

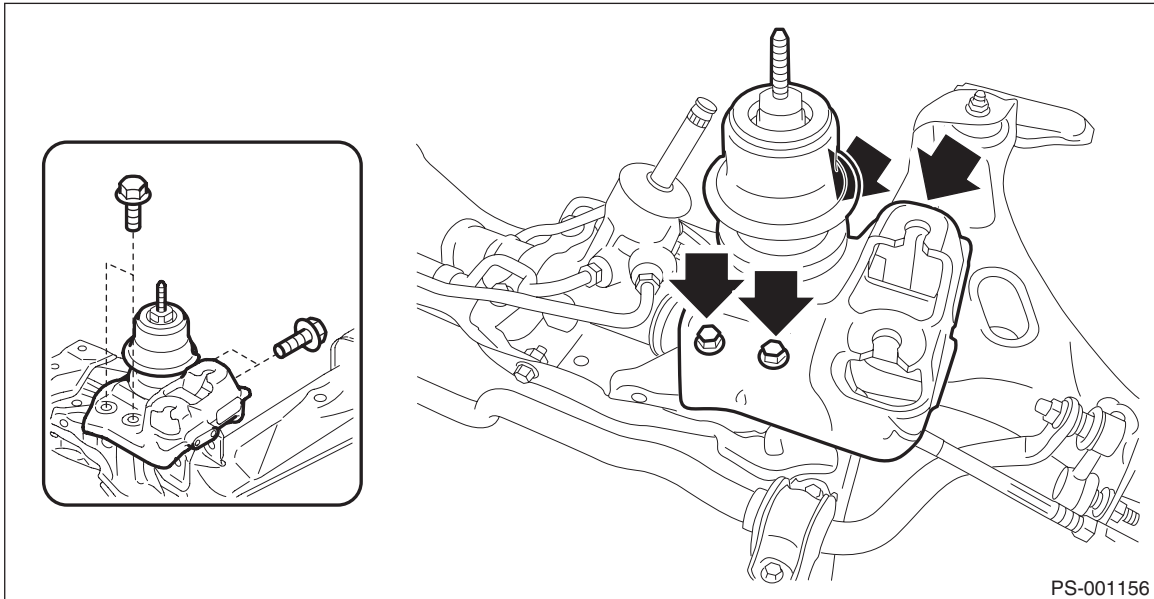
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5. Steering Gearbox

A: REMOVAL

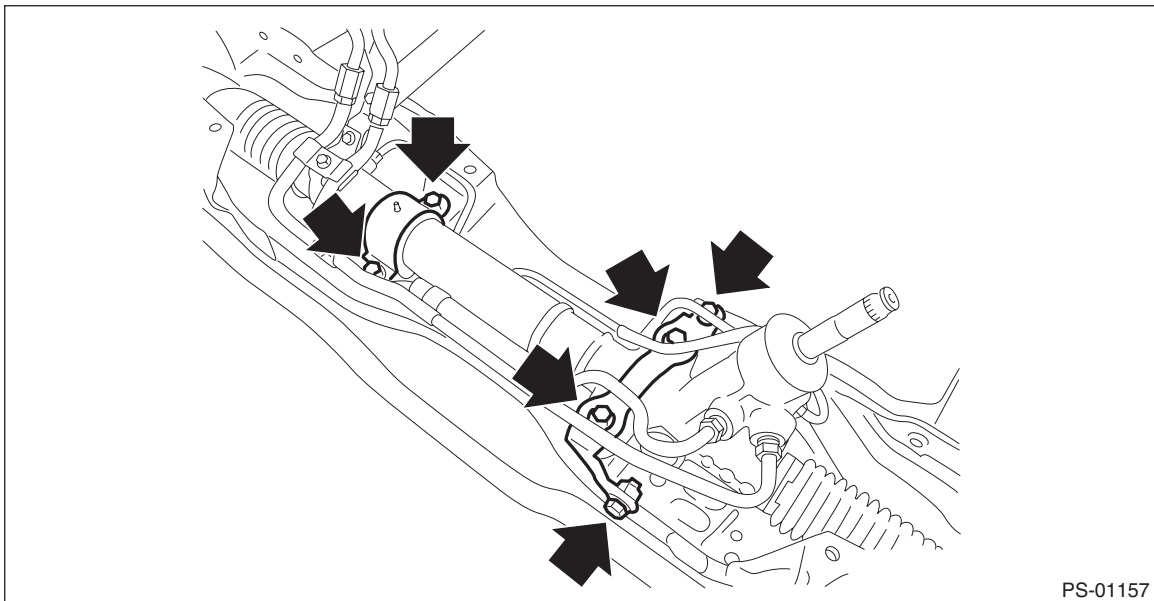
- 1) Remove the cradle. <Ref. to FS-20, REMOVAL, Cradle.>
- 2) Remove the bolts, and remove left and right main mounting brackets.



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

CAUTION:

Be careful not to damage the steering boot.



B: INSTALLATION

- 1) Before installation, check the steering gearbox. <Ref. to PS-55, INSPECTION, Steering Gearbox.>
- 2) Install each part in the reverse order of removal.

Tightening torque:

Steering gearbox parts: <Ref. to PS-4, COMPONENT, General Description.>

Front suspension parts: <Ref. to FS-3, COMPONENT, General Description.>

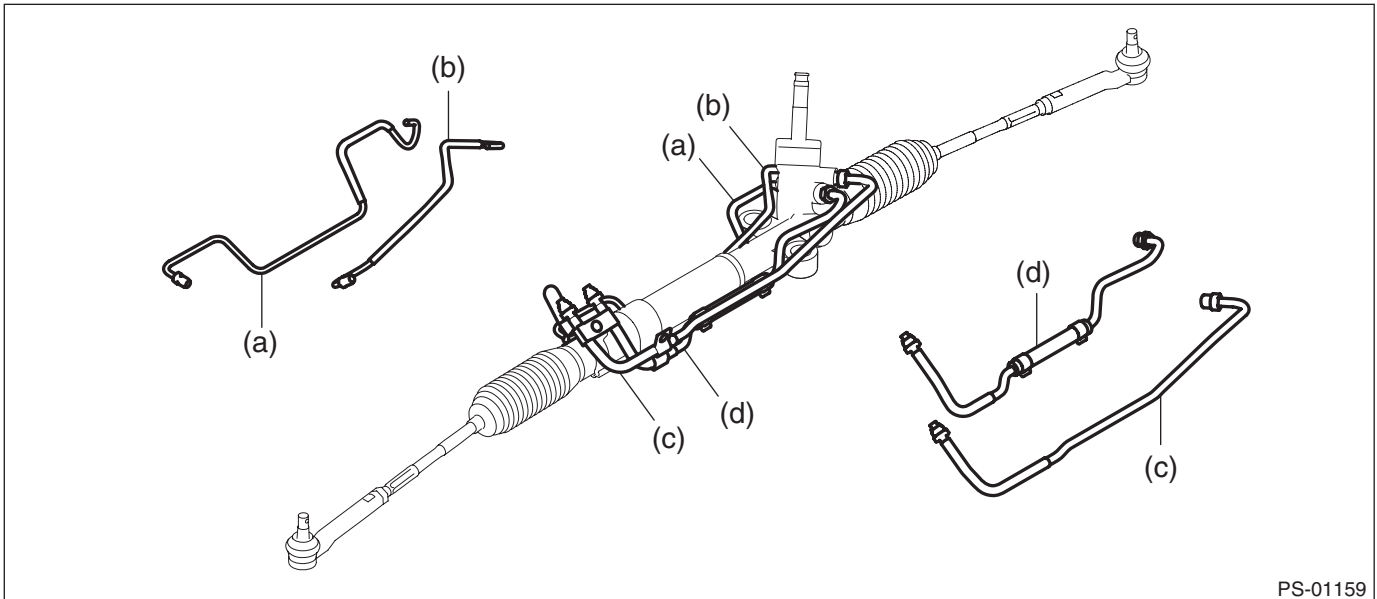
- 3) Inspect the wheel alignment and adjust if necessary.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

C: DISASSEMBLY

1) Disconnect the four pipes from steering body and control valve housing.



PS-01159

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

CAUTION:

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

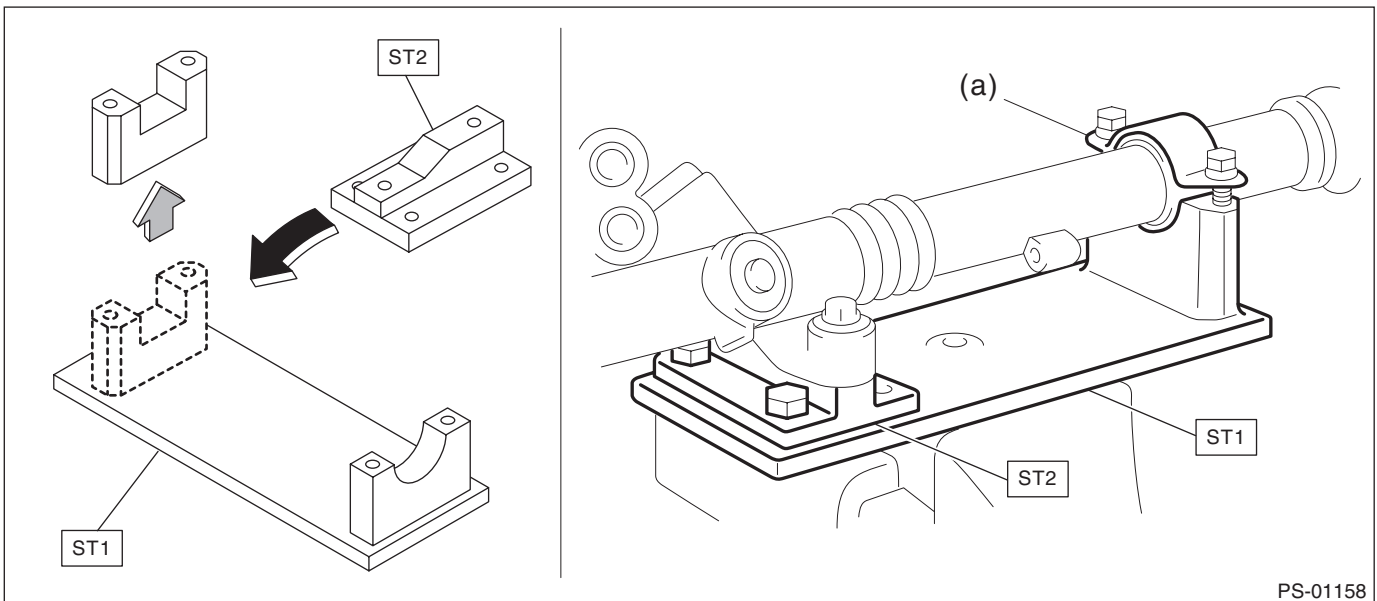
PREPARATION TOOL:

ST1: STAND (926200000)

ST2: BOSS D (34199AG000)

(1) Replace BOSS of STAND (ST1) with BOSS D (ST2).

(2) Using the clamp (a) removed from vehicle body, attach the gearbox assembly to ST.



PS-01158

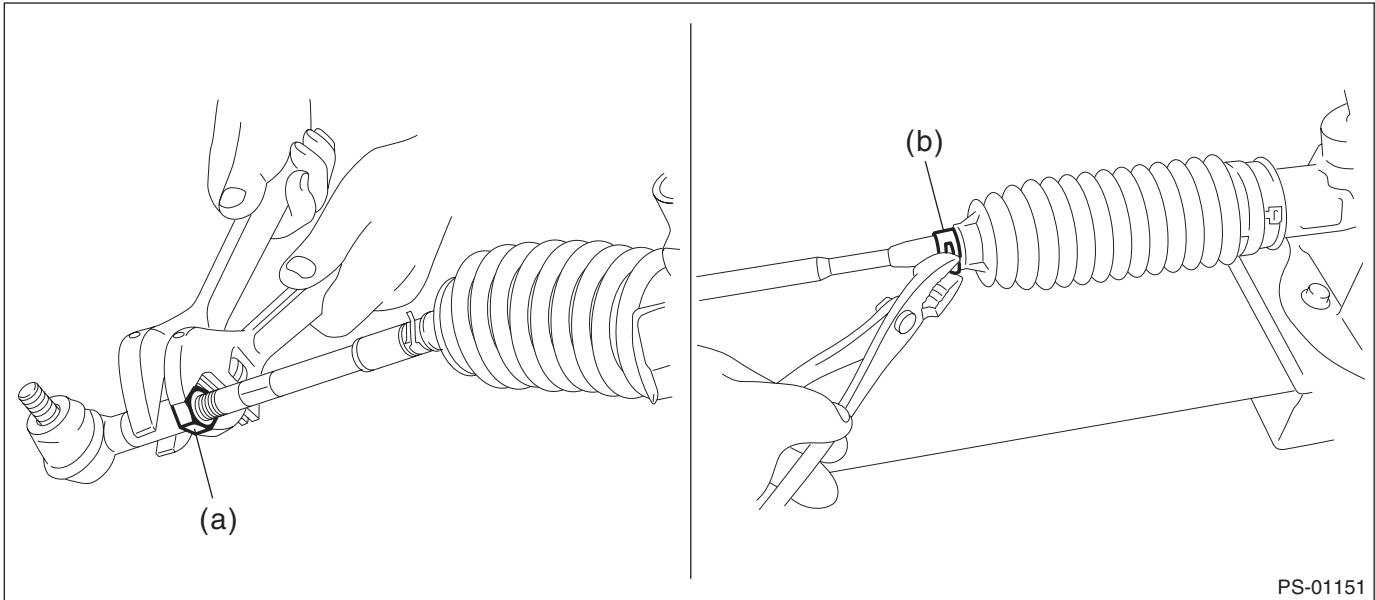
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

3) Remove the left and right boots from the gearbox.

(1) Remove the tie-rod end and lock nut (a) from gearbox.

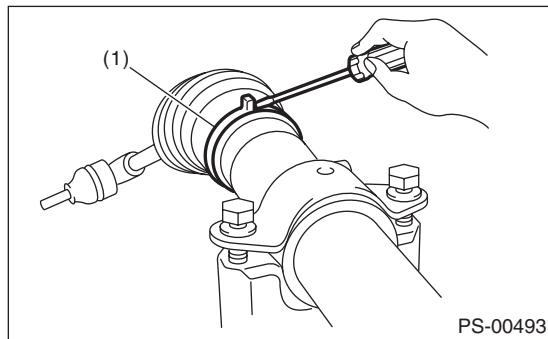
(2) Remove the clip (b) located outside the boot using the pliers, and then slide the boot to the tie-rod end side.



