

CHASSIS SECTION

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.

This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.

Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FRONT SUSPENSION

FS

REAR SUSPENSION

RS

WHEEL AND TIRE SYSTEM

WT

DIFFERENTIALS

DI

TRANSFER CASE

TC

DRIVE SHAFT SYSTEM

DS

ABS

ABS

ABS (DIAGNOSTICS)

ABS(diag)

BRAKE

BR

PARKING BRAKE

PB

**POWER ASSISTED SYSTEM
(POWER STEERING)**

PS

POWER ASSISTED SYSTEM (POWER STEERING)

PS

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Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

6. Steering Gearbox [RHD MODEL]

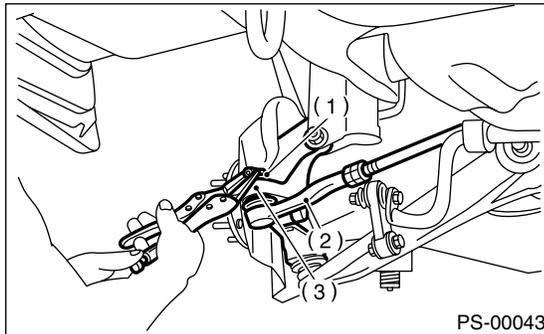
A: REMOVAL

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

WARNING:

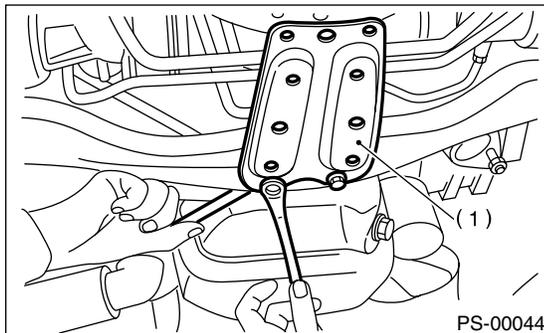
Be careful, the exhaust pipe is hot.

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



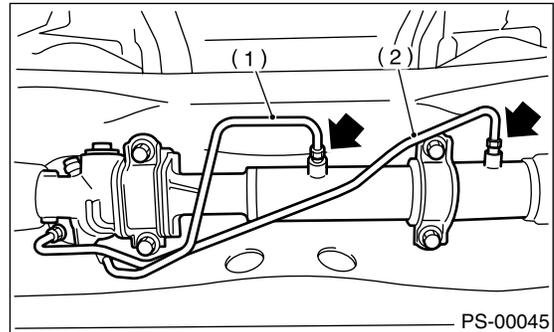
- (1) Castle nut
- (2) Tie-rod end
- (3) Knuckle arm

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



- (1) Jack-up plate

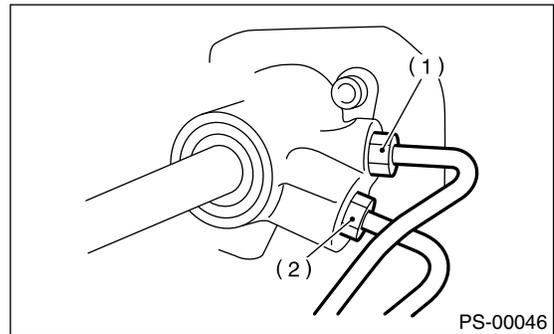
- 10) Remove the one pipe joint at center of gearbox, and connect vinyl hose to pipe and joint. Discharge fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.



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

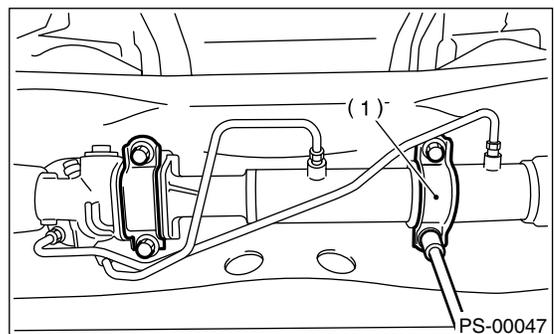
- 11) Remove the universal joint. <Ref. to PS-24, REMOVAL, Universal Joint.>

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



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

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



- (1) Clamp

Steering Gearbox [RHD MODEL]

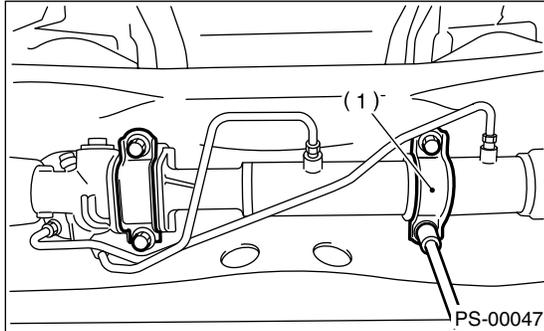
POWER ASSISTED SYSTEM (POWER STEERING)

B: INSTALLATION

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

Tightening torque:

60 N·m (6.1 kgf·m, 44.1 ft·lb)

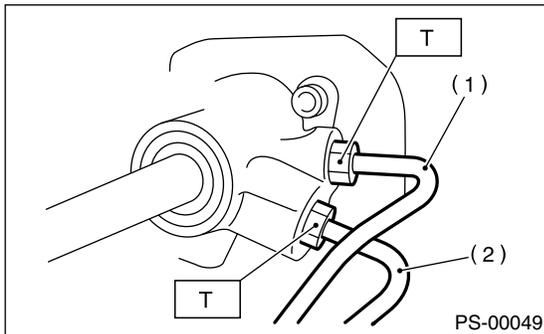


(1) Clamp

- 3) Connect the pipe D first to gear box, and pipe C second.

Tightening torque:

T: 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-24, INSTALLATION, Universal Joint.>
- 5) Connect the tie-rod end and knuckle arm, and tighten with castle nut.

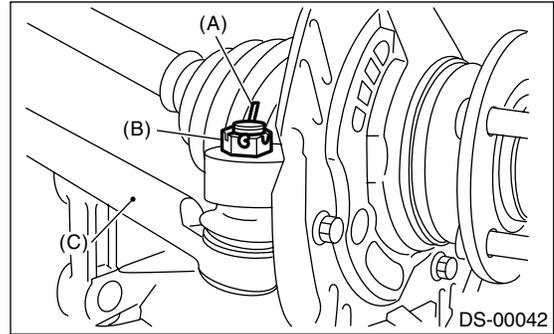
Castle nut tightening torque:

27 N·m (2.75 kgf·m, 19.9 ft·lb)

CAUTION:

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

- 6) After tightening the castle nut to the specified tightening torque, tighten it further within 60° until 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

- 7) Install the front stabilizer to vehicle.
- 8) Install the front exhaust pipe assembly.
- 9) Install the sub frame.
- 10) Install the under cover.
- 11) Align the center of roll connector. <Ref. to AB-18, ADJUSTMENT, Roll Connector.>
- 12) Install the steering wheel. <Ref. to PS-23, INSTALLATION, Steering Wheel.>
- 13) Install the front wheels.
- 14) Tighten the wheel nuts to specified torque.

Tightening torque:

90 N·m (9.1 kgf·m, 65.8 ft·lb)

- 15) Connect the battery ground cable to battery.
- 16) Pour fluid into the oil tank, and bleed air. <Ref. to PS-86, Power Steering Fluid.>
- 17) Check for fluid leaks.
- 18) Install the jack-up plate.
- 19) Lower the vehicle.
- 20) Check the fluid level in oil tank.

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

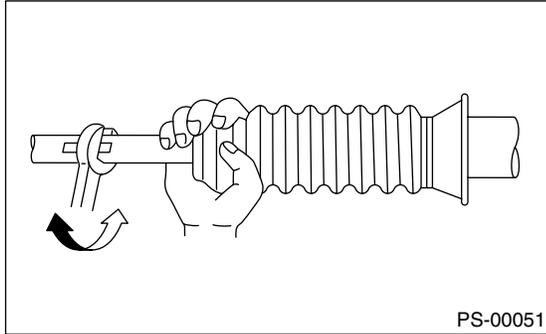
21) After adjusting the toe-in and steering angle, tighten the lock nut on tie-rod end.

Tightening torque:

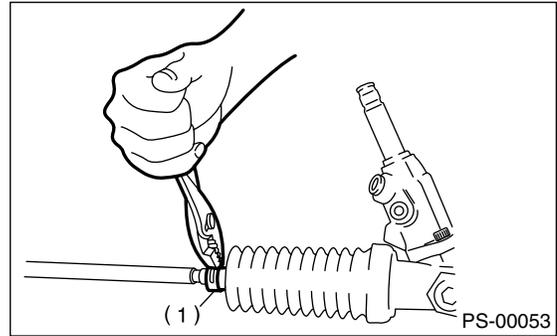
83 N-m (8.5 kgf-m, 61.5 ft-lb)

NOTE:

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



3) Remove the clip on outside of boot using pliers, and then slide the boot to tie-rod end side.

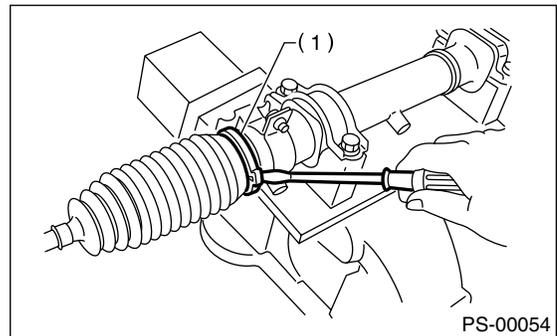


(1) Clip

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

NOTE:

Check the boot for crack, damage or deterioration. Replace the boot with a new one if necessary.



(1) Band

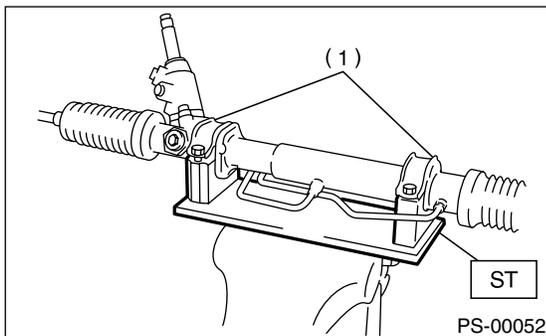
C: DISASSEMBLY

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

ST 926200000 STAND

CAUTION:

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

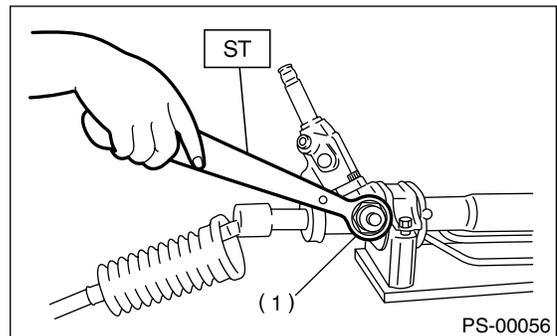


(1) Clamp

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

5) Using the ST, loosen lock nut.

ST 926230000 SPANNER

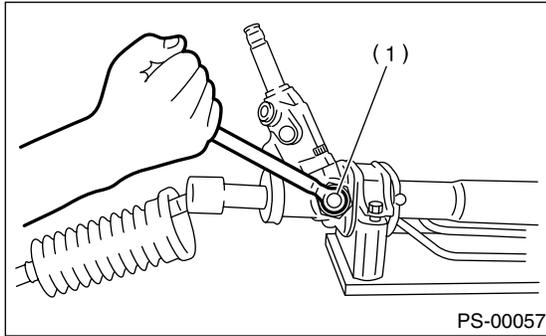


(1) Lock nut

Steering Gearbox [RHD MODEL]

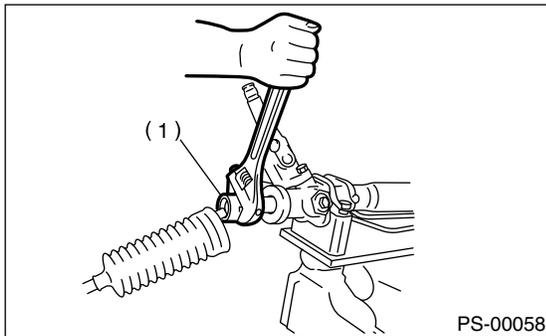
POWER ASSISTED SYSTEM (POWER STEERING)

6) Tighten the adjusting screw until it no longer tightens.



(1) Adjusting screw

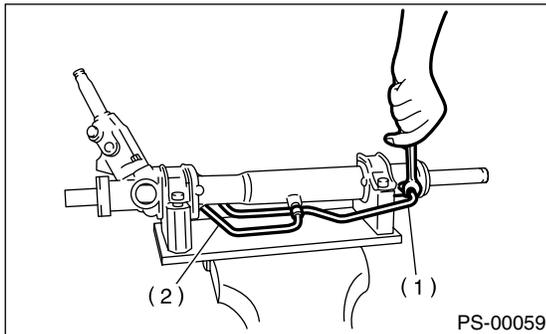
7) Using a wrench (32 mm (1.26 in) width across flats) or adjustable wrench with cinching boot, remove the tie-rod.



(1) Tie-rod

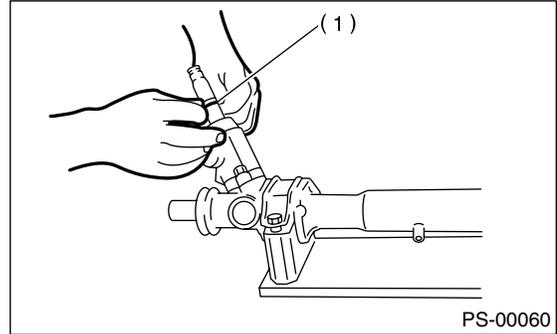
8) Loosen the adjusting screw, and then remove the spring and sleeve.

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



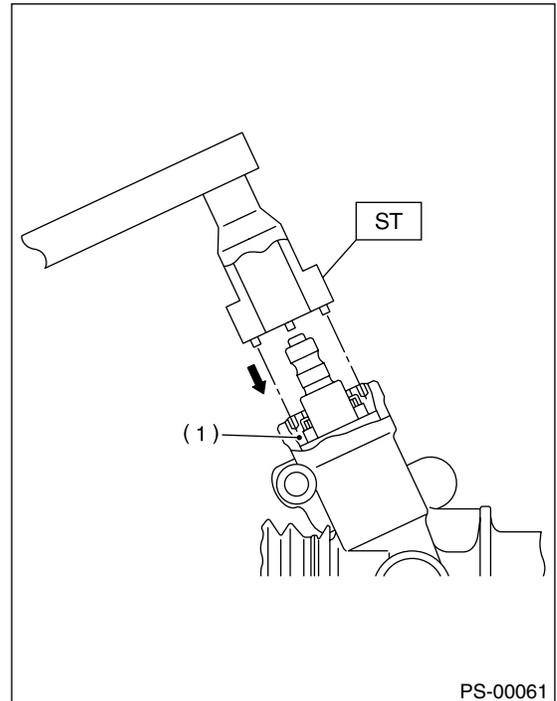
(1) Pipe A
(2) Pipe B

10) Clean the dirt of input shaft. Remove the dust cover taking care not to scratch the housing or input shaft and allow foreign matter to enter gear box interior.



(1) Dust cover

11) Align the ST pin to plug hole to install. Rotate the ST counterclockwise to remove plug.
ST 34199AE090 PLUG WRENCH

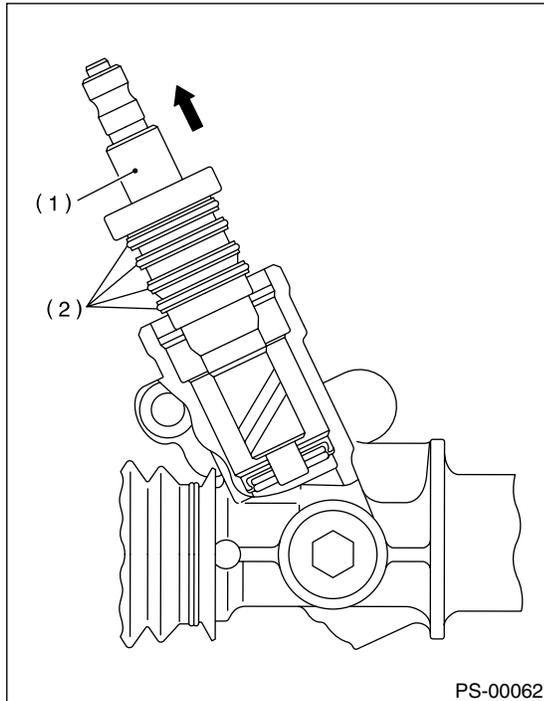


(1) Plug

Steering Gearbox [RHD MODEL]

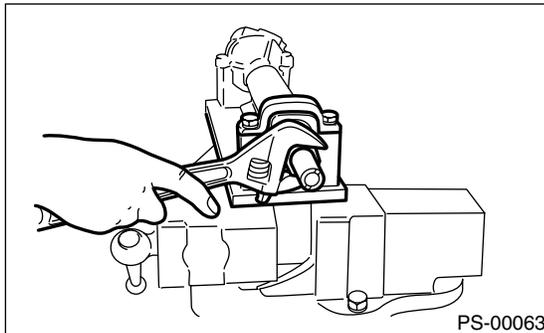
POWER ASSISTED SYSTEM (POWER STEERING)

12) Remove the valve assembly taking care not to scratch seal ring and valve housing inner surface.



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

13) Remove the holder using a wrench (32 mm (1.26 in) width across flats) or adjustable wrench.

