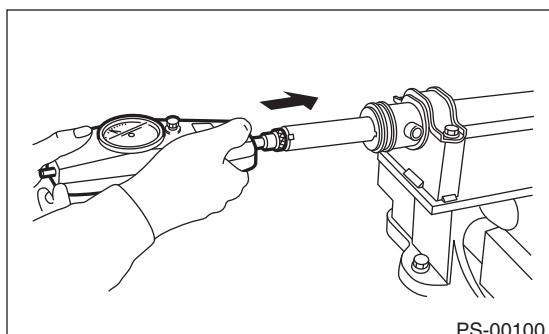
314 N (32 kgf, 71 lbf) or less

Difference between right and left sliding resistance:

20% or less



PS-00099



PS-00100

3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

Right-turn steering:

Service limit

Direction ↘ ↗

0.4 mm (0.016 in) or less

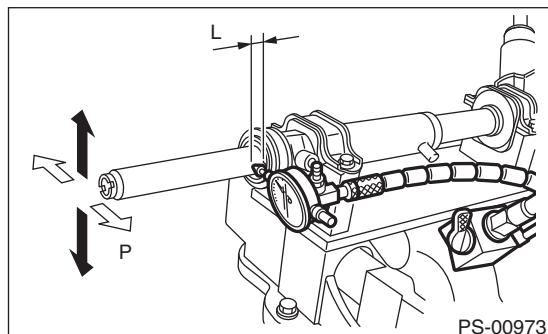
Direction ↙ ↖

0.6 mm (0.024 in) or less

Condition

L: 5 mm (0.20 in)

P: 98 N (10 kgf, 22 lbf)



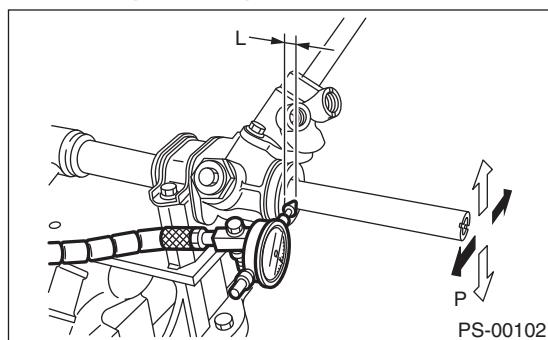
PS-00973

Left-turn steering:

Service limit

Direction ↘ ↗ ↙ ↖

0.4 mm (0.016 in) or less



PS-00102

4. INPUT SHAFT PLAY

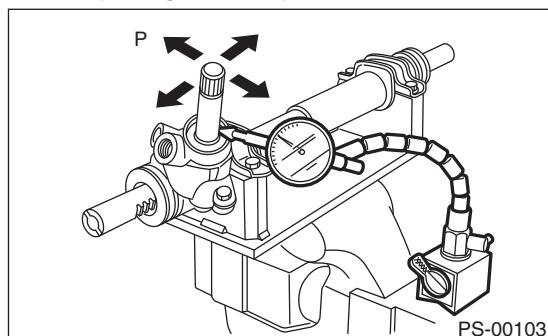
In radial direction:

Service limit

0.18 mm (0.0071 in) or less

Condition

P: 98 N (10 kgf, 22 lbf)



PS-00103

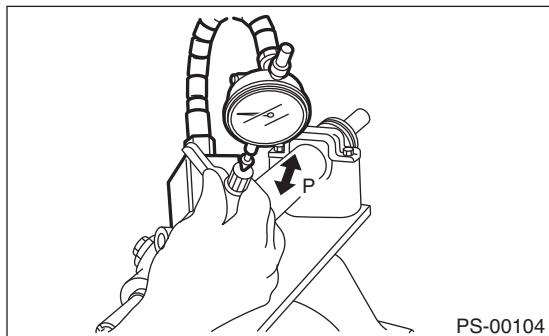
In axial direction:

Service limit

0.27 mm (0.0106 in) or less

Condition

$P: 20 - 49 \text{ N (2 - 5 kgf, 4 - 11 lbf)}$



5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the gearbox turning resistance.

