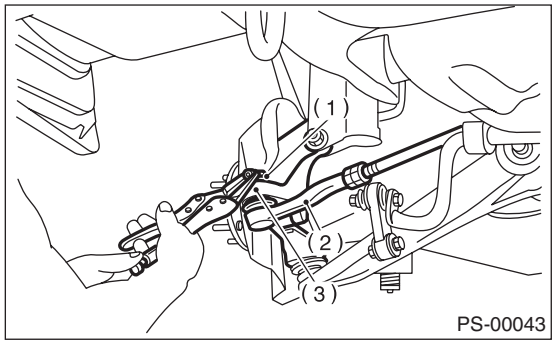
5. Steering Gearbox

A: REMOVAL

1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.
3) Loosen the front wheel nuts.
4) Lift-up the vehicle, and remove the front wheels.
5) Remove the under cover. <Ref. to EI-26, REMOVAL, Front Under Cover.>
6) Remove the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

WARNING:
Be careful not to burn yourself because the exhaust pipe is hot.

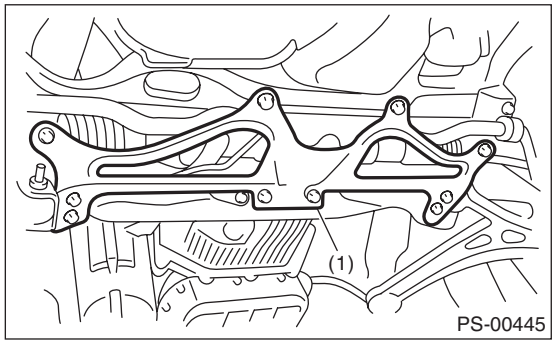
7) After pulling off the cotter pin and removing the castle nut, use a puller to remove the tie-rod end from the knuckle arm.



(1) Castle nut
(2) Tie-rod end
(3) Knuckle arm

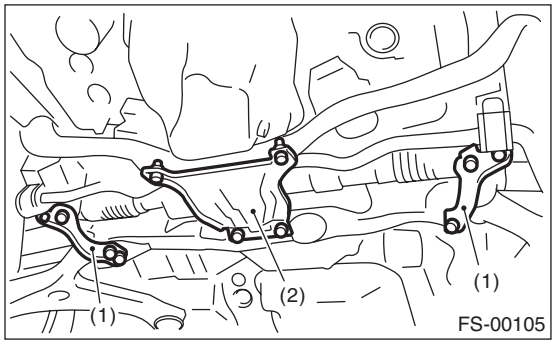
8) Remove the front crossmember support plate, jack-up plate and front stabilizer. <Ref. to FS-14, REMOVAL, Front Stabilizer.>

- Large type



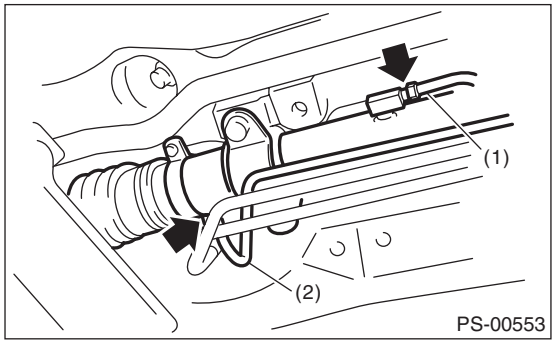
(1) Front crossmember support plate

- Small type



(1) Crossmember support plate
(2) Jack-up plate

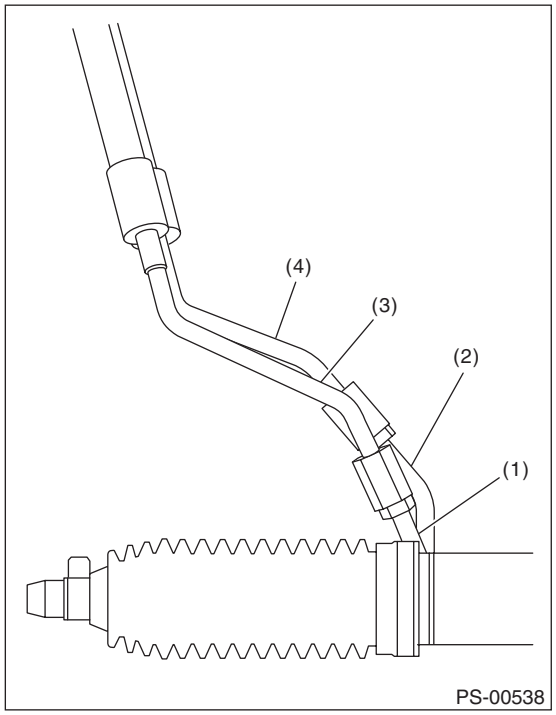
9) Remove the one pipe joint at the center of the gearbox, and connect the vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



(1) Pipe A
(2) Pipe B

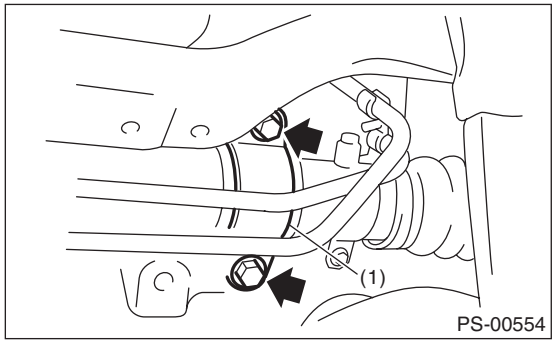
10) Remove the universal joint. <Ref. to PS-15, REMOVAL, Universal Joint.>

11) Disconnect the pipe C from pressure hose first, then disconnect pipe D from the return hose.



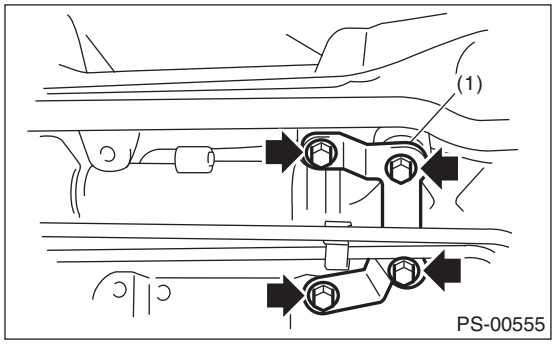
(1) Pipe C
(2) Pipe D
(3) Pressure hose
(4) Return hose

12) Remove the clamp bolts securing the gearbox to the crossmember, and remove the clamp.



(1) Clamp

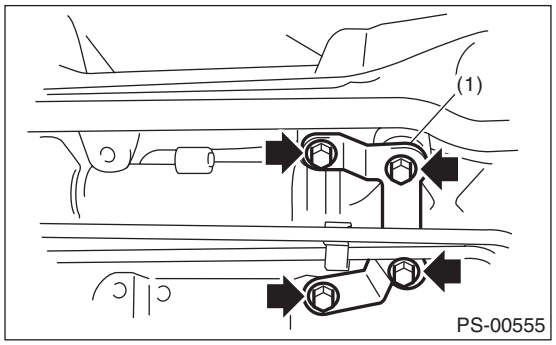
13) Remove the bolts which secure the gearbox bracket, and remove the bracket and gearbox.



(1) Bracket

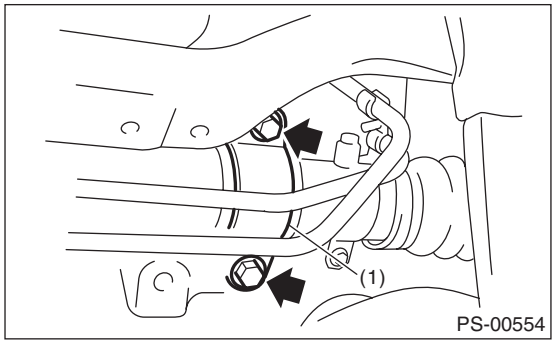
B: INSTALLATION

1) Insert the gearbox into crossmember, being careful not to damage gearbox boot.
2) Install the gearbox and bracket. Temporarily tighten the bolts.



(1) Bracket

3) Insert bolts through the clamp to temporarily tighten the gearbox to the crossmember bracket.



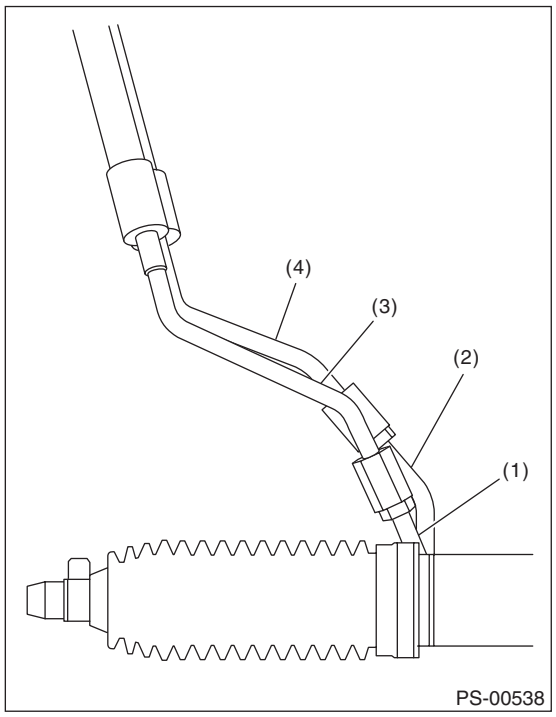
(1) Clamp

4) Tighten the bolts temporarily holding the gearbox clamp and bracket together to the specified torque.

