POWER ASSISTED SYSTEM (POWER STEERING)

PS

SPECIFICATION

1. HYDRAULIC TYPE

Model			STI model
Whole system	Minimum turning radius: m (ft)		5.5 (18.05)
	Steering angle	Inner wheel	36.3°±1.5°
		Outer wheel	32.0°±1.5°
	Steering wheel diameter: mm (in)		369 (14.53)
	Lock-to-lock revolution number		2.5
Gearbox	Type		Rack & pinion type Integral type
	Backlash		0 (automatic adjusting)
	Valve type		Rotary valve
Power steering pump	Type		Vane pump
	Oil tank		Installed on body
	Specific discharge rate: cm^3 (cu in)/rev.		8.5 (0.519)
	Relief pressure: kPa (kgf/cm^2, psi)		8,300 — 9,000 (85 — 92, 1,203 — 1,305)
	Hydraulic fluid control		Engine speed sensitive
	Operation flow rate: L (US qt, Imp qt)		1,000 r/min: 7.5 (7.9, 6.6) 3,000 r/min: 7.3 (7.7, 6.4)
	Revolution speed range: r/min		560 — 9,600
	Direction of rotation		Clockwise
Power steering fluid	Description		SUBARU ATF or ATF DEXRON III
	Capacity: L (US qt, Imp qt)		Oil tank: 0.2 (0.2, 0.2)
			Whole system: 0.7 (0.7, 0.6)

Steering wheel

Free play:	mm (in)	17 (0.67)

Column assembly - steering

Clearance: Between steering wheel and cover assembly - column	mm (in)	4 — 6 (0.16 — 0.24)

Steering gearbox

Sliding resistance:	N (kgf, lbf)	343 (35, 77) or less Difference between right and left sliding resistance: 20% or less

Rack shaft play in radial direction: mm (in)	Right-turn steering	Both amplitudes: 0.4 (0.016) or less
	Left-turn steering	Play in the horizontal direction: 0.6 (0.024) or less (both amplitudes) Play in the vertical direction: 0.4 (0.016) or less (both amplitudes)
Input shaft play: mm (in)	In radial direction	Both amplitudes: 0.26 (0.0102) or less
	In axial direction	Without play
Rotational resistance: N (kgf, lbf)		Maximum allowable value: 21 (2.14, 4.7) or less Difference between right and left rotating resistance: 20% or less

Power steering oil pump

Pulley shaft	Lateral play: mm (in)	0.2 (0.008) or less
	Axial play: mm (in)	0.9 (0.035) or less
Pulley	Groove runout: mm (in)	1 (0.039) or less
	Rotational resistance: N (kgf, lbf)	9.22 (0.94, 2.07) or less
Regular pressure (unloaded): kPa (kgf/cm^2, psi)		981 (10, 142) or less

Steering effort (with power steering assist)

At standstill on paved road with engine idling: N (kgf, lbf)	31 (3.16, 7) or less
At standstill on paved road with engine stalled: N (kgf, lbf)	294.2 (29.9, 66.2) or less

Recommended power steering fluid

SUBARU ATF or ATF DEXRON III

2. ELECTRIC TYPE

Model			WRX model	
			17-inch wheel	18-inch wheel
Whole system	Minimum turning radius: m (ft)		5.4 (17.72)	5.5 (18.05)
	Steering angle	Inner wheel	37.5°±1.5°	36.4°±1.5°
		Outer wheel	32.9°±1.5°	32.0°±1.5°
	Steering wheel diameter: mm (in)		369 (14.53)	
	Lock-to-lock revolution number		2.8	2.7
Gearbox	Type		Rack & pinion type	
	Backlash		0 (automatic adjusting)	
Motor (Temperature 20°C (68°F))	Rated voltage: V		13.5	
	Rated torque: N·m (kgf-m, ft-lb)		5.96 (0.61, 4.4)	

	Rated revolution speed:	r/min	760
	Rated current:	A	77
	Rated output:	W	491

Steering wheel

Free play:	mm (in)	17 (0.67) or less

Column assembly - steering

Clearance: Between steering wheel and cover assembly - column	mm (in)	4 — 6 (0.16 — 0.24)

Steering gearbox

Sliding resistance:	N (kgf, lbf)	360 (37, 81) or less Difference between right and left sliding resistance: 20% or less
Rack shaft play in radial direction: mm (in)	Right-turn steering	Both amplitudes: 0.6 (0.024) or less
	Left-turn steering	Both amplitudes: 0.6 (0.024) or less
Input shaft play: mm (in)	In radial direction	Both amplitudes: 0.6 (0.024) or less
	In axial direction	0.27 (0.0106) or less
Rotational resistance:	N (kgf, lbf)	Maximum allowable value: 18 (1.8, 4) or less Difference between right and left sliding resistance: 20% or less

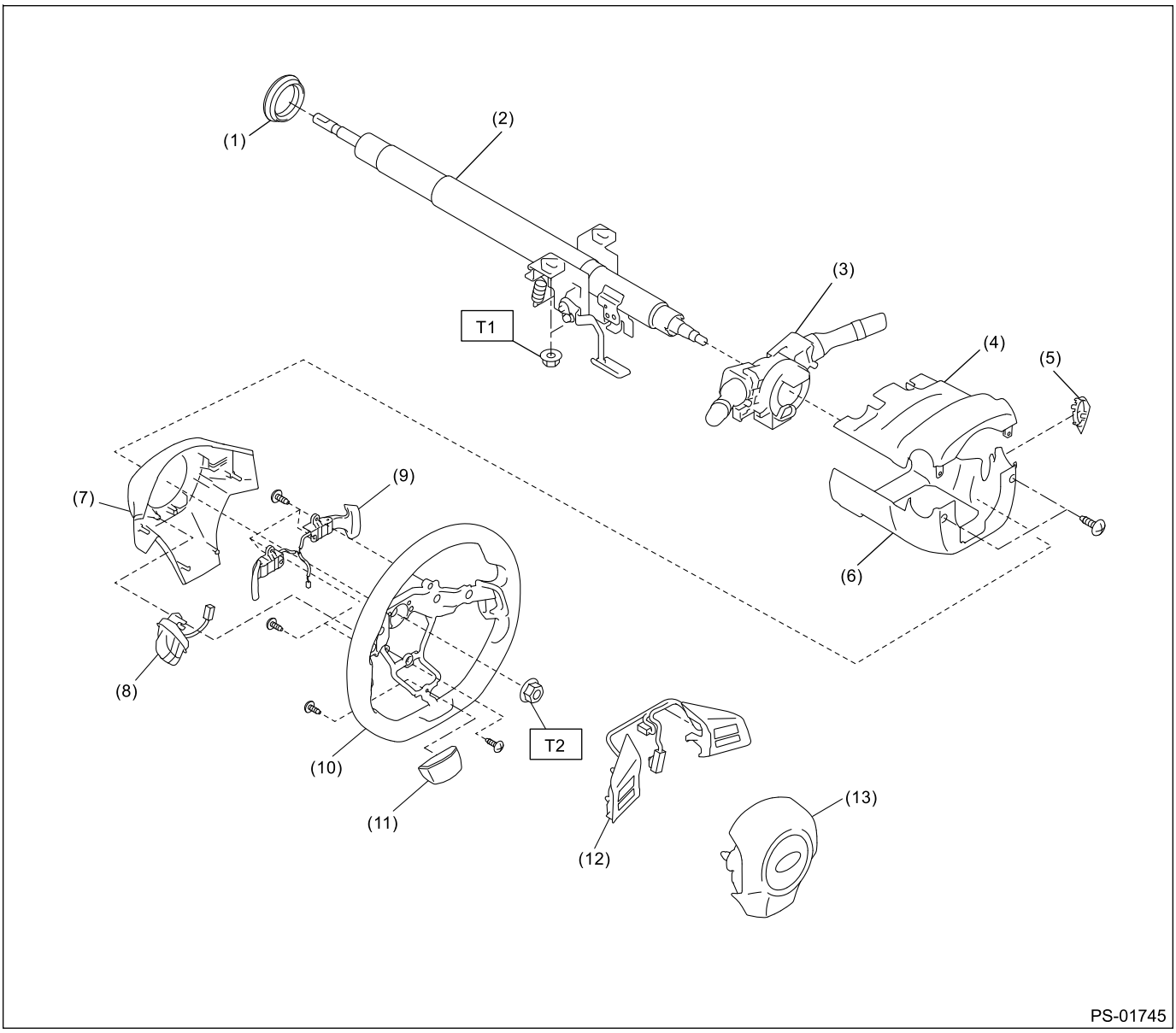
Steering effort (with power steering assist)

At standstill on paved road with engine idling:	N (kgf, lbf)	31 (3.2, 7) or less
At standstill on paved road with engine stalled:	N (kgf, lbf)	294.2 (30, 66.2) or less

POWER ASSISTED SYSTEM (POWER STEERING) > General Description

COMPONENT

1. STEERING WHEEL AND COLUMN

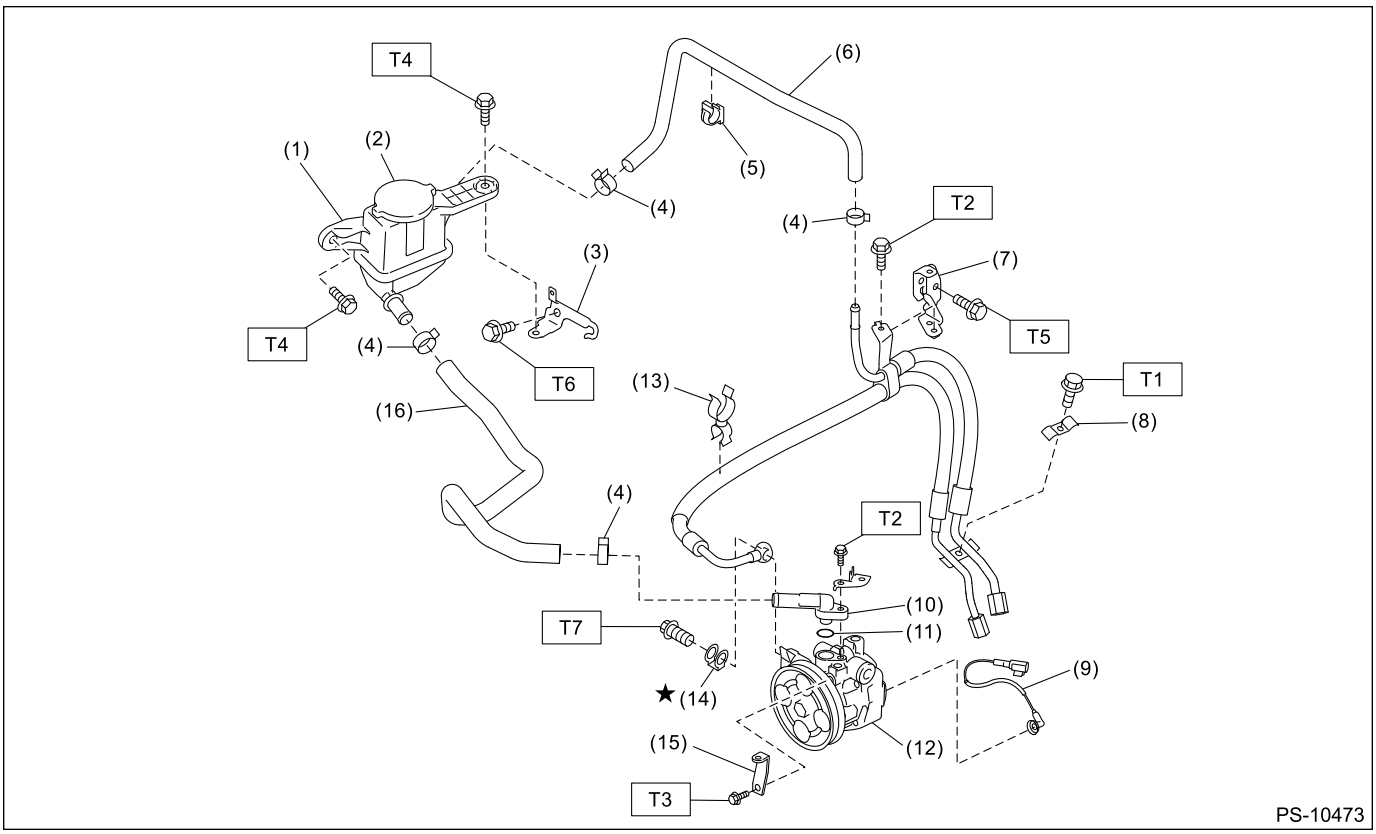


(1) Bushing
(2) Column assembly - steering
(3) Switch ASSY - combination
(4) Cover ASSY - column UPR
(5) Cap - key cylinder (model with keyless access with push button start)
(6) Cover ASSY - column LWR
(7) Cover - steering wheel LWR
(8) MID switch (multi information display switch)
(9) Paddle shift
(10) Steering wheel
(11) Cover - spoke
(12) Satellite switch
(13) Airbag module

Tightening torque: N·m (kgf-m, ft-lb)

T1: 20 (2, 14.8)
T2: 39 (4, 28.8)

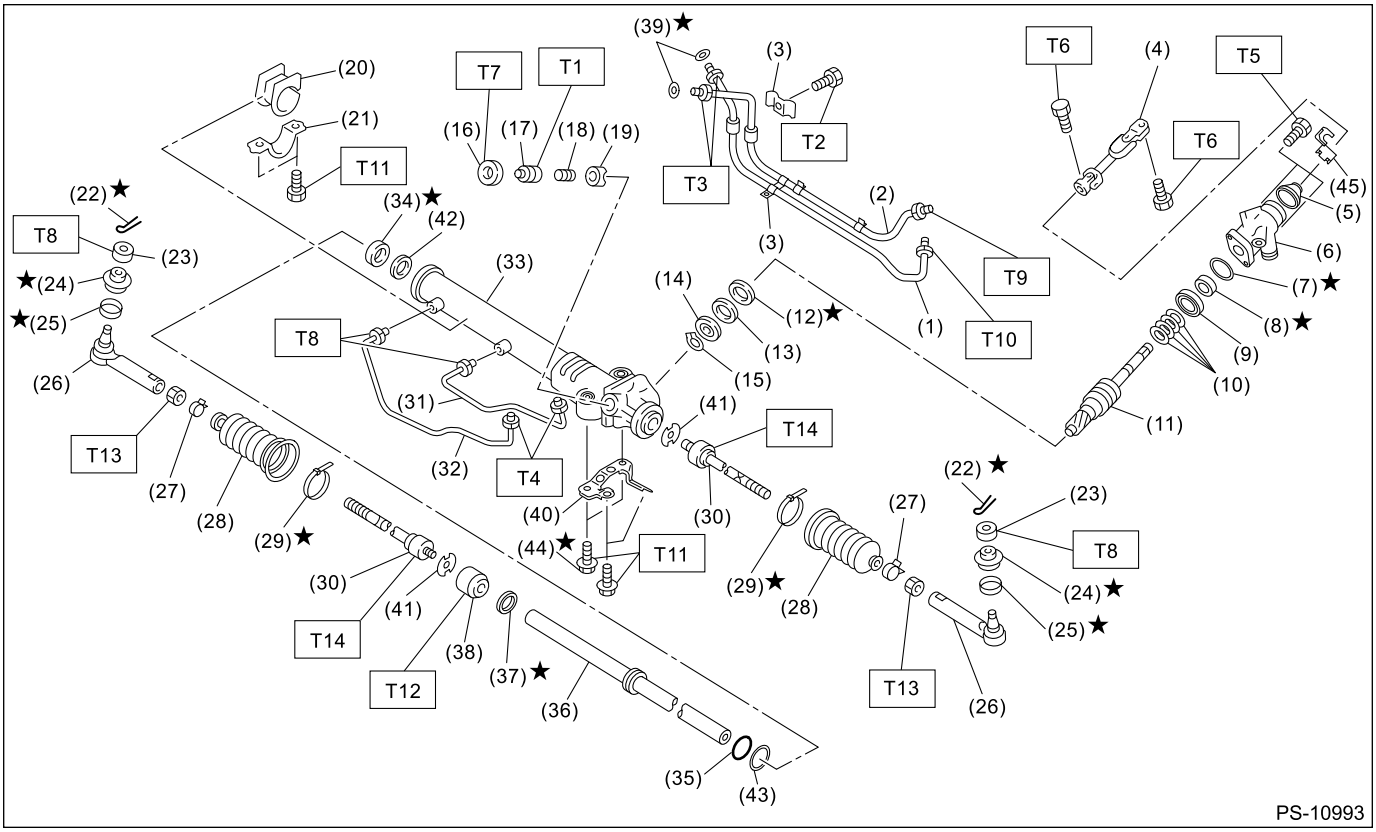
2. HOSE AND TANK



(1) Reservoir tank	(10) Suction connector	***Tightening torque: N·m (kgf-m, ft-lb)***
(2) Cap	(11) O-ring	***T1: 7.5 (0.8, 5.5)***
(3) Tank bracket	(12) Oil pump	***T2: 10 (1, 7.4)***
(4) Clip	(13) Clip	***T3: 11 (1.1, 8.1)***
(5) Hose clip	(14) Eyebolt gasket	***T4: 13 (1.3, 9.6)***
(6) Return hose	(15) Bracket - belt cover	***T5: 18 (1.8, 13.3)***
(7) Bracket - hose	(16) Hose - suction	***T6: 33 (3.4, 24.3)***
(8) Clamp E		***T7: 40 (4.1, 29.5)***
(9) Switch - harness		

3. STEERING GEARBOX

- Hydraulic type

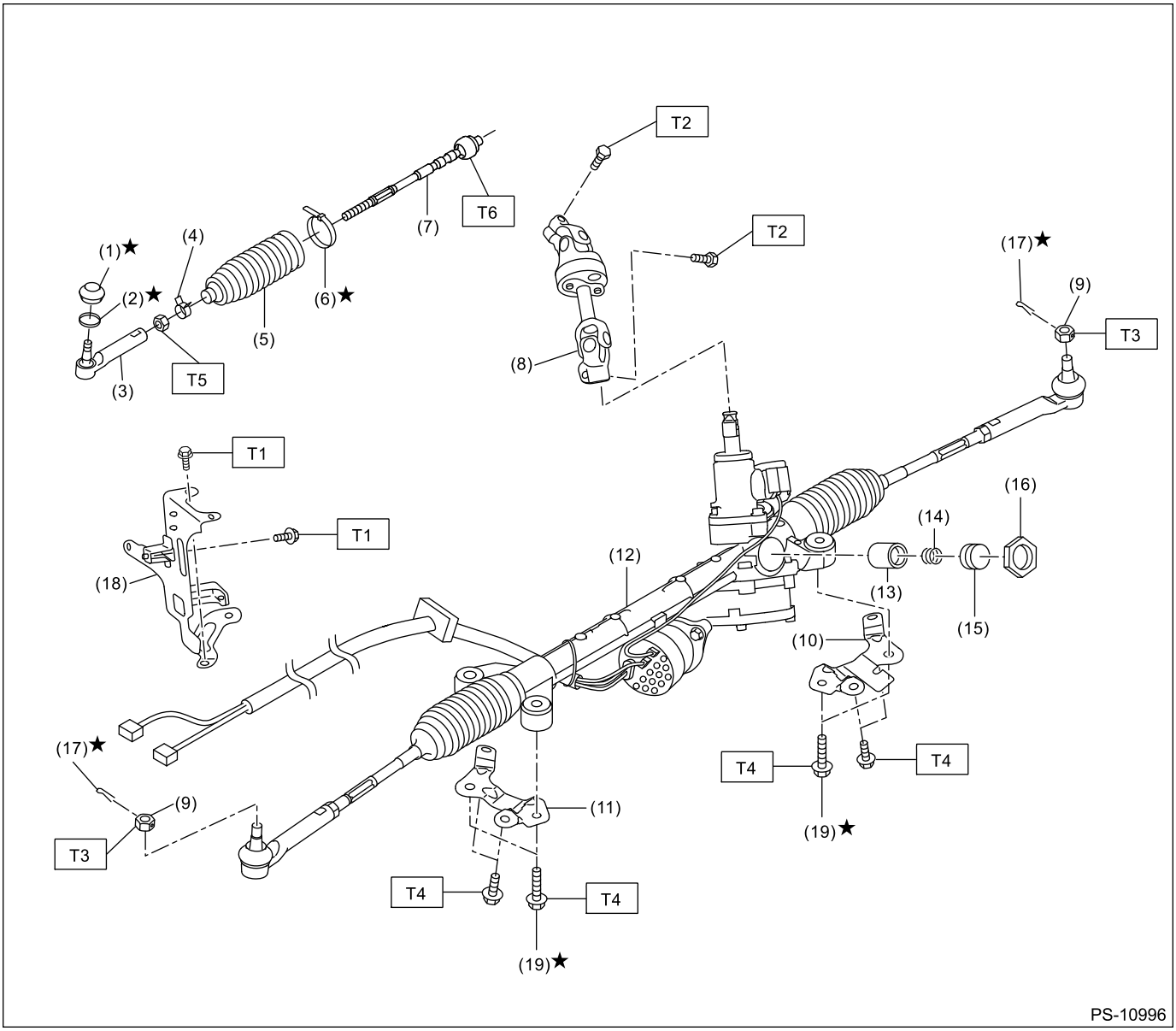


(1) Feed pipe
(2) Return pipe
(3) Clamp plate
(4) Universal joint
(5) Dust seal
(6) Valve housing
(7) O-ring
(8) Oil seal
(9) Bushing
(10) Seal ring
(11) Pinion & valve ASSY
(12) Oil seal
(13) Back-up washer
(14) Ball bearing
(15) Snap ring
(16) Lock nut
(17) Adjusting screw
(18) Spring
(19) Sleeve
(20) Adapter
(21) Clamp
(22) Cotter pin
(23) Castle nut
(24) Dust cover
(25) Clip
(26) Tie-rod end
(27) Clip
(28) Boot
(29) Band
(30) Tie-rod
(31) Pipe B
(32) Pipe A
(33) Steering body
(34) Oil seal
(35) Piston seal ring
(36) Rack
(37) Oil seal
(38) Holder
(39) O-ring
(40) Stiffener
(41) Lock washer
(42) Back-up ring
(43) O-ring
(44) Flange bolt
(45) Guide chip

