

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5. Steering Gearbox

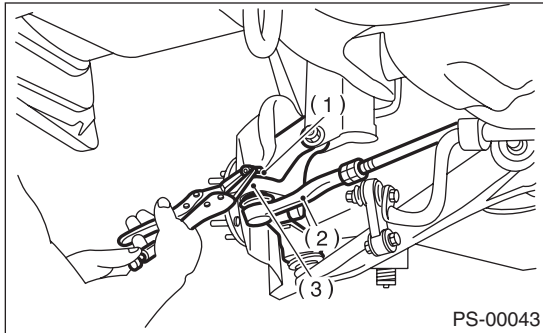
A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Loosen the front wheel nuts.
- 4) Lift-up the vehicle, and remove the front wheels.
- 5) Remove the under cover.
- 6) Remove the sub frame. <Ref. to FS-23, REMOVAL, Sub Frame.>
- 7) Remove the front exhaust pipe assembly. (Non-turbo model)
<Ref. to EX (H4SO)-4, REMOVAL, Front Exhaust Pipe.>

WARNING:

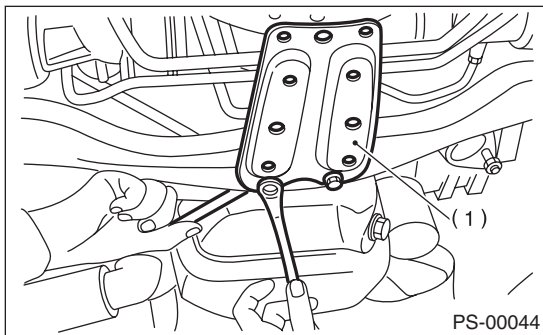
The exhaust pipe is extremely hot. Be careful not to burn your hand.

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



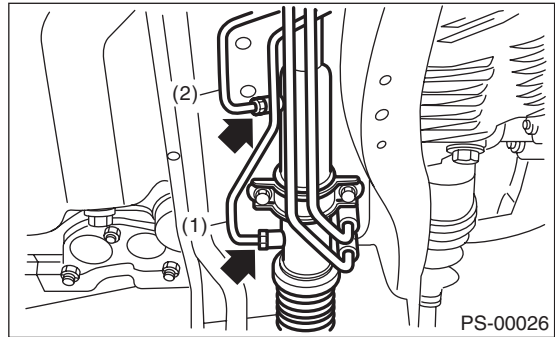
- (1) Castle nut
- (2) Tie-rod end
- (3) Knuckle arm

- 9) Remove the jack-up plate and front stabilizer.



- (1) Jack-up plate

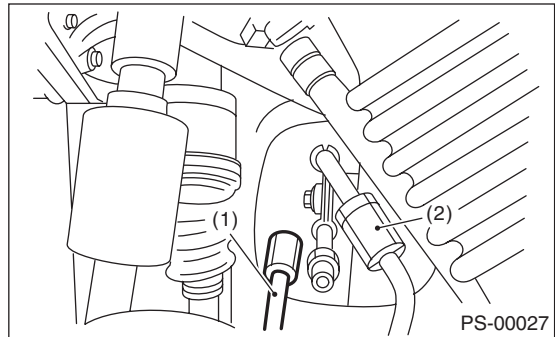
- 10) Remove the one pipe joint at the center of gearbox assembly, and connect a vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



- (1) Pipe A
- (2) Pipe B

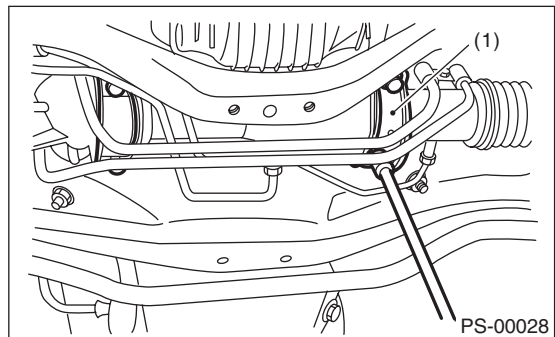
- 11) Remove the universal joint. <Ref. to PS-14, REMOVAL, Universal Joint.>

- 12) Disconnect the lower pipe C from gearbox assembly first, and upper pipe D second.



- (1) Pipe C
- (2) Pipe D

- 13) Remove the clamp bolts securing the gearbox assembly to the crossmember, and remove the gearbox.



- (1) Clamp

Steering Gearbox

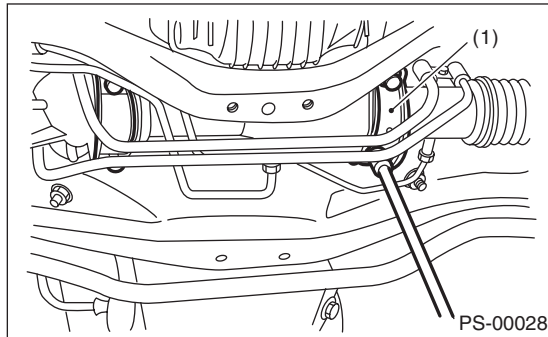
POWER ASSISTED SYSTEM (POWER STEERING)

B: INSTALLATION

- 1) Insert the gearbox assembly into the crossmember, being careful not to damage the gearbox assembly boot.
- 2) Tighten the gearbox assembly to the crossmember bracket via clamp with bolt, and tighten to the specified torque.

Tightening torque:

60 N·m (6.1 kgf-m, 44.1 ft-lb)

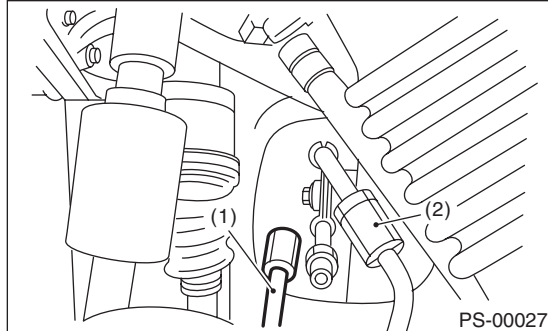


(1) Clamp

- 3) Connect the pipe D first to gearbox, then lower pipe C.

Tightening torque:

15 N·m (1.5 kgf-m, 10.8 ft-lb)



(1) Pipe C

(2) Pipe D

- 4) Install the universal joint. <Ref. to PS-14, INSTALLATION, Universal Joint.>
- 5) Connect the tie-rod end and knuckle arm, and tighten with castle nut.

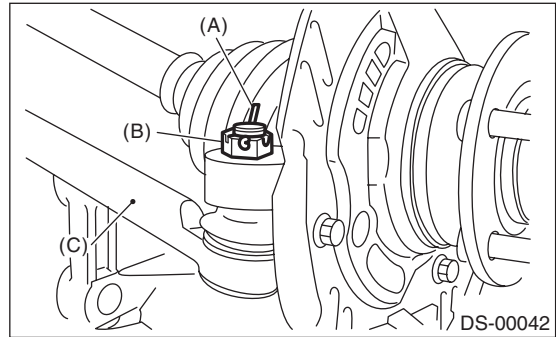
Tightening torque:

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.

- 6) 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 nut, and then bend the pin to lock.



(A) Cotter pin

(B) Castle nut

(C) Tie-rod end

- 7) Install the front stabilizer to vehicle. <Ref. to FS-21, INSTALLATION, Front Stabilizer.>
- 8) Install the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX (H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
- 9) Install the sub frame. <Ref. to FS-23, INSTALLATION, Sub Frame.>
- 10) Install the under cover. <Ref. to EI-20, INSTALLATION, Front Under Cover.>
- 11) Align the center position of the roll connector. <Ref. to AB-20, ADJUSTMENT, Roll Connector.>
- 12) Install the steering wheel. <Ref. to PS-13, INSTALLATION, Steering Wheel.>
- 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) Connect the ground cable to the battery.
- 16) Pour fluid into the reservoir, and bleed the air. <Ref. to PS-49, Power Steering Fluid.>
- 17) Check for fluid leaks.
- 18) Install the jack-up plate.
- 19) Lower the vehicle.
- 20) Check the fluid level in the reservoir tank.