Tightening torque:
60 N·m (6.1 kgf-m, 44.1 ft-lb)

5) Connect pipe D to the return hose, then connect pipe C to the pressure hose.

Tightening torque:
15 N·m (1.5 kgf-m, 10.8 ft-lb)



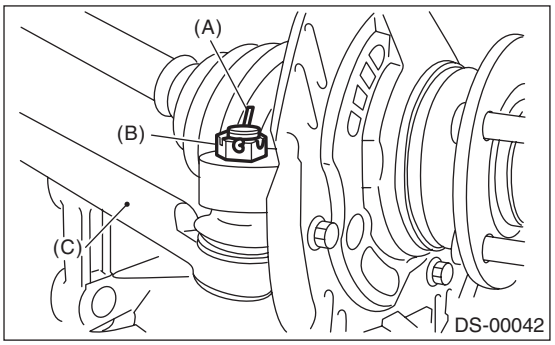
(1) Pipe C
(2) Pipe D
(3) Pressure hose
(4) Return hose

6) Install the universal joint. <Ref. to PS-15, INSTALLATION, Universal Joint.>
7) Connect the tie-rod end and knuckle arm, and tighten with castle nut.

Castle nut tightening torque:
27 N·m (2.75 kgf-m, 19.9 ft-lb)

CAUTION:
When connecting, do not hit the cap at the bottom of tie-rod end with hammer.

8) After tightening the castle nut to the specified tightening torque, tighten it further within 60° until the cotter pin hole is aligned with slot in the nut. Fit the cotter pin into the nut, and then bend the pin to lock.



(A) Cotter pin
(B) Castle nut
(C) Tie-rod end

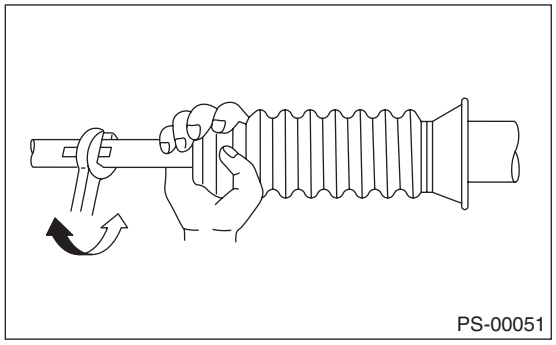
9) Install the front stabilizer. <Ref. to FS-14, INSTALLATION, Front Stabilizer.>
10) Install the front crossmember support plate and jack-up plate.
11) Install the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
12) Install the under cover. <Ref. to EI-26, INSTALLATION, Front Under Cover.>
13) Install the front wheels.
14) Tighten the wheel nuts to the specified torque.

Tightening torque:
90 N·m (9.1 kgf-m, 65.8 ft-lb)
15) Lower the vehicle.
16) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
17) Align the center position of the roll connector. <Ref. to AB-26, ADJUSTMENT, Roll Connector.>
18) Install the steering wheel. <Ref. to PS-14, INSTALLATION, Steering Wheel.>
19) Connect the ground cable to battery.
20) Pour fluid into the oil tank, and bleed air. <Ref. to PS-54, Power Steering Fluid.>
21) Check for fluid leaks.
22) Check the fluid level in oil tank.

23) After adjusting toe-in and steering angle, tighten the lock nut on tie-rod end.

Tightening torque:
85 N·m (8.7 kgf-m, 62.7 ft-lb)

NOTE:
When adjusting toe-in, hold the boot as shown to prevent it from being rotated or twisted. If it becomes twisted, straighten it.



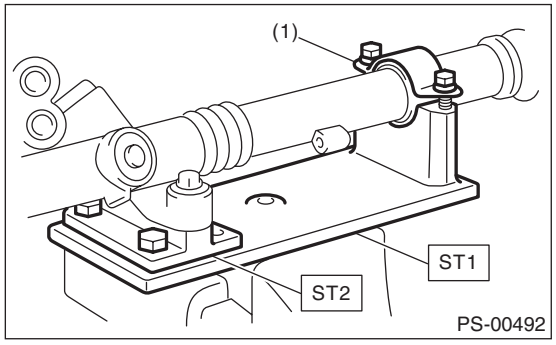
C: DISASSEMBLY

1. RACK HOUSING ASSEMBLY

1) Disconnect the four pipes from gearbox.

NOTE:
Remove the pipes C and D, which are fixed to clamp plate, as a unit.
2) Secure the gearbox removed from vehicle in a vise using ST.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

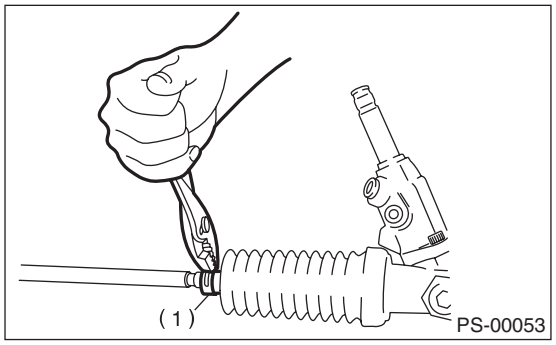
CAUTION:
Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.



(1) Clamp

3) Remove the tie-rod end and lock nut from gearbox.

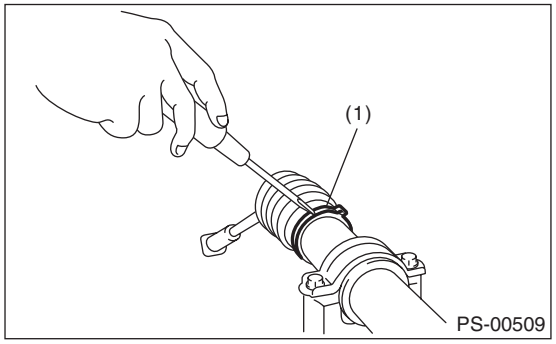
4) Remove the small clip from the boot using pliers, and then move the boot to tie-rod end side.



(1) Clip

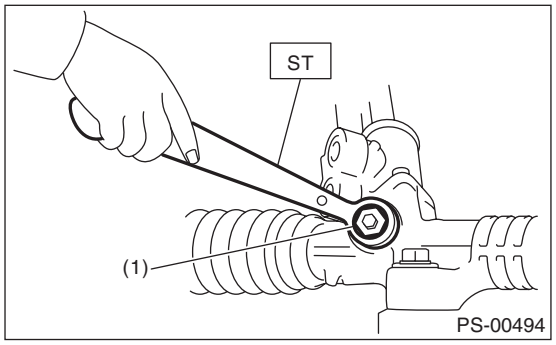
5) Using a flat tip screwdriver, remove the band from boot.

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



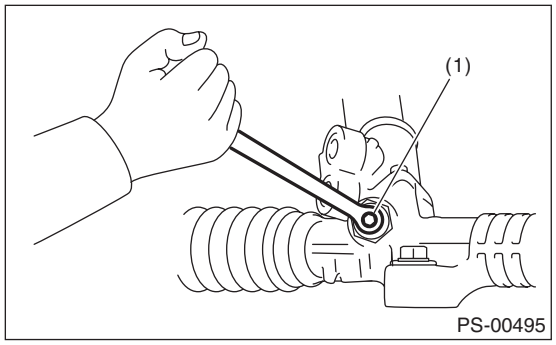
(1) Band

6) Using the ST, loosen the lock nut.
ST 926230000 SPANNER



(1) Lock nut

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

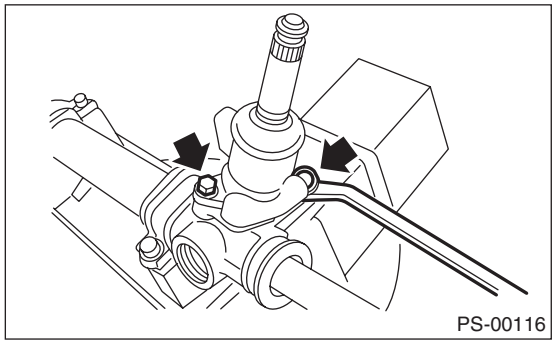


(1) Adjusting screw

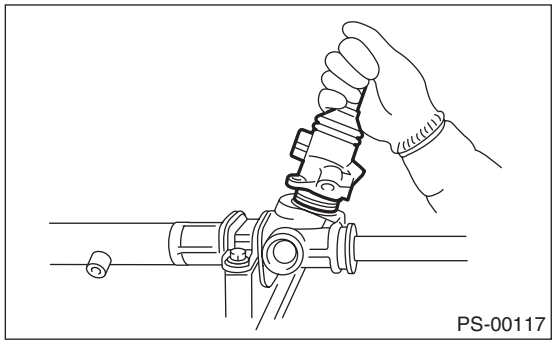
8) Using the ST, remove the tie-rod.
ST 926230000 SPANNER

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

10) Remove the two bolts securing valve assembly.