Tightening torque: N·m (kgf-m, ft-lb)

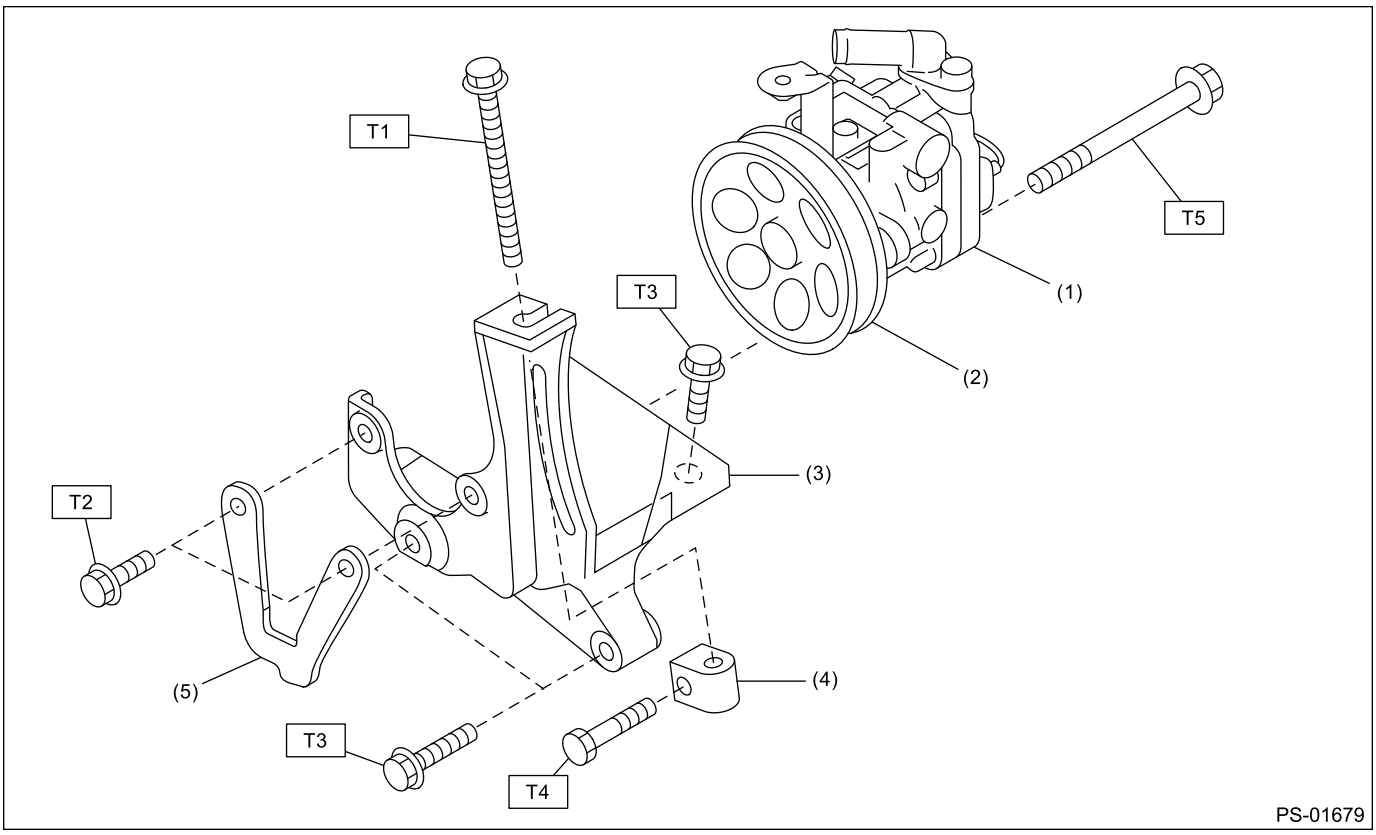
T1: Tighten to 5.9 (0.6, 4.4), and loosen by 5 degrees.
T2: 9 (0.9, 6.6)
T3: 15 (1.5, 11.1)
T4: 17 (1.7, 12.5)
T5: 20 (2, 14.8)
T6: 24 (2.4, 17.7)
T7: 25 (2.5, 18.4)
T8: 27 (2.8, 19.9)
T9: 29 (3, 21.4)
T10: 37 (3.8, 27.3)
T11: 60 (6.1, 44.3)
T12: 70 (7.1, 51.6)
T13: 85 (8.7, 62.7)
T14: 93 (9.5, 68.6)

- Electric type



(1) Dust seal	(10) Stiffener LH	(19) Flange bolt
(2) Clip - boot tie-rod end	(11) Stiffener RH	
(3) Tie-rod end	(12) Steering gearbox ASSY	***Tightening torque: N·m (kgf-m, ft-lb)***
(4) Clip - boot tie-rod	(13) Pad - pressure	***T1: 7.5 (0.8, 5.5)***
(5) Boot - steering gearbox	(14) Spring - gearbox	***T2: 24 (2.4, 17.7)***
(6) Band - boot	(15) Adjusting screw	***T3: 27 (2.8, 19.9)***
(7) Tie-rod	(16) Lock nut	***T4: 60 (6.1, 44.3)***
(8) Universal joint ASSY - steering	(17) Cotter pin	***T5: 85 (8.7, 62.7)***
(9) Castle nut	(18) Bracket - harness	***T6: 90 (9.2, 66.4)***

4. OIL PUMP



(1) Oil pump	(4) Belt tension nut	***Tightening torque: N·m (kgf-m, ft-lb)***
(2) Pulley	(5) Washer plate	***T1: 8 (0.8, 5.9)***
(3) Bracket		***T2: 16 (1.6, 11.8)***
		T3: 22 (2.2, 16.2)
		T4: 25 (2.5, 18.4)
		T5: 48 (4.9, 35.4)

POWER ASSISTED SYSTEM (POWER STEERING) > General Description

CAUTION

- When performing any work, always wear work clothes, a work cap and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Some vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine grease, the recommended or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Do not secure a part in a vise directly. Place cushioning materials such as wood blocks, aluminum plates, or waste cloth between the part and the vise.

- When removing, installing or replacing the VDCCM&H/U, VDCCM&H/U bracket, electronic power steering gearbox, steering wheel or steering angle sensor (steering roll connector), perform “VSC(VDC) Centering Mode” of the VDC. Ref. to VEHICLE DYNAMICS CONTROL (VDC)>VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)>ADJUSTMENT > VDC SENSOR MIDPOINT SETTING MODE.
- When the wheel alignment has been adjusted, perform the following adjustment.
  - Lane keep assist learning value clear (model with EyeSight): Ref. to EyeSight (DIAGNOSTICS)>Clear Active Lane Keep System Learning Value>OPERATION.
  - VDC sensor midpoint setting mode: Ref. to VEHICLE DYNAMICS CONTROL (VDC)>VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)>ADJUSTMENT.

POWER ASSISTED SYSTEM (POWER STEERING) > General Description

PREPARATION TOOL

1. SPECIAL TOOL

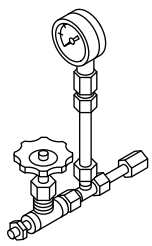
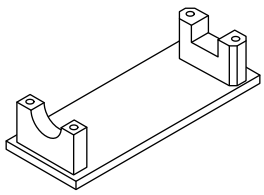
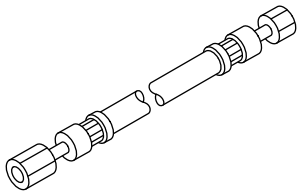
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-925711000	925711000	PRESSURE GAUGE	Used for measuring oil pressure.
 ST-926200000	926200000	STAND	• Used when inspecting characteristic of gearbox assembly and disassembling it. • Used together with BOSS D (34199AG000).
 ST34099AC010	34099AC010	ADAPTER HOSE A	Used together with PRESSURE GAUGE (925711000).

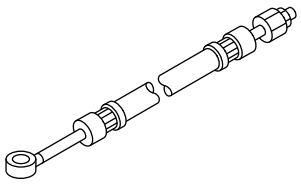
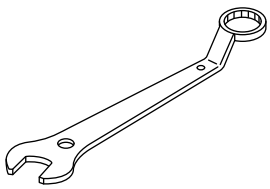
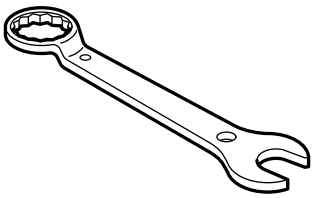
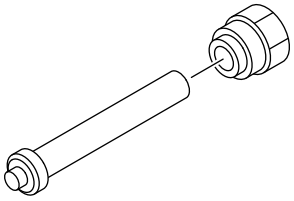
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099AC020	34099AC020	ADAPTER HOSE B	Used together with PRESSURE GAUGE (925711000).
 ST-926230000	926230000	SPANNER	For the lock nut when adjusting backlash of gearbox.
 ST34099PA100	34099PA100	SPANNER	Used when measuring the rotational resistance of gearbox assembly.
 ST-926420000	926420000	PLUG	When fluid leaks from pinion side of gearbox assembly, remove pipe B from valve housing, attach this tool and check fluid leaking points.

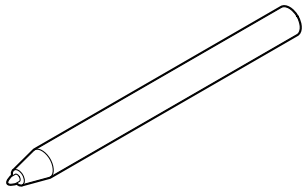
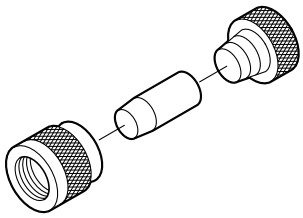
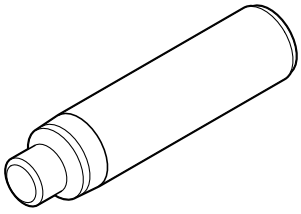
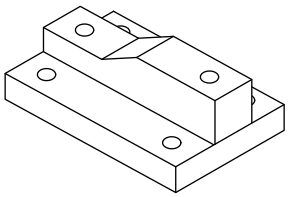
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099FA060	34099FA060	PUNCH HOLDER	Used for crimping.
 ST34199FE040	34199FE040	INSTALLER A, B, C	• Used for installing the oil seal to the rack assembly. • INSTALLER A: 34199FE070 • INSTALLER B: 34199FE080 • INSTALLER C: 34199FE090
 ST34199XA030	34199XA030	INSTALLER & REMOVER	Used for removing and installing the rack oil seal (outer and inner).
 ST34199AG000	34199AG000	BOSS D	• Used when inspecting characteristic of gearbox assembly and disassembling it. • Used together with STAND (926200000).

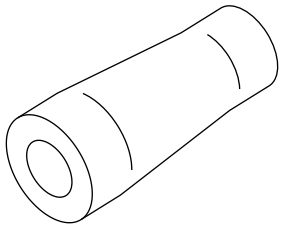
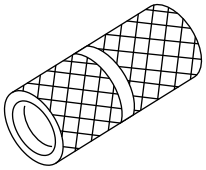
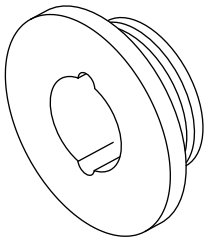
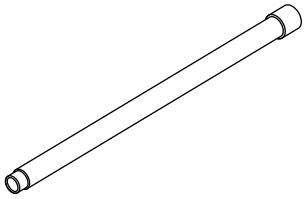
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AG040	34199AG040	GUIDE	Used for installing seal ring of rack.
 ST34199AG070	34199AG070	FORMER	Used for forming seal ring of pinion.
 ST34199AG060	34199AG060	GUIDE G (26)	• Used for forming seal ring of rack. • Used together with FORMER PISTON (34199AG080).
 ST34099PA010	34099PA010	OIL SEAL REMOVER	Used for removing oil seal.

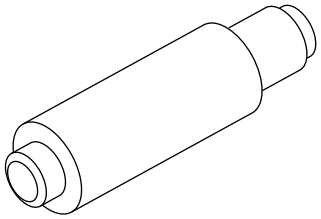
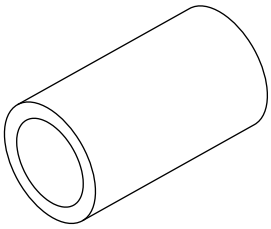
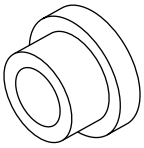
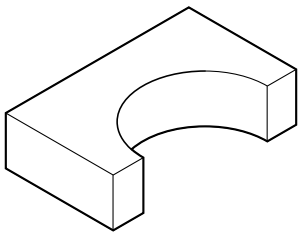
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AG090	34199AG090	INSTALLER & REMOVER	• Used for installing oil seal of valve housing. • Used for installing ball bearing of valve housing. • Used for removing oil seal and ball bearing from valve housing.
 ST34199AG080	34199AG080	FORMER PISTON	• Used for forming seal ring of rack. • Used together with GUIDE G (26) (34199AG060).
 ST34199AG010	34199AG010	INSTALLER	Used for pressing-fit oil seal of gearbox cylinder.
 ST34199FE020	34199FE020	BASE	Used for crimping.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 STSSM4	—	SUBARU SELECT MONITOR 4	Used for setting of each function and troubleshooting for electrical system. **Note:** **For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".**

2. GENERAL TOOL

TOOL NAME	REMARKS
Steering wheel puller	Used for removing the steering wheel.
Ball joint puller	Used for disconnecting tie-rod end.
Dial gauge	Used when measuring steering gearbox run-out.
Magnet stand	Used when measuring steering gearbox run-out.
Circuit tester	Used for measuring voltage, resistance and current.
DST-i	Used together with Subaru Select Monitor 4.
C-clamp	Used when inspecting steering gearbox assembly.

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering System

WIRING DIAGRAM

Refer to “Electric Power Steering System” in the wiring diagram. Ref. to WIRING SYSTEM>Vehicle Dynamics Control System>WIRING DIAGRAM.

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering System

ELECTRICAL SPECIFICATION

Refer to Control Module I/O Signal of “POWER ASSISTED SYSTEM (POWER STEERING) (DIAGNOSTICS)”. Ref. to POWER ASSISTED SYSTEM (POWER STEERING) (DIAGNOSTICS)>Control Module I/O Signal>ELECTRICAL SPECIFICATION.

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering System

INSPECTION

Refer to “POWER ASSISTED SYSTEM (POWER STEERING) (DIAGNOSTICS)”. Ref. to POWER ASSISTED SYSTEM (POWER STEERING) (DIAGNOSTICS)>Basic Diagnostic Procedure.

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering System

NOTE

For procedure of each component in the power steering system, refer to the respective section.

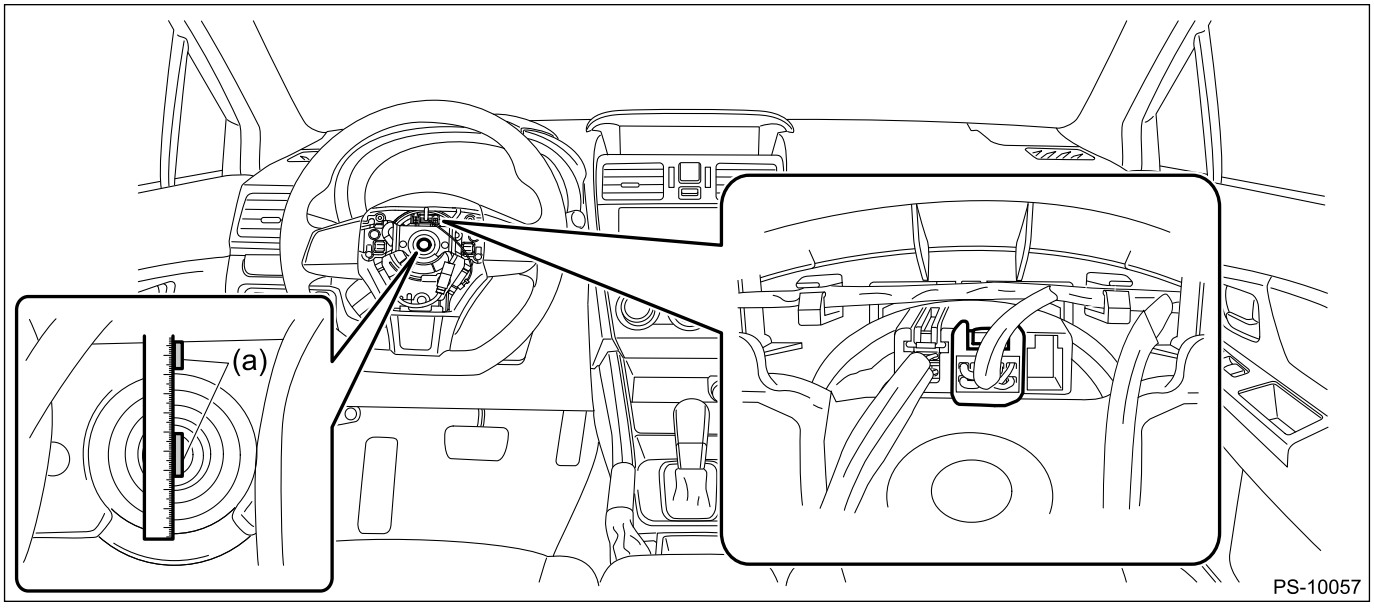
- Steering wheel: Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Wheel.
- Universal joint assembly - steering: Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint.
- Steering column: Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Column.
- Steering gearbox (hydraulic type): Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Gearbox.
- Electric power steering gearbox (electric type): Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.
- Pipe assembly (hydraulic type): Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Pipe Assembly.
- Oil pump (hydraulic type): Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Oil Pump.
- Reservoir tank (hydraulic type): Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Reservoir Tank.
- Power steering fluid (hydraulic type): Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Power Steering Fluid.

REMOVAL

Caution:
Before handling the airbag system components, always refer to "CAUTION" of "General Description" in "AIRBAG SYSTEM". Ref. to AIRBAG SYSTEM>General Description>CAUTION.

1. Disconnect the ground terminal from battery and wait for at least 60 seconds before starting work. Ref. to NOTE>NOTE > BATTERY.
   Note:
   For model with battery sensor, disconnect the ground terminal from battery sensor.
2. Set the tire to the straight-ahead position.
3. Remove the driver's airbag module. Ref. to AIRBAG SYSTEM>Driver's Airbag Module>REMOVAL.
4. Remove the steering wheel.
   Caution:
   - **Always use the steering wheel puller for removal to avoid deforming the steering wheel.**
   - **If the steering wheel has been removed, make sure that the steering roll connector is not turned from the original position.**

   (1) Disconnect the connector and remove the nut.
   (2) Put alignment marks (a) and remove the steering wheel.
   Preparation tool:
   Steering wheel puller



INSTALLATION

Caution:

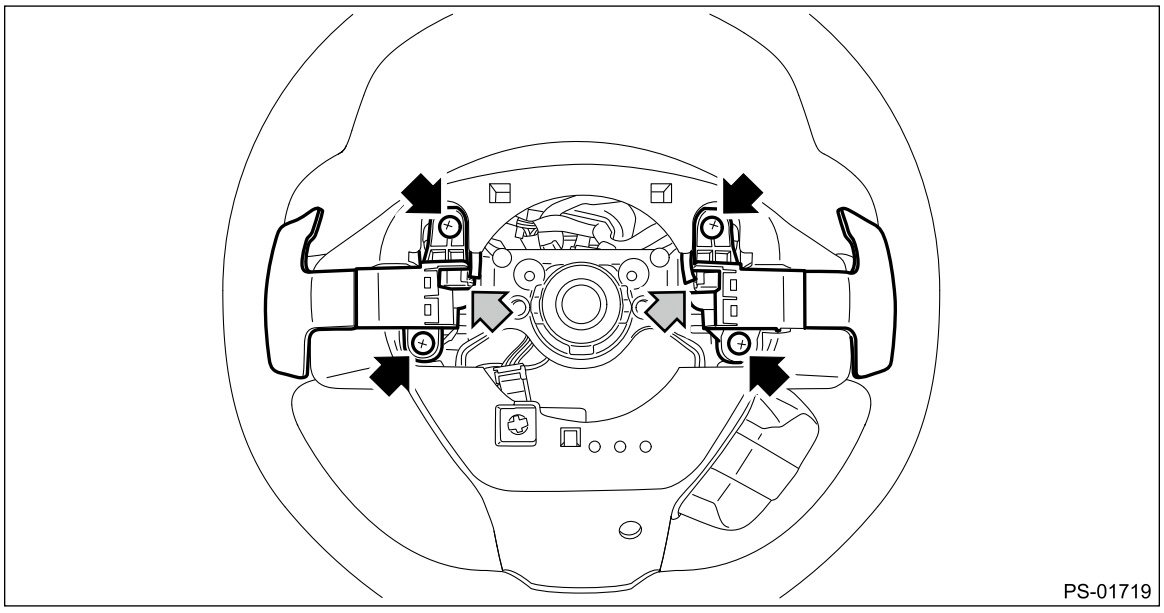
- **Before handling the airbag system components, refer to "CAUTION" of "General Description" in "AIRBAG SYSTEM". Ref. to AIRBAG SYSTEM>General Description>CAUTION.**
- **If the steering wheel has been removed, make sure that the steering roll connector is not turned from the original position.**
- **If the steering wheel and steering angle sensor are removed, perform "VSC(VDC) Centering Mode" of the VDC. Ref. to VEHICLE DYNAMICS CONTROL (VDC)>VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)>ADJUSTMENT > VDC SENSOR MIDPOINT SETTING MODE.**

1. Align the center position of the roll connector. Ref. to AIRBAG SYSTEM>Roll Connector>ADJUSTMENT.
2. Install the steering wheel.
   Tightening torque:
   Steering wheel: 39 N·m (4 kgf-m, 28.8 ft-lb)
   Clearance:
   Between cover assembly - column and steering wheel: 4 — 6 mm (0.16 — 0.24 in)
3. Install the driver's airbag module. Ref. to AIRBAG SYSTEM>Driver's Airbag Module>INSTALLATION.
4. Connect the battery ground terminal. Ref. to NOTE>NOTE > BATTERY.