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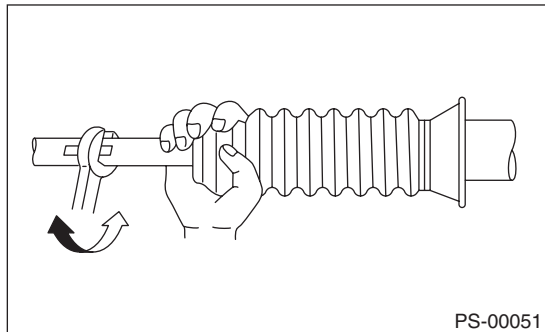
21) After adjusting toe-in and steering angle, tighten the lock nut on the tie-rod end.

Tightening torque:

83 N·m (8.5 kgf-m, 61.5 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) Disconnect the four pipes from gearbox.

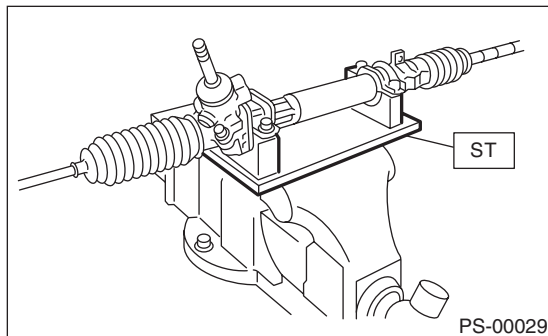
NOTE:

Remove the pipes E and F, which are fixed to the clamp plate, as a unit.

2) Secure the gearbox assembly removed from the vehicle in a vise using a ST.
ST 92620000 STAND

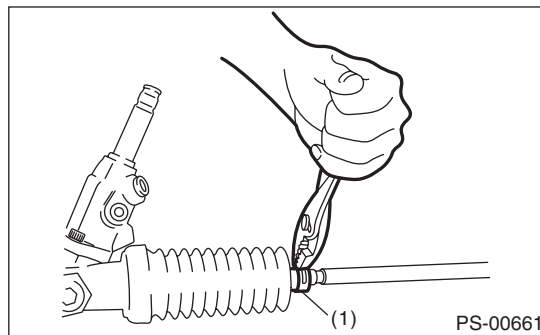
CAUTION:

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



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

4) Move the clip of the boot using the pliers, and then slide the boot to the tie-rod end side.

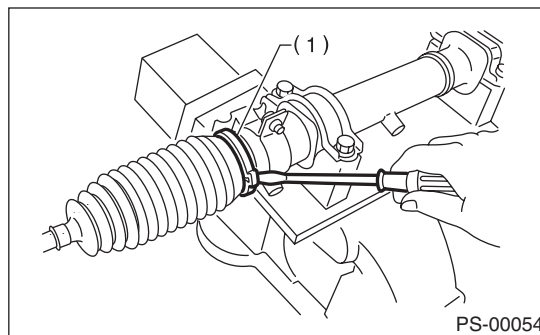


(1) Clip

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

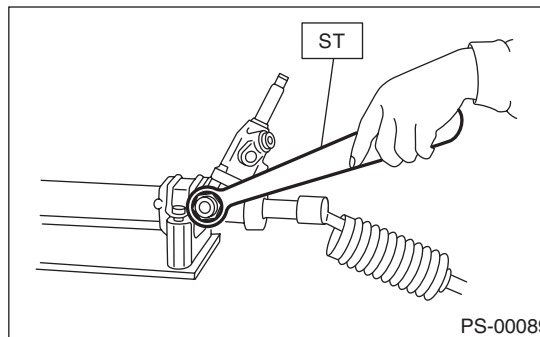
NOTE:

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



(1) Band

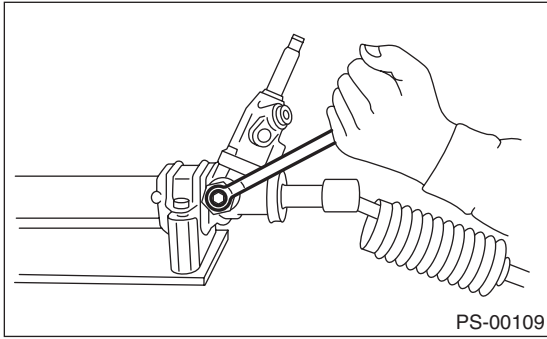
6) Using the ST, loosen the lock nut.
ST 926230000 WRENCH



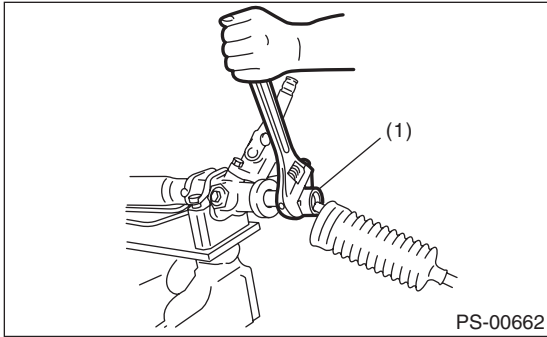
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7) Tighten the adjusting screw until it can no longer be tightened.



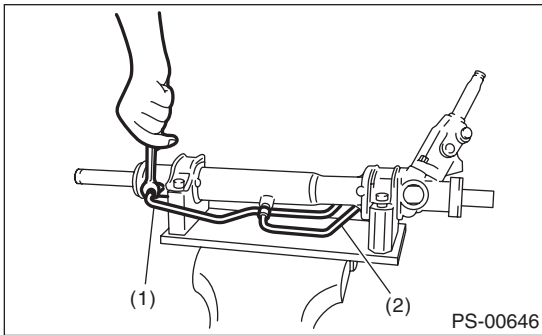
8) Remove the tie-rod using a 32 mm (1.26 in) wrench or adjustable wrench.



(1) Tie-rod

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

10) Disconnect the pipes A and B from steering body and control valve housing.



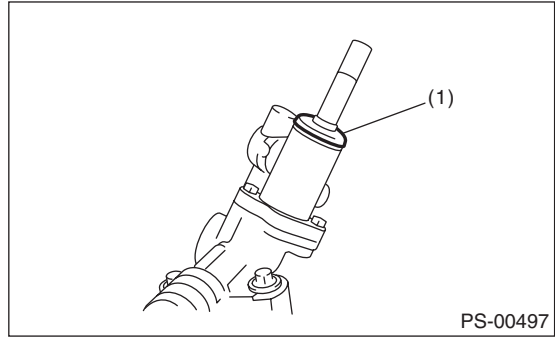
(1) Pipe A

(2) Pipe B

11) 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 gear box interior.

CAUTION:

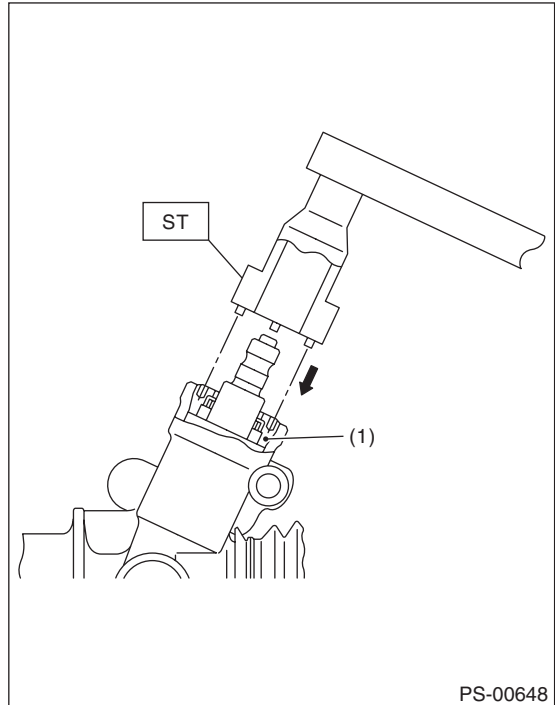
Wrap a tape around the input shaft spline in order not to damage the dust cover.



