POWER ASSISTED SYSTEM (POWER STEERING)

PS

1. General Description

A: SPECIFICATIONS

Item			Designation
Whole system	Minimum turning diameter m (ft)		10.6 (34.8)
	Steering angle (Inside-Outside)		36° 25′ — 32° 00′
	Steering wheel diameter mm (in)		385 (15.16)
	Maximum rotation		3.0
Gearbox	Type		Rack and pinion, Integral
	Backlash		0 (Automatically adjustable)
	Valve (Power steering system)		Rotary valve
Pump (Power steering system)	Type		Vane pump
	Oil tank		Installed on body
	Output cm^3 (cu in)/rev.		7.2 (0.439)
	Relief pressure kPa (kg/cm^2, psi)		7,360 — 8,050 (75 — 82, 1,067 — 1,166)
	Hydraulic fluid control		Dropping in response to increased engine revolutions
	Hydraulic fluid ℓ (US qt, Imp qt)/min		1,000 rpm: 7 (7.4, 6.2) 3,000 rpm: 5 (5.3, 4.4)
	Range of revolution rpm		595 — 8,925
	Revolving direction		Clockwise (Viewed from pulley side)
Working fluid (Power steering system)	Name		ATF DEXRON III or equivalent
	Capacity ℓ (US qt, Imp qt)	Oil tank	0.3 (0.3, 0.3)
		Total	0.7 (0.7, 0.6)

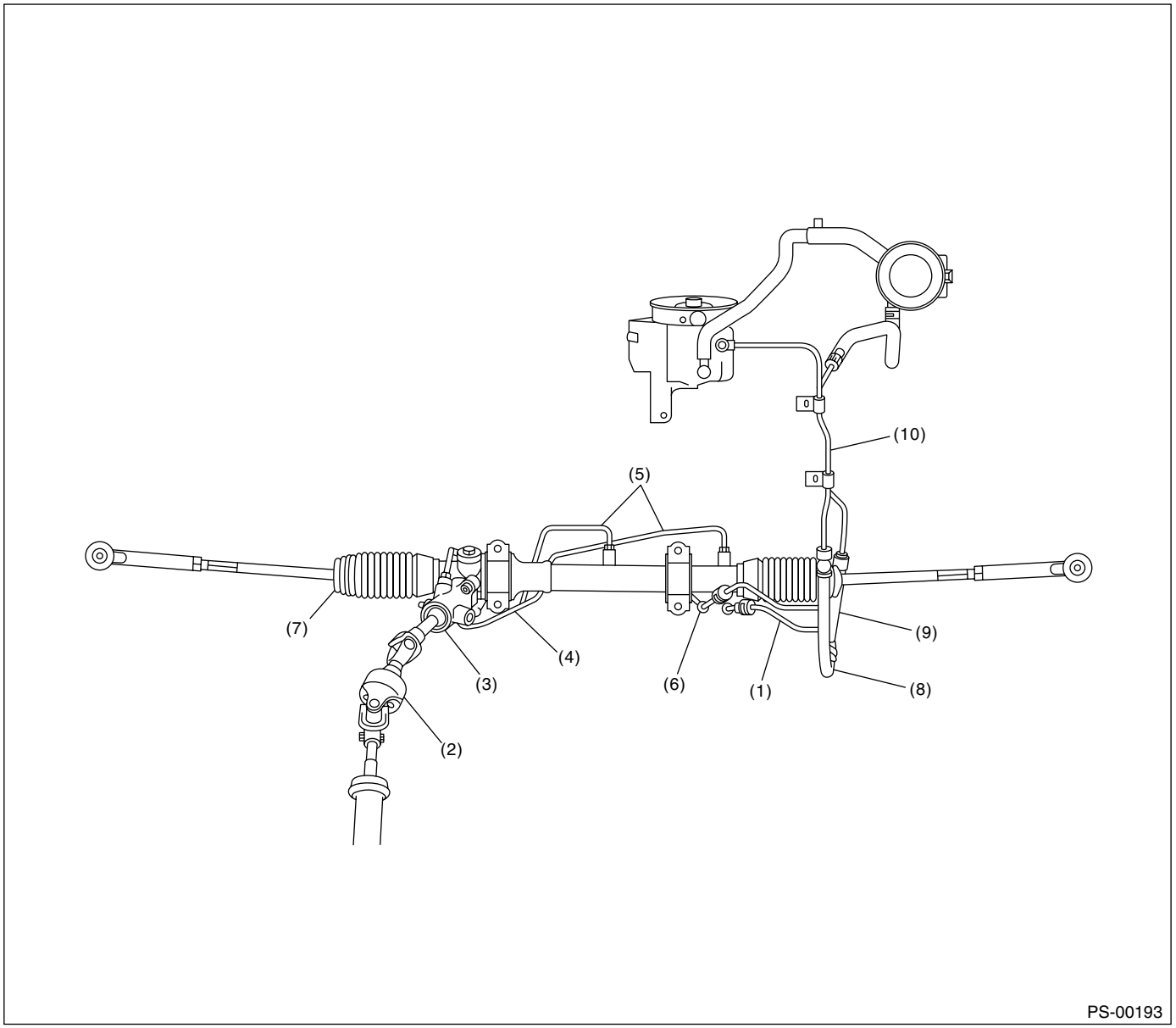
Model				LHD	RHD
Steering wheel	Free play		mm (in)	17 (0.67)	
Turning angle	Inner tire & wheel			32°25′±1°30′	
	Outer tire & wheel			32°00′±1°30′	
Steering shaft	Clearance between steering wheel and column cover		mm (in)	3.0 (0.118)	
Steering gear-box (Power steering system)	Sliding resistance		N (kgf, lb)	400 (41, 90) or less	
	Rack shaft play in radial direction	Right-turn steering	mm (in)	0.19 (0.0075) or less	Horizontal movement: 0.19 (0.0075) or less Vertical movement: 0.3 (0.012) or less
		Left-turn steering	mm (in)	Horizontal movement: 0.15 (0.0059) or less Vertical movement: 0.3 (0.012) or less	0.19 (0.0075) or less
	Input shaft play	In radial direction	mm (in)	0.18 (0.0071) or less	
		In axial direction	mm (in)	0.5 (0.020) or less	
	Turning resistance		N (kgf, lb)	Maximum allowable value: Less than 10.5 N (1.1 kgf, 2.4 lb) Difference between right and left sliding resistance: Less than 20 %	
Oil pump (Power steering system)	Pulley shaft	Radial play	mm (in)	0.4 (0.016) or less	
		Axial play	mm (in)	0.9 (0.035) or less	
	Pulley	Ditch deflection	mm (in)	1.0 (0.039) or less	
		Resistance to rotation	N (kgf, lb)	9.22 (0.94, 2.07) or less	
	Regular pressure		kPa (kg/cm^2, psi)	981 (10, 142) or less	
Steering wheel effort (Power steering system)	At standstill with engine idling on a concrete road		N (kgf, lb)	31.4 (3.2, 7.1) or less	
	At standstill with engine stalled on a concrete road		N (kgf, lb)	294.2 (30, 66.2) or less	

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

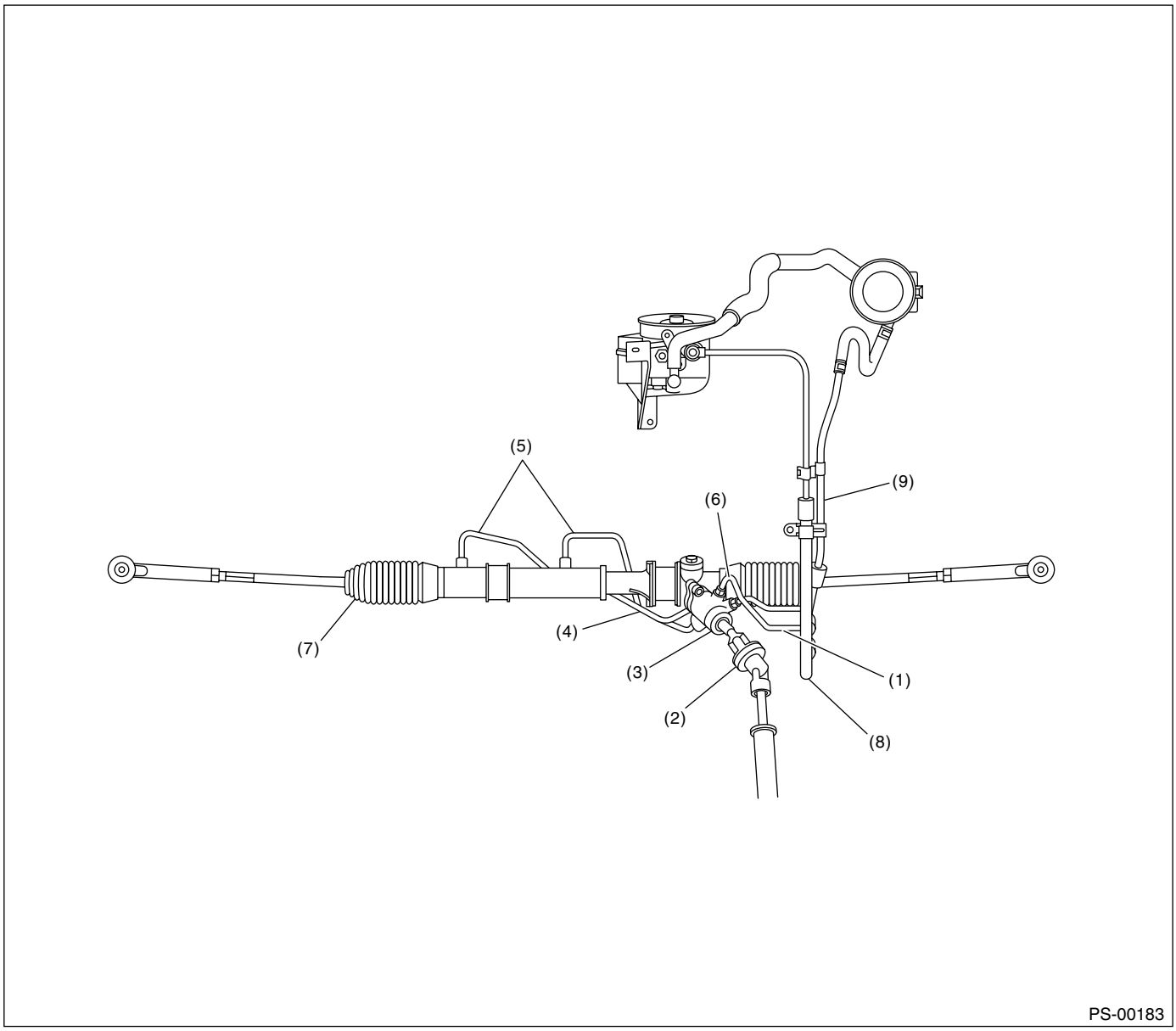
CAUTION:
This table lists various clearances that must be correctly adjusted to ensure the normal vehicle driving without interfering noise, or any other faults.

Location	Minimum allowance
(1) Crossmember — Pipe	5 mm (0.20 in)
(2) DOJ — Shaft or joint	14 mm (0.55 in)
(3) DOJ — Valve housing	11 mm (0.43 in)
(4) Pipe — Pipe	2 mm (0.08 in)
(5) Stabilizer — Pipe	5 mm (0.20 in)
(6) Exhaust pipe — Pipe	11 mm (0.43 in)
(7) Exhaust pipe — Gearbox bolt	15 mm (0.59 in)
(8) Side frame — Hose A and B	10 mm (0.39 in)
(9) Cruise control pump — Hose A and B	15 mm (0.59 in)
(10) Pipe portion of hose A — Pipe portion of hose B	1.5 mm (0.059 in)

• LHD MOEL

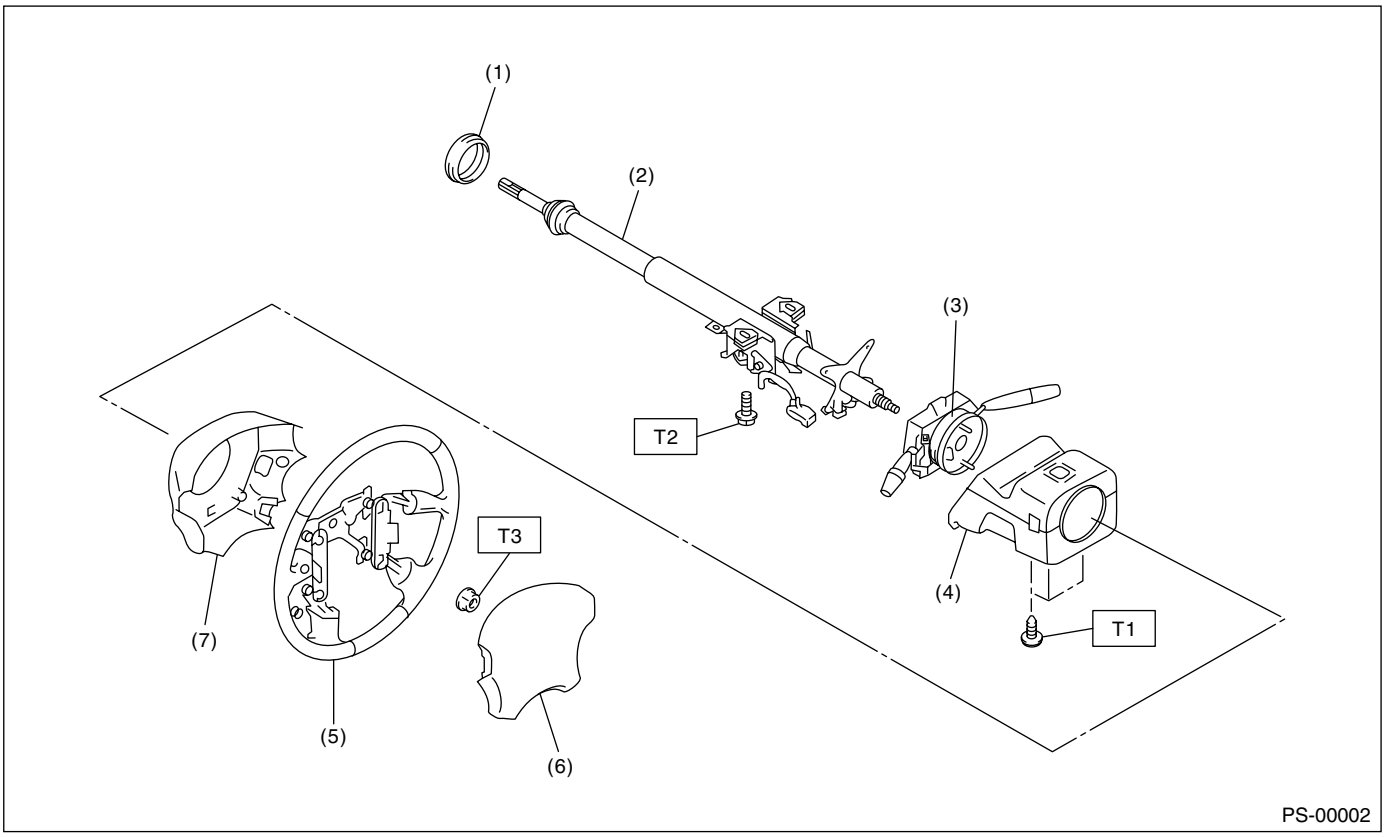


• RHD MODEL



B: COMPONENT

1. STEERING WHEEL AND COLUMN

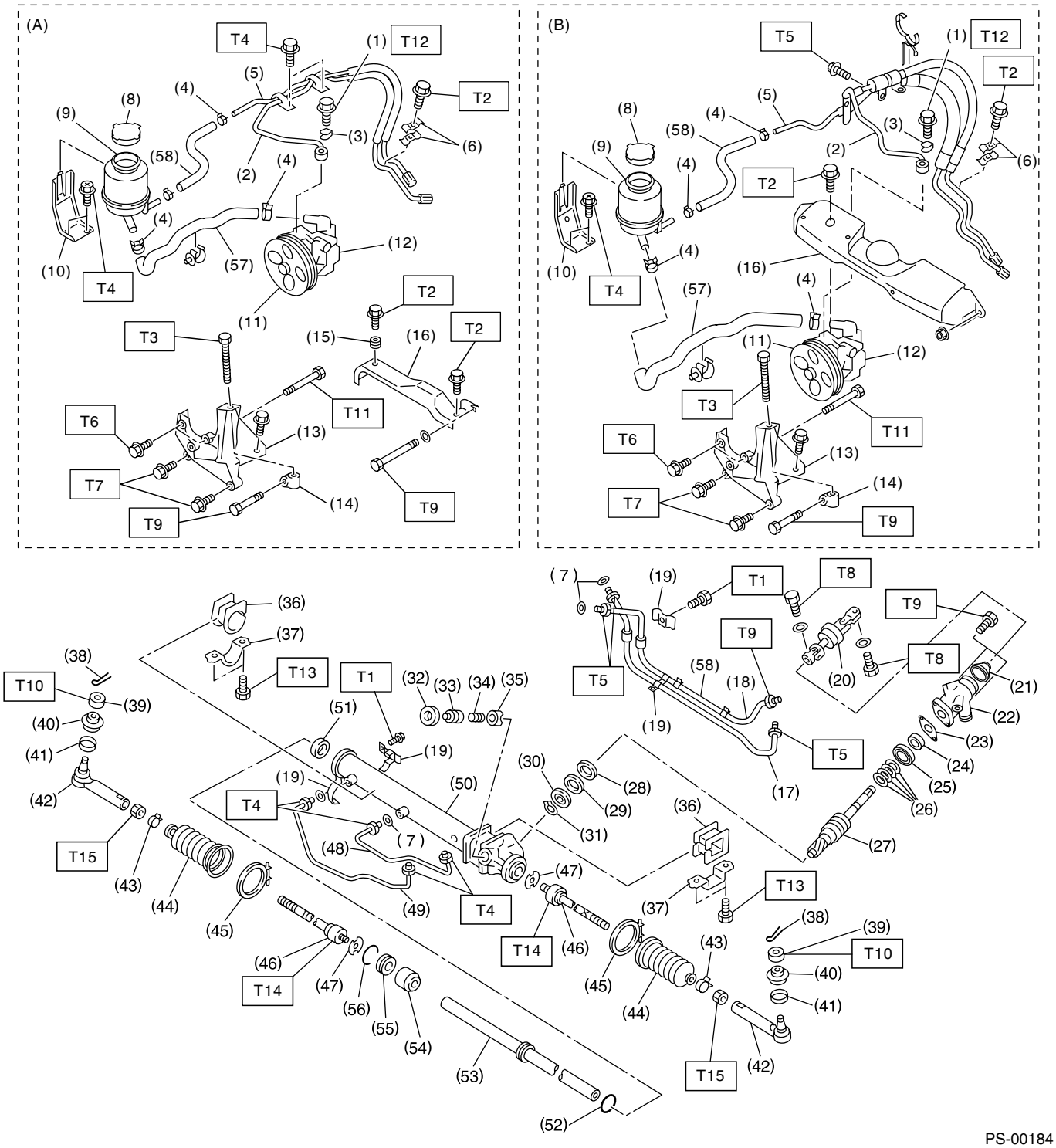


(1) Bushing
(2) Steering shaft
(3) Steering roll connector
(4) Column cover
(5) Steering wheel
(6) Airbag module
(7) Lower steering wheel cover

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.2 (0.12, 0.9)
T2: 25 (2.5, 18.1)
T3: 45 (4.6, 33.2)

2. POWER ASSISTED SYSTEM

• LHD MODEL

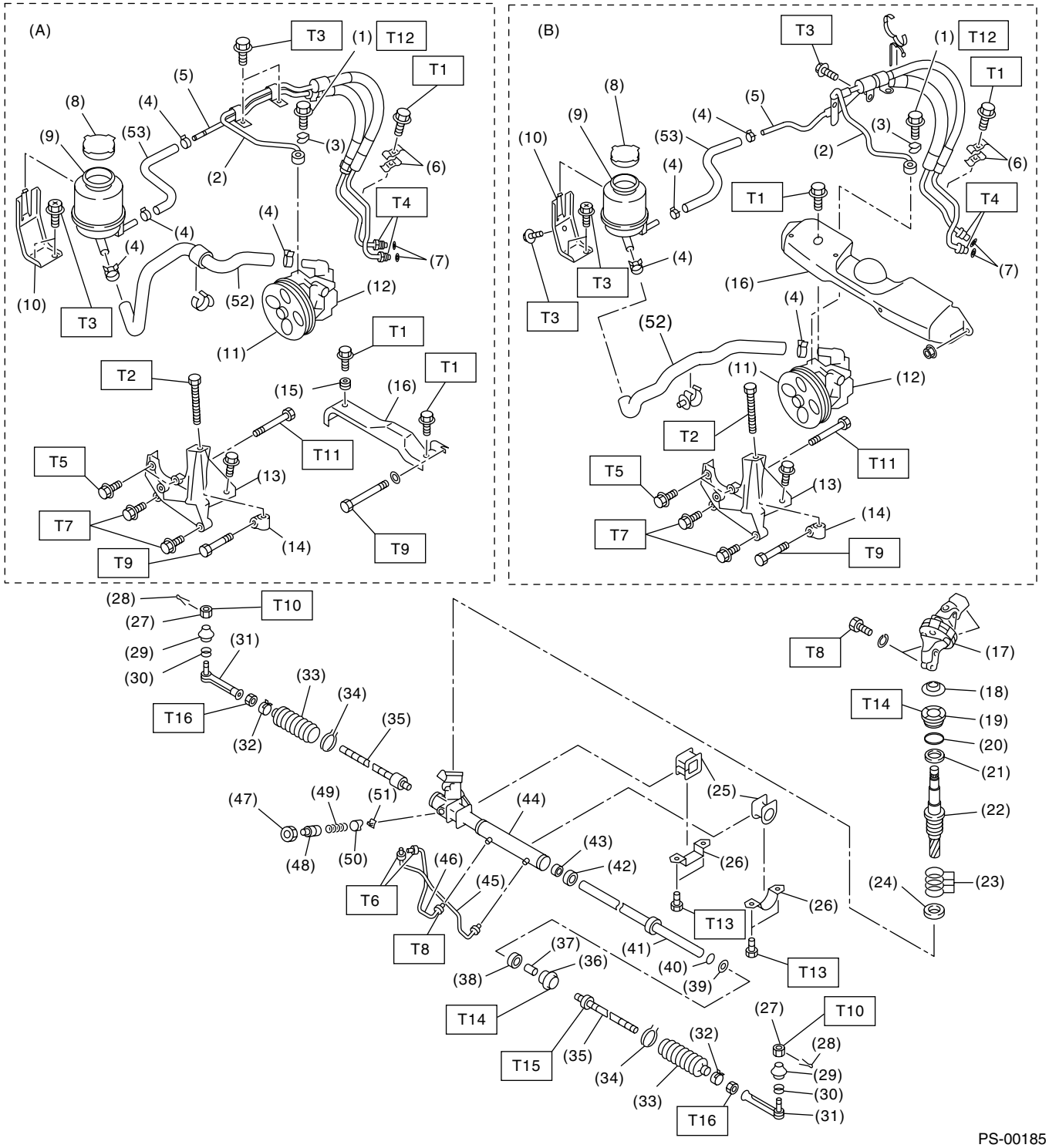


(A) NON-TURBO MODEL
(B) TURBO MODEL

(1) Eye bolt
(2) Pipe C
(3) Gasket
(4) Clip
(5) Pipe D
(6) Clamp E
(7) O-ring
(8) Cap
(9) Reservoir tank
(10) Reservoir tank bracket
(11) Pulley
(12) Oil pump
(13) Bracket
(14) Belt tension nut
(15) Bush
(16) Belt cover
(17) Pipe E
(18) Pipe F
(19) Clamp plate
(20) Universal joint
(21) Dust seal
(22) Valve housing
(23) Gasket
(24) Oil seal
(25) Ball bearing
(26) Seal ring
(27) Pinion and valve ASSY
(28) Oil seal
(29) Back-up washer
(30) Ball bearing
(31) Snap ring
(32) Lock nut
(33) Adjusting screw
(34) Spring
(35) Sleeve
(36) Adapter
(37) Clamp
(38) Cotter pin
(39) Castle nut
(40) Dust cover
(41) Clip
(42) Tie-rod end
(43) Clip
(44) Boot
(45) Band
(46) Tie-rod
(47) Lock washer
(48) Pipe B
(49) Pipe A
(50) Steering body
(51) Oil seal
(52) Piston ring
(53) Rack
(54) Rack bushing
(55) Rack stopper
(56) Circlip
(57) Suction hose
(58) Hose