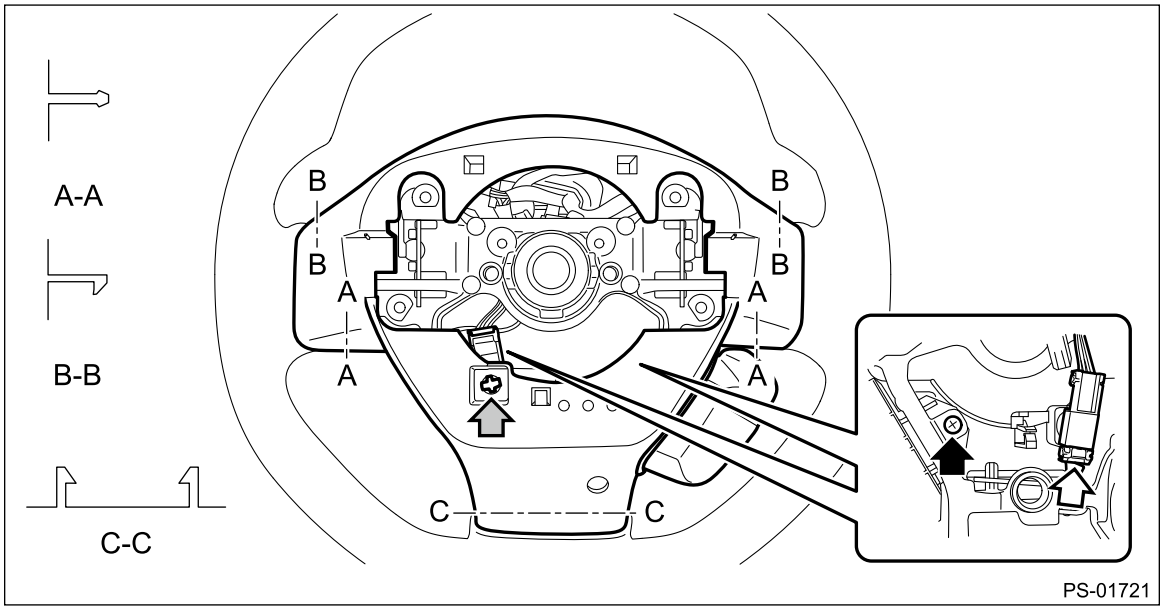
POWER ASSISTED SYSTEM (POWER STEERING) > Steering Wheel

DISASSEMBLY

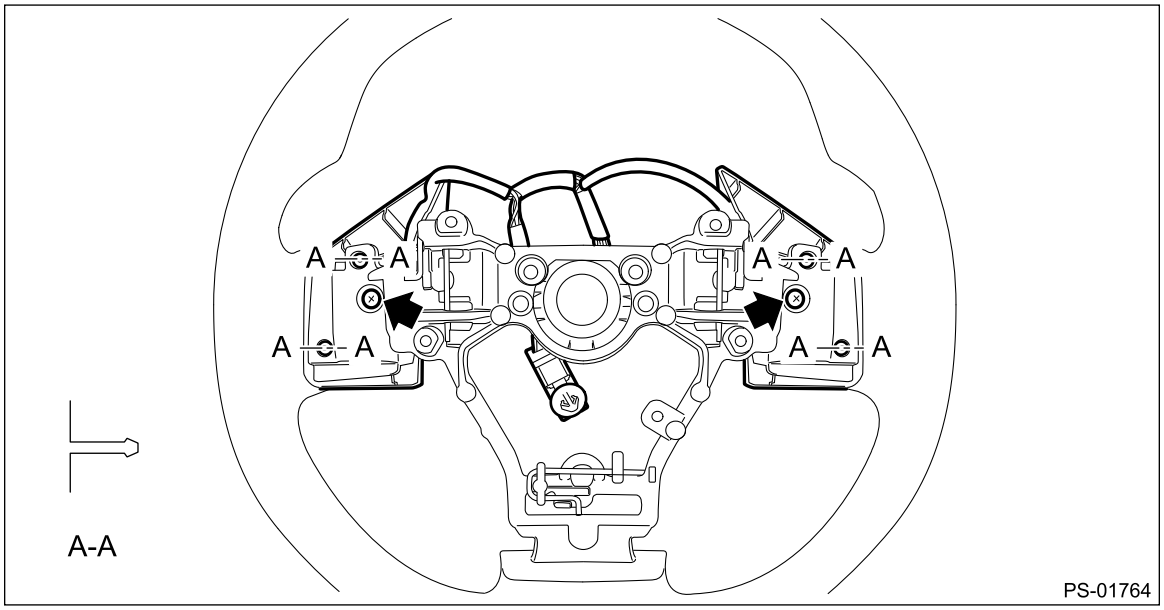
1. Remove the screw, disconnect the connector and remove the paddle shift switch. (Model with paddle shift)



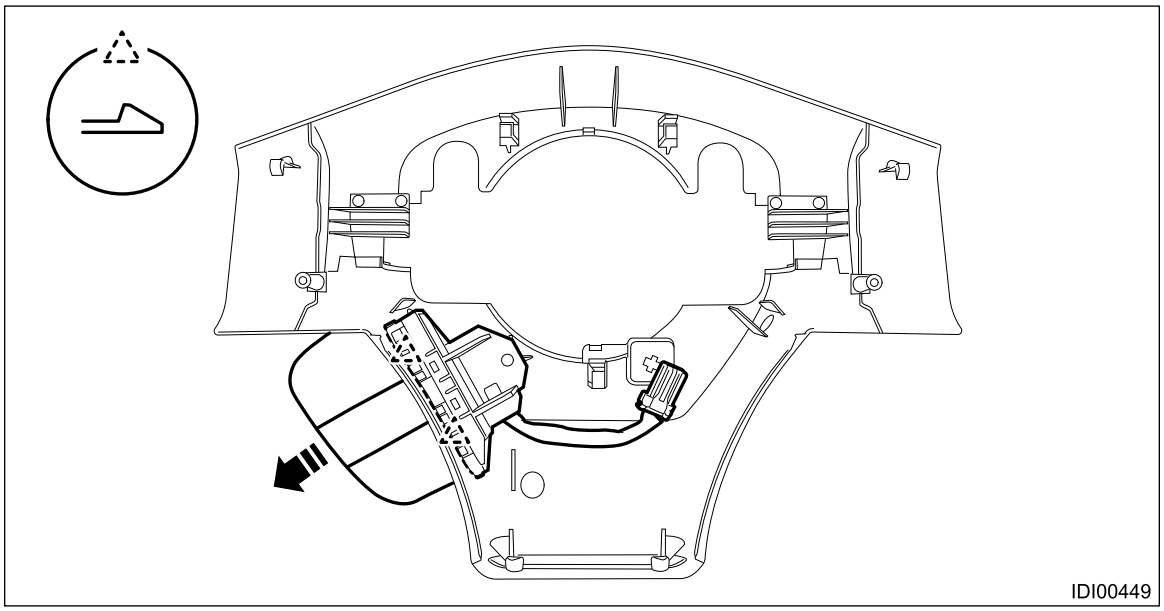
2. Remove the cover - steering wheel LWR.
   (1) Remove the connectors and screws.
   (2) Release the claws and harness clips, detach the cover - steering wheel LWR.



3. Release the claws and remove the screws, then detach the satellite switch.



4. Release the claws, and then remove the MID switch.



ASSEMBLY

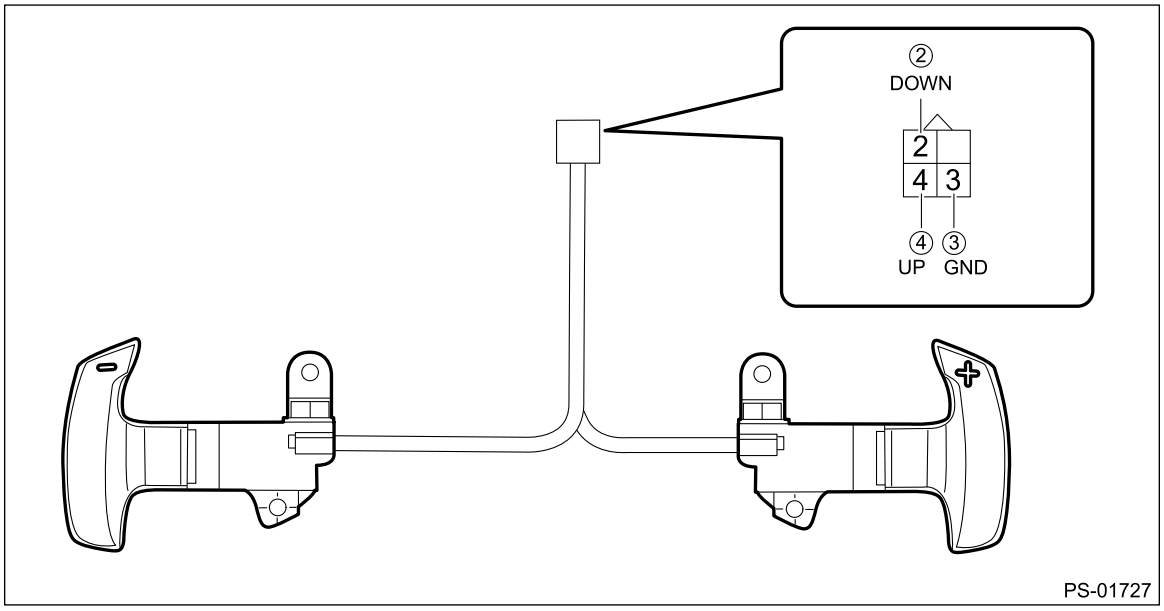
Caution:
Securely install the switch. Improper insertion of the pin or claw of the switch may cause improper installation.

1. Install the MID switch.
2. Install the satellite switch.
3. Install the cover - steering wheel LWR.
4. Install the paddle shift switch. (Model with paddle shift)

INSPECTION

1. PADDLE SHIFT SWITCH

1. Measure the resistance between connector terminals.
   Preparation tool:
   Circuit tester



Terminal No.	Inspection conditions	Standard
3 — 4	Operate the + side of paddle shift assembly and hold it.	Less than 10 Ω
2 — 3	Operate the − side of paddle shift assembly and hold it.	Less than 10 Ω
2 — 3 3 — 4	Do not operate the paddle shift assembly.	Is the resistance 1 MΩ or more?

2. Replace the paddle shift switch if the inspection result is not within the standard value.

2. SATELLITE SWITCH ASSEMBLY

- Audio (navigation) switch: Ref. to ENTERTAINMENT & MONITORING>Switches and Harness>INSPECTION > SATELLITE SWITCH ASSEMBLY.
- EyeSight steering switch: Ref. to EyeSight>Switches and Harness>INSPECTION > EyeSight STEERING SWITCH.
- Cruise control command switch: Ref. to CRUISE CONTROL SYSTEM>Cruise Control Command Switch>INSPECTION.

3. MID SWITCH

Refer to “Switch & harness” of “INSTRUMENTATION/DRIVER INFO” section. Ref. to INSTRUMENTATION/DRIVER INFO>Switches and Harness>INSPECTION > MULTI INFORMATION DISPLAY

SWITCH.

REMOVAL

1. Remove the universal joint assembly - steering.

(1) Place alignment marks on the universal joint assembly - steering.

Note:

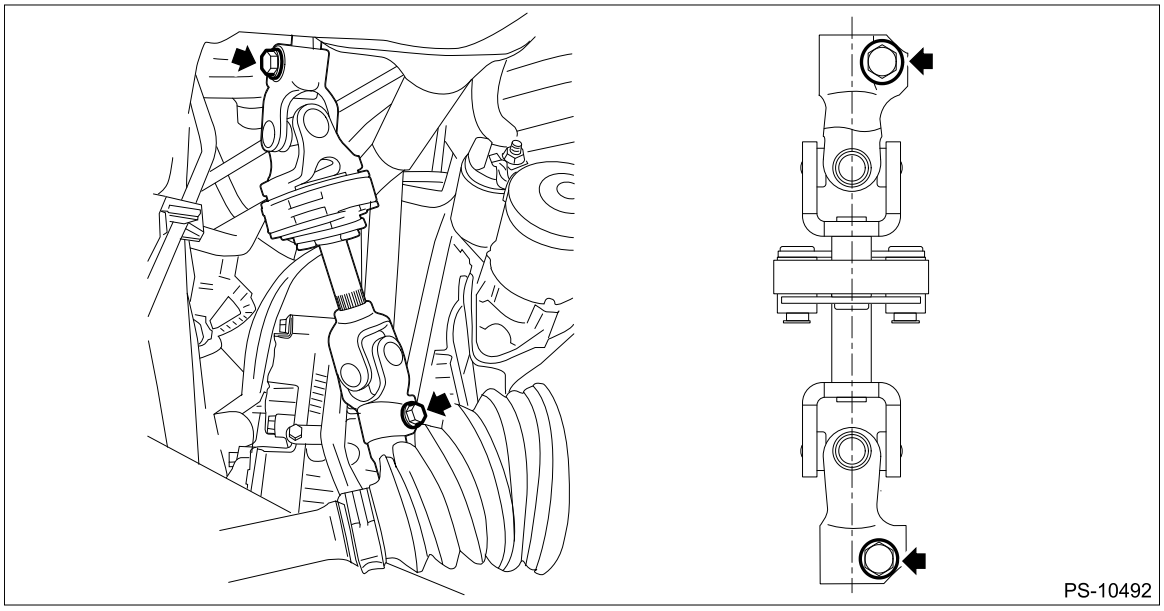
Place alignment marks on the following positions.

- **Between the column assembly - steering and the universal joint assembly - steering**

(2) Remove the bolt, and remove the universal joint assembly - steering.

Caution:

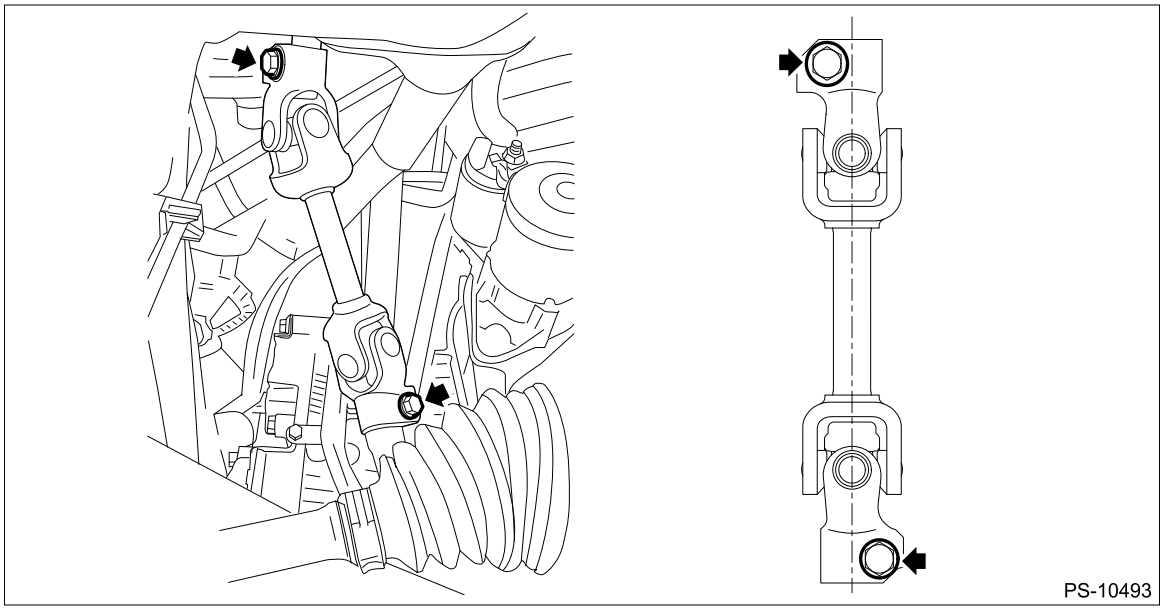
Do not remove the guide.



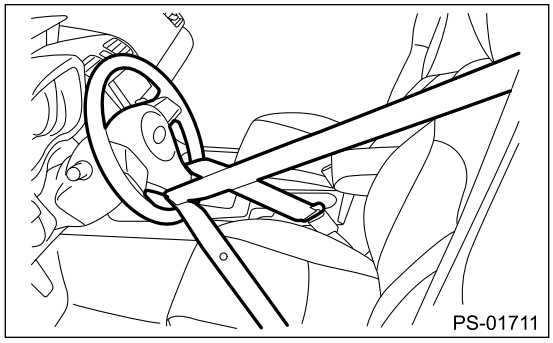
(3) Remove the bolt, and remove the universal joint assembly - steering. (WRX STI model)

Caution:

Do not remove the guide.



2. Set the steering column and the driver's seat to the neutral position.
   Caution:
   Always place the tilt lever to the lock position after the steering column is adjusted.
3. Prevent the steering wheel from turning using the seat belt.



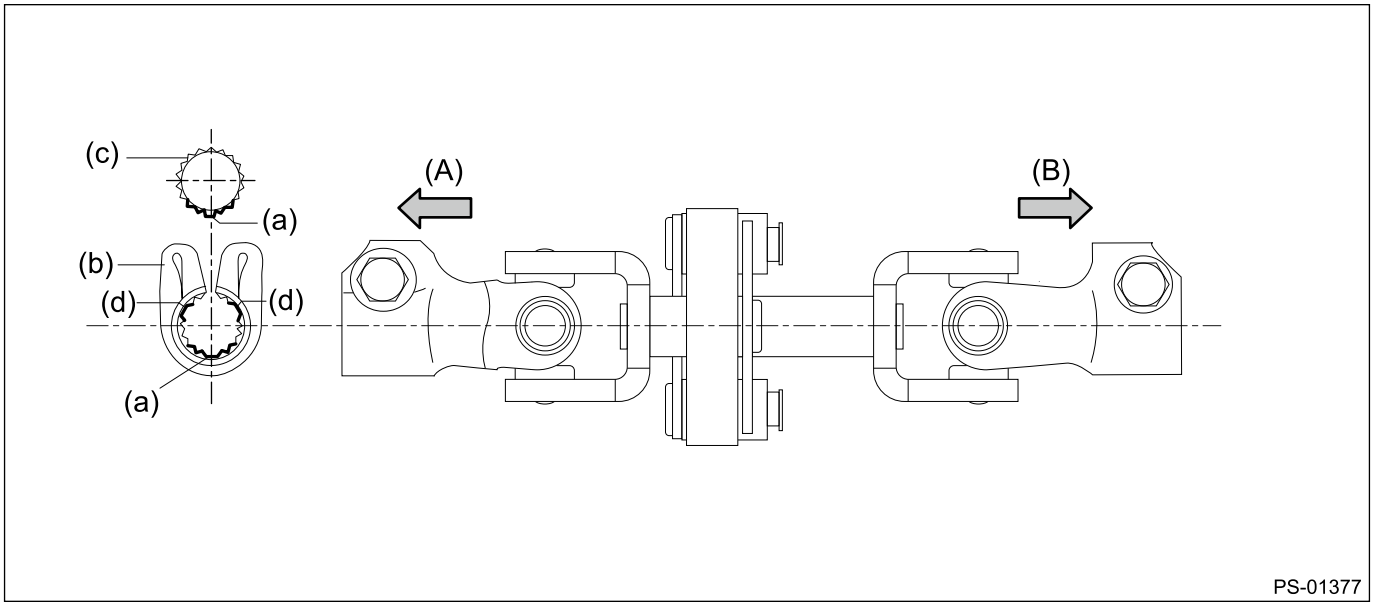
POWER ASSISTED SYSTEM (POWER STEERING) > Universal Joint

INSTALLATION

1. Before installation, check the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSPECTION.
2. Unfasten the seat belt and make the steering wheel turn freely.
3. Install the universal joint assembly - steering to the column shaft.
   Caution:
   - **Be sure to align the protrusion section (a) of the column shaft side with the cutout (a) of the serration. If another cutout portions (d) are used for alignment, the bolt of the universal joint assembly - steering cannot be assembled.**
   - **Be sure to follow the tightening order and tightening torque of the universal joint assembly - steering to avoid the steering effort from becoming heavy.**
   - **When tightening the mounting bolts of the universal joint assembly - steering, always tighten the gearbox side bolts first.**
   - **Always place the tilt lever to the lock position after the steering column is adjusted.**

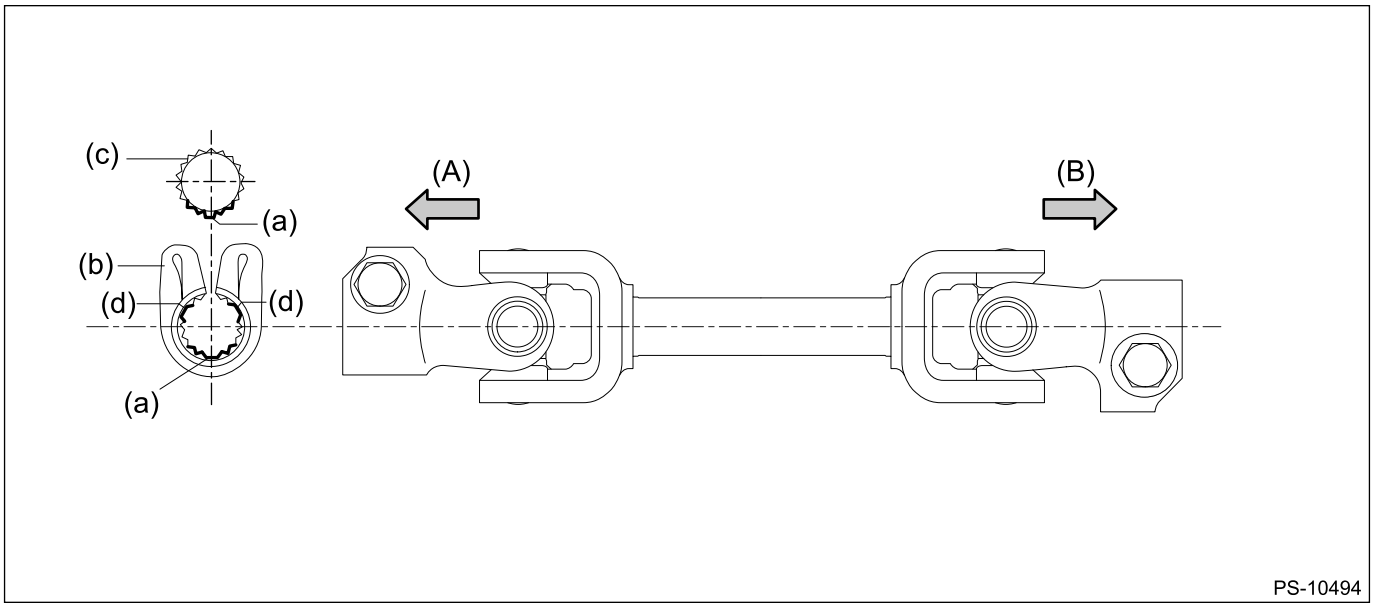
   (1) Match the alignment marks that have been marked when removing with the column shaft (c) and the cutout portion (a) at the serrations of the yoke (b).