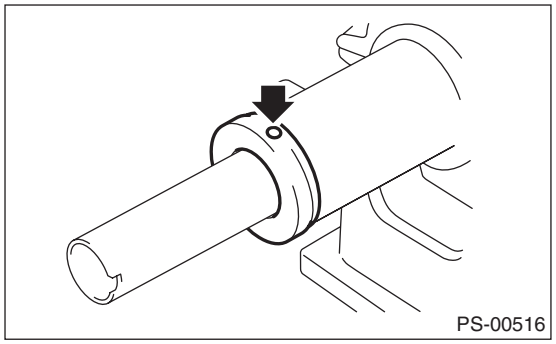


11) Carefully draw out the input shaft and remove the valve assembly.

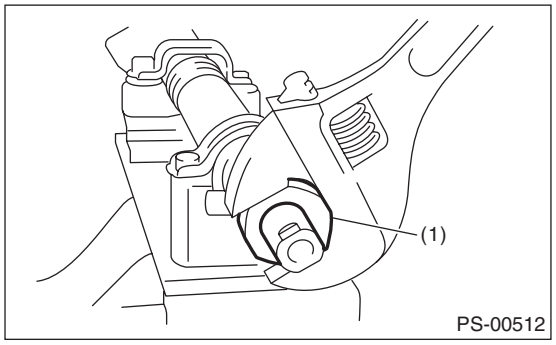


12) Using a drill, release the crimping of holder.

CAUTION:
Make a hole of 2 mm (0.08 in) depth using a drill with 3 mm (0.12 in) diameter.



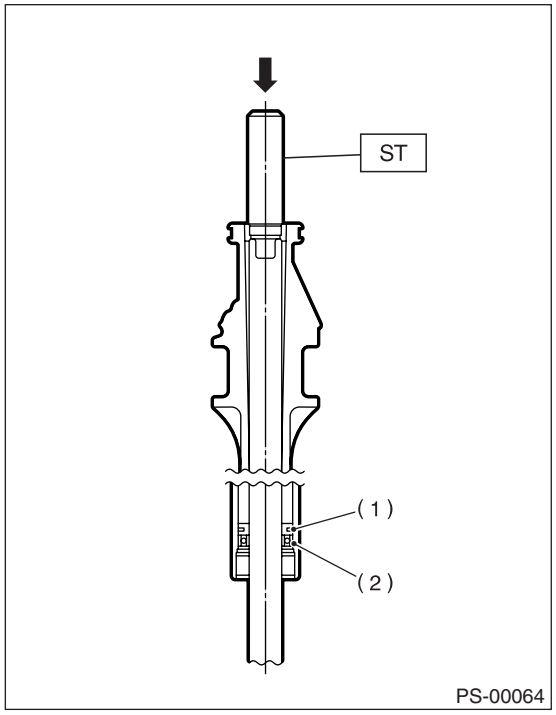
13) Remove the holder.



(1) Holder

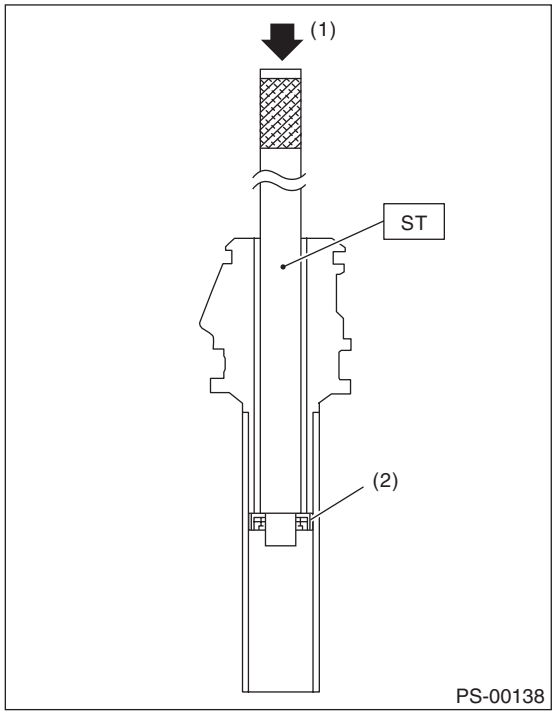
14) Attach the ST to the pinion housing side of the rack and push out the rack along with the outer side oil seal.
ST 34199FE000 INSTALLER & REMOVER

NOTE:
Plug the connecting section of the steering body pipe to prevent the fluid from flowing out.



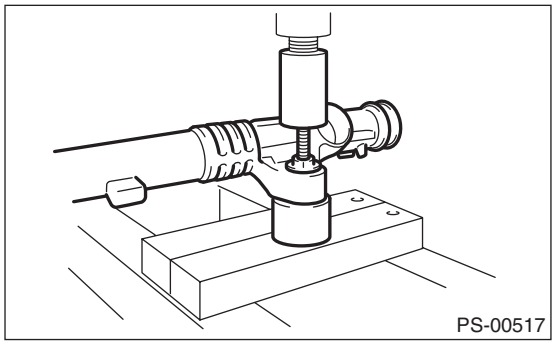
(1) Rack piston
(2) Outer side oil seal

15) Insert the ST from pinion housing side and remove the oil seal using a press.
ST 927580000 OIL SEAL REMOVER



(1) Press
(2) Oil seal

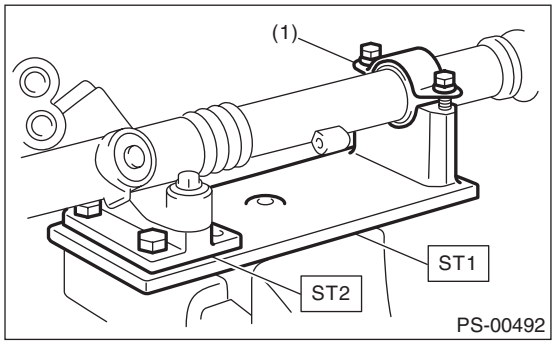
16) Using a press, remove the bushing of gearbox installation portion.



2. CONTROL VALVE

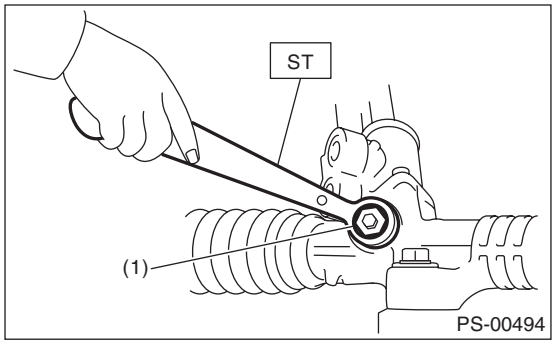
1) Disconnect the pipes A and B from gearbox.
2) Secure the gearbox removed from vehicle in a vise using ST.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

CAUTION:
Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.



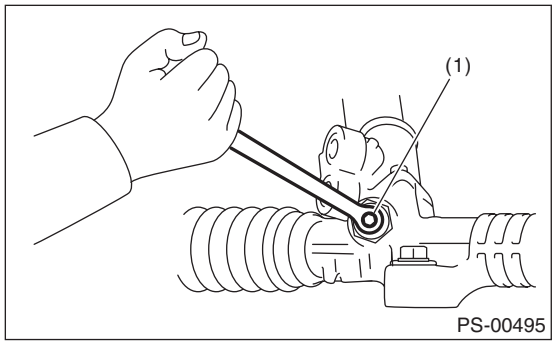
(1) Clamp

3) Using the ST, loosen the lock nut.
ST 926230000 SPANNER



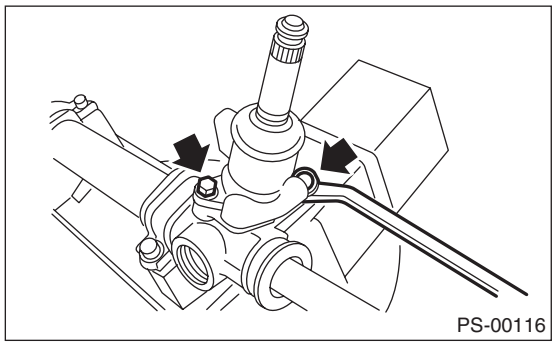
(1) Lock nut

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

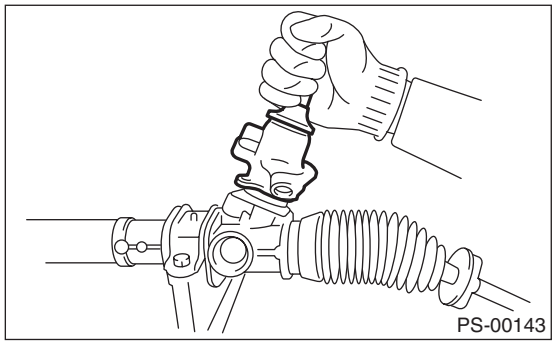


(1) Adjusting screw

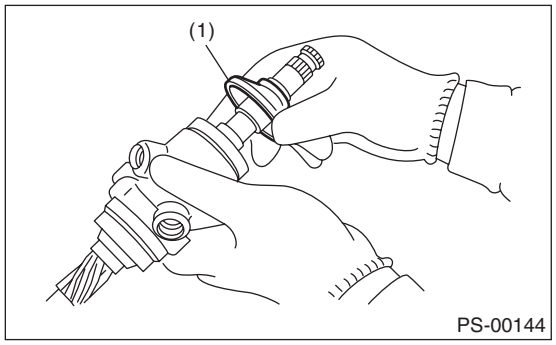
5) Loosen the adjusting screw, and remove the spring and sleeve.
6) Remove the two bolts securing valve assembly.



7) Carefully draw out the input shaft and remove the valve assembly.