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

NOTE:

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



(1) Band

Steering Gearbox

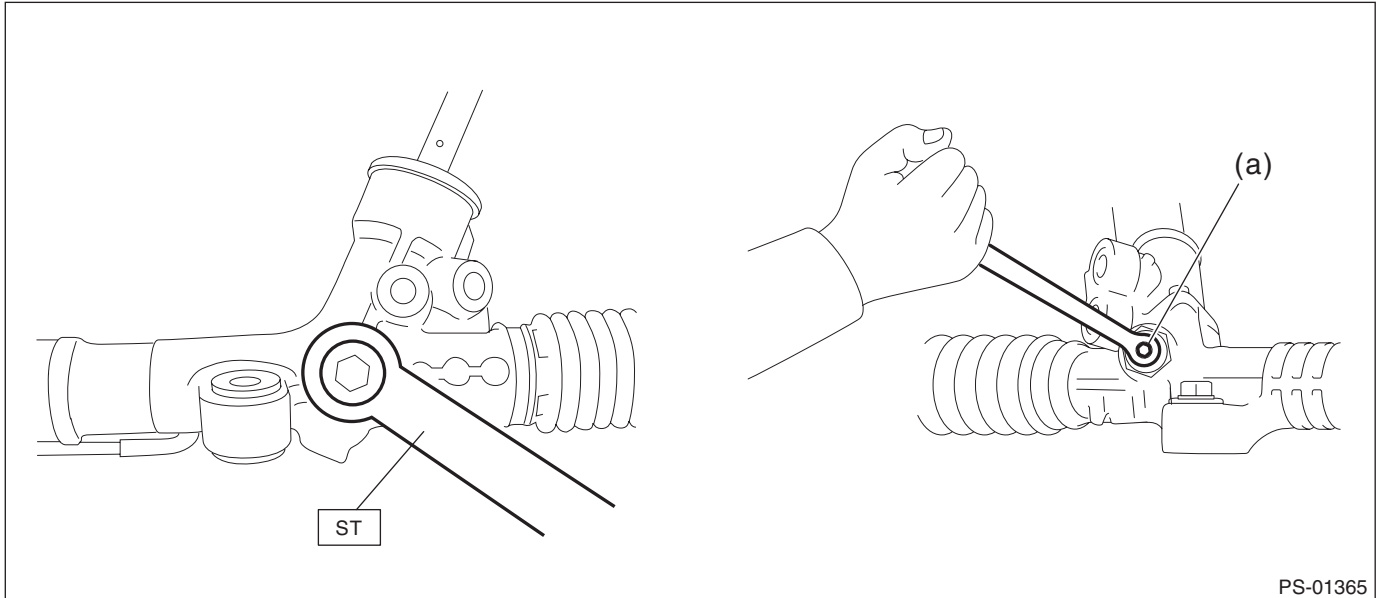
POWER ASSISTED SYSTEM (POWER STEERING)

- 4) Remove the left and right tie-rods.
(1) Using the ST, loosen the lock nut.

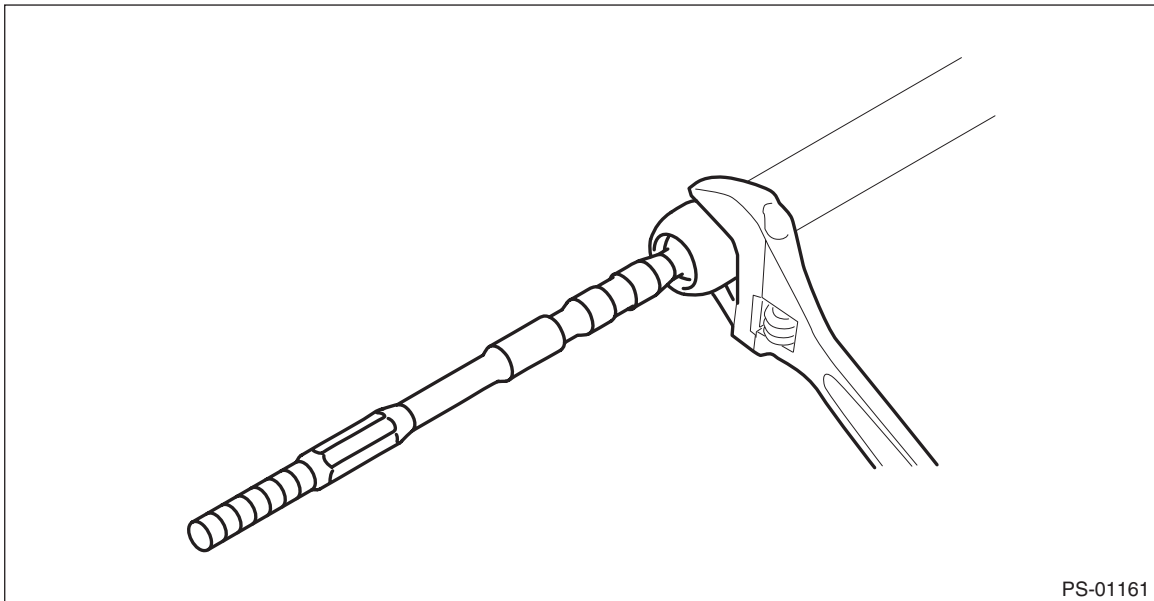
PREPARATION TOOL:

ST: SPECIAL TOOL CPS (34199AJ060)

- (2) Tighten the adjusting screw (a) until it can no longer be tightened.



- (3) Remove the tie-rod.

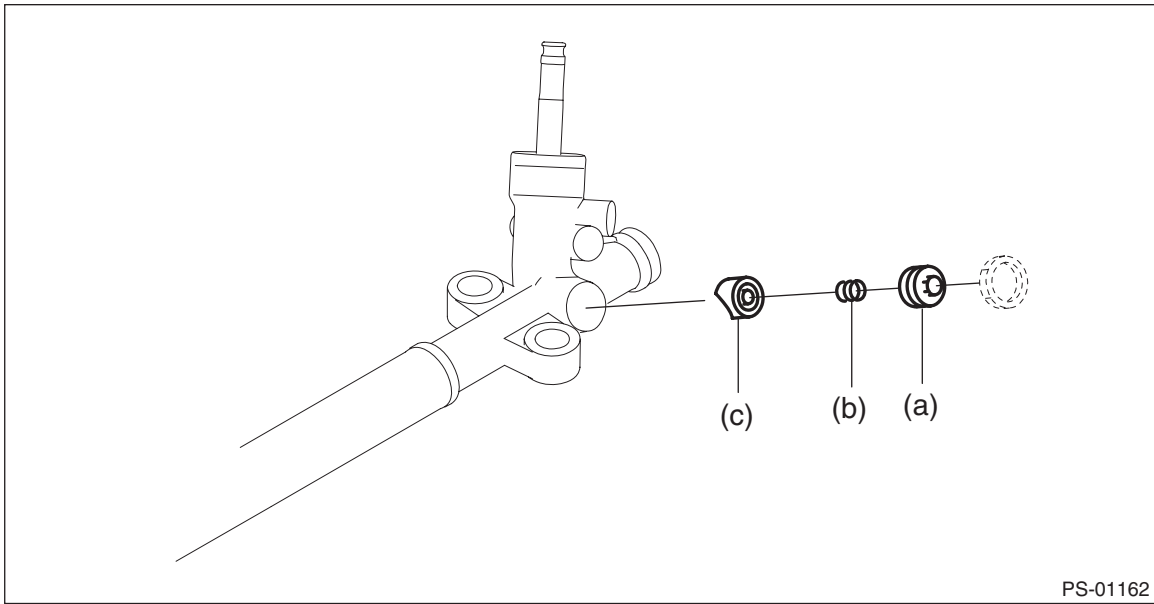


Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5) Remove the control valve.

(1) Loosen the adjusting screw (a), and remove the spring (b) and sleeve (c).

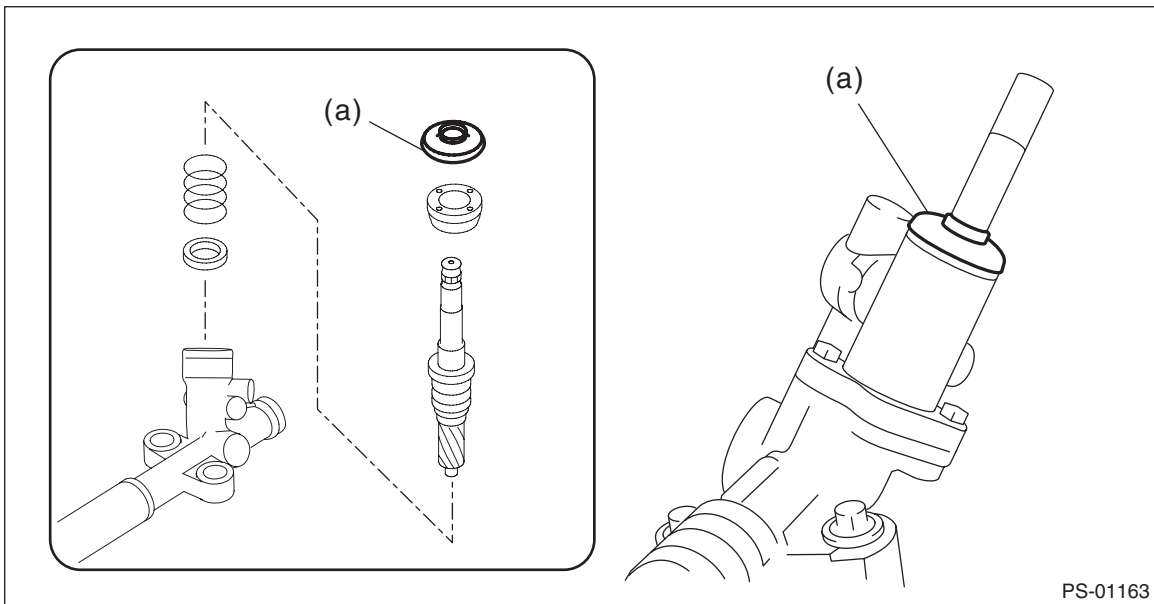


(2) Clean any dirt adhered to the input shaft.

(3) Remove the dust cover (a).

CAUTION:

- Pay attention not to scratch the housing or input shaft and not to allow foreign matter to enter gear-box interior.
- Roll a vinyl tape around the input shaft spline to avoid scratching the dust cover.



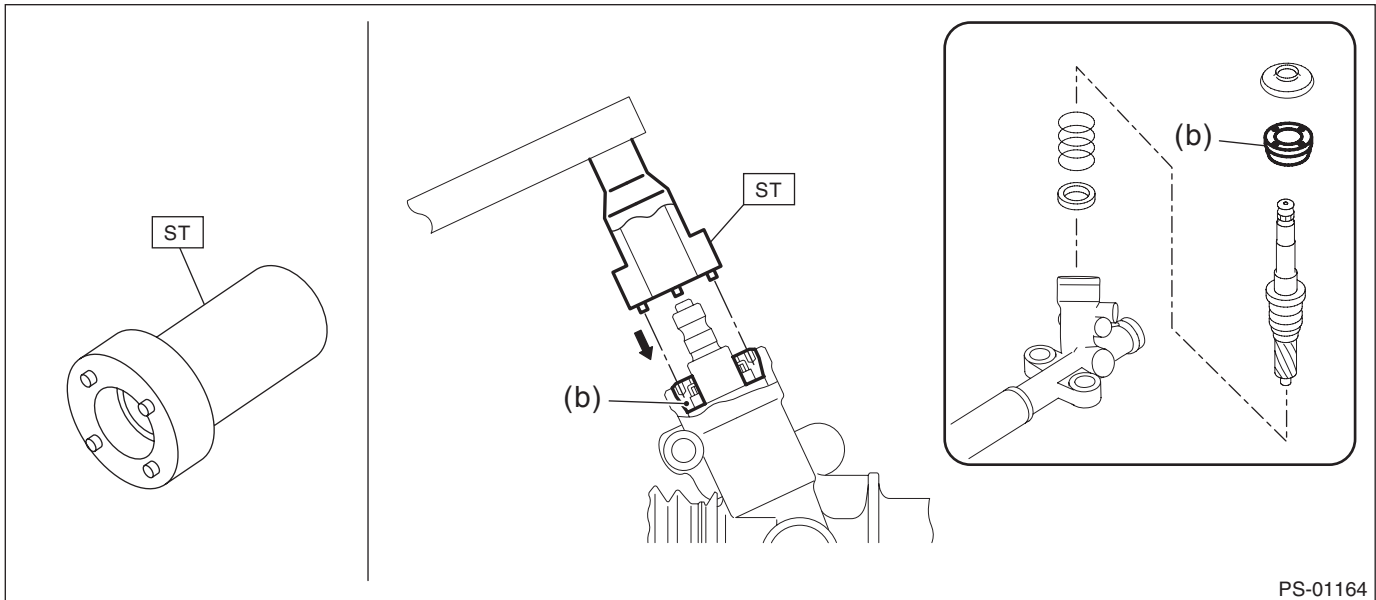
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

(4) Align the ST pin with plug hole to install, and then rotate the ST counterclockwise to remove plug (b).

PREPARATION TOOL:

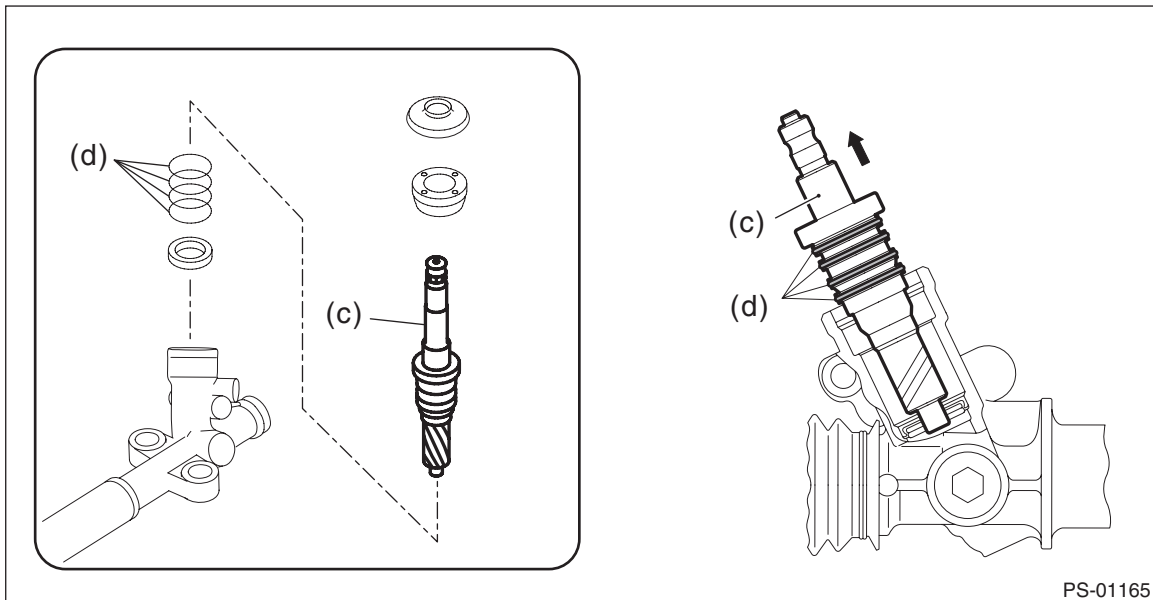
ST: PLUG-WRENCH (34199AE090)



(5) Remove the valve assembly (c).

CAUTION:

Be careful not to scratch the seal rings (d) and inner surface of the valve housing.