   (2) Connect the universal joint assembly - steering with the column shaft.
   - Except for WRX STI model



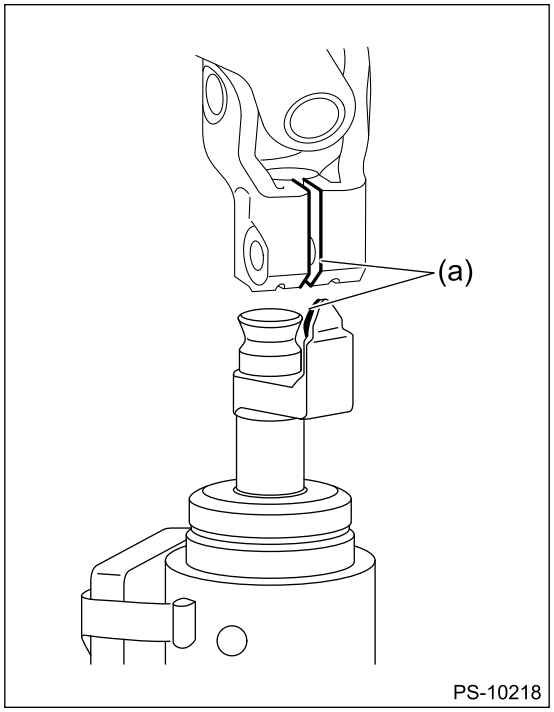
(A) Column shaft side (B) Gearbox side

- WRX STI model



(A) Column shaft side (B) Gearbox side

(3) Install the universal joint assembly - steering to the serrations of the gearbox assembly, by matching the cutout of guide (a) or the alignment marks that have been marked when removing.



(4) Tighten the bolts on the gearbox side first, and then the column shaft side.

Tightening torque:

24 N·m (2.4 kgf-m, 17.7 ft-lb)

Clearance:

Universal joint assembly - steering coupling to adjacent parts: 15 mm (0.59 in) or more

POWER ASSISTED SYSTEM (POWER STEERING) > Universal Joint

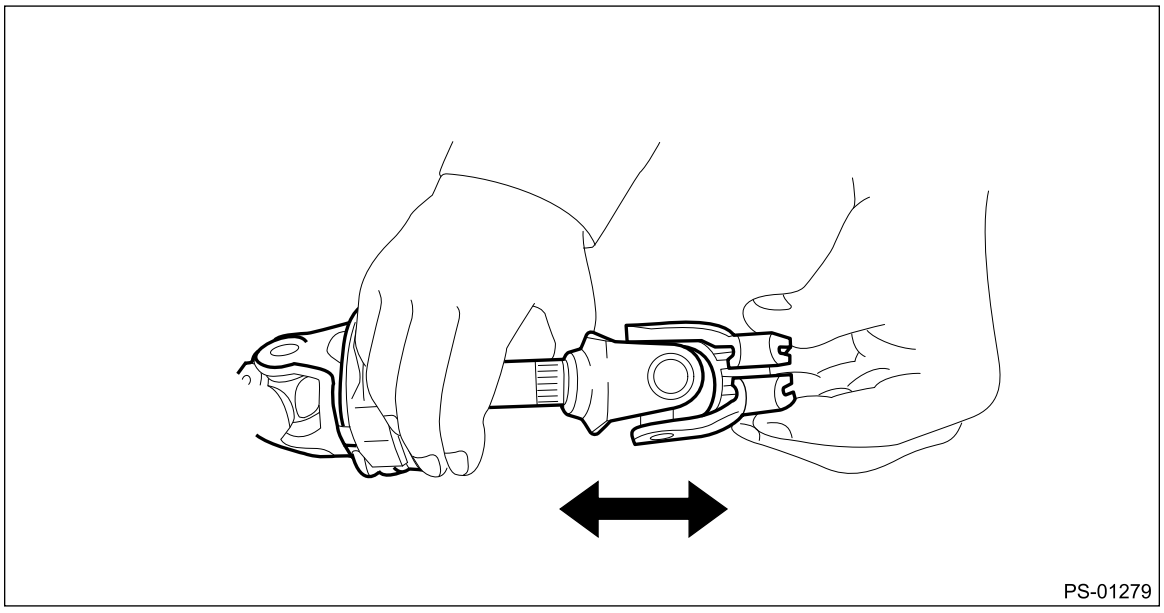
INSPECTION

Check for wear, damage or any other faults.

1. Check the universal joint assembly - steering for excessive looseness.

Service limit:

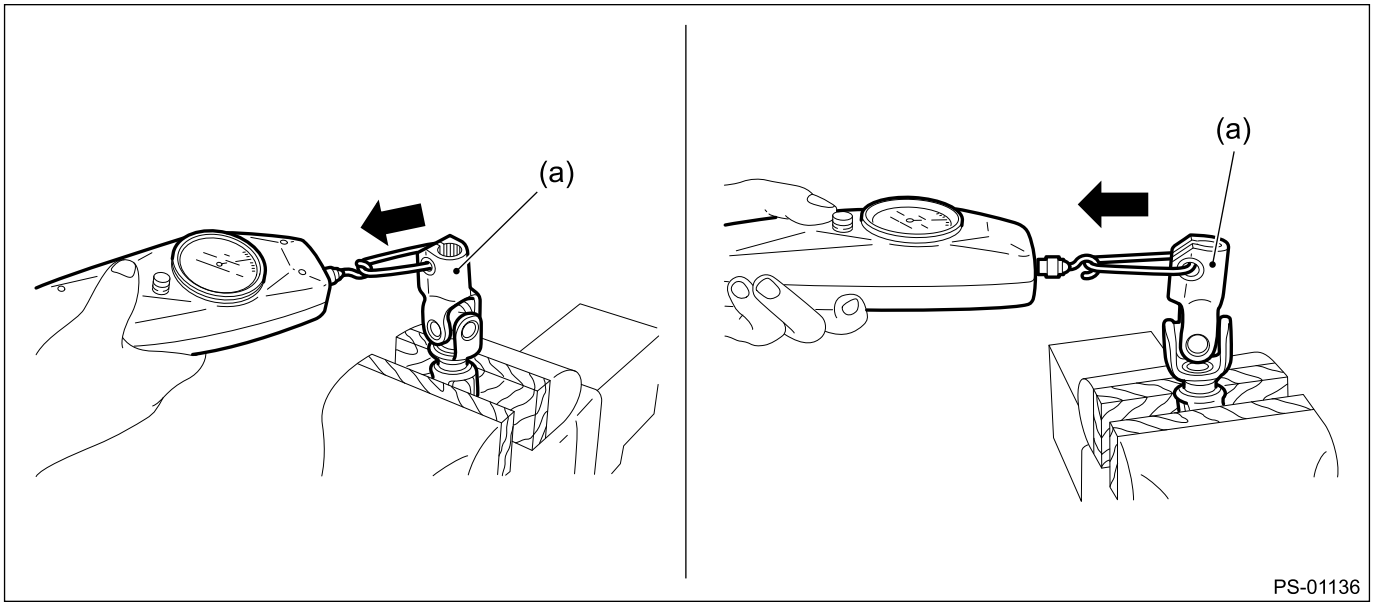
Play of the universal joint assembly - steering: 0 mm (0 in)



2. Measure the swing torque of the universal joint assembly - steering.

(1) Place the universal joint assembly - steering between wooden blocks and fix it on a vise.

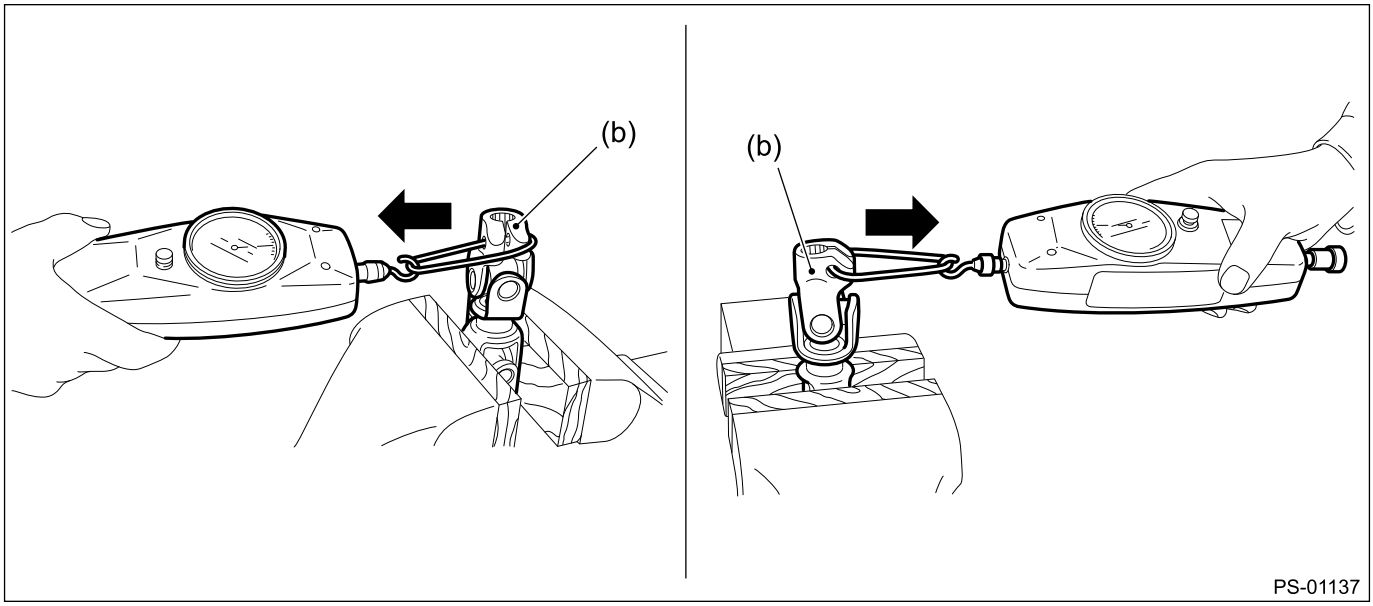
(2) With the yoke (a) of gearbox side facing up, measure the swing torque in two directions.



Service limit:

Maximum load: 3.8 N (0.39 kgf, 0.86 lbf) or less

(3) With the yoke (b) of the column assembly - steering side facing up, measure the swing torque in two directions.



Service limit:

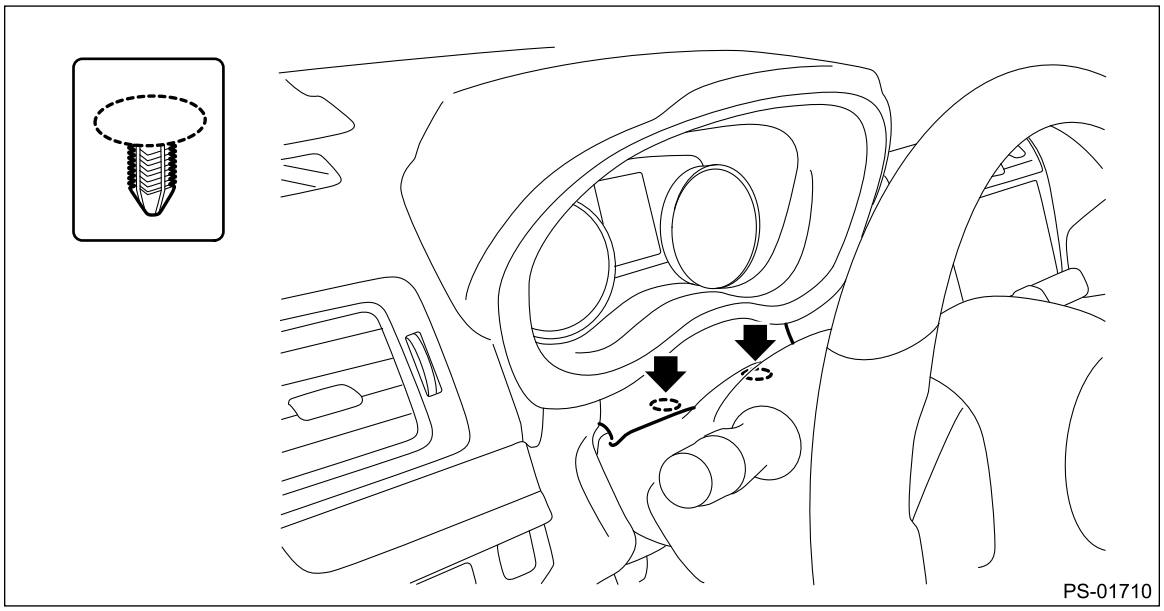
Maximum load: 7.3 N (0.74 kgf, 1.64 lbf) or less

(4) Replace as necessary, if it is found defective.

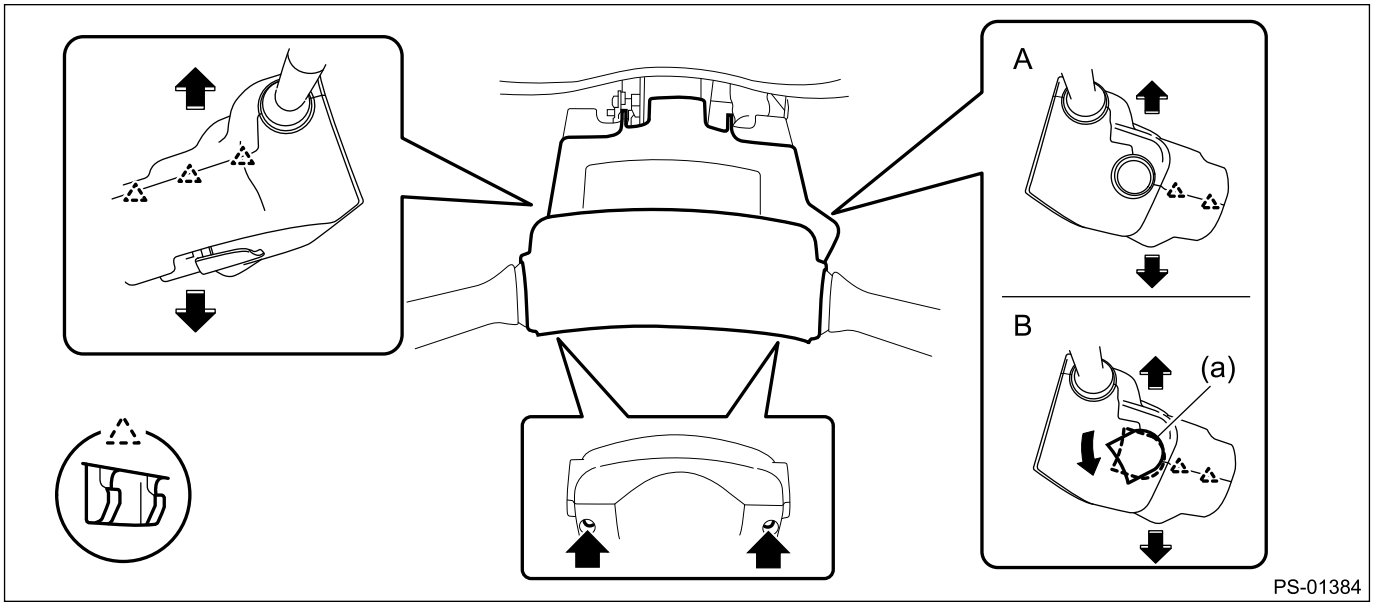
REMOVAL

Caution:
Before handling the airbag system components, always refer to "CAUTION" of "General Description" in "AIRBAG SYSTEM". Ref. to AIRBAG SYSTEM>General Description>CAUTION.

1. Disconnect the ground cable from battery and wait for at least 60 seconds before starting work. Ref. to NOTE>NOTE > BATTERY.
   Note:
   For model with battery sensor, disconnect the ground terminal from battery sensor.
2. Remove the cover assembly - instrument panel LWR driver. Ref. to EXTERIOR/INTERIOR TRIM>Instrument Panel Lower Cover>REMOVAL.
3. Remove the knee airbag module. Ref. to AIRBAG SYSTEM>Knee Airbag Module>REMOVAL.
4. Remove the driver's airbag module. Ref. to AIRBAG SYSTEM>Driver's Airbag Module>REMOVAL.
5. Remove the steering wheel. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Wheel>REMOVAL.
6. Remove the cover assembly - column.
   (1) Release the clips, and remove the cover assembly - steering UPR.



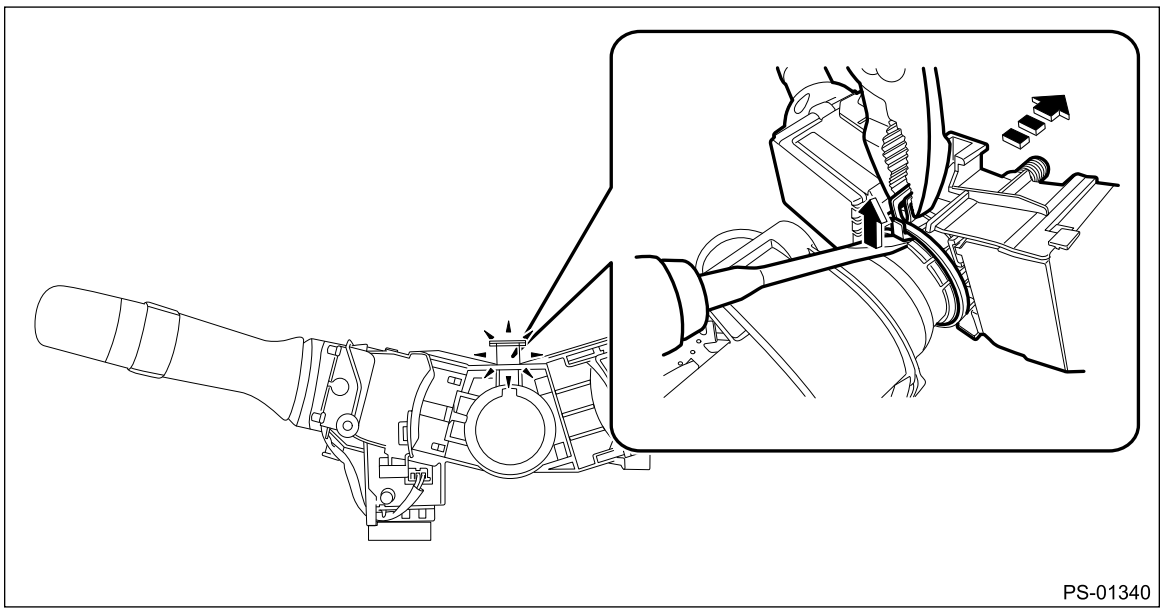
   (2) Remove the screws.
   (3) Remove the cap - key cylinder (a). (Model with keyless access with push button start)
   (4) Release the claw, and remove the cover assembly - column UPR and the cover assembly - column LWR.



A Model without keyless access with push button start

B Model with keyless access with push button start

7. Remove the switch assembly - combination.
(1) Disconnect the connector, and loosen the clamp to release the claws.
(2) Pull out the switch assembly - combination from the column assembly - steering.



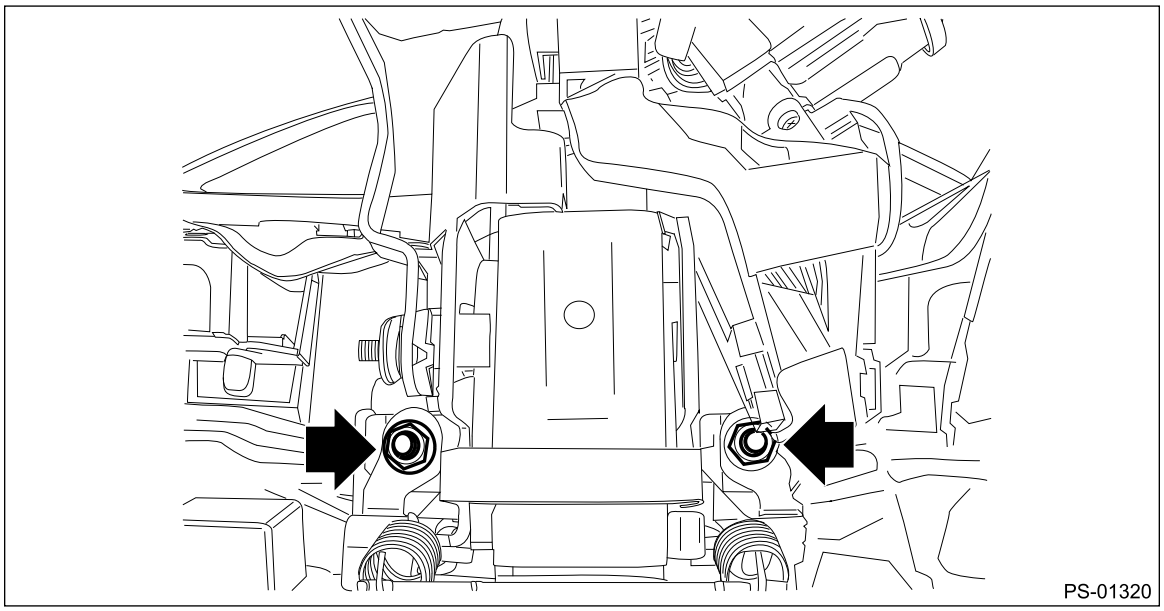
8. Remove all connectors from the column assembly - steering.

