

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5. Steering Gearbox

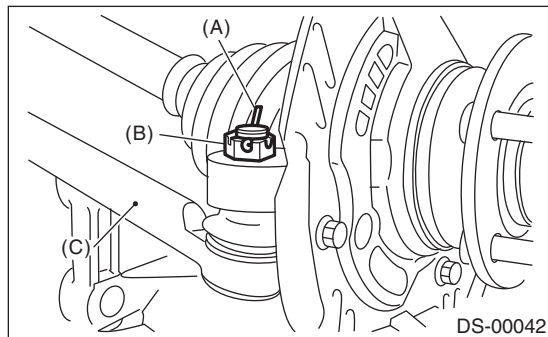
A: REMOVAL

- 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. <Ref. to EI-25, REMOVAL, Front Under Cover.>
- 6) Remove the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

WARNING:

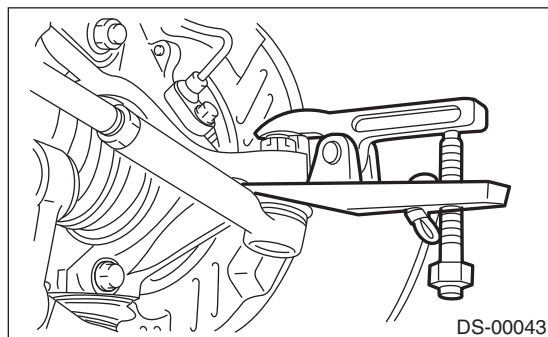
Be careful not to burn yourself because the exhaust pipe is hot.

- 7) Remove the cotter pin and castle nut securing the tie-rod end.



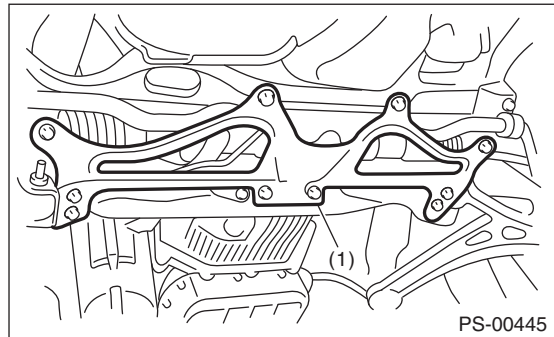
- (A) Cotter pin
- (B) Castle nut
- (C) Tie-rod end

- 8) Using a puller, remove the tie-rod.



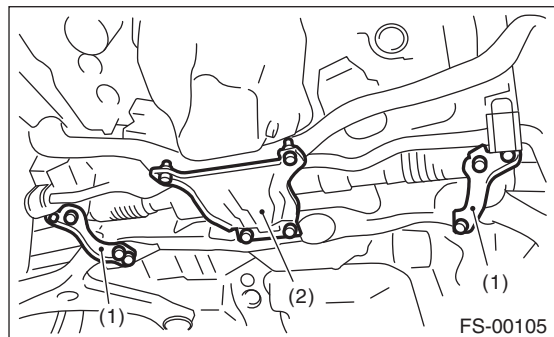
- 9) Remove the front crossmember support plate, jack-up plate and front stabilizer. <Ref. to FS-16, REMOVAL, Front Stabilizer.>

- Large type



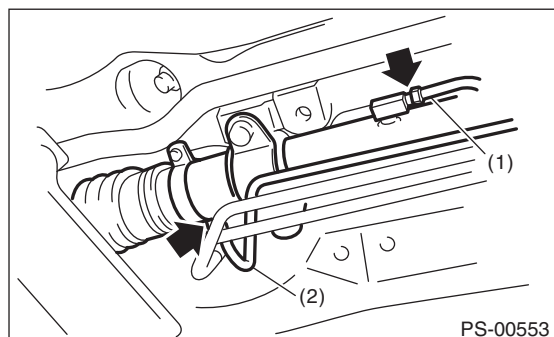
- (1) Front crossmember support plate

- Small type



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

- 10) 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.



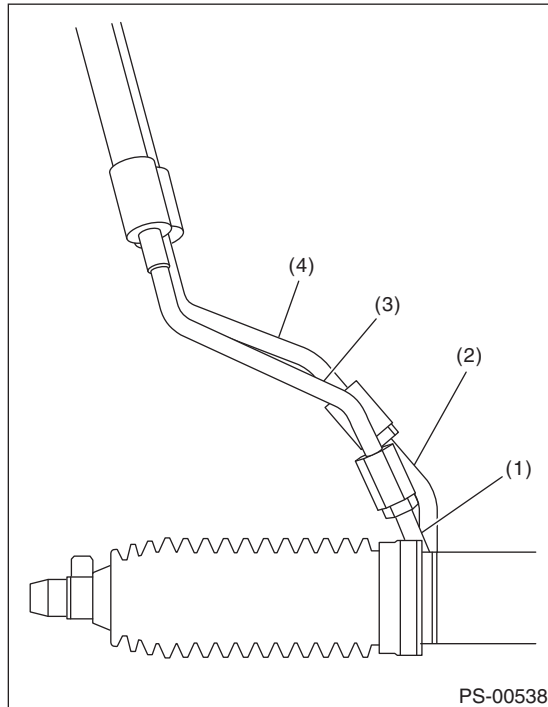
- (1) Pipe A
- (2) Pipe B

- 11) Remove the universal joint. <Ref. to PS-13, REMOVAL, Universal Joint.>

Steering Gearbox

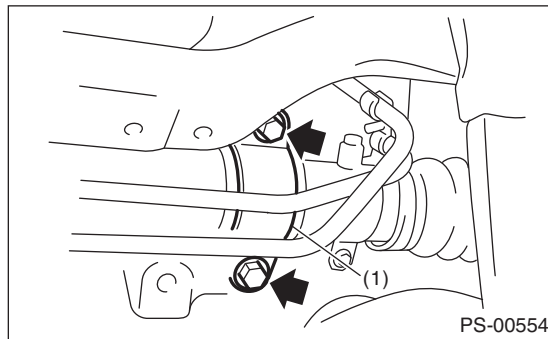
POWER ASSISTED SYSTEM (POWER STEERING)

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



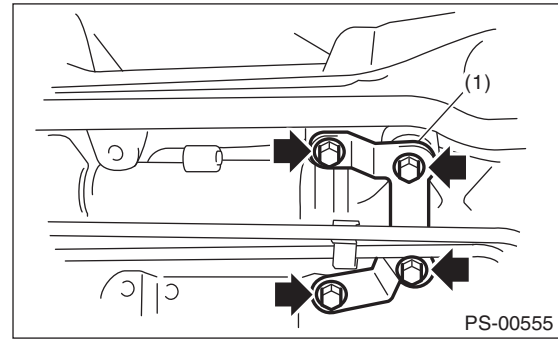
- (1) Pipe C
- (2) Pipe D
- (3) Pressure hose
- (4) Return hose

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



- (1) Clamp

14) Remove the bolts securing the gearbox, and remove the stiffener and gear box.