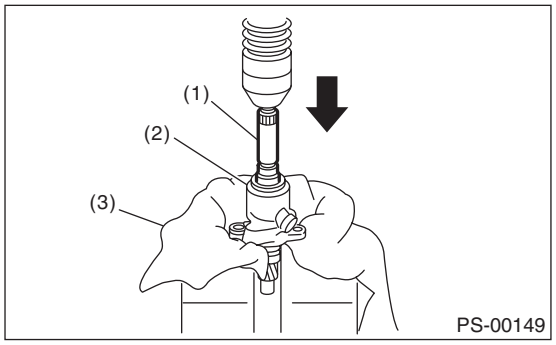


8) Put a vinyl tape around the spline portion, and slide the dust cover to remove.



(1) Dust cover

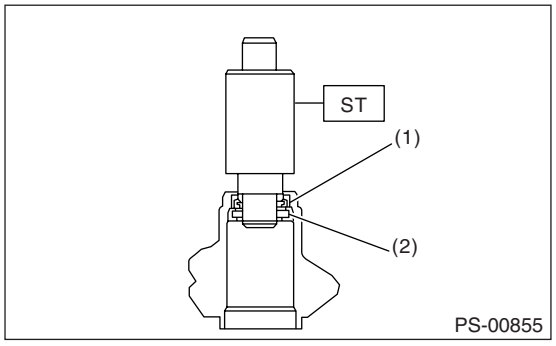
9) Using a press, remove the pinion & valve assembly from valve housing.



(1) Pinion & valve ASSY
(2) Valve housing
(3) Cloth

10) Using the ST and a press, remove the bushing and oil seal from the valve housing.
ST 34199AG090 INSTALLER & REMOVER

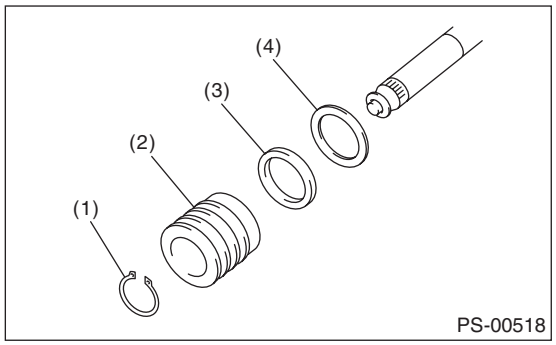
CAUTION:
• Do not apply a force to the end surface of valve housing.
• Do not reuse the oil seal after removal.



(1) Oil seal
(2) Bushing

11) Using a snap ring pliers, remove the snap ring, valve, oil seal and back-up washer.

CAUTION:
Be careful not to scratch the pinion and valve assembly.

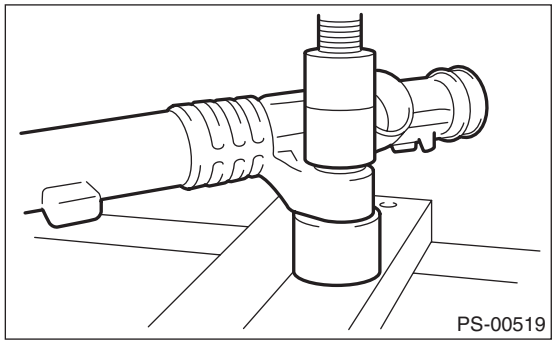


(1) Snap ring
(2) Valve
(3) Oil seal
(4) Back-up ring

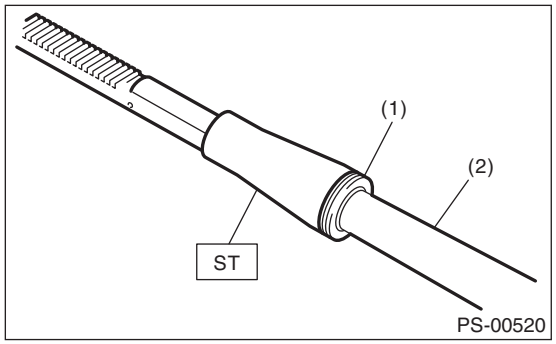
D: ASSEMBLY

1. RACK HOUSING ASSEMBLY

1) Using a press, install the bushing to gearbox installation portion.



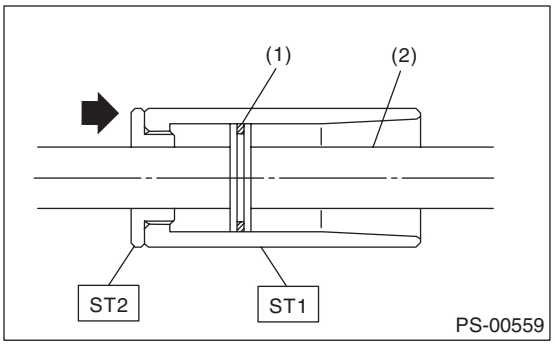
2) Insert the ST to rack.
ST 34199AG030 GUIDE



(1) Seal ring
(2) Rack

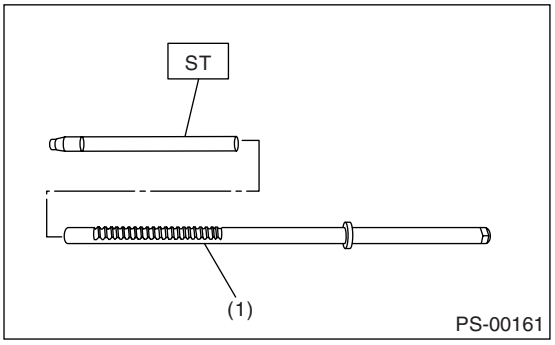
3) Install the seal ring to piston portion of rack.

4) Using the ST, form the seal ring properly.
ST1 34199AG080 FORMER PISTON
ST2 34199AG050 GUIDE G (24)



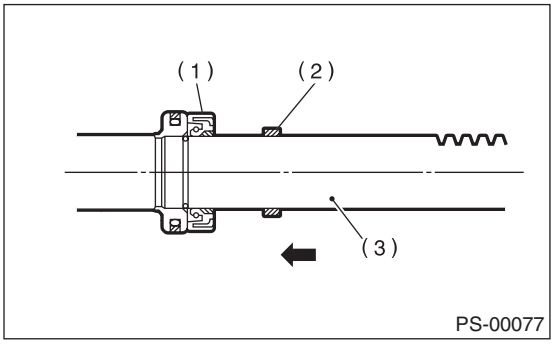
(1) Seal ring
(2) Rack

5) Fit the ST over toothed portion of rack assembly, and insert the oil seal to rack.
ST 926390001 COVER & REMOVER



(1) Rack ASSY

6) Remove the ST from rack assembly.
7) Install the back-up washer from the gear side of rack.



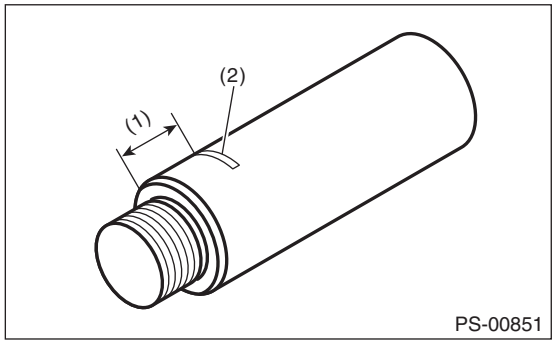
(1) Oil seal
(2) Back-up washer
(3) Rack

8) Check the threaded end of holder and gearbox cylinder end for burrs, damage, etc. Correct if faulty.

9) 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.
10) Temporarily tighten the new holder to gearbox cylinder.
11) Put a mark at the specified position from the end surface of the ST as shown in the figure.

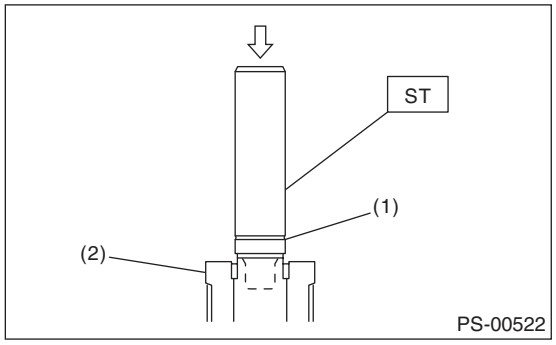
Specified position:
Except for 2.5 GT-B:
13.5 mm (0.53 in)
2.5 GT-B:
18.9 mm (0.74 in)

ST 34199FE000 INSTALLER & REMOVER



(1) 13.5 mm (0.53 in) or 18.9 mm (0.74 in)
(2) Put a mark.

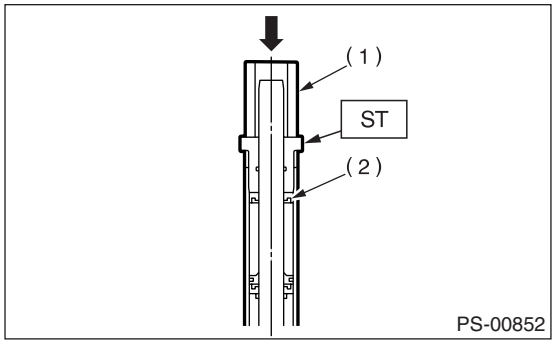
12) Attach the ST to the rack end surface.
ST 34199FE000 INSTALLER & REMOVER
13) Using a press, press-fit until the mark on the ST is aligned to the end surface of the holder.