9. Remove the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>REMOVAL.

Caution:

To prevent damage to the universal joint assembly - steering and improper steering effort, make sure to remove the universal joint assembly - steering.

10. Remove the nut under the beam COMPL - steering securing the column assembly - steering.



11. Pull out the column assembly - steering from the hole on toe board.

Caution:

Do not loosen the tilt lever when the column assembly - steering is not secured to the vehicle.

12. Remove the ignition key lock. Ref. to SECURITY AND LOCKS>Ignition Key Lock>REPLACEMENT.

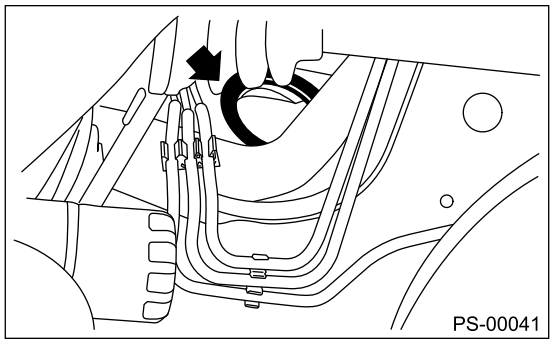
POWER ASSISTED SYSTEM (POWER STEERING) > Steering Column

INSTALLATION

Caution:

- **When removing, installing or replacing the VDCCM&H/U, VDCCM&H/U bracket, electronic power steering gearbox, steering wheel or steering angle sensor (steering roll connector), perform "VSC(VDC) Centering Mode" of the VDC. Ref. to VEHICLE DYNAMICS CONTROL (VDC)>VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)>ADJUSTMENT > VDC SENSOR MIDPOINT SETTING MODE.**
- **Before handling the airbag system components, always refer to "CAUTION" of "General Description" in "AIRBAG SYSTEM". Ref. to AIRBAG SYSTEM>General Description>CAUTION.**

1. Install the bushing to the toe board.



2. Insert the end of the column assembly - steering into the toe board bushing.

3. Tighten the column assembly - steering installation nut located under the beam COMPL - steering with the tilt lever fixed.
   Tightening torque:
   20 N·m (2 kgf-m, 14.8 ft-lb)
4. Install the ignition key lock. Ref. to SECURITY AND LOCKS>Ignition Key Lock>REPLACEMENT.
5. Install the switch assembly - combination.
6. Connect all the connectors under the instrument panel.
7. Install the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSTALLATION.
   Caution:
   - **Always install the universal joint assembly - steering after installing the steering column to avoid damage to the universal joint assembly - steering.**
   - **Be sure to follow the tightening order and tightening torque of the universal joint assembly - steering to avoid the steering effort from becoming heavy.**
8. Install the knee airbag module. Ref. to AIRBAG SYSTEM>Knee Airbag Module>INSTALLATION.
9. Install the cover assembly - instrument panel LWR driver.
10. Install the cover assembly - column.
11. Align the center position of the steering roll connector. Ref. to AIRBAG SYSTEM>Roll Connector>ADJUSTMENT.
12. Install the steering wheel.
    Tightening torque:
    Steering wheel: 39 N·m (4 kgf-m, 28.8 ft-lb)
    Clearance:
    Between cover assembly - column and steering wheel: 4 — 6 mm (0.16 — 0.24 in)
13. Install the driver's airbag module. Ref. to AIRBAG SYSTEM>Driver's Airbag Module>INSTALLATION.
14. Connect the battery ground terminal. Ref. to NOTE>NOTE > BATTERY.

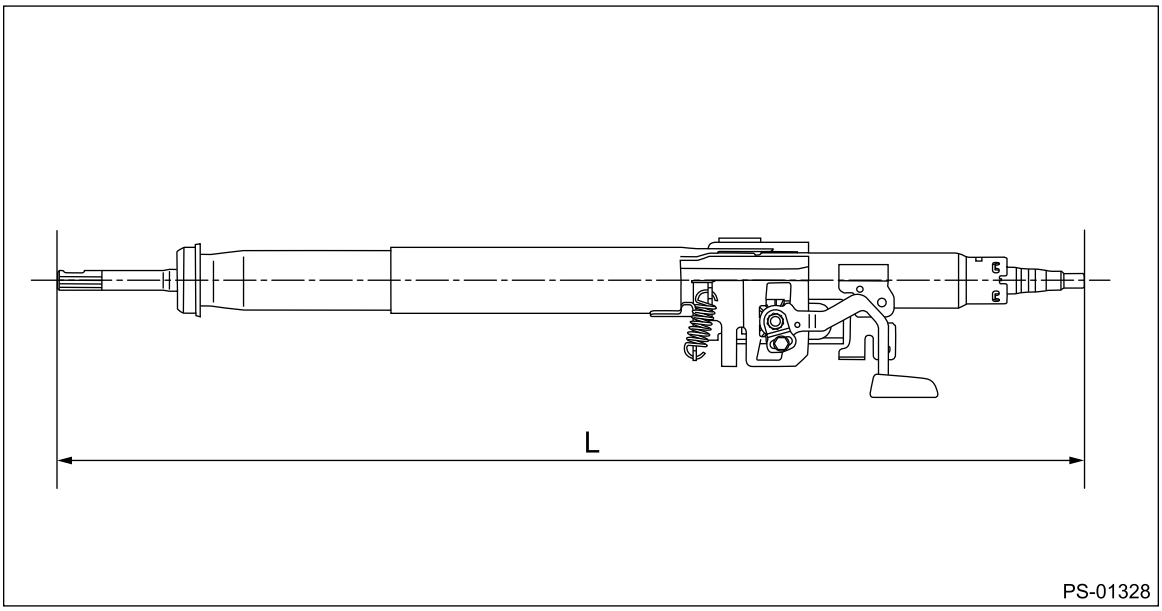
POWER ASSISTED SYSTEM (POWER STEERING) > Steering Column

INSPECTION

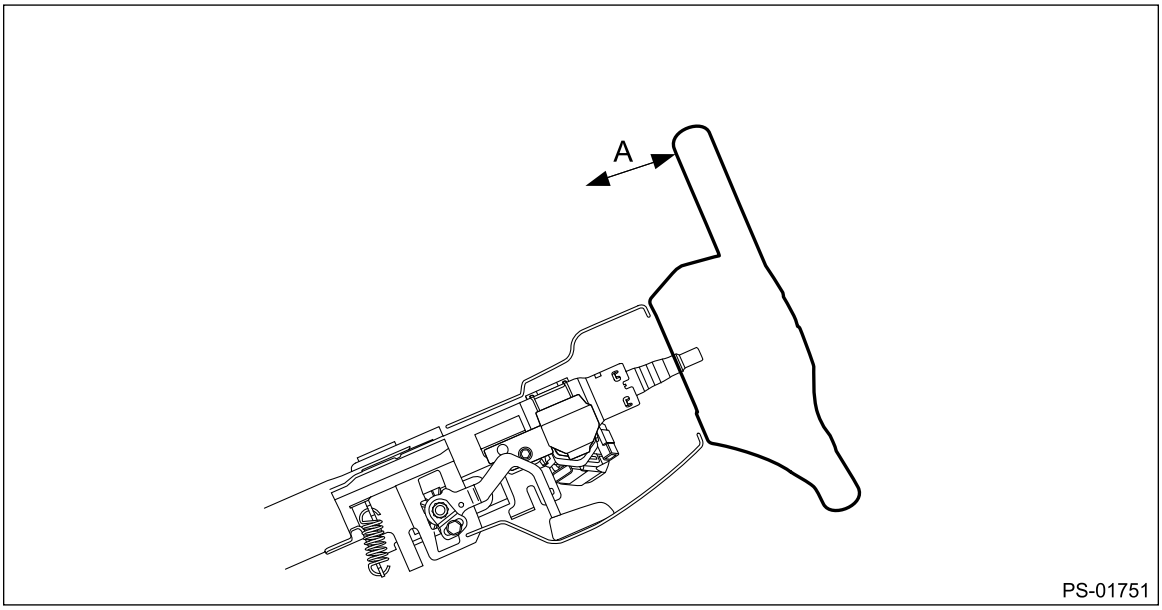
1. UNIT INSPECTION

Check the following items, and if there is anything out of standard value, it is considered to be damaged. If so, replace it with a new part.

- Measure the whole length of the column assembly - steering.
  Standard: Overall length L
  Tilt and telescopic column (measure while minimized)
  $819.7^{+1.5}_{-1.5}$ mm ($32.27^{+0.059}_{-0.059}$ in)



- Check the steering wheel deflection in axial and vertical directions.
  Specification:
  Axial deflection A (deflection of steering wheel)
  Less than 6 mm (0.24 in)



2. INSPECTION OF AIRBAG SYSTEM

Refer to “AIRBAG SYSTEM” section for airbag inspection procedure. Ref. to AIRBAG SYSTEM>Driver’s Airbag Module>INSTALLATION.

REMOVAL

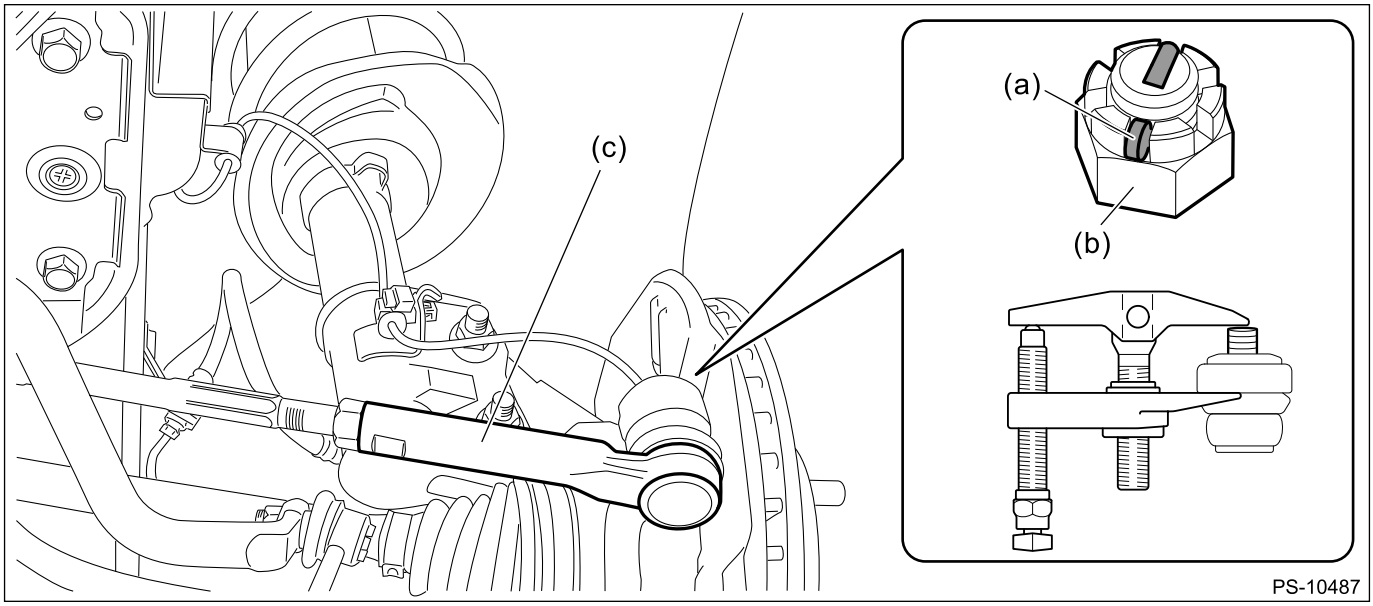
1. Lift up the vehicle, and then remove the front wheels.
2. Remove the under cover - front. Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.
3. Disconnect the tie-rod end.
   (1) Pull out the cotter pin (a).
   (2) Remove the castle nut (b).
   (3) Using a tie-rod end puller, remove the tie-rod end (c).

   Caution:

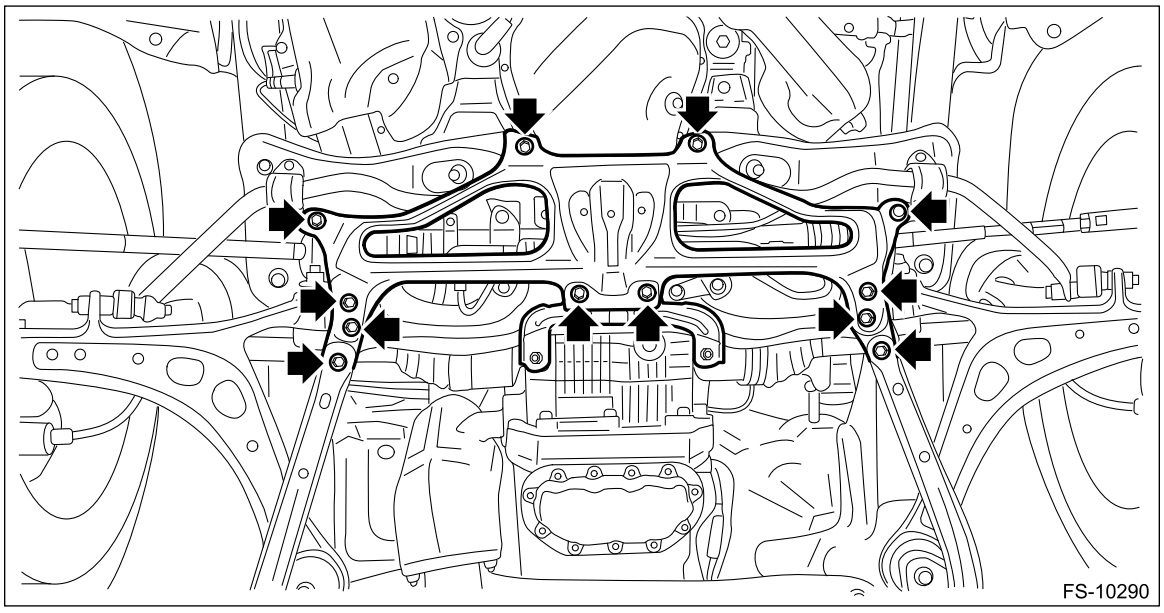
   Be careful not to damage the boot of the joint.

   Preparation tool:

   Tie-rod ball joint puller



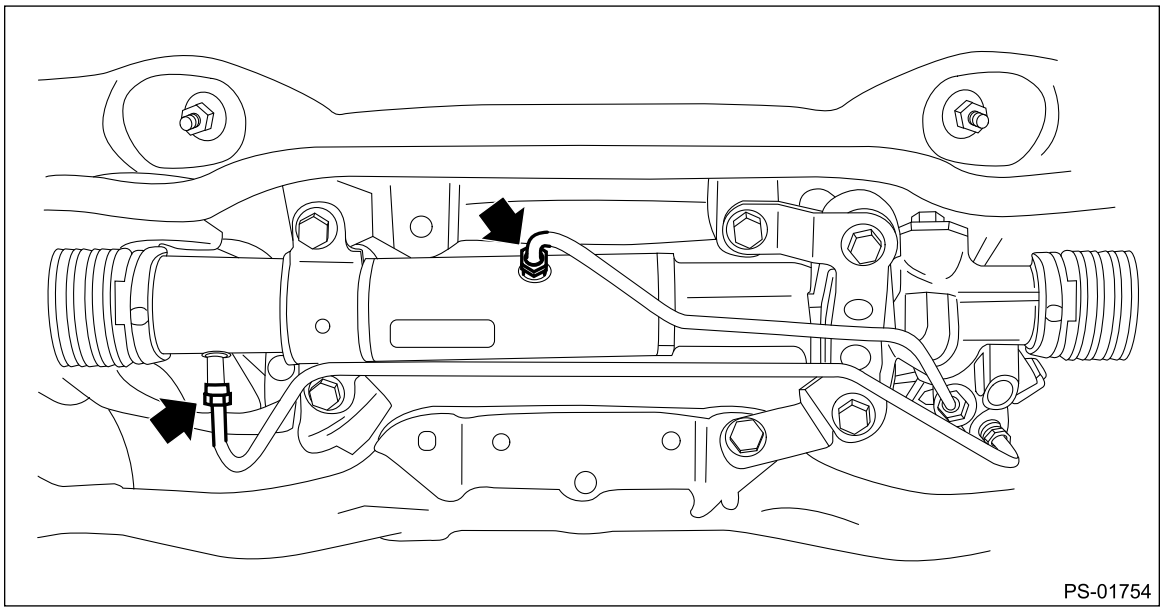
4. Remove the bolt, and remove the front crossmember support.



5. Remove the front stabilizer. Ref. to FRONT SUSPENSION>Front Stabilizer>REMOVAL.

6. Drain the power steering fluid.

(1) Remove the pipe joint of the gearbox, and connect the vinyl hose to the pipe and the joint.



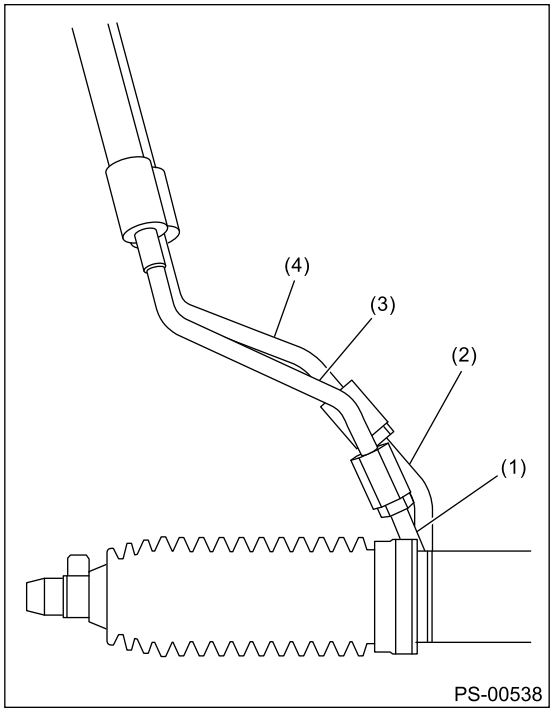
(2) Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise.

(3) Discharge the fluid similarly from other pipes.

7. Remove the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>REMOVAL.

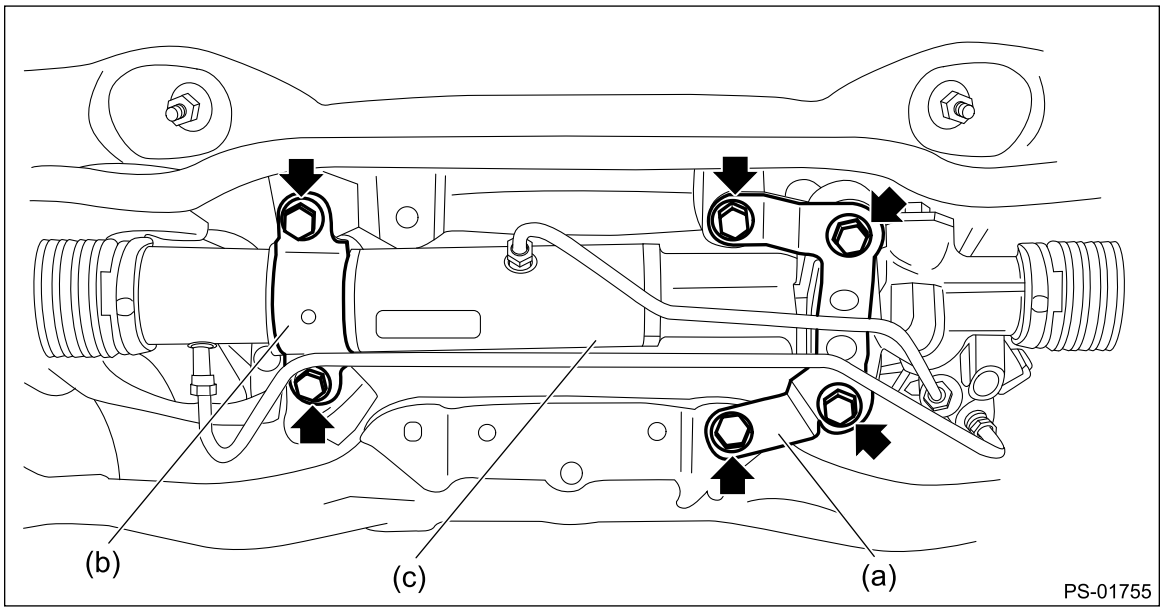
8. Disconnect the ground terminal from battery. Ref. to NOTE>NOTE > BATTERY.