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	***6 (0.6, 4.3)***
T2:	***7.4 (0.75, 5.4)***
T3:	***8 (0.8, 5.8)***
T4:	***13 (1.3, 9.4)***
T5:	***15 (1.5, 10.8)***
T6:	***15.7 (1.6, 11.6)***
T7:	***22 (2.2, 15.9)***
T8:	***24 (2.4, 17.4)***
T9:	***25 (2.5, 18.1)***
T10:	***27 (2.75, 19.9)***
T11:	***37.3 (3.8, 27.5)***
T12:	***39 (4.0, 28.9)***
T13:	***59 (6.0, 43.4)***
T14:	***78 (8.0, 57.9)***
T15:	***83 (8.5, 61.5)***

• RHD MODEL



(A) NON-TURBO MODEL
(B) TURBO MODEL

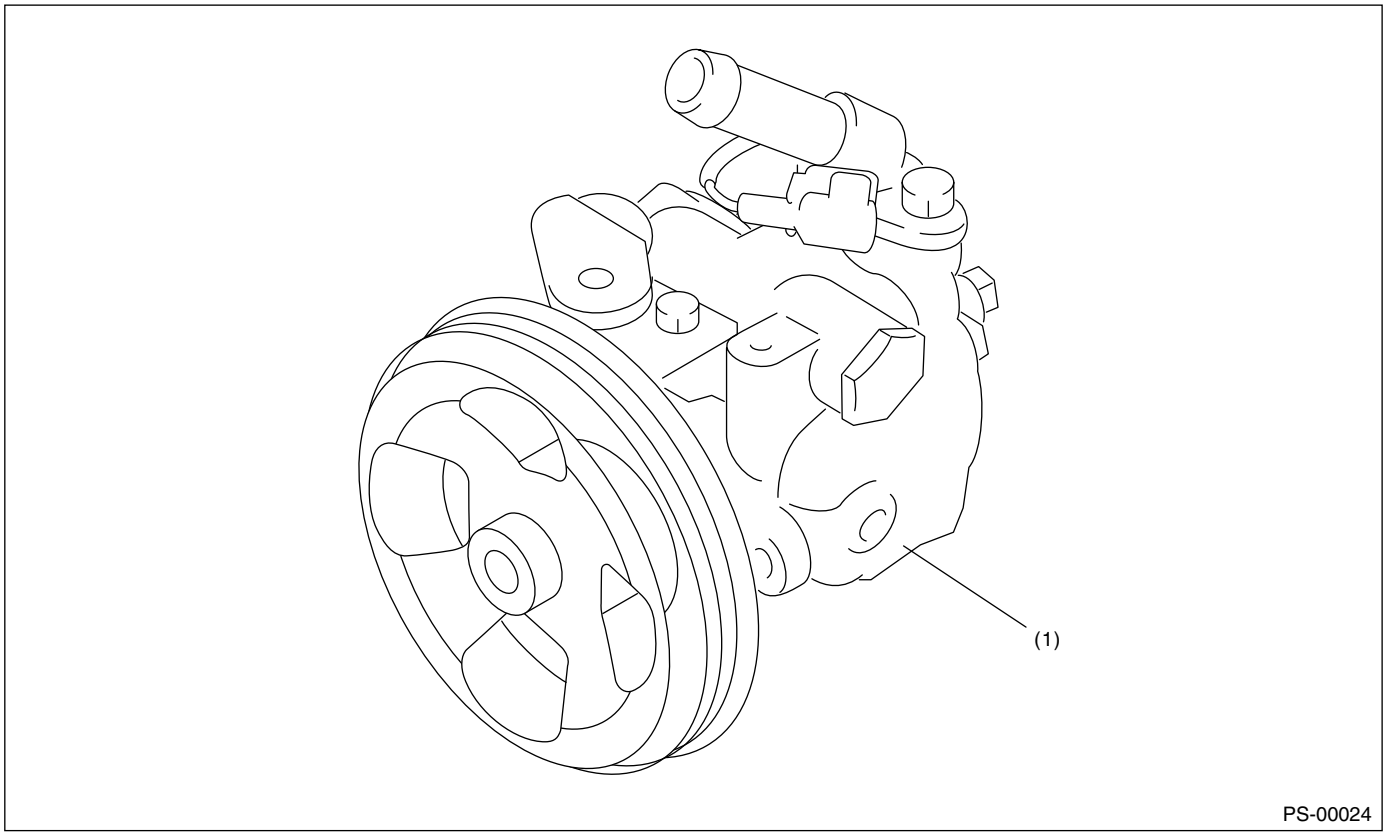
(1) Eye bolt
(2) Pipe C
(3) Gasket
(4) Clip
(5) Pipe D
(6) Clamp E
(7) O-ring
(8) Cap
(9) Reservoir tank
(10) Reservoir tank bracket
(11) Pulley
(12) Oil pump
(13) Bracket
(14) Belt tension nut
(15) Bush
(16) Belt cover
(17) Universal joint
(18) Dust cover
(19) Plug
(20) O-ring
(21) Oil seal
(22) Pinion
(23) Seal ring
(24) Oil seal
(25) Adapter
(26) Clamp
(27) Castle nut
(28) Cotter pin
(29) Dust seal
(30) Clip
(31) Tie-rod end
(32) Clip
(33) Boot
(34) Wire
(35) Tie-rod
(36) Holder
(37) Bush
(38) Oil seal
(39) Oil seal
(40) O-ring
(41) Rack
(42) Oil seal
(43) Back-up washer
(44) Steering body
(45) Pipe A
(46) Pipe B
(47) Lock nut
(48) Adjusting screw
(49) Spring
(50) Sleeve
(51) Seat pad
(52) Suction hose
(53) Return hose

Tightening torque: N·m (kgf-m, ft-lb)

T1:	***7.4 (0.75, 5.4)***
T2:	***8 (0.8, 5.8)***
T3:	***13 (1.3, 9.4)***
T4:	***15 (1.5, 10.8)***
T5:	***15.7 (1.6, 11.6)***
T6:	***20 (2.0, 14.5)***
T7:	***22 (2.2, 15.9)***
T8:	***24 (2.4, 17.4)***
T9:	***25 (2.5, 18.1)***
T10:	***27 (2.75, 19.9)***
T11:	***37.3 (3.8, 27.5)***
T12:	***39 (4.0, 28.9)***
T13:	***60 (6.1, 44.1)***
T14:	***64 (6.5, 47.0)***
T15:	***90 (9.0, 65.1)***
T16:	***85 (8.6, 62.2)***

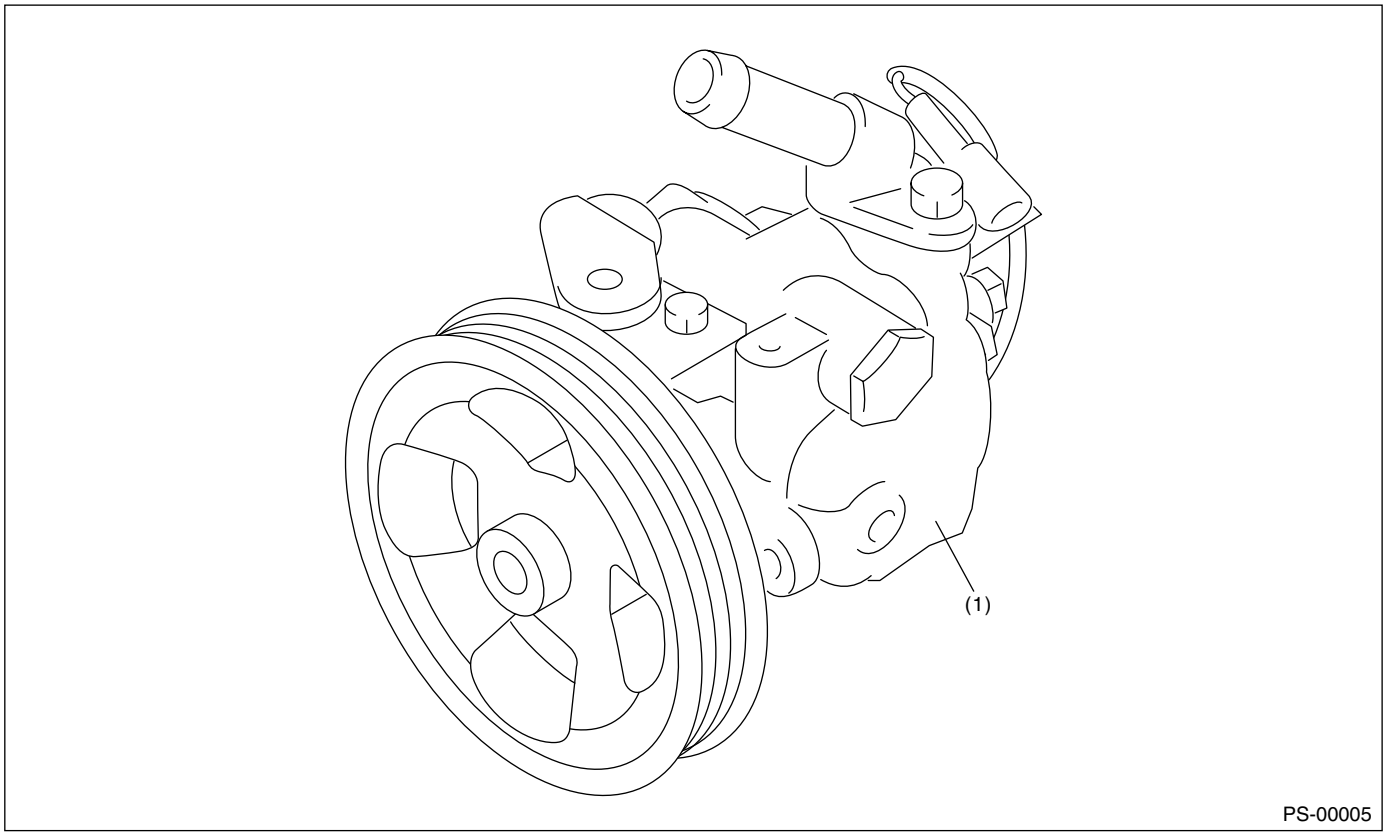
3. OIL PUMP

• NON-TURBO MODEL



(1) Oil pump ASSY

• TURBO MODEL



(1) Oil pump ASSY

C: CAUTION

• Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Be careful not to burn your hands, because each part on the vehicle is hot after running.
• Use SUBARU genuine power steering fluid, grease etc. or the equivalent. Do not mix steering fluid, grease etc. with that of another grade or from other manufacturers.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or safety stands at the specified points.
• Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.

D: PREPARATION TOOL

1. SPECIAL TOOLS

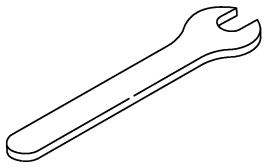
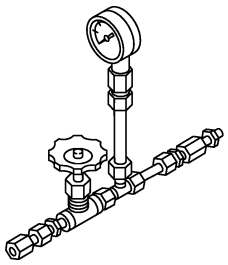
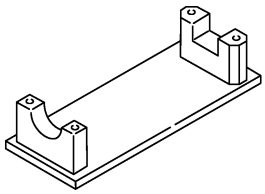
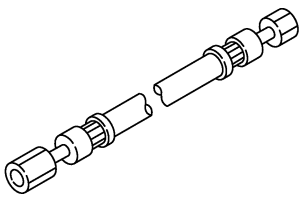
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-925700000	925700000	WRENCH	• Used for removing and installing tie-rod. • Apply this tool to rack.
 ST-925711000	925711000	PRESSURE GAUGE	Used for measuring oil pump pressure.
 ST-926200000	926200000	STAND	Used when inspecting characteristic of gearbox assembly and disassembling it.
 ST34099AC010	34099AC010	ADAPTER HOSE A	Used with PRESSURE GAUGE (925711000).

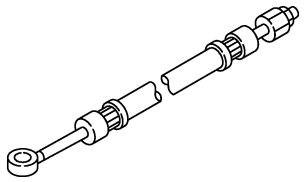
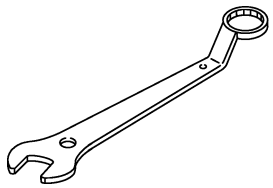
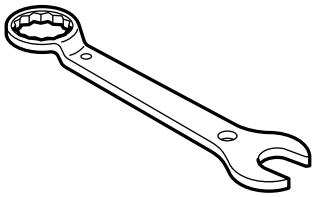
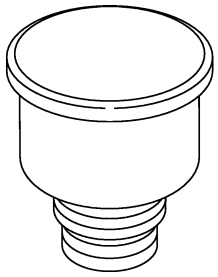
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099AC020	34099AC020	ADAPTER HOSE B	Used with PRESSURE GAUGE (925711000).
 ST926230000	926230000	SPANNER	For the lock nut when adjusting backlash of gear-box.
 ST34099PA100	34099PA100	SPANNER	Measurement of rotating resistance of gear-box assembly.
 ST34199AE040	34199AE040	OIL CHARGE GUIDE	Used for charging power steering fluid.

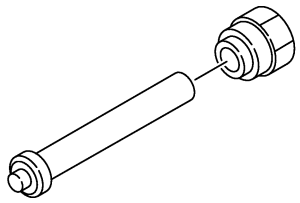
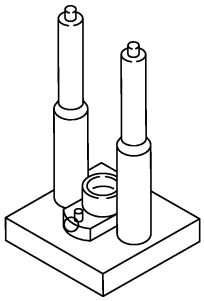
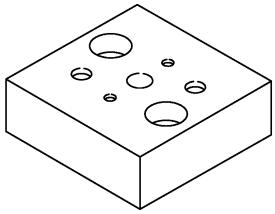
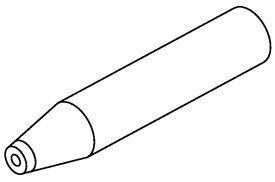
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-926420000	926420000	PLUG	When oil leaks from pinion side of gearbox assembly, remove pipe B from valve housing, attach this tool and check oil leaking points.
 ST-926370000	926370000	INSTALLER A	• Used for installing valve assembly into valve housing assembly. • Used with STAND BASE (34099FA100). • For LHD model.
 ST34099FA100	34099FA100	STAND BASE	• Used for assembling power steering gearbox. • For LHD model.
 ST-926390001	926390001	COVER & REMOVER ASSY	• Used for assembling rack assembly. • For LHD model.

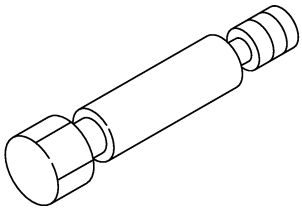
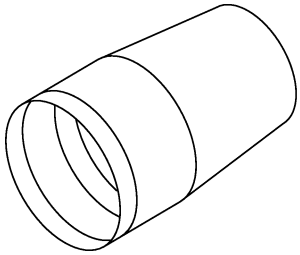
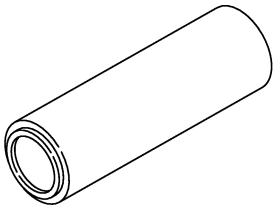
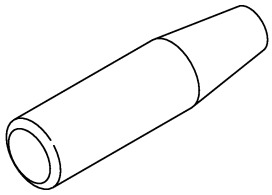
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-926400000	926400000	GUIDE	• Right side of rack when installing rack bush. • Used with GUIDE (927660000). • For LHD model.
 ST-927660000	927660000	GUIDE	• Right side of rack when installing rack bush. • Used with GUIDE (926400000). • For LHD model.
 ST-927620000	927620000	INSTALLER B	• Used for installing oil seal of valve housing. • Used with INSTALLER A (926360000).
 ST-926360000	926360000	INSTALLER A	• Used as a guide to install oil seal. • Used with INSTALLER B (927620000).

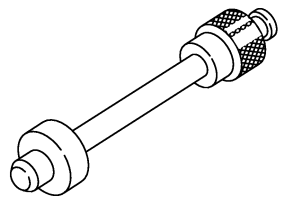
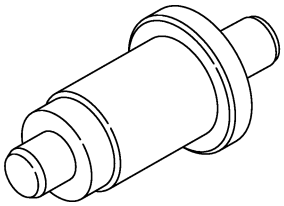
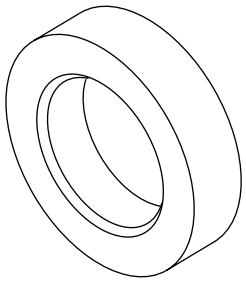
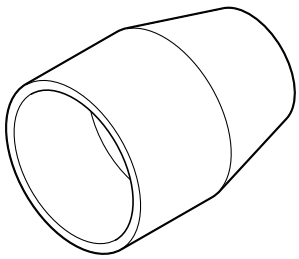
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099FA110	34099FA110	INSTALLER	Used for installing oil seal.
 ST34099FA120	34099FA120	INSTALLER AND REMOVER SEAL	• Used for installing valve housing oil seal. • Used with INSTALLER SEAL. (34099FA130) • Used for installing valve housing ball bearing. • Used for removing oil seal and ball bearing from valve housing.
 ST34099FA130	34099FA130	INSTALLER SEAL	• Used for installing valve housing oil seal. • Used with INSTALLER AND REMOVER SEAL (34099FA120).
 ST-926250000	926250000	GUIDE	• Used for installing holder ASSY into rack housing. • For RHD model.

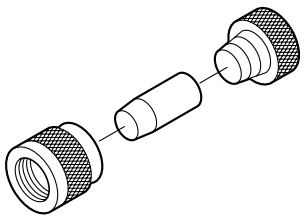
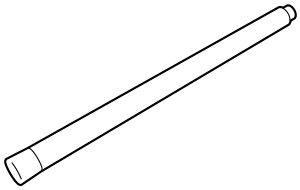
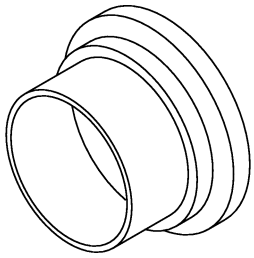
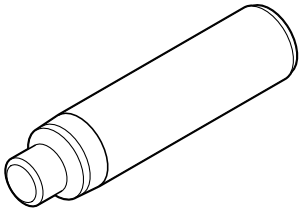
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927490000	927490000	INSTALLER A, B, C	• Used for installing oil seal into rack assembly. • For RHD model.
 ST-927580000	927580000	REMOVER	• Used for removing back-up ring and oil seal. • For RHD model.
 ST34199AE000	34199AE000	GUIDE	• Used for installing rack and seal into housing assembly. • For RHD model.
 ST34099FA030	34099FA030	INSTALLER & REMOVER	• Used for removing and installing rack oil seal (outer & inner). • For RHD model.

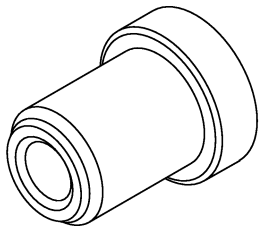
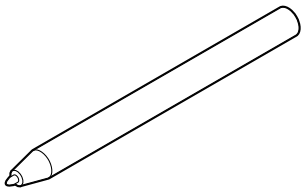
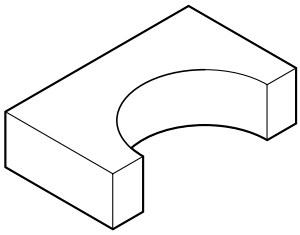
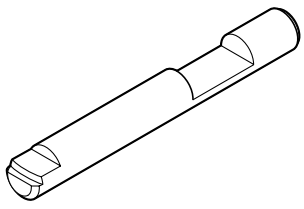
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AE010	34199AE010	INSTALLER	• Used for installing rack oil seal (outer). • For RHD model.
 ST34099FA060	34099FA060	PUNCH HOLDER	• Used for caulking. • For RHD model.
 ST34099FA070	34099FA070	BASE	• Used for supporting housing assembly. • For RHD model.
 ST34099FA080	34099FA080	PUNCH	• Used for removing caulking. • For RHD model.

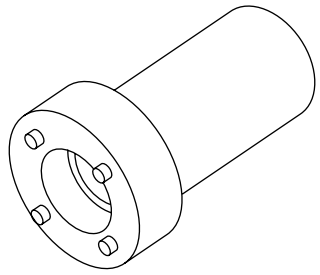
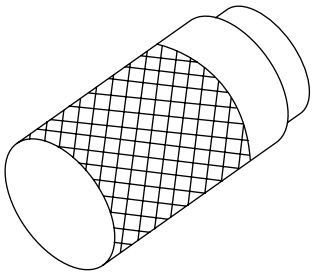
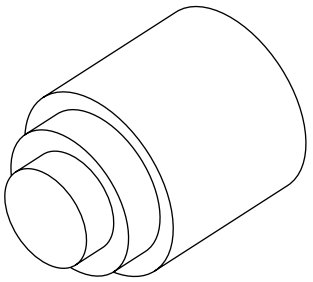
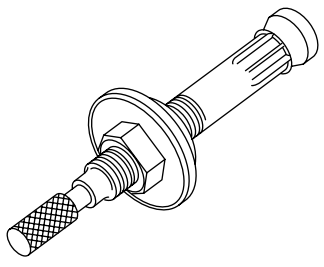
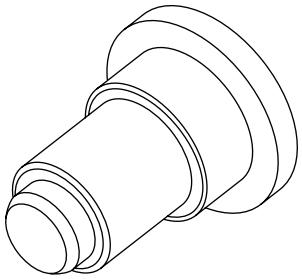
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AE090	34199AE090	PLUG WRENCH	• Used for removing plug. • For RHD model.
 ST34199AE100	34199AE100	PLUG OIL SEAL REMOVER	• Used for removing plug oil seal. • For RHD model.
 ST34199AE110	34199AE110	PLUG OIL SEAL INSTALLER	• Used for installing plug oil seal. • For RHD model.
 ST34199AE120	34199AE120	GEARBOX OIL SEAL REMOVER	• Used for removing gearbox oil seal. • For RHD model.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AE130	34199AE130	GEARBOX OIL SEAL INSTALLER	• Used for installing gearbox oil seal. • For RHD model.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Spring scale	Used for measuring tightening torque.
Snap ring pliers	Used for removing and installing snap ring.
Dial gauge	Used for measuring steering gearbox.

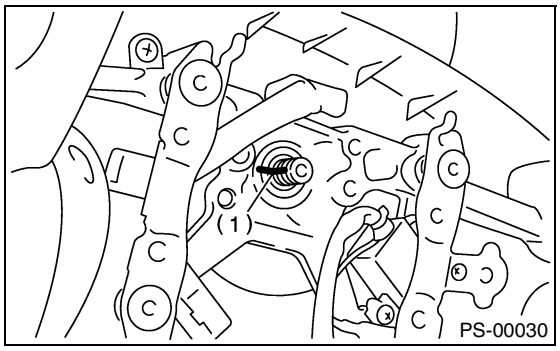
2. Steering Wheel

A: REMOVAL

1) Disconnect the ground cable from battery.
2) Set the tires to straight-ahead position.
3) Remove the airbag module.<Ref. to AB-15, REMOVAL, Driver's Airbag Module.>

WARNING:
Always refer to "AirBag System" before performing airbag module service. <Ref. to AB-3, CAUTION, General Description.>

4) Make matching marks on the steering wheel and steering shaft.