(1) Marked position
(2) Holder

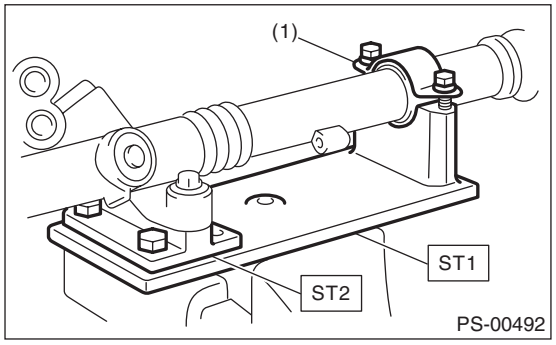
14) Remove the ST and the holder.
15) Insert the outer side oil seal to the rack in the same procedure as in step 5) and 6).
ST 926390001 COVER & REMOVER

16) Put the ST and pipe through the rack and press-fit the outer side oil seal using a press.
ST 34199AG010 INSTALLER



(1) Pipe
(2) Outer side oil seal

17) Secure the gearbox in a vise using ST.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

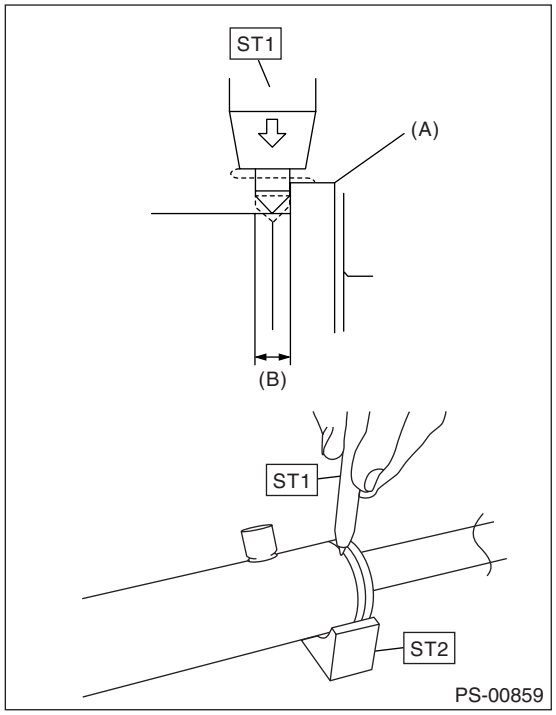


(1) Clamp

18) Tighten the new holder.

Tightening torque:
70 N·m (7.1 kgf-m, 51.6 ft-lb)

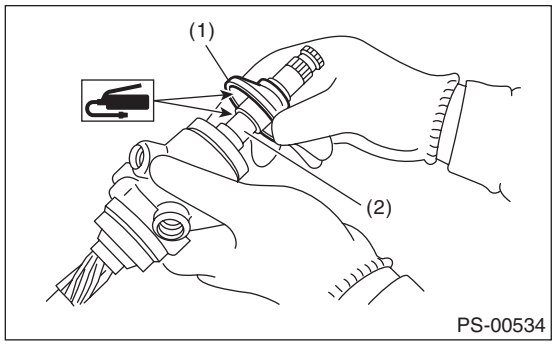
19) Using the ST, crimp so that the diameter of punch hole is 2 — 2.5 mm (0.08 — 0.10 in) and is aligned to the position of 2 mm (0.08 in) from gearbox cylinder end surface.
ST1 34099FA060 PUNCH HOLDER
ST2 34199XA050 BASE



(A) Holder
(B) 2 mm (0.08 in)

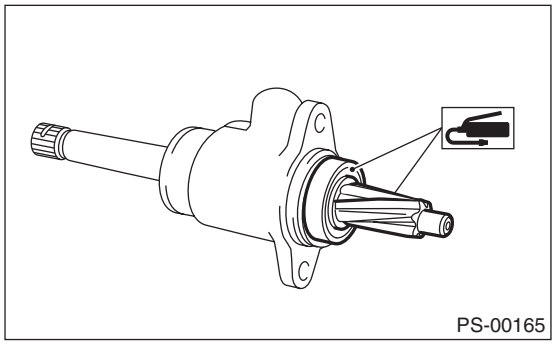
20) Put a vinyl tape around the spline portion and apply genuine grease to the dust cover and install to valve assembly.

CAUTION:
Be sure to install the dust cover to groove of shaft.

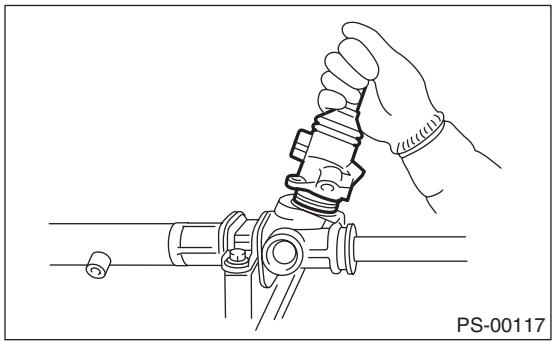


(1) Dust cover
(2) Groove

21) Apply the genuine grease to the pinion gear and bearing of valve assembly.



22) Install a new gasket on valve assembly. Insert the valve assembly into place while facing the rack teeth toward pinion.



23) Tighten the bolts alternately to secure the valve assembly.

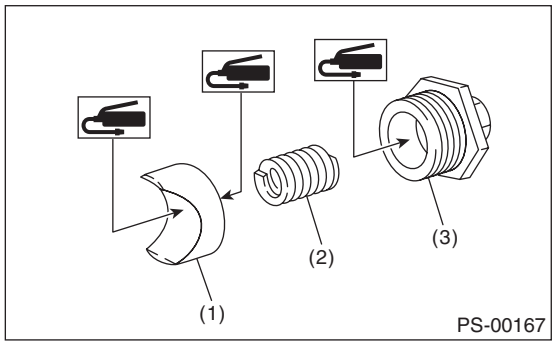
Tightening torque:
20 N·m (2.0 kgf-m, 14.8 ft-lb)

CAUTION:
Be sure to alternately tighten the bolts.
24) Temporarily install the tie-rod to rack end, and then operate the rack from lock to lock for two or three times to make it fit in.

CAUTION:
Operating the rack from lock to lock without installing tie-rods may damage the oil seal. Always install the left and right tie-rods.
25) Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

Liquid gasket:
THREE BOND 1102 or equivalent

26) 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.



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

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

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)

28) Tighten the adjusting screw to the specified torque, then loosen it 20°.

Tightening torque:
3.9 N·m (0.4 kgf-m, 2.9 ft-lb)

29) Remove the tie-rod.
30) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-36, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>
31) Apply liquid gasket to lock nut and install it into adjusting screw. While holding the adjusting screw with wrench, tighten the lock nut using ST.

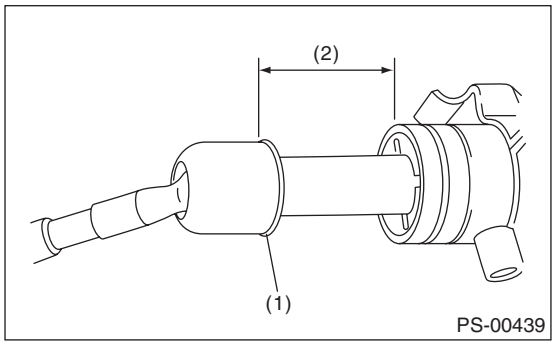
Liquid gasket:
THREE BOND 1102 or equivalent
ST 926230000 SPANNER

Tightening torque (lock nut):
25 N·m (2.5 kgf-m, 18.1 ft-lb)

NOTE:
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.
32) Extend the rack approx. 40 mm (1.57 in) from steering body.

33) Install the tie-rod and new lock washer into rack.

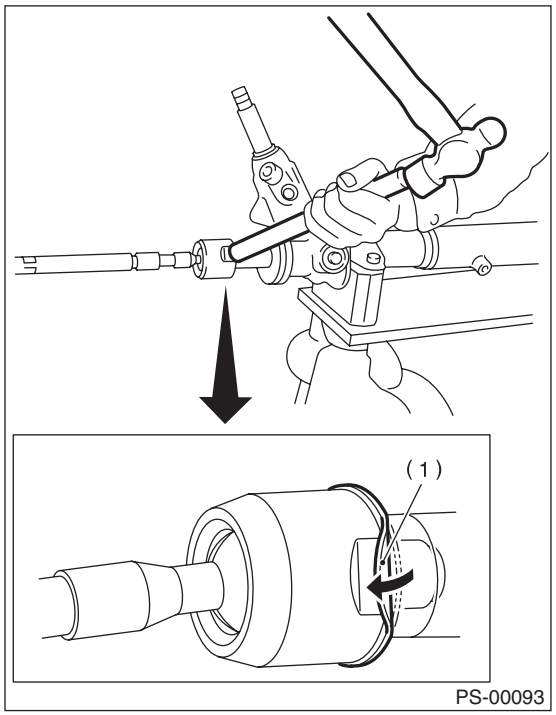
Tightening torque:
90 N·m (9.1 kgf-m, 65.8 ft-lb)



(1) Lock washer
(2) Approx. 40 mm (1.57 in)

34) Bend the lock washer and crimp it.