9. Disconnect the feed pipe from the pressure hose first, then disconnect the return pipe from the hose - return.



(1) Feed pipe
(2) Return pipe
(3) Pressure hose
(4) Hose - return

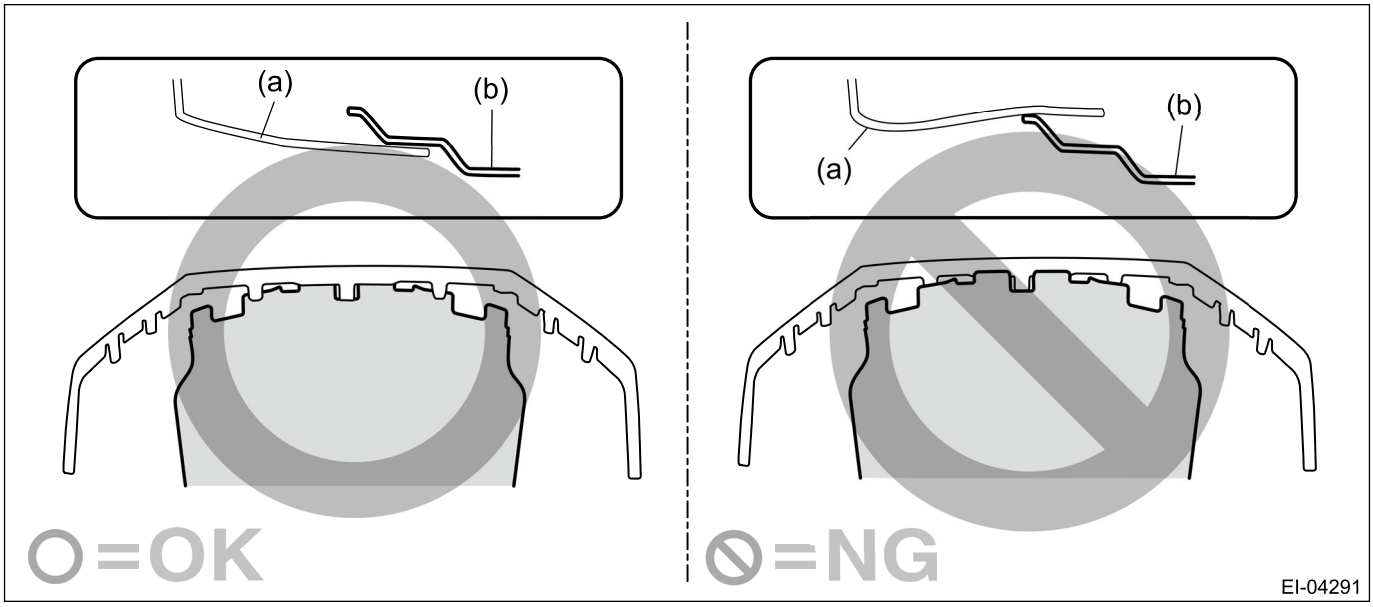
10. Remove the bolts securing the gearbox, and remove the stiffener (a), clamp (b) and gearbox (c).



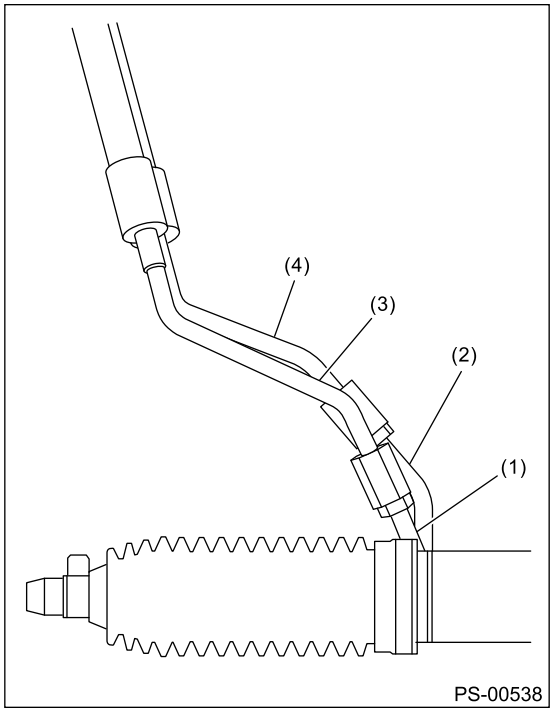
POWER ASSISTED SYSTEM (POWER STEERING) > Steering Gearbox

INSTALLATION

Caution:
Install the under cover - front so that the front end of the under cover (b) comes inside the bumper face - front (a).



1. Insert the gearbox into crossmember, being careful not to damage gearbox boot.
2. Install the gearbox to the crossmember through the clamp and stiffener.
   Caution:
   Since the bushing mounting bolt is applied with lubricant, always use a new bolt.
   Tightening torque:
   60 N·m (6.1 kgf-m, 44.3 ft-lb)
3. Connect the return pipe to the hose - return and then connect the feed pipe to the pressure hose.



(1) Feed pipe

(2) Return pipe

(3) Pressure hose

(4) Hose - return

Tightening torque:

15 N·m (1.5 kgf-m, 11.1 ft-lb)

4. Install the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSTALLATION.
5. Connect the tie-rod ends.
   (1) Connect the tie-rod end (a) to the housing assembly - front axle.
   (2) Tighten the castle nuts (b) to the specified torque.

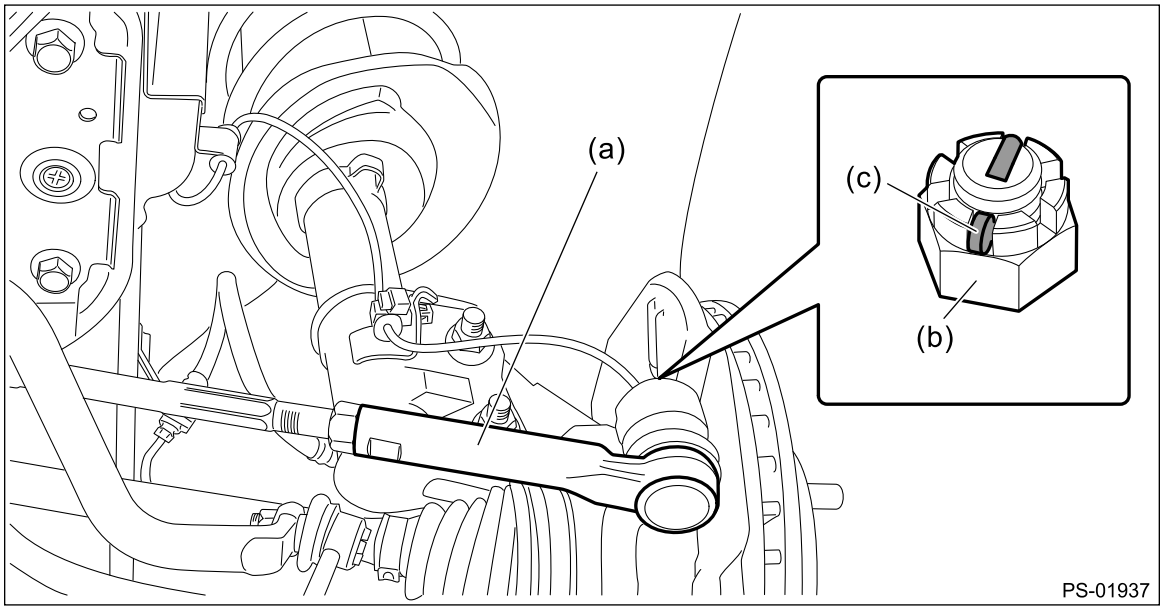
   Caution:

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

   Tightening torque:

   27 N·m (2.8 kgf-m, 19.9 ft-lb)

   (3) Tighten within the range of 60° so that the cotter pin hole and cutout portion of the castle nut (b) are aligned.
   (4) Insert a new cotter pin (c), and bend the tip of the pin to fix it.



6. Install the front stabilizer. Ref. to FRONT SUSPENSION>Front Stabilizer>INSTALLATION.
7. Install the front crossmember support.

   Tightening torque:

   Front suspension parts: Ref. to FRONT SUSPENSION>General Description>COMPONENT > FRONT SUSPENSION.
8. Install the under cover - front. Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.
9. Install the front wheels.
10. Lower the vehicle.
11. Tighten the wheel nuts to the specified torque.

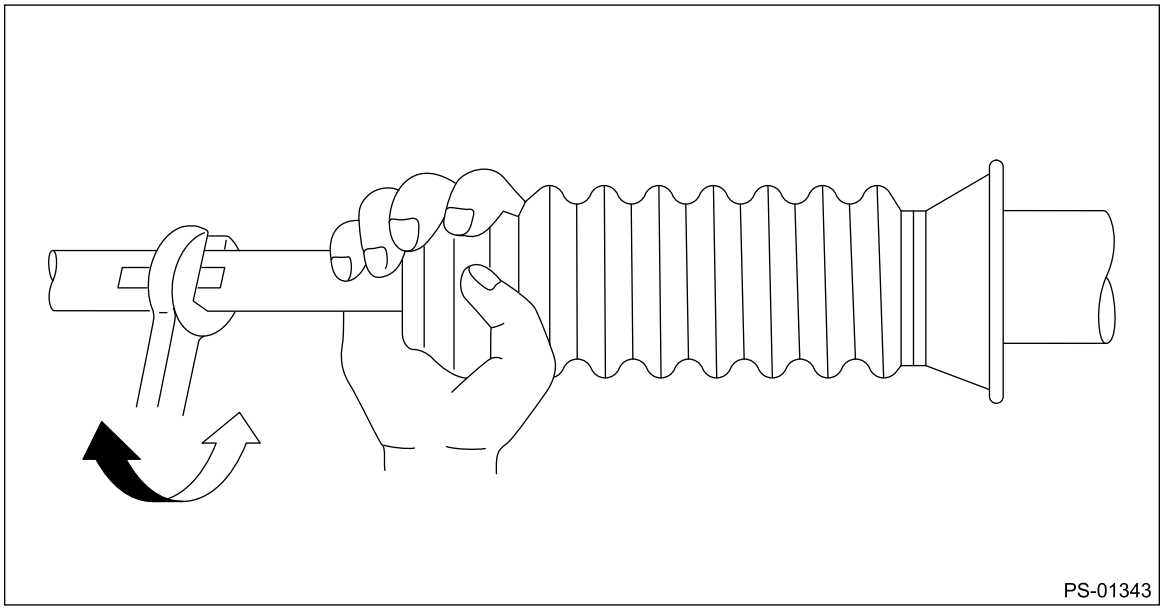
    Tightening torque:

    120 N·m (12.2 kgf-m, 88.5 ft-lb)

12. Connect the battery ground terminal. Ref. to NOTE>NOTE > BATTERY.
13. Pour fluid into the oil tank, and bleed air. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Power Steering Fluid.
14. Check for fluid leaks.
15. Check the fluid level in oil tank.
16. Adjust the toe-in and steering angle. Ref. to FRONT SUSPENSION>Wheel Alignment>ADJUSTMENT > FRONT WHEEL TOE-IN.

    Note:

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



17. Tighten the tie-rod end lock nut.

    Tightening torque:

    85 N·m (8.7 kgf-m, 62.7 ft-lb)

POWER ASSISTED SYSTEM (POWER STEERING) > Steering Gearbox

DISASSEMBLY

1. RACK HOUSING ASSEMBLY

1. Disconnect the four pipes from gearbox.

   Note:

   Remove the pipes C and D, which are fixed to clamp plate, as a unit.
2. Secure the gearbox removed from vehicle in a vise using ST.

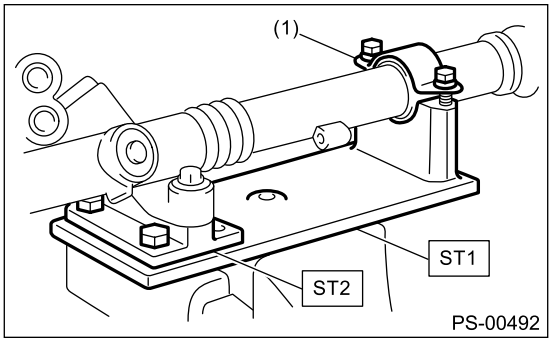
   Caution:

   Using the ST, secure the gearbox assembly in a vise as shown in the figure. Do not secure the gearbox without this ST.

   Preparation tool:

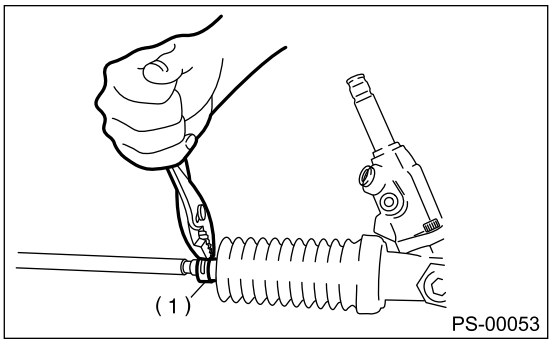
   ST1: STAND (926200000)

   ST2: BOSS D (34199AG000)



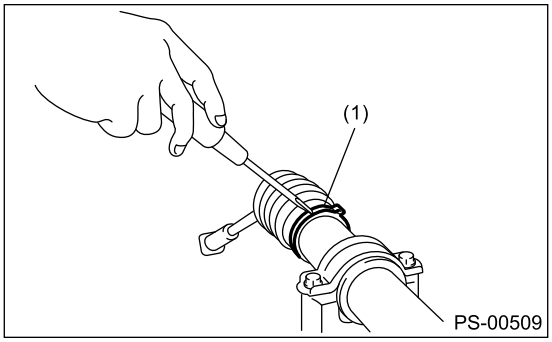
(1) Clamp

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



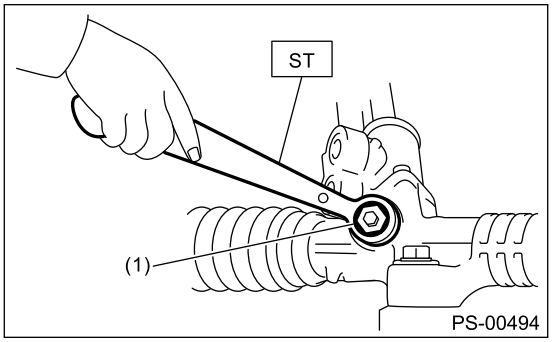
(1) Clip

5. Using a flat tip screwdriver, remove the band from boot.
   Note:
   Replace the boot if there is damage, cracks or deterioration.



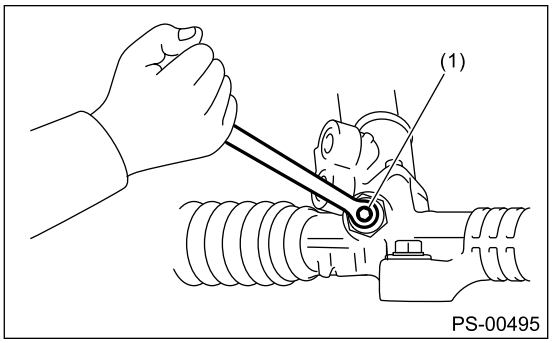
(1) Band

6. Using the ST, loosen the lock nut.
   Preparation tool:
   ST: SPANNER (926230000)



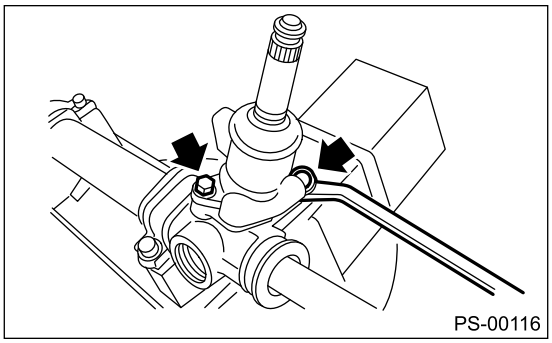
(1) Lock nut

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

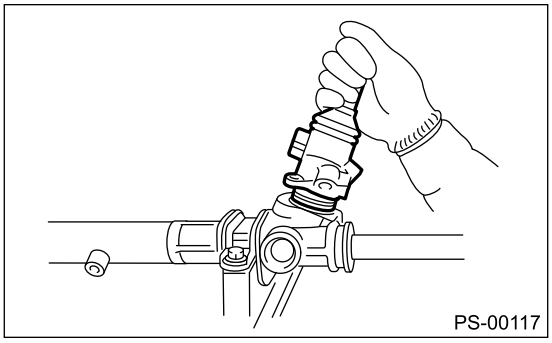


(1) Adjusting screw

8. Remove the tie-rod.
9. Loosen the adjusting screw, and remove the spring and sleeve.
10. Remove the two bolts securing valve assembly.

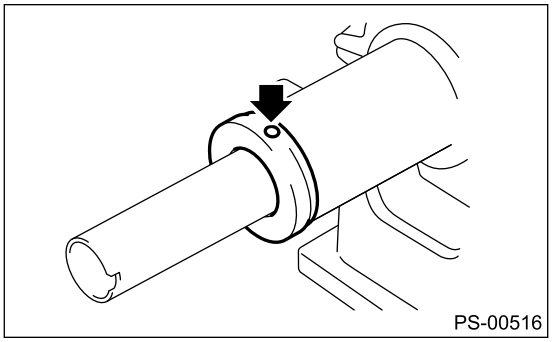


11. Carefully draw out the input shaft and remove the valve assembly.



12. Using a drill, release the crimping of holder.

Caution:
Make a hole of 2 mm (0.08 in) depth using a drill with 3 mm (0.12 in) diameter.



13. Remove the holder.

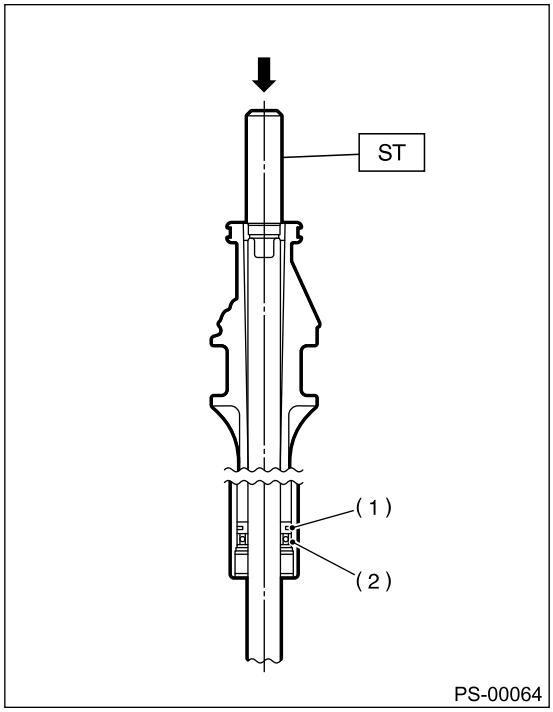
14. Attach the ST on the valve side of rack, and press out the rack together with the outer side oil seal while taking care that the rack and the steering body inner surface do not come into contact with each other.

Preparation tool:

ST: INSTALLER & REMOVER (34199XA030)

Note:

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



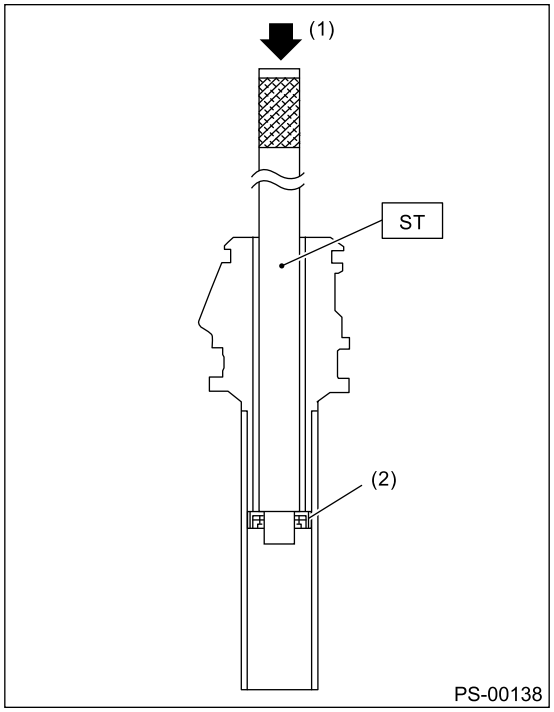
(1) Rack piston

(2) Outer side oil seal

15. Insert the ST from pinion housing side and remove the oil seal and back-up ring using a press.

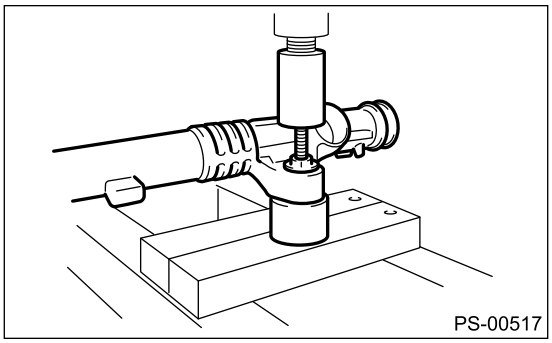
Preparation tool:

ST: OIL SEAL REMOVER (34099PA010)



(1) Press
(2) Oil seal

16. Using a press, remove the bushing of gearbox installation portion.

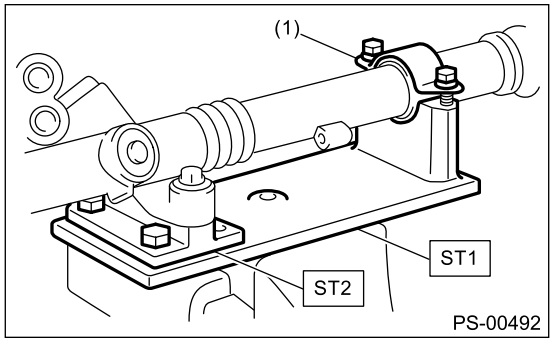


2. CONTROL VALVE

1. Disconnect the four pipes from gearbox.
2. Secure the gearbox removed from vehicle in a vise using ST.

Caution:
Using the ST, secure the gearbox assembly in a vise as shown in the figure. Do not secure the gearbox without this ST.