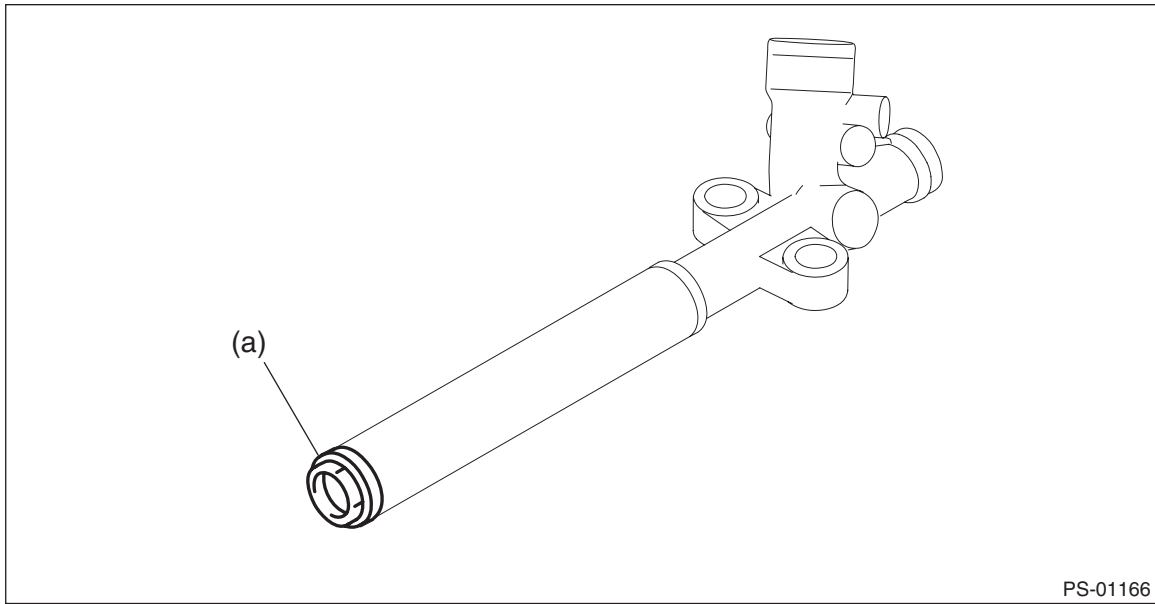


Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

6) Remove the rack.

(1) Remove the holder (a).

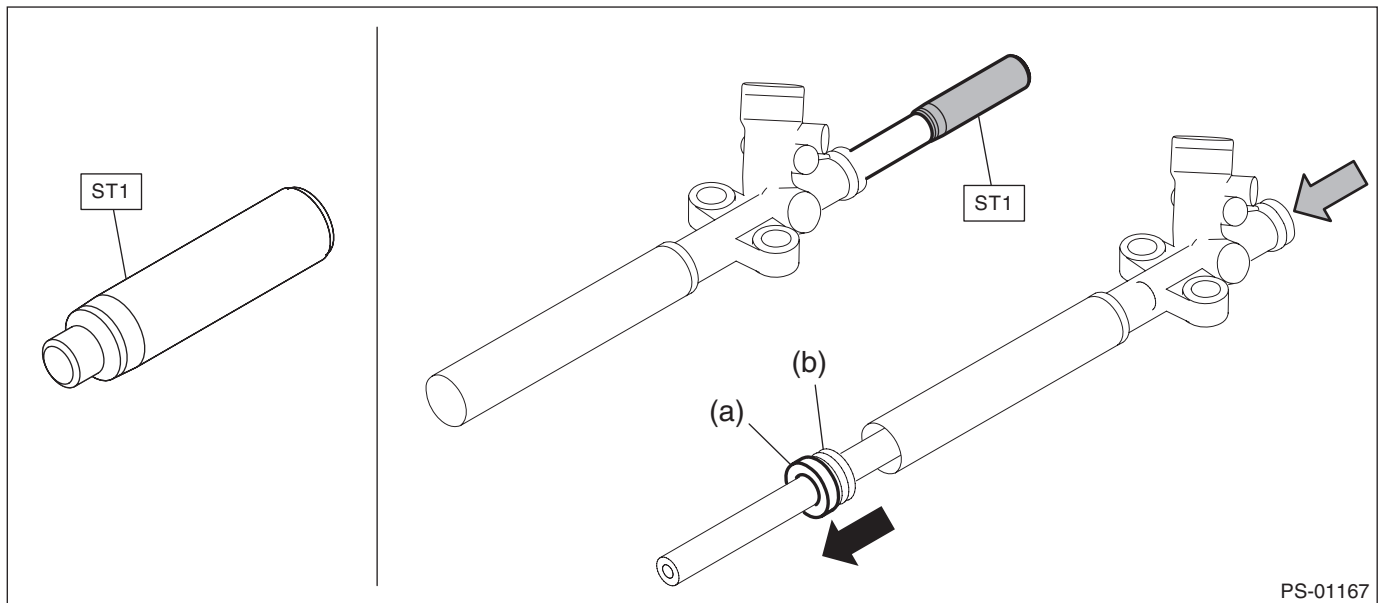


(2) Attach the ST1 to the pinion housing side of the rack.

(3) Push the rack so that the rack piston (b) pushes out the outer side oil seal (a) to be removed.

PREPARATION TOOL:

ST1: INSTALLER & REMOVER (34199FE000)



NOTE:

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

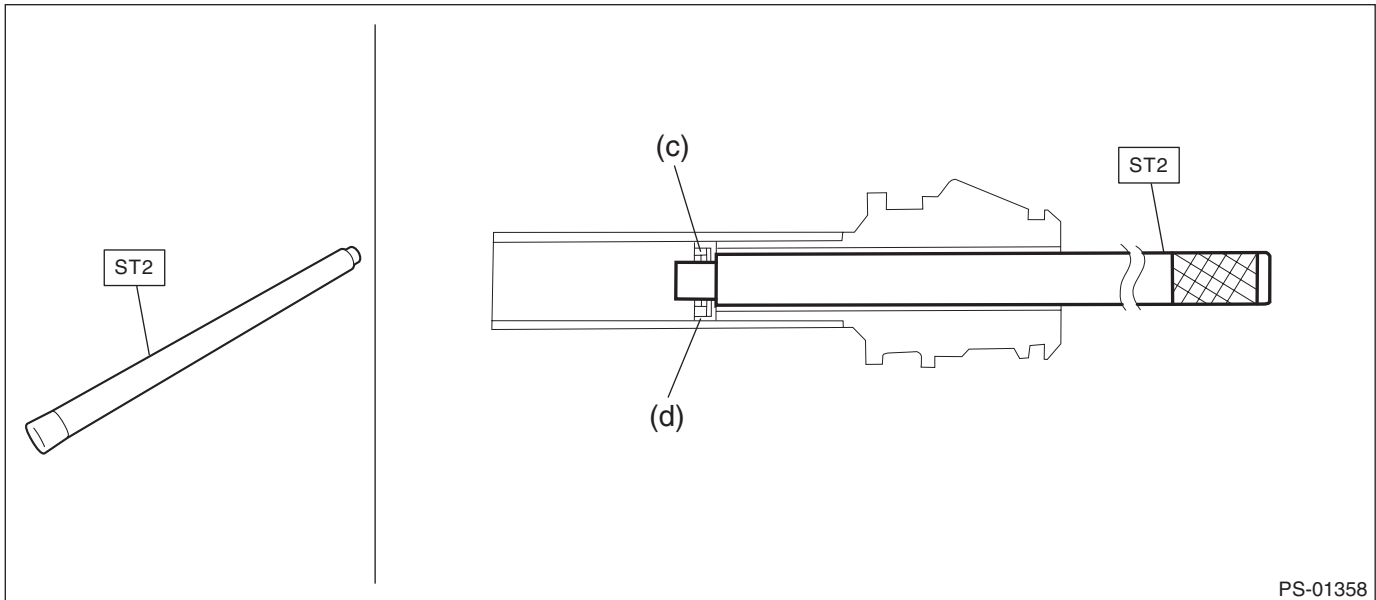
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

(4) Insert the ST2 from the valve side of the rack, and push out the back-up ring (c) and oil seal (d).

PREPARATION TOOL:

ST2: REMOVER (34199FE010)



NOTE:

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

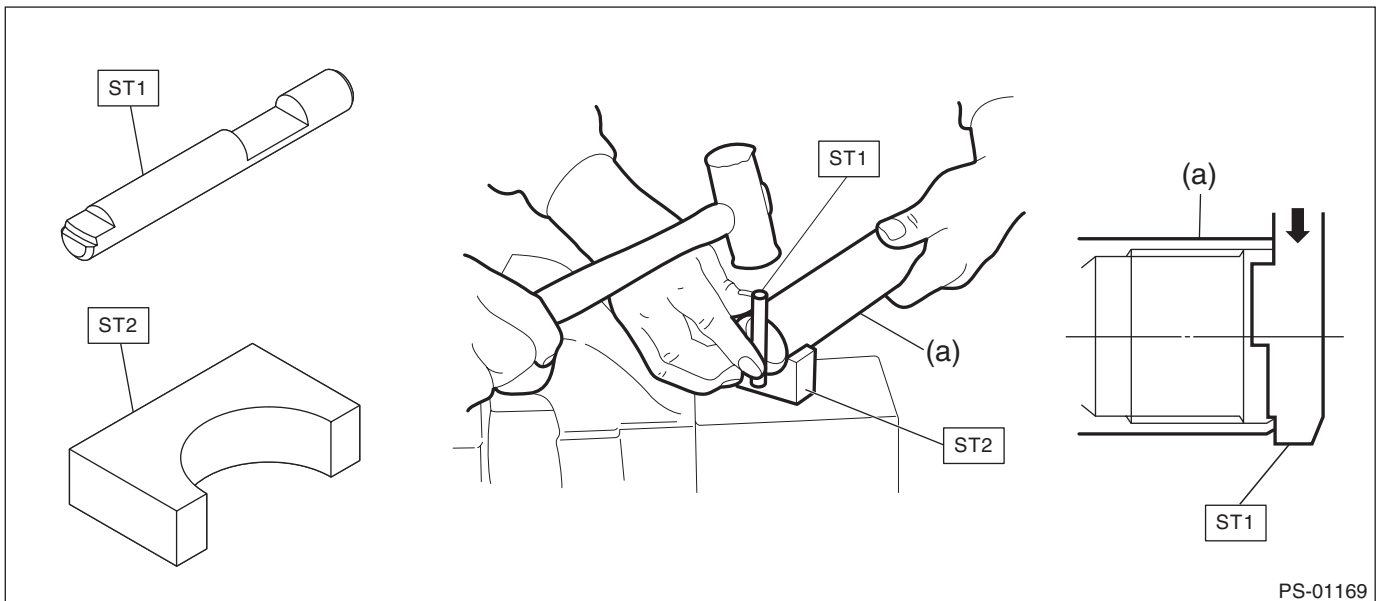
7) Repair the crimped portion of cylinder.

(1) Using ST, repair the crimped portion of cylinder (a).

PREPARATION TOOL:

ST1: PUNCH (34099FA080)

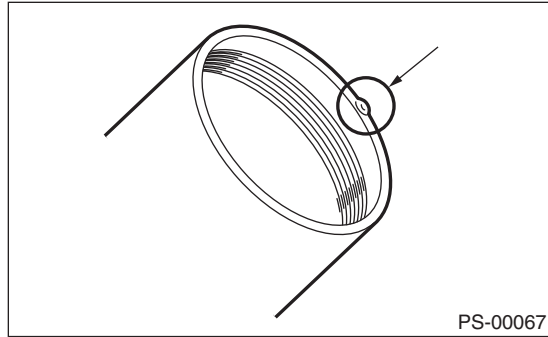
ST2: BASE (34199FE020)



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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



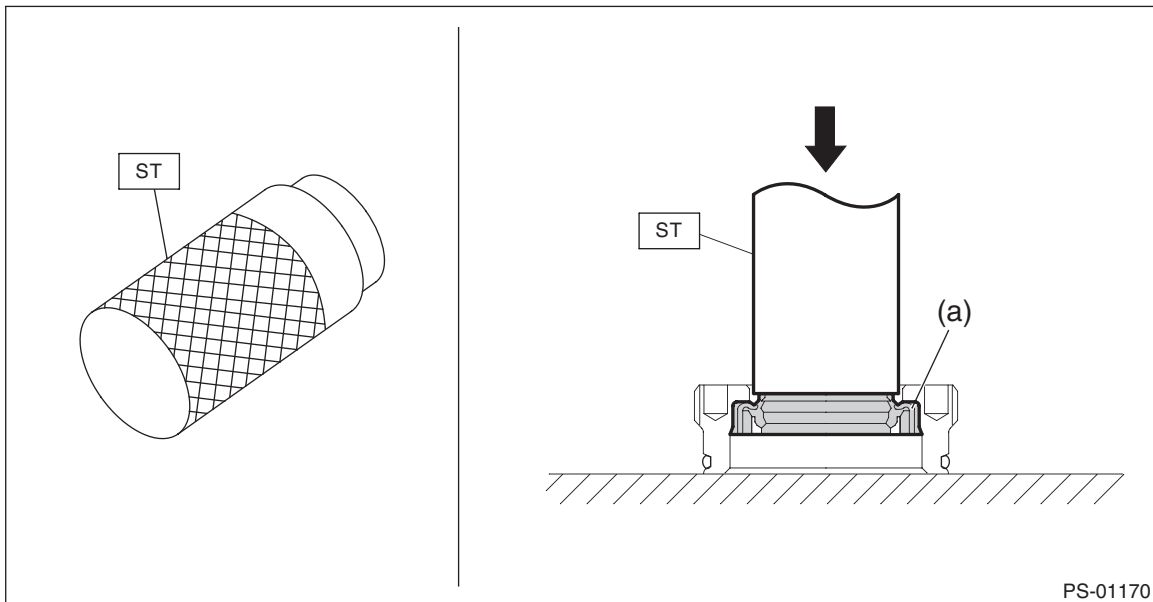
8) Using the ST, press the oil seal (a) out of plug.

CAUTION:

Do not apply force on the plug edge surface.

PREPARATION TOOL:

ST: OIL SEAL PLUG REMOVER (34199AE100)



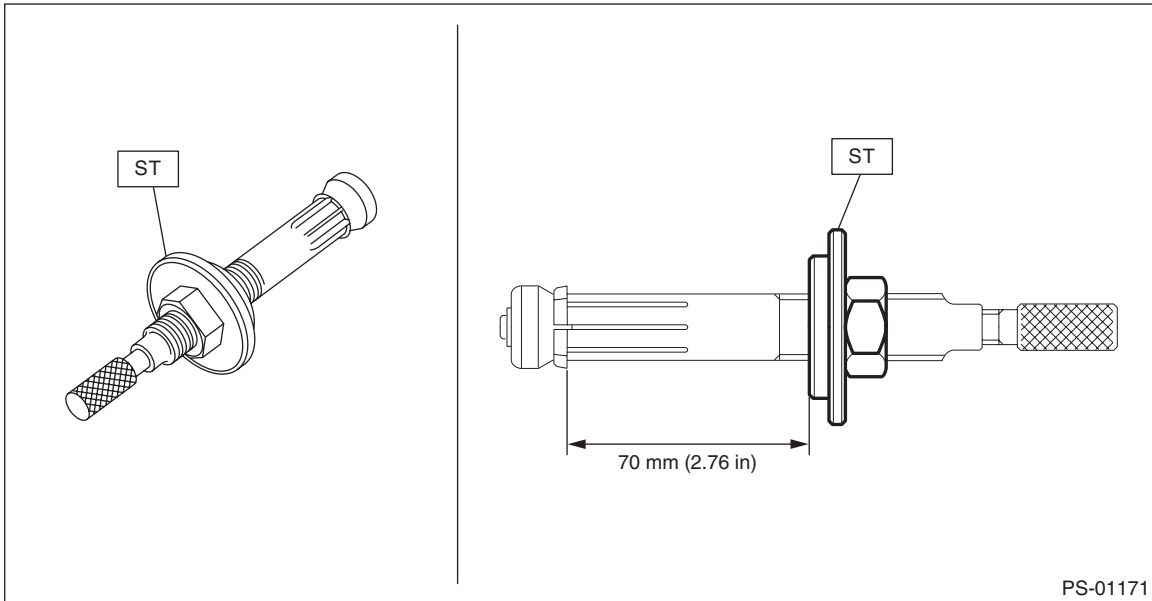
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

- 9) Remove the oil seal from the valve housing.
(1) Set the ST at a size shown in the figure.