(1) Matching mark

5) Remove the steering wheel nut, and then draw out the steering wheel from shaft using steering puller.

B: INSTALLATION

WARNING:
Always refer to "AirBag System" before performing airbag module service. <Ref. to AB-3, CAUTION, General Description.>

1) Align the center of roll connector. <Ref. to AB-20, ADJUSTMENT, Roll Connector.>
2) Install in the reverse order of removal.

NOTE:
Align matching marks on the steering wheel and steering shaft.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)

Column cover-to-steering wheel clearance:
2 — 4 mm (0.08 — 0.16 in)

CAUTION:
Insert the roll connector guide pin into guide hole on lower end of surface of steering wheel to prevent damage.

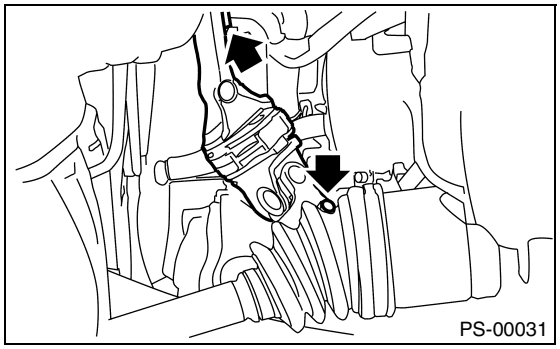
C: INSPECTION

1) Check the steering wheel for deformation. If the deformation is excessive, replace steering wheel.
2) Check the splines on steering wheel for damage. If the damage is excessive, replace steering wheel.

3. Universal Joint

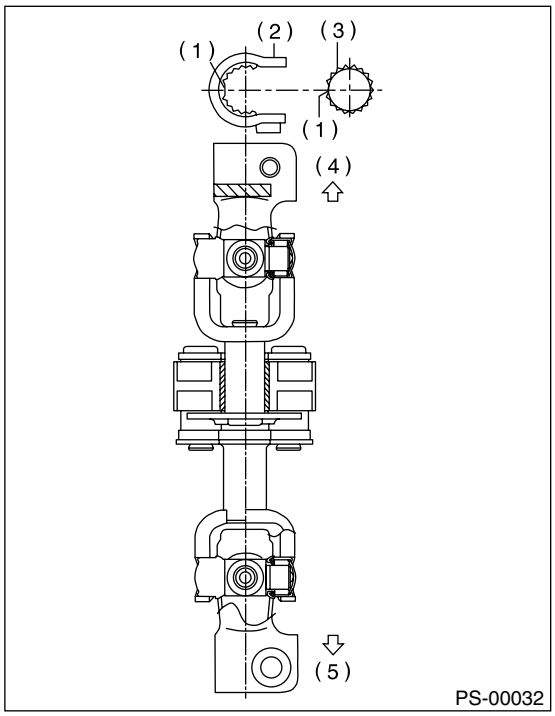
A: REMOVAL

1) Remove the steering wheel. <Ref. to PS-23, REMOVAL, Steering Wheel.>
2) Make matching mark on the universal joint.
3) Remove the universal joint bolts, and then remove the universal joint.



B: INSTALLATION

1) Align the cutout at serrated section of the column shaft and yoke, and then insert the universal joint into column shaft.



(1) Cutout
(2) Yoke
(3) Column shaft
(4) Column shaft side
(5) Gearbox side

2) Align the matching marks, and then insert the universal joint to serrated section of gear box assembly.
3) Tighten the bolt.

Tightening torque:
24 N·m (2.4 kgf-m, 17.4 ft-lb)

CAUTION:
Excessively large tightening torque of the universal joint bolts may lead to heavy steering wheel operation.

Standard clearance between gearbox to DOJ:
Over 14 mm (0.55 in)

4) Align the center of roll connector. <Ref. to AB-20, ADJUSTMENT, Roll Connector.>
5) Install the steering wheel and airbag module. <Ref. to PS-23, INSTALLATION, Steering Wheel.>

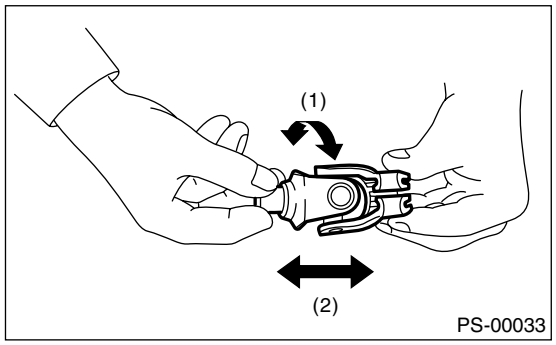
WARNING:
Always refer to "AirBag System" before performing airbag module service. <Ref. to AB-3, CAUTION, General Description.>

C: INSPECTION

Check for wear, damage, or any other faults. If necessary, replace.

Service limit:

Universal joint play; 0 mm (0 in)
Maximum swing torque; 0.3 N (0.03 kgf, 0.07 lb)

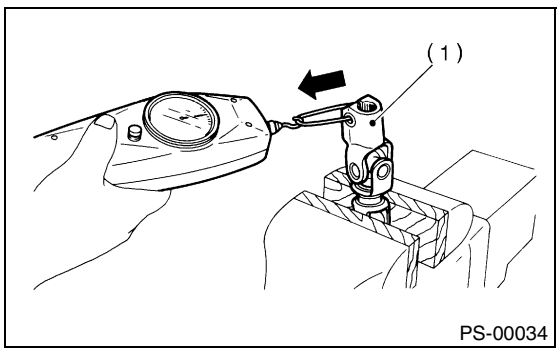


(1) Swing torque
(2) Play

Measurement of folding torque of universal joint is as shown in the figures.

Service limit:

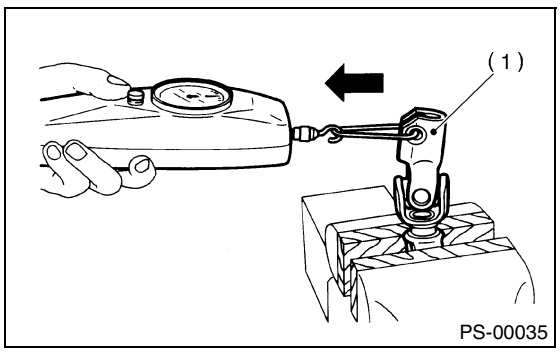
Maximum load; 3.8 N (0.39 kgf, 0.86 lb) or less



(1) Yoke (gearbox side)

Service limit:

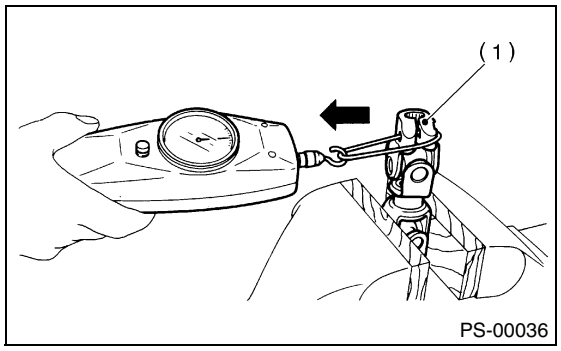
Maximum load; 3.8 N (0.39 kgf, 0.86 lb) or less



(1) Yoke (gearbox side)

Service limit:

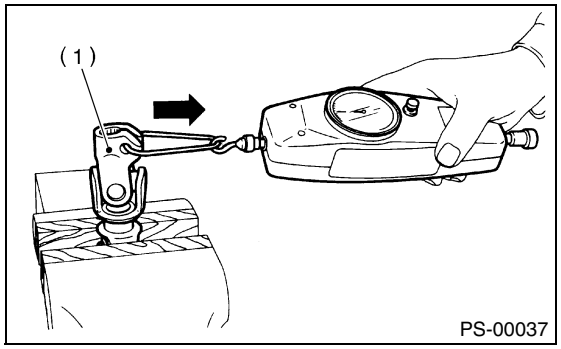
Maximum load; 7.3 N (0.74 kgf, 1.64 lb) or less



(1) Yoke (Steering column side)

Service limit:

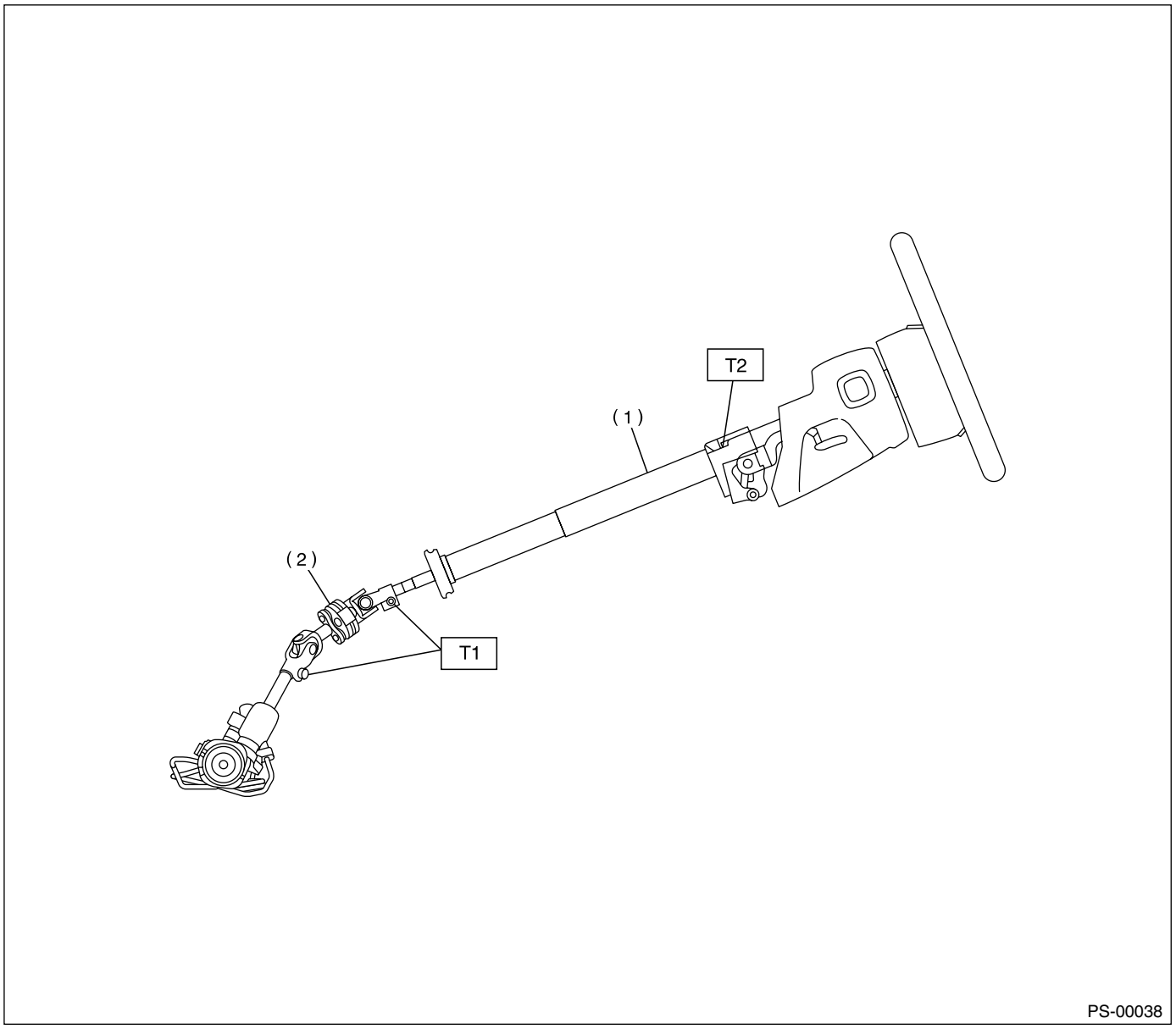
Maximum load; 7.3 N (0.74 kgf, 1.64 lb) or less



(1) Yoke (Steering column side)

4. Tilt Steering Column

A: REMOVAL



(1) Tilt steering column
(2) Universal joint

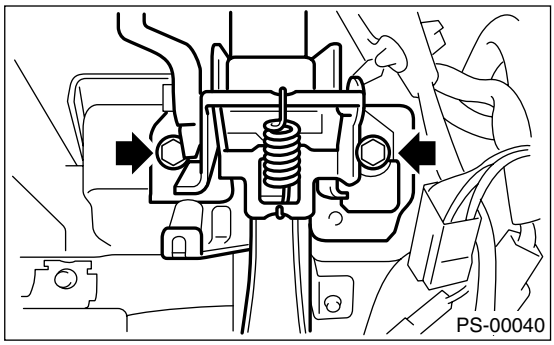
Tightening torque: N·m (kgf-m, ft-lb)
T1: 24 (2.4, 17.4)
T2: 25 (2.5, 18.1)

1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.
3) Remove the airbag module. <Ref. to AB-15, REMOVAL, Driver's Airbag Module.>

WARNING:
Always refer to "AirBag System" before performing airbag module service. <Ref. to AB-3, CAUTION, General Description.>

4) Remove the steering wheel. <Ref. to PS-23, REMOVAL, Steering Wheel.>
5) Remove the universal joint. <Ref. to PS-24, REMOVAL, Universal Joint.>
6) Remove the trim panel under instrument panel.
7) Remove the steering column lower cover.
8) Remove all connectors from steering column.

9) Remove the two bolts under instrument panel securing steering column.

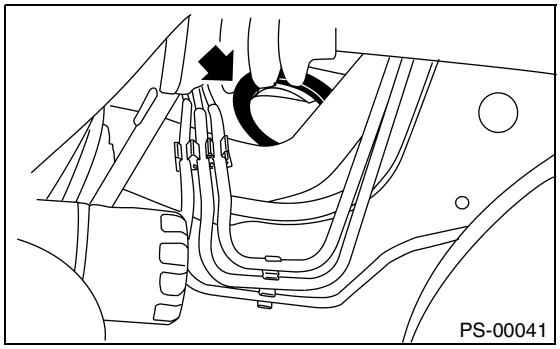


10) Pull out the steering shaft assembly from hole on toe board.

CAUTION:
• Be sure to remove the universal joint before removing steering shaft assembly installing bolts when removing steering shaft assembly or when lowering it for servicing of other parts.
• Do not loosen the tilt lever when the steering column is not secured to the vehicle.

B: INSTALLATION

1) Set the grommet to toe board.



2) Insert the end of steering shaft into toe board grommet.
3) With the tilt lever secured, tighten the steering shaft mounting bolts under instrument panel.

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

4) Connect all connectors under instrument panel.
5) Connect the airbag system connector at harness spool.

NOTE:
Make sure to apply double lock.

6) Install the lower column cover with tilt lever held in the lowered position.
7) Install the universal joint. <Ref. to PS-24, INSTALLATION, Universal Joint.>
8) Align center of roll connector. <Ref. to AB-20, ADJUSTMENT, Roll Connector.>
9) Install the steering wheel. <Ref. to PS-23, INSTALLATION, Steering Wheel.>

CAUTION:
Insert the roll connector guide pin into guide hole on lower end of surface of steering wheel to prevent damage.

10) Install the airbag module to steering wheel.

WARNING:
Always refer to "AirBag System" before performing the service operation. <Ref. to AB-3, CAUTION, General Description.>

C: DISASSEMBLY

Remove the two screws securing upper steering column covers, and two screws securing combination switch, and then remove the related parts.

D: ASSEMBLY

1) Insert the combination switch to upper column shaft, and then install the upper column cover. Then route the ignition key harness and combination switch harness between column cover mounting bosses.

Tightening torque:
1.2 N·m (0.12 kgf-m, 0.9 ft-lb)

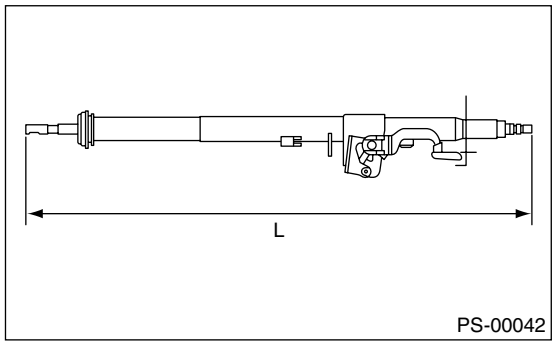
CAUTION:
Do not overtorque the screw.

E: INSPECTION

1. BASIC INSPECTION

Measure overall length of the steering column. If not as specified, replace.

Standard value:
Overall length L
815.6±1.5 mm (32.11±0.059 in)



2. AIRBAG MODEL INSPECTION

WARNING:
For airbag model inspection procedures, refer to "AirBag System". <Ref. to AB-3, CAUTION, General Description.>

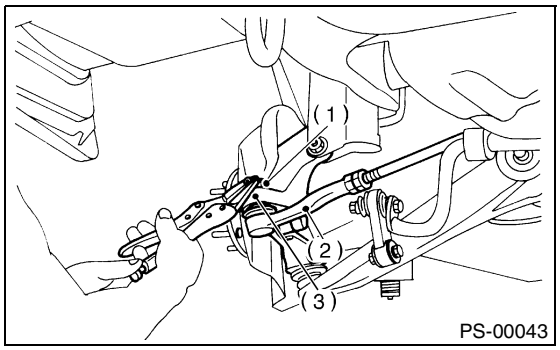
5. Steering Gearbox [LHD MODEL]

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. <Ref. to FS-25, REMOVAL, Sub Frame.>
7) Remove the front exhaust pipe assembly. (Non-turbo model)
<Ref. to EX(SOHC)-7, REMOVAL, Front Exhaust Pipe.>

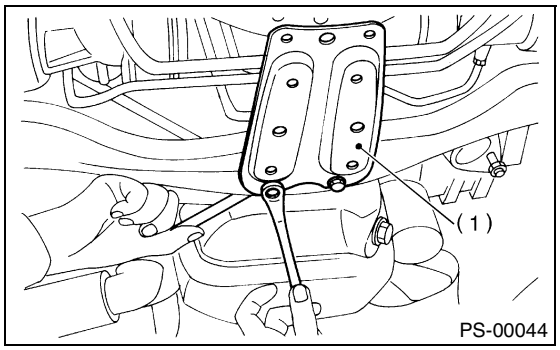
WARNING:
Be careful, the exhaust pipe is hot.

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



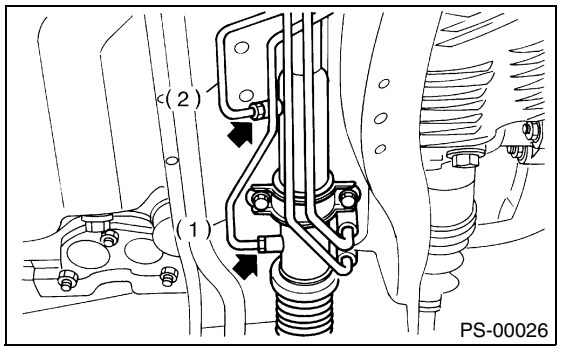
(1) Castle nut
(2) Tie-rod end
(3) Knuckle arm

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



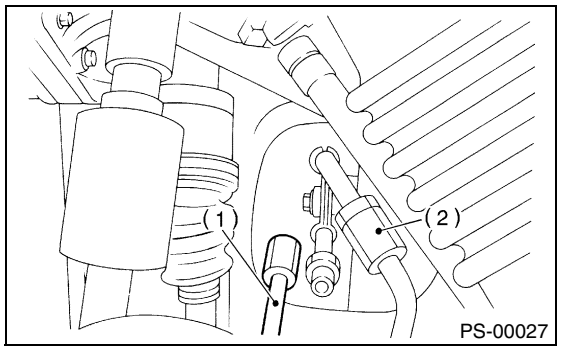
(1) Jack-up plate

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.



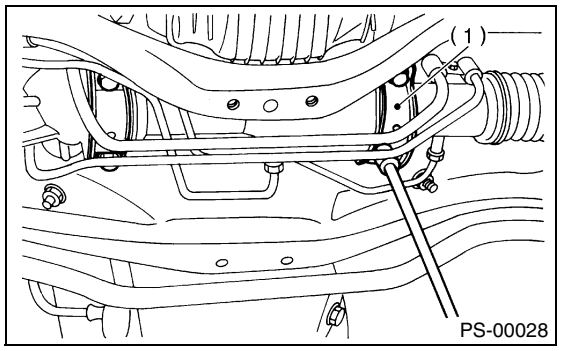
(1) Pipe A
(2) Pipe B

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 gearbox to crossmember, and then remove the gearbox.

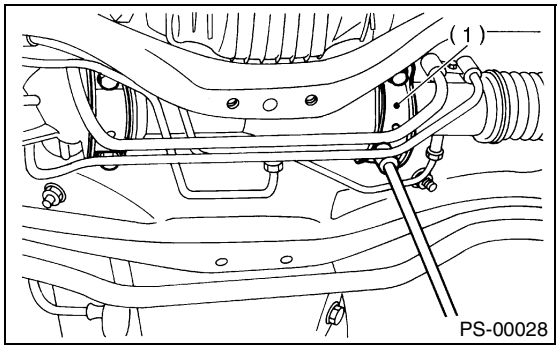


(1) Clamp

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 bolt to specified torque.

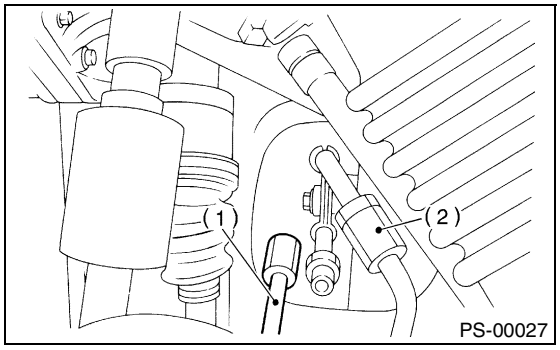
Tightening torque:
59 N·m (6.0 kgf-m, 43.4 ft-lb)



(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)



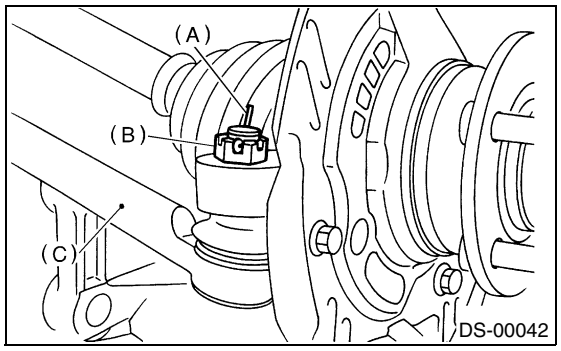
(1) Pipe C
(2) Pipe D

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 specified torque, tighten it further within 60° until cotter pin hole is aligned with the slot in nut, and then bend the cotter pin to lock.



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

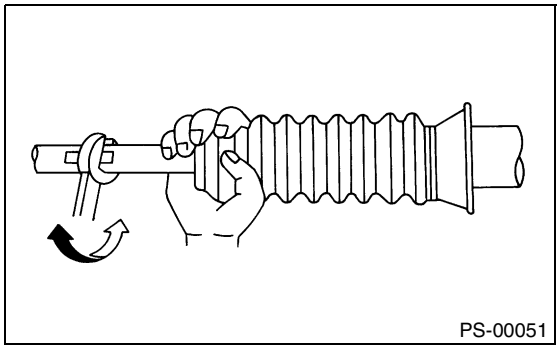
7) Install the front stabilizer to vehicle. <Ref. to FS-23, INSTALLATION, Front Stabilizer.>
8) Install the front exhaust pipe assembly.
9) Install the sub frame. <Ref. to FS-25, INSTALLATION, Sub Frame.>
10) Install the under cover. <Ref. to EI-22, INSTALLATION, Front Under Cover.>
11) Align the center of roll connector. <Ref. to AB-20, ADJUSTMENT, Roll Connector.>
12) Install the steering wheel. <Ref. to PS-23, INSTALLATION, Steering Wheel.>
13) Install the tires.
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-89, 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.
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.