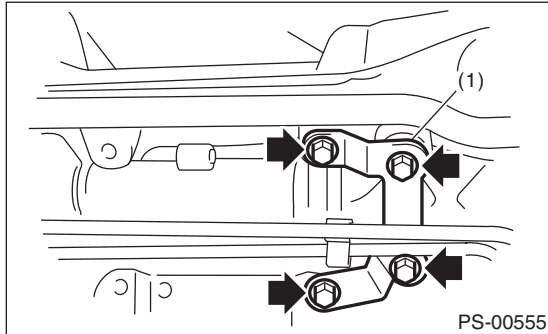
- (1) Stiffener

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

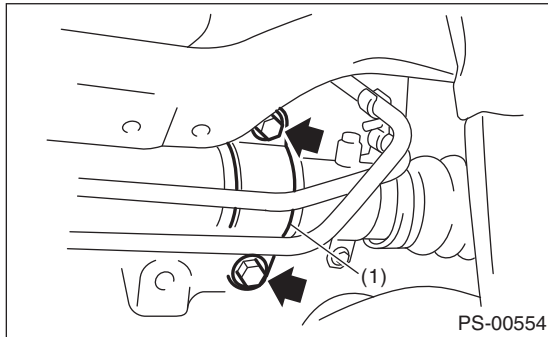
B: INSTALLATION

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



(1) Stiffener

- 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.

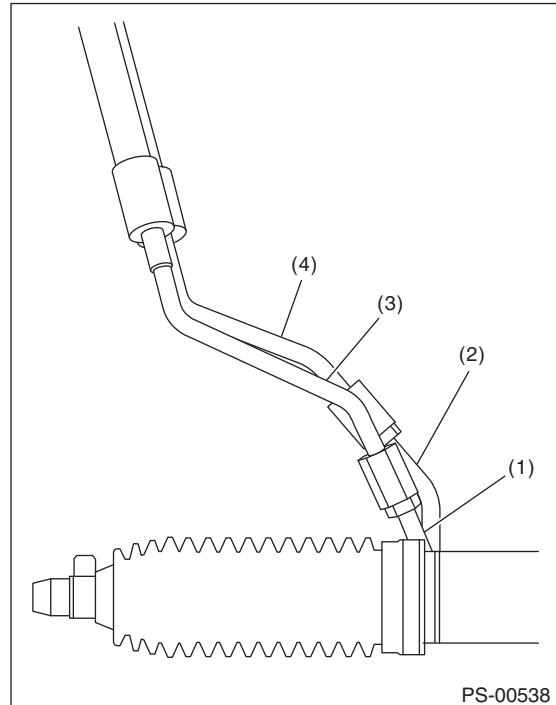
Tightening torque:

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-13, 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)

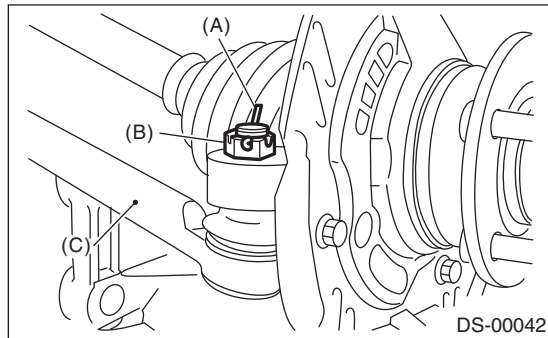
CAUTION:

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

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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-16, 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-25, INSTALLATION, Front Under Cover.>

13) Install the front wheels.

14) Tighten the wheel nuts to the specified torque.

Tightening torque:

100 N·m (10.2 kgf-m, 73.8 ft-lb)

15) Lower the vehicle.

16) Remove the steering wheel. <Ref. to PS-12, REMOVAL, Steering Wheel.>

17) Align the center position of the roll connector. <Ref. to AB-28, ADJUSTMENT, Roll Connector.>

18) Install the steering wheel. <Ref. to PS-12, INSTALLATION, Steering Wheel.>

19) Connect the ground cable to the battery.

20) Pour fluid into the oil tank, and bleed air. <Ref. to PS-50, Power Steering Fluid.>

21) Check for fluid leaks.

22) Check the fluid level in oil tank.

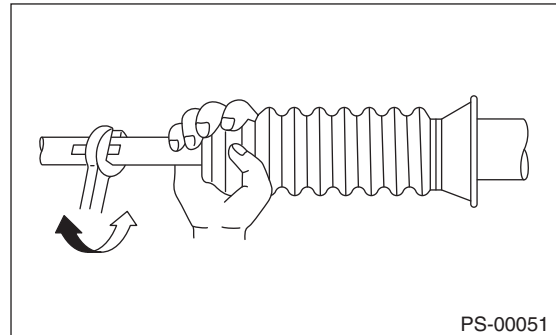
23) After adjusting toe-in and steering angle, tighten the lock nut on tie-rod end.

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.



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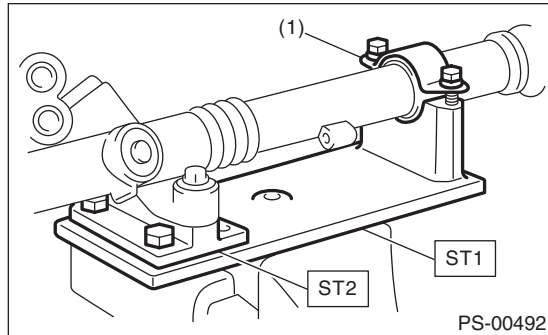
C: DISASSEMBLY

- 1) Disconnect the four pipes from the 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

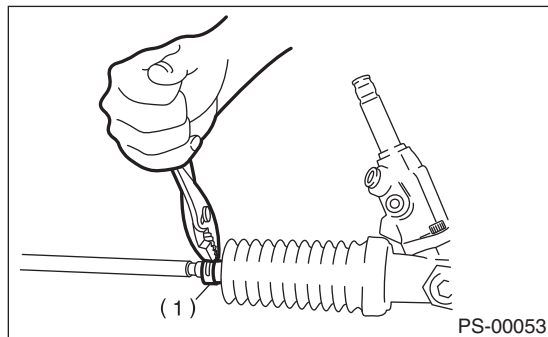
CAUTION:

Using the ST, affix the gear box assembly to a vise as shown in the figure. Do not hold the gearbox on the vise without this ST.



(1) Clamp

- 3) Remove the tie-rod end and lock nut from the gearbox.
- 4) Remove the clip on the outer side of the boot, and move the boot towards the tie-rod end.

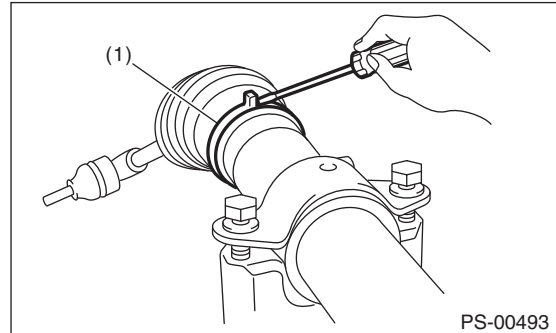


(1) Clip

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

NOTE:

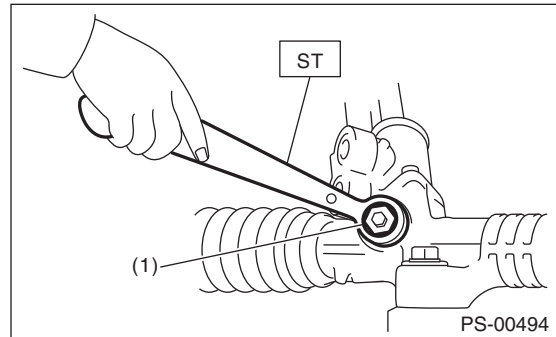
Replace the boot if there is damage, cracks or deterioration.