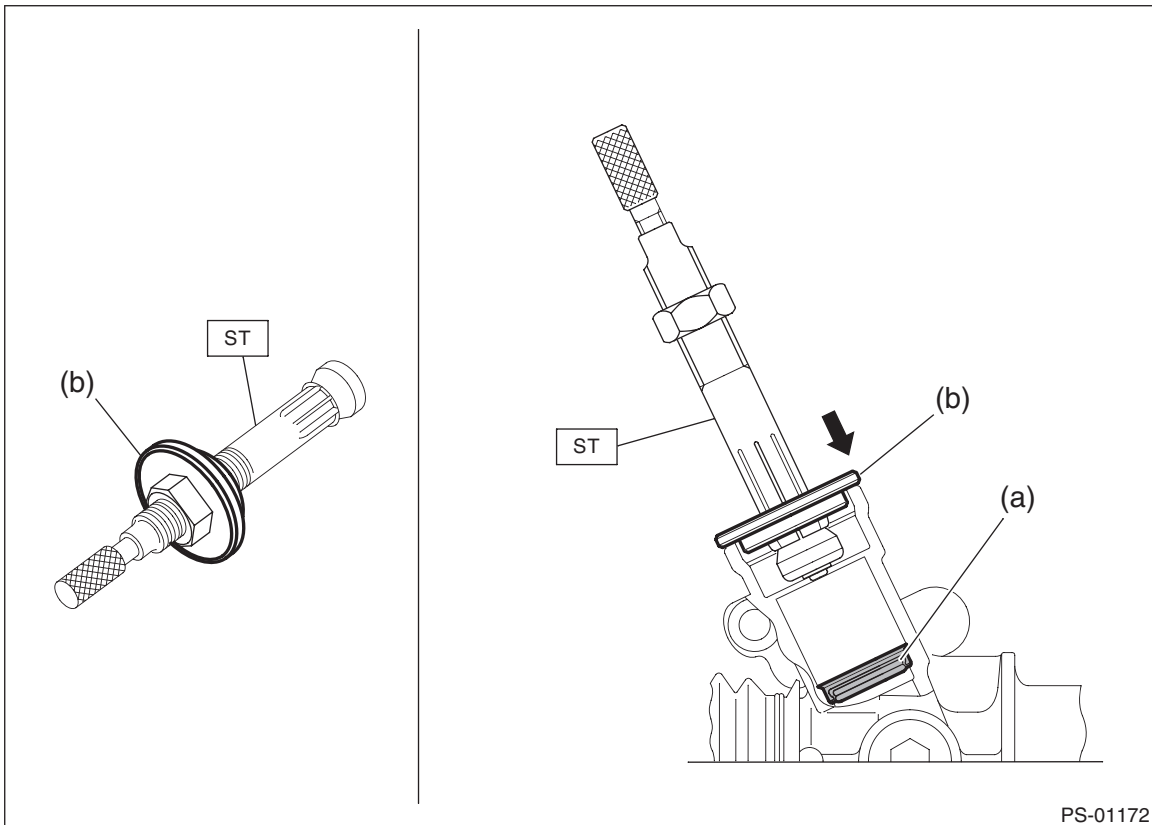
PREPARATION TOOL:

ST: GEARBOX OIL SEAL REMOVER (34199AE120)



PS-01171

- (2) Set the stopper (b) to gearbox, then insert the tip of the ST to the gearbox.



PS-01172

- (3) By fixing section (A), press-in the rod (c) while rotating it and catch the oil seal (a).

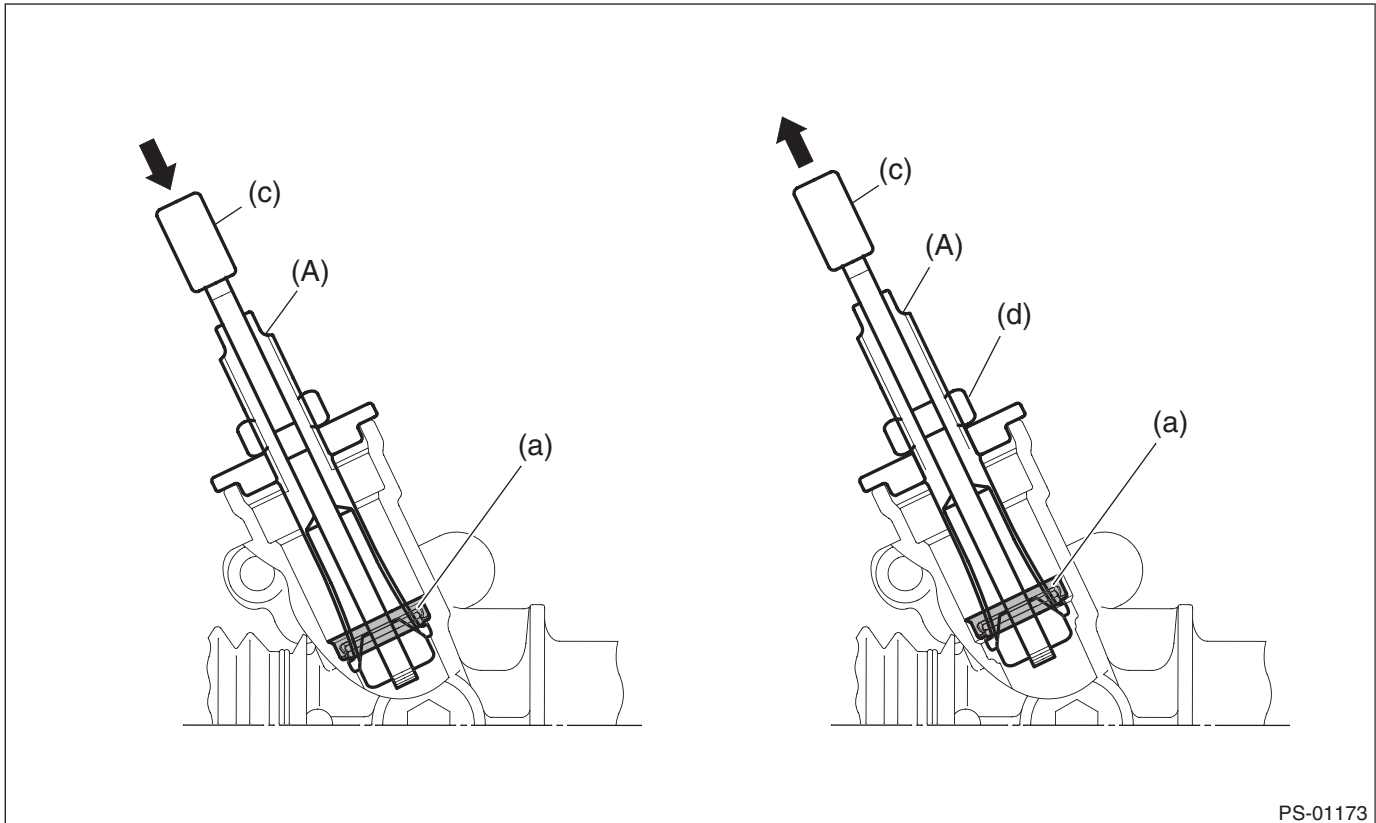
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

(4) While fixing section (A), pull out the oil seal (a) by rotating nut (d).

CAUTION:

Take care not to scratch the gearbox inner surface.



PS-01173

D: ASSEMBLY

1) Secure the gearbox to the ST.

CAUTION:

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

PREPARATION TOOL:

ST1: STAND (926200000)

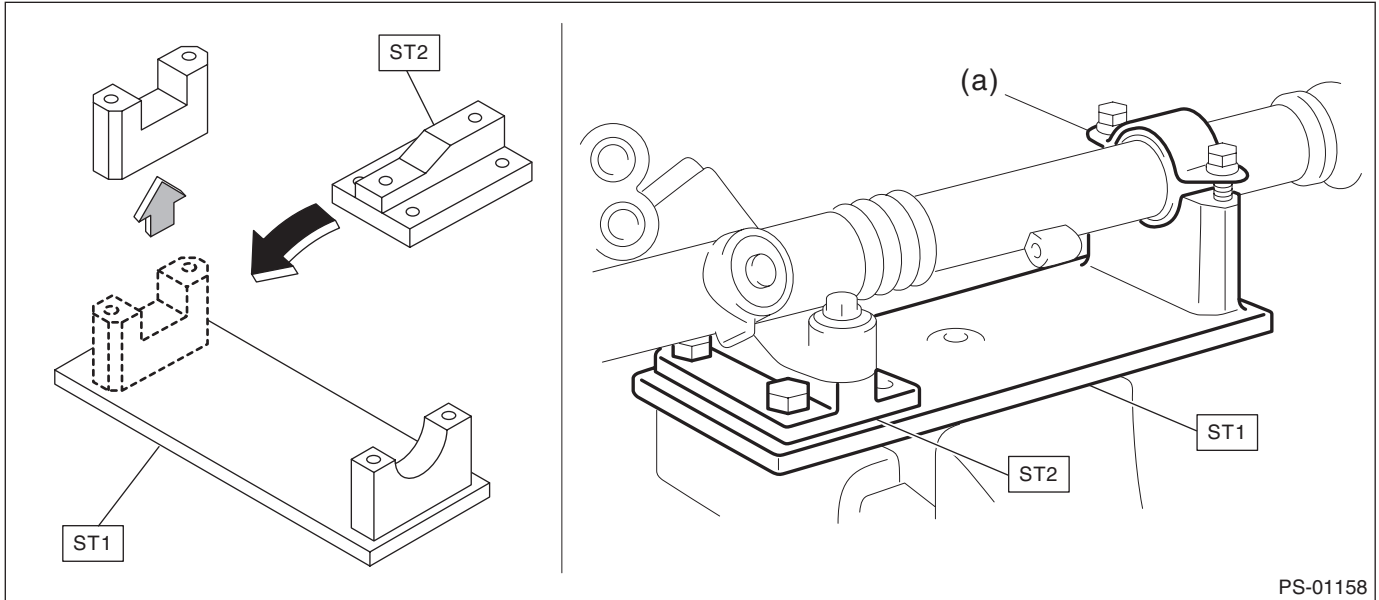
ST2: BOSS D (34199AG000)

(1) Replace BOSS of STAND (ST1) with BOSS D (ST2).

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

(2) Using the clamp (a) removed from vehicle body, attach the gearbox assembly to ST.



2) Apply a coat of grease to needle bearing.

CAUTION:

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

3) Install the oil seal.

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

Steering grease:

VALIANT GREASE M2

(2) Verify the direction of the oil seal and installation position.

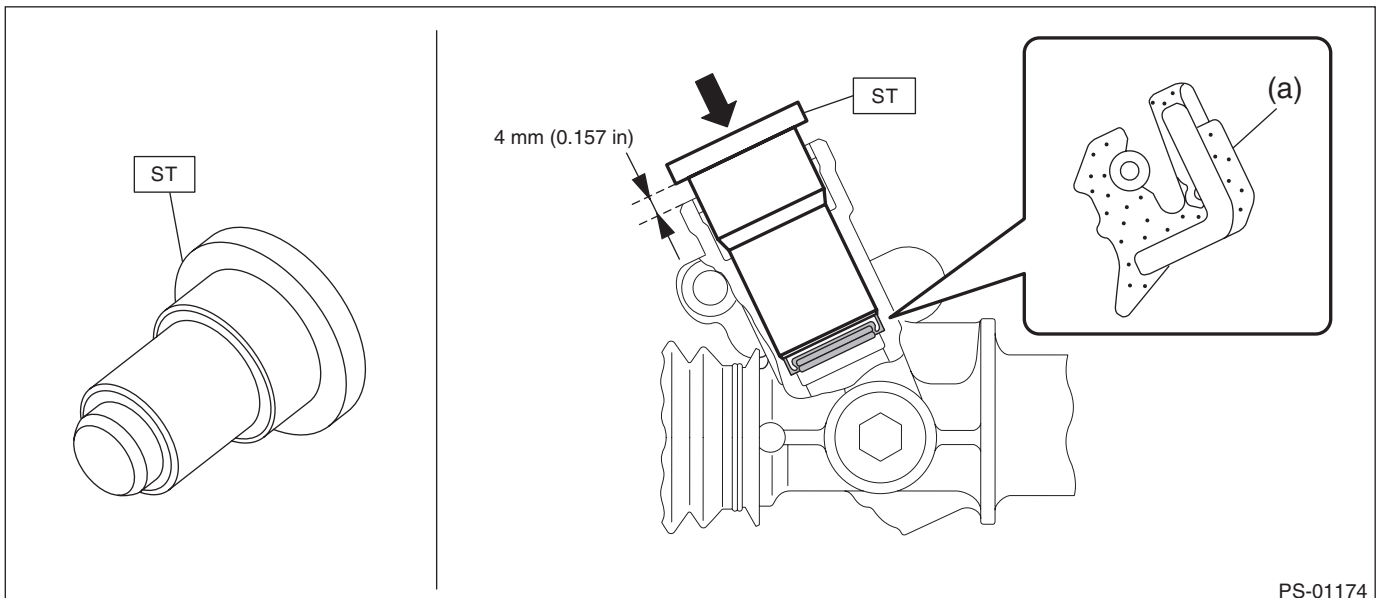
(3) Using the ST and a press, press-fit the oil seal (a) into the gearbox.