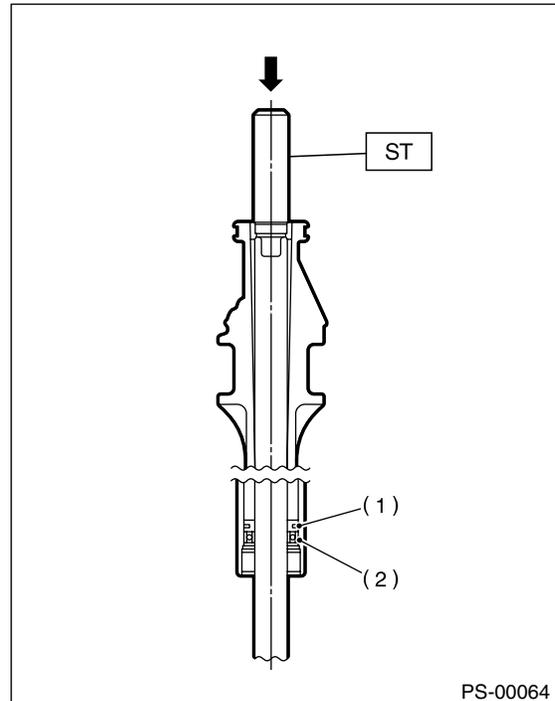


14) Install the ST on valve side of rack and press outer side oil seal out taking care not to contact rack with steering body inner surface.

ST 34099FA030 INSTALLER & REMOVER

NOTE:

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



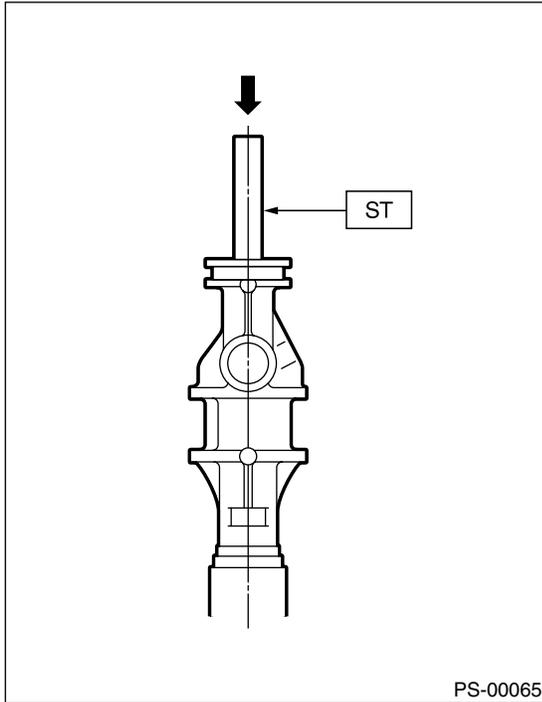
- (1) Rack piston
- (2) Outer side oil seal

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 927580000 REMOVER

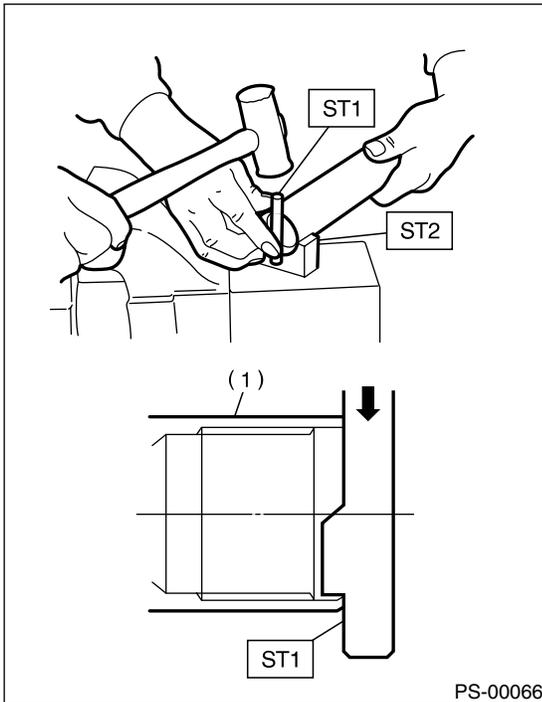


PS-00065

16) Using the ST1 and ST2, repair the cylinder's clinched sections.

ST1 34099FA080 PUNCH

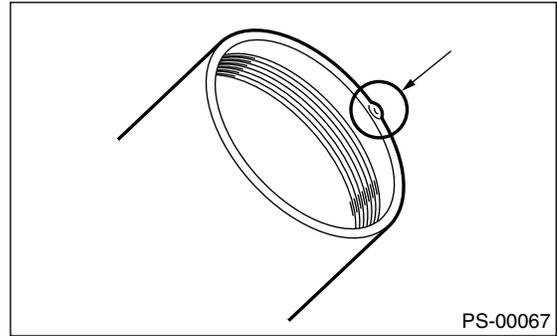
ST2 34099FA070 BASE



PS-00066

(1) Cylinder

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



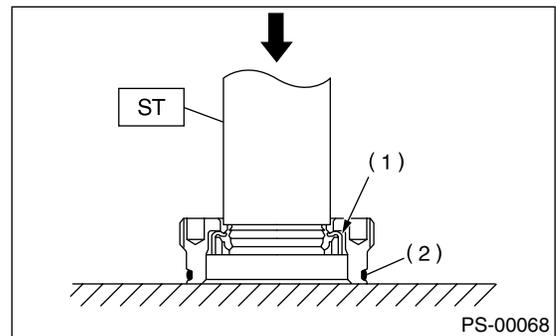
PS-00067

18) Remove the oil seal using ST and press from plug.

ST 34199AE100 PLUG OIL SEAL REMOVER

NOTE:

Do not apply force on the plug edge surface.

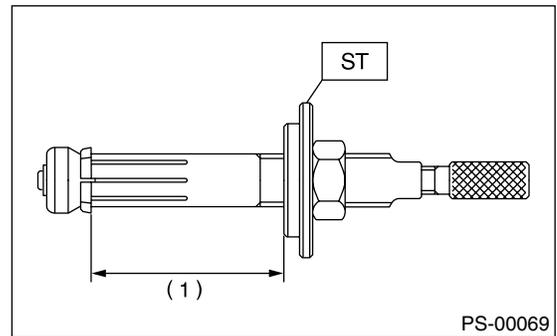


PS-00068

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

19) Set the ST on drawing dimension.

ST 34199AE120 GEARBOX OIL SEAL REMOVER



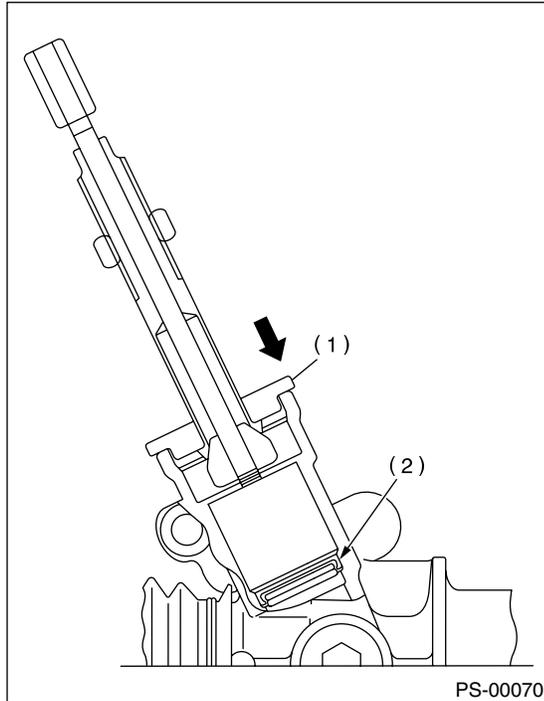
PS-00069

(1) 70 mm (2.76 in)

Steering Gearbox [RHD MODEL]

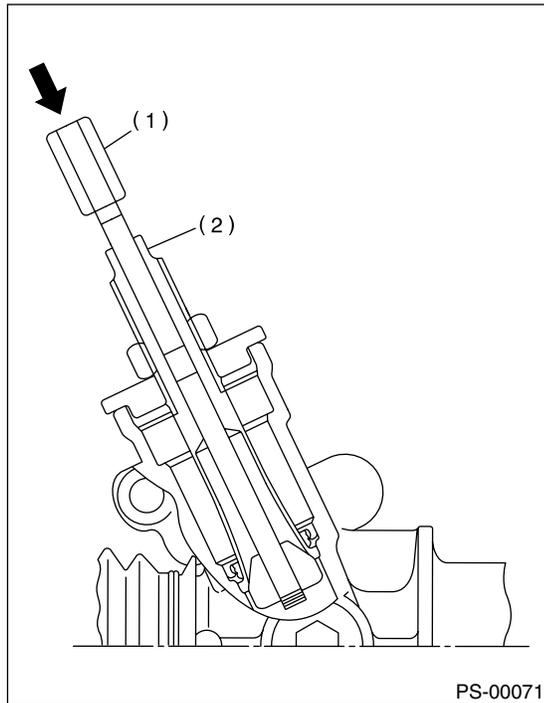
POWER ASSISTED SYSTEM (POWER STEERING)

20) Set the stopper to gear box, and then insert the tip of ST to gear box.



- (1) Stopper
- (2) Oil seal

21) By fixing the 2-surface width, press in by rotating the rod and attach to oil seal.

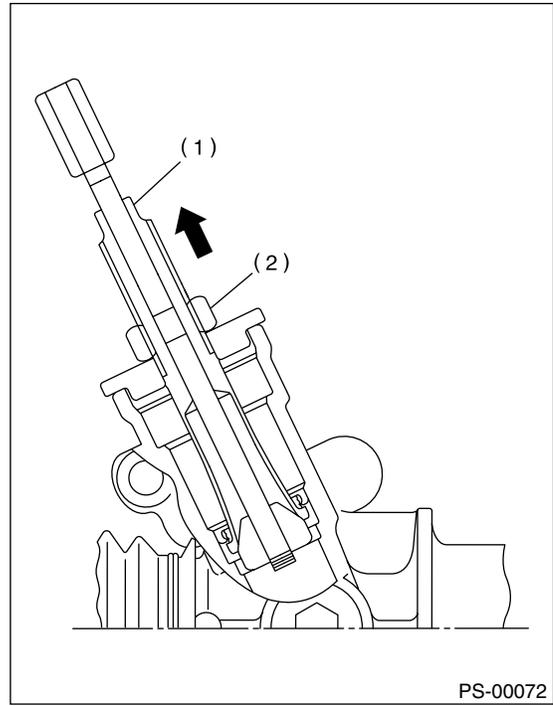


- (1) Rod
- (2) 2-surface width

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

CAUTION:

Take care not to scratch the gear box inner surface.



- (1) 2-surface width
- (2) Nut

D: ASSEMBLY

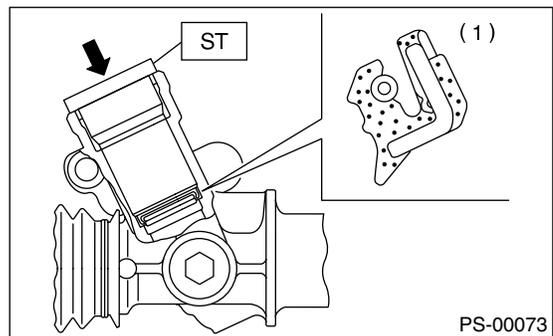
1) Apply a coat of grease to inside and outside of new oil seal.

Specified steering grease:

VALIANT GREASE M2 (Part No. 003608001)

2) Verify the oil seal direction and installation position. Using the ST and press, press fit the oil seal to gear box.

ST 34199AE130 GEARBOX OIL SEAL INSTALLER



- (1) Oil seal

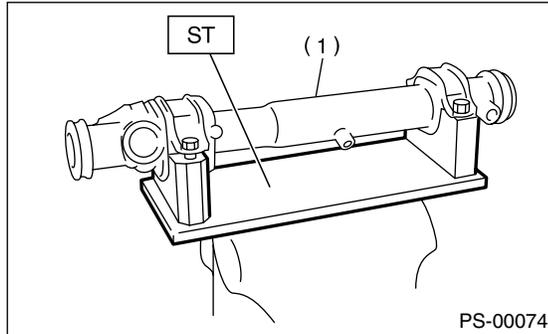
Steering Gearbox [RHD MODEL]

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:

Ensure the needle bearing is free from defects. If it is faulty, replace the steering body with a new one.



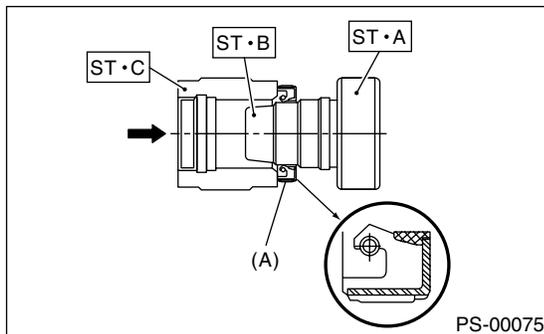
(1) Steering body

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

ST 927490000 INSTALLER A, B, C

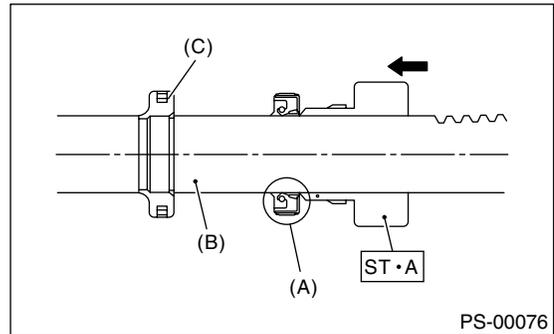
NOTE:

Face the oil seal in direction shown in the figure.



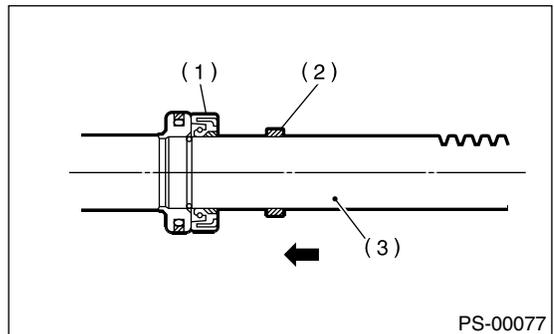
(A) Oil seal

5) Insert the ST·A with oil seal assembled, through 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 gear side of rack.



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

Steering Gearbox [RHD MODEL]

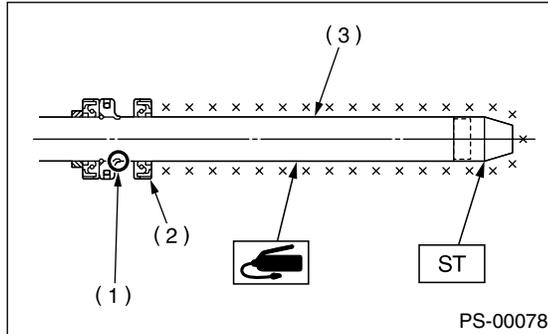
POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 926250000 GUIDE

CAUTION:

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



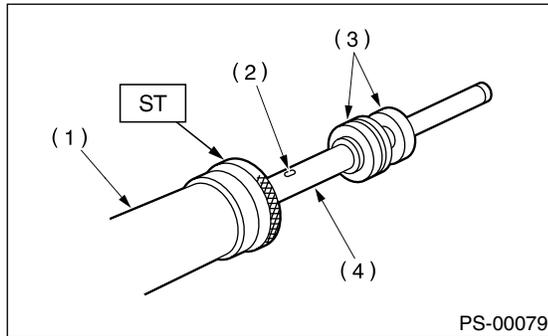
- (1) Rack piston inner ring
- (2) Outer side oil seal
- (3) Rack

8) Apply a coat of grease to the grooves in rack, sliding surface of sleeve and sealing surface of piston. Install the ST on 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.

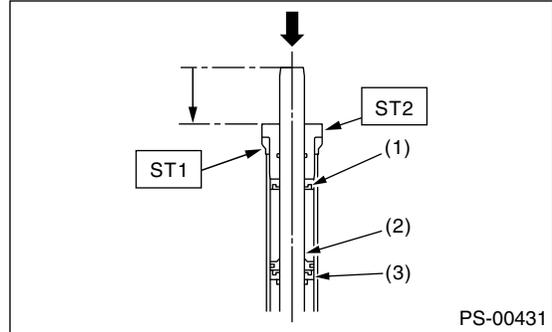


- (1) Cylinder side of steering body
- (2) Air vent hole
- (3) Oil seal
- (4) Rack

9) Make the ST2 pass through rack, and then push in the rack and ST2 using a press until ST1 comes in contact with ST2 and the end of rack is aligned with end of ST2.

ST1 34199AE000 GUIDE (Oil seal)

ST2 34199AE010 INSTALLER (Oil seal)

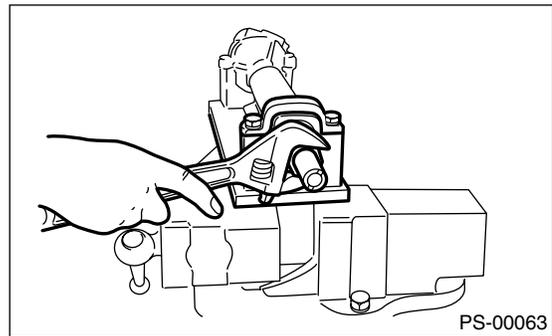


- (1) Outer side oil seal
- (2) Rack piston
- (3) Inner side oil seal

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

Tightening torque:

64 N·m (6.5 kgf·m, 47.0 ft·lb)



Steering Gearbox [RHD MODEL]

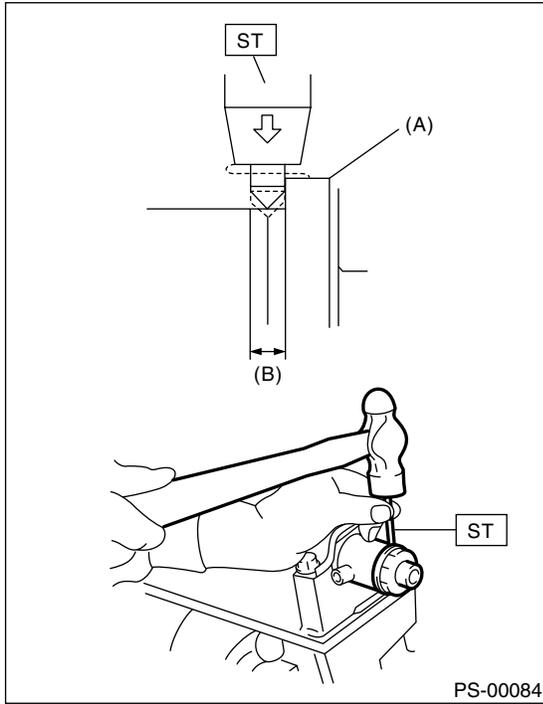
POWER ASSISTED SYSTEM (POWER STEERING)

11) Using the ST, clinch steering body cylinder at a point less than 3 mm (0.12 in) from holder.