(1) Band

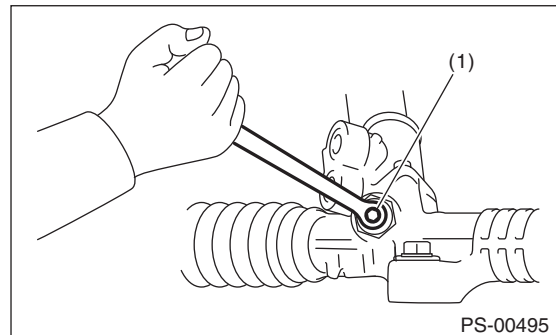
- 6) Using the ST, loosen the lock nut.

ST 926230000 SPANNER



(1) Lock nut

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



(1) Adjusting screw

- 8) Remove the tie-rod.
- 9) Loosen the adjusting screw, and remove the spring and sleeve.

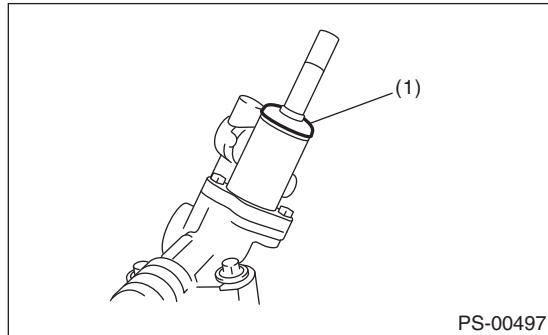
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

10) Remove any soil on the input shaft. Being careful not to damage the housing and input shaft, and that no foreign objects enter the gear box, pull out the dust cover.

CAUTION:

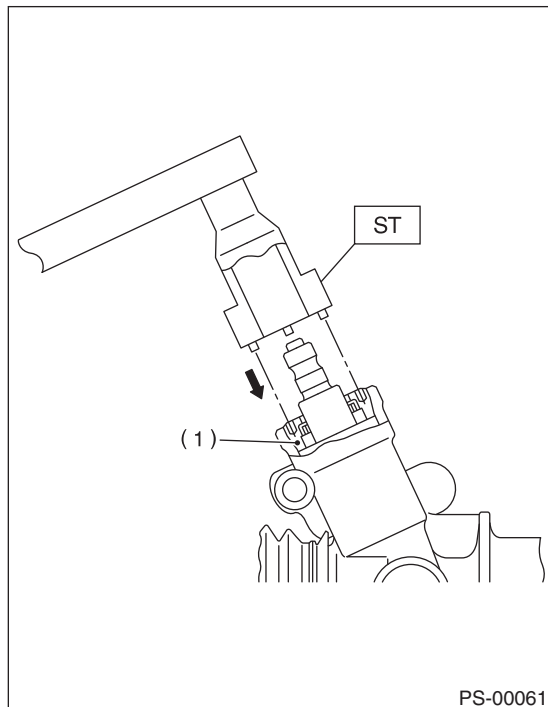
Wrap tape around the input shaft splines to prevent damaging the dust cover.



(1) Dust cover

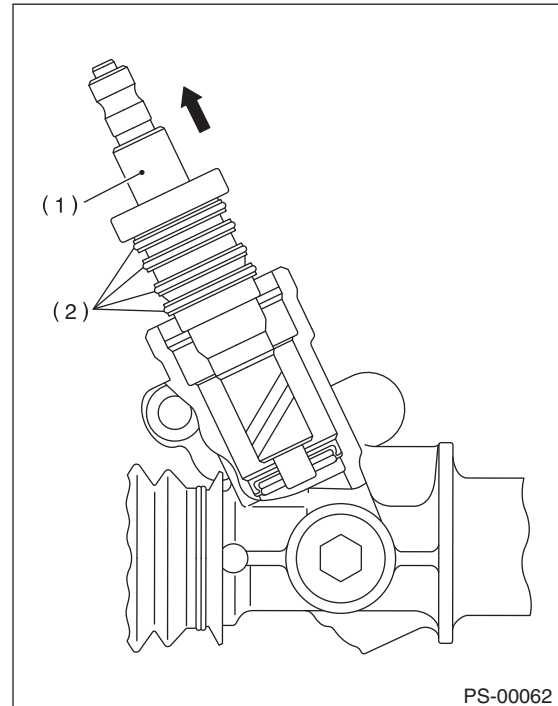
11) Match the pin of the ST to the plug hole and attach. Turn the ST counterclockwise to remove the plug.

ST 34199AE090 PLUG WRENCH



(1) Plug

12) Remove the valve assembly while being careful not to damage the seal rings and valve housing inner surfaces.



(1) Valve assembly

(2) Seal ring

13) Remove the holder.

Steering Gearbox

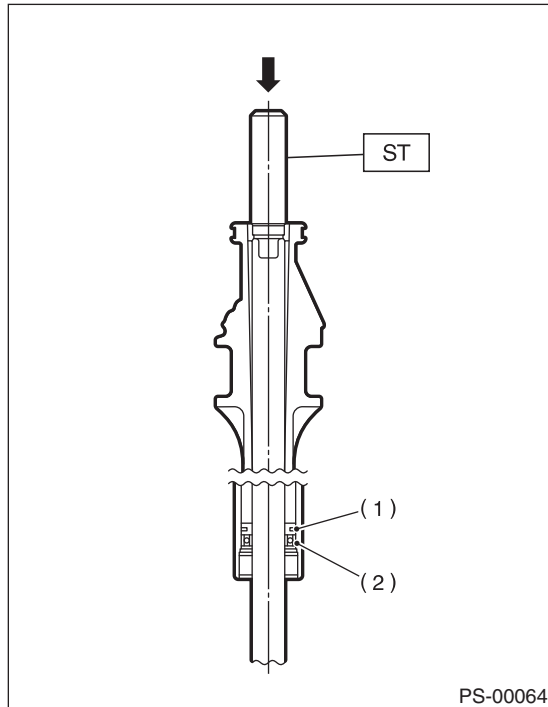
POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 34199FE000 INSTALLER & REMOVER

NOTE:

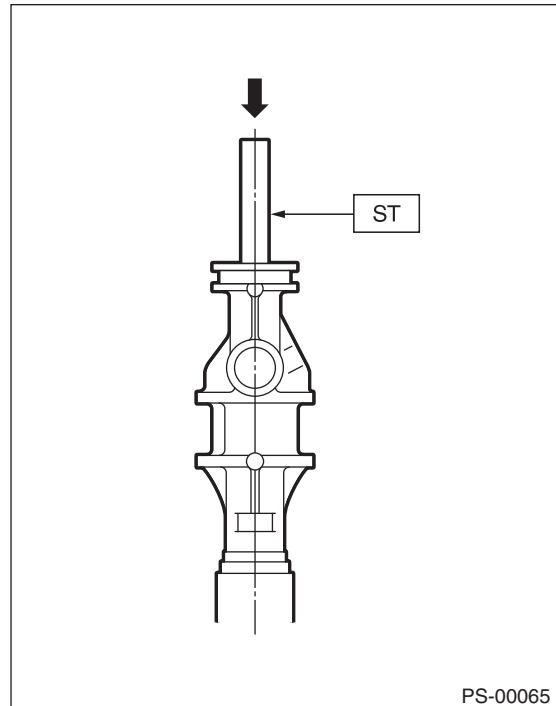
Plug the pipe connection of the steering body, so that fluid will not come pouring out.



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

15) Insert the ST from the valve side, and push out the backup ring and oil seal.