CAUTION:

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

PREPARATION TOOL:

ST: GEARBOX OIL SEAL INSTALLER (34199AE130)



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

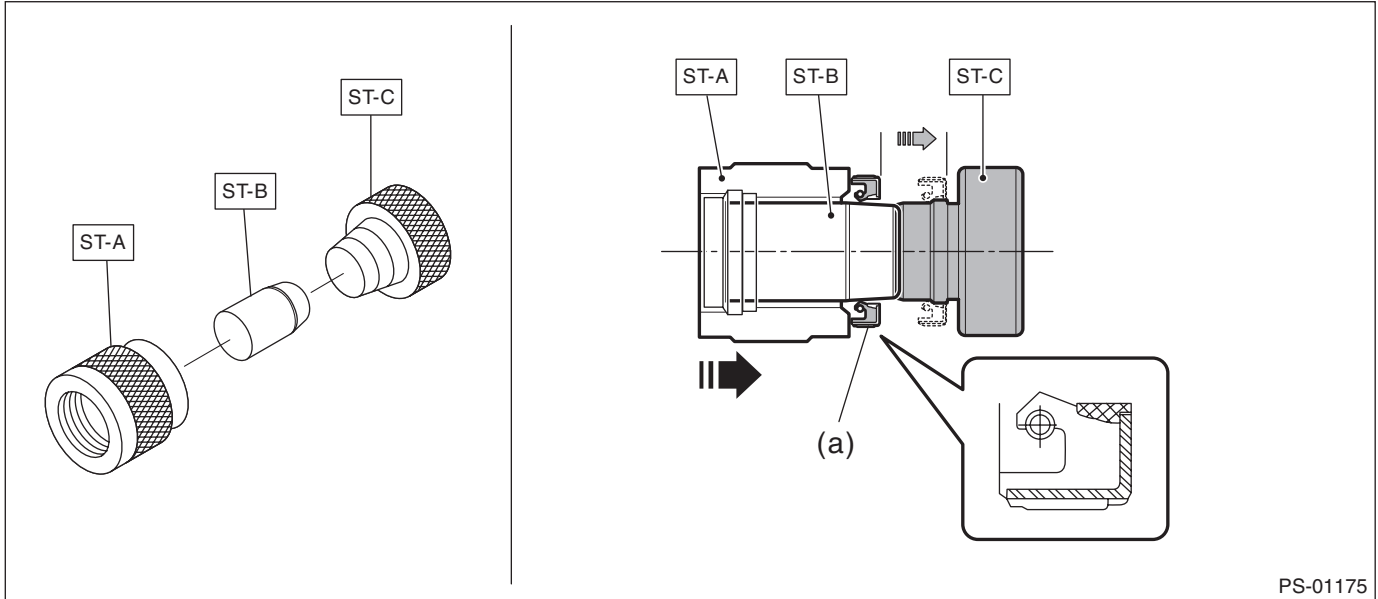
- 4) Using the ST, install the inner oil seal (a) to the rack.
(1) Using (ST-A) and (ST-B), install the inner oil seal (a) to (ST-C).

CAUTION:

Pay attention to the orientation of the oil seal.

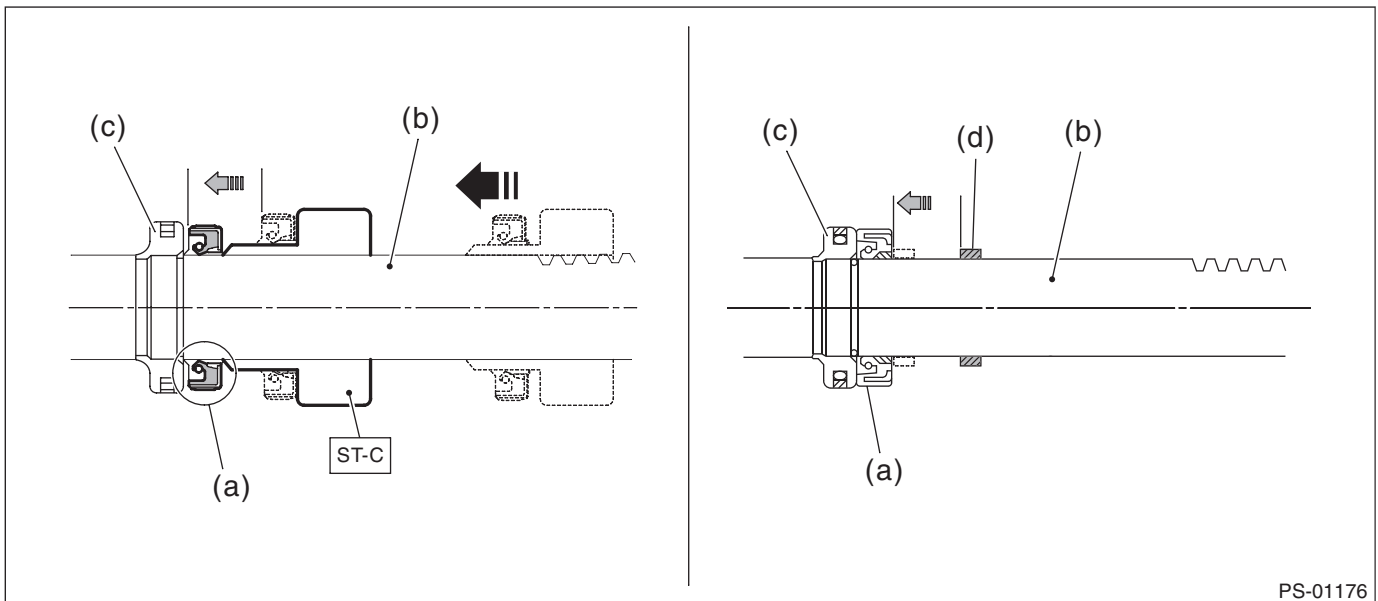
PREPARATION TOOL:

ST: INSTALLER A, B, C (34199FE040)



PS-01175

- (2) Insert (ST-C) with oil seal assembled from the gear side of rack (b).
(3) Remove the inner oil seal (a) from (ST-C) near piston (c), and then remove (ST-C) from rack.
(4) Install the back-up washer (d) from the gear side of rack (b).



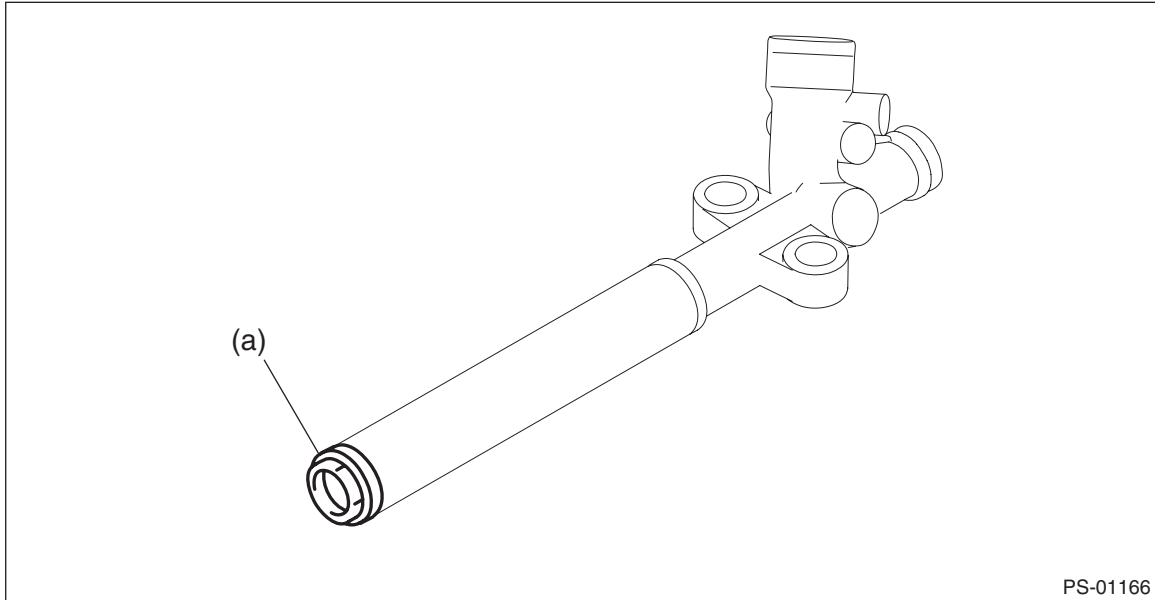
PS-01176

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

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

- (3) Temporarily tighten the holder (a) to gearbox cylinder.



NOTE:

For temporarily tightening, reuse the holder removed during disassembly.

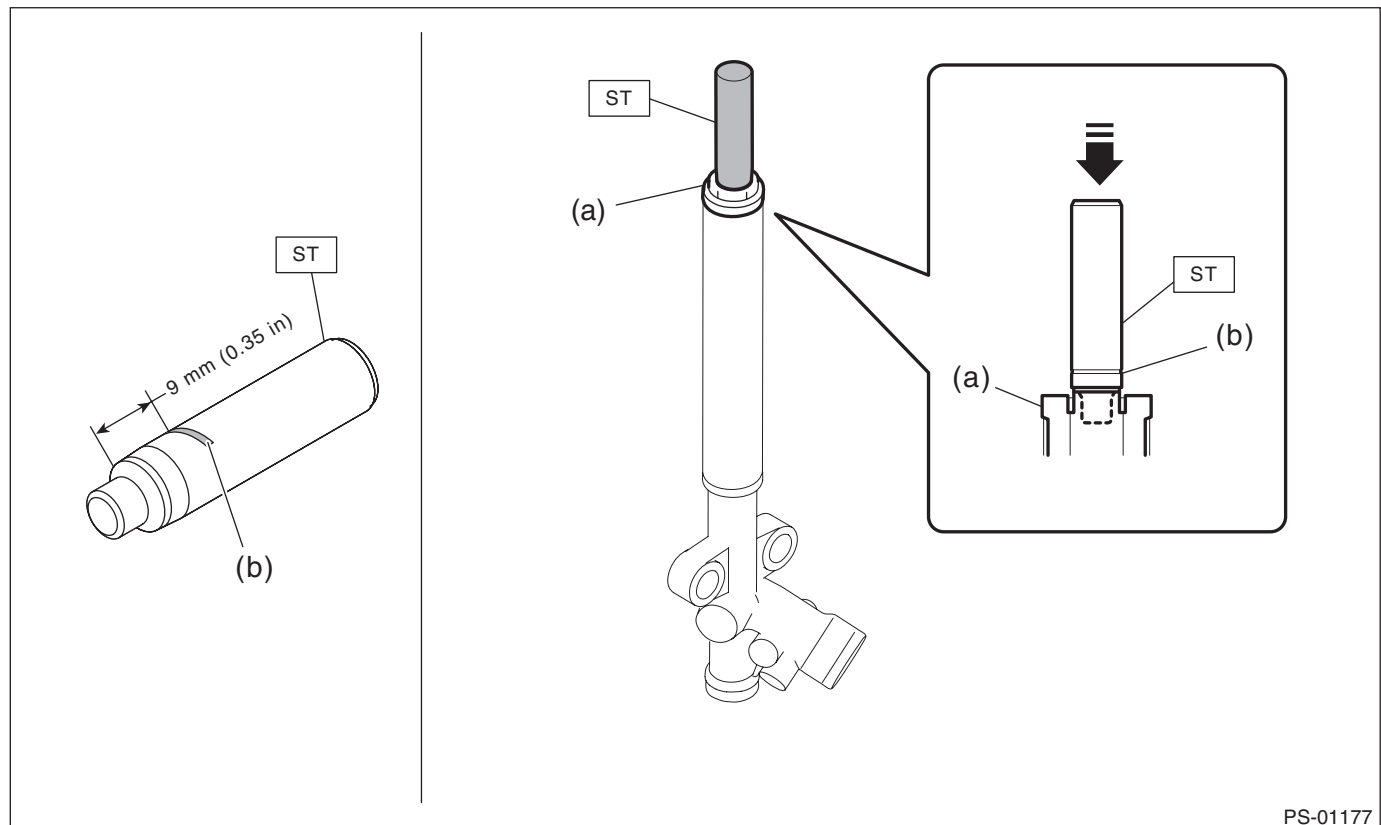
- (4) Place a mark (b) at the location 9 mm (0.35 in) from the ST end surface.

PREPARATION TOOL:

ST: INSTALLER & REMOVER (34199FE000)

- (5) Set the ST to the end of rack.

- (6) Using a press, press-fit until the mark (b) on the ST is aligned with the end surface of the holder.



- (7) Remove the ST and temporarily tightened holder.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

6) Insert the outer oil seal (e) into the rack using the same procedure as step 4).

(1) Using (ST-A) and (ST-B), install the outer oil seal (e) to (ST-C).

CAUTION:

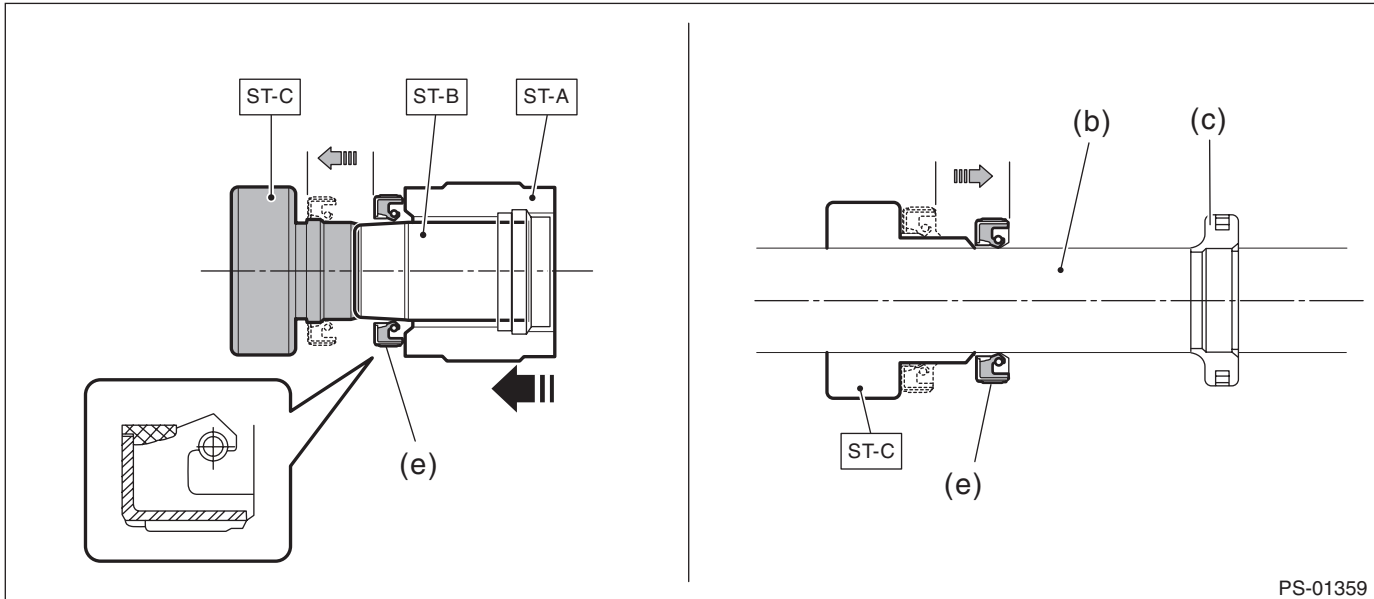
Pay attention to the orientation of the oil seal.

PREPARATION TOOL:

ST: INSTALLER A, B, C (34199FE040)

(2) Insert (ST-C) with outer oil seal (e) assembled into the rack (b).

(3) Remove the outer oil seal (e) from (ST-C), and then remove (ST-C) from rack (b).