Preparation tool:
ST1: STAND (926200000)
ST2: BOSS D (34199AG000)

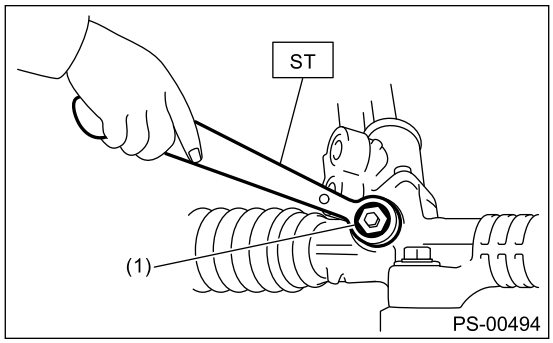


(1) Clamp

3. Using the ST, loosen the lock nut.

Preparation tool:

ST: SPANNER (926230000)

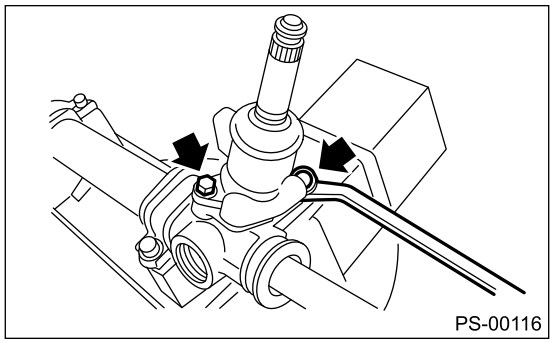


(1) Lock nut

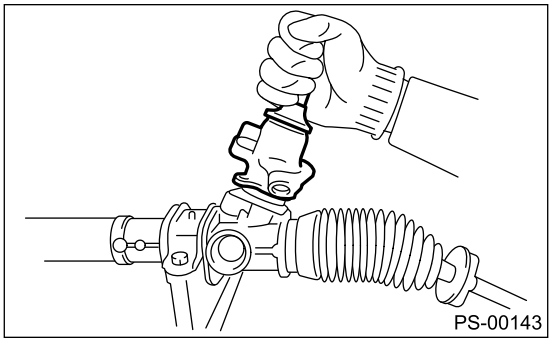
4. Loosen the adjusting screw, and remove the spring and sleeve.

5. Remove the guide chip.

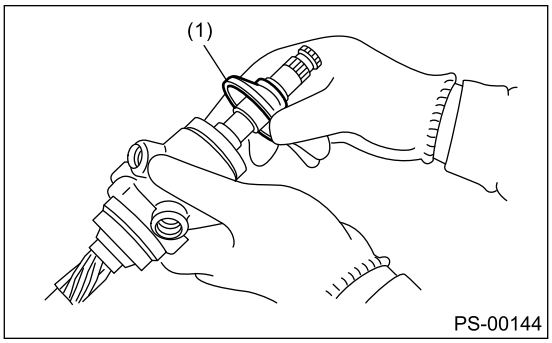
6. Remove the two bolts securing valve assembly.



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

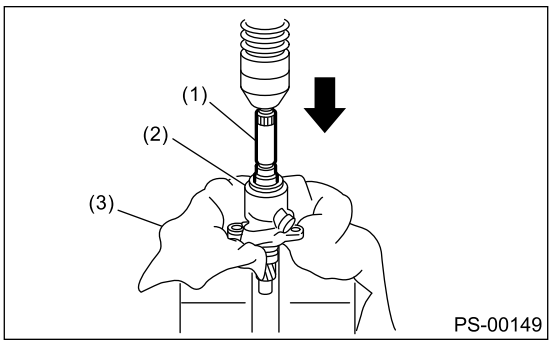


8. Put a vinyl tape around the spline portion, and slide the dust cover to remove.



(1) Dust cover

9. Using a press, remove the pinion & valve assembly from valve housing.



(1) Pinion & valve ASSY
(2) Valve housing
(3) Cloth

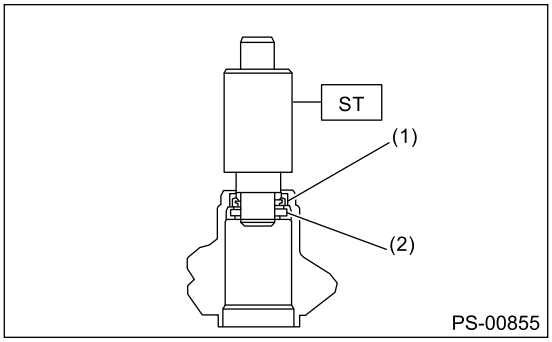
10. Using the ST and a press, remove the bushing and oil seal from the valve housing.

Caution:

- **Do not apply a force to the end surface of valve housing.**
- **Do not reuse the oil seal after removal.**

Preparation tool:

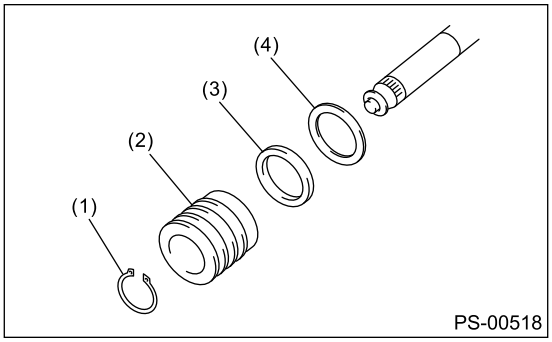
ST: INSTALLER & REMOVER (34199AG090)



(1) Oil seal
(2) Bushing

11. Using a snap ring pliers, remove the snap ring, valve, oil seal and back-up washer.

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



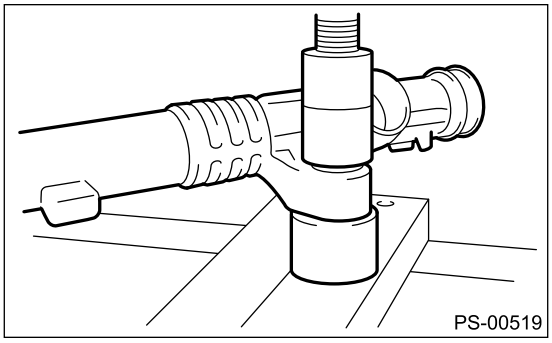
(1) Snap ring
(2) Valve
(3) Oil seal
(4) Back-up ring

POWER ASSISTED SYSTEM (POWER STEERING) > Steering Gearbox

ASSEMBLY

1. RACK HOUSING ASSEMBLY

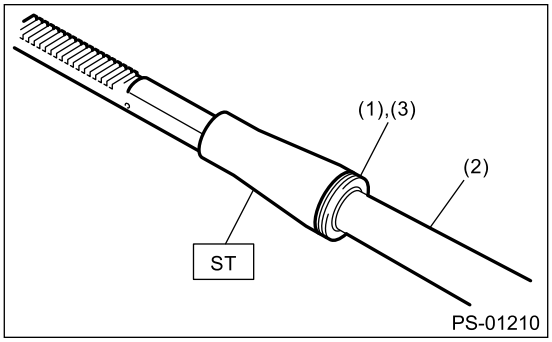
1. Using a press, install the bushing to gearbox installation portion.



2. Insert the ST to rack.

Preparation tool:

ST: GUIDE (34199AG040)



(1) Seal ring

(2) Rack

(3) O-ring

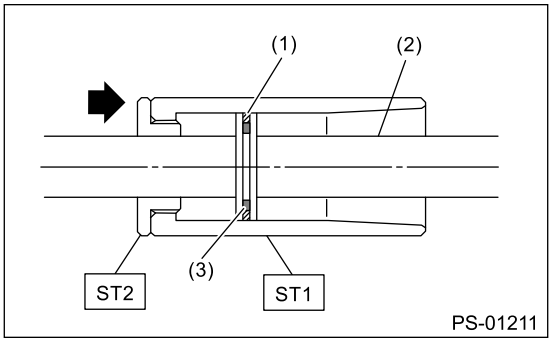
3. Install the seal ring and O-ring to piston portion of rack.

4. Using the ST, form the seal ring properly.

Preparation tool:

ST1: FORMER PISTON (34199AG080)

ST2: GUIDE G (26) (34199AG060)



(1) Seal ring

(2) Rack

(3) O-ring

5. Using the ST-A and ST-B, attach the oil seal to ST-C.

Preparation tool:

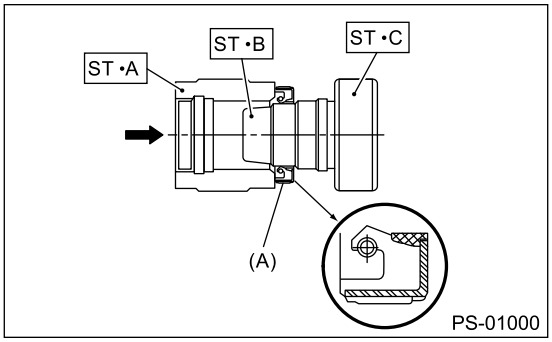
ST-A: INSTALLER A (34199FE070)

ST-B: INSTALLER B (34199FE080)

ST-C: INSTALLER C (34199FE090)

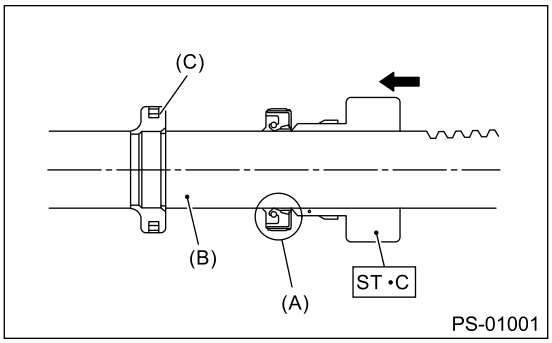
Note:

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



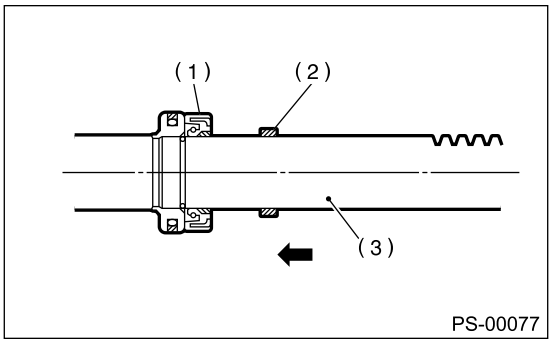
(A) Oil seal

6. Insert the ST-C with oil seal assembled from the gear side of rack. Remove the oil seal from ST-C near piston, and then remove the ST-C from rack.



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

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



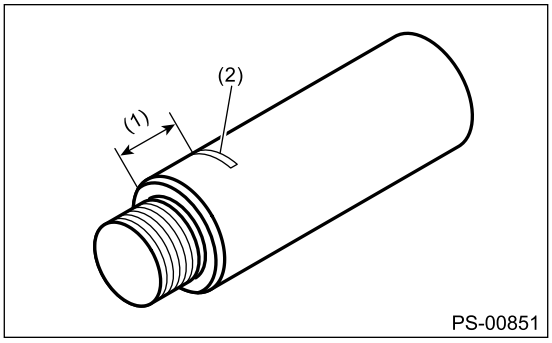
(1) Oil seal
(2) Back-up ring
(3) Rack

8. Check the threaded end of holder and gearbox cylinder end for burrs, damage, etc. Correct if faulty.
9. Apply a coat of grease to the grooves in rack, sliding surface of sleeve and sealing surface of piston. Then insert the rack into steering body from cylinder side.
10. Temporarily tighten a new holder to the gearbox cylinder.
11. Put a mark at the specified position measured from the end surface of ST as shown in the figure.
Specified position:

15 mm (0.59 in)

Preparation tool:

ST: INSTALLER & REMOVER (34199XA030)



(1) 15 mm (0.59 in)

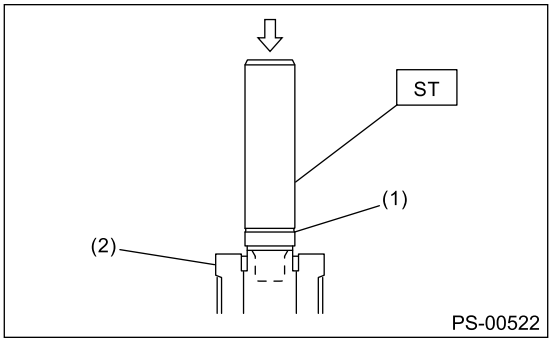
(2) Place a mark

12. Set the ST to the end of rack.

Preparation tool:

ST: INSTALLER & REMOVER (34199XA030)

13. Using a press, press-fit until the mark on the ST is aligned with the end surface of the holder.



(1) Mark

(2) Holder

14. Remove the ST and holder.

15. Insert the outer side oil seal into the rack using the same procedure as steps 5) and 6).

Preparation tool:

ST-A: INSTALLER A (34199FE070)

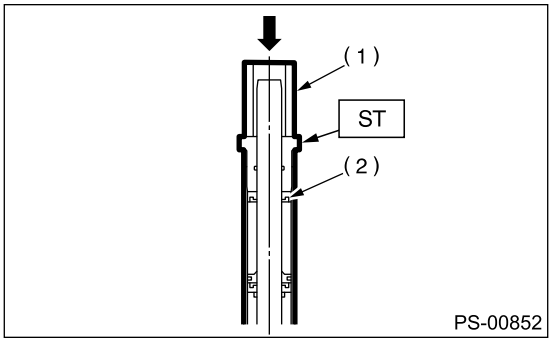
ST-B: INSTALLER B (34199FE080)

ST-C: INSTALLER C (34199FE090)

16. Put the ST and pipe through the rack, and press-fit the outer side oil seal using a press.

Preparation tool:

ST: INSTALLER (34199AG010)



(1) Pipe

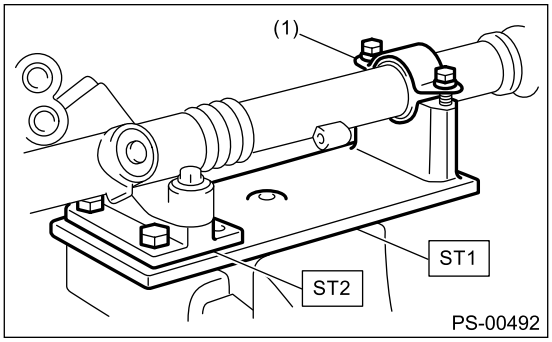
(2) Outer side oil seal

17. Secure the gearbox in a vise using ST.

Preparation tool:

ST1: STAND (926200000)

ST2: BOSS D (34199AG000)



(1) Clamp

18. Tighten the holder.

Tightening torque:

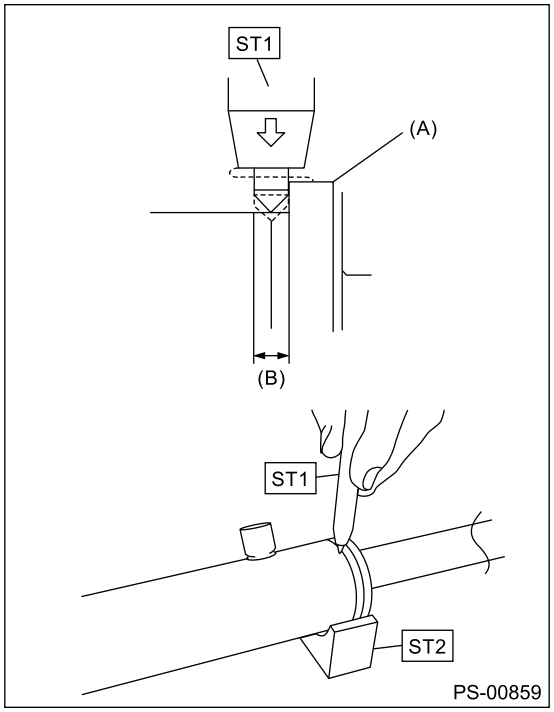
70 N·m (7.1 kgf-m, 51.6 ft-lb)

19. Using the ST, crimp so that the diameter of punch hole is 2 — 2.5 mm (0.08 — 0.10 in) and is aligned to the position of 2 mm (0.08 in) from gearbox cylinder end surface.

Preparation tool:

ST1: PUNCH HOLDER (34099FA060)

ST2: BASE (34199FE020)



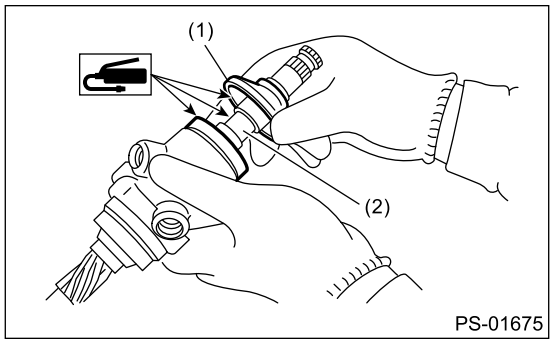
(A) Holder

(B) 2 mm (0.08 in)

20. Put a vinyl tape around the spline portion and apply genuine grease to the dust cover and fill it to the clearance between pinion shaft and housing, then install the valve assembly.

Caution:

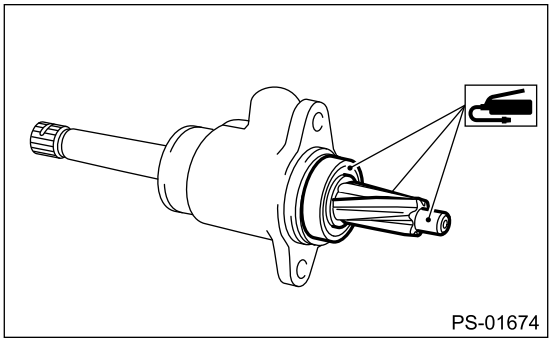
Be sure to install the dust cover to groove of shaft.



(1) Dust cover

(2) Groove

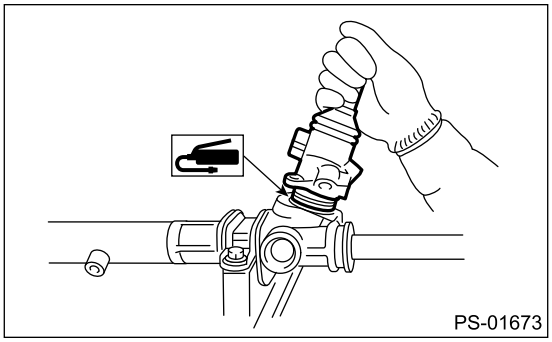
21. Apply the genuine grease to the edge and body of pinion gear and bearing of valve assembly.



22. Apply grease to a new O-ring and attach it to the valve assembly. Insert the valve assembly into the given place while facing the rack teeth toward pinion.

Caution:

Check that the needle bearing is not damaged. Replace with a new steering gearbox if damage is found.



23. Tighten the bolts alternately to secure the valve assembly.

Caution:

Be sure to alternately tighten the bolts.

Tightening torque:

20 N·m (2 kgf-m, 14.8 ft-lb)

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

Caution:

Operating the rack from lock to lock without installing tie-rods may damage the oil seal. Always install the left and right tie-rods.

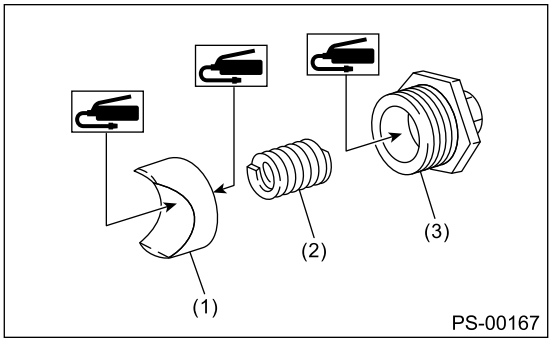
25. Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

Liquid gasket:

THREE BOND 1102

26. Apply a coat of grease to the sliding surface of sleeve and seating surface of spring, and then insert the sleeve into steering body.

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



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

27. Tighten the adjusting screw to the specified torque, then loosen it.
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

28. Tighten the adjusting screw to the specified torque, then loosen it 5°.
Tightening torque:
5.9 N·m (0.6 kgf-m, 4.4 ft-lb)

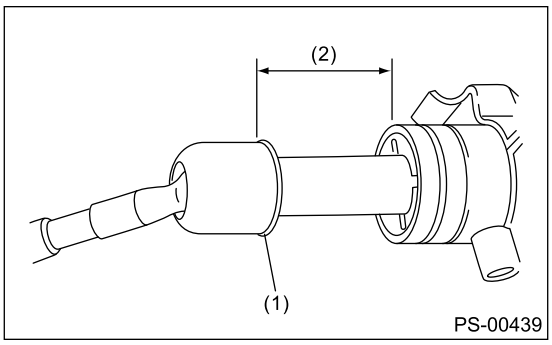
29. Remove the tie-rod.

30. Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Gearbox>INSPECTION > LIMIT.

31. Attach the lock nut into adjusting screw, and while holding the adjusting screw with wrench, tighten the lock nut.
Preparation tool:
Monkey type torque wrench available for width across flat 35 mm (1.4 in) operation.
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)
Note:
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

32. Extend the rack approx. 40 mm (1.57 in) from steering body.

33. Install the tie-rod and new lock washer into rack.
Tightening torque:
93 N·m (9.5 kgf-m, 68.6 ft-lb)

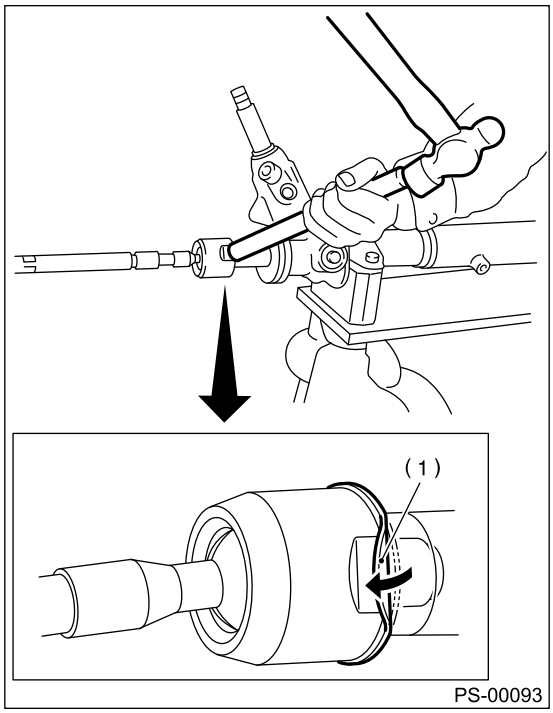


(1) Lock washer
(2) Approx. 40 mm (1.57 in)

34. Bend the lock washer and crimp it.

Caution:

Be careful not to scratch the rack when crimping lock washer.