(1) Dust cover

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

ST 34199AE090 PLUG WRENCH

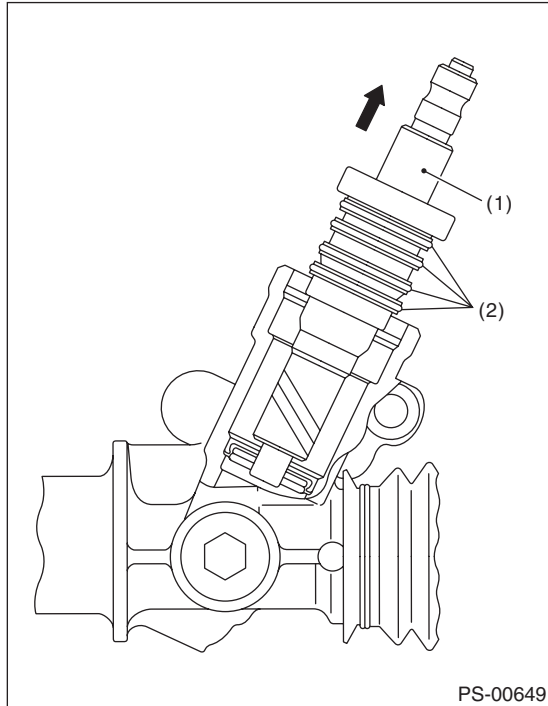


(1) Plug

Steering Gearbox

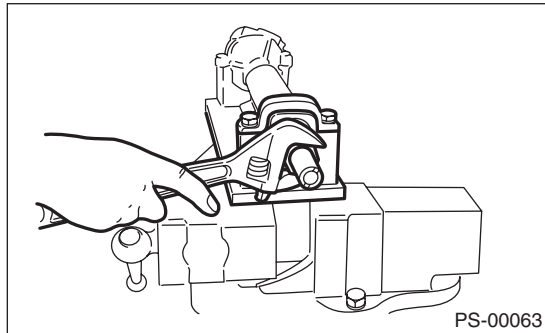
POWER ASSISTED SYSTEM (POWER STEERING)

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



- (1) Valve ASSY
- (2) Seal ring

14) Remove the holder using a 32 mm (1.26 in) wrench or adjustable wrench.

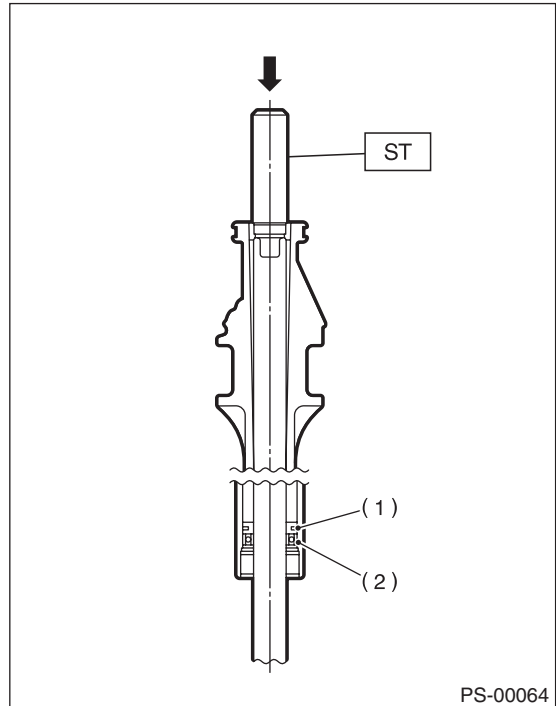


15) Attach the ST on the valve side of rack, and press out the outer side oil seal while taking care that the rack and the steering body inner surface do not come into contact with each other.

ST 34199FE000 INSTALLER & REMOVER

NOTE:

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



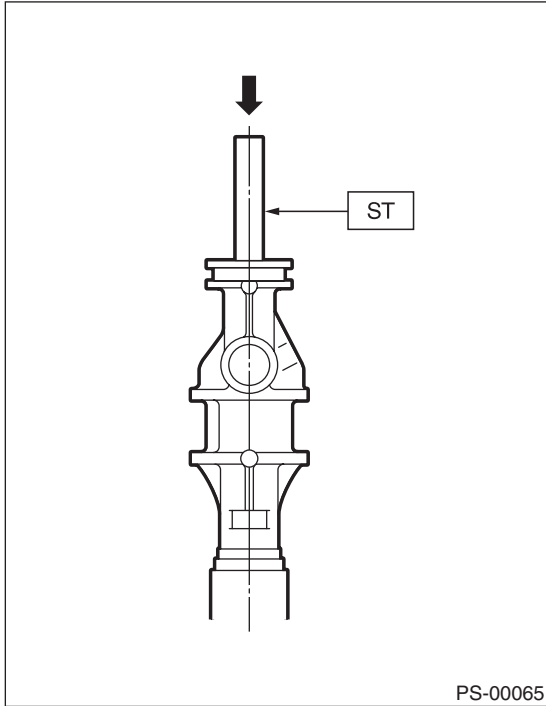
- (1) Rack piston
- (2) Outer side oil seal

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 927580000 REMOVER

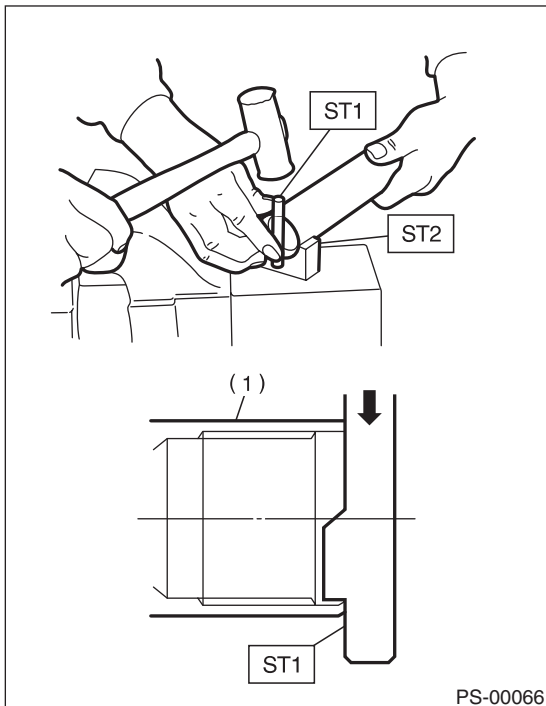


PS-00065

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

ST1 34099FA080 PUNCH

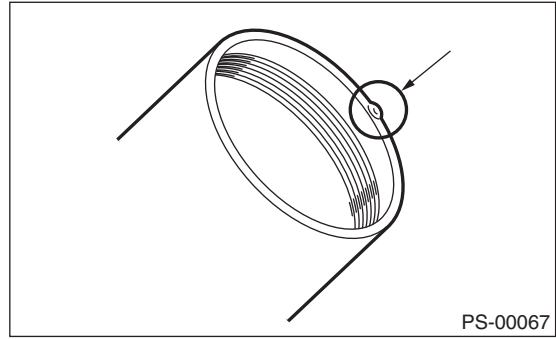
ST2 34099FA070 BASE



PS-00066

(1) Cylinder

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



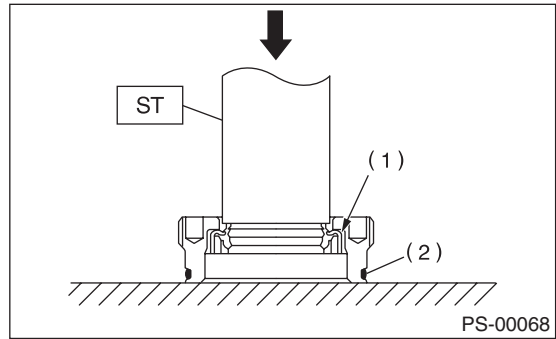
PS-00067

19) Remove the oil seal using ST and push out from the plug.