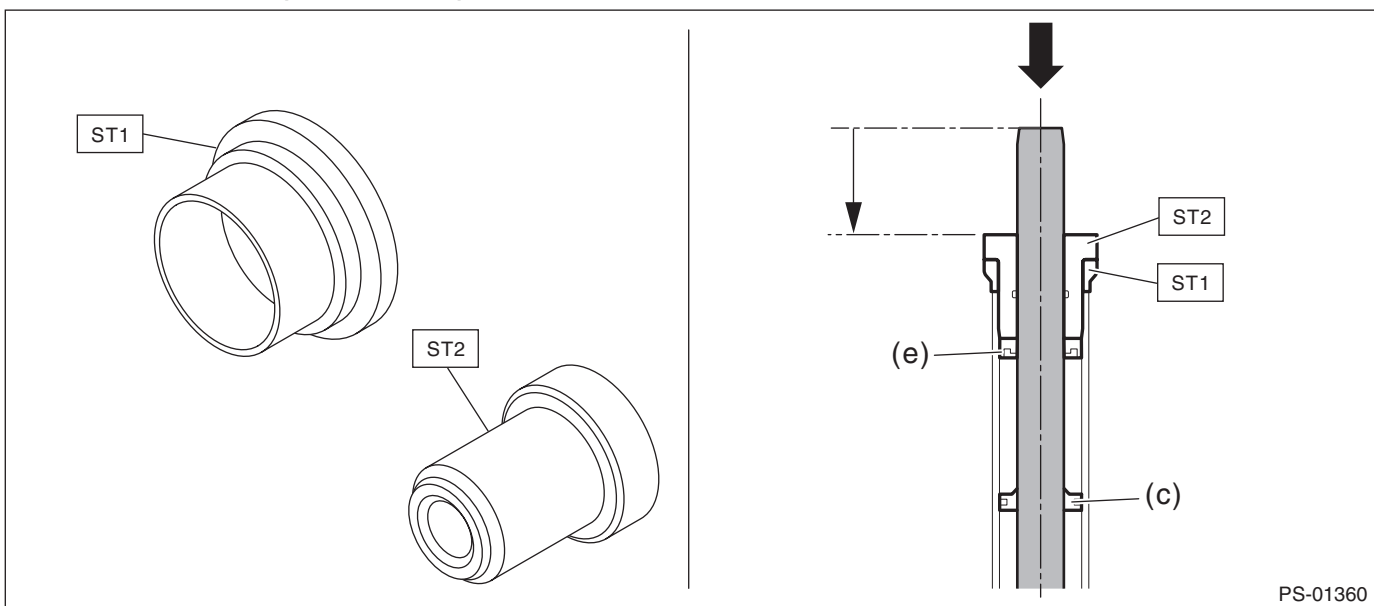
(4) Make the ST1 pass through the rack, and then press in the rack and ST2 using a press.

(5) Press in the outer oil seal (e) until ST1 and ST2 contact each other, and the rack end face is aligned with the end face of ST.

PREPARATION TOOL:

ST1: GUIDE (34199FE050)

ST2: INSTALLER (34199FE060)



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

- 7) Install the holder (a) to the steering body (b).
- (1) Install a new holder to the cylinder side of steering body.

Tightening torque:

75 N·m (7.65 kgf-m, 55.3 ft-lb)

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

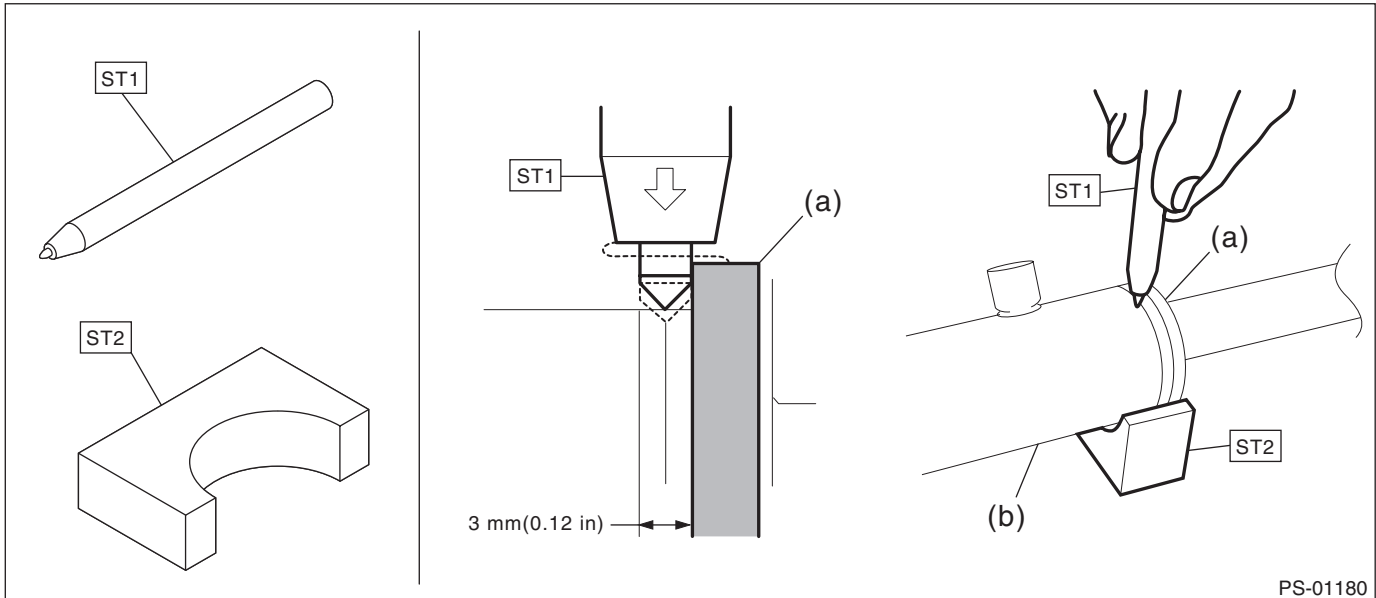
CAUTION:

Be careful not to deform the holder.

PREPARATION TOOL:

ST1: PUNCH HOLDER (34099FA060)

ST2: BASE (34199FE020)



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

8) Install the valve assembly.

(1) Replace the O-ring (c) of plug (b) circumference with a new O-ring.

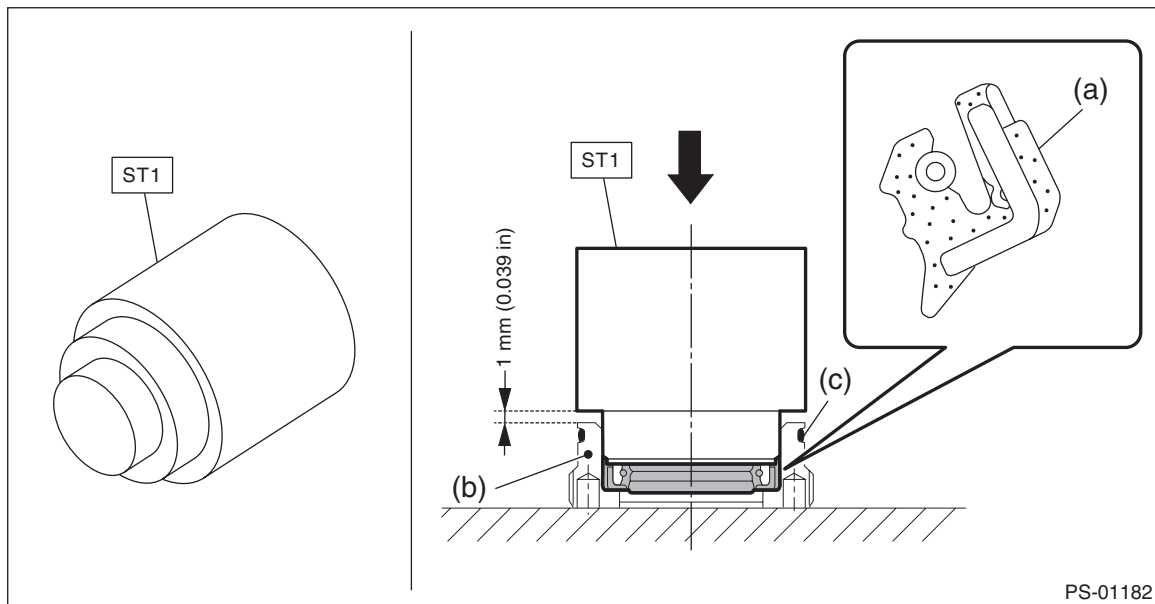
(2) Apply grease on the oil seal (a) circumference, and then press it into the plug using ST1 and a press.

CAUTION:

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

PREPARATION TOOL:

ST1: OIL SEAL PLUG INSTALLER (34199AE110)



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

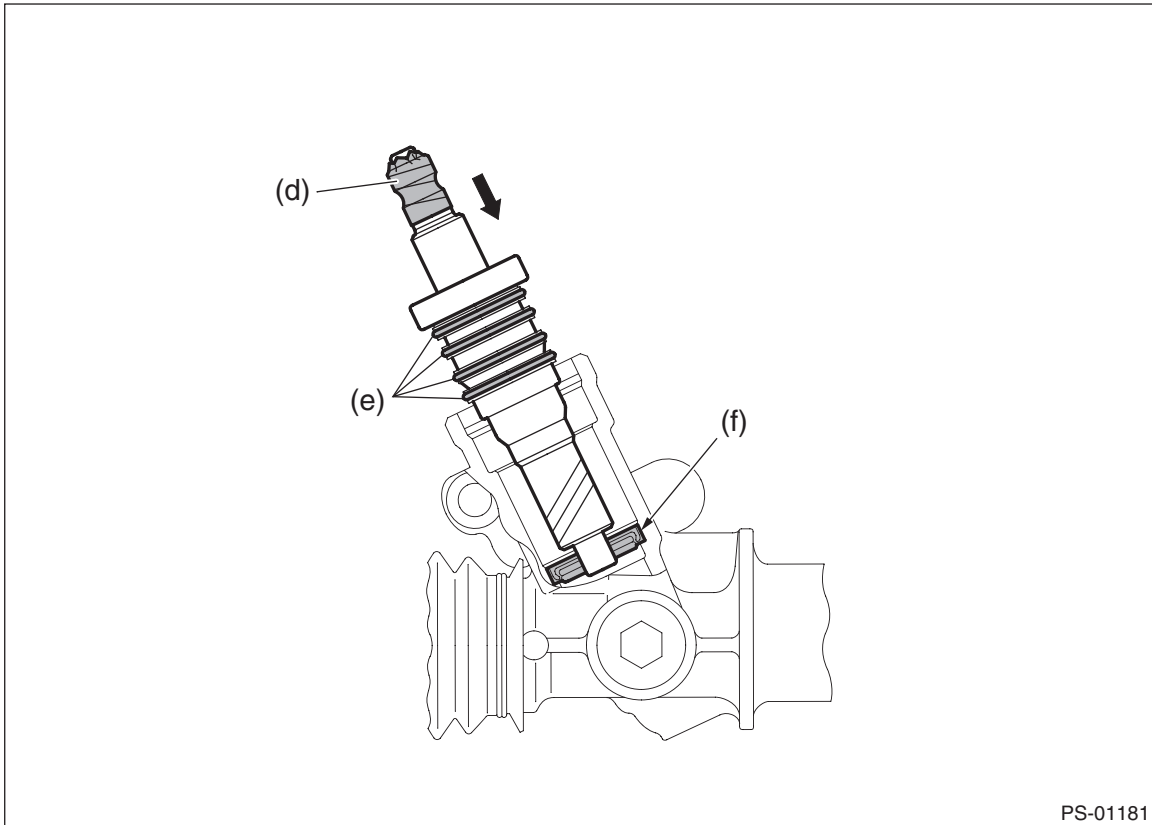
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

(4) Apply a coat of grease on the gear teeth of the valve assembly, and then attach the valve assembly.

CAUTION:

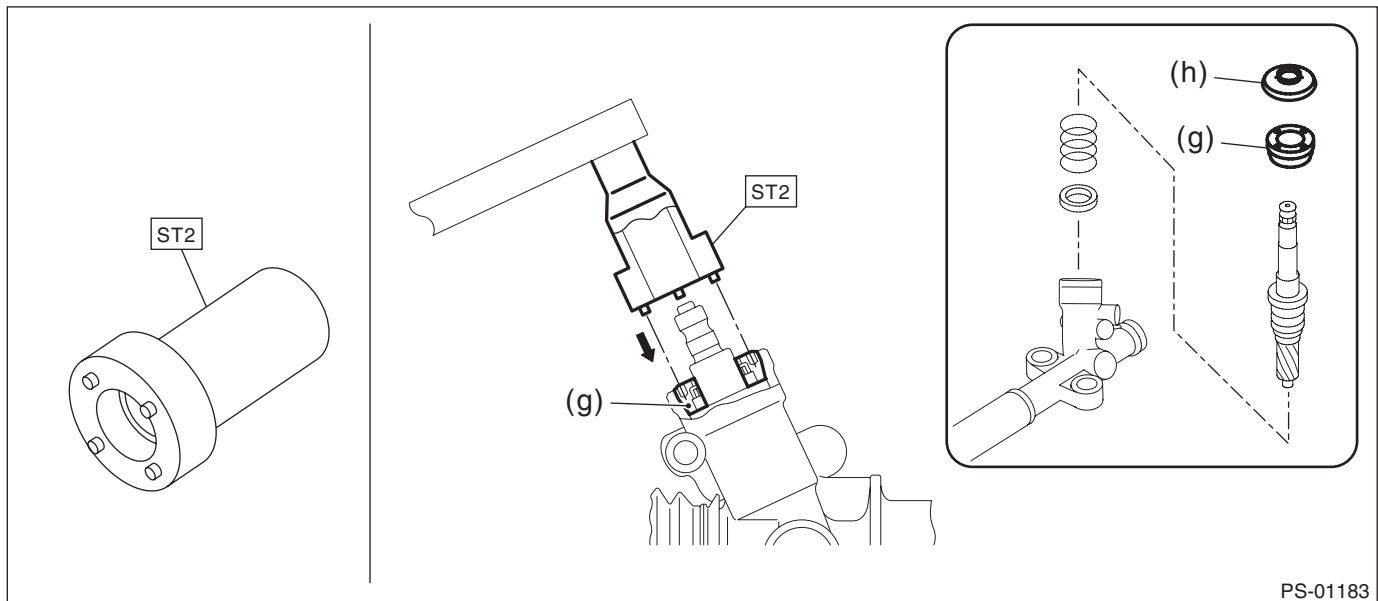
Be careful not to scratch the oil seals (e) and seal ring (f).



(5) Attach the plug (g) using ST2.

PREPARATION TOOL:

ST2: PLUG-WRENCH (34199AE090)



Tightening torque:

64 N·m (6.53 kgf-m, 47.2 ft-lb)

(6) Install the dust cover (h), and remove the vinyl tape (d).

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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

CAUTION:

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

10) Install the adjusting screw to the steering body.