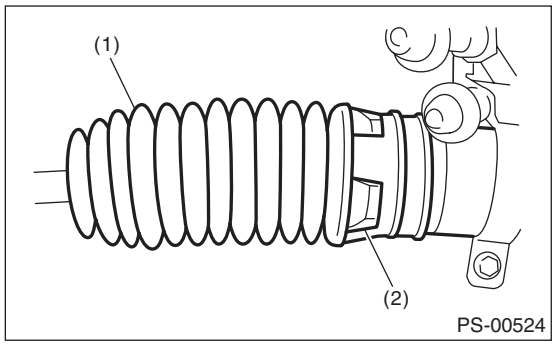
CAUTION:
Be careful not to scratch the rack when crimping lock washer.



(1) Lock washer

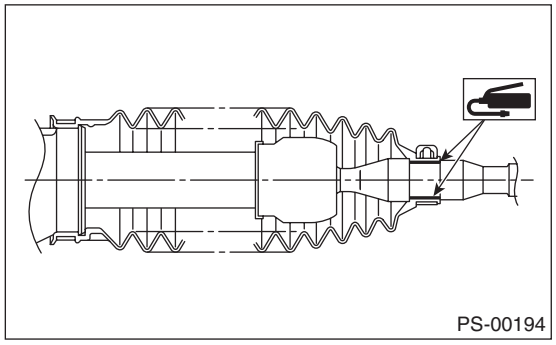
35) Apply a coat of grease to the tie-rod groove, and then install the boot to the housing.

CAUTION:
Right side boot has groove for identification, be sure to install the right and left of boot.

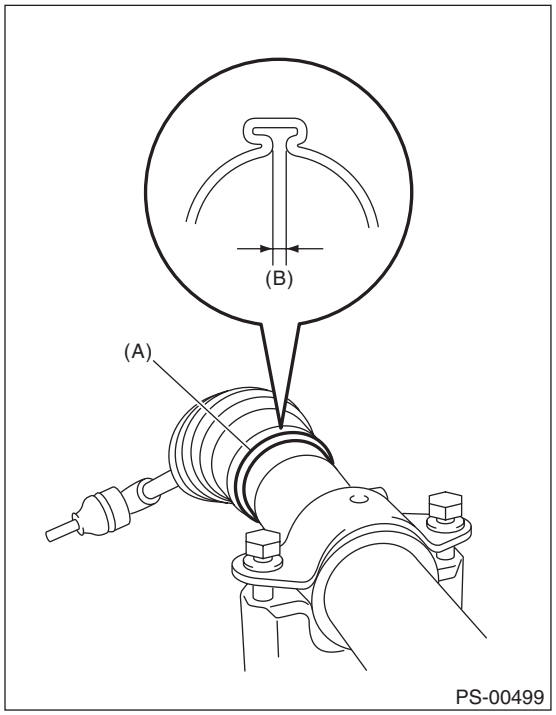


(1) Right side boot
(2) Groove for identification

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

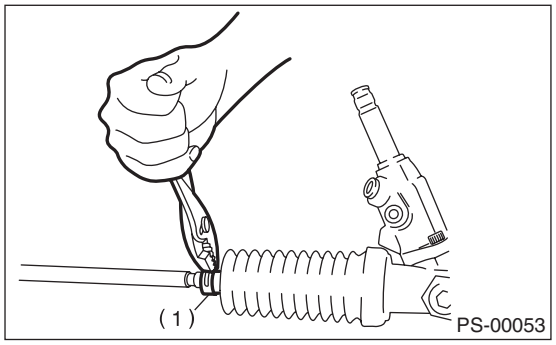


36) Install a new boot band. Using band clamp pliers, crimp it so that the clearance of crimping portion becomes 2 mm (0.079 in) or less.



(A) Boot band
(B) 2 mm (0.079 in) or less

37) Fix the boot end with small clip.

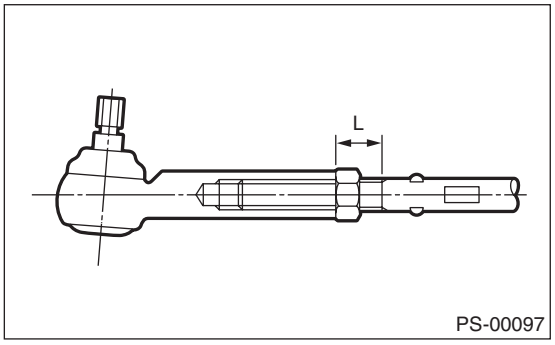


(1) Clip

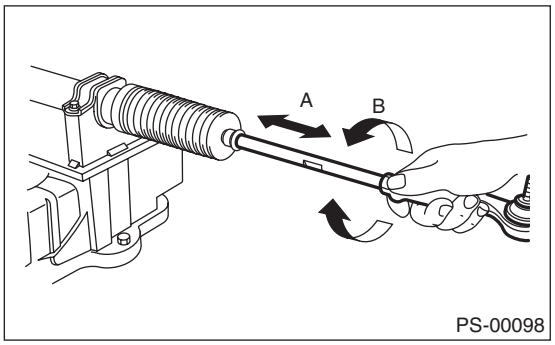
38) After installing, check that the boot end is installed to the groove of the tie-rod.

39) 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.

Installed tie-rod length L:
31 mm (1.22 in)



40) Inspect the gearbox as follows:
"A" Holding the tie-rod end, repeat movement from lock to lock two or three times as quickly as possible.
"B" Holding the tie-rod end, turn a few times as slowly as possible.
Finally, make sure that the boot is installed in the specified position without inflating.

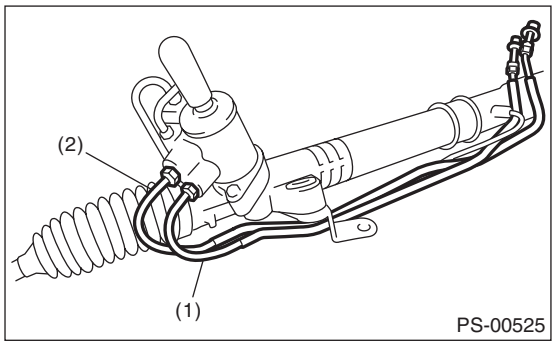


41) Remove the gearbox from ST.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

42) Install the four pipes on gearbox.
(1) Connect the pipes A and B to the four pipe joints of gearbox.

Tightening torque:
Refer to the component parts. <Ref. to PS-4, POWER ASSISTED SYSTEM, COMPONENT, General Description.>
(2) Connect the pipes C and D to gearbox.

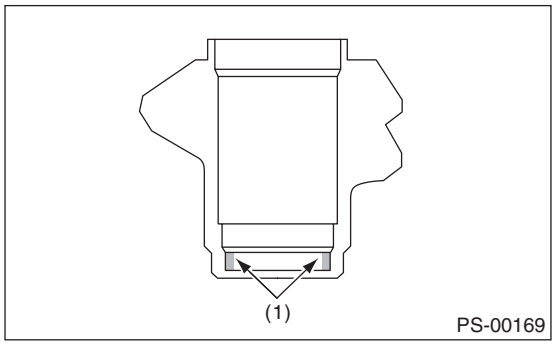
Tightening torque:
Pipe C: 37 N·m (3.8 kgf-m, 27.3 ft-lb)
Pipe D: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(1) Pipe C
(2) Pipe D

2. CONTROL VALVE ASSEMBLY

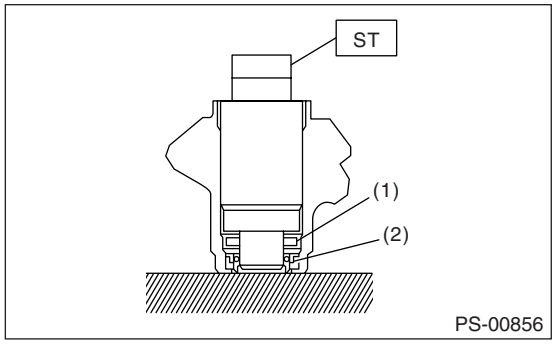
Specified steering grease:
VALIANT GREASE M2 (Part No. 003608001)
1) Clean all parts and tools before reassembling.
2) Apply a coat of specified power steering fluid to the inner wall of valve housing.



(1) Apply fluid.

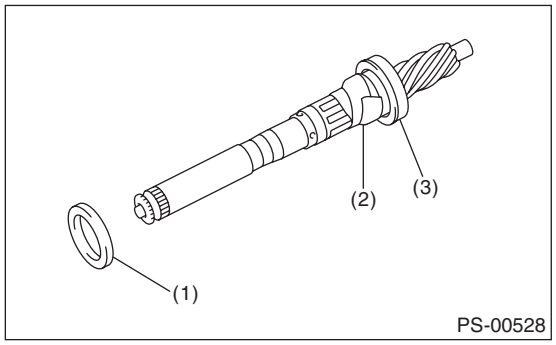
3) Apply a coat of grease to the oil seal.
4) Verify the direction of oil seal.