ST 34199AE100 OIL SEAL PLUG REMOVER

NOTE:

Do not apply force on the plug edge surface.



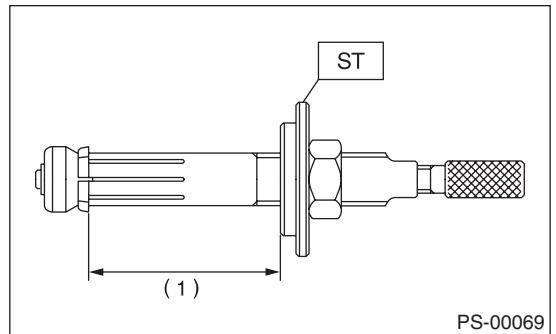
PS-00068

(1) Oil seal

(2) O-ring

20) Set the ST at a size shown in the figure.

ST 34199AE120 GEARBOX OIL SEAL RE-MOVER



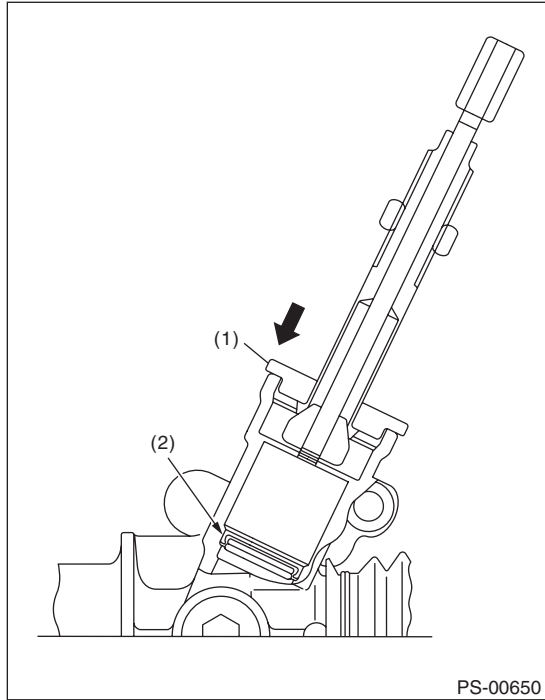
PS-00069

(1) 70 mm (2.76 in)

Steering Gearbox

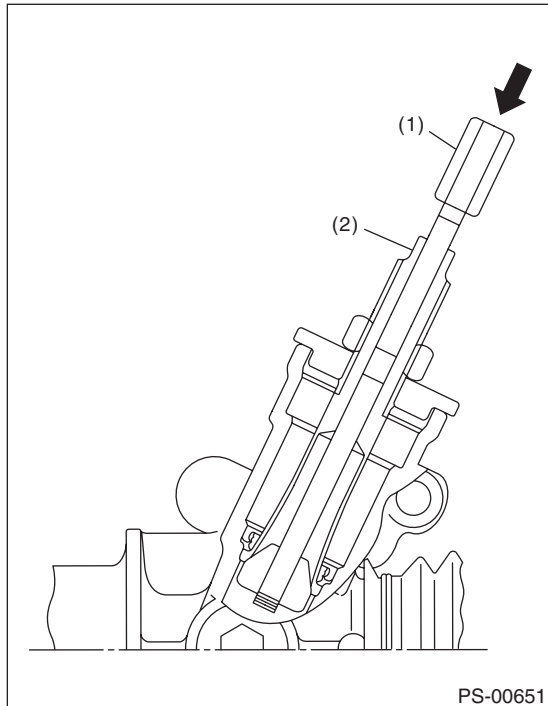
POWER ASSISTED SYSTEM (POWER STEERING)

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



- (1) Stopper
- (2) Oil seal

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

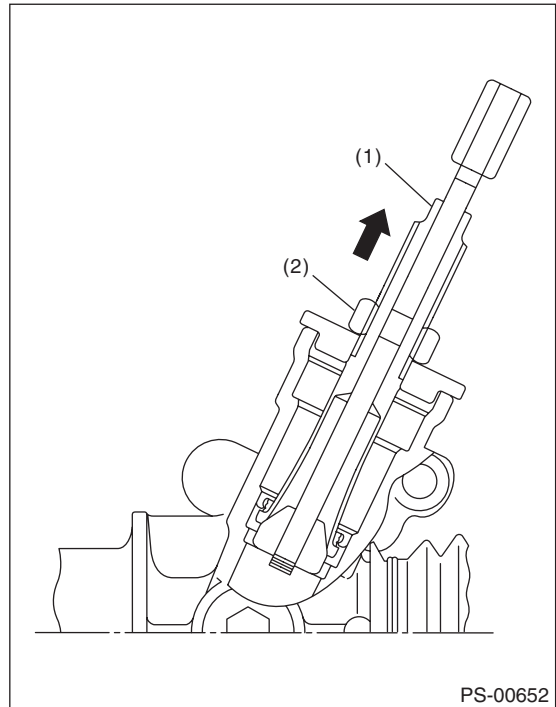


- (1) Rod
- (2) 2-surface widths

23) 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

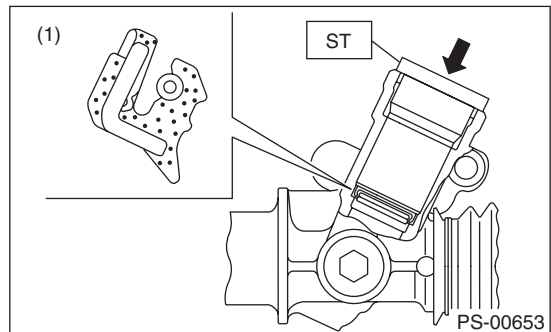
1) Apply a coat of grease to the inside and outside of the new oil seal.

Steering grease:

ONE LUBER MO (Part No. 003608001)

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.

ST 34199AE130 GEARBOX OIL SEAL INSTALLER



- (1) Oil seal

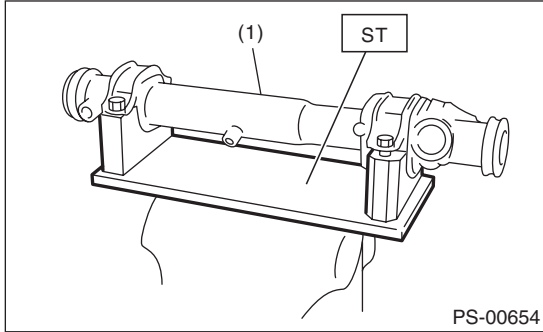
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

3) Attach the steering body to ST as shown in the figure. Apply a coat of grease to needle bearing.
ST 926200000 STAND

CAUTION:

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



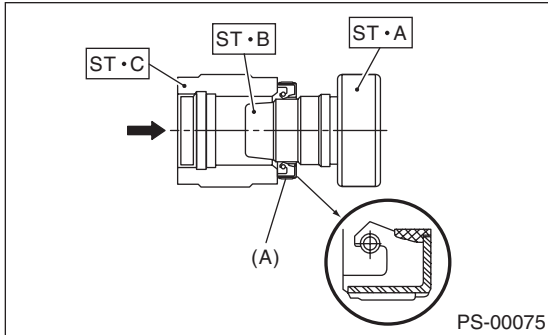
(1) Steering body

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

ST 927490000 INSTALLER A, B, C

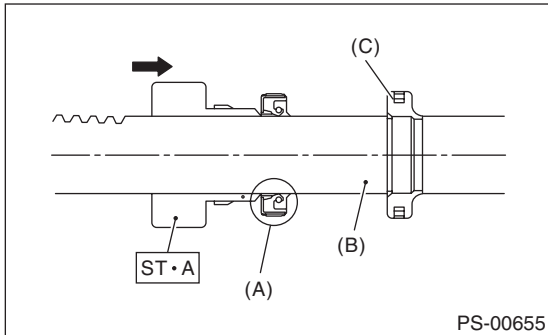
NOTE:

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



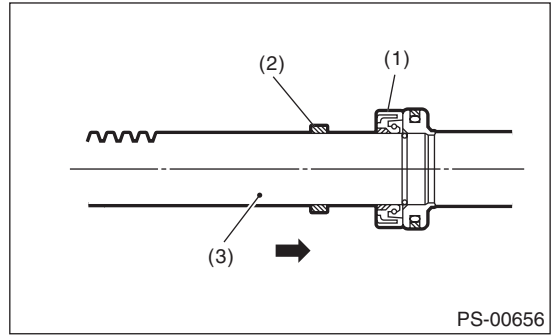
(A) Oil seal

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



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

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



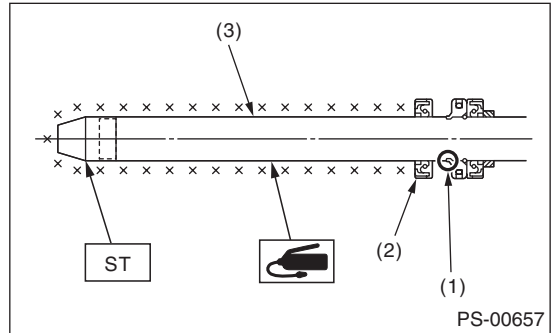
(1) Oil seal
(2) Back-up washer
(3) Rack

7) Attach the ST on rack, equally apply a thin coat of grease to the rack and ST, and then install the oil seal.

ST 926250000 GUIDE

CAUTION:

Be careful not to scratch the oil seal lips with the inner ring section of piston.



(1) Rack piston inner ring
(2) Outer side oil seal
(3) Rack

Steering Gearbox

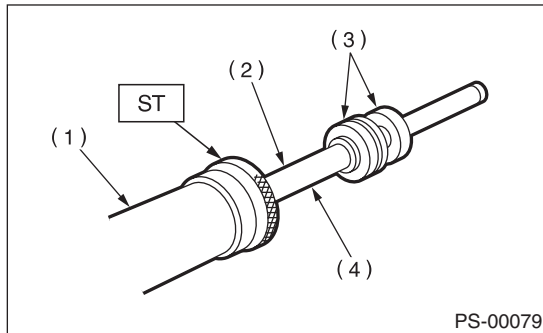
POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 34199AE000 GUIDE (OIL SEAL)

CAUTION:

Do not allow grease to block the air vent hole on rack.



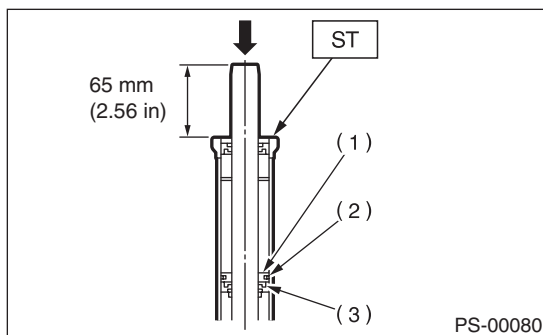
- (1) Cylinder side of steering body
- (2) Air vent hole
- (3) Oil seal
- (4) Rack

9) Slowly push the inner side oil seal using the press until the distance from the ST to the end of the rack is 65 mm (2.56 in).

ST 34199AE000 GUIDE (OIL SEAL)

CAUTION:

Make sure that there are no scratches on the inner wall of the ST. Otherwise there is a possibility of the oil seal being damaged when it is installed.

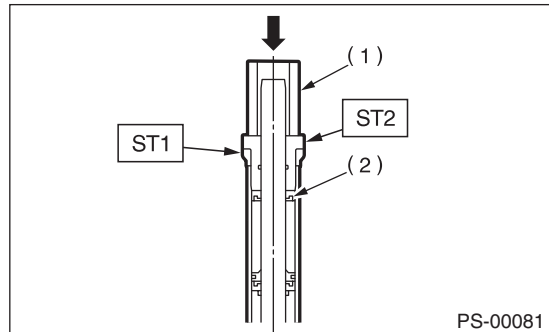


- (1) Rack piston
- (2) Inner side oil seal
- (3) Back-up ring

10) Make the ST2 and pipe pass through rack, and then press-in the ST1, ST 2 and the outer side oil seal 2 using a press.

ST1 34199AE000 GUIDE (OIL SEAL)

ST2 34199AE010 INSTALLER (OIL SEAL)

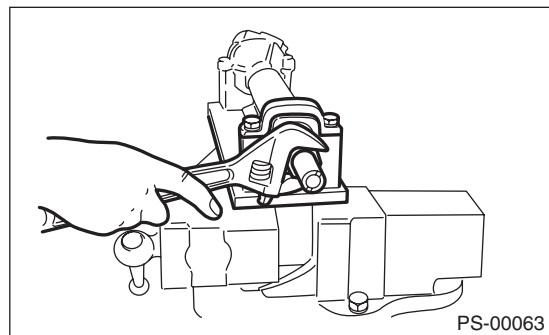


- (1) Pipe
- (2) Outer side oil seal

11) Install a new holder to the cylinder side of steering body.

Tightening torque:

64 N·m (6.5 kgf·m, 47.0 ft·lb)

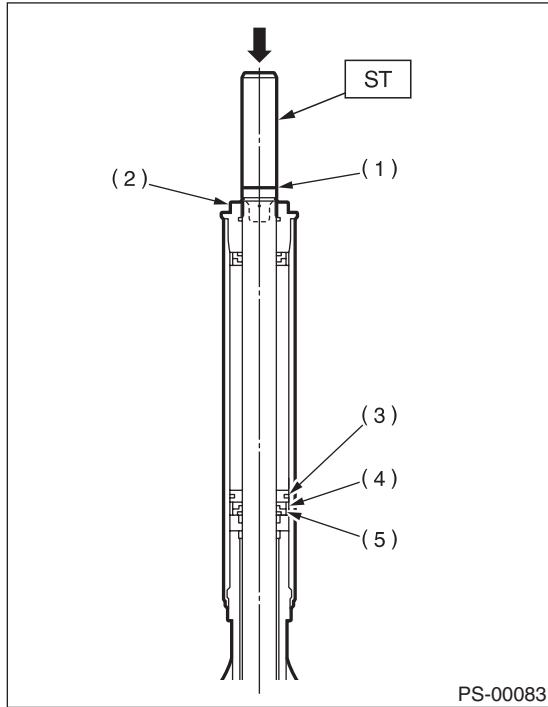


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12) Attach the ST on rack cylinder. Using the press, press in the ST until the groove on the ST aligns with the edge of the holder.

ST 34199FE000 INSTALLER & REMOVER



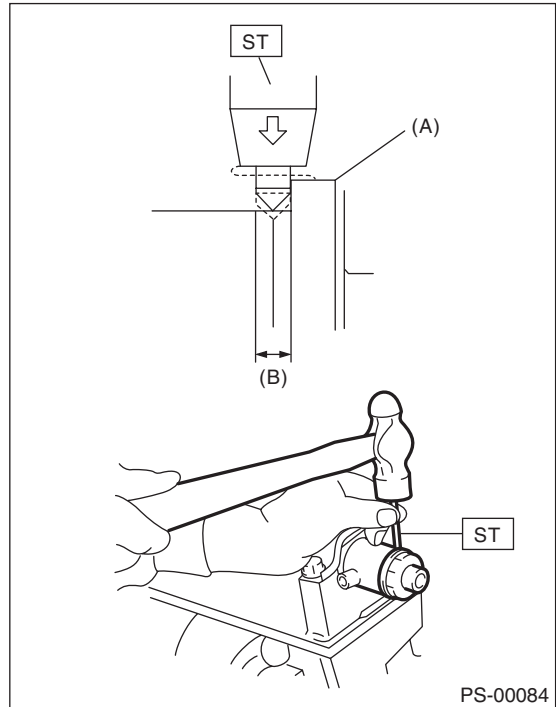
- (1) Groove
- (2) Holder
- (3) Rack piston
- (4) Oil seal
- (5) Back-up ring

13) Using the ST, crimp the steering body at one point less than 3 mm (0.12 in) from holder.