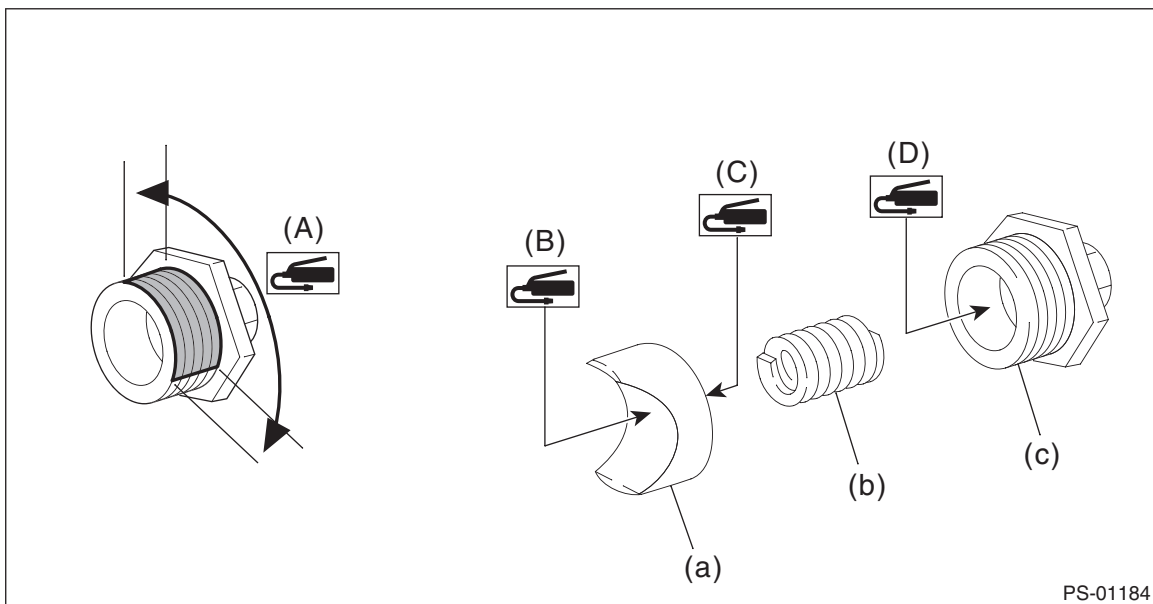
(1) Apply liquid gasket to 1/3 or more (A) of entire perimeter of adjusting screw thread (c).

Liquid gasket:

THREE BOND 1102 or THREE BOND 1215

(2) Apply a coat of grease to the sliding surface (B) of sleeve (a) and seating surface (C) of spring (b), and then insert the sleeve into steering body.

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



(4) 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)

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

Tightening torque:

6.0 N·m (0.61 kgf-m, 4.4 ft-lb)

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

CAUTION:

Do not loosen 30° or more.

Tightening torque:

6.0 N·m (0.61 kgf-m, 4.4 ft-lb)

11) Remove the tie-rod which was temporarily tightened in step 9).

12) Check that play and looseness are within specifications. <Ref. to PS-56, SERVICE LIMIT, INSPECTION, Steering Gearbox.>

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

13) While holding the adjusting screw (a) with a wrench, tighten the lock nut using ST.

CAUTION:

Make sure that the screw is not turning while tightening the lock nut.

PREPARATION TOOL:

ST: SPECIAL TOOL CPS (34199AJ060)

Tightening torque (lock nut):

39 N·m (3.98 kgf-m, 28.8 ft-lb)

14) Install the tie-rod into rack.

CAUTION:

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

Tightening torque:

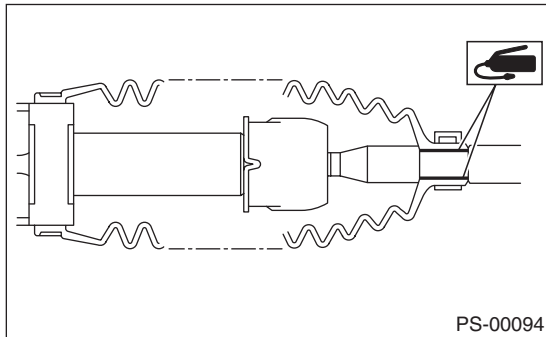
90 N·m (9.18 kgf-m, 66.4 ft-lb)

15) Install the boot to the housing.

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

CAUTION:

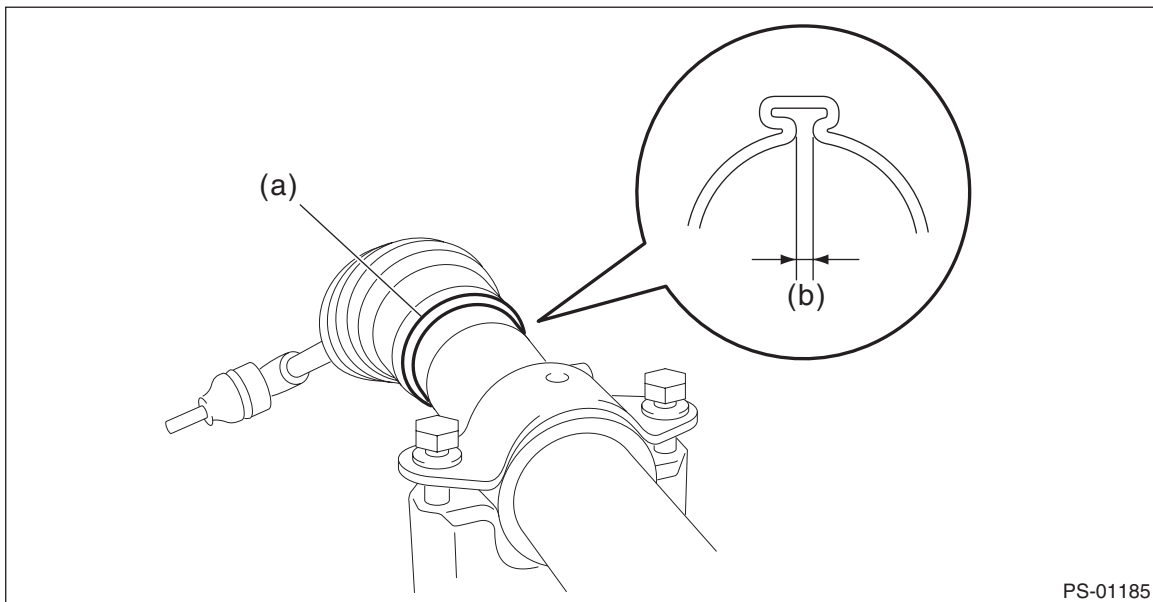
Make sure that the boot is installed properly without unusual inflation or deflation.



(2) Using the boot clamp pliers, crimp the boot so that the clearance (b) of the boot band (a) crimp portion becomes 2 mm (0.08 in) or less.

CAUTION:

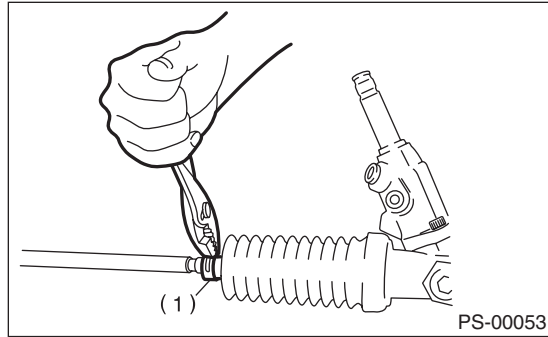
Use a new boot band.



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POWER ASSISTED SYSTEM (POWER STEERING)

(3) Fix the boot end with small clip (1).

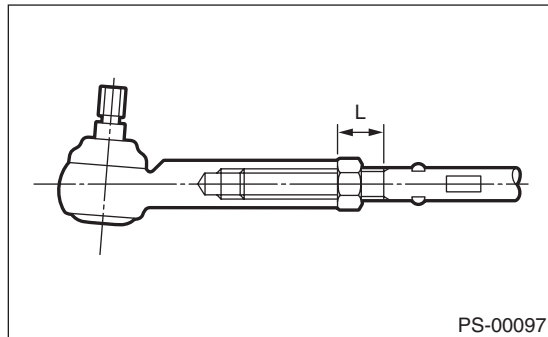


(4) After installing, check that the boot end is installed to the groove of the tie-rod.

(5) 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.

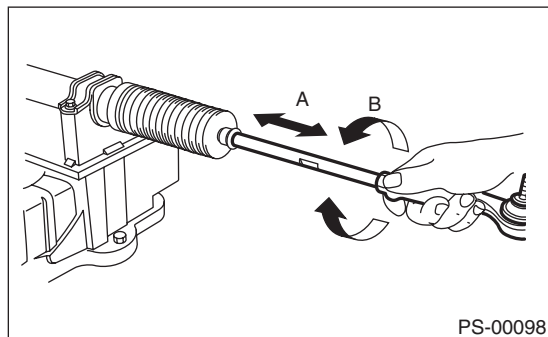
Installed tie-rod length L:

24 mm (0.9 in)



16) Inspect the gearbox as follows:

- “A” Holding the tie-rod end, repeat lock to lock several times as quickly as possible.
- “B” Holding the tie-rod end, turn it slowly at a radius several times as large as possible.
- Finally, make sure that the boot is installed in the specified position without inflating.



17) Remove the ST (STAND and BOSS D) from gearbox.

18) Attach the 4 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 and 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 aluminum 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.

CAUTION:

When making a measurement, secure the gearbox in a vise using ST.

When fixing the gearbox in a vise, apply a wooden piece on the flange portion.

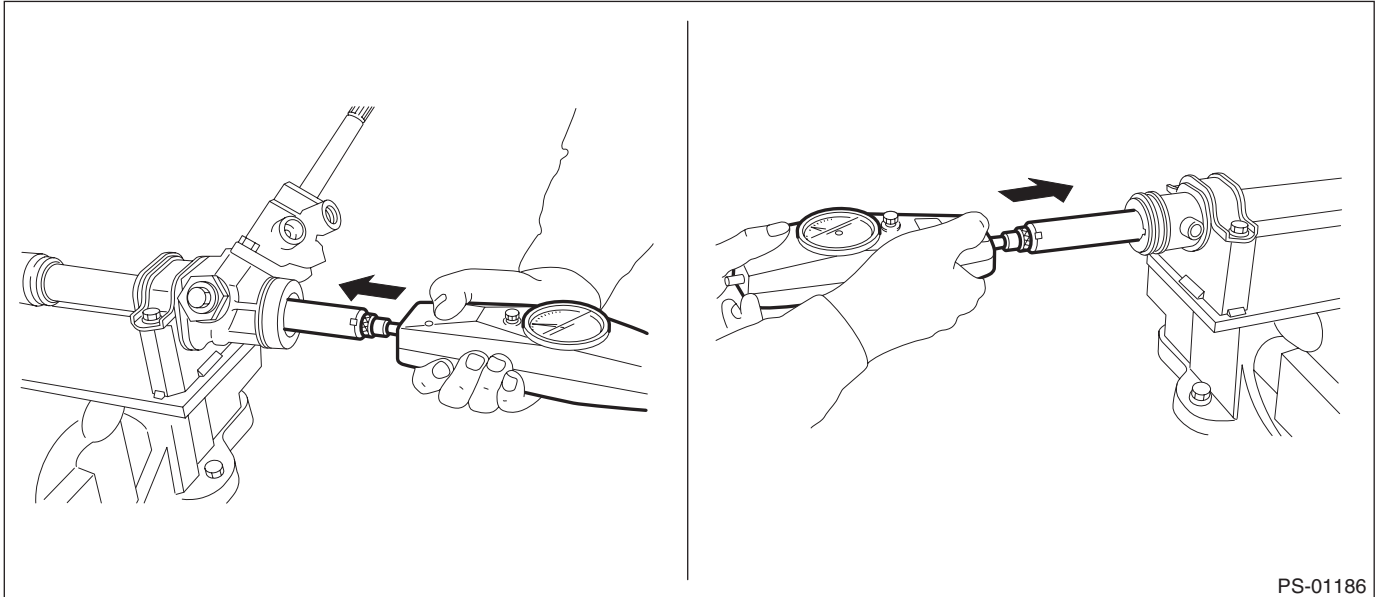
PREPARATION TOOL:

ST1: STAND (926200000)

ST2: BOSS D (34199AG000)

Rack shaft sliding resistance

Measure the resistance with the rack shaft pulled.



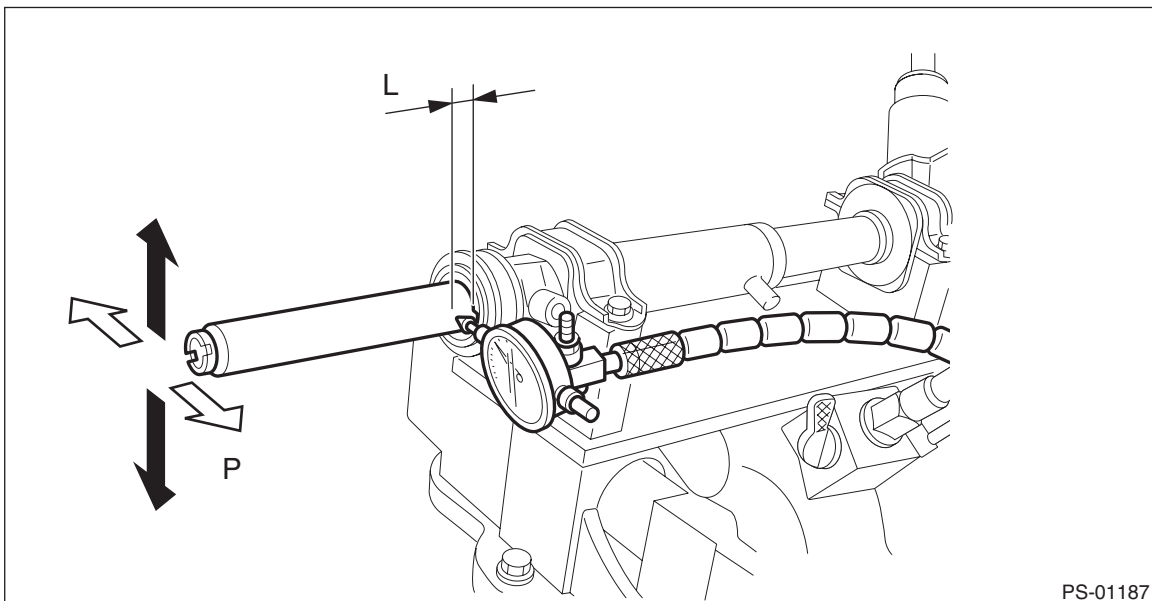
PS-01186

Limit: 650 N (66.2 kgf, 146 lbf) or less

Left/right differential of sliding resistance: 20 % or less

Rack shaft play in the radial direction

- Right-turn steering



PS-01187

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

Limit

Direction ◀ ▶: 0.4 mm (0.016 in) or less

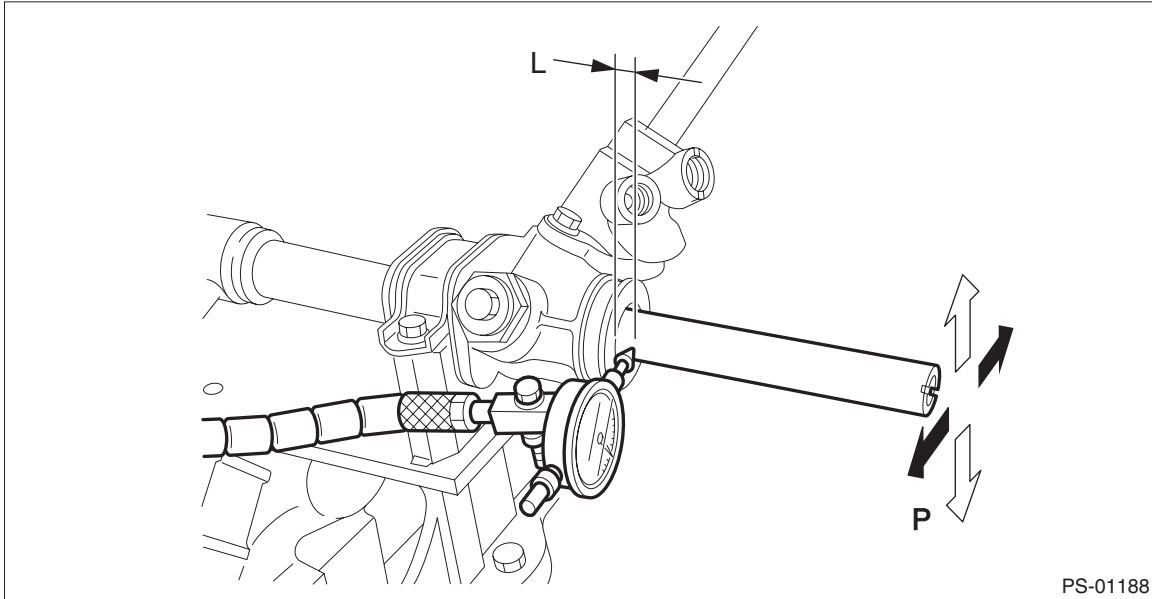
Direction ⇐ ⇒: 0.6 mm (0.024 in) or less