ST 34099PA100 SPANNER

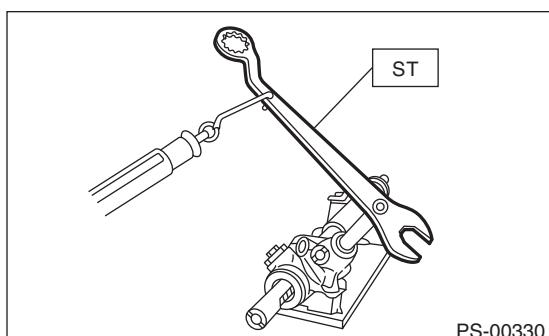
Service limit:

Maximum allowable resistance:

13 N (1.3 kgf, 2.9 lbf) or less

Difference between right and left turning resistance:

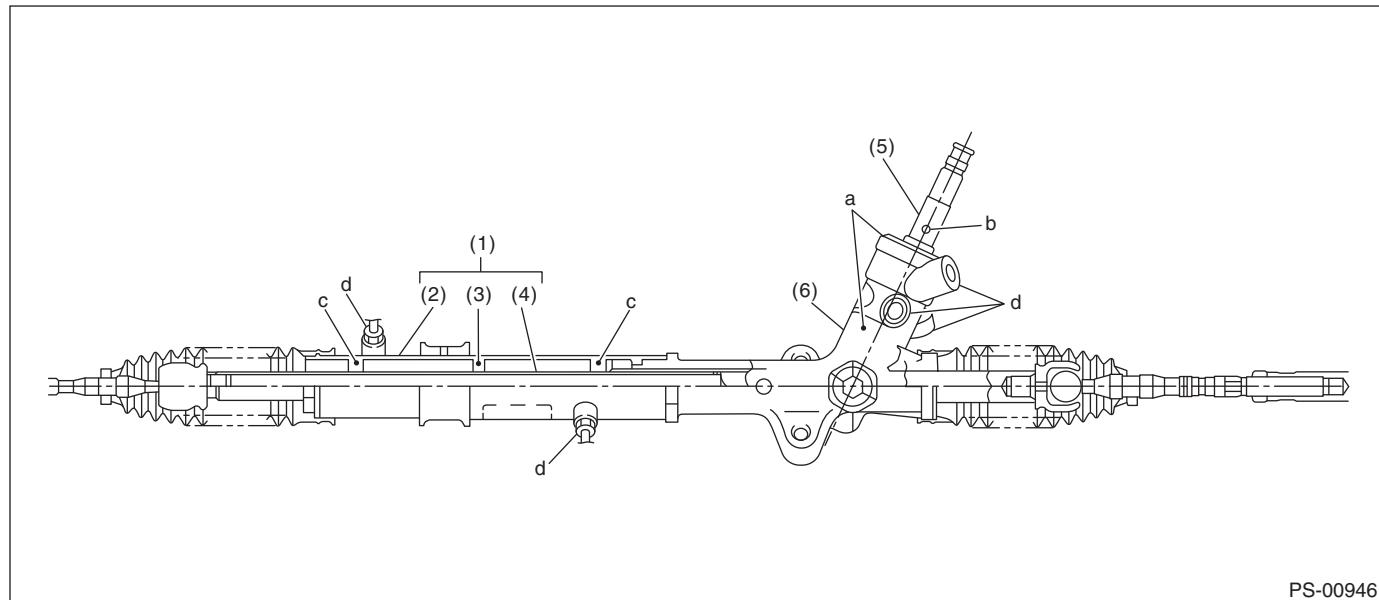
20% or less



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

6. OIL LEAKAGE



PS-00946

(1) Power cylinder

(3) Rack piston

(5) Input shaft

(2) Cylinder

(4) Rack axle

(6) Valve housing

1) Lift up the vehicle.

2) If a fluid leak is found, clean the fluid completely from the suspect area, and turn the steering wheel 30 to 40 times to the left and right from lock to lock, with the engine running, and check again for leaks immediately, and also after a few hours have passed.

3) Cause and solution for oil leakage from "a"

The oil seal is damaged. Replace the valve assembly with a new part.

4) Cause and measure for oil leakage from "b".

The torsion bar O-ring is damaged. Replace the valve assembly with a new part.

5) Cause and measure for oil leakage from "c".

The oil seal is damaged. Replace the oil seal.