CAUTION:

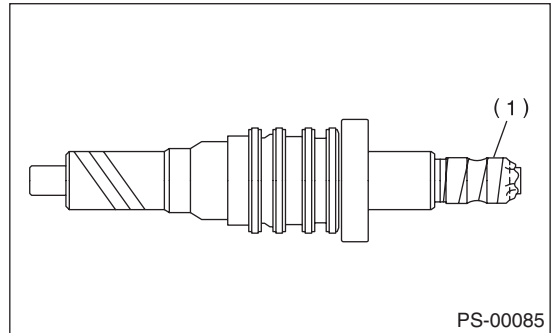
Be careful not to deform the holder.

ST 34099FA060 PUNCH HOLDER



- (A) Holder
- (B) 3 mm (0.12 in)

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

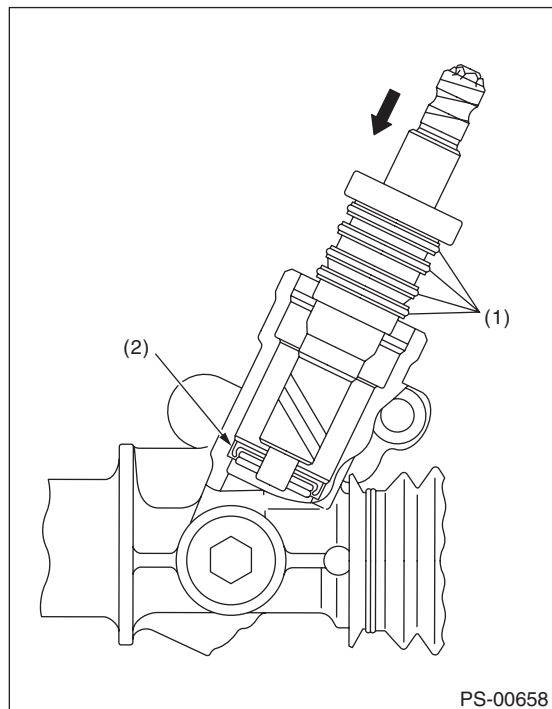


- (1) Vinyl tape

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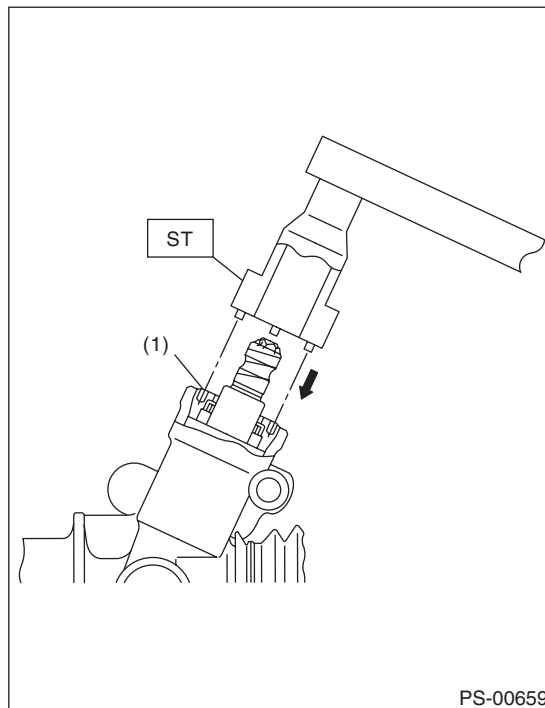
15) Apply a coat of grease on the gear teeth of the valve assembly, and then attach the valve assembly taking care not to scratch oil seal and seal ring.



- (1) Seal ring
- (2) Oil seal

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

Tightening torque:
64 N·m (6.5 kgf·m, 47.0 ft·lb)



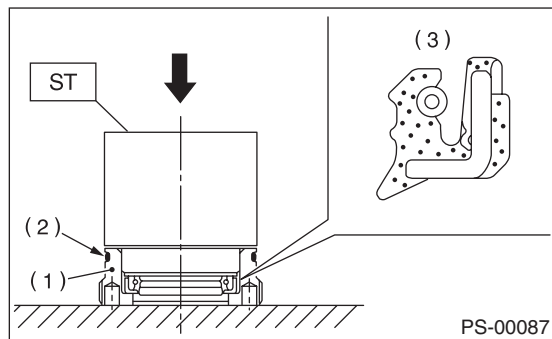
- (1) Plug

16) Apply grease on the oil seal circumference, and then press it into the plug using ST and a press. Replace the O-rings of plug circumference with new O-rings.

ST 34199AE110 OIL SEAL PLUG INSTALLER

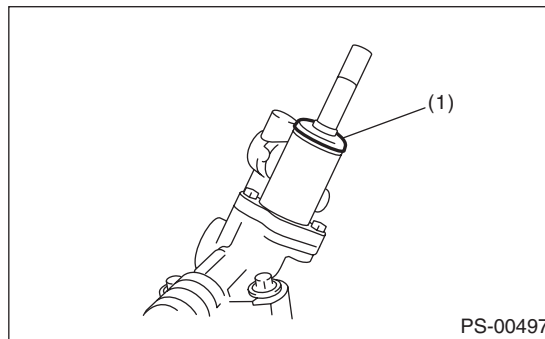
CAUTION:

Install the oil seal paying attention to correct direction.



- (1) Plug
- (2) O-ring
- (3) Oil seal

18) Install the dust cover and then remove the vinyl tape.



- (1) Dust cover

19) 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. Remove any grease blocking the air vent hole.

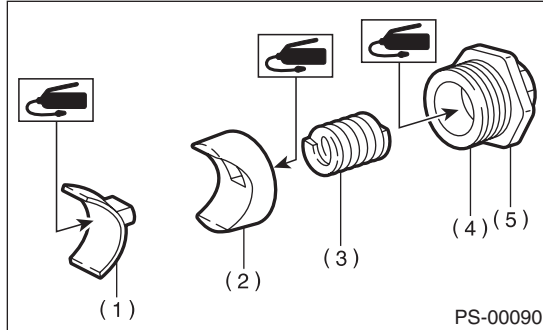
CAUTION:

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.

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20) Apply a coat of grease to the sliding surface of seat pad, sleeve and seating surface of spring, and then insert 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) Sheet pad
- (2) Sleeve
- (3) Spring
- (4) Adjusting screw
- (5) Lock nut

21) Tighten the adjusting screw to the specified torque.

Tightening torque:
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

NOTE:

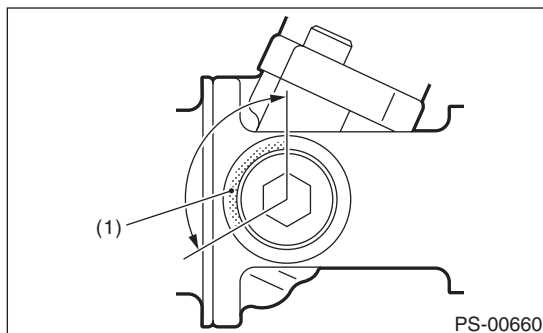
After tightening with the specified torque, loosen it by 25°.

22) Remove the tie-rod.

23) Check that the play, or looseness, is at the standard value. <Ref. to PS-33, SERVICE LIMIT, INSPECTION, Steering Gearbox.>

24) Loosen the adjusting screw, and then apply liquid gasket to at least 1/3 of the entire perimeter of adjusting screw thread.

Liquid gasket:
THREE BOND 1141



- (1) Apply liquid gasket to at least 1/3 of entire perimeter.

25) Tighten the adjusting screw.

(1) 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)

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

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

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

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

26) Install the lock nut. While holding the adjusting screw with a wrench, tighten the lock nut using ST. ST 926230000 WRENCH

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 the lock nut.

27) Install the tie-rod into rack.

Tightening torque:
90 N·m (9.0 kgf-m, 65.1 ft-lb)

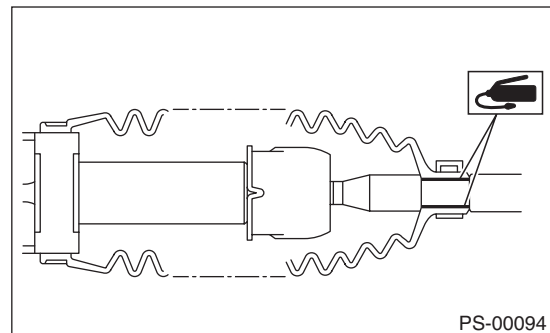
NOTE:

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

28) 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.