C: DISASSEMBLY

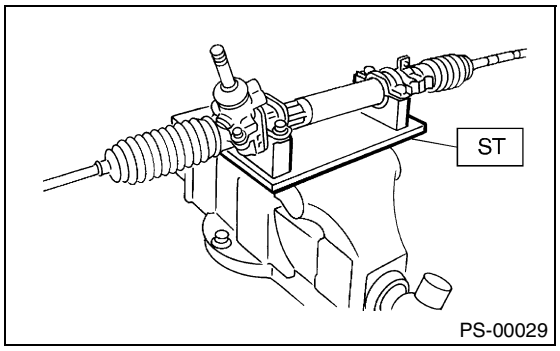
1. RACK HOUSING ASSEMBLY

1) Disconnect the four pipes from gearbox.

NOTE:
Remove the pipes E and F as a single unit being fixed at clamp plate.

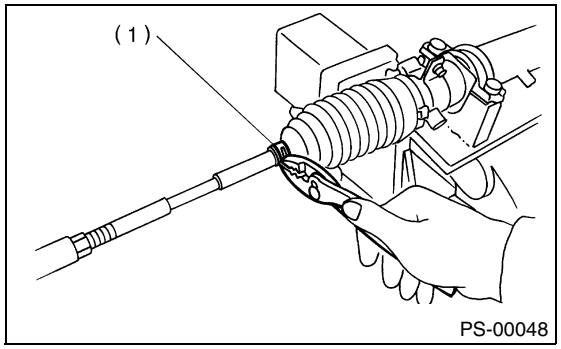
2) Secure the gearbox removed from vehicle in vice using ST.
ST 926200000 STAND

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



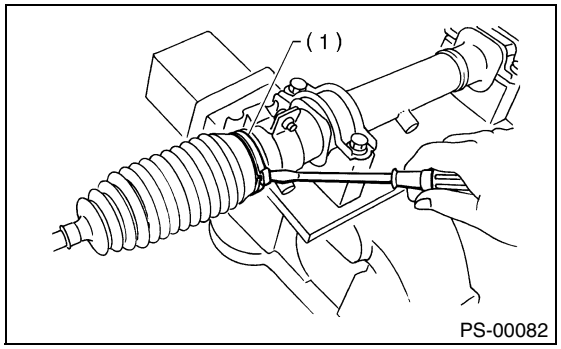
3) Remove the tie-rod end and lock nut from gearbox.

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



(1) Clip

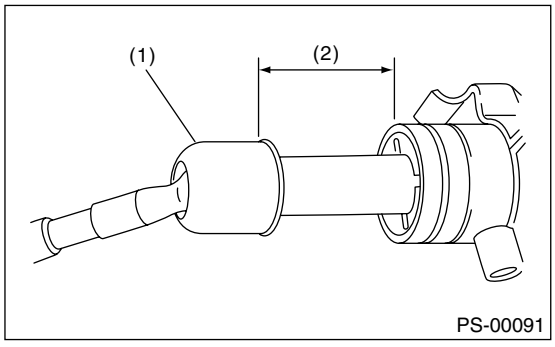
5) Using a flat tip screwdriver, remove the band from boot.



(1) Band

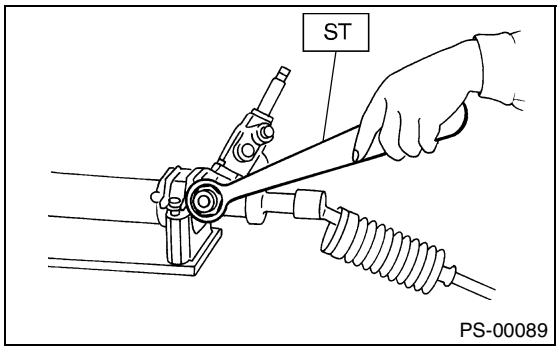
6) Extend the rack approx. 40 mm (1.57 in) out. Unlock the lock washer on both side of tie-rod end using a flat tip screwdriver.

CAUTION:
Be careful not to scratch the rack surface as oil leaks may result.

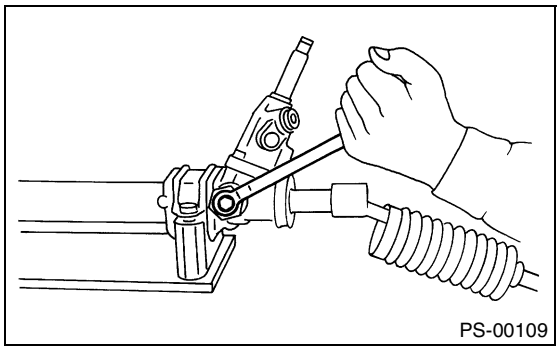


(1) Lock washer
(2) Approx. 40 mm (1.57 in)

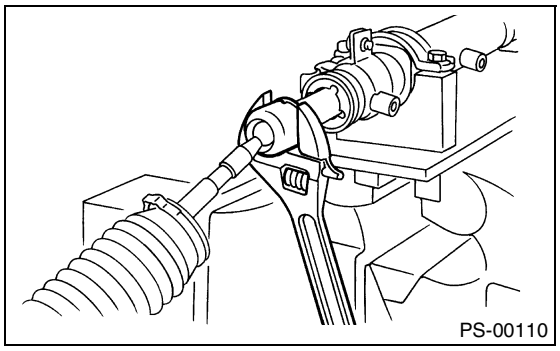
7) Using the ST, loosen the lock nut.
ST 926230000 SPANNER



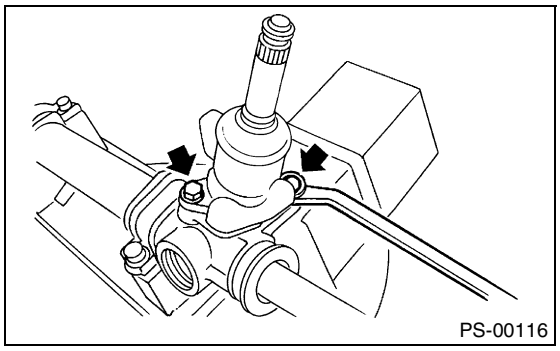
8) Tighten the adjusting screw until it no longer tightens.



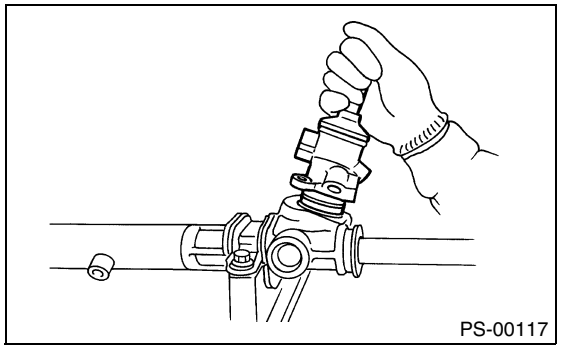
9) Using a wrench [32 mm (1.26 in) width across flats] or adjustable wrench, remove the tie-rod.



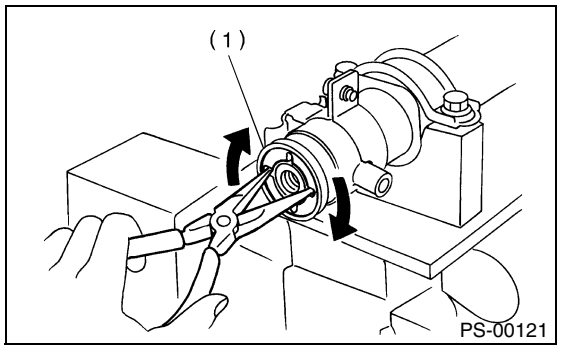
10) Loosen the adjusting screw, and then remove the spring and sleeve.
11) Remove the two bolts securing valve assembly.



12) Carefully draw out the input shaft, and then remove the valve assembly.



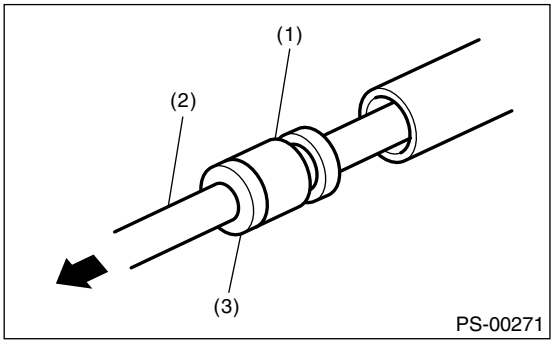
13) Using a sharp pointed pliers, rotate the rack stopper in direction of the arrow until end of the circlip comes out of stopper. Rotate the circlip in opposite direction and pull it out.



(1) Rack stopper

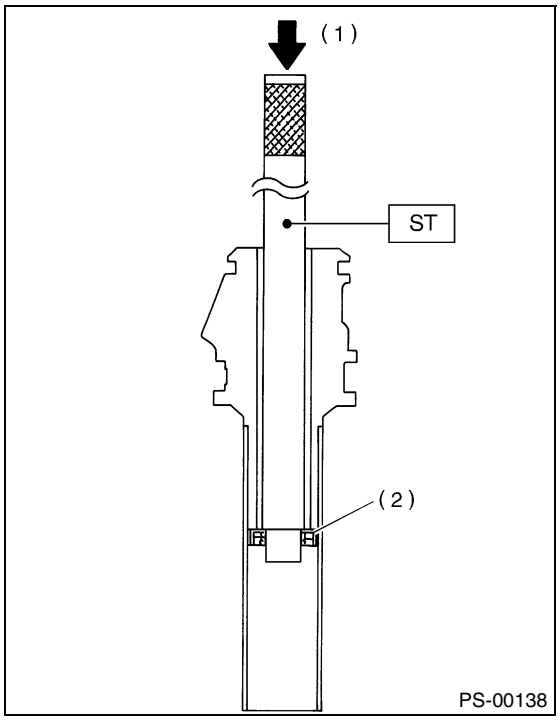
14) Pull the rack assembly from cylinder side, and draw out the rack bushing and rack stopper together with the rack assembly.

CAUTION:
Be careful not to contact the rack to inner wall of cylinder when drawing out. Any scratch on the cylinder inner wall will cause oil leakage.



(1) Rack bushing
(2) Rack assembly
(3) Rack stopper

15) Remove the rack bushing and rack stopper from rack assembly.
16) Remove the oil seal from rack.
17) Insert the ST from pinion housing side, and then remove the oil seal using a press.
ST 34099FA110 INSTALLER



(1) Press
(2) Oil seal

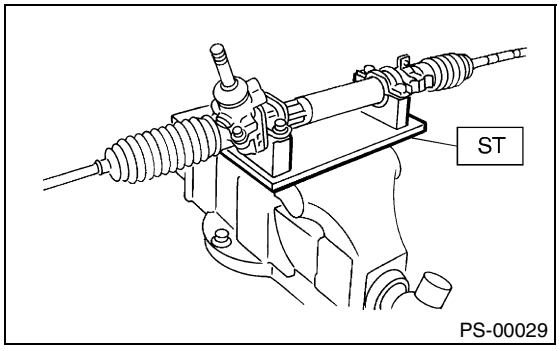
2. CONTROL VALVE

1) Disconnect the four pipes from gearbox.

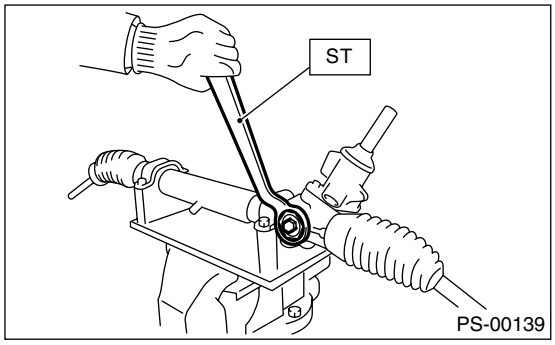
NOTE:
Remove the pipes E and F as a single unit being fixed at clamp plate.

2) Secure the gearbox removed from the vehicle in vise using ST.
ST 926200000 STAND

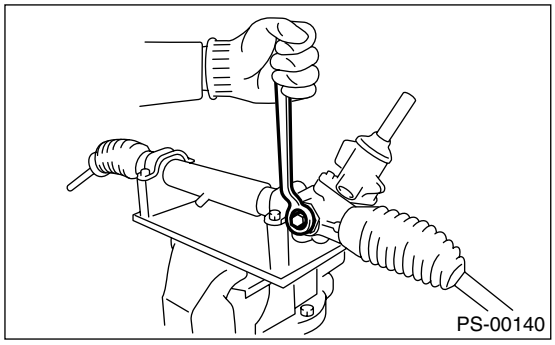
CAUTION:
Secure the gearbox in a vise using ST as shown. Do not attempt to secure it without this ST.



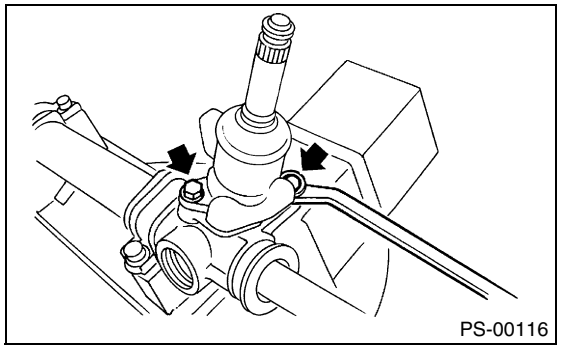
3) Using the ST, loosen the lock nut.
ST 926230000 SPANNER



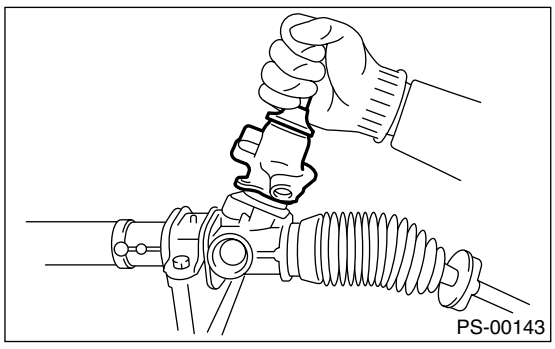
4) Tighten the adjusting screw until it no longer tightens.



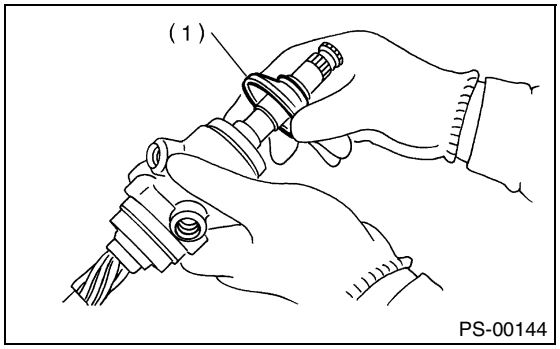
5) Loosen the adjusting screw, and then remove the spring and sleeve.
6) Remove the two bolts securing valve assembly.



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

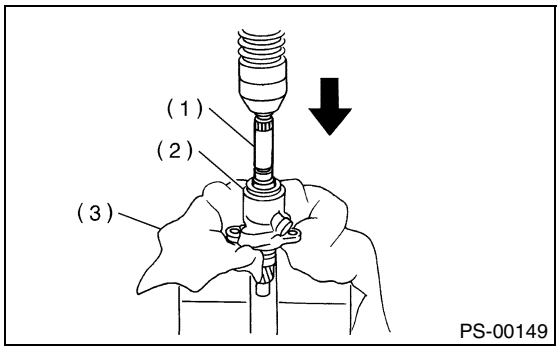


8) Slide the dust cover out.



(1) Dust cover

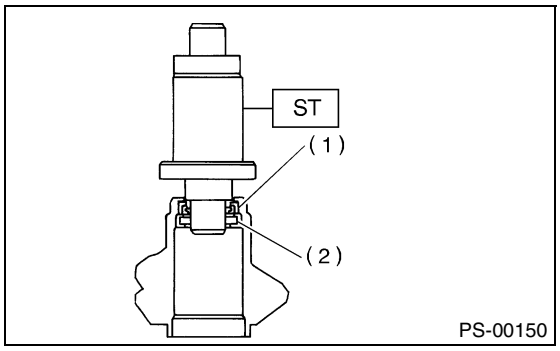
9) Using a press remove the pinion and valve assembly from valve housing.



(1) Valve assembly
(2) Valve housing
(3) Cloth

10) Using the ST and press, remove the dust seal, oil seal and special bearing from valve housing.
ST 34099FA120 INSTALLER & REMOVER SEAL

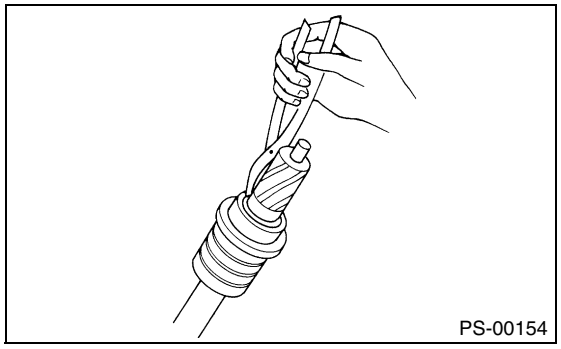
CAUTION:
• Do not apply force to the end surface of valve housing.
• Do not reuse the oil seal after removal.



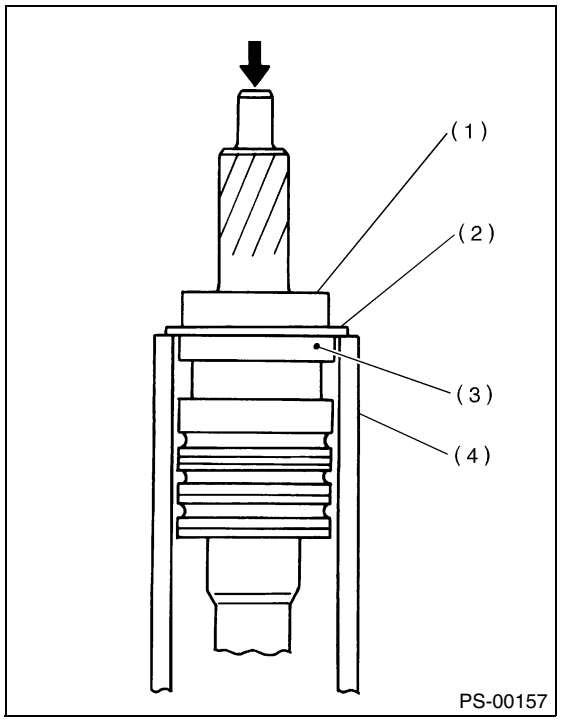
(1) Oil seal
(2) Special bearing

11) Remove the snap ring using snap ring pliers.

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



12) Press out the bearing together with the back up washer using pipe of I.D. 38.5 to 39.5 mm (1.516 to 1.555 in) and press.



(1) Bearing
(2) Backing washer
(3) Oil seal
(4) Pipe

13) Remove the oil seal.

D: ASSEMBLY

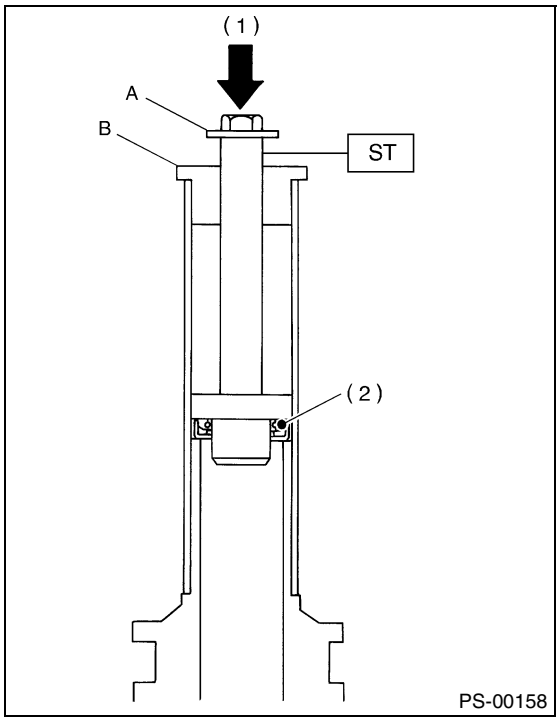
1. RACK HOUSING ASSEMBLY

CAUTION:
Use only SUBARU genuine grease for the gearbox.

Specified grease for gearbox:
VALIANT GREASE M2 (Part No. 003608001)

1) Apply power steering fluid to a new oil seal.
2) Install the oil seal in correct position as shown in the figure. Push the oil seal using a press until portion A of ST contacts face of B.
ST 34099FA110 INSTALLER

CAUTION:
Be careful not to damage or scratch the cylinder inner wall.

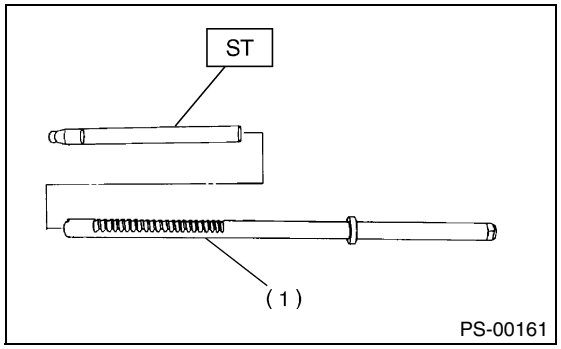


(1) Press
(2) Oil seal

3) Fix the rack housing in vise using ST.
ST 926200000 STAND

CAUTION:
• When fixing the rack housing in vise, be sure to use this special tool. Do not fix rack housing in vise using pad such as aluminum plates, etc.
• When using the old rack housing, be sure to clean and remove rust before assembling. Check pinion housing bushing carefully.

4) Fit the ST over toothed portion of rack assembly, and check for binding or unsmooth insertion. If any deformation is noted on flats at the end of rack, shape by using file, and wash with cleaning fluid.
ST 926390001 COVER & REMOVER



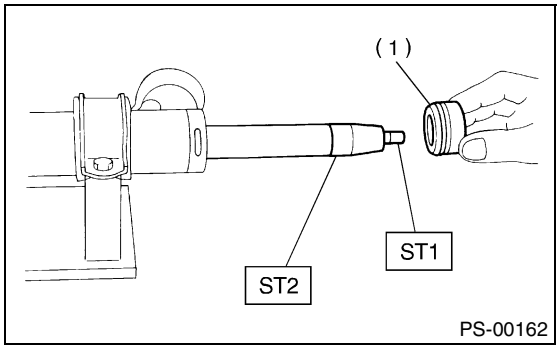
(1) Rack assembly

5) Apply genuine grease to the teeth of thoroughly washed rack assembly, and then fit the ST over the toothed portion.

CAUTION:
• Be careful not to block the air passage with grease. Remove excessive grease.
• After fitting cover, check the air passage hole for clogging. If clogged, open by removing grease from the hole.

6) Before inserting the rack assembly, apply a coat of specified power steering fluid to the surfaces of ST and rack piston.
7) Insert the rack assembly into rack housing from cylinder side, and then remove the ST after it has passed completely through oil seal.
8) Fit the ST1 and ST2 over the end of rack, and then install a new rack bushing.
ST1 926400000 GUIDE
ST2 927660000 GUIDE

CAUTION:
• If burrs or nicks are found on this guide and rack shaft portion, remove by filing.
• Dip the rack bushing in specified power steering fluid before installing, and pay attention not to damage O-ring and oil seal.