CAUTION:

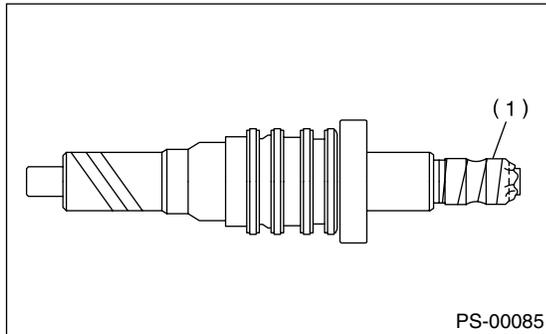
Be careful not to deform the holder.

ST 34099FA060 PUNCH HOLDER



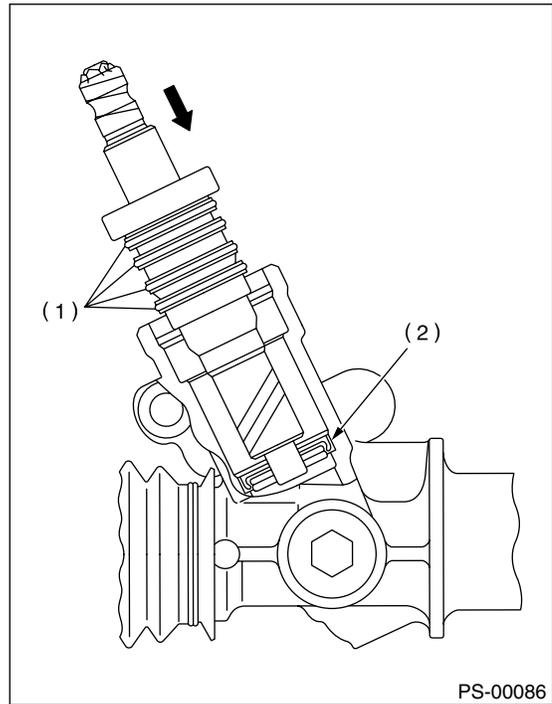
- (A) Holder
- (B) 3 mm (0.1 in)

12) Roll the vinyl tape on serration part of valve assembly, and then apply grease on the tape surface.



- (1) Vinyl tape

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



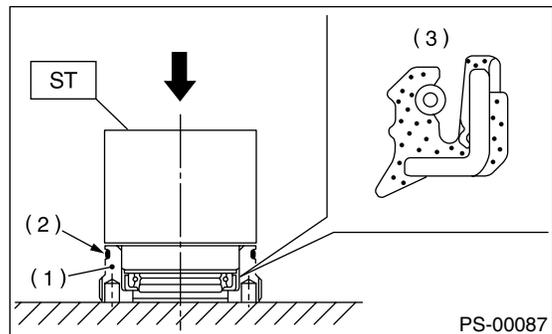
- (1) Seal ring
- (2) Oil seal

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

ST 34199AE110 PLUG OIL SEAL INSTALLER

CAUTION:

Pay attention to the oil seal direction, and attaching position.



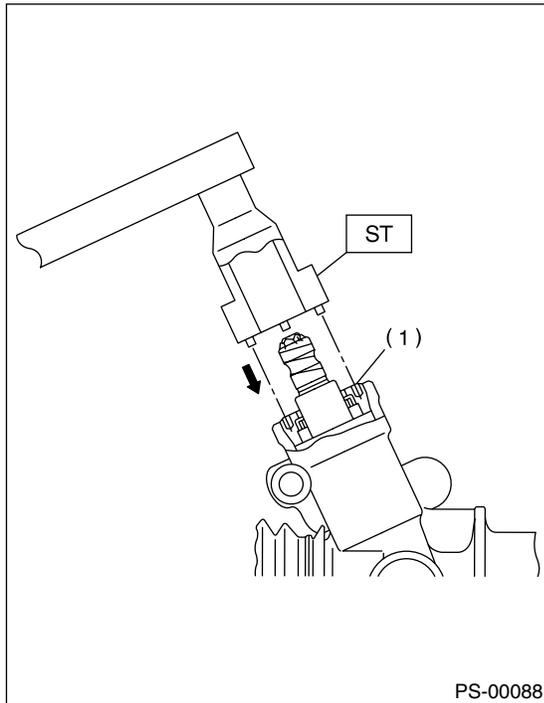
- (1) Plug
- (2) O-ring
- (3) Oil seal

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

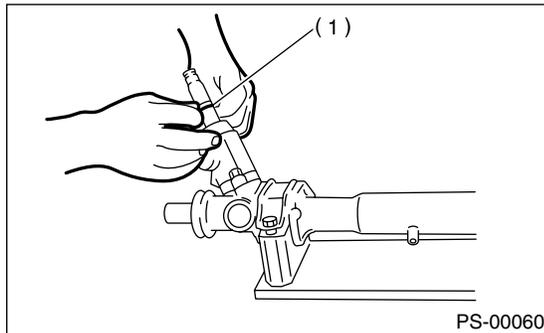
- 15) Using the ST, install plug.
ST 34199AE090 PLUG WRENCH

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



(1) Plug

- 16) Install the dust cover. Remove the vinyl tape.

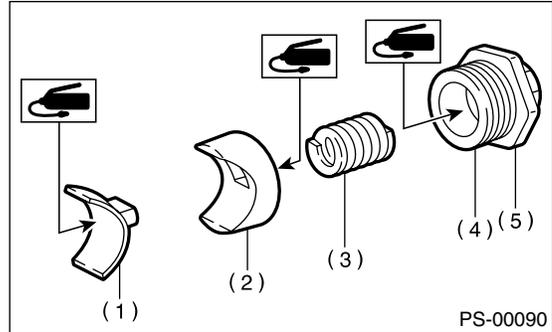


(1) Dust cover

- 17) Temporarily install the rack, and then operate it from lock to lock two or three times to make it fit in. Remove the grease blocking air vent hole.

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

- 18) 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 and install on steering body.



- (1) Seat pad
(2) Sleeve
(3) Spring
(4) Adjusting screw
(5) Lock nut

- 19) Tighten the adjusting screw to specified torque.

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

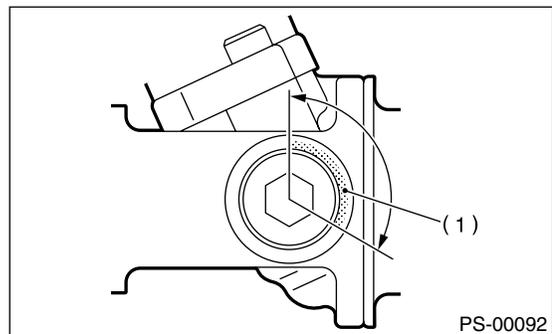
- 20) After tightening to the specified tightening torque, loosen it by 25°.

- 21) Remove the tie-rod.

- 22) Verify that play is within specified value. <Ref. to PS-61, SERVICE LIMIT, INSPECTION, Steering Gearbox [RHD MODEL].>

- 23) 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.

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

24) Tighten the adjusting screw.

Tightening torque:

9.8 N-m (10.0 kgf-m, 7.2 ft-lb)

25) After tightening to the specified tightening torque, loosen it.

26) Tighten the adjusting screw.

Tightening torque:

4.8 N-m (0.49 kgf-m, 3.5 ft-lb)

27) After tightening to the specified tightening torque, loosen it.

28) Tighten the adjusting screw.

Tightening torque:

4.8 N-m (0.49 kgf-m, 3.5 ft-lb)

29) After tightening to the specified tightening torque, loosen it by 25°.

30) Install the lock nut. While holding the adjusting screw with a wrench, tighten 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.

31) Install the tie-rod into rack.

Tightening torque:

90 N-m (9.0 kgf-m, 65.1 ft-lb)

NOTE:

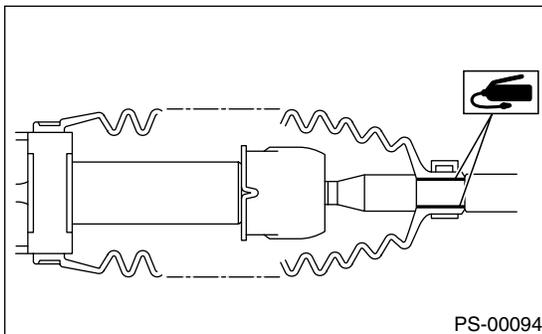
Check the mating face of rack and tie-rod for foreign material, dirt, dust and etc.

If required, clean the mating face.

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

NOTE:

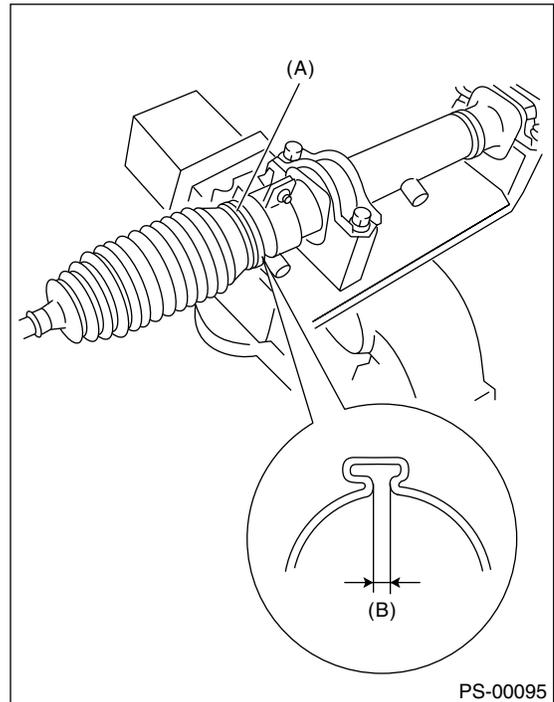
Make sure that the boot is installed without unusual inflation or deflation.



33) Caulk the boot so the space inside boot band caulking portion becomes 2 mm (0.08 in) or less.

NOTE:

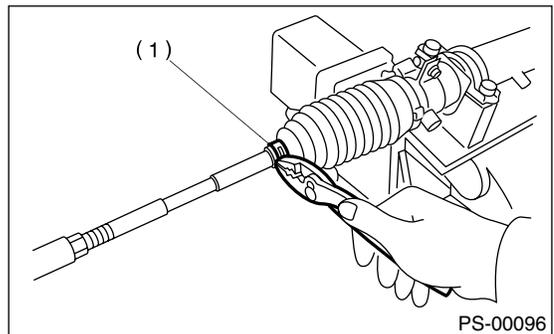
Use a new boot band.



(A) Boot band

(B) Less than 2mm (0.08 in)

34) Fix the boot end with clip (small).



(1) Clip

35) After installing, check the boot end is positioned into groove on tie-rod.

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

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

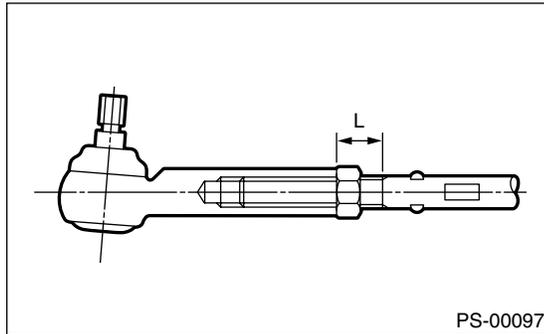
Installed tie-rod length: L

Sedan:

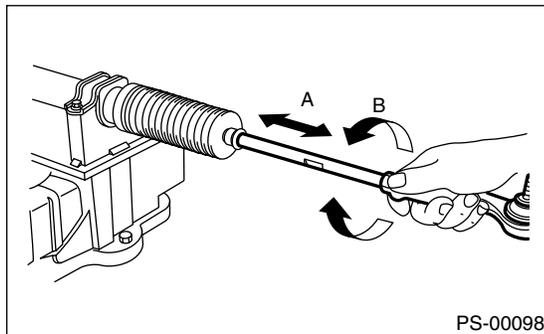
25 mm (0.98 in)

Wagon:

15 mm (0.59 in)



37) Inspect the gearbox as follows:
"A" Holding the tie-rod end, repeat lock to lock two or three times as quickly as possible.
"B" Holding the tie-rod end, turn it slowly at a radius one or two times as large as possible.
After all, make sure that the boot is installed in specified position without deflation.



38) Remove the gearbox from ST.
ST 926200000 STAND

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

E: INSPECTION

1. BASIC INSPECTION

- 1) Clean all 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) Bend of 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, lip is worn out or damage is found, replace it with a new one.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust the backlash properly. By measuring the turning torque of gearbox and sliding resistance of rack, check if rack and pinion engage uniformly and smoothly with each other. (Refer to "Service limit".) (2) Keeping the rack pulled out all the way so that all teeth emerge, check teeth for damage. Even if abnormality is found in either (1) or (2), replace the entire gearbox.
4	Gearbox unit	(1) Bend of rack shaft (2) Bend of cylinder portion (3) Crack or damage on cast iron portion	Replace the gearbox with a new one.
		(4) Wear or damage on rack bush	If the free play of rack shaft in radial direction is out of the specified range, replace the gearbox with a new one. (Refer to "Service limit".)
		(5) Wear on input shaft bearing	If the free plays of input shaft in radial and axial directions are out of the specified ranges, replace the gearbox with a new one. (Refer to "Service limit".)
5	Boot	Crack, damage or deterioration	Replace with a new one.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace with a new one.
7	Tie-rod end	Damage or deterioration on dust seal	Replace with a new one.
8	Adjusting screw spring	Deterioration	Replace with a new one.
9	Boot clip	Deterioration	Replace with a new one.
10	Sleeve	Damage	Replace with a new one.
11	Pipes	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace with a new one.

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

2. SERVICE LIMIT

Make a measurement as follows. If it exceeds the specified service limit, adjust or replace.

NOTE:

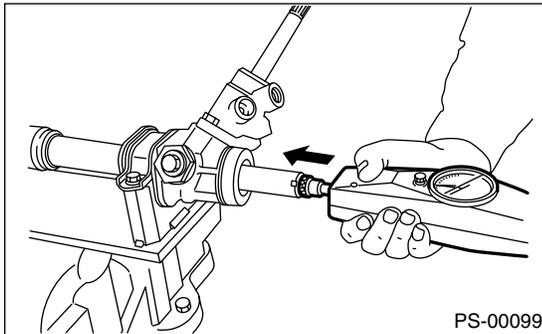
When making a measurement, vise gearbox by using ST. Never vise the gearbox by inserting aluminum plates, etc. between vise and gearbox.

ST 926200000 STAND

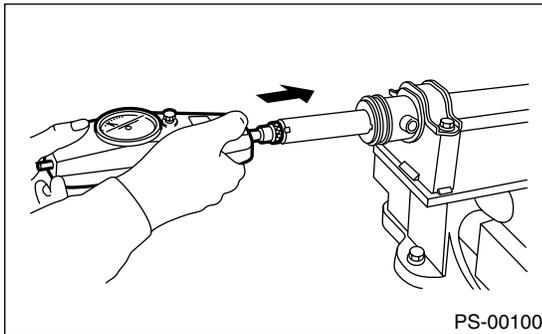
Sliding resistance of rack shaft:

Service limit

400 N (41 kgf, 90 lb) or less



PS-0009



PS-0010

3. RACK SHAFT PLAY IN RADIAL DIRECTION

Left-turn steering:

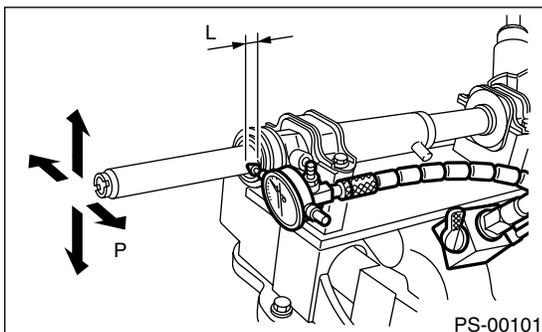
Service limit

0.19 mm (0.0075 in) or less

On condition

L: 5 mm (0.20 in)

P: 98 N (10 kgf, 22 lb)



PS-0011

Right-turn steering:

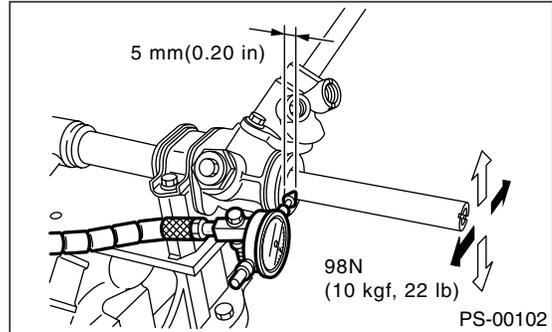
Service limit

Direction $\leftarrow \rightarrow$

0.3 mm (0.012 in) or less

Direction $\leftarrow \rightarrow$

0.19 mm (0.0075 in) or less



PS-00102

4. INPUT SHAFT PLAY

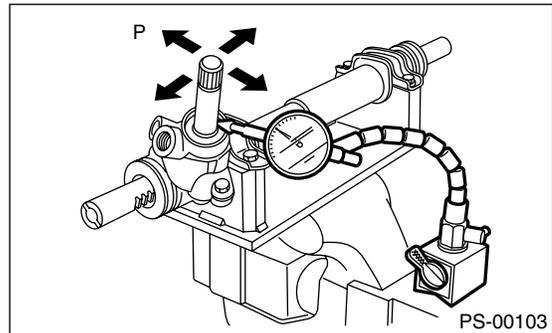
In radial direction:

Service limit

0.18 mm (0.0071 in) or less

On condition

P: 98 N (10 kgf, 22 lb)



PS-00103

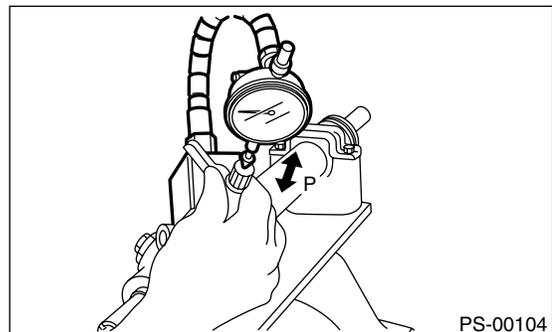
In axial direction:

Service limit

0.5 mm (0.020 in) or less

On condition

P: 20 — 49 N (2 — 5 kgf, 4 — 11 lb)



PS-00104

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure gearbox turning resistance.