Condition

L: 5 mm (0.20 in)

P: 98 N (10 kgf, 22 lbf)

- Left-turn steering



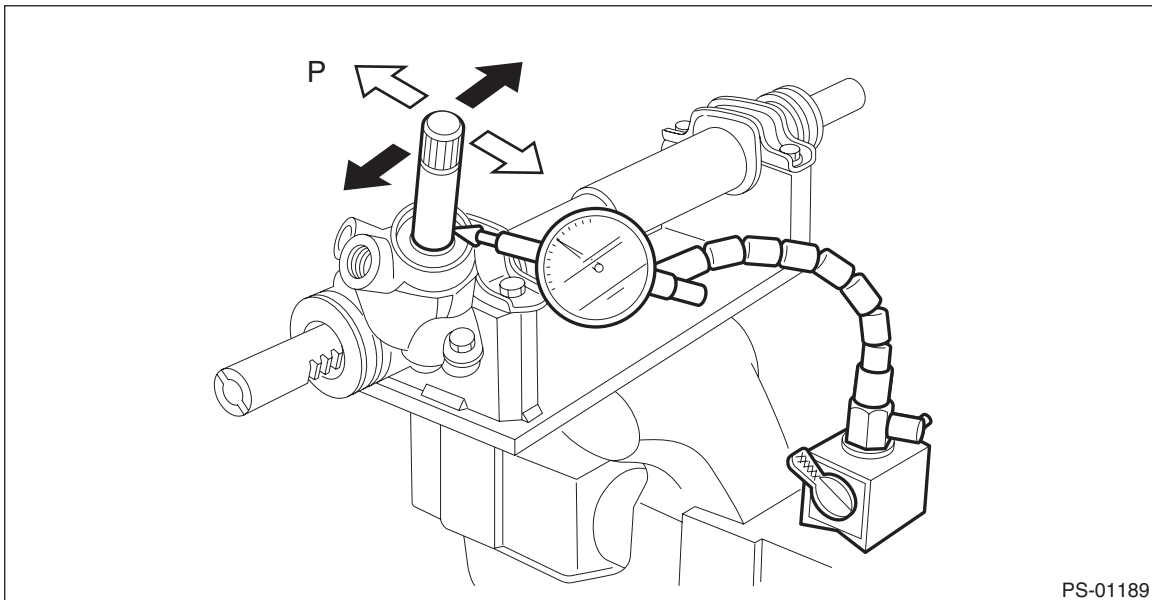
Service limit:

Direction ⇐ ⇒: 0.4 mm (0.016 in) or less

Direction ◀ ▶: 0.4 mm (0.016 in) or less

Input shaft play

- In radial direction



Limit

0.18 mm (0.0071 in) or less

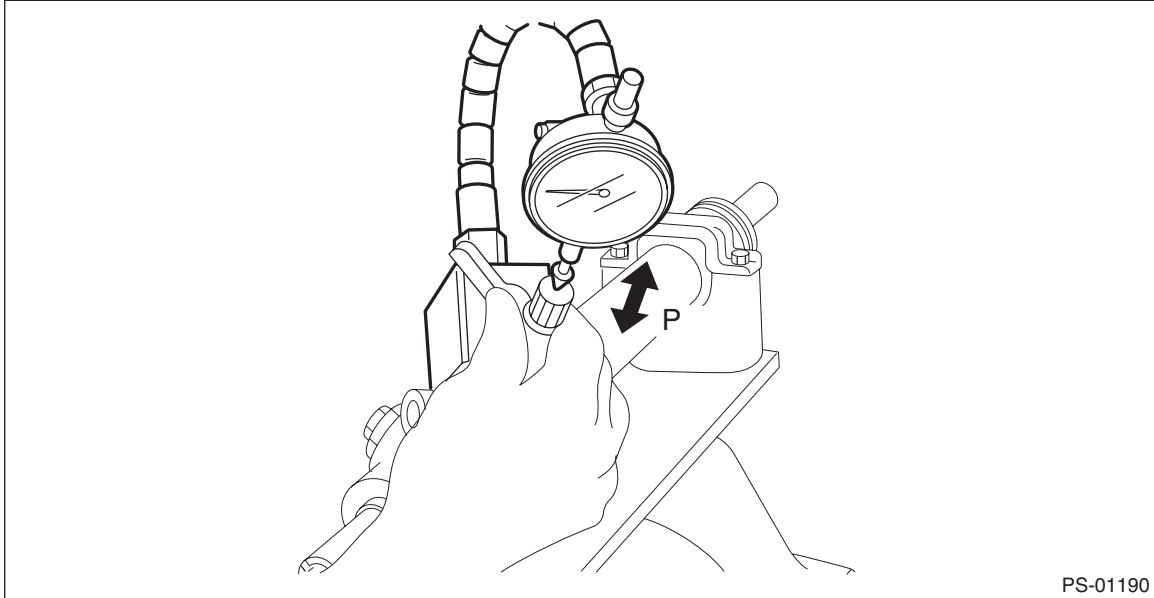
Condition

P: 98 N (10 kgf, 22 lbf)

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

- In axial direction



PS-01190

Service limit

0.27 mm (0.0106 in) or less

Condition

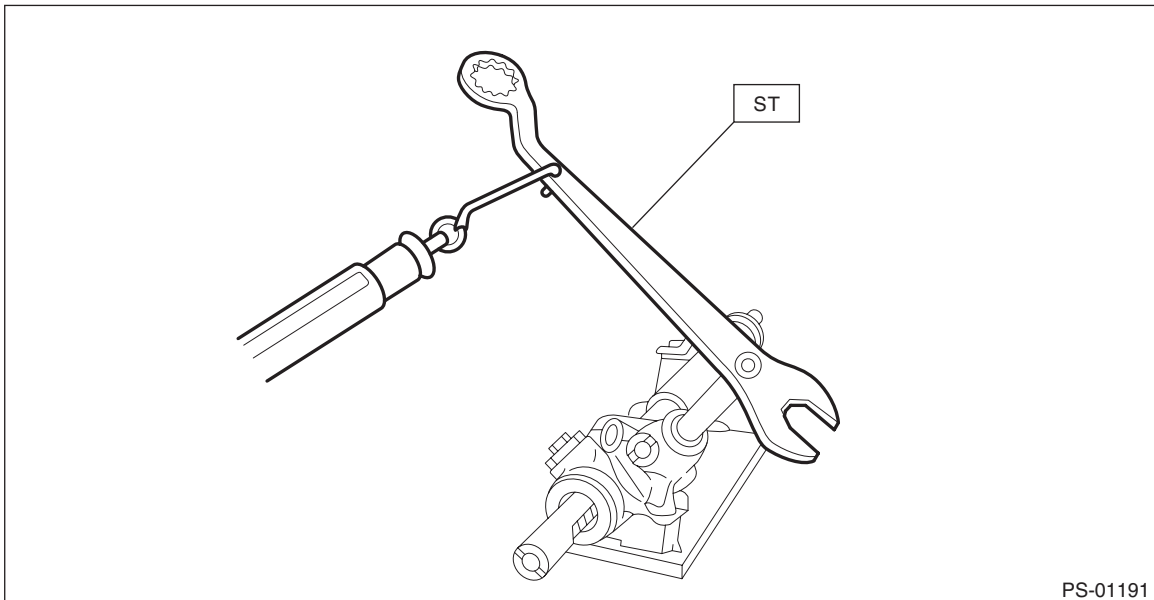
P: 20 — 49 N (2 — 5 kgf, 4 — 11 lbf)

ROTATIONAL RESISTANCE OF GEARBOX

Using the ST, measure the gearbox rotational resistance.

PREPARATION TOOL:

ST: SPECIAL TOOL EPS (34099PA100)



PS-01191

Service limit:

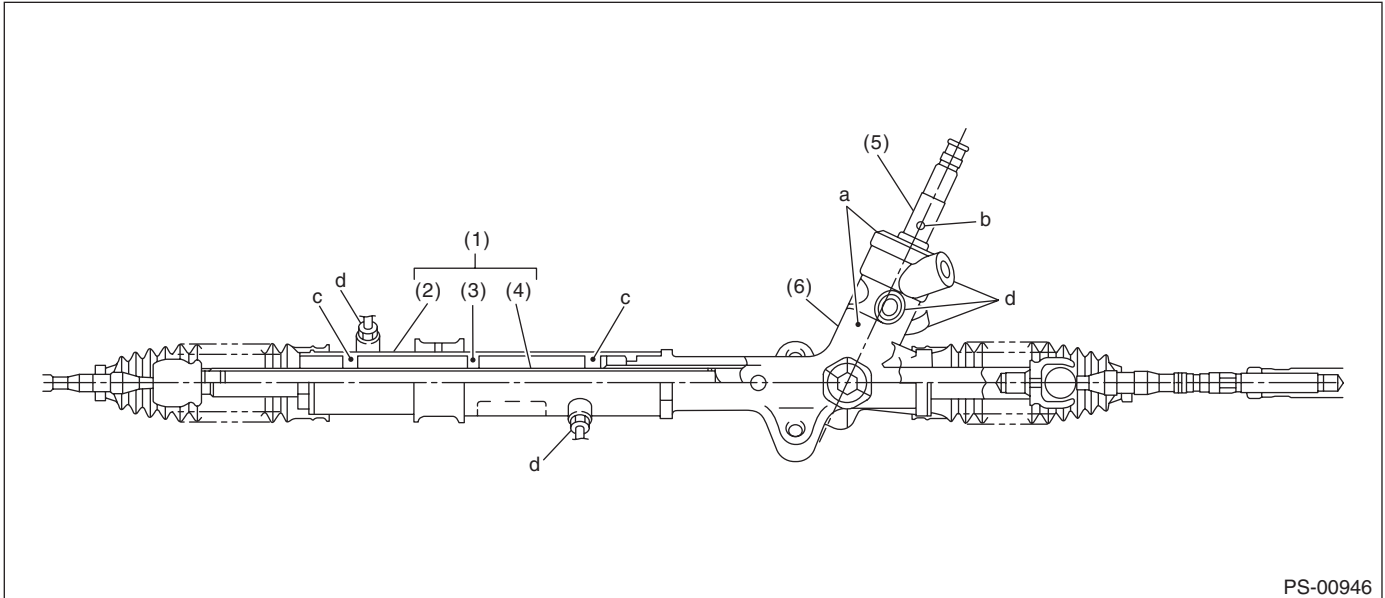
Maximum allowable resistance: 30 N (3.1 kgf, 6.7 lbf) or less

Difference between right and left rotational resistance: 20 % or less

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

3. 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 or oil seal with a new part.

4) **Cause and solution for oil leakage from “b”**

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

5) **Cause and solution for oil leakage from “c”**

The oil seal is damaged. Replace the oil seal.

6) **Cause and solution for oil leakage from “d”**

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

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

F: ADJUSTMENT

1. GEARBOX BACKLASH ADJUSTMENT (SERVICING ON VEHICLE)

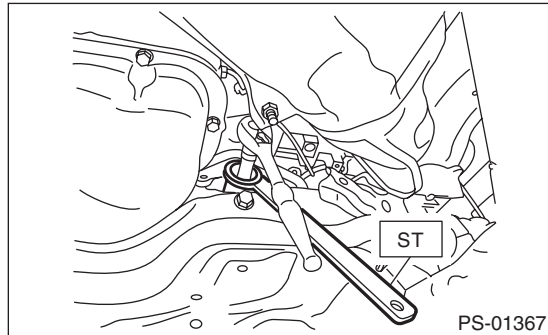
- 1) Using the ST, loosen the lock nut.
- 2) Loosen the adjusting screw by using ST, and apply liquid gasket to the entire area of the adjusting screw threads.

PREPARATION TOOL:

ST: SPECIAL TOOL CPS (34199AJ060)

Liquid gasket:

THREE BOND 1102 or THREE BOND 1215



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

Tightening torque:

9.8 N·m (1.0 kgf-m, 7.2 ft-lb)

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

Tightening torque:

6.0 N·m (0.61 kgf-m, 4.4 ft-lb)

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

CAUTION:

Do not loosen 30° or more.

Tightening torque:

6.0 N·m (0.61 kgf-m, 4.4 ft-lb)

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

Tightening torque (lock nut):

39 N·m (3.98 kgf-m, 28.8 ft-lb)

NOTE:

Secure the adjusting screw to prevent it from rotating while tightening the lock nut.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

2. FRONT WHEEL ALIGNMENT ADJUSTMENT

1) Adjust the front toe.

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

CAUTION:

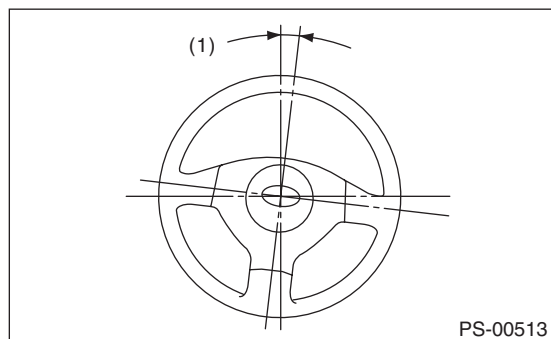
When the wheel alignment has been adjusted, perform the 0 point setting mode for each sensor in the VDCCM&H/U. <Ref. to VDC-20, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

2) Check the steering angle of the wheels.

Standard of steering angle:

Model	Inner wheel	Outer wheel
P225/50R17 tire	$37.4^{\circ} \pm 1.5^{\circ}$	$33.0^{\circ} \pm 1.5^{\circ}$
P225/45R18 tire	$37.4^{\circ} \pm 1.5^{\circ}$	$33.0^{\circ} \pm 1.5^{\circ}$
P215/50R17 tire	$37.6^{\circ} \pm 1.5^{\circ}$	$33.3^{\circ} \pm 1.5^{\circ}$
P205/60R16 tire	$37.6^{\circ} \pm 1.5^{\circ}$	$33.3^{\circ} \pm 1.5^{\circ}$
P225/60R17 tire	$38.4^{\circ} \pm 1.5^{\circ}$	$34.1^{\circ} \pm 1.5^{\circ}$
P215/70R16 tire	$38.4^{\circ} \pm 1.5^{\circ}$	$34.1^{\circ} \pm 1.5^{\circ}$

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. Also check that there are no abnormal steering force, failure of the steering wheel to return or other faults.