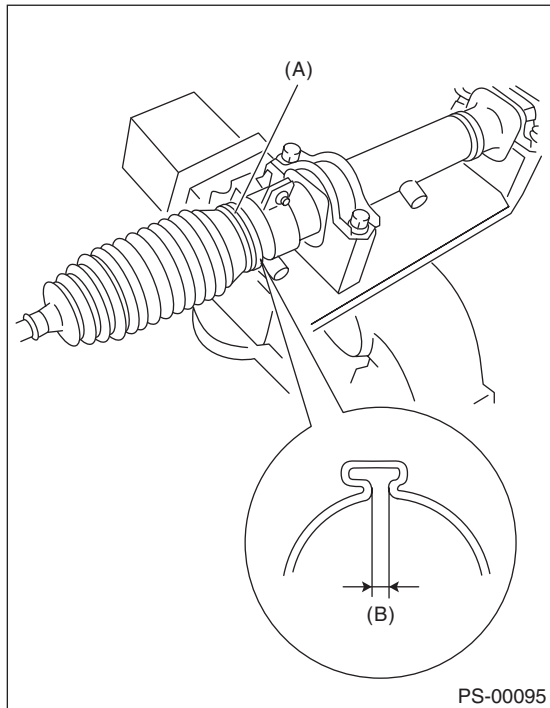
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

29) Crimp the boot so that the clearance of the boot band crimp portion becomes 2 mm (0.08 in) or less.

NOTE:

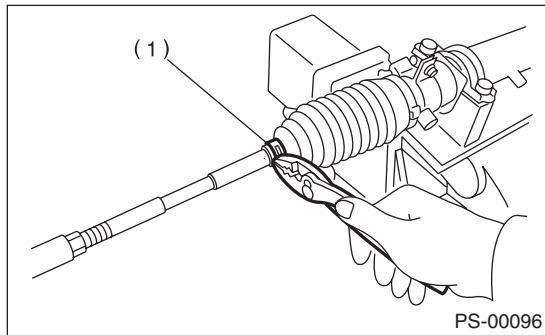
Use a new band.



(A) Boot band

(B) 2 mm (0.08 in) or less

30) Fix the boot end with small clip.



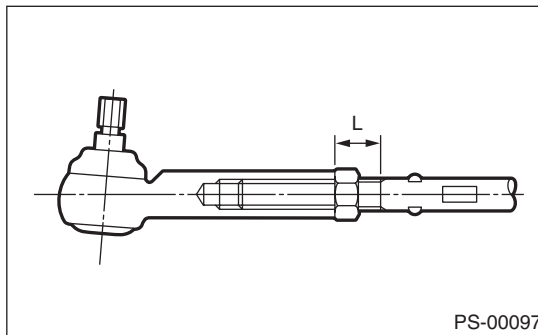
(1) Clip

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

32) 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

31.2 mm (1.23 in)

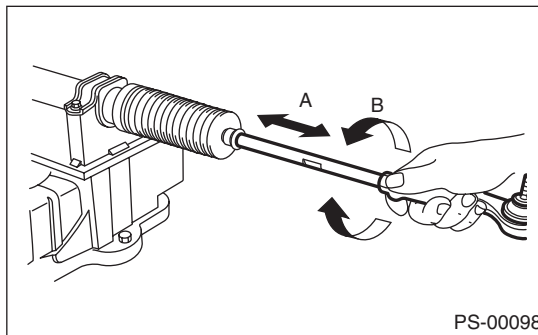


33) Inspect the gearbox as follows.

Holding the "A" tie-rod end, repeat movement from lock to lock two or three times as quickly as possible.

Holding the "B" 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.



34) Remove the gearbox from ST.

ST 926200000 STAND

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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 assembly for water. If any water is found, carefully check the boot for damage, and the 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 there is excessive bend or damage, replace the entire gearbox assembly.
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 dust seal.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust the backlash properly. By measuring the turning torque of the gearbox and the sliding resistance of rack, check if the rack and pinion engages 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. If a problem of either (1) or (2) is found, replace the entire gearbox assembly.
4	Gearbox unit	(1) Bending of the rack shaft (2) Bending of the cylinder portion (3) Crack or damage on cast iron portion	Replace the gearbox assembly with a new part.
		(4) Wear or damage on rack bushing	If the free play of the rack shaft in the radial direction is out of the specified range, replace the gearbox assembly with a new part. (Refer to "SERVICE LIMIT")
		(5) Wear on input shaft bearing	If the free play of the input shaft in the radial direction is out of the specified range, replace the gearbox assembly 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:

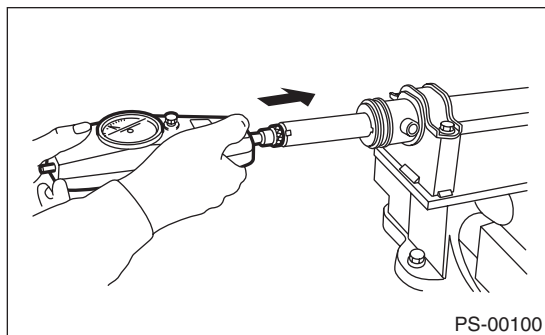
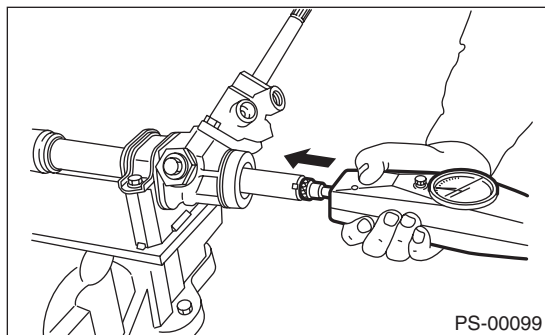
When making a measurement, hold the gearbox assembly in a vise using the ST. Do not hold the gearbox in a vice by inserting aluminum plates etc. between the vise and gearbox assembly.

ST 926200000 STAND

Rack shaft sliding resistance:

Service limit:

400 N (41 kgf, 90 lb) or less



3. RACK SHAFT FREE PLAY IN THE RADIAL DIRECTION

Right-turn steering

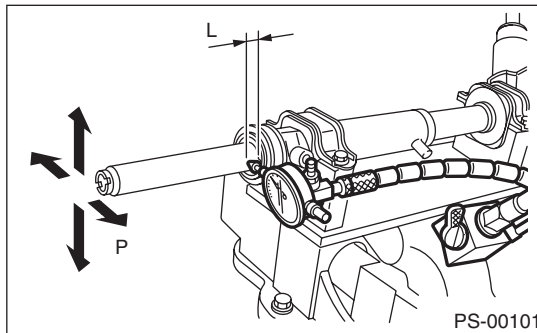
Service limit:

0.19 mm (0.0075 in) or less

Condition

L: 5 mm (0.20 in)

P: 122.6 N (12.5 kgf, 27.6 lb)



Left-turn steering

Service limit:

Direction ← →

0.3 mm (0.012 in) or less

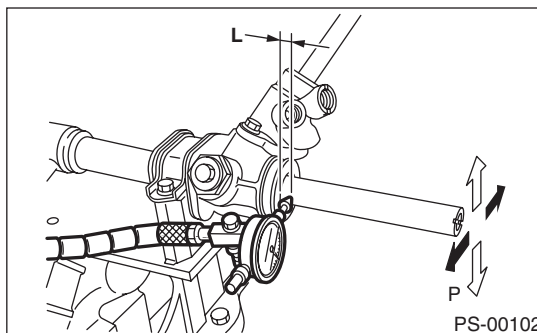
Direction ← →

0.15 mm (0.0059 in) or less

Condition

L: 5 mm (0.20 in)