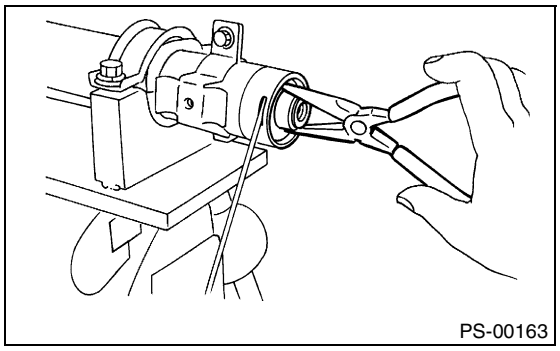


(1) Rack bushing assembly

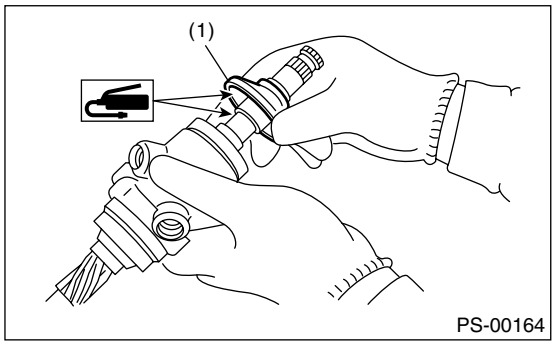
9) Insert the rack stopper into the cylinder tube until internal groove (on cylinder side) is aligned with external groove (on rack stopper). Turn the rack stopper with ST so that the rack stopper hole is seen through cylinder slits.
10) Insert the rack stopper into the rack housing, and then wrap a new circlip using a sharp pointed pliers to secure the rack stopper in position.

CAUTION:
Be careful not to scratch the rack while winding circlip.

NOTE:
Rotate the wrench another 90 to 180° after end of circlip has been wrapped in.

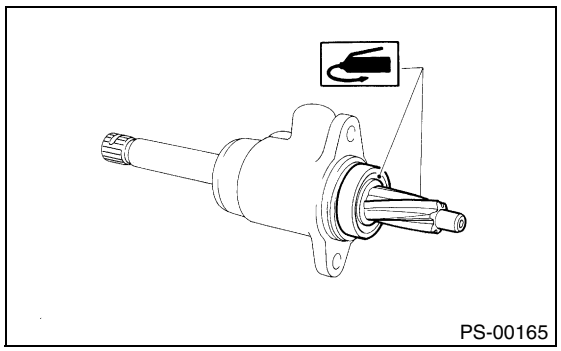


11) Apply genuine grease to dust cover, and then install the dust cover to valve assembly.

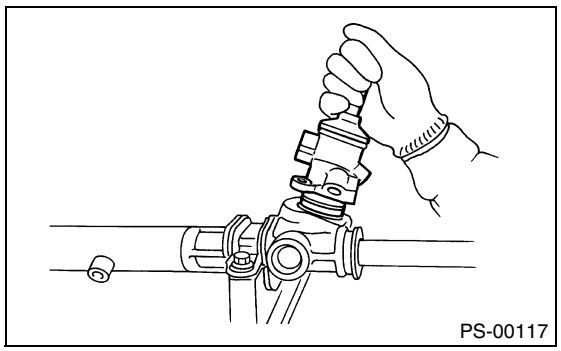


(1) Dust cover

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



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



14) Tighten the bolts alternately to secure valve assembly.

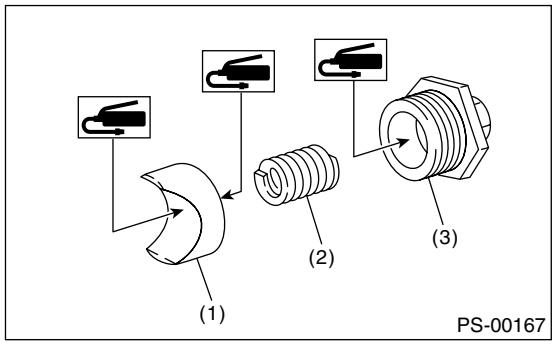
Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)

CAUTION:
Be sure to alternately tighten the bolts.

15) 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.

16) Apply a coat of grease to the sliding surface of 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.



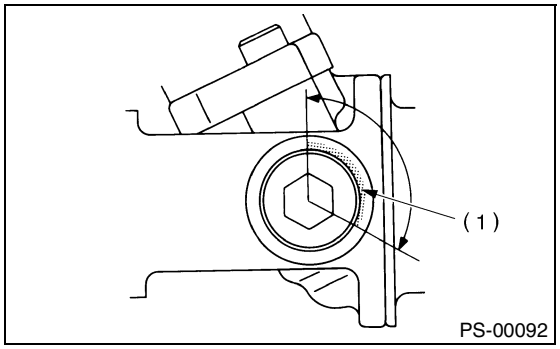
(1) Sleeve
(2) Spring
(3) Adjusting screw

17) Tighten the adjusting screw to specified torque.

Tightening torque:
First step; 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)
Second step; Back off 25°.

18) Remove the tie-rod.
19) Verify that play is within specified value. <Ref. to PS-44, SERVICE LIMIT, INSPECTION, Steering Gearbox [LHD MODEL].>
20) 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.

21) Tighten the adjusting screw to specified torque.

Tightening torque:
First step; 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)
Second step; Back off 25°.

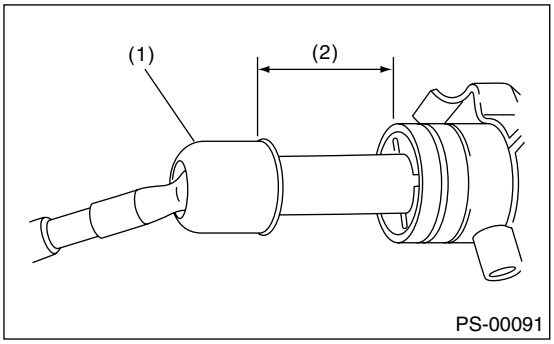
22) Install the lock nut. While holding the adjusting screw with a wrench, tighten lock nut using ST.
ST 926230000 SPANNER

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.

23) Extend the rack approx. 40 mm (1.57 in) beyond side of steering body.
24) Install the tie-rod and a new lock washer into rack.

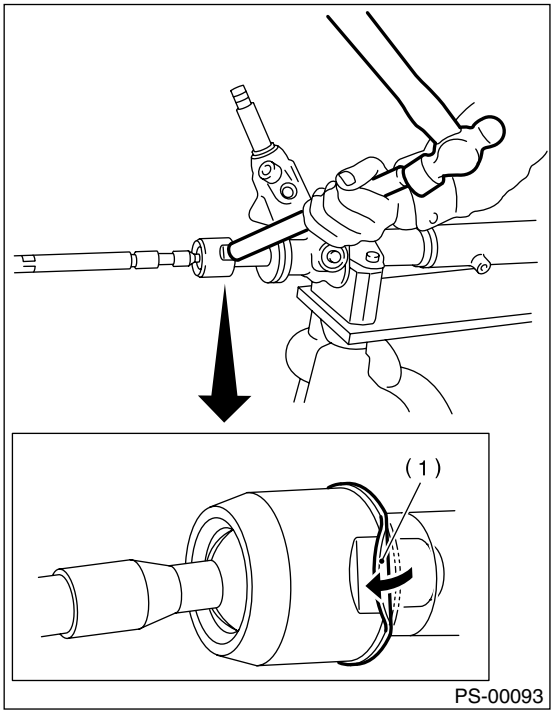
Tightening torque:
78 N·m (8.0 kgf-m, 57.9 ft-lb)



(1) Tie-rod
(2) Approx. 40 mm (1.57 in)

25) Bend the lock washer.

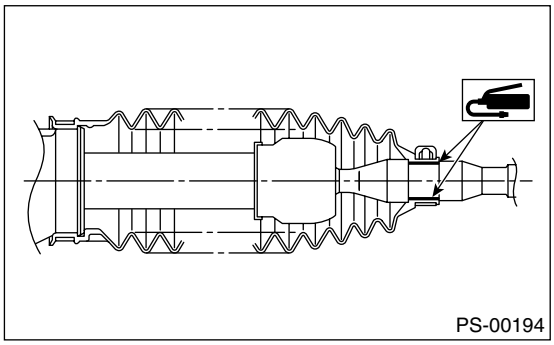
CAUTION:
Be careful not to scratch the rack when bending lock washer.



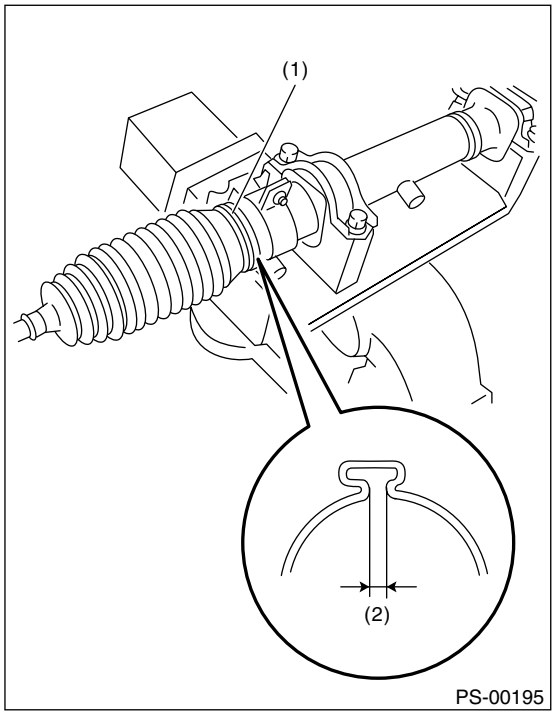
(1) Lock washer

26) 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.

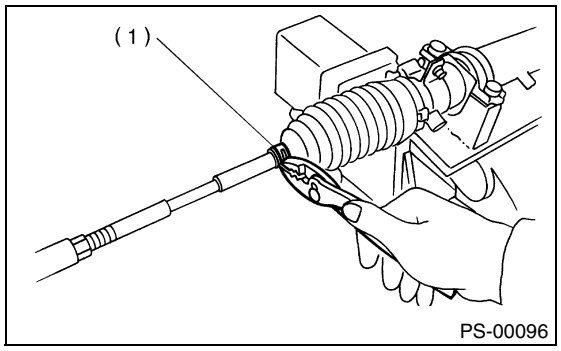


27) Install a new boot band. Using band clamp pliers, caulk the boot band until caulking part clearance is 2 mm (0.079 in) or less.



(1) Boot band
(2) 2 mm (0.079 in) or less

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

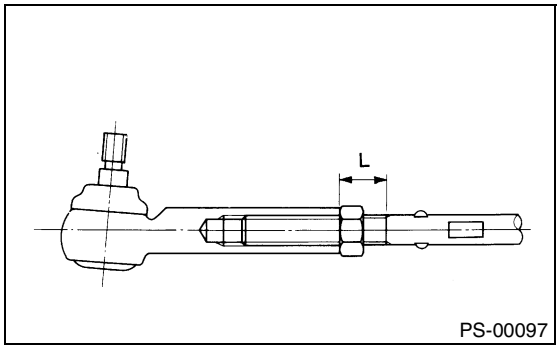


(1) Clip

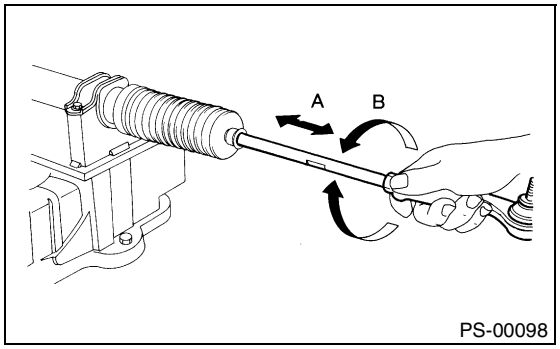
29) After installing, check the boot end is positioned into groove on tie-rod.

30) 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
31.2 mm (1.23 in)



31) 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.



32) Remove the gearbox from ST.
ST 926200000 STAND
33) Install the four pipes on gearbox.
(1) Connect the pipe A and B to four pipe joints of gearbox.

Tightening torque:
13 N·m (1.3 kgf-m, 9.4 ft-lb)

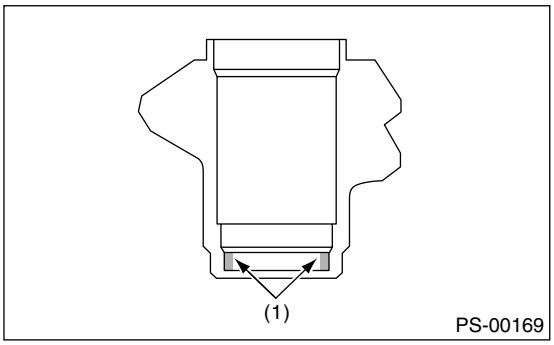
(2) Connect the pipe E and F to gearbox.

Tightening torque:
Pipe E: 15 N·m (1.5 kgf-m, 10.8 ft-lb)
Pipe F: 25 N·m (2.5 kgf-m, 18.1 ft-lb)

2. CONTROL VALVE ASSEMBLY

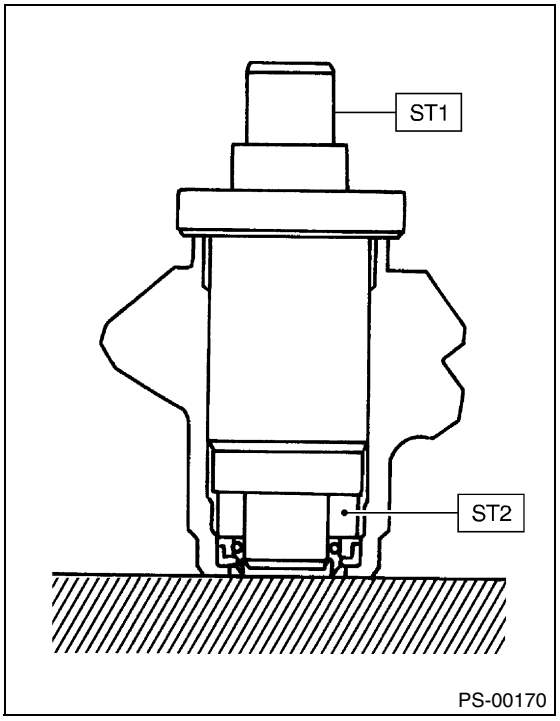
Specified steering grease:
VALIANT GREASE M2 (Part No. 003608001)

1) Clean all parts and tools before reassembling.
2) Apply a coat of specified power steering fluid to the inner wall of valve housing.

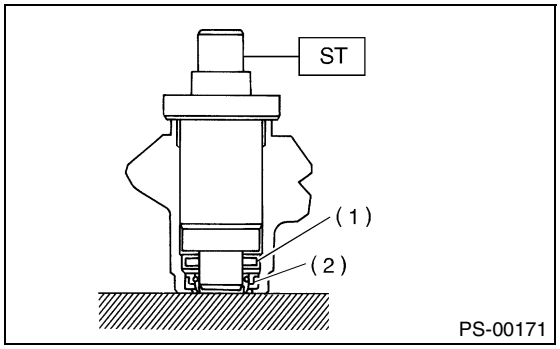


(1) Apply fluid.

3) Attach the ST2 to ST1.
ST1 34099FA120 INSTALLER & REMOVER SEAL
ST2 34099FA130 INSTALLER SEAL
4) To avoid scratching the oil seal, apply a coat of grease to the contact surface of installer and oil seal.
5) Verify the oil seal direction.
Attach the oil seal to installer and position in valve housing before pressing into place.
6) Press the oil seal into place using a press.



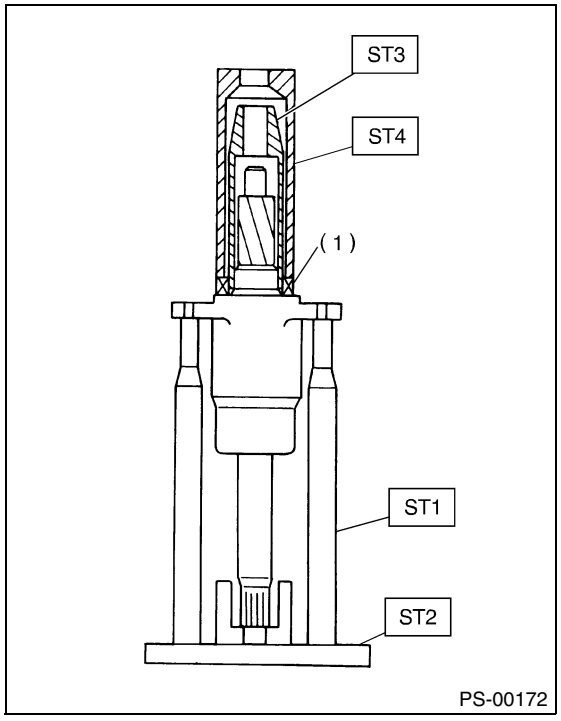
7) Attach the bearing to ST, and then position in value housing. Using the ST and press, install the special bearing in valve housing.
ST 34099FA120 INSTALLER & REMOVER SEAL



(1) Special bearing
(2) Oil seal

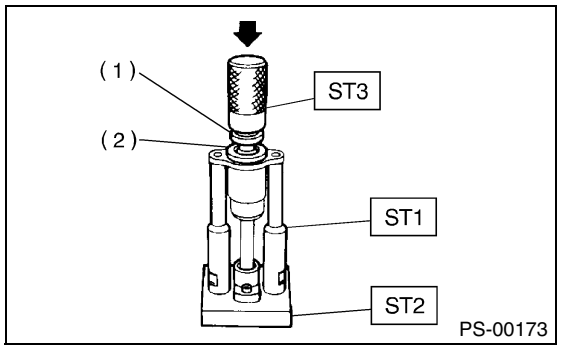
8) Put vinyl tape around the pinion shaft splines to protect oil seal from damage.
9) Fit the pinion and valve assembly into valve housing.
10) Secure the valve assembly to ST1 and ST2.
ST1 926370000 INSTALLER A
ST2 34099FA100 STAND BASE
11) Apply specified power steering fluid to oil seal and ST3.

12) Install the ST3 to pinion, and then insert the oil seal. Press the oil seal using a press until ST4 contacts face end of valve housing.
ST3 926360000 INSTALLER A
ST4 927620000 INSTALLER B



(1) Oil seal

13) Remove the ST3, and then fit the backing washer.
14) Force-fit the ball bearing using ST3.
ST1 926370000 INSTALLER A
ST2 34099FA100 STAND BASE
ST3 927640000 INSTALLER B



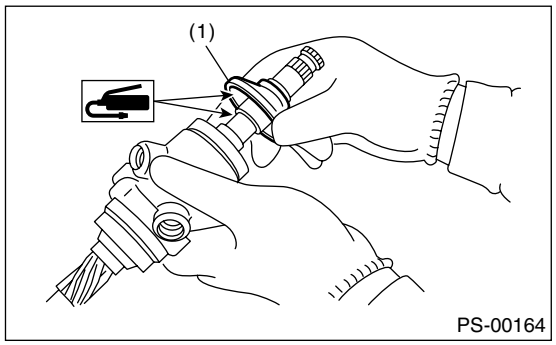
(1) Ball bearing
(2) Backing washer

NOTE:
Be careful not to tilt the ball bearing during installation.

15) Install the snap ring using snap ring pliers.

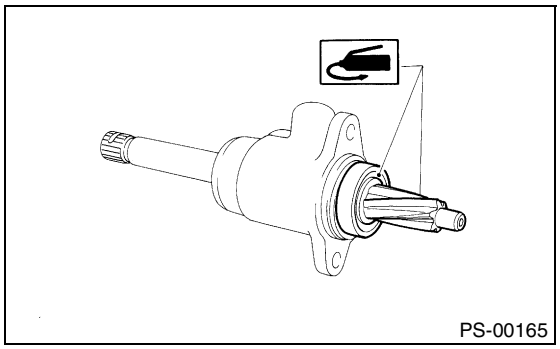
NOTE:
Rotate the snap ring to check for proper installation.

16) Apply the specified grease to dust cover.
17) Install the dust cover on valve assembly.

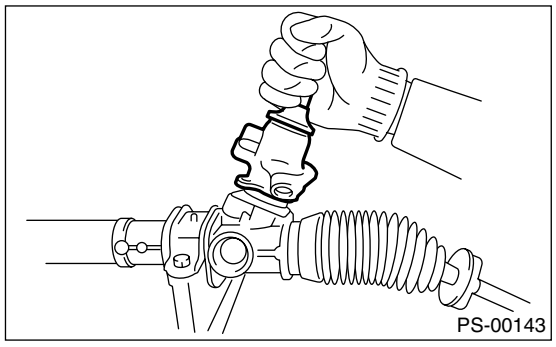


(1) Dust cover

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



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

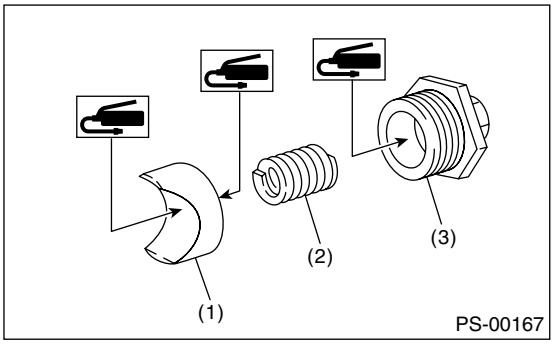


20) Tighten the bolts alternately to secure valve assembly.

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

CAUTION:
Be sure to alternately tighten the bolts.

21) Apply a coat of grease to the sliding surface of 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.



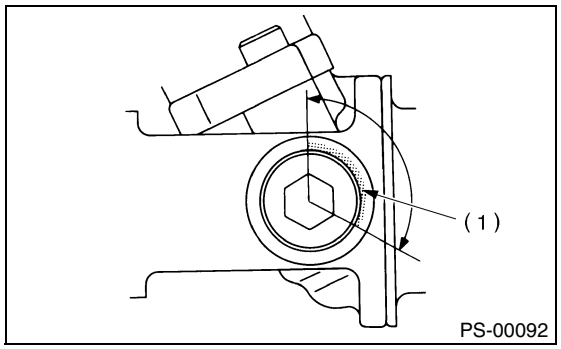
(1) Sleeve
(2) Spring
(3) Adjusting screw

22) Tighten the adjusting screw to specified torque.

Tightening torque:
First step; 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)
Second step; Back off 25°.

23) Verify that play is within specified value. <Ref. to PS-44, SERVICE LIMIT, INSPECTION, Steering Gearbox [LHD MODEL].>
24) Loosen the adjusting screw, and then apply liquid gasket to at least 1/3 of the entire perimeter of adjusting screw thread.

Liquid gasket:
THREE BOND 1141



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

25) Tighten the adjusting screw to specified torque.

Tightening torque:
First step; 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)
Second step; Back off 25°.

26) 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.

27) Remove the gearbox from ST.
28) Install the four pipes on gearbox.
(1) Connect the pipe A and B to the gearbox.

Tightening torque:
13 N·m (1.3 kgf-m, 9.4 ft-lb)

(2) Connect the pipe E and F to gearbox.

Tightening torque:
Pipe E: 15 N·m (1.5 kgf-m, 10.8 ft-lb)
Pipe F: 25 N·m (2.5 kgf-m, 18.1 ft-lb)

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, the 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.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration on dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipes	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.