6) Cause and solution for oil leakage from "d".

The pipe is damaged. Replace the faulty pipe or O-ring.

F: ADJUSTMENT

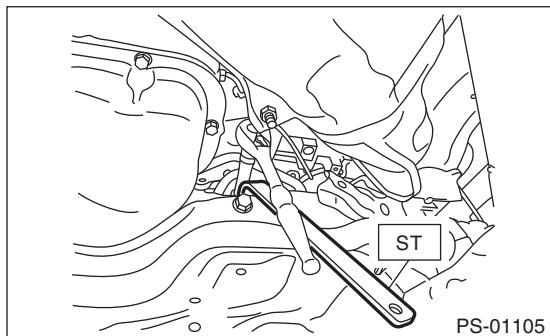
1. GEARBOX BACKLASH ADJUSTMENT (SERVICING ON VEHICLE)

- 1) Using the ST, loosen the lock nut.
- 2) Loosen the adjusting screw using ST, and apply liquid gasket to the entire area of the adjusting screw threads.

ST 34199AJ000 SPECIAL TOOL CPS LHD

Liquid gasket:

THREE BOND 1141 (Part No. 004403006)



- 3) Tighten the adjusting screw to the specified torque, then loosen it.

Tightening torque:

9.8 N·m (1.0 kgf·m, 7.2 ft-lb)

- 4) Tighten the adjusting screw to the specified torque, then loosen it.

Tightening torque:

4.9 N·m (0.5 kgf·m, 3.6 ft-lb)

- 5) Tighten the adjusting screw to the specified torque, then loosen it approx. 30°.

CAUTION:

Do not loosen by 37° or more.

Tightening torque:

4.9 N·m (0.5 kgf·m, 3.6 ft-lb)

- 6) Install the lock nut. While holding the adjusting screw, tighten the lock nut using ST.

Tightening torque (lock nut):

39 N·m (4.0 kgf·m, 28.9 ft-lb)

NOTE:

While tightening the lock nut, hold the adjusting screw not to rotate.

2. FRONT WHEEL ALIGNMENT ADJUSTMENT

- 1) Adjust the front toe.

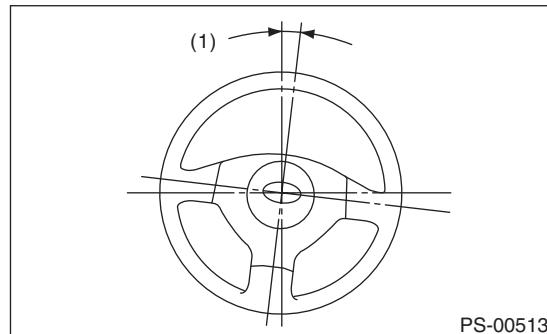
<Ref. to FS-12, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment. >

- 2) Adjust the steering angle of the wheels.

Standard of steering angle:

Model	Inner wheel	Outer wheel
225/50R17 tire	$37.4^{\circ}\pm1.5^{\circ}$	$33.0^{\circ}\pm1.5^{\circ}$
225/45R18 tire	$37.4^{\circ}\pm1.5^{\circ}$	$33.0^{\circ}\pm1.5^{\circ}$
215/50R17 tire	$37.6^{\circ}\pm1.5^{\circ}$	$33.3^{\circ}\pm1.5^{\circ}$
205/60R16 tire	$37.6^{\circ}\pm1.5^{\circ}$	$33.3^{\circ}\pm1.5^{\circ}$
225/60R17 tire	$38.4^{\circ}\pm1.5^{\circ}$	$34.1^{\circ}\pm1.5^{\circ}$
215/70R16 tire	$38.4^{\circ}\pm1.5^{\circ}$	$34.1^{\circ}\pm1.5^{\circ}$

- 3) If the steering wheel spokes are not horizontal when wheels are set in the straight ahead position, or error is more than 5° on the periphery of the steering wheel, correctly re-install the steering wheel.



(1) 5° or less

- 4) If the steering wheel spokes are not horizontal with vehicle set in the straight ahead position after this adjustment, correct it by turning the right and left tie-rods in the opposite direction from each other by the same angle. Also check that there are no abnormal steering force, failure of the steering wheel to return or other faults.