P: 98 N (10 kgf, 22 lb)



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

4. INPUT SHAFT PLAY

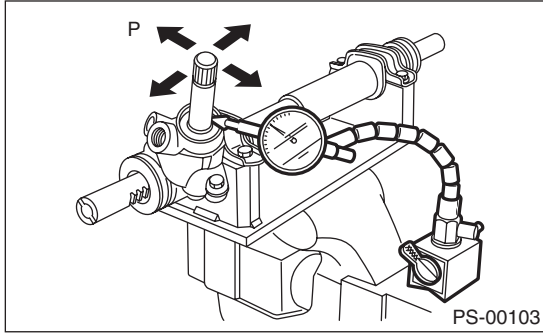
In radial direction

Service limit:

0.18 mm (0.0071 in) or less

Condition

P: 98 N (10 kgf, 22 lb)



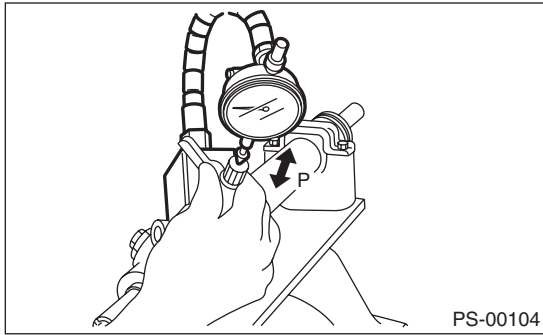
In axial direction

Service limit:

0.5 mm (0.020 in) or less

Condition

P: 20 — 49 N (2 — 5 kgf, 4 — 11 lb)



5. TURNING RESISTANCE OF GEARBOX

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

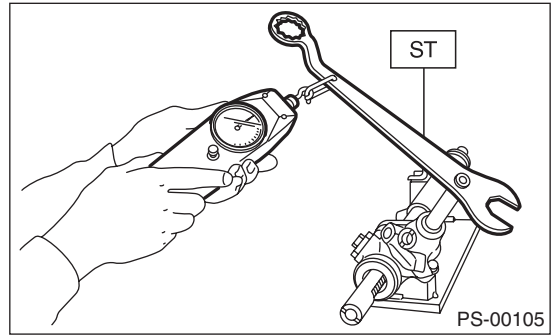
Service limit:

Maximum allowable resistance:

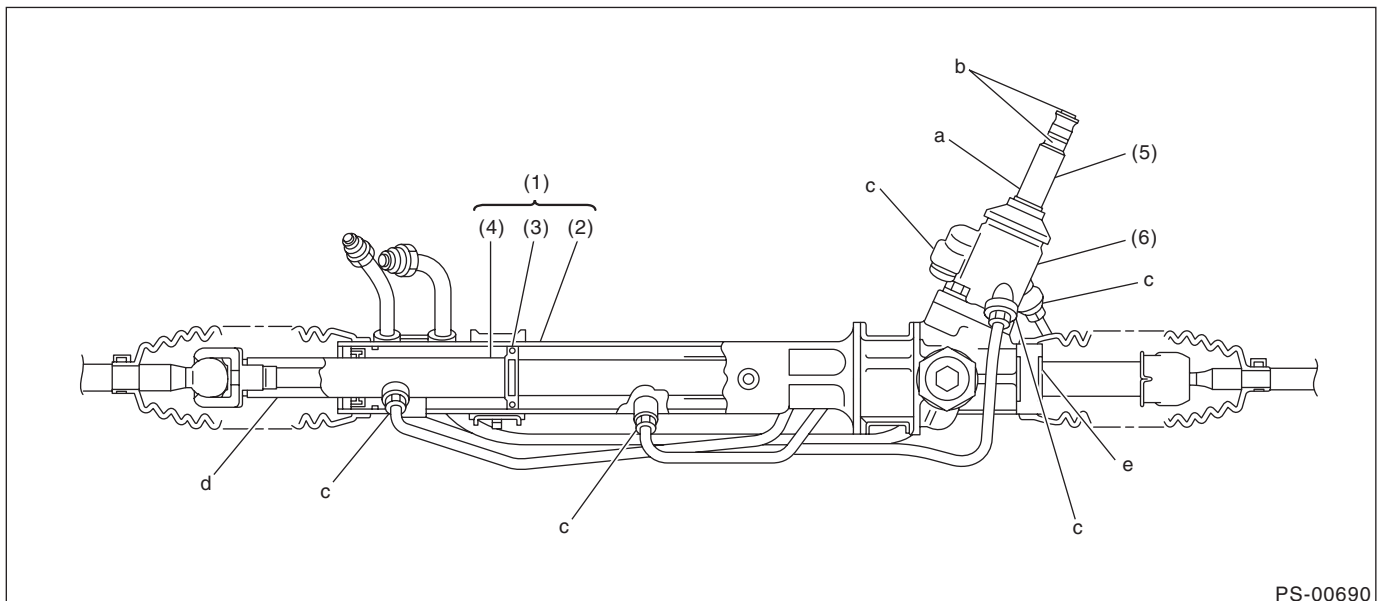
9.33 N (0.95 kgf, 2.10 lb) or less

Difference between right and left turning resistance:

Less than 20%



6. OIL LEAKAGE



PS-00690

- (1) Power cylinder
- (2) Cylinder

- (3) Rack piston
- (4) Rack

- (5) Input shaft
- (6) Valve housing

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

1) 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

2) Cause and solution for oil leakage from “a”
The oil seal is damaged. Replace the valve assembly with a new part.

3) Cause and measure for oil leakage from “b”
The torsion bar O-ring is damaged. Replace the valve assembly with a new part.

4) Cause and measure for oil leakage from “c”
The pipe is damaged. Replace the faulty pipe or O-ring.

5) If the leak is other than a, b, c or if oil is leaking from the 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 areas. Then, turn the steering wheel from lock to lock 30 to 40 times with the engine running, then re-inspect the leaking area immediately after and several hours after this operation.

(1) Cause and solution for oil leakage from “d”
The cylinder seal is damaged. Replace the rack bushing with a new part.

(2) Cause and solution for oil leakage from “e”
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 30 to 40 times with the engine running, then inspect the leaking section immediately after and several hours after this operation.

- If leakage from “e” is found again:
The oil seal of pinion and valve assembly is damaged. Replace the pinion and valve assembly with a new part. Or replace the oil seal and the parts that are damaged during disassembly with new parts.

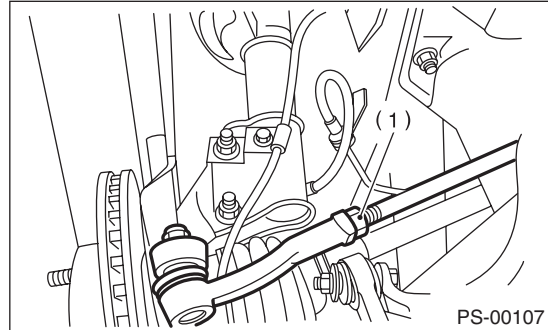
- If oil stops leaking from “e”:
The oil seal of rack housing is damaged. Replace the oil seal and parts that are damaged during disassembly with new parts.

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)



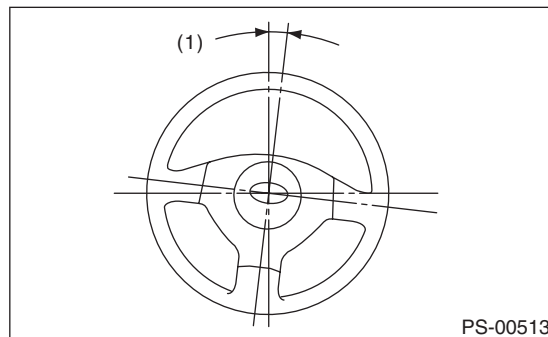
(1) Lock nut

2) Adjust the steering angle of the steering wheel.

Steering angle:

Model	Non-turbo	Turbo
Inner wheel	36°25'±1°30'	35°00'±1°30'
Outer wheel	32°00'±1°30'	30°54'±1°30'

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.