2. SERVICE LIMIT

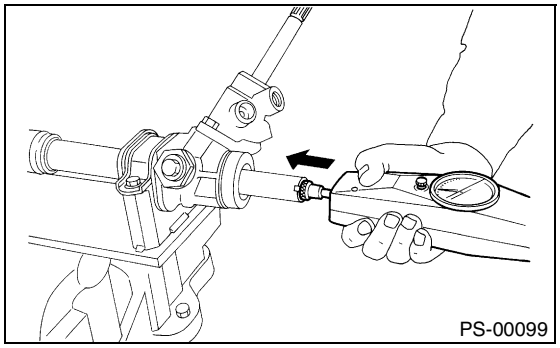
Make a measurement as follows. If it exceeds the specified service limit, adjust or replace.

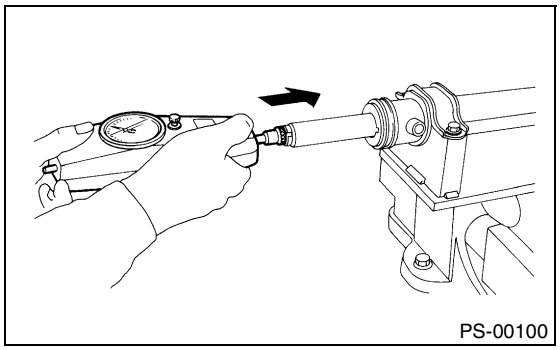
NOTE:
When making a measurement, vise the gearbox by using ST. Never vise the gearbox by inserting aluminum plates, etc. between vise and gearbox.

ST 926200000 STAND

Sliding resistance of rack shaft:

Service limit
400 N (41 kgf, 90 lb) or less


PS-00099

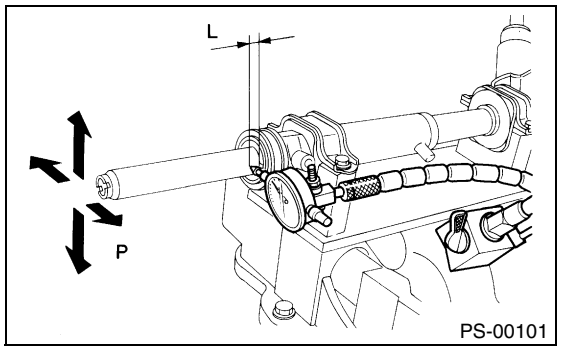

PS-00100

3. RACK SHAFT PLAY IN RADIAL DIRECTION

Right-turn steering:

Service limit
0.19 mm (0.0075 in) or less

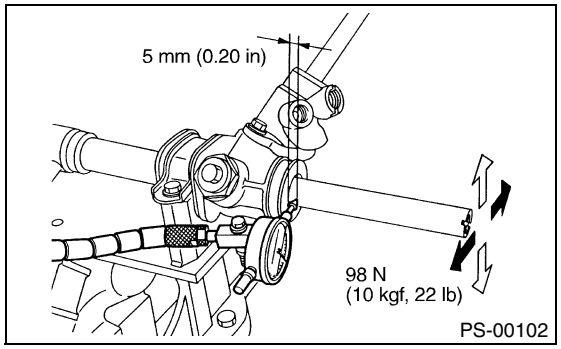
On condition
L: 5 mm (0.20 in)
P: 122.6 N (12.5 kgf, 27.6 lb)



PS-00101

Left-turn steering:

Service limit
Direction ⇦⇨
0.3 mm (0.012 in) or less
Direction ⬅➡
0.15 mm (0.0059 in) or less



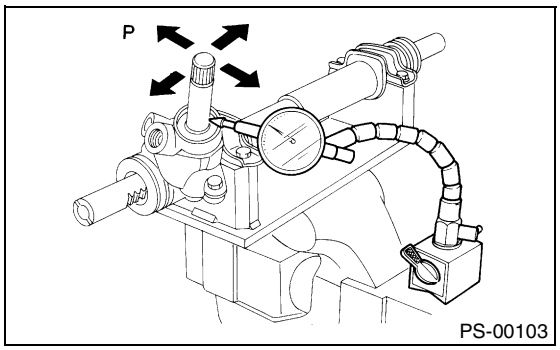
PS-00102

4. INPUT SHAFT PLAY

In radial direction:

Service limit
0.18 mm (0.0071 in) or less

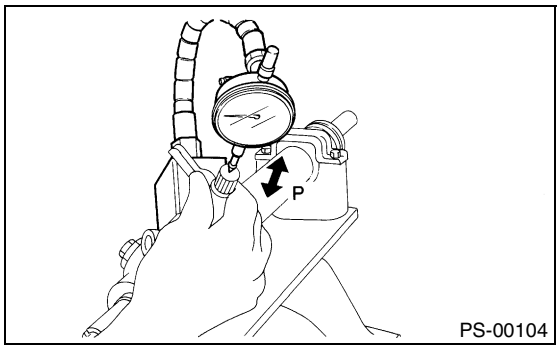
On condition
P: 98 N (10 kgf, 22 lb)



In axial direction:

Service limit
0.5 mm (0.020 in) or less

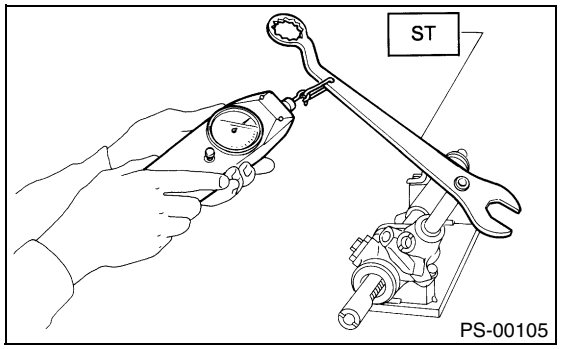
On condition
P: 20 — 49 N (2 — 5 kgf, 4 — 11 lb)



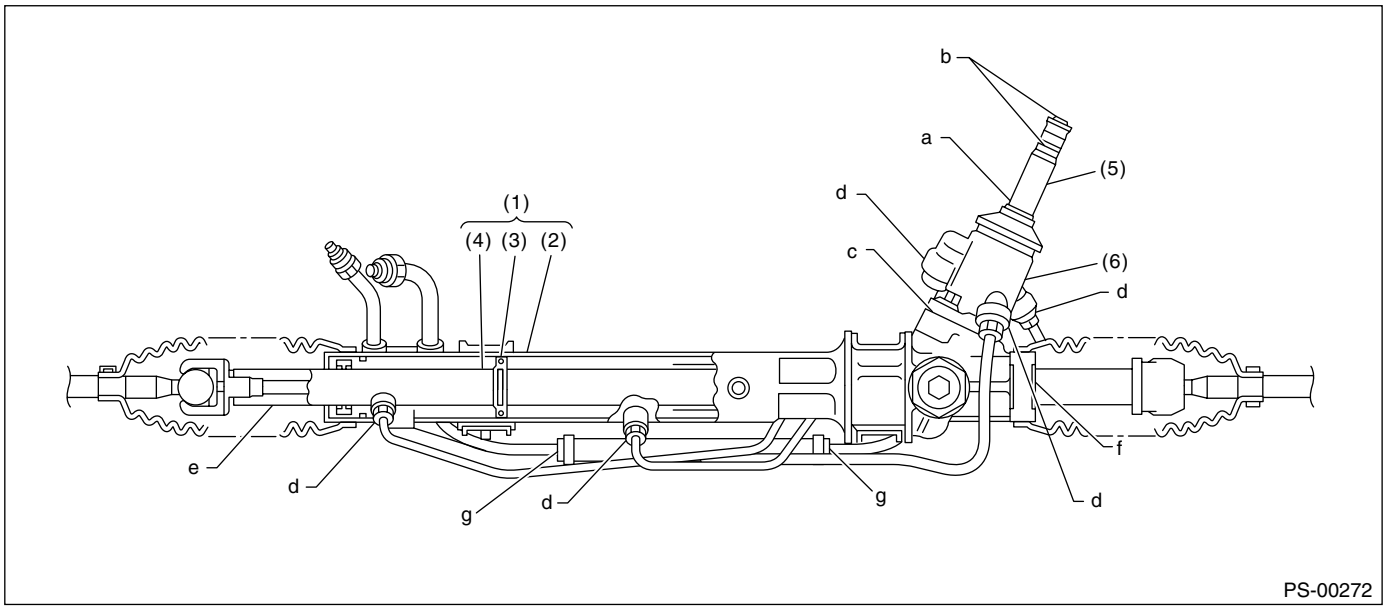
5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the 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 axle
(5) Input shaft
(6) Valve housing

1) Even if the location of the leak can be easily found by observing the leaking condition, it is necessary to thoroughly remove the fluid from the suspected portion and turn the steering wheel from lock to lock about thirty to forty times with engine running, then make comparison of the suspected portion between immediately after and several hours after this operation.
2) Inspect leakage from “a”
The oil seal is damaged. Replace the valve assembly with a new one.
3) Inspect leakage from “b”
The torsion bar O-ring is damaged. Replace the valve assembly with a new one.
4) Inspect leakage from “c”
The oil seal is damaged. Replace the valve assembly or oil seal with a new one.
5) Inspect leakage from “d”
The pipe is damaged. Replace the faulty pipe or O-ring.
6) Inspect leakage from “g”
The hose is damaged. Replace the hose with a new one.
7) If leak is other than a, b, c, d, or g, and if oil is leaking from the gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove fluid from the surrounding portions. Then, turn the steering wheel from lock to lock thirty to forty times with the engine running, then make comparison of the leaked portion immediately after and several hours after this operation.
(1) Leakage from “e”
The cylinder seal is damaged. Replace the rack bush with a new one.
(2) Leakage from “f”
There are two possible causes. Take the following step first. Remove the pipe assembly B from the valve housing, and close the circuit with ST.
ST 926420000 PLUG
Turn the steering wheel from lock to lock thirty to forty times with the engine running, then make comparison of the leaked portion between immediately after and several hours after this operation.
- If leakage from “f” is noted again:

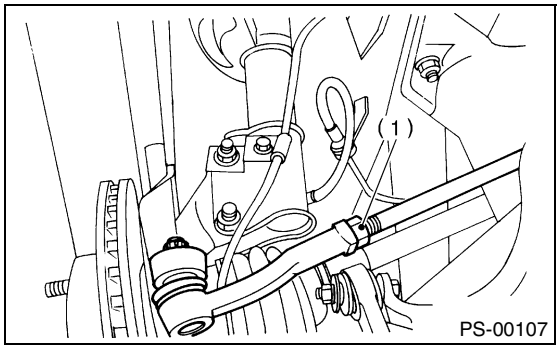
The oil seal of pinion and valve assembly is damaged. Replace the pinion and valve assembly with a new one. Or replace the oil seal and parts that are damaged during disassembly with new ones.
- If oil stops leaking from “f”:

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

F: ADJUSTMENT

1) Adjust the front toe. <Ref. to FS-11, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

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



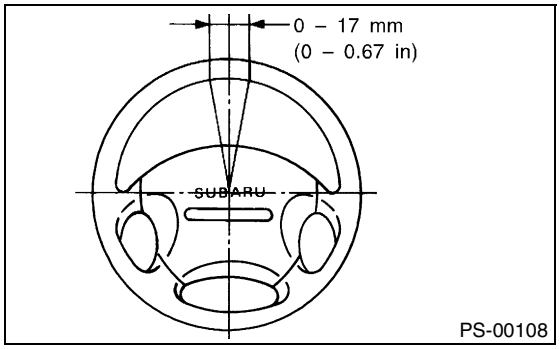
(1) Lock nut

2) Adjust the steering angle of wheels.

Standard of steering angle:

Inner wheel	**32°25' ± 1°30'**
Outer wheel	**32°00' ± 1°30'**

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.



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 opposite direction by same angle.

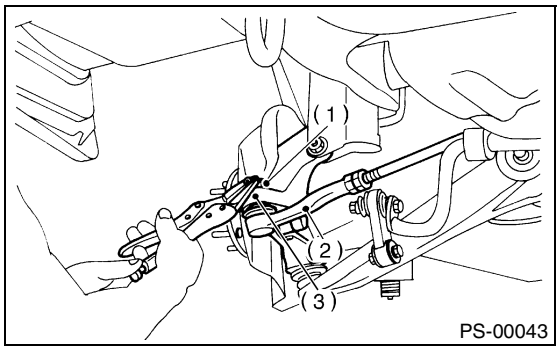
6. Steering Gearbox [RHD MODEL]

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(SOHC)-7, REMOVAL, Front Exhaust Pipe.>

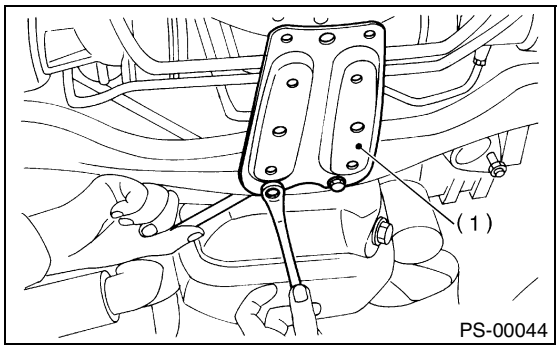
WARNING:
Be careful, the exhaust pipe is hot.

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



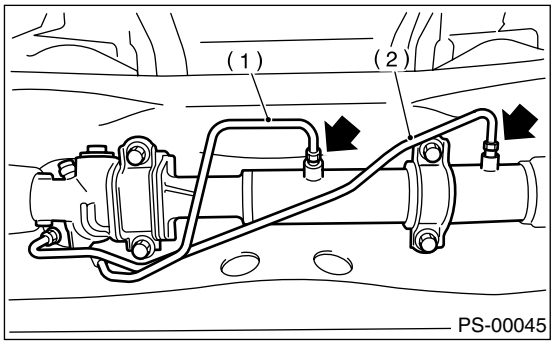
(1) Castle nut
(2) Tie-rod end
(3) Knuckle arm

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



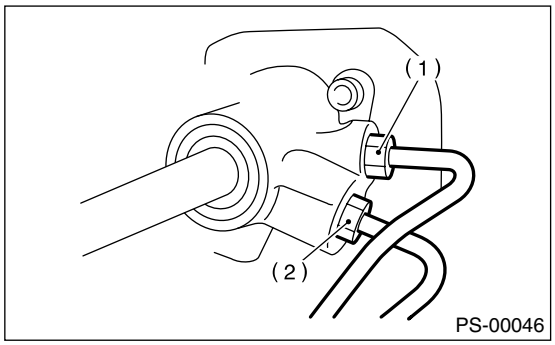
(1) Jack-up plate

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.



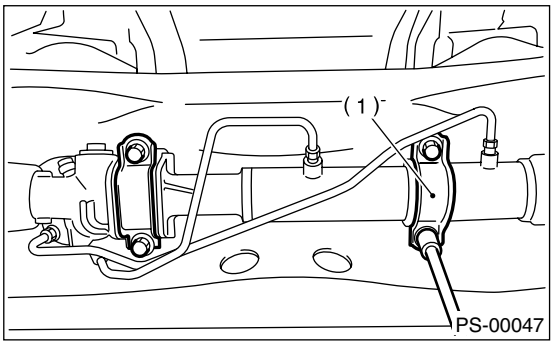
(1) Pipe A
(2) Pipe B

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 gearbox to crossmember, and then remove the gearbox.

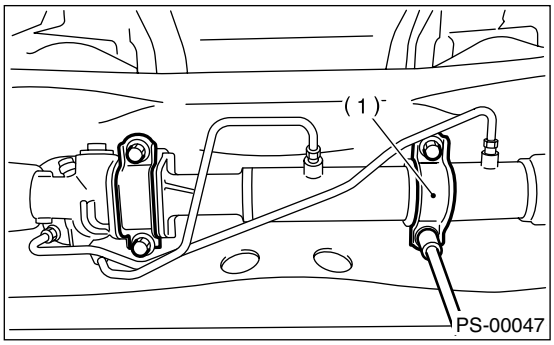


(1) Clamp

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 bolt to specified torque.

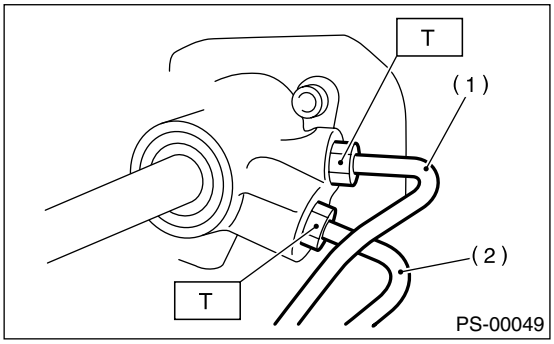
Tightening torque:
60 N·m (6.1 kgf-m, 44.1 ft-lb)



(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)



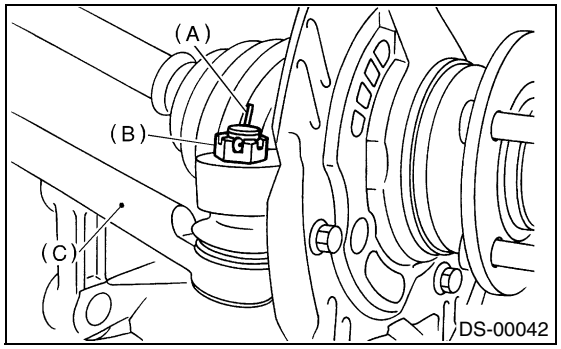
(1) Pipe C
(2) Pipe D

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. Fit the cotter pin into nut, and then bend the pin to lock.

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

CAUTION:
• Tighten to the specified tightening torque, and tighten further within 60° until cotter pin hole is aligned with slot in the nut.
• When connecting, do not hit the cap at bottom of tie-rod end with hammer.



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

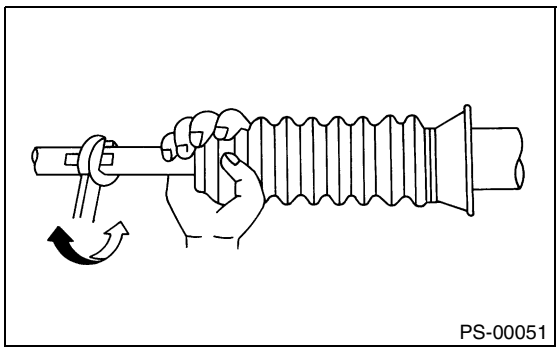
6) Install the front stabilizer to vehicle.
7) Install the front exhaust pipe assembly.
8) Install the sub frame.
9) Install the under cover.
10) Align the center of roll connector. <Ref. to AB-20, ADJUSTMENT, Roll Connector.>
11) Install the steering wheel. <Ref. to PS-23, INSTALLATION, Steering Wheel.>
12) Install the tires.
13) Tighten the wheel nuts to specified torque.

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

14) Connect the battery ground cable to battery.
15) Pour fluid into the oil tank, and bleed air. <Ref. to PS-89, Power Steering Fluid.>
16) Check for fluid leaks.
17) Install the jack-up plate.
18) Lower the vehicle.
19) Check the fluid level in oil tank.
20) 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)

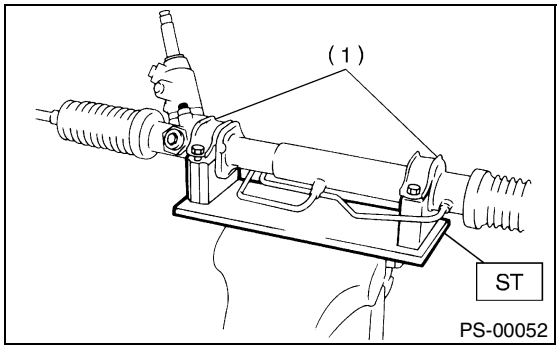
NOTE:
When adjusting the toe-in, hold boot as shown to prevent it from being rotated or twisted. If twisted, straighten it.



C: DISASSEMBLY

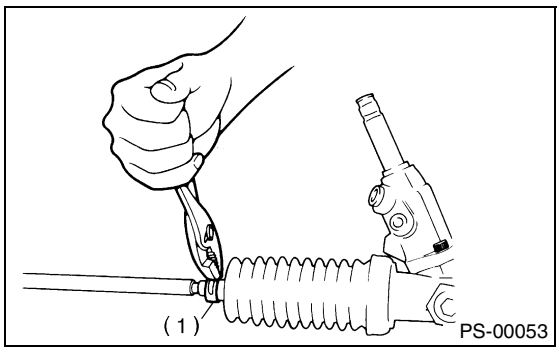
1) Secure the gearbox removed from vehicle in vise using the ST.
ST 926200000 STAND

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



(1) Clamp

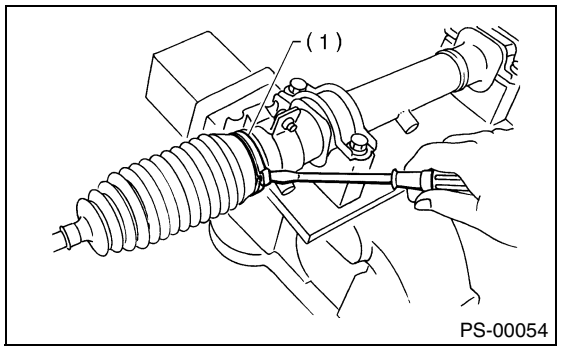
2) Remove the tie-rod end and lock nut from gearbox.
3) Remove the clip on outside of boot using pliers, and then slide the boot to tie-rod end side.



(1) Clip

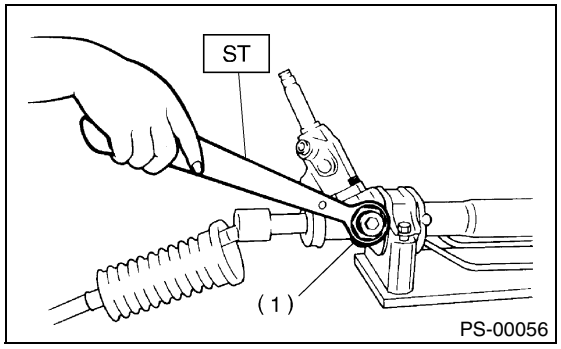
4) Using flat tip screwdriver, remove the band from boot.

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



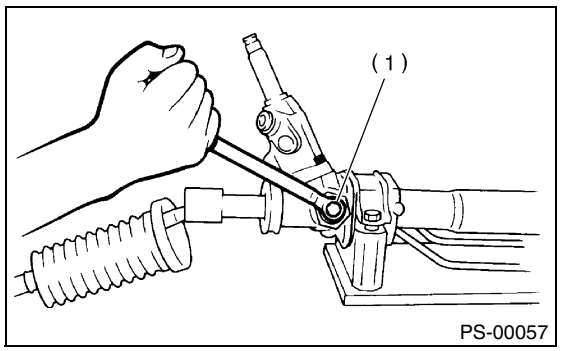
(1) Band

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



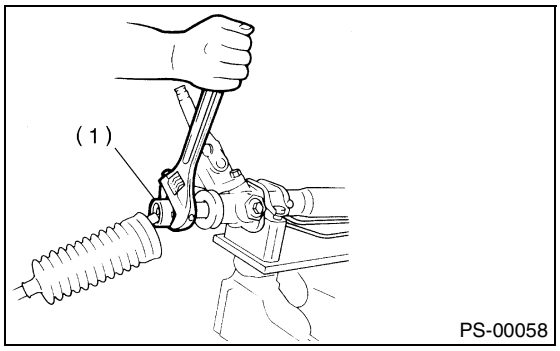
(1) Lock nut

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



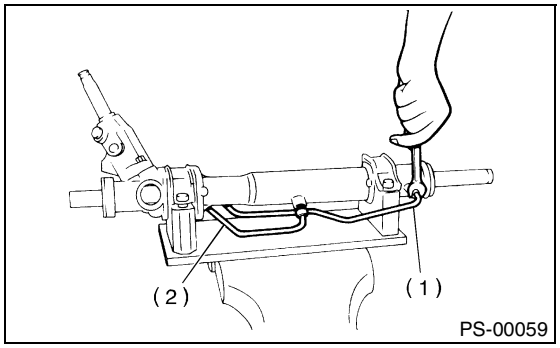
(1) Adjusting screw

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



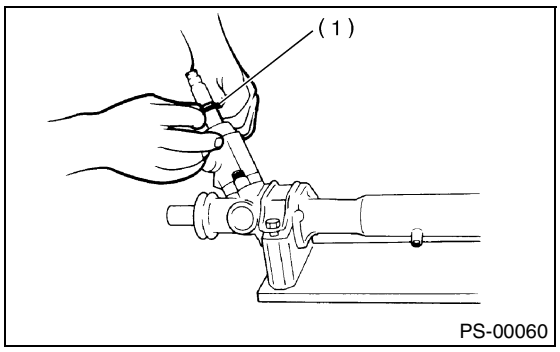
(1) Tie-rod

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.