5) Using the ST and a press, install the oil seal and bushing in valve housing.
ST 34199AG090 INSTALLER & REMOVER



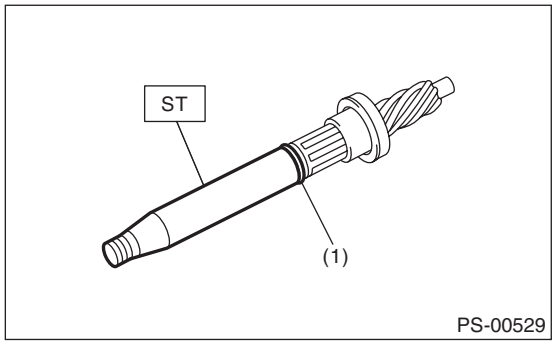
(1) Bushing
(2) Oil seal

6) Apply vinyl tape to the groove of pinion.
7) Install the back-up ring and oil seal to pinion, and then remove the vinyl tape.



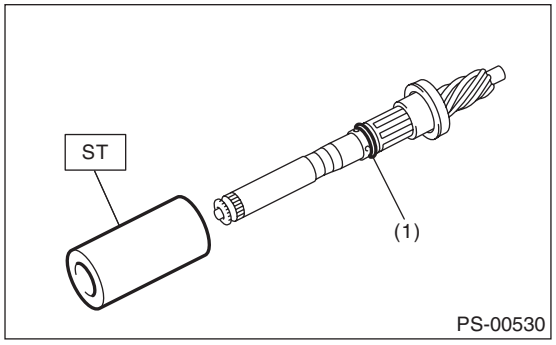
(1) Oil seal
(2) Vinyl tape
(3) Back-up ring

8) Attach the ST to pinion, and install the seal ring.
ST 34199AG020 GUIDE



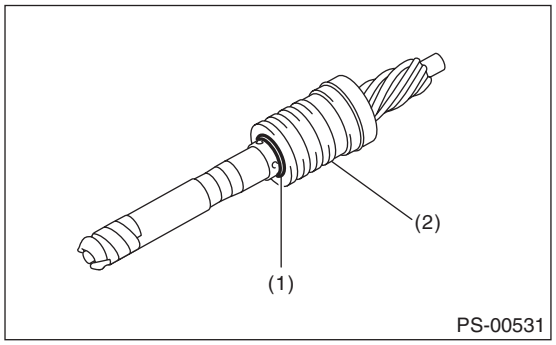
(1) Seal ring

9) Remove the ST GUIDE, and form the seal ring properly using ST FORMER.
ST 34199AG070 FORMER



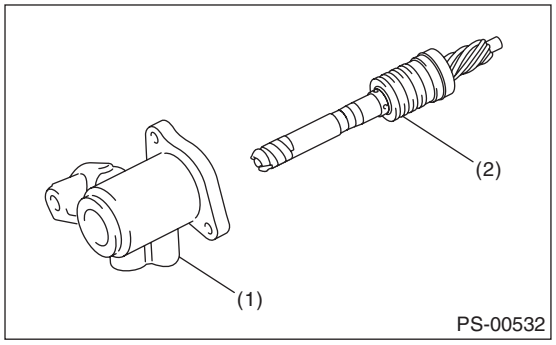
(1) Seal ring

10) Put vinyl tape around pinion shaft spline to protect oil seal from damage.
11) Install the valve to pinion, and install the snap ring.



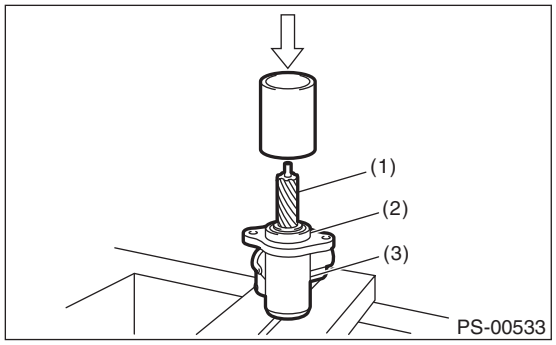
(1) Snap ring
(2) Valve

12) Attach the pinion and valve assembly into the valve housing.



(1) Valve housing
(2) Pinion & valve ASSY

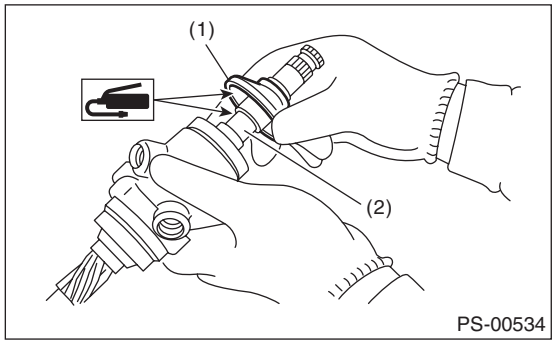
13) Using a press, push the outer race of bearing and press-fit the pinion & valve assembly into housing.



(1) Pinion & valve ASSY
(2) Bearing
(3) Housing

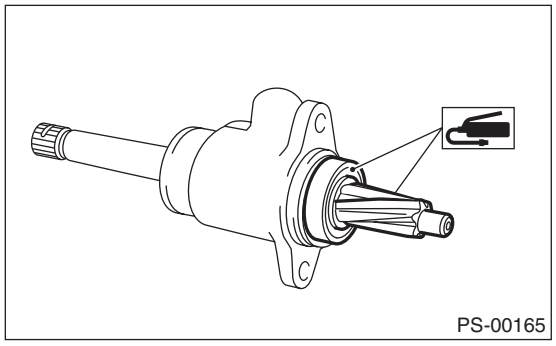
14) Apply the specified grease to dust cover.
15) Install the dust cover on valve assembly.

CAUTION:
Be sure to install the dust cover to groove of shaft.

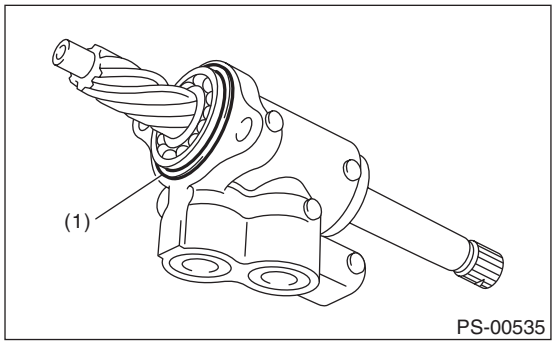


(1) Dust cover
(2) Groove

16) Apply the genuine grease to the pinion gear and bearing of valve assembly.

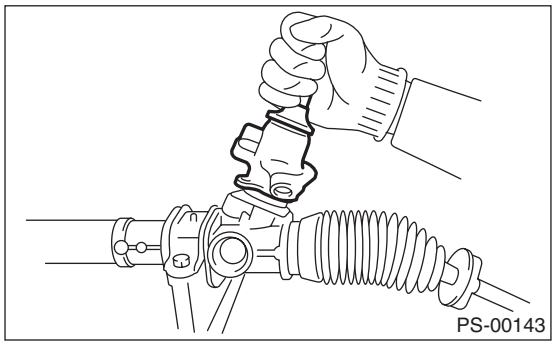


17) Install new O-ring to valve assembly.



(1) O-ring

18) Insert the valve assembly into place while facing the rack teeth toward pinion.



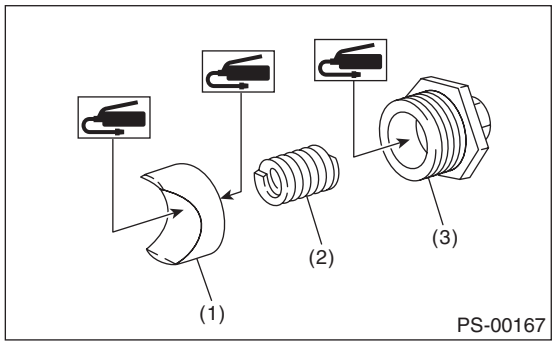
19) Tighten the bolts alternately to secure the valve assembly.

Tightening torque:
20 N·m (2.0 kgf-m, 14.8 ft-lb)

CAUTION:
Be sure to alternately tighten the bolts.
20) Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

Liquid gasket:
THREE BOND 1102 or equivalent

21) 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.



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

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

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)

23) Tighten the adjusting screw to the specified torque, then loosen it 20°.

Tightening torque:
3.9 N·m (0.4 kgf-m, 2.9 ft-lb)

24) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-36, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>
25) Apply liquid gasket to lock nut and install it into adjusting screw. While holding the adjusting screw with wrench, tighten the lock nut using ST.

Liquid gasket:
THREE BOND 1102 or equivalent
ST 926230000 SPANNER

Tightening torque (lock nut):
25 N·m (2.5 kgf-m, 18.1 ft-lb)

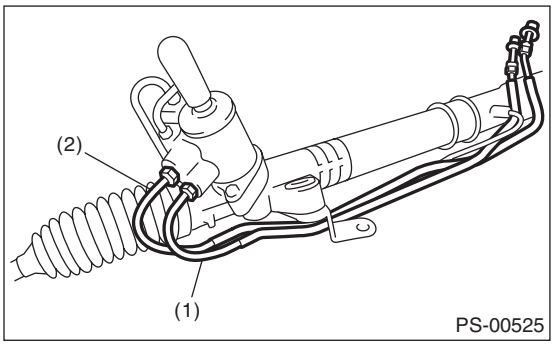
NOTE:
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.
26) Remove the gearbox from ST.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

27) Install the four pipes on gearbox.
(1) Connect the pipes A and B to gearbox.

Tightening torque:
Refer to the component parts. <Ref. to PS-4, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

(2) Connect the pipes C and D to gearbox.

Tightening torque:
Pipe C: 37 N·m (3.8 kgf-m, 27.3 ft-lb)
Pipe D: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(1) Pipe C
(2) Pipe D

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. Even if 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.