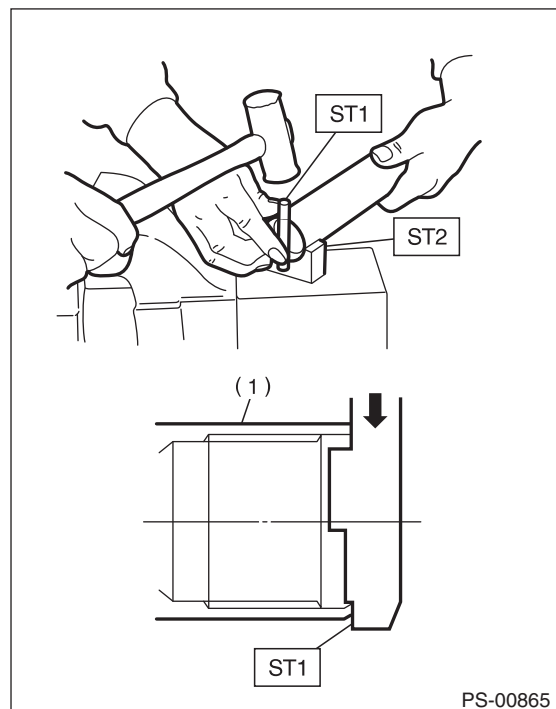
ST 34199FE010 REMOVER



16) Correct the crimped area of the cylinder using ST1 and ST2.

ST1 34099FA080 PUNCH

ST2 34199FE020 BASE

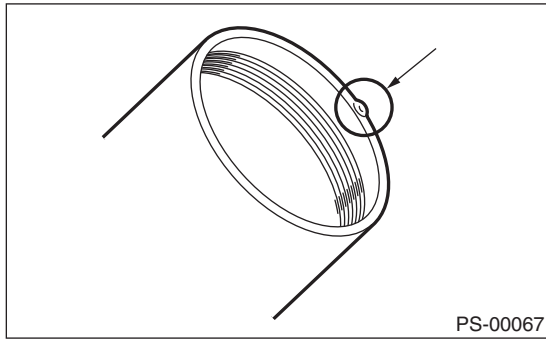


- (1) Cylinder

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POWER ASSISTED SYSTEM (POWER STEERING)

17) If the cylinder end is deformed to form a protrusion, use an oil stone to correct.

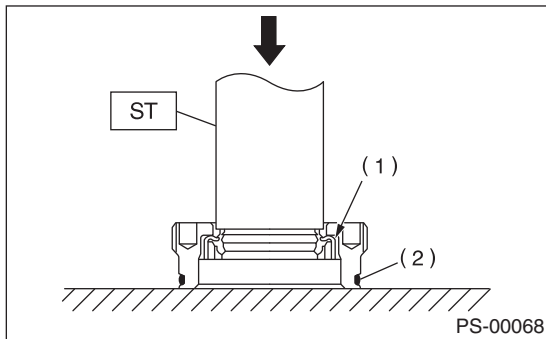


18) Using the ST, remove the oil seal and push out from the plug.

ST 34199AE100 OIL SEAL PLUG REMOVER

NOTE:

Do not apply a force to the end surface of a plug.

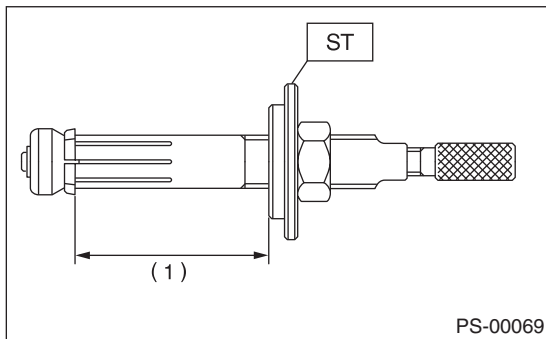


(1) Oil seal

(2) O-ring

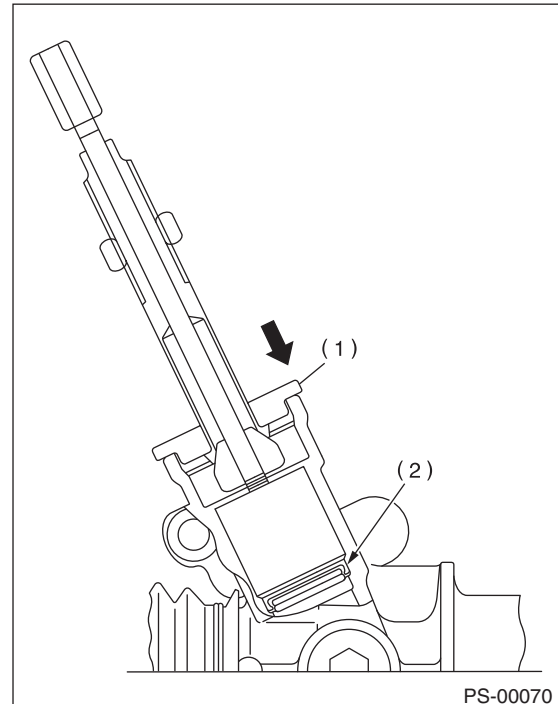
19) Set the ST at the dimensions indicated in the figure.

ST 34199AE120 GEAR BOX OIL SEAL REMOVER



(1) 70 mm (2.76 in)

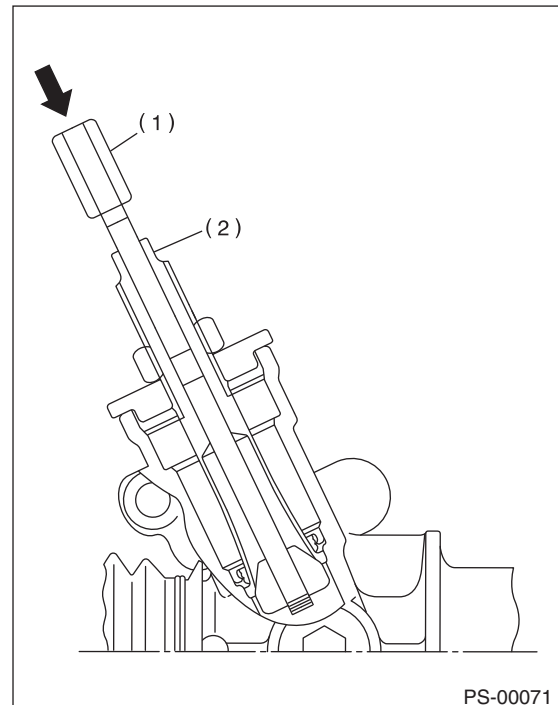
20) Set the stopper in the gearbox body first, then insert the tip of the ST into the gearbox body.



(1) Stopper

(2) Oil seal

21) Fix the width across flats in place, push in while rotating the rod, and hook the oil seal.



(1) Rod

(2) Width across flats

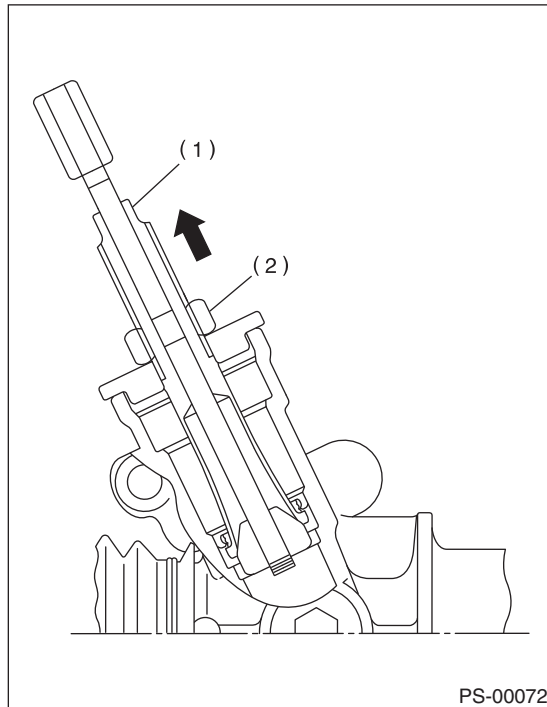
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

22) Fix the width across flats in place, turn the nut and pull out the oil seal.