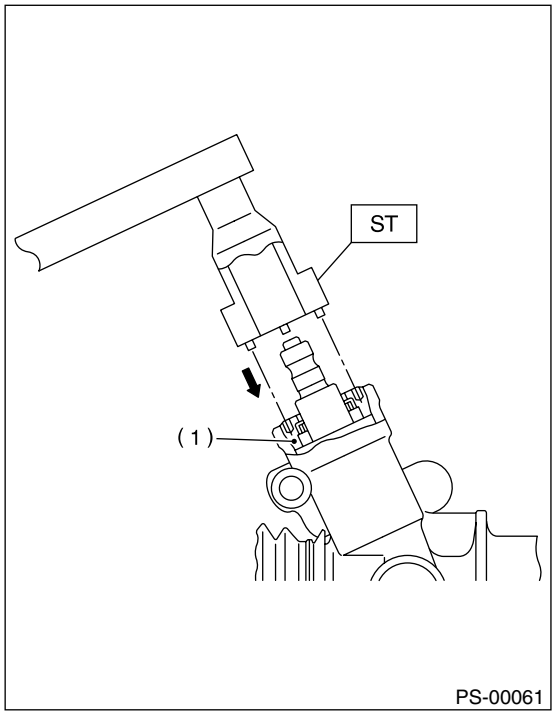
(1) Pipe A
(2) Pipe B

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.



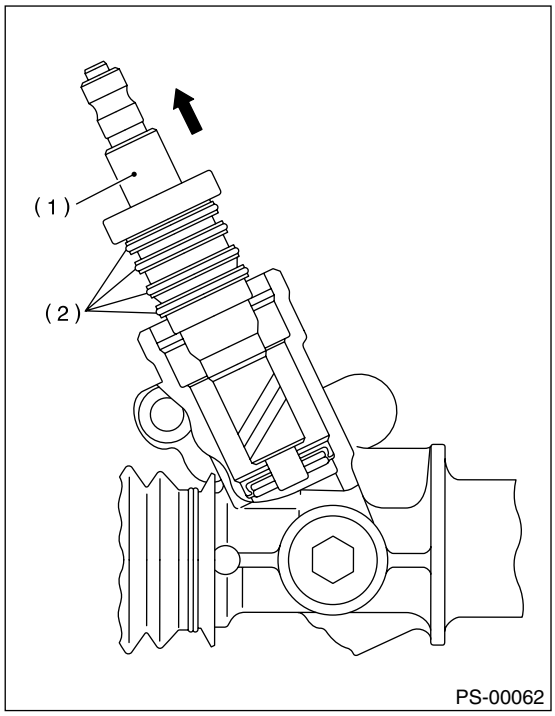
(1) Dust cover

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



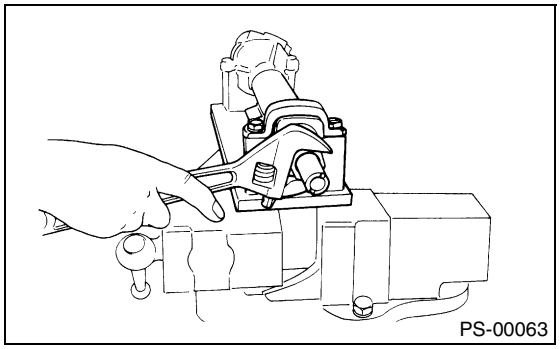
(1) Plug

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



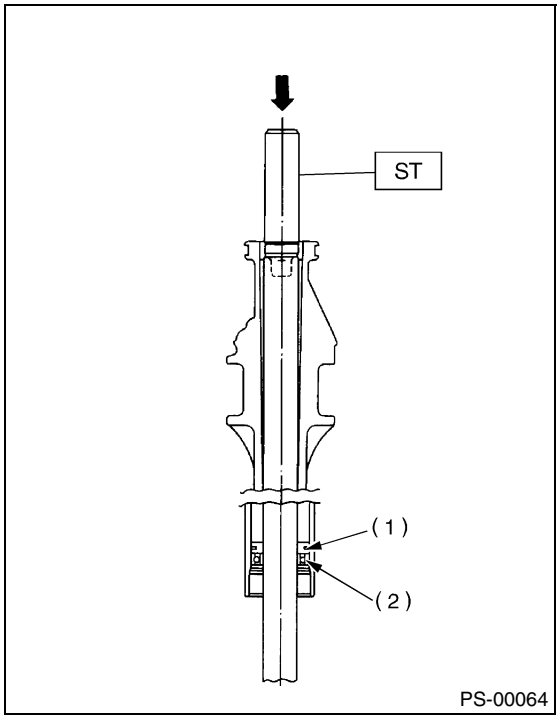
(1) Valve ASSY
(2) Seal ring

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



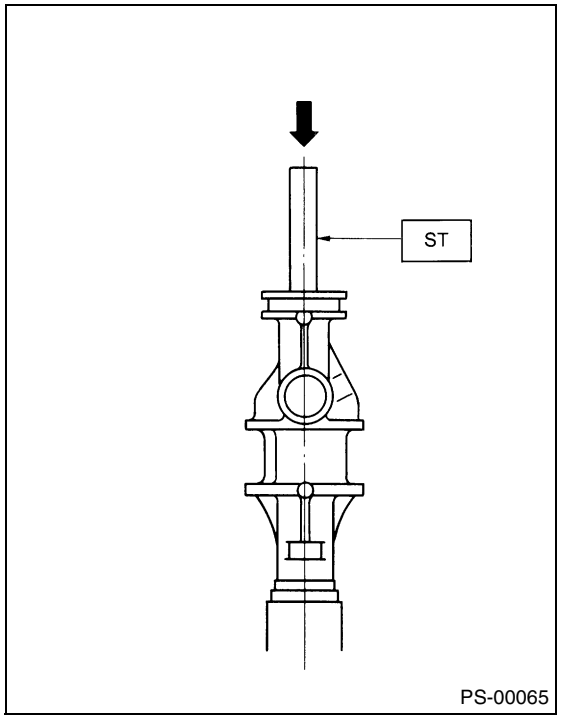
14) Install the ST on valve side of rack and press outer side oil seal out taking care not to contact rack with steering body inner surface.
ST 34099FA030 INSTALLER & REMOVER

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

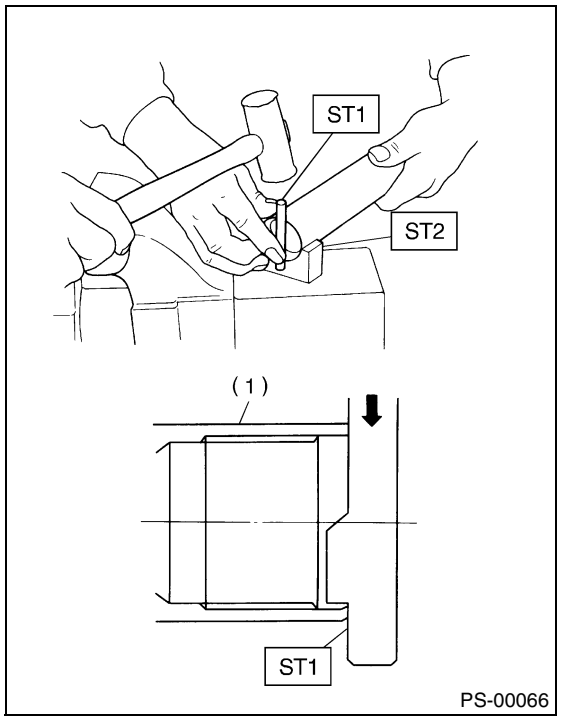


(1) Rack piston
(2) Outer side oil seal

15) Insert the ST from valve side and press back-up ring and oil seal out.
ST 927580000 REMOVER

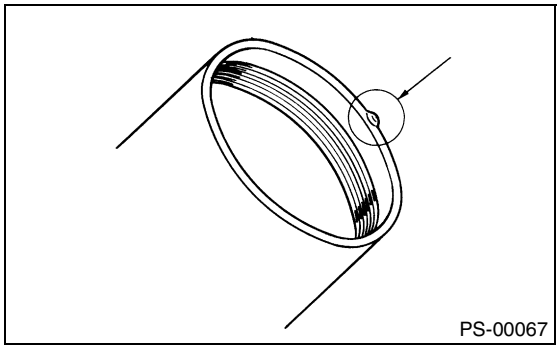


16) Using the ST1 and ST2, repair the cylinder's clinched sections.
ST1 34099FA080 PUNCH
ST2 34099FA070 BASE



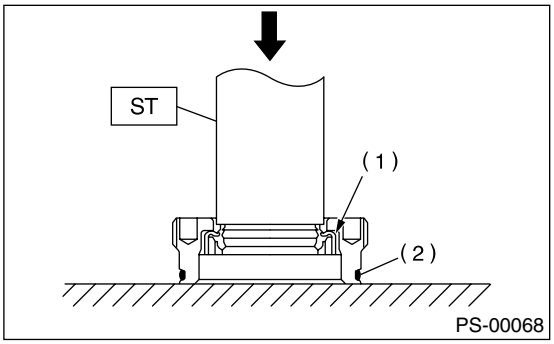
(1) Cylinder

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



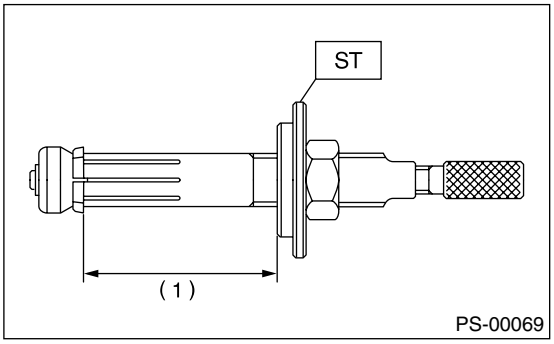
18) Remove the oil seal using ST and press from plug.
ST 34199AE100 PLUG OIL SEAL REMOVER

NOTE:
Do not apply force on the plug edge surface.



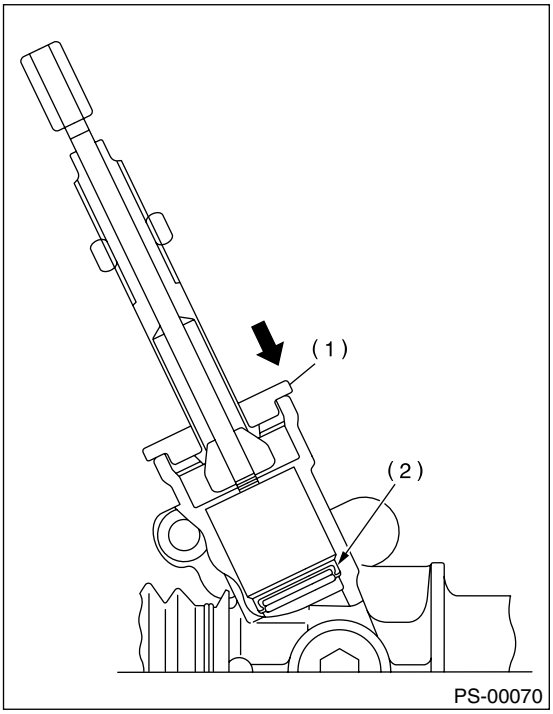
(1) Oil seal
(2) O-ring

19) Set the ST on drawing dimension.
ST 34199AE120 GEARBOX OIL SEAL REMOVER



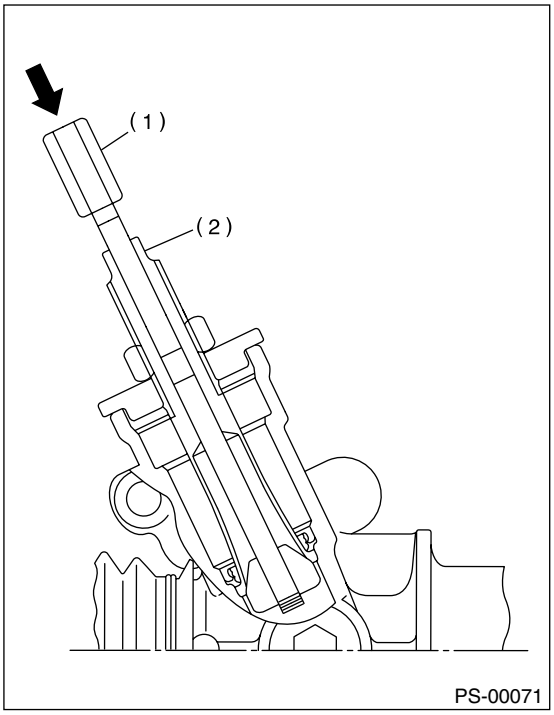
(1) 70 mm (2.76 in)

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



(1) Stopper
(2) Oil seal

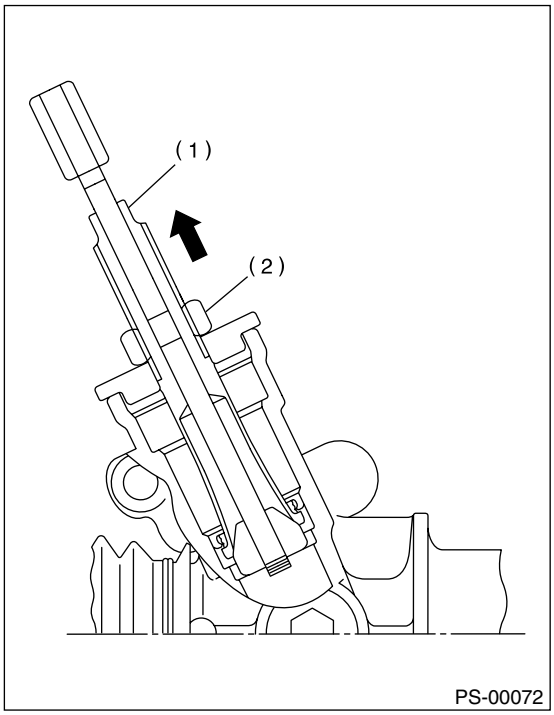
21) By fixing the 2-surface width, press in by rotating the rod and attach to oil seal.



(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.



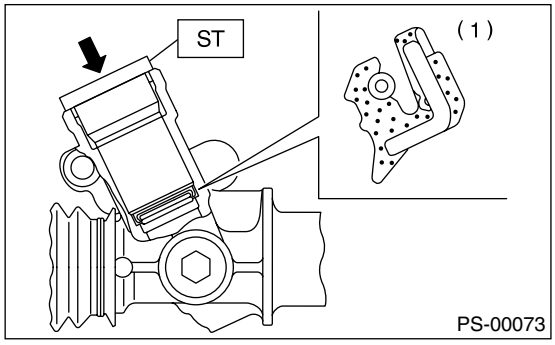
(1) 2-surface width
(2) Nut

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)

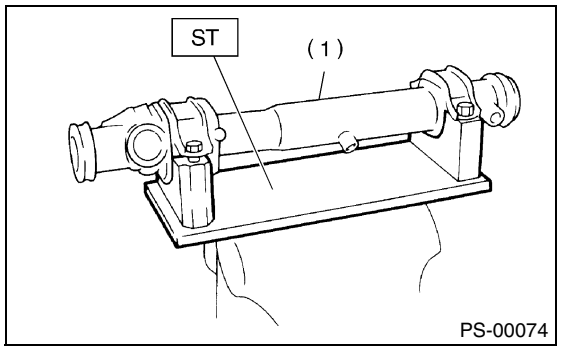
2) Verify the oil seal direction and installation position. Using the ST and press, press fit the oil seal to gear box.
ST 34199AE130 GEARBOX OIL SEAL INSTALLER



(1) Oil seal

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

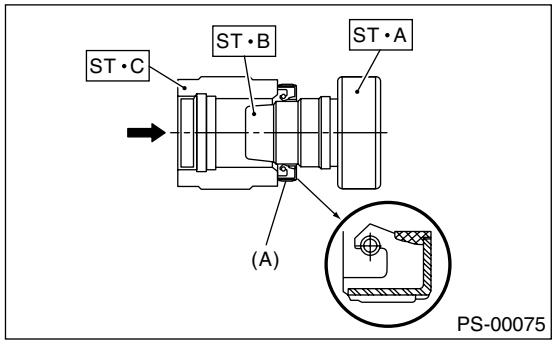
CAUTION:
Ensure the needle bearing is free from defects. If it is faulty, replace the steering body with a new one.



(1) Steering body

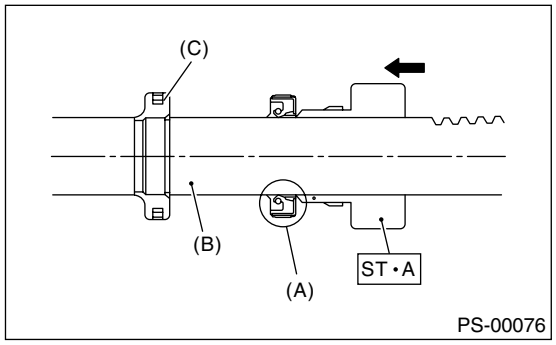
4) Using the ST·B and ST·C, attach the oil seal to ST·A.
ST 927490000 INSTALLER; A, B, C

NOTE:
Face the oil seal in direction shown in the figure.



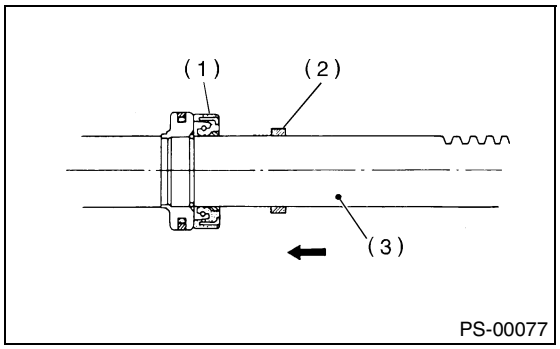
(A) Oil seal

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

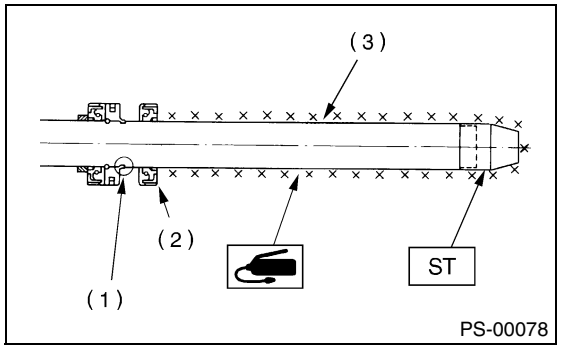
6) Install the back-up ring from gear side of rack.



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

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

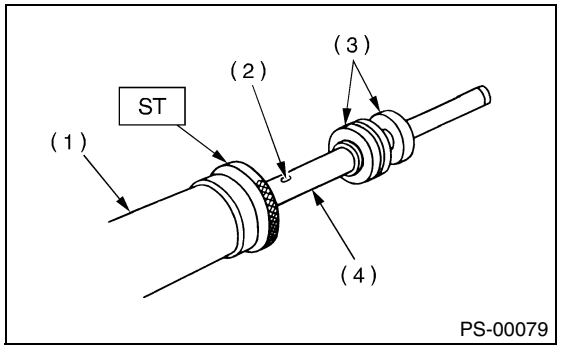
CAUTION:
Be careful not to scratch the oil seal lips with piston's inner ring section.



(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)

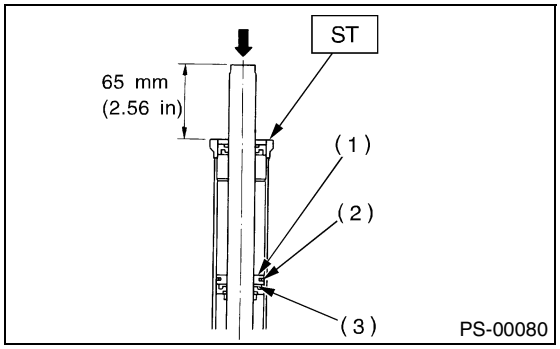
CAUTION:
Do not allow grease to block the air vent hole on rack.



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

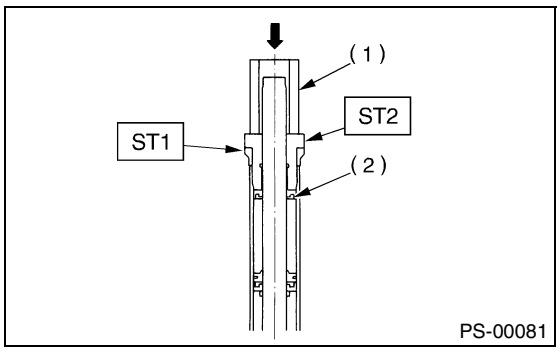
9) Using the press, slowly press the inner side oil seal until distance between ST and end of rack is 65 mm (2.56 in).
ST 34199AE000 GUIDE (Oil seal)

CAUTION:
Ensure the ST's inner wall is free of scratches. Otherwise, it may damage the oil seal during installation.