2. SERVICE LIMIT

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

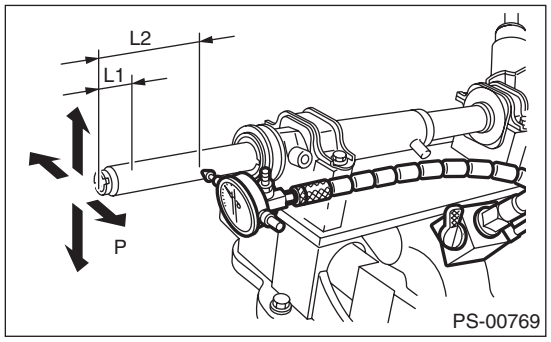
NOTE:
When making a measurement, vise the gearbox using ST. Never vise the gearbox by inserting aluminum plates etc. between vise and gearbox.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

Right-turn steering:

Service limit
0.12 mm (0.005 in) or less

On condition
Weighting point
L1: 10 mm (0.39 in)
P: 98 N (10 kgf, 22 lb)
Measuring point
L2: 25 mm (0.98 in)

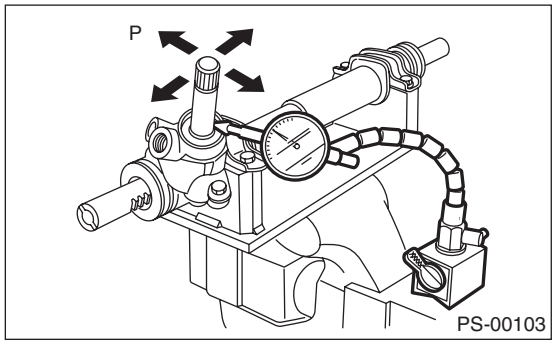


4. INPUT SHAFT PLAY

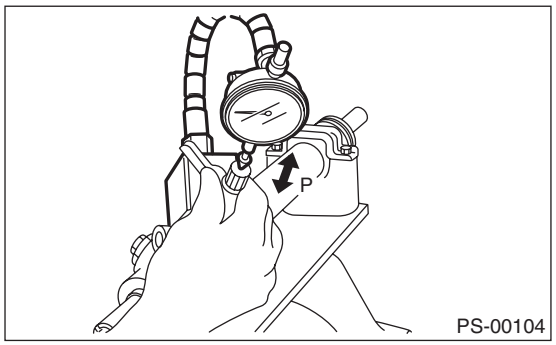
In radial direction:

Service limit
0.26 mm (0.01 in) or less

On condition
P: 98 N (10 kgf, 22 lb)



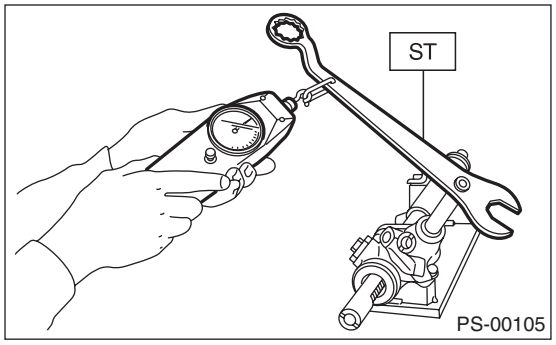
In axial direction:
Without play



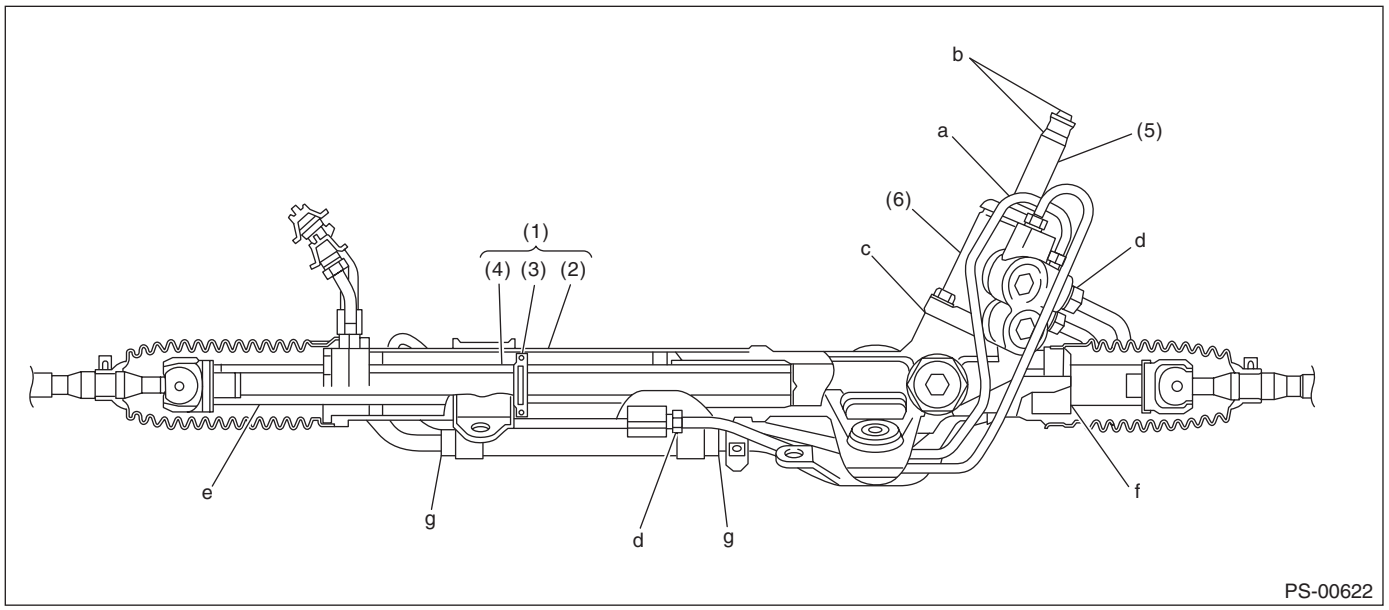
5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the gearbox turning resistance.
ST 34099PA100 SPANNER

Service limit:
Maximum allowable resistance:
11.3 N (1.15 kgf, 2.54 lb) or less.
Difference between right and left turning resistance:
24% or less



6. OIL LEAKAGE



(1) Power cylinder
(2) Cylinder
(3) Rack piston
(4) Rack axle
(5) Input shaft
(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 valve assembly or oil seal with a new part.
6) Cause and solution for oil leakage from “d”.
The pipe is damaged. Replace the faulty pipe or O-ring.
7) Cause and solution for oil leakage from “g”.
The hose is damaged. Replace the hose with a new part.
8) If leak is other than a, b, c, d or g, or if oil is leaking from gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove fluid from surrounding portions. Then, turn the steering wheel from lock to lock about thirty to forty times with the engine running, and make comparison of the leaked portion immediately after and several hours after this operation.
(1) Leakage from “e”
The cylinder seal is damaged. Replace the rack bushing with a new part.
(2) Leakage from “f”
There are two possible causes. Perform the following step first. Remove the pipe assembly B from the valve housing, and close the circuit using ST.

ST 926420000 PLUG

Turn the steering wheel from lock to lock approx. 30 to 40 times with the engine running, then inspect the leaked portion immediately after and several hours after this operation.

- If leakage from “f” is noted again:

The oil seal of pinion and valve assembly is damaged. Replace the pinion & valve assembly with a new part. Or replace the oil seal and the parts that are damaged during disassembly with new parts.

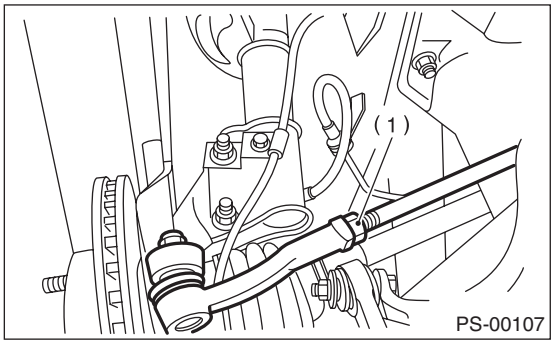
- If oil stops leaking from “f”:

The oil seal of rack housing is damaged. Replace the oil seal and parts that are damaged during disassembly with new parts.

F: ADJUSTMENT

1) Adjust the front toe.
<Ref. to FS-10, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

Standard of front toe:
IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)



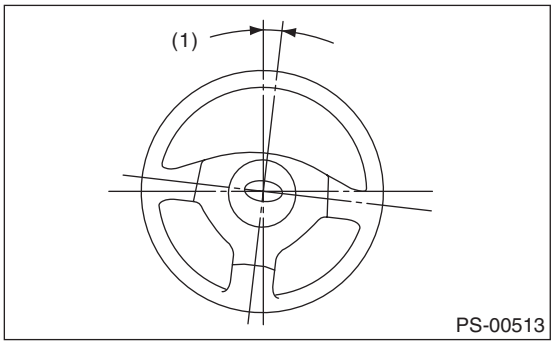
(1) Lock nut

2) Adjust the steering angle of the wheels.

Standard of steering angle:

Model	Except for OUTBACK	OUTBACK
Inner wheel	37.2°±1.5°	38.0°±1.5°
Outer wheel	33.0°±1.5°	33.5°±1.5°

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) Within 5°

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.