CAUTION:

Be careful not to damage the inner surface of the gearbox.



- (1) Width across flats
- (2) Nut

D: ASSEMBLY

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

Steering grease:

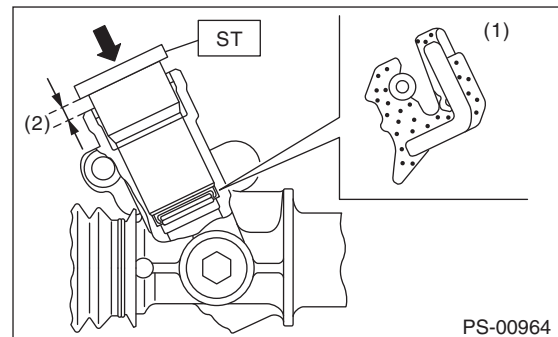
VALIANT GREASE M2 (Part No 003608001)

2) Check the direction and attachment location of the oil seal. Using an ST and a press, press fit the oil seal into the gear box.

CAUTION:

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

ST 34199AE130 GEAR BOX OIL SEAL
INSTALLER



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

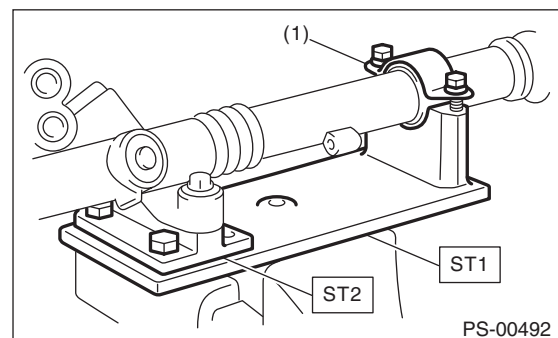
3) Attach the steering body to the ST as shown in the figure. Apply grease to the needle bearing.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

CAUTION:

Make sure that there are no problems with the needle bearing. If faulty, replace with a new steering body.



- (1) Clamp

Steering Gearbox

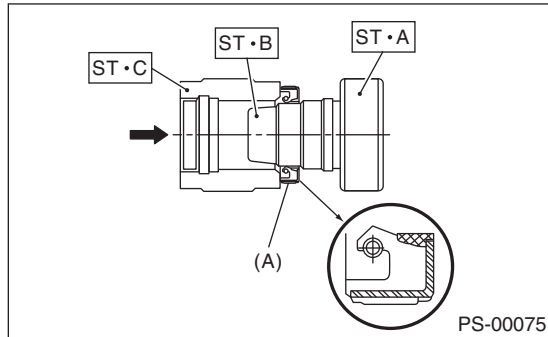
POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 34199FE040 INSTALLER A, B, C

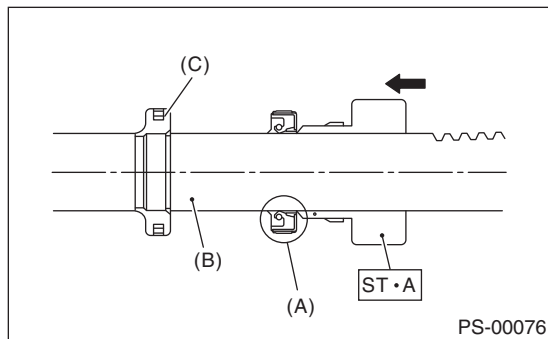
NOTE:

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



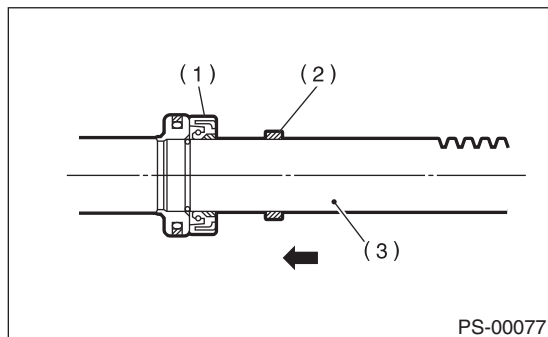
(A) Oil seal

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.



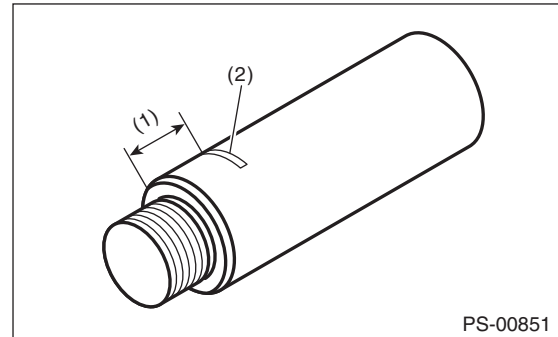
(1) Oil seal
(2) Back-up washer
(3) Rack

7) 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) Mark a position 9 mm (0.35 in) from the end of the ST as indicated in the figure.

ST 34199FE000 INSTALLER & REMOVER

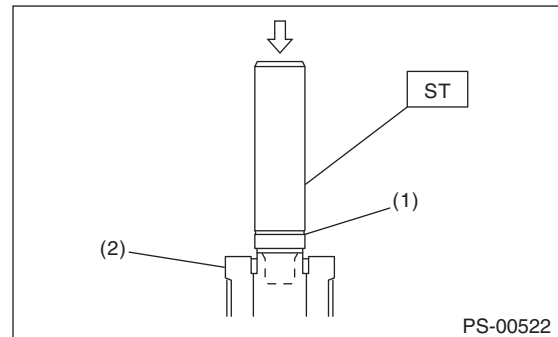


(1) 9 mm (0.35 in)
(2) Place a mark

10) Set the ST to the end of rack.

ST 34199FE000 INSTALLER & REMOVER

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



(1) Mark
(2) Holder

12) Remove the ST and holder.

13) Using the same procedures as steps 4)-5), insert the outer side oil seal to the rack.

ST 34199FE040 INSTALLER A, B, C

Steering Gearbox

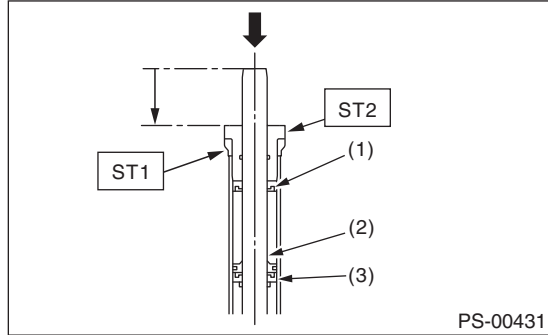
POWER ASSISTED SYSTEM (POWER STEERING)

14) Place ST2 through the rack, and use the press to hold the rack and ST2.

Push in the outer side oil seal until ST1 and ST2 contact each other, and the rack end face is aligned with the end face of ST2.