ST 34099PA100 SPANNER

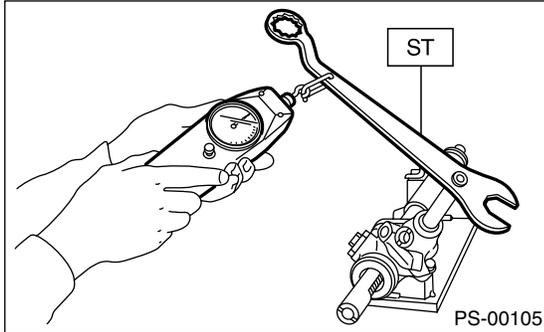
Service limit

Maximum allowable resistance

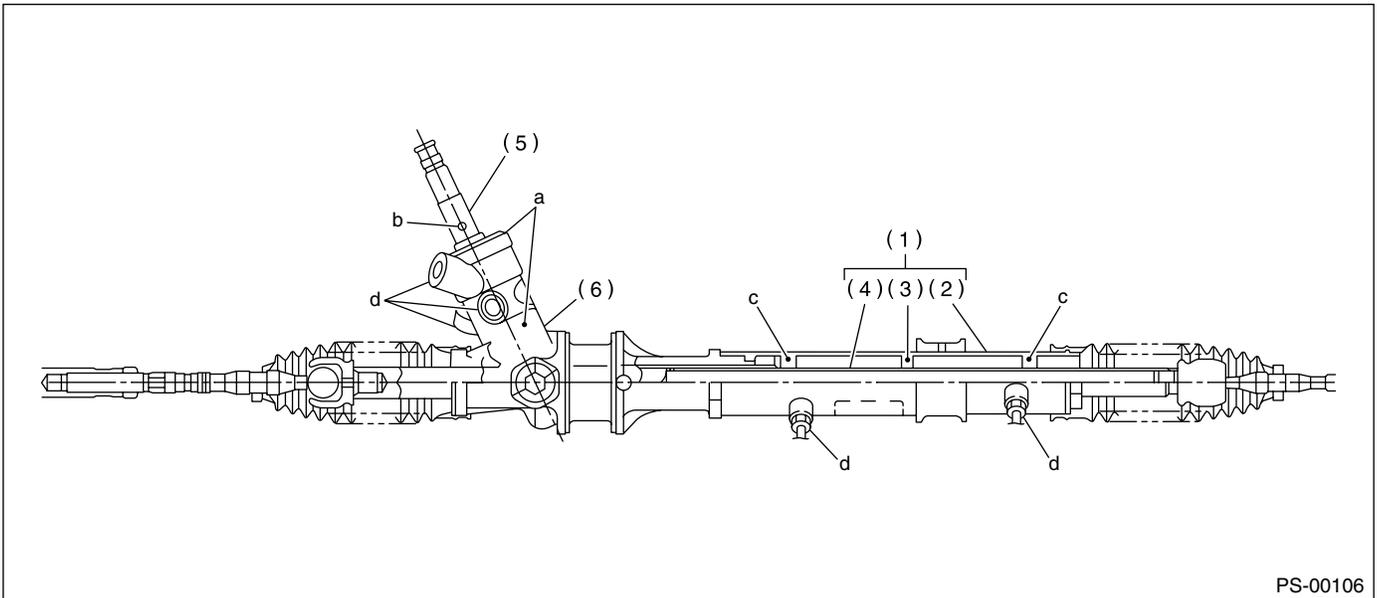
10.5 N (1.1 kgf, 2.4 lb) or less

Difference between right and left turning resistance:

Less than 20%



6. OIL LEAKING



(1) Power cylinder
(2) Cylinder

(3) Rack piston
(4) Rack

(5) Input shaft
(6) Valve housing

Steering Gearbox [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

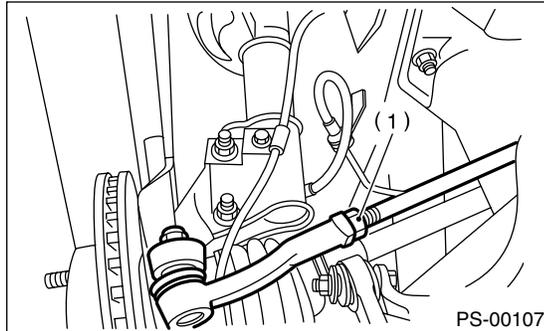
- 1) Lift up the vehicle.
- 2) Even if the location of leak can be easily found by observing leaking condition, it is necessary to thoroughly remove the oil from suspected portion and turn steering wheel from lock to lock about thirty to forty times with engine running, then reinspect the suspected portion between immediately after and several hours after this operation.
- 3) Inspect leakage from "a".
The oil seal is damaged. Replace the valve assembly with a new one.
- 4) Inspect leakage from "b".
The torsion bar O-ring is damaged. Replace the valve assembly with a new one.
- 5) Inspect leakage from "c".
The oil seal is damaged. Replace the oil seal with a new one.
- 6) Inspect leakage from "d".
The pipe is damaged. Replace the faulty pipe or O-ring with a new one.

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)



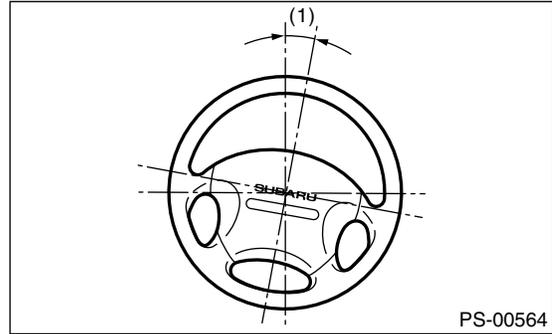
(1) Lock nut

- 2) Adjust the steering angle of wheels. <Ref. to FS-10, STEERING ANGLE, INSPECTION, Wheel Alignment.>

Standard of steering angle:

Model	TURBO, 2.5 L and OUTBACK	Others
Inner wheel	34.5°±1.5°	37.3°±1.5°
Outer wheel	30.3°±1.5°	32.4°±1.5°

- 3) If the steering wheel spokes are not horizontal when wheels are set in the straight ahead position, and error is more than 5° on the periphery of 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 each other by the same angle.

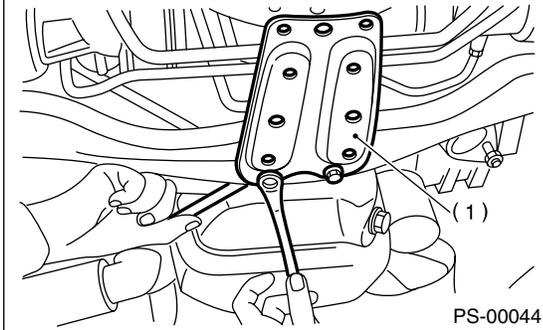
Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

7. Pipe Assembly [LHD MODEL]

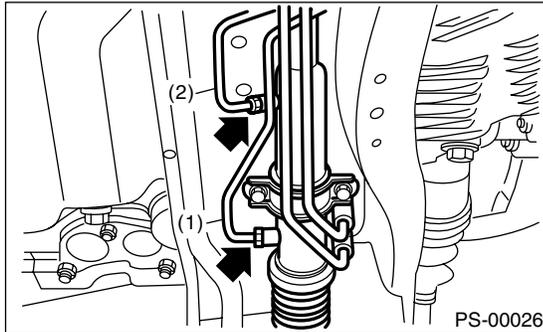
A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift-up the vehicle, and then remove the jack-up plate.



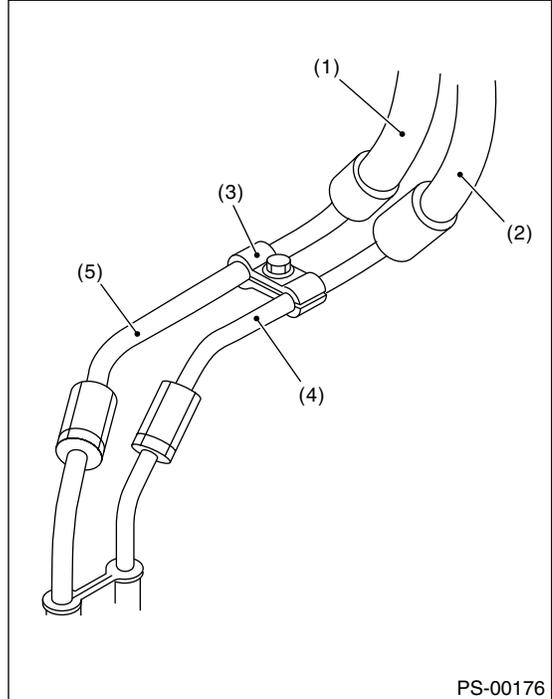
(1) Jack-up plate

- 3) Remove the one pipe joint at the center of gear-box, and then connect the vinyl hose to pipe and joint. Discharge fluid by turning steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.



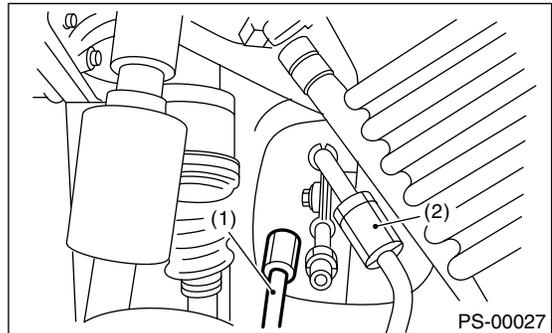
(1) Pipe A
(2) Pipe B

- 4) Remove the clamp E from pipes C and D.



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

- 5) Disconnect the pipe C and D from gear box.



(1) Pipe C
(2) Pipe D

Pipe Assembly [LHD MODEL]

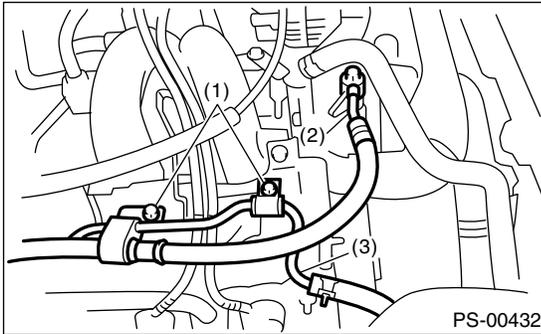
POWER ASSISTED SYSTEM (POWER STEERING)

6) NON-TURBO MODEL

- (1) Remove the air intake duct. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.>
- (2) Remove the bolt A.
- (3) Disconnect the pipe C from oil pump. Disconnect the pipe D from return hose.

CAUTION:

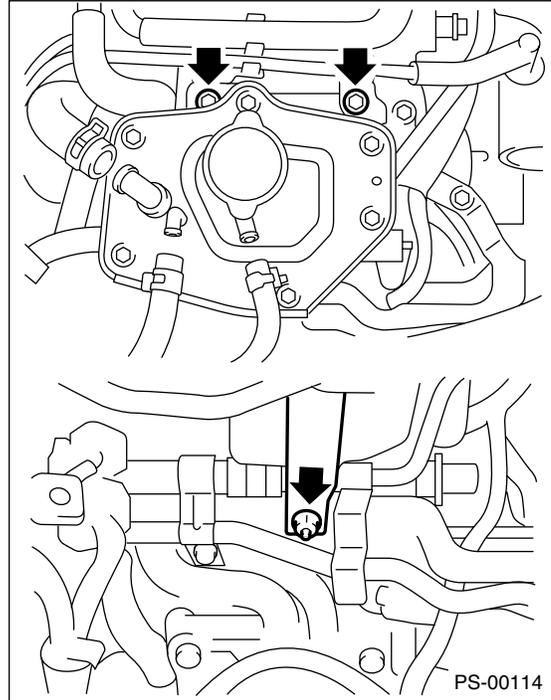
- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.



- (1) Bolt A
- (2) Pipe C
- (3) Pipe D

7) TURBO MODEL

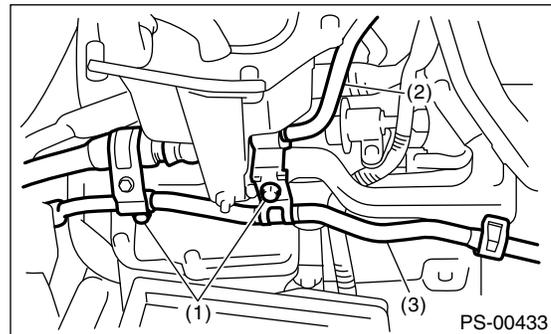
- (1) Remove the air cleaner. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
- (2) Remove the coolant filler tank.



- (3) Remove the two bolts fixing pipe C and D.
- (4) Disconnect the pipe C from oil pump. Disconnect the pipe D from return hose.

CAUTION:

- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.



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

Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

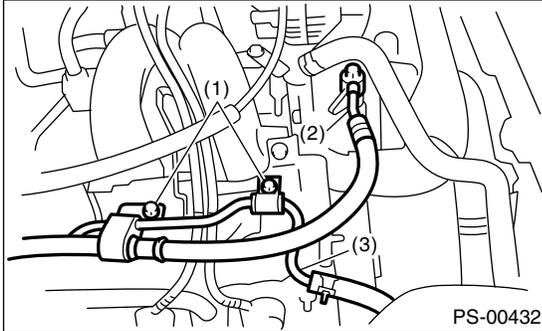
B: INSTALLATION

1) Temporarily tighten the two bolts fixing pipe C and D. (bolt A)

NOTE:

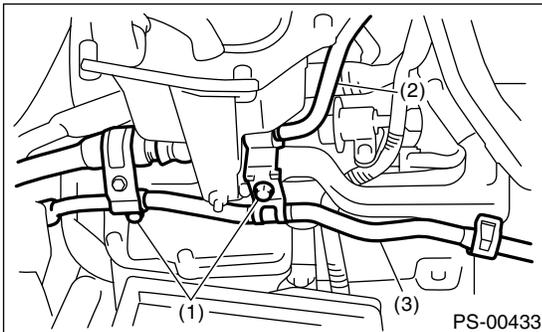
Visually check that the hose between tank and pipe D is free from bending or twisting.

- NON-TURBO MODEL



- (1) Bolt A
- (2) Pipe C
- (3) Pipe D

- TURBO MODEL



- (1) Bolt A
- (2) Pipe C
- (3) Pipe D

- (1) Connect the pipe D to oil tank.
- (2) Using a new gasket, connect the pipe C to oil pump.

Tightening torque:

39 N·m (4.0 kgf·m, 28.9 ft·lb)

- (3) Tighten the two bolts fixing pipe C and D. (bolt A)

Tightening torque:

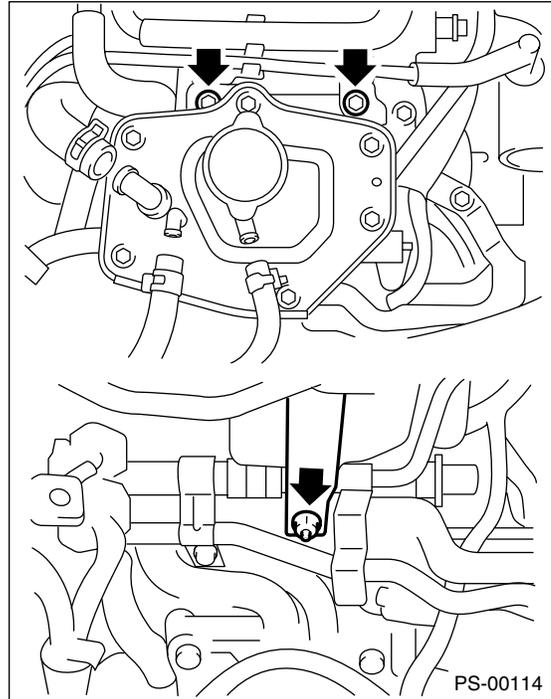
13 N·m (1.3 kgf·m, 9.4 ft·lb)

2) Install the coolant filler tank. (Turbo model)

Tightening torque:

T1: 19 N·m (1.9 kgf·m, 13.7 ft·lb)

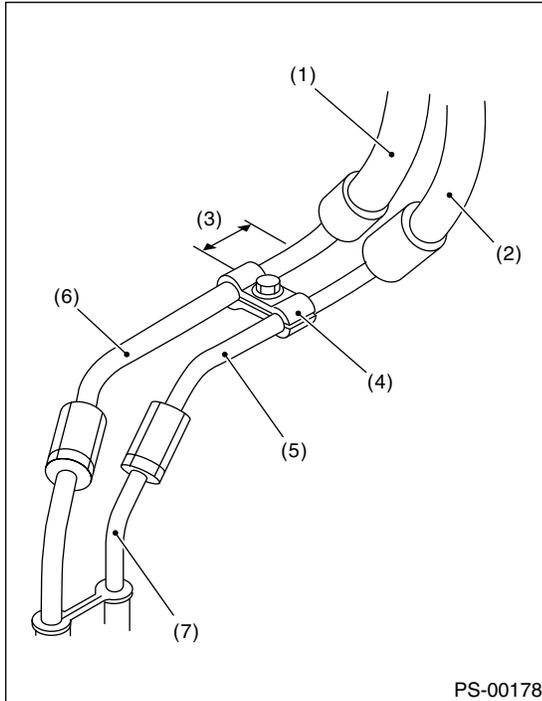
T2: 21 N·m (2.1 kgf·m, 15.2 ft·lb)



Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

3) Temporarily connect the pipe C and D to gear box.