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

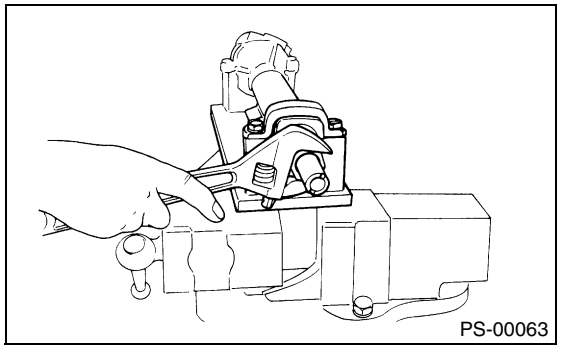
10) Pass the ST2 and pipe through rack and press outer side oil seal until ST1 is in contact with ST2 using press.
ST1 34199AE000 GUIDE (Oil seal)
ST2 34199AE010 INSTALLER (Oil seal)



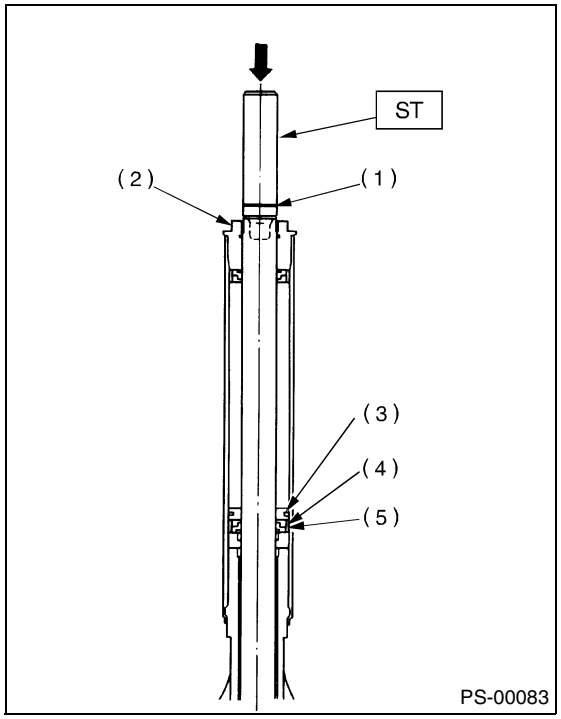
(1) Pipe
(2) Outer side oil seal

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

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



12) Using a press, press the ST until its groove is aligned with end of holder.
ST 34099FA030 INSTALLER & REMOVER

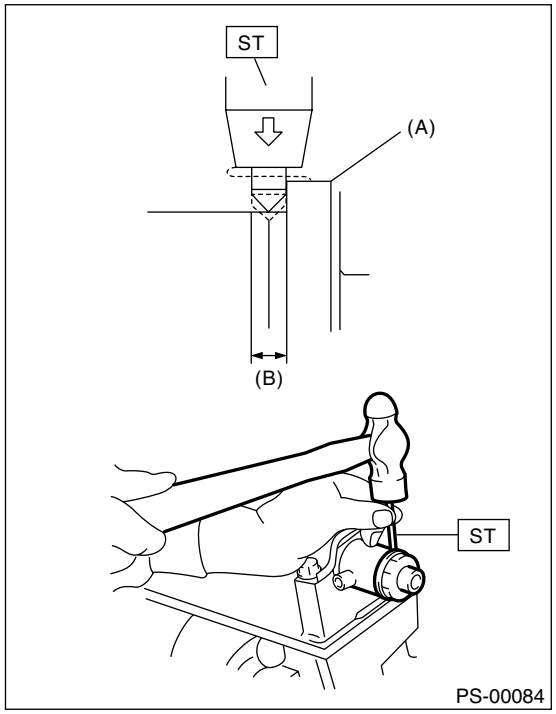


(1) Installer guide
(2) Holder
(3) Rack piston
(4) Oil seal
(5) Back-up ring

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

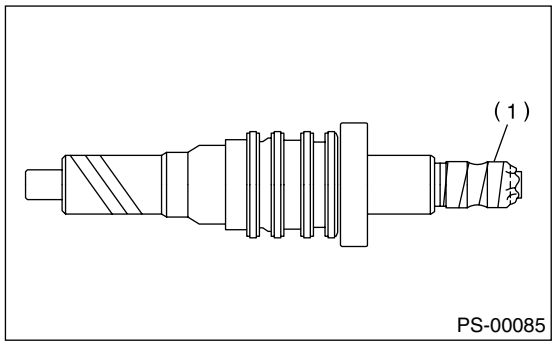
CAUTION:
Be careful not to deform the holder.

ST 34099FA060 PUNCH HOLDER



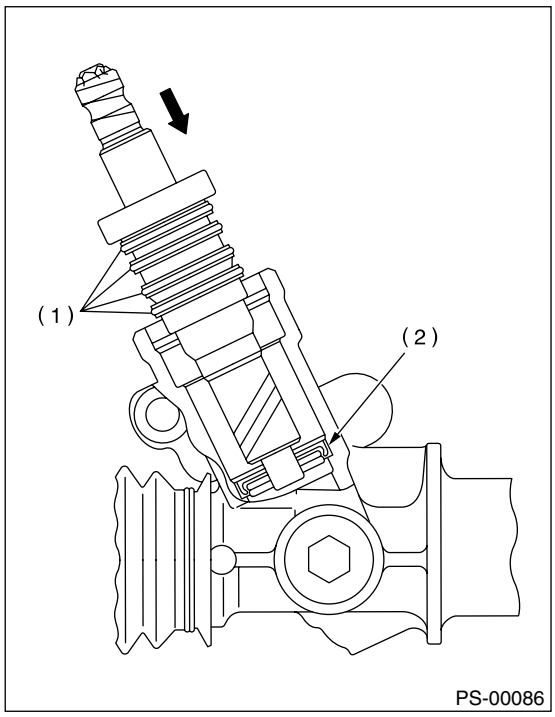
(A) Holder
(B) 3 mm (0.1 in)

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



(1) Vinyl tape

15) 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.

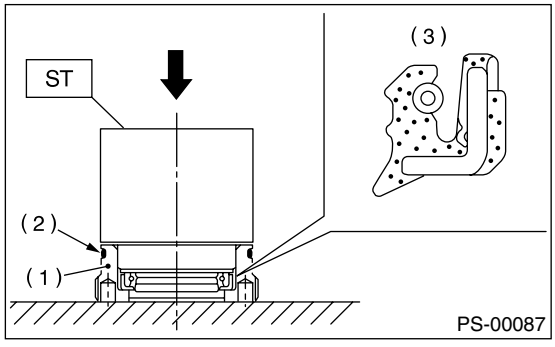


(1) Seal ring
(2) Oil seal

16) 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

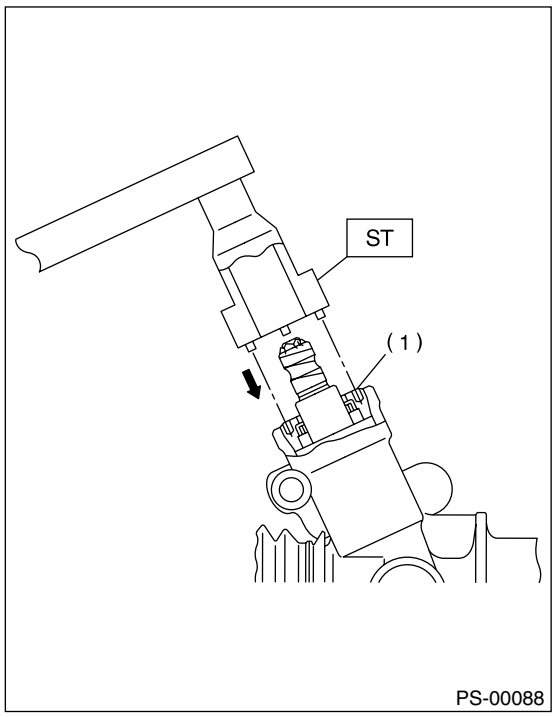
CAUTION:
Pay attention to the oil seal direction, and attaching position.



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

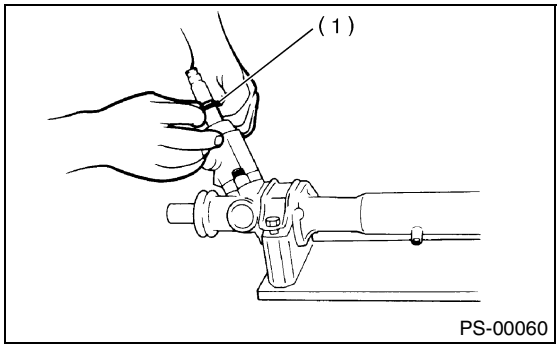
17) Using the ST, install plug.
ST 34199AE090 PLUG WRENCH

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



(1) Plug

18) Install the dust cover. Remove the vinyl tape.

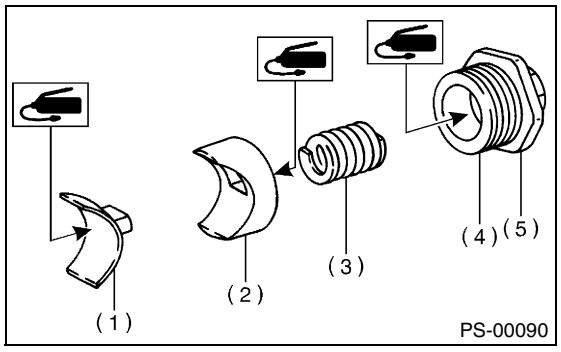


(1) Dust cover

19) 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.

20) Apply a coat of grease to the sliding surface of seat pad, sleeve and seating surface of spring, and then insert sleeve into steering body.
Charge the adjusting screw with grease, and then insert the spring into adjusting screw and install on steering body.



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

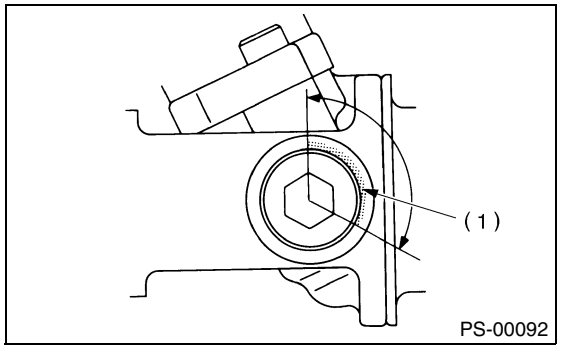
21) Tighten the adjusting screw to specified torque.

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

NOTE:
Tighten to the specified tightening torque, and then loosen by 25°.

22) Remove the tie-rod.
23) Verify that play is within specified value. <Ref. to PS-62, SERVICE LIMIT, INSPECTION, Steering Gearbox [RHD MODEL].>
24) Loosen the adjusting screw, and then apply liquid gasket to at least 1/3 of the entire perimeter of adjusting screw thread.

Liquid gasket:
THREE BOND 1141



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

25) Tighten the adjusting screw.

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

NOTE:
Tighten to the specified tightening torque, and then loosen by 25°.

26) 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.

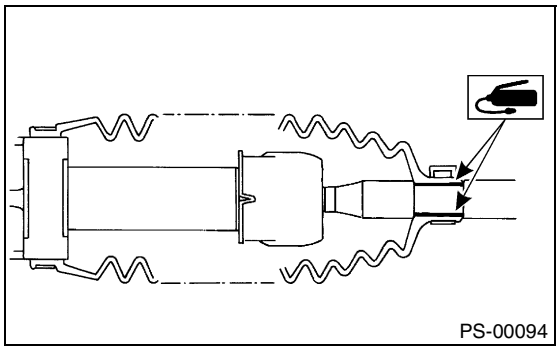
27) Install the tie-rod into rack.

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

NOTE:
Check the mating face of rack and tie-rod for foriegn material, dirt, dust and etc.
If required, clean the mating face.

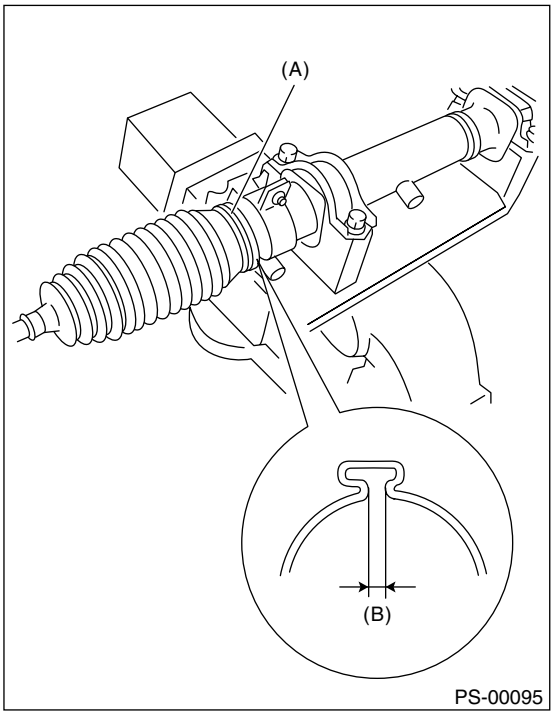
28) Apply a coat of grease to the tie-rod groove, and then install the boot to housing.

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



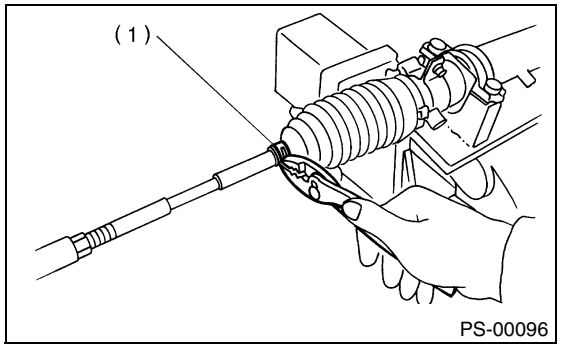
29) Caulk the boot so the space inside boot band caulking portion becomes 2 mm (0.08 in) or less.

NOTE:
Use a new boot band.



(A) Boot band
(B) Less than 2mm (0.08 in)

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

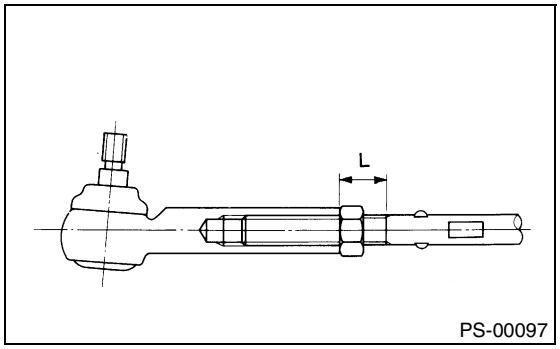


(1) Clip

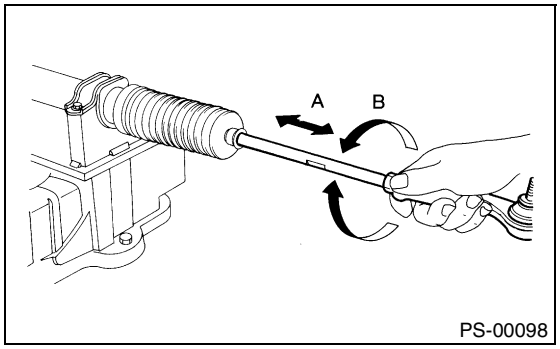
31) After installing, check the boot end is positioned into groove on tie-rod.

32) 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
31.2 mm (1.23 in)



33) 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.



34) Remove the gearbox from ST.
ST 926200000 STAND

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.

2. SERVICE LIMIT

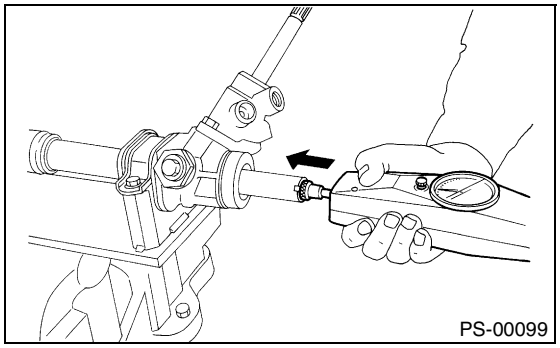
Make a measurement as follows. If it exceeds the specified service limit, adjust or replace.

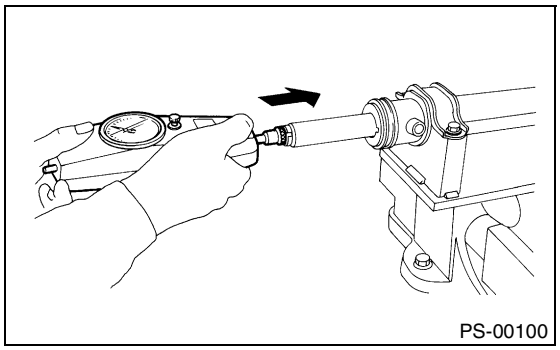
NOTE:
When making a measurement, vise gearbox by using ST. Never vise the gearbox by inserting aluminum plates, etc. between vise and gearbox.

ST 926200000 STAND

Sliding resistance of rack shaft:

Service limit
400 N (41 kgf, 90 lb) or less



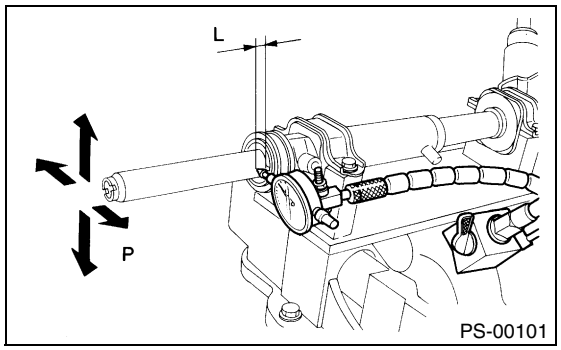


3. RACK SHAFT PLAY IN RADIAL DIRECTION

Left-turn steering:

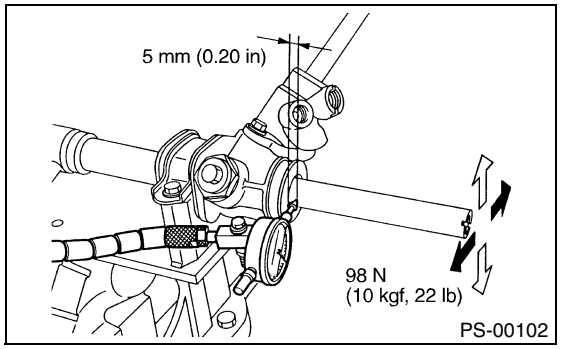
Service limit
0.19 mm (0.0075 in) or less

On condition
L: 5 mm (0.20 in)
P: 98 N (10 kgf, 22 lb)



Right-turn steering:

Service limit
Direction ⇦⇨
0.3 mm (0.012 in) or less
Direction ⬅➡
0.19 mm (0.0075 in) or less

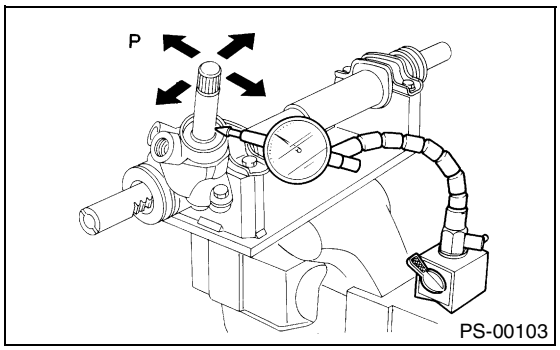


4. INPUT SHAFT PLAY

In radial direction:

Service limit
0.18 mm (0.0071 in) or less

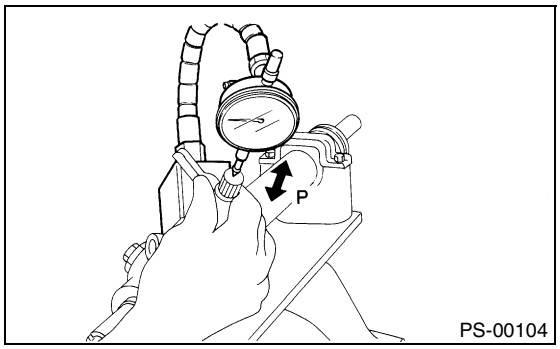
On condition
P: 98 N (10 kgf, 22 lb)



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)

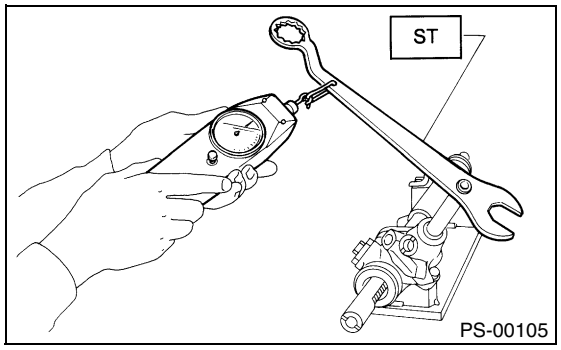


5. TURNING RESISTANCE OF GEARBOX

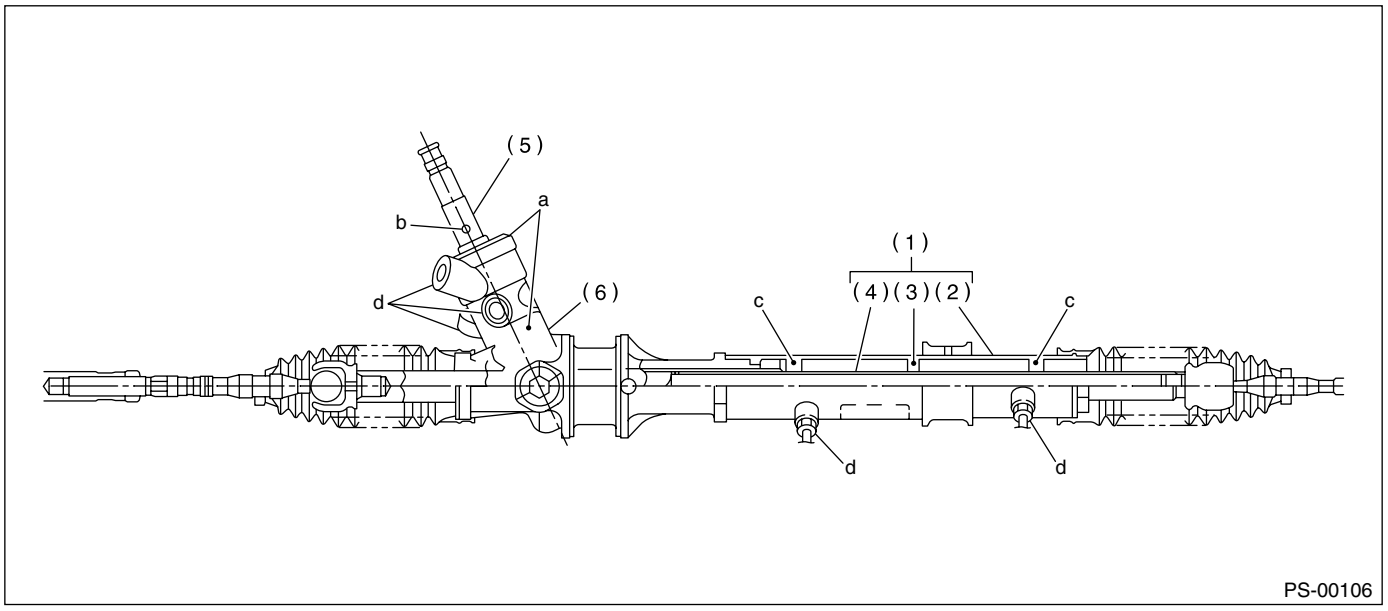
Using the ST, measure gearbox turning resistance.
ST 34099PA100 SPANNER

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



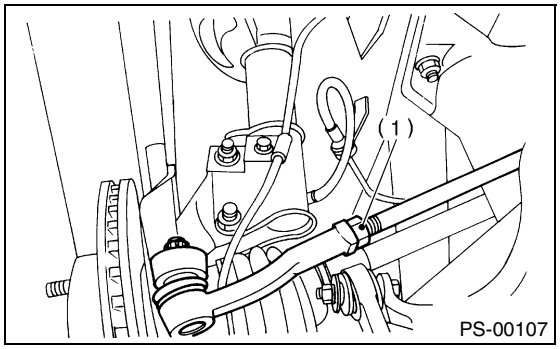
(1) Power cylinder
(2) Cylinder
(3) Rack piston
(4) Rack
(5) Input shaft
(6) Valve housing

1) 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.
2) Inspect leakage from “a”
The oil seal is damaged. Replace the valve assembly with a new one.
3) Inspect leakage from “b”
The torsion bar O-ring is damaged. Replace the valve assembly with a new one.
4) Inspect leakage from “c”
The oil seal is damaged. Replace the oil seal with a new one.
5) 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-11, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

Standard of front toe:
IN 3 — OUT 1 mm (IN 0.12 — OUT 0.039 in)



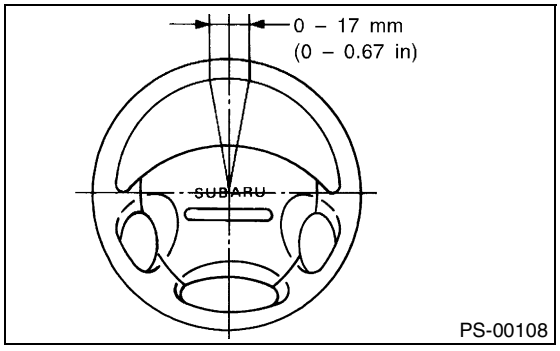
(1) Lock nut

2) Adjust the steering angle of wheels. <Ref. to FS-11, STEERING ANGLE, INSPECTION, Wheel Alignment.>

Standard of steering angle:

Inner wheel	**32°25'±1°30'**
Outer wheel	**32°00'±1°30'**

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.



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.