ST1 34199FE050 GUIDE

ST2 34199FE060 INSTALLER



(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:

90 N·m (9.1 kgf-m, 65.7 ft-lb)

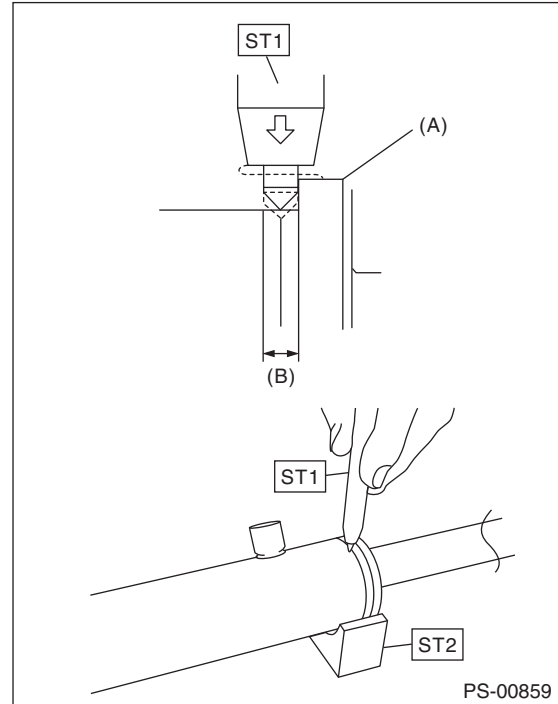
16) Using the ST, crimp one location less than 3 mm (0.12 in) from the holder.

CAUTION:

Be careful not to deform the holder.

ST1 34099FA060 PUNCH HOLDER

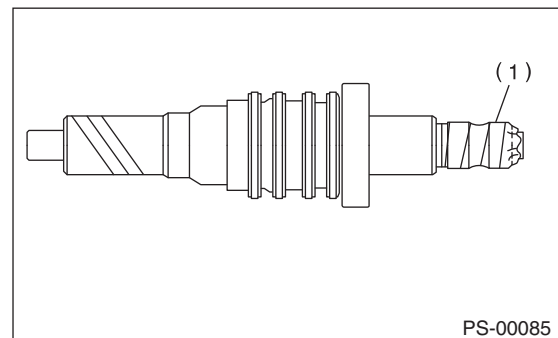
ST2 34199FE020 BASE



(A) Holder

(B) 3 mm (0.12 in)

17) Wrap the serrated part of the valve assembly with vinyl tape, and apply grease to the tape surface.

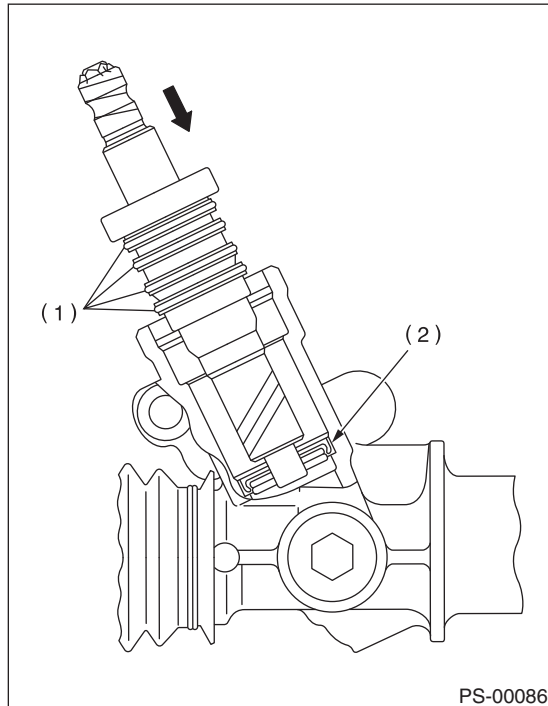


(1) Vinyl tape

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18) Apply grease to the gear teeth of the valve assembly, and while being careful not to damage the oil seals and seal rings, attach the valve assembly.



(1) Seal ring

(2) Oil seal

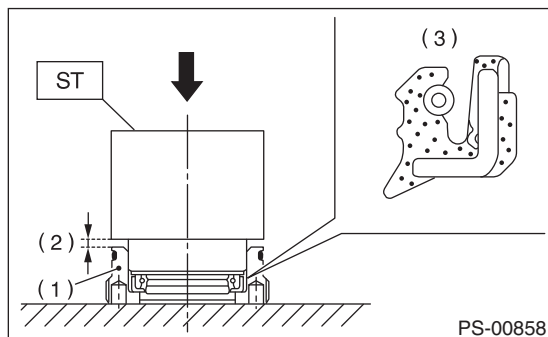
19) Replace the O-ring for the plug periphery with a new O-ring.

20) Apply grease around the oil seal, and use the ST and press to insert into the plug

ST 34199AE110 OIL SEAL PLUG INSTALLER

CAUTION:

- Attach the oil seal in the correct direction.
- To avoid compression of the oil seal, pressure insert with the plug and ST separated by 1 mm (0.039 in).



(1) Plug

(2) 1 mm (0.039 in)

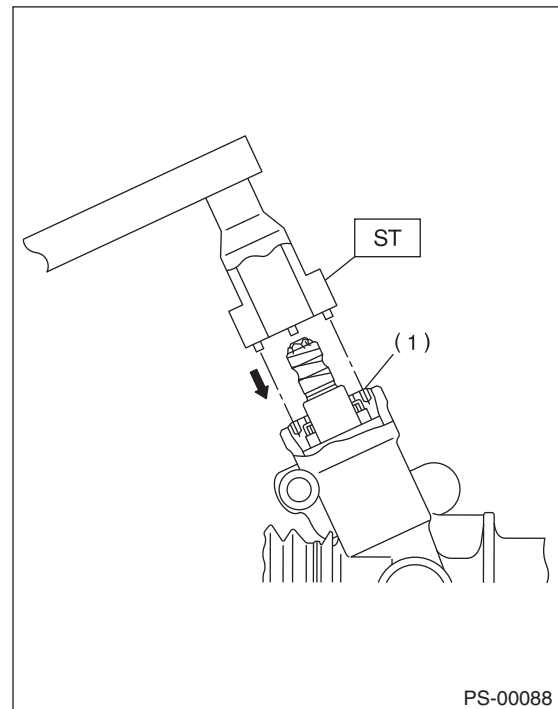
(3) Oil seal

21) Using the ST, attach the plug.

ST 34199AE090 PLUG WRENCH

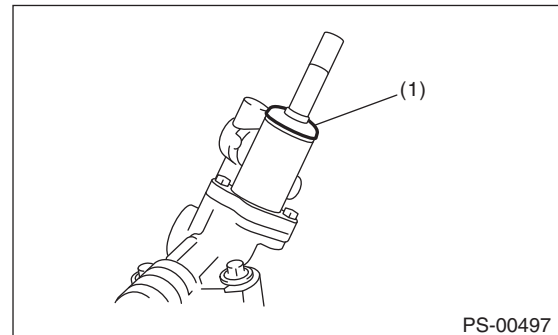
Tightening torque:

64 N·m (6.5 kgf·m, 47.0 ft·lb)



(1) Plug

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



(1) Dust cover

23) Temporarily attach the tie-rod to the rack end, and fully stroke the rack two or three times to the left and right to properly fit the rack.

CAUTION:

Moving the rack for across its full stroke without installing tie-rods may damage the oil seal. Always install the left and right tie-rods.