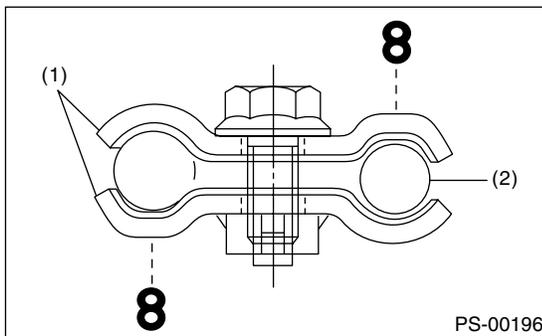


- (1) Return hose
- (2) Pressure hose
- (3) Approx. 30 mm (1.18 in)
- (4) Clamp E
- (5) Pipe C
- (6) Pipe D
- (7) Pipe (Gear box side)

4) Temporarily install the clamp E on pipes C and D.

NOTE:

Ensure the letter “8” on each clamp are diagonally opposite each other as shown in the figure.



- (1) Clamp E
- (2) Pipe C

5) Tighten the clamp E firmly.

Tightening torque:

7.4 N·m (0.75 kgf·m, 5.4 ft·lb)

6) Tighten the joint nut.

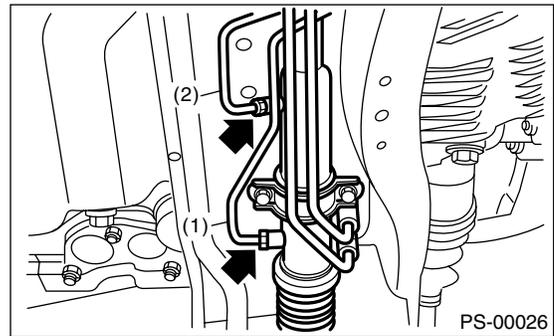
Tightening torque:

15 N·m (1.5 kgf·m, 10.8 ft·lb)

7) Connect the pipes A and B to four pipe joints of gearbox. Connect the upper pipe B first, and lower pipe A second.

Tightening torque:

13 N·m (1.3 kgf·m, 9.4 ft·lb)



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

8) Install the jack-up plate.

9) Install the air intake duct. <Ref. to IN(H4SO)-6, INSTALLATION, Air Intake Duct.>

10) Install the air intake duct, air cleaner upper cover and air intake boot.

<Ref. to IN(H4DOTC)-7, INSTALLATION, Air Cleaner.> and <Ref. to IN(H4SO)-6, INSTALLATION, Air Intake Duct.>

11) Connect the battery ground cable to battery.

12) Feed the specified fluid.

CAUTION:

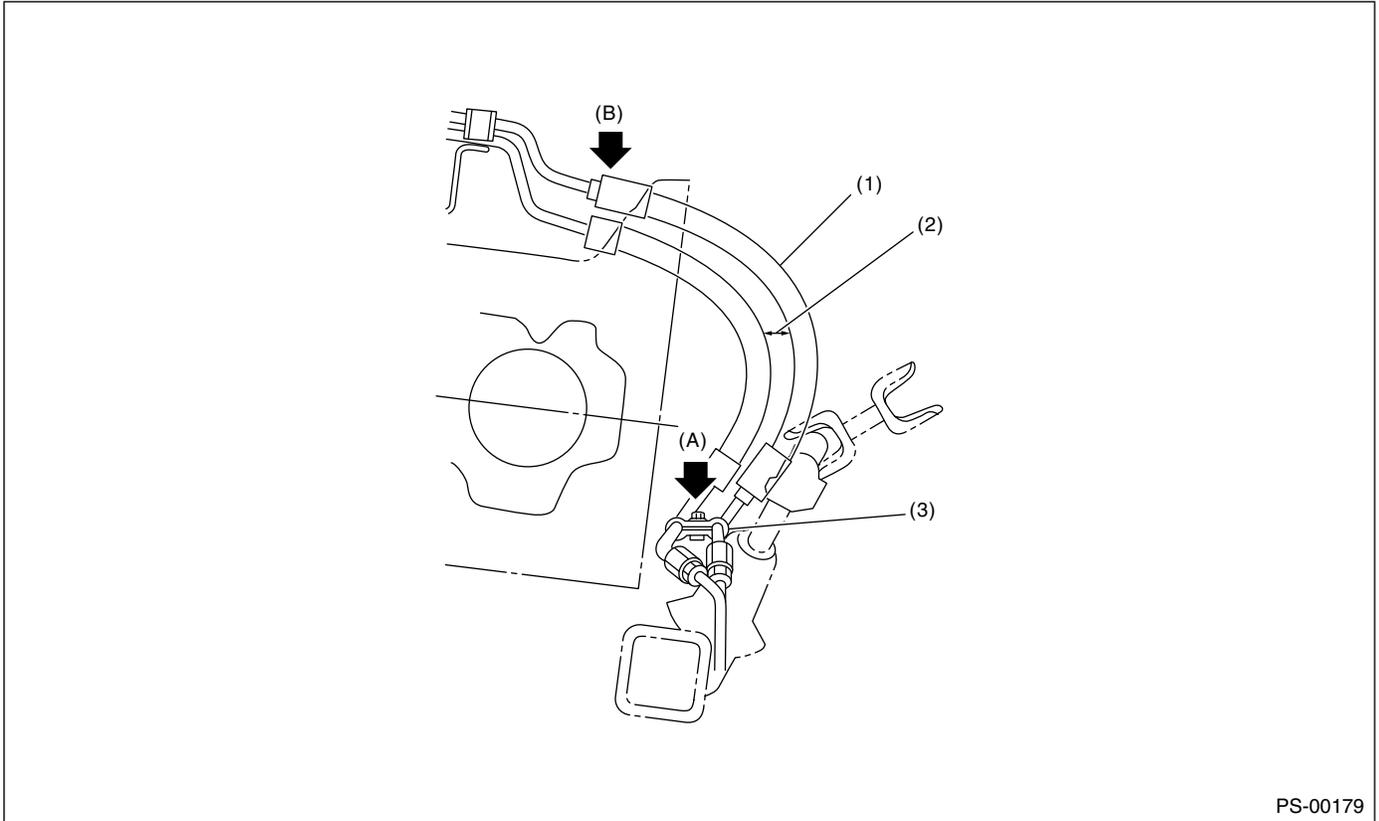
Never start the engine before feeding the fluid; otherwise vane pump might be seized up.

Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

13) Finally check clearance between pipes and/or hoses, as shown above.

If cruise control actuator-to-power steering hose clearance is less than 10 mm (0.39 in), move the portion (A) secured by clamp to other portion, or bend portion (B) to adjust.



(1) High pressure hose

(2) No interference is allowed between hoses.

(3) Clearance between crossmember and pipe: 3 — 8 mm (0.12 — 0.31 in)

Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

C: INSPECTION

Check all disassembled parts for wear, damage or other abnormalities. Repair or replace faulty parts as required.

Part name	Inspection	Remedy
Pipe	<ul style="list-style-type: none"> • O-ring fitting surface for damage • Nut for damage • Pipe for damage 	Replace with a new one.
Clamp	<ul style="list-style-type: none"> • Clamps for weak clamping force 	Replace with a new one.
Hose	<ul style="list-style-type: none"> • Flared surface for damage • Flare nut for damage • Outer surface for cracks • Outer surface for wear • Clip for damage • End coupling or adapter for degradation 	Replace with a new one.

CAUTION:

Although the surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. It is very important to keep the hoses free from before mentioned fluids and to wipe out immediately when the hoses are adhered with the fluids.

Since the resistances for heat or low temperature brittleness are gradually declining according to time accumulation of hot or cold conditions for the hoses and their service lives are shortening accordingly, it is necessary to perform the careful inspection frequently when the vehicle is used in hot weather areas, cold weather area and a driving condition in which many steering operations are required in short time.

Particularly, continuous work of relief valve over 5 seconds causes to reduce service lives of the hoses, the oil pump, the fluid, etc. due to over heat.

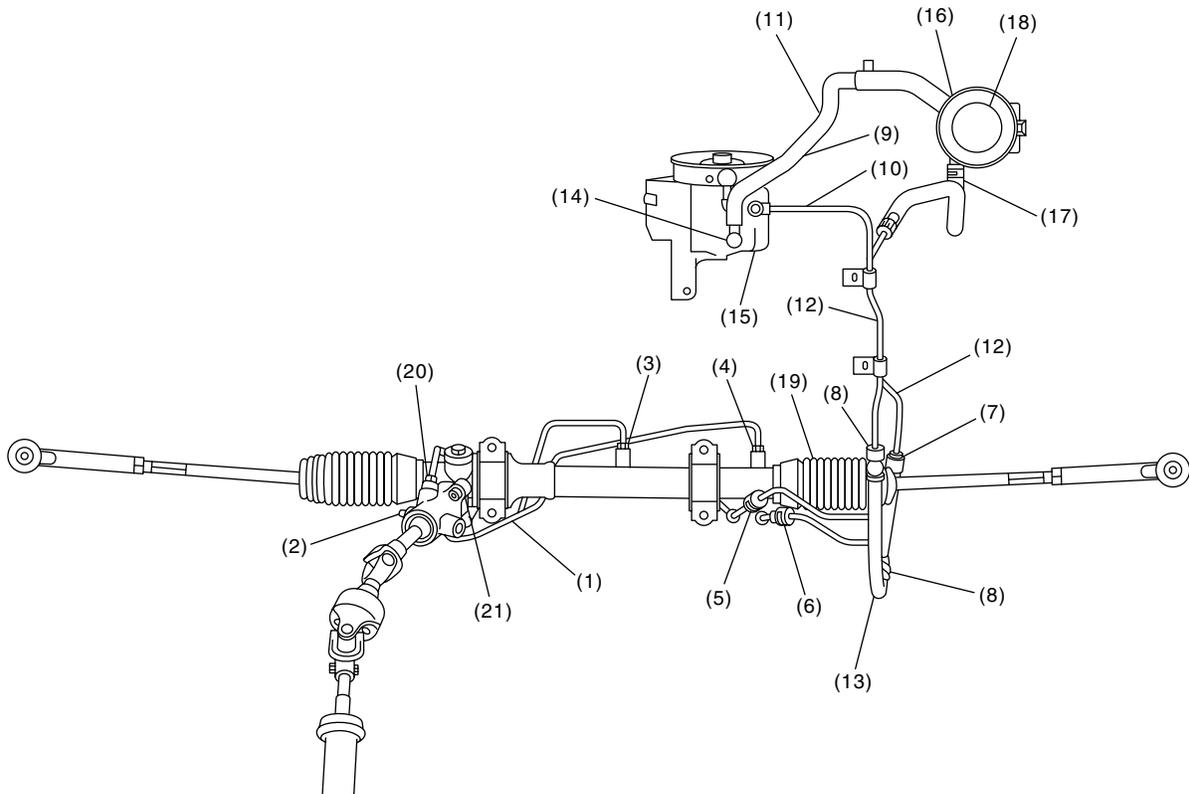
Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct the customers.
	Malfunction of relief valve	Replace the oil pump.
	Poor cold characteristic of fluid	Replace the fluid.
Forced out return hose	Poor connection	Correct.
	Poor holding of clip	Retighten.
	Poor cold characteristic of fluid	Replace the fluid.
Fluid bleeding out of hose slightly	Wrong layout, tensioned	Replace the hose.
	Excessive play of engine due to deterioration of engine mounting rubber	Replace the defective parts.
	Improper stop position of pitching stopper	Replace the defective parts.
Crack on hose	Excessive holding time of relief status	Replace. Instruct customer.
	Excessive tightening torque for return hose clip	Replace.
	Power steering fluid, brake fluid, engine oil, electrolyte adhere on the hose surface	Replace. Pay attention on service work.
	Too many times use in extremely cold weather	Replace. Instruct the customers.

Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

NOTE:

It is likely that although one judges fluid leakage, there is actually no leakage. This is because the fluid spilt during the last maintenance was not completely wiped off. Be sure to wipe off spilt fluid thoroughly after maintenance.



PS-00022

Pipe Assembly [LHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

Fluid leaking area	Possible cause	Corrective action
Leakage from connecting portions of pipes and hoses, numbered with (1) through (10) in figure	Insufficient tightening of flare nut, catching dirt or the like, damage to flare or flare nut or eye bolt	Loosen and retighten, if ineffective, replace.
	Poor insertion of hose, poor clamping	Retighten or replace the clamp.
	Damaged O-ring or gasket	Replace the O-ring or gasket pipe or hose with new one, if ineffective, replace gearbox also.
Leakage from hose (11), (12) and (13) in figure	Crack or damage in hose	Replace with a new one.
	Crack or damage in hose hardware	Replace with a new one.
Leakage from surrounding of cast iron portion of oil pump (14) and (15) in figure	Damaged O-ring	Replace the oil pump.
	Damaged gasket	Replace the oil pump.
Leakage from oil tank (16) and (17) in figure	Crack in oil tank	Replace the oil tank.
Leakage from filler neck (18)	Damaged cap packing	Replace the cap.
	Crack in root of filler neck	Replace the oil tank.
	High fluid level	Adjust the fluid level.
Leakage from surrounding of power cylinder of gearbox (19) in figure	Damaged oil seal	Replace the oil seal.
Leakage from control valve of gearbox (20) and (21) in figure	Damaged packing or oil seal	Replace the problem parts.
	Damage in control valve	Replace the control valve.

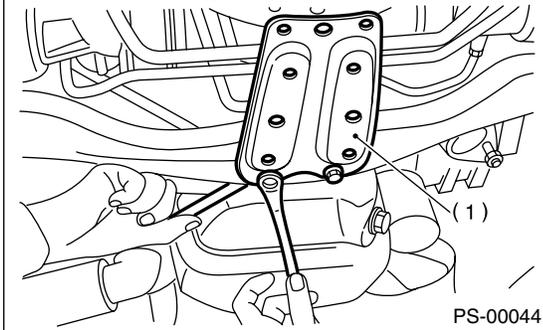
Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

8. Pipe Assembly [RHD MODEL]

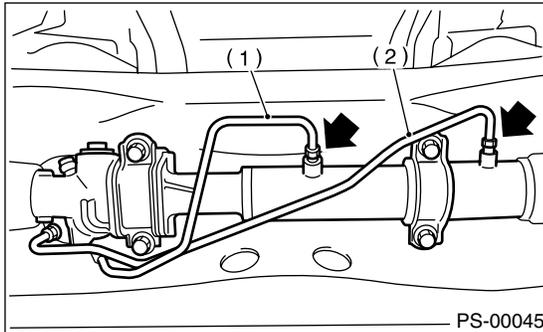
A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift-up the vehicle, and then remove the jack-up plate.



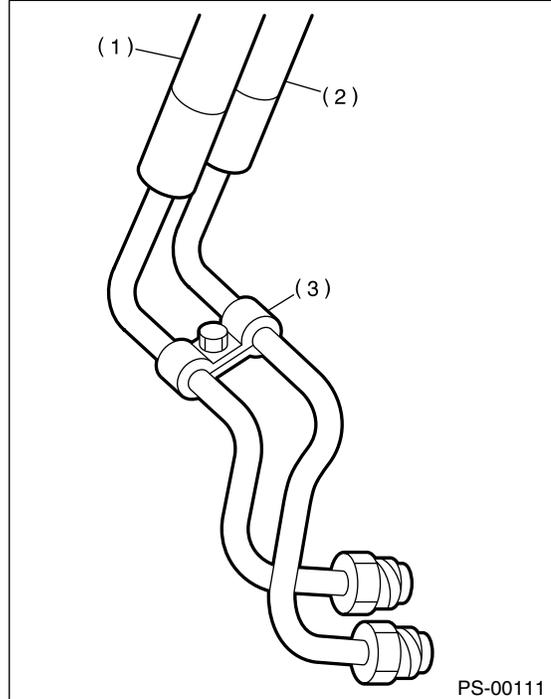
(1) Jack-up plate

- 3) Remove the one pipe joint at the center of gear-box, and then connect the vinyl hose to pipe and joint. Discharge fluid by turning steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.



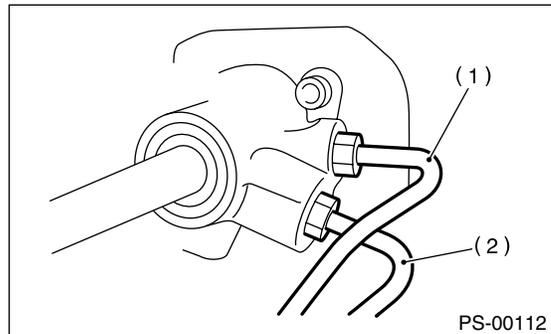
(1) Pipe A
(2) Pipe B

- 4) Remove the clamp E from pipes C and D.



(1) Return hose
(2) Pressure hose
(3) Clamp E

- 5) Disconnect the pipe C and D from gear box.



(1) Pipe C
(2) Pipe D

Pipe Assembly [RHD MODEL]

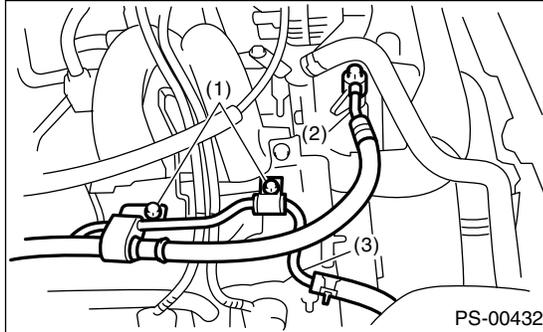
POWER ASSISTED SYSTEM (POWER STEERING)

6) Non-turbo model

- (1) Remove the air cleaner.
- (2) Remove the bolt A.
- (3) Disconnect the pipe C from oil pump. Disconnect the pipe D from return hose.