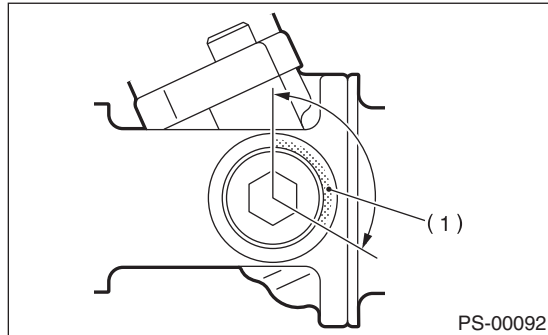
Steering Gearbox

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

Liquid gasket:

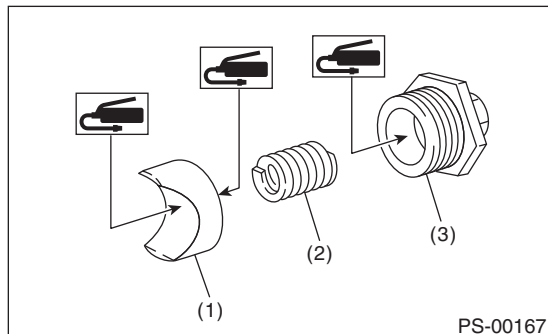
THREE BOND 1141 (Part No. 004403006)



(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.



(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 (0.50 kgf-m, 3.6 ft-lb)

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

CAUTION:

Do not loosen by more 37° or more.

Tightening torque:

4.9 N-m (0.50 kgf-m, 3.6 ft-lb)

29) Remove the tie-rod.

30) Check for whether play and looseness is within specifications. <Ref. to PS-32, SERVICE LIMIT, INSPECTION, Steering Gearbox.>

31) Install the lock nut. While holding the adjusting screw with wrench, tighten the lock nut using ST. ST 926230000 SPANNER

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) Attach the tie-rod to the rack.

Tightening torque:

90 N-m (9.1 kgf-m, 65.7 ft-lb)

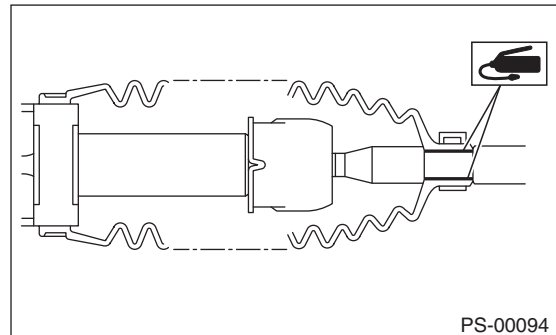
NOTE:

Be careful that debris, dust, and other foreign objects do not become attached to the attachment surfaces of the rack and tie-rod.

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.



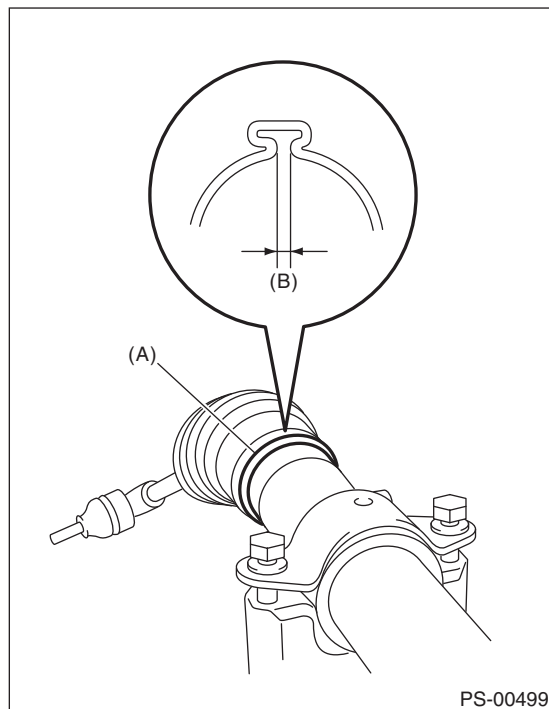
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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:

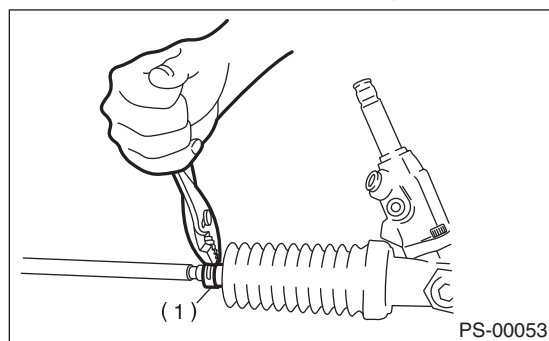
Use a new boot band.



(A) Boot band

(B) 2 mm (0.08 in) or less

35) Fix the boot end with small clip.



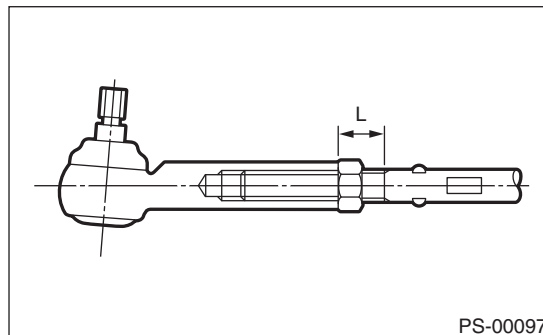
(1) Clip

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.

Installed tie-rod length L:

28 mm (1.1 in)

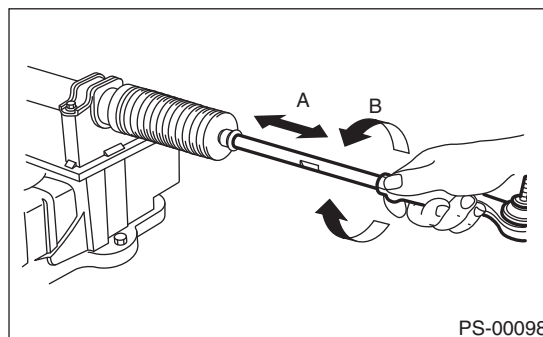


38) Inspect the gearbox as follows:

“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 at the specified position without inflating.



39) Remove the gearbox from ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

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

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 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 the 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

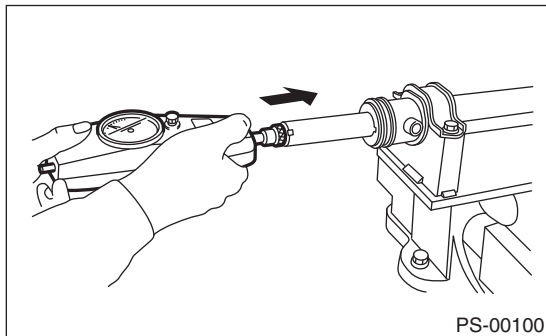
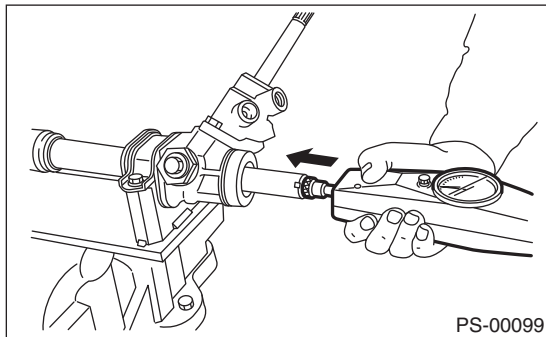
Rack shaft sliding resistance:

Service limit

314 N (32 kgf, 71 lbf) or less

Left/right differential of sliding resistance:

20% or less



3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

Right-turn steering:

Service limit

Direction

0.4 mm (0.016 in) or less

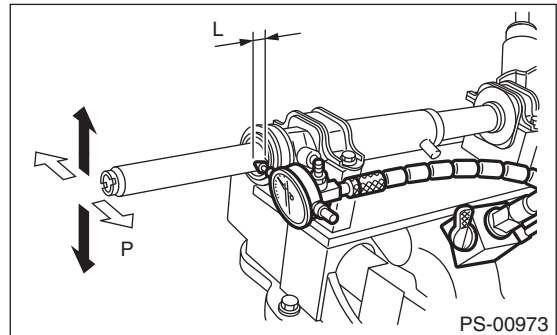
Direction

0.6 mm (0.024 in) or less

Condition

L: 5 mm (0.20 in)

P: 98 N (10 kgf, 22 lbf)

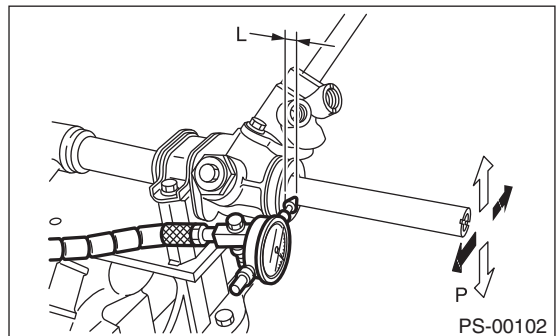


Left-turn steering:

Service limit

Direction

0.4 mm (0.016 in) or less



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

4. INPUT SHAFT PLAY

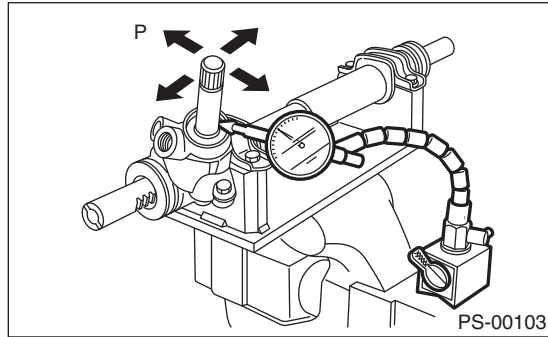
In radial direction:

Service limit

0.18 mm (0.0071 in) or less

Condition

P: 98 N (10 kgf, 22 lbf)



In axial direction:

Service limit

0.27 mm (0.0106 in) or less

Condition

P: 20 — 49 N (2 — 5 kgf, 4 — 11 lbf)



5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the gearbox turning resistance.

ST 34099PA100 SPANNER

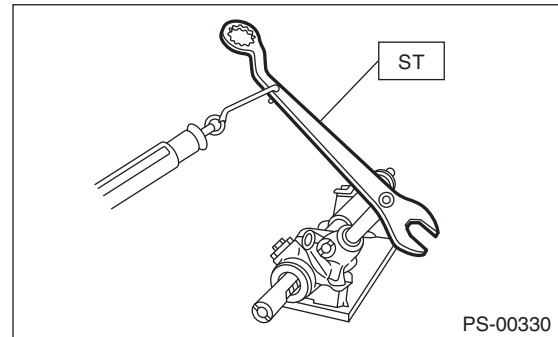
Service limit:

Maximum allowable resistance:

13 N (1.3 kgf, 2.9 lbf) or less

Difference between right and left turning resistance:

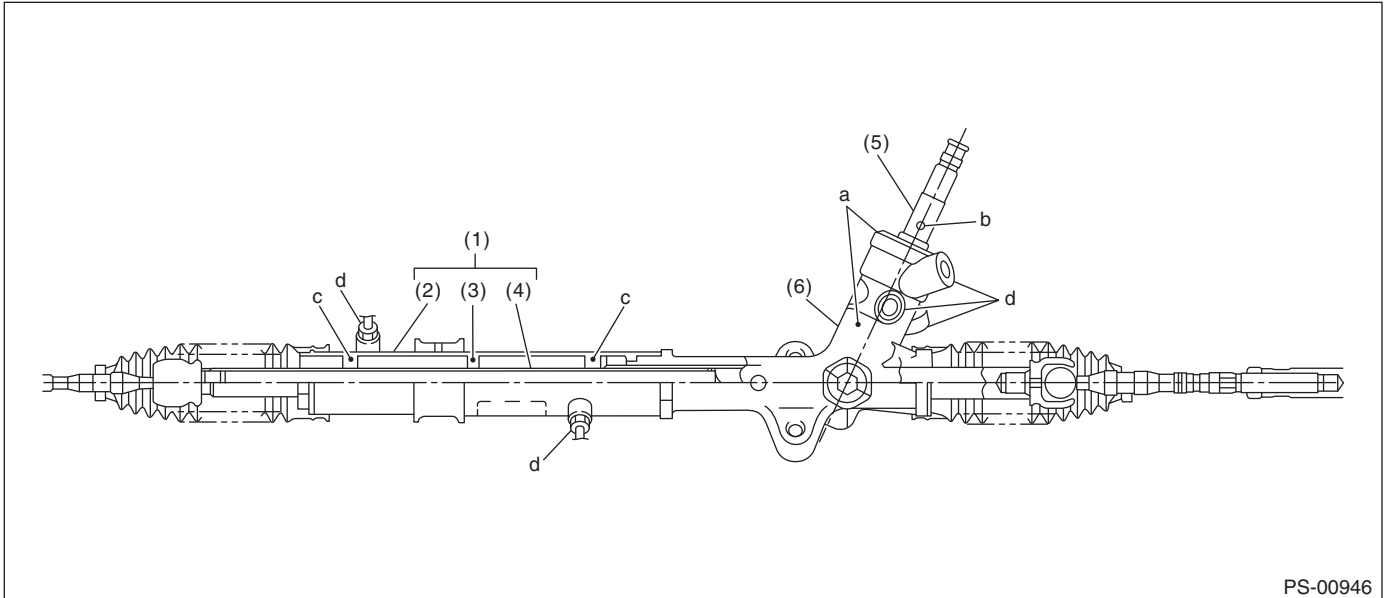
20% or less



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 with a new part.

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

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

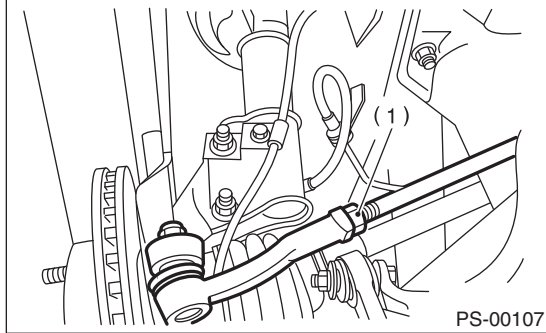
F: ADJUSTMENT

1) Adjust the front toe.

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

Standard of front toe:

IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)



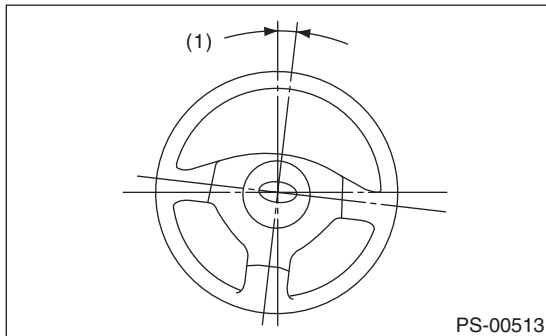
(1) Lock nut

2) Adjust the steering angle of the wheels.

Standard of steering angle:

Model	Inner wheel	Outer wheel
All models	$38.3^{\circ} \pm 1.5^{\circ}$	$33.8^{\circ} \pm 1.5^{\circ}$

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.