CAUTION:

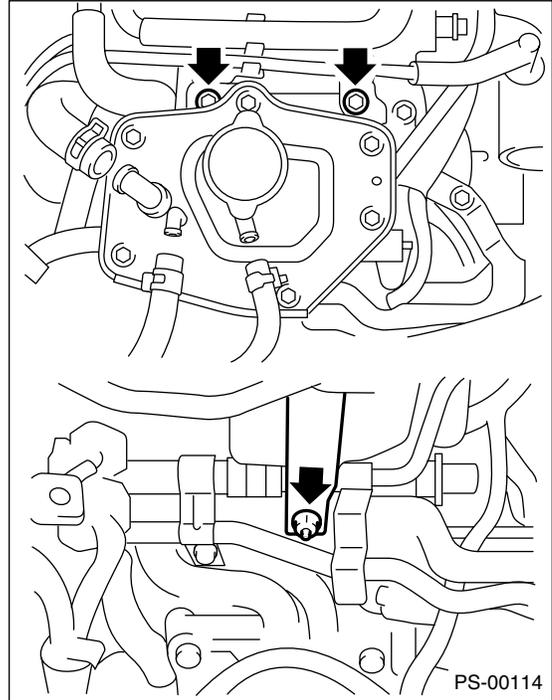
- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.



- (1) Bolt A
- (2) Pipe C
- (3) Pipe D

7) Turbo model

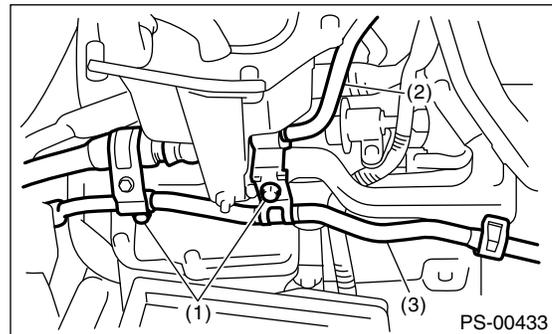
- (1) Remove the air cleaner.
<Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
- (2) Remove the coolant filler tank.



- (3) Remove the two bolts fixing pipe C and D.
- (4) Disconnect the pipe C from oil pump. Disconnect pipe D from return hose.

CAUTION:

- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.



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

Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

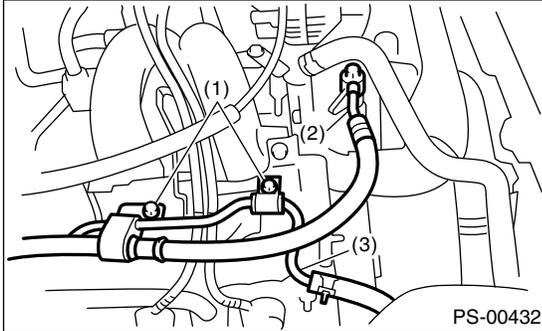
B: INSTALLATION

1) Temporarily tighten the two bolts fixing pipe C and D. (bolt A for Non-turbo model.)

NOTE:

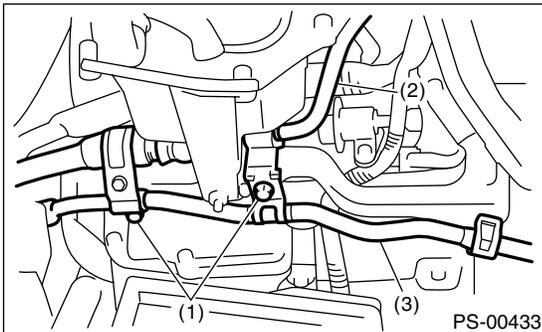
Visually check that the hose between tank and pipe D is free from bending or twisting.

• NON-TURBO MODEL



- (1) Bolt A
- (2) Pipe C
- (3) Pipe D

• TURBO MODEL



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

- (1) Connect the pipe D to oil tank.
- (2) Using a new gasket, connect the pipe C to oil pump.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

- (3) Tighten the two bolts fixing pipe C and D. (bolt A for Non-turbo model.)

Tightening torque:

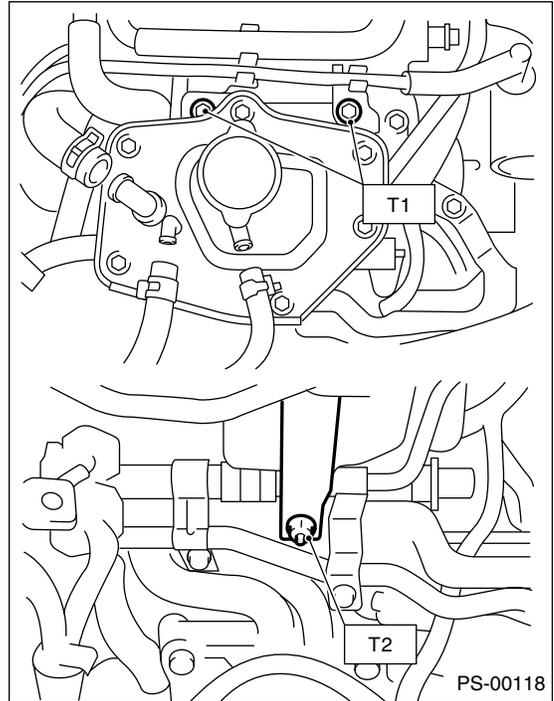
13 N·m (1.3 kgf-m, 9.4 ft-lb)

2) Install the coolant filler tank. (Turbo model)

Tightening torque:

T1: 19 N·m (1.9 kgf-m, 13.7 ft-lb)

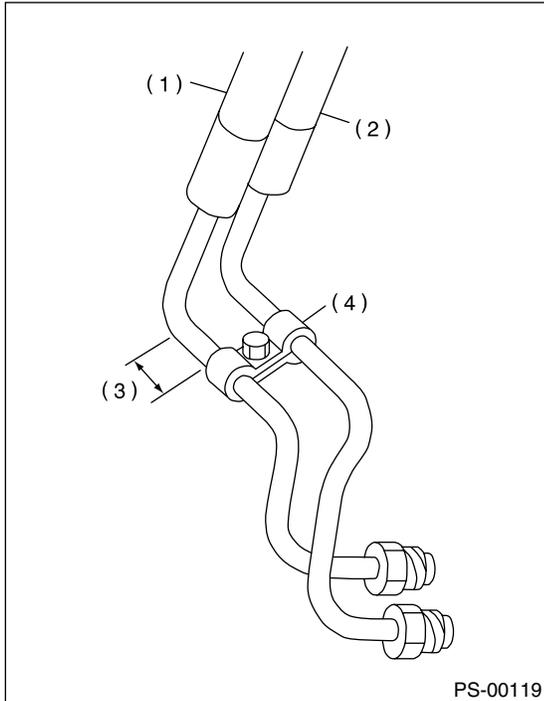
T2: 21 N·m (2.1 kgf-m, 15.2 ft-lb)



Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

3) Temporarily connect the pipe C and D to gear box.

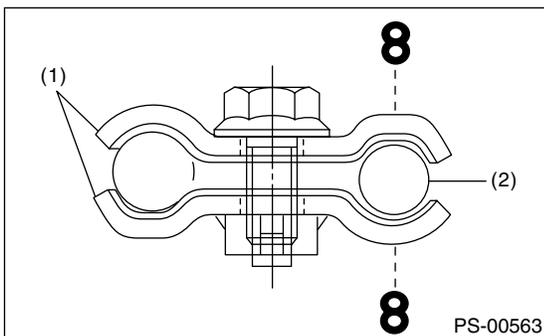


- (1) Return hose
- (2) Pressure hose
- (3) Approx. 30 mm (1.18 in)
- (4) Clamp E

4) Temporarily install the clamp E on pipes C and D.

NOTE:

Ensure the letter "8" on each clamp are opposite each other as shown in the figure.



- (1) Clamp E
- (2) Pipe C

5) Tighten the clamp E firmly.

Tightening torque:

7.4 N·m (0.75 kgf·m, 5.4 ft·lb)

6) Tighten the joint nut.

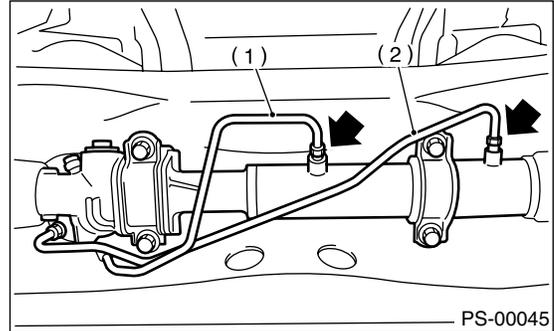
Tightening torque:

15 N·m (1.5 kgf·m, 10.8 ft·lb)

7) Connect the pipes A and B to four pipe joints of gearbox. Connect the upper pipe B first, and lower pipe A second.

Tightening torque:

24 N·m (2.4 kgf·m, 17.4 ft·lb)



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

8) Install the jack-up plate.

9) Install the air intake duct, air cleaner upper cover and air intake boot.

<Ref. to IN(H4DOTC)-7, INSTALLATION, Air Cleaner.> and <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.>

10) Connect the battery ground cable to battery.

11) Feed the specified fluid.

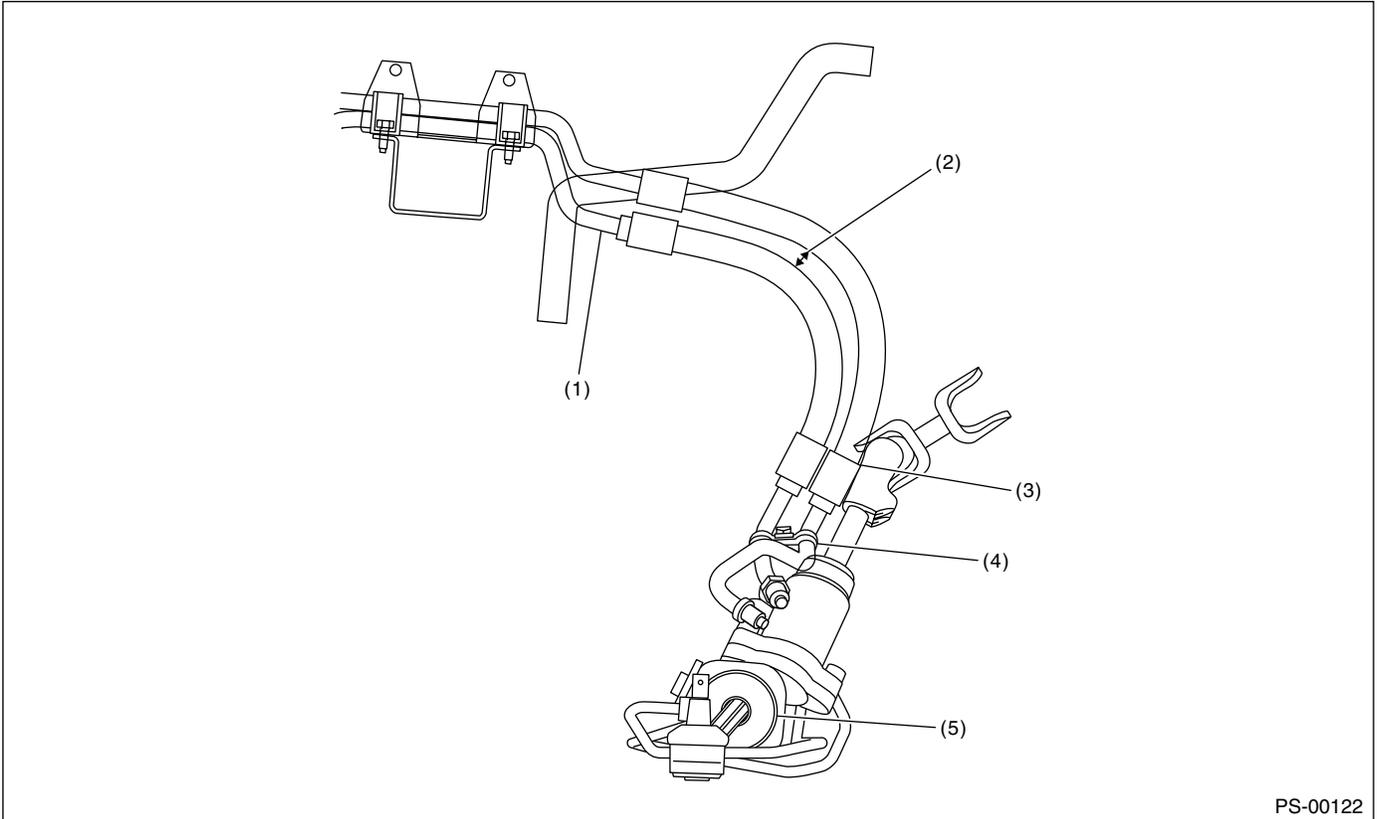
CAUTION:

Never start the engine before feeding the fluid; otherwise vane pump might be seized up.

Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

12) Finally check clearance between pipes and/or hoses, as shown in the figure.



PS-00122

(1) Clearance between blow-by hose and pipe: 3 — 5 mm (0.12 — 0.20 in)

(2) No interference is allowed between hoses.

(3) Clearance between side frame and hose: 15 mm (0.59 in) or more

(4) Clearance between crossmember and pipe: 5 — 13 mm (0.20 — 0.51 in)

(5) Steering gearbox

Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

C: INSPECTION

Check all disassembled parts for wear, damage or other abnormalities. Repair or replace faulty parts as required.

Part name	Inspection	Remedy
Pipe	<ul style="list-style-type: none"> • O-ring fitting surface for damage • Nut for damage • Pipe for damage 	Replace with a new one.
Clamp	<ul style="list-style-type: none"> • Clamps for weak clamping force 	Replace with a new one.
Hose	<ul style="list-style-type: none"> • Flared surface for damage • Flare nut for damage • Outer surface for cracks • Outer surface for wear • Clip for damage • End coupling or adapter for degradation 	Replace with a new one.

CAUTION:

Although the surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. It is very important to keep the hoses free from before mentioned fluids and to wipe out immediately when the hoses are adhered with the fluids.

Since the resistances for heat or low temperature brittleness are gradually declining according to time accumulation of hot or cold conditions for the hoses and their service lives are shortening accordingly, it is necessary to perform the careful inspection frequently when the vehicle is used in hot weather areas, cold weather area and a driving condition in which many steering operations are required in short time.

Particularly, continuous work of relief valve over 5 seconds causes to reduce service lives of the hoses, the oil pump, the fluid, etc. due to over heat.

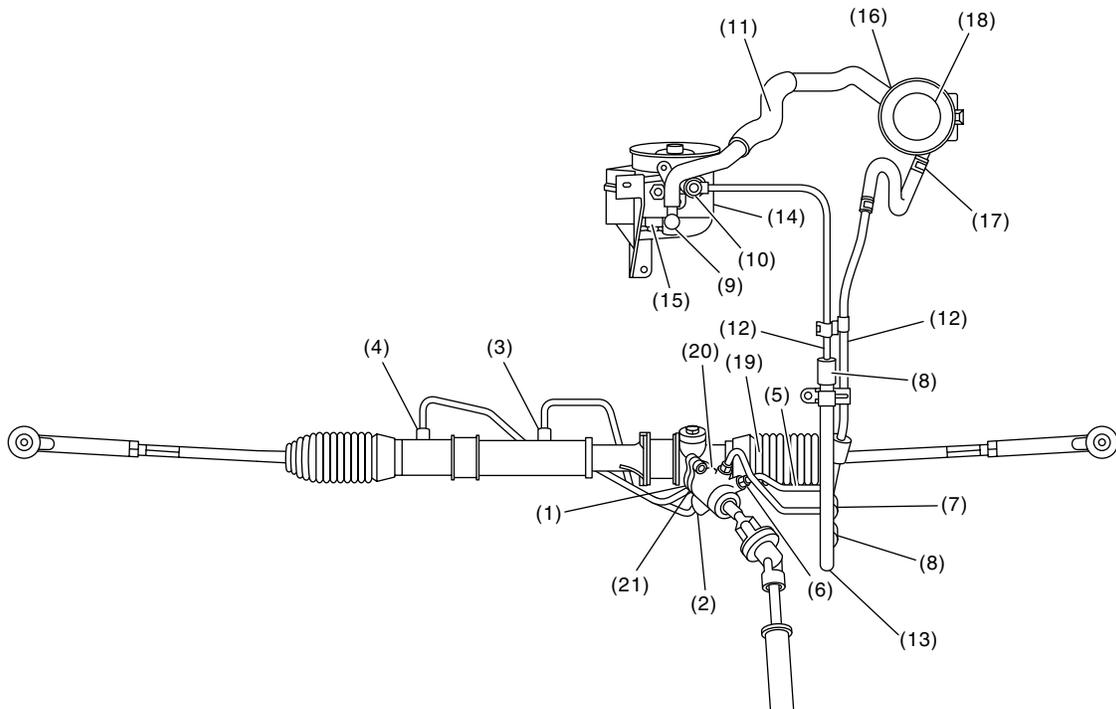
Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct the customers.
	Malfunction of relief valve	Replace the oil pump.
	Poor cold characteristic of fluid	Replace the fluid.
Forced out return hose	Poor connection	Correct.
	Poor holding of clip	Retighten.
	Poor cold characteristic of fluid	Replace the fluid.
Fluid bleeding out of hose slightly	Wrong layout, tensioned	Replace the hose.
	Excessive play of engine due to deterioration of engine mounting rubber	Replace the defective parts.
	Improper stop position of pitching stopper	Replace the defective parts.
Crack on hose	Excessive holding time of relief status	Replace. Instruct customer.
	Excessive tightening torque for return hose clip	Replace.
	Power steering fluid, brake fluid, engine oil, electrolyte adhere on the hose surface	Replace. Pay attention on service work.
	Too many times use in extremely cold weather	Replace. Instruct the customers.

Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

NOTE:

It is likely that although one judges fluid leakage, there is actually no leakage. This is because the fluid spilt during the last maintenance was not completely wiped off. Be sure to wipe off spilt fluid thoroughly after maintenance.



PS-00187

Pipe Assembly [RHD MODEL]

POWER ASSISTED SYSTEM (POWER STEERING)

Fluid leaking area	Possible cause	Corrective action
Leakage from connecting portions of pipes and hoses, numbered with (1) through (10) in figure	Insufficient tightening of flare nut, catching dirt or the like, damage to flare or flare nut or eye bolt	Loosen and retighten, if ineffective, replace.
	Poor insertion of hose, poor clamping	Retighten or replace the clamp.
	Damaged O-ring or gasket	Replace the O-ring or gasket pipe or hose with new one, if ineffective, replace gearbox also.
Leakage from hose (11), (12) and (13) and oil cooler (22) in figure	Crack or damage in hose	Replace with a new one.
	Crack or damage in hose hardware	Replace with a new one.
Leakage from surrounding of cast iron portion of oil pump (14) and (15) in figure	Damaged O-ring	Replace the oil pump.
	Damaged gasket	Replace the oil pump.
Leakage from oil tank (16) and (17) in figure	Crack in oil tank	Replace the oil tank.
Leakage from filler neck (18)	Damaged cap packing	Replace the cap.
	Crack in root of filler neck	Replace the oil tank.
	High fluid level	Adjust the fluid level.
Leakage from surrounding of power cylinder of gearbox (19) in figure	Damaged oil seal	Replace the oil seal.
Leakage from control valve of gearbox (20) and (21) in figure	Damaged packing or oil seal	Replace the problem parts.
	Damage in control valve	Replace the control valve.

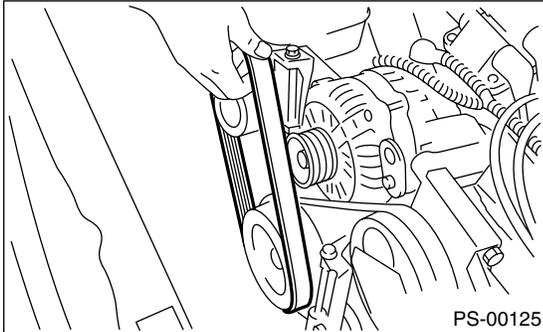
Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

9. Oil Pump

A: REMOVAL

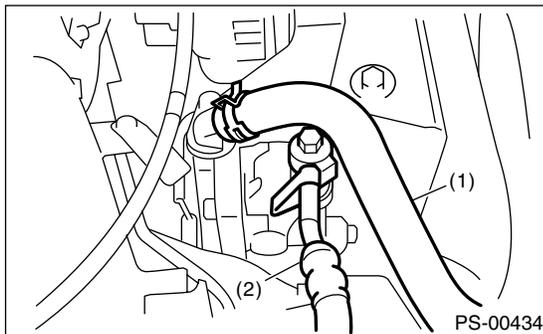
- 1) Disconnect the ground cable from battery.
- 2) Remove the pulley belt cover.
- 3) Loosen the belt tension adjusting bolt and generator securing bolt, and then remove the power steering pump V-belt.



- 4) Disconnect the connector from power steering pump switch.
- 5) Disconnect the pipe C and suction hose from oil pump.

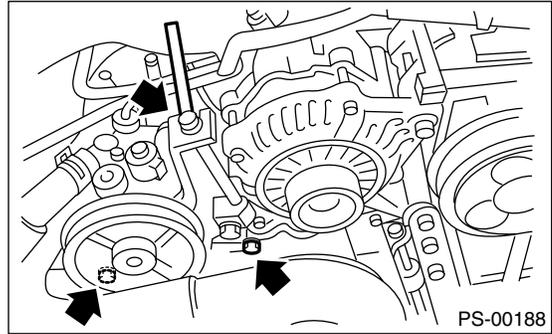
CAUTION:

- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose, cover the open ends of them with a clean cloth.



- (1) Suction hose
(2) Pipe C

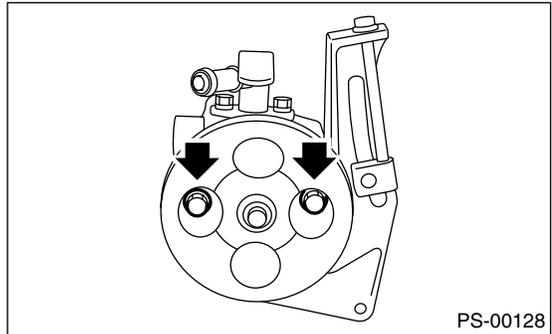
- 6) Remove the bolts which install the power steering pump bracket.



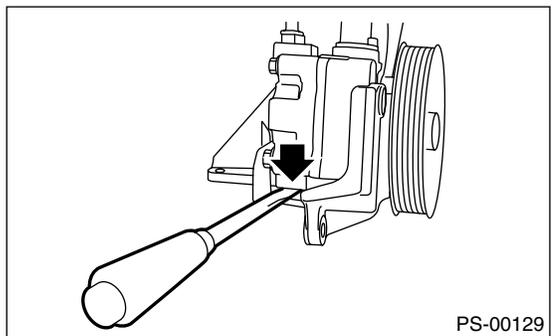
- 7) Place the oil pump bracket in a vise, remove the two bolts from front side of oil pump.

CAUTION:

Do not place the oil pump bracket directly in the vise; use soft pads and hold oil pump lightly to protect the pump.



- 8) Remove the bolt from the rear side of oil pump.
- 9) Disassemble the oil pump and bracket by inserting a flat tip screwdriver as shown in the figure.



Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

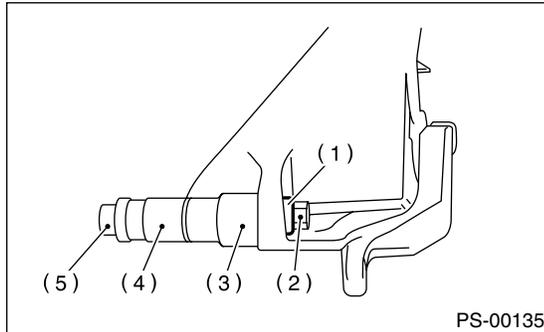
B: INSTALLATION

1) Install the oil pump to bracket.

(1) Place the oil pump bracket in a vise. Tighten the bushing using a 12.7 mm (1/2") type 14 mm and 21 mm box wrench until it is in contact with the oil pump mounting surface.

CAUTION:

Do not place the oil pump bracket directly in the vise; use soft pads and hold oil pump lightly to protect the pump.

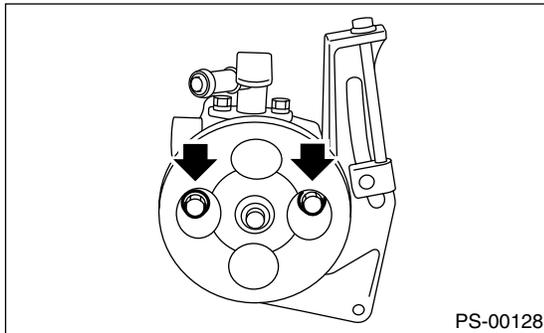


- (1) Bush
- (2) Nut
- (3) 21 mm
- (4) 14 mm
- (5) Bolt

(2) Tighten the bolts which install the oil pump to bracket.

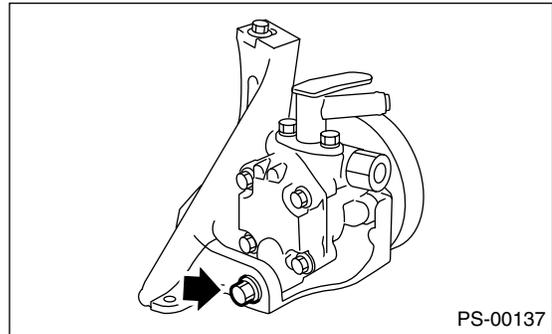
Tightening torque:

15.7 N-m (1.6 kgf-m, 11.6 ft-lb)

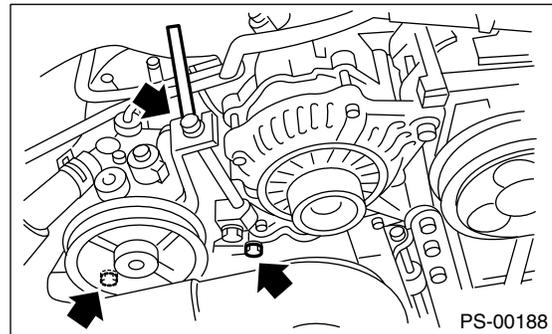


Tightening torque:

37.3 N-m (3.8 kgf-m, 27.5 ft-lb)



2) Tighten the bolts which install the power steering pump bracket.



3) Interconnect the pipe C and suction hose.

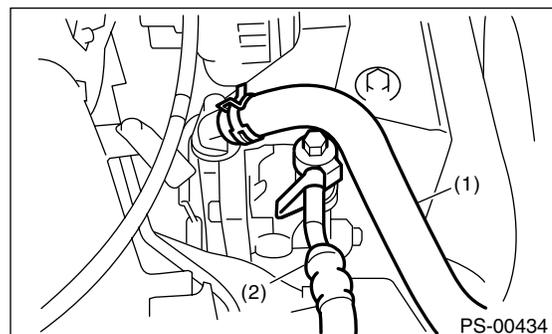
Tightening torque:

Eye bolt

39 N-m (4.0 kgf-m, 28.9 ft-lb)

CAUTION:

If a hose is twisted at this step, the hose may come into contact with some other parts.



- (1) Suction hose
- (2) Pipe C

4) Connect the connector to power steering pump switch.

5) Install the pulley belt to oil pump.

6) Check the pulley belt tension.

<Ref. to ME(H4SO)-44, INSPECTION, V-belt.>

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

7) Tighten the bolt of belt tension.

Tightening torque:

25 N-m (2.5 kgf-m, 18.1 ft-lb)

8) Install the pulley belt cover.

9) Connect the battery ground cable to battery.

10) Feed the specified power steering fluid. <Ref. to PS-86, Power Steering Fluid.>

CAUTION:

Never start the engine before feeding the fluid; otherwise vane pump might be seized up.

C: INSPECTION

1. BASIC INSPECTION

Perform the following inspection procedures and repair or replace defective parts.

No.	Parts	Inspection	Corrective action
1	Oil pump (Exterior)	(1) Crack, damage or oil leakage	Replace the oil pump with a new one.
		(2) Play of pulley shaft	Measure the radial play and axial play. If any of these exceeds the service limit, replace the oil pump with a new one.
2	Pulley	(1) Damage	Replace it with a new one.
		(2) Bend	Measure the V ditch deflection. If it exceeds the service limit, replace the pulley with a new one.
3	Oil pump (Interior)	(1) Defect or burning of vane pump	Check the resistance to rotation of pulley. If it is past the service limit, replace the oil pump with a new one.
		(2) Bend in the shaft or damage to bearing	Oil pump emits a noise that is markedly different in tone and loudness from a sound of a new oil pump when turning with a string put around its pulley, replace the oil pump with a new one.
4	O-ring	Crack or deterioration	Replace it with a new one.
5	Bracket	Crack	Replace it with a new one.

2. SERVICE LIMIT

Make a measurement as follows. If it exceeds the specified service limit, replace the parts with new ones.

CAUTION:

- Fix the oil pump on a vise to make a measurement. At this time, hold the oil pump with least possible force between two wood pieces.
- Do not set outside of flow control valve or pulley on a vise; otherwise outside or pulley might be deformed. Select properly sized wood pieces.

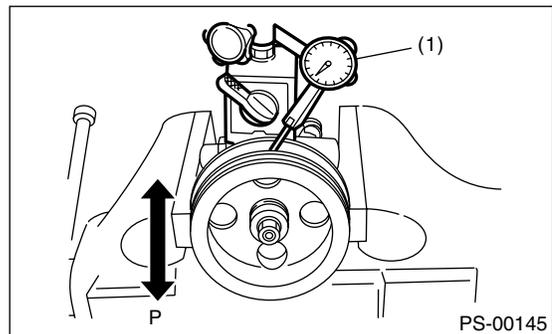
1) Play of the pulley shaft

Condition:

P: When applying the force of 9.8 N (1.0 kgf, 2.2 lb)

Service limit:

**Radial play (Direction ↔)
0.4 mm (0.016 in) or less**

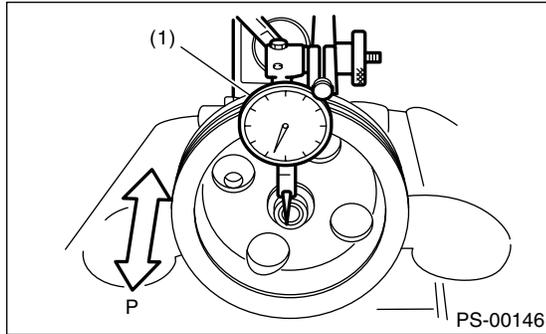


(1) Dial indicator

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

Axial play (Direction \leftrightarrow)
0.9 mm (0.035 in) or less



(1) Dial indicator

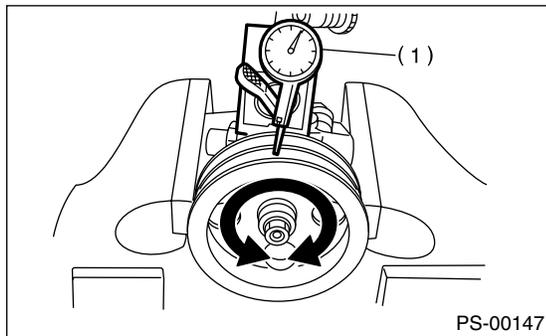
2) Ditch deflection of pulley

Service limit:

1.0 mm (0.039 in) or less

NOTE:

Read the value for one surface of V ditch, and then the value for another off the dial.



(1) Dial indicator

3) Resistance to rotation of pulley

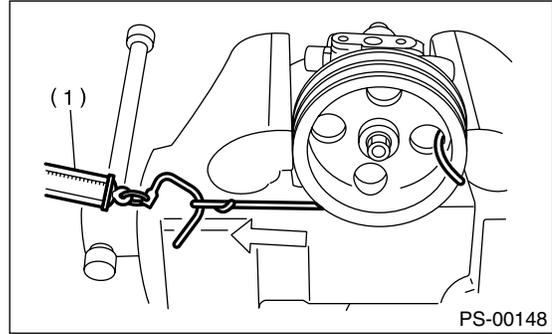
Service limit:

Maximum load; 9.22 N (0.94 kgf, 2.07 lb) or less

NOTE:

• A rather higher value may be indicated when pulley starts turning.

• Measure the load during rotation and make a judgment.



(1) Spring balance

3. HYDRAULIC PRESSURE

NOTE:

• Be sure to complete all items aforementioned in "INSPECTION", prior to measuring hydraulic pressure. Otherwise, pressure can not be measured correctly. <Ref. to PS-87, INSPECTION, General Diagnostic Table.>

• Do not leave the valve of pressure gauge closed or hold the steering wheel at stop end for 5 seconds or more in any case, as the oil pump may be damaged due to long keep of these conditions.

• Put a cotton cloth waste at a place where fluid drops before the pressure gauge is installed. Wipe off split fluid thoroughly after the measurement.

1) REGULAR PRESSURE MEASUREMENT

(1) Connect the ST1, ST2 and ST3.

ST1 92511000 PRESSURE GAUGE

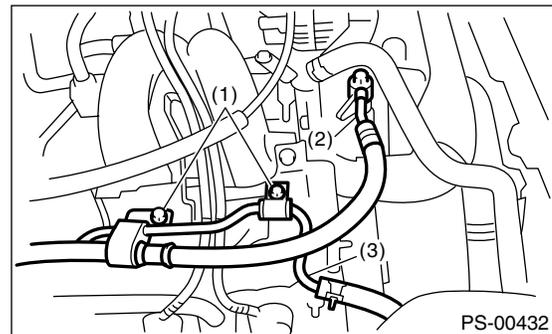
ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A

(2) Remove the air intake duct.

(3) Disconnect the pipe C from the pump.

(4) Using the gasket (Part No. 34621AC021) and bolt (Part No. 34620AC010), install the ST2 to the pump instead of pipe C.



(1) Bolt A

(2) Pipe C

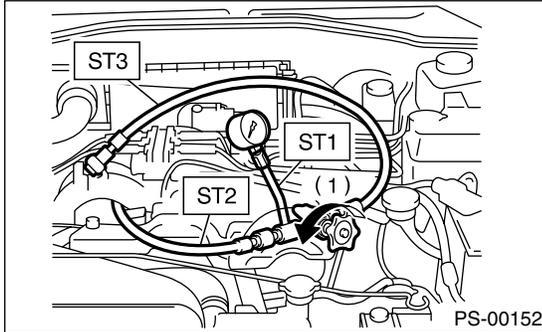
(3) Pipe D

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

- (5) Install the ST3 to end of pipe C removed from pump.
- (6) Replenish power steering fluid up to the specified level.
- (7) Open the valve, and start the engine.
- (8) Measure the regular pressure.

ST1 925711000 PRESSURE GAUGE
ST2 34099AC020 ADAPTER HOSE B
ST3 34099AC010 ADAPTER HOSE A

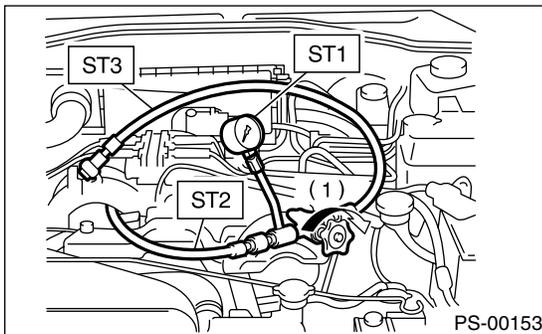


Service limit:

981 kPa (10 kg/cm², 142 psi) or less

- (9) If it is not within the specified value, replace the troubled part caused by the following symptoms; pipe or hose clogged, leaks from fluid line, and mix of foreign objects in fluid line.
- 2) Measure the relief pressure.
 - (1) Using the STs, measure the relief pressure.
 - (2) Close the valve.
 - (3) Measure the relief pressure.

ST1 925711000 PRESSURE GAUGE
ST2 34099AC020 ADAPTER HOSE B
ST3 34099AC010 ADAPTER HOSE A



Service limit:

1.6 L model:

**6,174 — 6,860 kPa
(63 — 70 kg/cm², 896 — 994 psi)**

2.0 L Non-turbo model, 2.5 L model:

**6,767 — 7,453 kPa
(69 — 76 kg/cm², 981 — 1,081 psi)**

2.0 L Turbo model:

**7,350 — 8,036 kPa
(75 — 82 kg/cm², 1,067 — 1,165 psi)**

- (4) If it is not within the specified value, replace the oil pump.

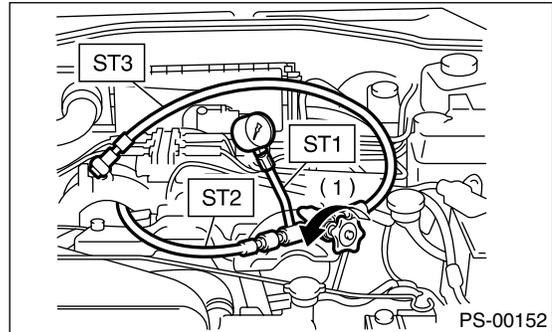
3) Measure the working pressure.

- (1) Using the STs, measure the working pressure.

- (2) Open the valve.

- (3) Measure the working pressure of control valve by turning wheel from stop to stop.

ST1 925711000 PRESSURE GAUGE
ST2 34099AC020 ADAPTER HOSE B
ST3 34099AC010 ADAPTER HOSE A



Service limit:

1.6 L model:

**6,174 — 6,860 kPa
(63 — 70 kg/cm², 896 — 994 psi)**

2.0 L Non-turbo model, 2.5 L model:

**6,767 — 7,453 kPa
(69 — 76 kg/cm², 981 — 1,081 psi)**

2.0 L Turbo model:

**7,350 — 8,036 kPa
(75 — 82 kg/cm², 1,067 — 1,165 psi)**

- (4) If it is within the specified value, measure the steering effort. <Ref. to PS-90, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.> If it is not within specified value, replace the control valve itself or control valve and pinion as a single unit with new ones.

Reservoir Tank

POWER ASSISTED SYSTEM (POWER STEERING)

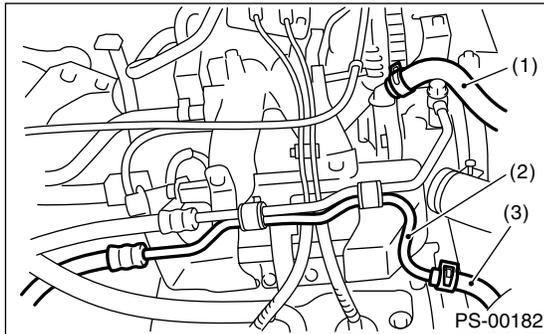
10. Reservoir Tank

A: REMOVAL

- 1) Remove the air intake duct. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.>
- 2) Drain fluid from the reservoir tank.
- 3) Disconnect the pipe D from return hose and suction hose from oil pump.

CAUTION:

- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.

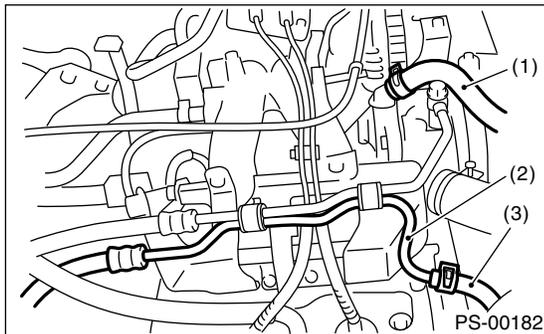


- (1) Suction hose
- (2) Pipe D
- (3) Return hose

- 4) Remove the reservoir tank from bracket by pulling it upwards.

B: INSTALLATION

- 1) Install the reservoir tank to bracket.
- 2) Connect the pipes D to return hose and suction hose to oil pump.



- (1) Suction hose
- (2) Pipe D
- (3) Return hose

- 3) Feed the power steering fluid to the specified level. <Ref. to PS-86, Power Steering Fluid.>

Power Steering Fluid

POWER ASSISTED SYSTEM (POWER STEERING)

11. Power Steering Fluid

A: SPECIFICATION

Recommended power steering fluid	Manufacturer
DEXRON III or equivalent	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

B: INSPECTION

1) Check the power steering fluid for deterioration or contamination. If the fluid is highly deteriorated or contaminated, drain it and refill with new fluid.

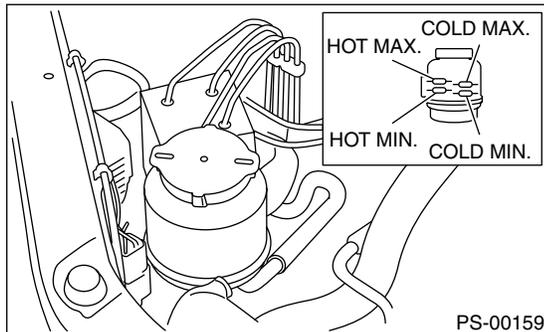
2) Check the joints and units for oil leakage. If any oil leaks are found, repair or replace the applicable part.

3) Inspect the fluid level on flat and level surface with engine "OFF" by indicator of reservoir tank.

If the level is at MIN. point or below, add fluid to keep the level in the specified range of the indicator. If at MAX. point or above, drain fluid by using a syringe or the like.

(1) Check at power steering fluid temperature 20°C (68°F); read the fluid level on the "COLD" side.

(2) Check at power steering fluid temperature 80°C (176°F); read the fluid level on the "HOT" side.



C: REPLACEMENT

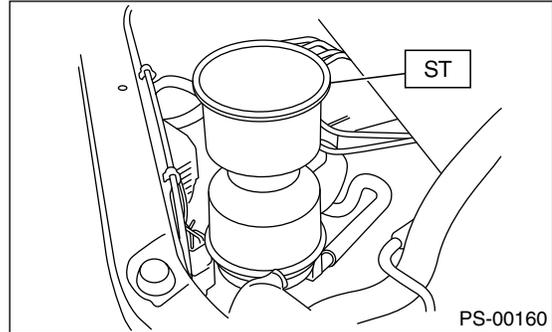
1) Lift up the vehicle.

2) Remove the jack up plate.

3) Remove the pipe joint in center of gear box, and then install the vinyl hose to pipe and joint. Drain the fluid while turning steering wheel.

4) Set the ST on top of reservoir tank and fill it about half way with the specified fluid.

ST 34199AE040 OIL CHARGE



5) Continue to turn the steering wheel slowly from lock to lock until bubbles stop appearing on oil surface while keeping the fluid at that level.

6) If turning the steering wheel in low fluid level condition, air will be sucked in pipe. In this case, leave it about half an hour and then do the step 5) again.

7) Lift up the vehicle, start the engine and let it idle.

8) Continue to turn the steering wheel slowly from lock to lock again until bubbles stop appearing on oil surface while keeping the fluid at that level.

It is normal that bubbles stop appearing after three times turning of steering wheel from lock to lock.

9) In case the bubbles do not stop appearing in the tank, leave it about half an hour and then do the step 4) all over again.

10) Lower the vehicle, and then idle the engine.

11) Continue to turn the steering wheel from lock to lock until bubbles stop appearing and change of the fluid level is within 3 mm (0.12 in).

12) In case the following happens, leave it about half an hour and then do step 8) to 11) again.

(1) The fluid level changes over 3 mm (0.12 in).

(2) Bubbles remain on the upper surface of the fluid.

(3) Grinding noise is generated from oil pump.

13) Check the fluid leakage after turning steering wheel from lock to lock with engine running.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

12. General Diagnostic Table

A: INSPECTION

Trouble	Possible cause	Corrective action
<ul style="list-style-type: none"> • Heavy steering effort in all ranges • Heavy steering effort at stand still • Steering wheel surges when turning. 	1. Pulley belt <ul style="list-style-type: none"> • Unequal length of pulley belts • Adhesion of oil and grease • Loose or damage of pulley belt • Poor uniformity of pulley belt cross section • Pulley belt touches to pulley bottom • Poor revolution of pulleys (except oil pump pulley) • Poor revolution of oil pump pulley 	Adjust or replace.
	2. Tire and wheel <ul style="list-style-type: none"> • Improper tires out of specification • Improper wheels out of specification • Tires not properly inflated *1 	Replace or reinflate.
	3. Fluid <ul style="list-style-type: none"> • Low fluid level • Aeration • Dust mix • Deterioration of fluid • Poor warming-up of fluid *2 	Refill, bleed air, replace or instruct the customer.
	4. Idle speed <ul style="list-style-type: none"> • Lower idle speed • Excessive drop of idle speed at start or at turning steering wheel *3 	Adjust or instruct the customer.
	5. Measure hydraulic pressure. <Ref. to PS-82, INSPECTION, Oil Pump.>	Replace the problem parts.
	6. Measure steering effort. <Ref. to PS-87, INSPECTION, General Diagnostic Table.>	Adjust or replace.
<ul style="list-style-type: none"> • Vehicle leads to one side or the other. • Poor return of steering wheel to center • Steering wheel surges when turning. 	1. Fluid line <ul style="list-style-type: none"> • Folded hose • Flattened pipe 	Reform or replace.
	2. Tire and wheel <ul style="list-style-type: none"> • Flat tire • Mix use of different tires • Mix use of different wheels • Abnormal wear of tire • Unbalance of remained grooves • Unbalance of tire pressure 	Adjust, fix or replace.
	3. Front alignment <ul style="list-style-type: none"> • Improper or unbalance caster • Improper or unbalance toe-in • Loose connection of suspension 	Adjust or retighten.
	4. Others <ul style="list-style-type: none"> • Damaged joint assembly • Unbalanced height • One-sided weight 	Replace, adjust or instruct the customer.
	5. Measure steering effort. <Ref. to PS-87, INSPECTION, General Diagnostic Table.>	Adjust or replace.

*1 If tires and/or wheels are wider, the load to power steering system is the more. Accordingly, in a condition, for example before fluid warms-up, relief valve may work before maximum turning angle. In this case, steering effort may be heavy. When measured hydraulic pressure is normal, there is no abnormal thing.

*2 In cold weather, steering effort may be heavy due to increased flow resistance of cold fluid. After warming-up engine, turn steering wheel from stop to stop several times to warm-up fluid. Then if steering effort reduces normally, there is no abnormal thing.

*3 In cold weather or with insufficient warm-up of engine, steering effort may be heavy due to excessive drop of idling when turning steering wheel. In this case, it is recommended to start the vehicle with increasing engine speed than usual. Then if steering effort reduces normally, there is no abnormal thing.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

1. NOISE AND VIBRATION

CAUTION:

Don't keep the relief valve operated over 5 seconds at any time or inner parts of the oil pump may be damaged due to rapid increase of fluid temperature.

NOTE:

- Grinding noise may be heard immediately after the engine start in extremely cold condition. In this case, if the noise goes off during warm-up there is no abnormal function in the system. This is due to the fluid characteristic in extremely cold condition.
- Oil pump makes whine or growl noise slightly due to its mechanism. Even if the noise can be heard when steering wheel is turned at stand still there is no abnormal function in the system provided that the noise eliminates when the vehicle is running.
- When turning the steering wheel with service brake and/or parking brake applied, the noise is generated by creaking between disk and pads. However this does not indicate abnormal function in system.
- There may be a little vibration around the steering devices when turning steering wheel at standstill, even though the component parts have no defects.

Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e., road surface and tire surface, engine speed and turning speed of steering wheel, fluid temperature and braking condition.

This phenomena does not indicate there is some abnormal function in the system.

The vibration can be known when steering wheel is turned repeatedly at various speeds from slow to rapid step by step with parking brake applied on concrete road and in "D" range for automatic transmission vehicle.

Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Don't keep this condition over 5 seconds.)	Normal
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is faulty.	Defective Replace the oil pump.
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check the clearance. Correct if necessary. <Ref. to PS-69, INSPECTION, Pipe Assembly [LHD MODEL].>
	Loosened installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Loosened installation of oil pump pulley or other pulley(s)	Retighten.
	Loosened linkage or play of steering or suspension Loosened tightening of joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace the faulty parts of gearbox or oil pump.
Knocking When turning steering wheel in both direction with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Loosened tightening or play of tie-rod, or tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Vane pump aeration	Inspect and retighten the fluid line connection. Refill fluid and vent air.
	Vane pump seizing	Replace the oil pump.
	Pulley bearing seizing of oil pump	Replace the oil pump.
	Folded hose, flat pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Maladjustment of pulley belt Damaged or charged pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Run out or soilage of V-groove surface of oil pump pulley	Clean or replace.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

Trouble	Possible cause	Corrective action
Sizzling noise (continuous) While engine is running.	Fluid aeration	Fix the wrong part causing aeration. Replace the fluid and vent air.
	Damaged pipe of gearbox	Replace the pipe.
	Abnormal inside of hose or pipe Flat hose or pipe	Rectify or replace.
	Abnormal inside of oil tank	Replace.
	Removed oil tank cap	Install the cap.
Whistle (continuous) While engine is running.	Abnormal pipe of gearbox or abnormal inside of hose	Replace the faulty parts of gearbox or hose.
Whine or growl (continuous or intermittent) While engine is running with/ without steering turned.	Loosened installation of oil pump, oil pump bracket	Retighten.
	Abnormal inside of oil pump, hose	Replace the oil pump, hose, if the noise can be heard when running as well as stand still.
	Torque converter growl, air conditioner compression growl	Remove the power steering pulley belt and confirm.
Creaking noise (intermittent) While engine is running with steering turned.	Abnormal inside of gearbox	Replace the faulty parts of gearbox.
	Abnormal bearing for steering shaft	Apply grease or replace.
	Generates when turning steering wheel with brake (service or parking) applied.	If the noise goes off when brake is released, it is normal.
Vibration While engine is running with/ without steering turned.	Too low engine speed	Adjust and instruct customers.
	Vane pump aeration	Fix the wrong part. Vent air.
	Damaged valve in oil pump, gearbox	Replace the oil pump, faulty parts of gearbox.
	Looseness of play of steering, suspension parts	Retighten.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

2. MEASUREMENT OF STEERING EFFORT

Step	Check	Yes	No
1 CHECK STEERING EFFORT. 1) Stop the vehicle on a concrete road. 2) Start the engine. 3) Idle the engine. 4) Install the spring scale on the steering wheel. 5) Pull the spring scale at an right angle to steering wheel, and measure both right and left steering wheel effort. NOTE: When turning the steering more quickly than necessary from a direction to the other direction at an engine speed over 2,000 rpm, steering effort may be heavy. This is caused by flow characteristic of oil pump and is not a problem.	Is the steering effort less than 29.4 N (3.0 kgf, 6.6 lb)?	Go to step 2.	Adjust the backlash.
2 CHECK STEERING EFFORT. 1) Stop the engine. 2) Pull the spring scale at an right angle to the steering wheel, and measure both right and left steering wheel effort.	Is the steering effort less than 400 N (41 kgf, 90 lb)?	Go to step 3.	Perform adjustment.
3 CHECK STEERING WHEEL EFFORT. 1) Remove the universal joint. 2) Measure the steering wheel effort.	Is the maximum steering effort less than 2.26 N (0.23 kgf, 0.51 lb)?	Go to step 4.	Check, adjust and replace if necessary.
4 CHECK STEERING WHEEL EFFORT. Measure the steering wheel effort.	Is the difference of steering effort between clockwise and counterclockwise less than 20%?	Go to step 5.	Check, adjust and replace if necessary.
5 CHECK UNIVERSAL JOINT. Measure the folding torque of the joint (yoke of steering column side). <Ref. to PS-24, INSPECTION, Universal Joint.>	Is the folding torque less than 7.3 N (0.74 kgf, 1.64 lb)?	Go to step 6.	Replace with new one.
6 CHECK UNIVERSAL JOINT. Measure the folding torque of the joint (yoke of gearbox side). <Ref. to PS-24, INSPECTION, Universal Joint.>	Is the folding torque less than 3.8 N (0.39 kgf, 0.86 lb)?	Go to step 7.	Replace with new one.
7 CHECK FRONT WHEEL. Check the front wheel.	Are the front wheels for unsteady revolution or rattling and brake for dragging?	Inspect, readjust and replace if necessary.	Go to step 8.
8 CHECK TIE-ROD ENDS. Remove the tie-rod ends.	Are the tie-rod ends of suspension for unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 9.
9 CHECK BALL JOINT. Remove the ball joint.	Are the ball joints of suspension for unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 10.
10 CHECK GEARBOX. Measure the rotating of gearbox. <Ref. to PS-45, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox [LHD MODEL].> or <Ref. to PS-62, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox [RHD MODEL].>	Is the rotating resistance of gear box less than 10.5 N (1.1 kgf, 2.4 lb)? Is the difference between clockwise and counterclockwise 20%?	Go to step 11.	Readjust the backlash, and if ineffective, replace the faulty parts.
11 CHECK GEARBOX. Measure the sliding of gearbox. <Ref. to PS-44, SERVICE LIMIT, INSPECTION, Steering Gearbox [LHD MODEL].> or <Ref. to PS-61, SERVICE LIMIT, INSPECTION, Steering Gearbox [RHD MODEL].>	Is the sliding resistance of gear box less than 400 N (41 kgf, 90 lb)? Is the difference between right and left 20%?	Steering effort is normal.	Readjust the backlash, and if ineffective, replace the faulty parts.