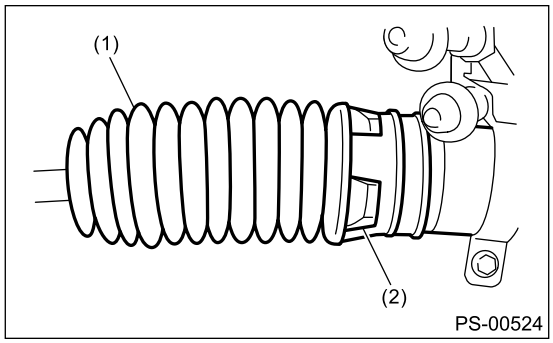


(1) Lock washer

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

Caution:

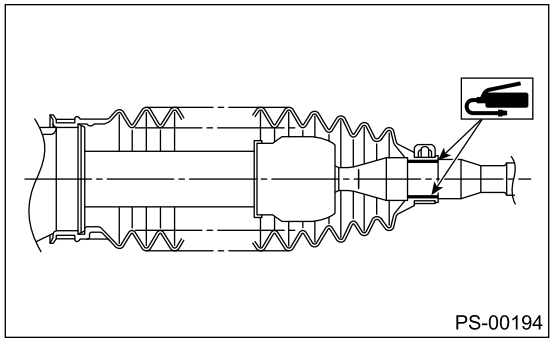
Right side boot has groove for identification, be sure to install the right and left of boot.



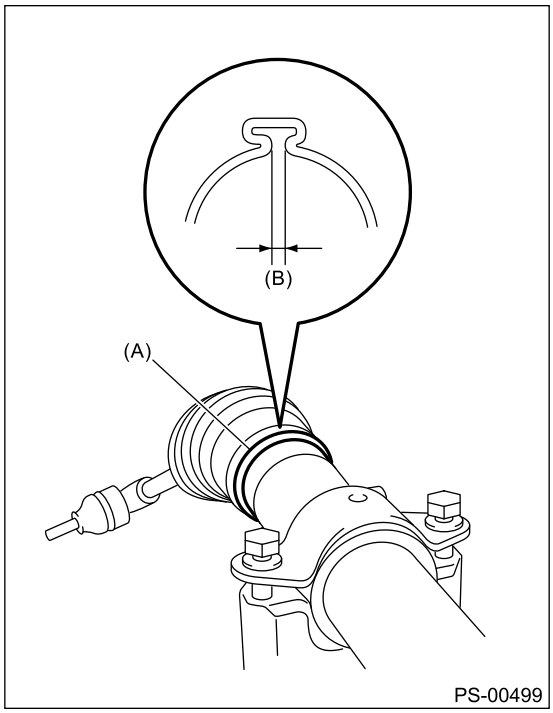
(1) Right side boot

(2) Groove for identification

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

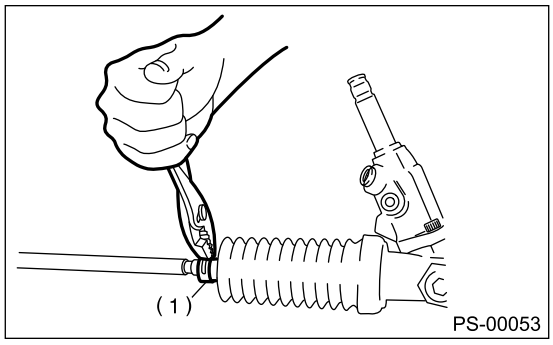


36. Install a new boot band. Using band clamp pliers, crimp it so that the clearance of crimping portion becomes 2 mm (0.079 in) or less.



(A) Boot band
(B) 2 mm (0.079 in) or less

37. Fix the boot end with small clip.



(1) Clip

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

39. If the tie-rod end has been removed, screw in lock nut and tie-rod end to the screwed portion of tie-rod, and tighten the lock nut at a position as shown in the figure.

Caution:

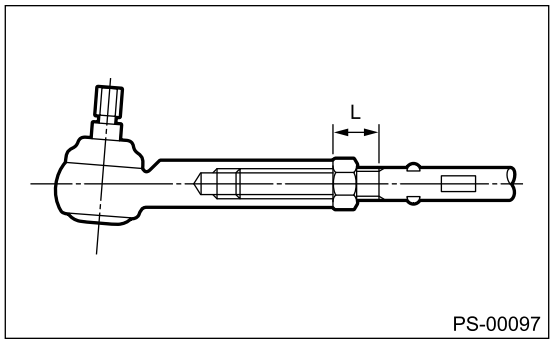
For models with tire repair kit, the left and right tie-rod ends differ in shape. Be sure to confirm the punch mark of tie-rod end (RH/LH) before installation.

Tightening torque:

85 N·m (8.7 kgf-m, 62.7 ft-lb)

Installed tie-rod length L:

28 mm (1.1 in)

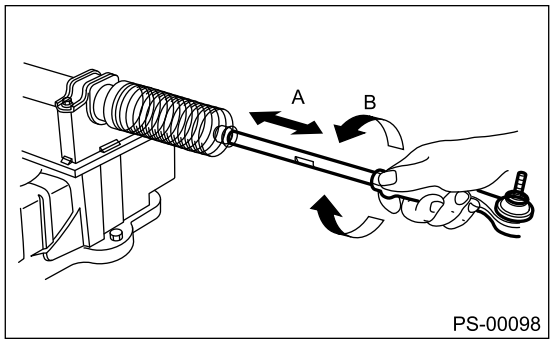


40. Inspect the gearbox as follows:

"A" Holding the tie-rod end, repeat lock to lock several times as quickly as possible.

"B" Holding the tie-rod end, turn it slowly at a radius several times as large as possible.

Finally, make sure that the boot is installed in the specified position without inflating.



41. Remove the gearbox from ST.

Preparation tool:

ST1: STAND (926200000)

ST2: BOSS D (34199AG000)

42. Install the four pipes on gearbox.

(1) Connect the pipes A and B to the four pipe joints of gearbox.

Tightening torque:

Cylinder side: 27 N·m (2.8 kgf-m, 19.9 ft-lb)

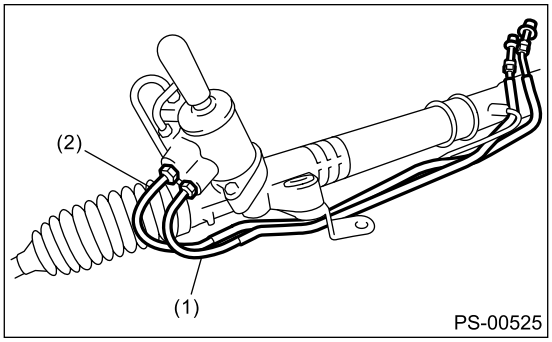
Gear housing side: 17 N·m (1.7 kgf-m, 12.5 ft-lb)

(2) Connect the feed pipe and return pipe to the gearbox.

Tightening torque:

Feed pipe: 37 N·m (3.8 kgf-m, 27.3 ft-lb)

Return pipe: 29 N·m (3 kgf-m, 21.4 ft-lb)



(1) Feed pipe

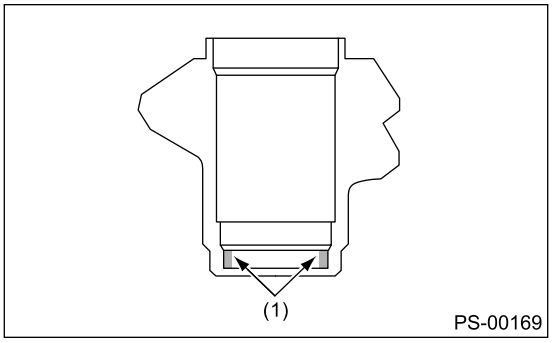
(2) Return pipe

2. CONTROL VALVE ASSEMBLY

Specified steering grease:

VALIANT GREASE M2

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

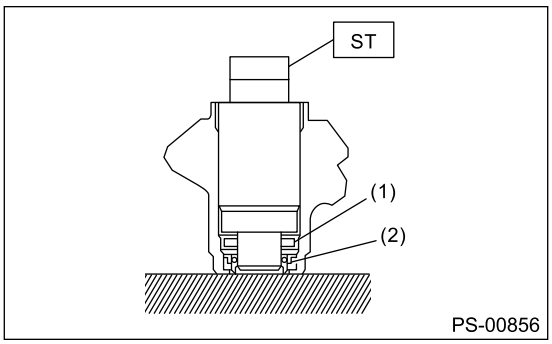


(1) Apply fluid.

3. Apply grease to the oil seal.
4. Verify the direction of oil seal.
5. Using the ST and a press, install the oil seal and the bushing in valve housing.

Preparation tool:

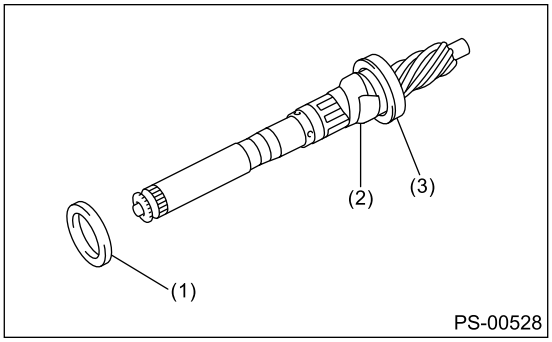
ST: INSTALLER & REMOVER (34199AG090)



(1) Bushing

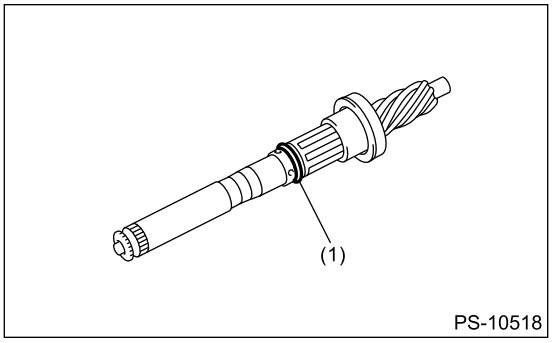
(2) Oil seal

6. Apply vinyl tape to the groove of pinion.
7. Install the wave washer and oil seal to pinion, and then remove the vinyl tape.



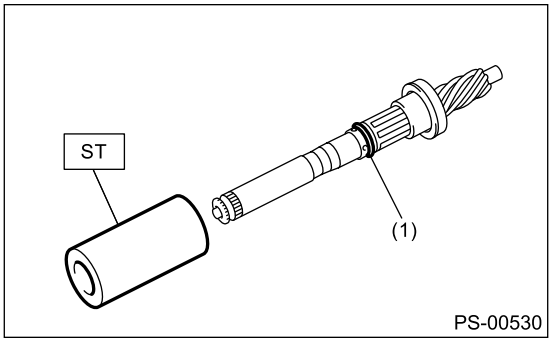
(1) Oil seal
(2) Vinyl tape
(3) Wave washer

8. Install the seal ring and O-ring.



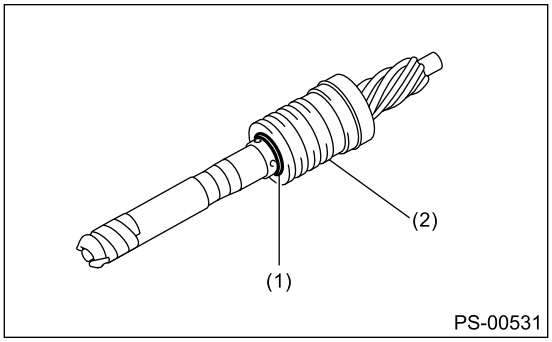
(1) Seal ring and O-ring

9. Using the ST FORMER, form the seal ring properly.
Preparation tool:
ST: FORMER (34199AG070)



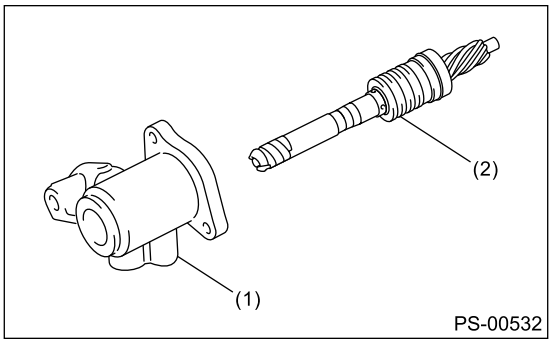
(1) Seal ring

10. Put vinyl tape around pinion shaft spline to protect oil seal from damage.
11. Install the valve to pinion, and install the snap ring.



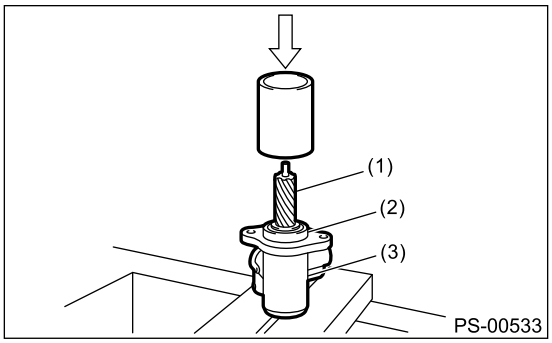
(1) Snap ring
(2) Valve

12. Attach the pinion & valve assembly into the valve housing.



(1) Valve housing
(2) Pinion & valve ASSY

13. Using a press, push the outer race of bearing and press-fit the pinion & valve assembly into housing.

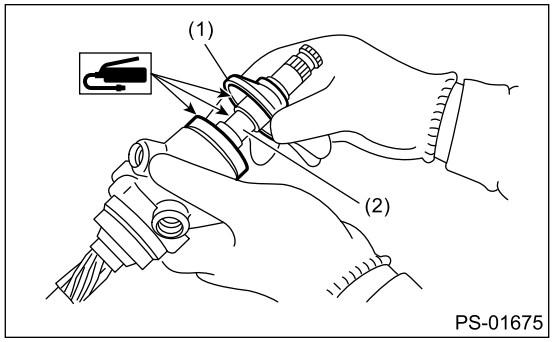


(1) Pinion & valve ASSY
(2) Bearing
(3) Housing

14. Apply the specified grease to the dust cover and fill it to the clearance between pinion shaft and housing.

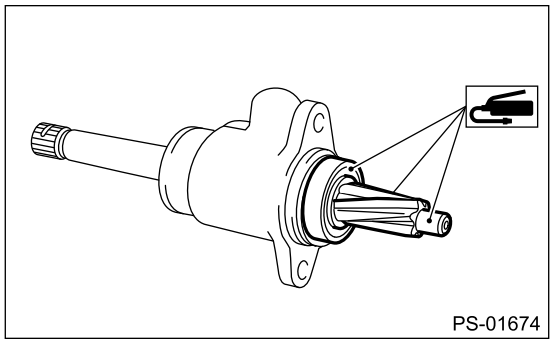
15. Install the dust cover on valve assembly.

Caution:
Be sure to install the dust cover to groove of shaft.

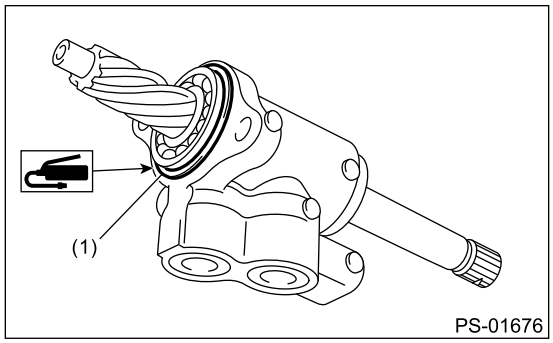


(1) Dust cover
(2) Groove

16. Apply the genuine grease to the edge and body of pinion gear and bearing of valve assembly.



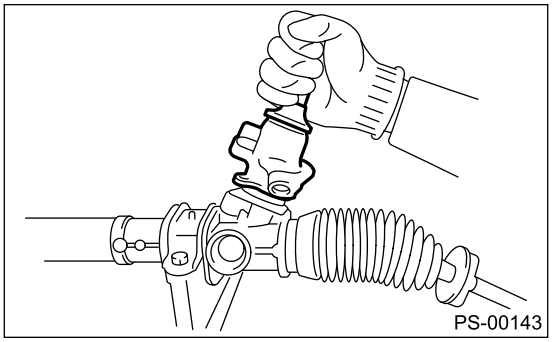
17. Apply grease to a new O-ring and attach it to the valve assembly.



(1) O-ring

18. Insert the valve assembly into the given place while facing the rack teeth toward pinion.

Caution:
Check that the needle bearing is not damaged. Replace with a new steering gearbox if damage is found.



19. Tighten the bolts alternately to secure the valve assembly.

Caution:

Be sure to alternately tighten the bolts.

Tightening torque:

20 N·m (2 kgf-m, 14.8 ft-lb)

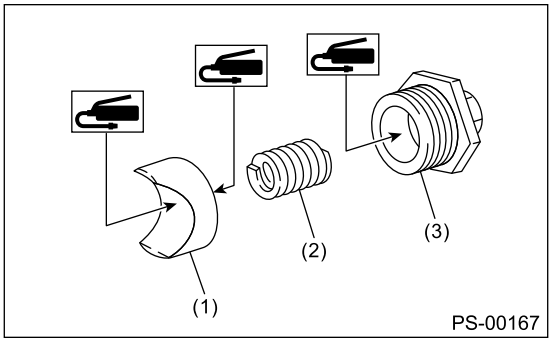
20. Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

Liquid gasket:

THREE BOND 1102

21. Apply a coat of grease to the sliding surface of sleeve and seating surface of spring, and then insert the sleeve into steering body.

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



(1) Sleeve

(2) Spring

(3) Adjusting screw

22. Tighten the adjusting screw to the specified torque, then loosen it.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)

23. Tighten the adjusting screw to the specified torque, then loosen it 5°.

Tightening torque:

5.9 N·m (0.6 kgf-m, 4.4 ft-lb)

24. Adjust the turning resistance of gearbox so that it is within specification using adjusting screw.

Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Gearbox>INSPECTION > LIMIT.

25. Attach the lock nut into adjusting screw, and while holding the adjusting screw with wrench, tighten the lock nut.

Preparation tool:

Monkey type torque wrench available for width across flat 35 mm (1.4 in) operation.

Tightening torque (lock nut):

25 N·m (2.5 kgf-m, 18.4 ft-lb)

Note:

Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

26. Remove the gearbox from ST.

Preparation tool:

ST1: STAND (926200000)

ST2: BOSS D (34199AG000)

27. Install the four pipes on gearbox.

(1) Connect the pipes A and B to gearbox.

Tightening torque:

Cylinder side: 27 N·m (2.8 kgf-m, 19.9 ft-lb)

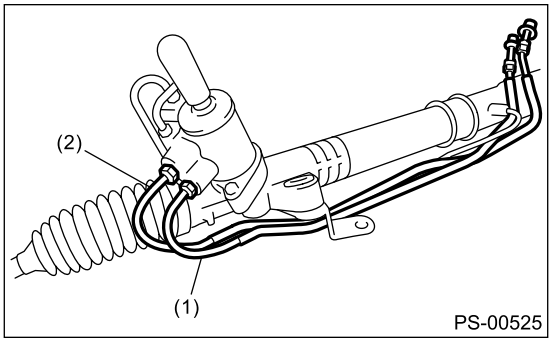
Gear housing side: 17 N·m (1.7 kgf-m, 12.5 ft-lb)

(2) Connect the feed pipe and return pipe to the gearbox.

Tightening torque:

Feed pipe: 37 N·m (3.8 kgf-m, 27.3 ft-lb)

Return pipe: 29 N·m (3 kgf-m, 21.4 ft-lb)



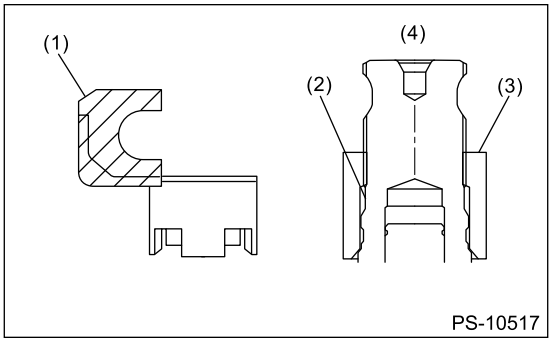
(1) Feed pipe

(2) Return pipe

28. Cut out the shaded area of the guide chip using a pair of nippers, etc., and attach by aligning with the groove of the spline. (Install in any direction. See the cross section.)

Caution:

If the guide chip is not installed, the position of the universal joint assembly - steering mounting bolt may move that may cause failure of installation.



(1) Cut-out area

(2) Groove of spline part

(3) Guide chip

(4) Cross section

POWER ASSISTED SYSTEM (POWER STEERING) > Steering Gearbox

INSPECTION

1. BASIC INSPECTION

1. Clean all the disassembled parts, and check for wear, damage or any other faults, then repair or replace as necessary.
2. When disassembling, check the inside of gearbox for water. If any water is found, carefully check the boot for damage, input shaft dust seal, adjusting screw and boot clips for poor sealing. If faulty, replace with new parts.

No.	Parts	Inspection	Corrective action
1	Input shaft	(1) Bent input shaft (2) Damage on serration	If the bend or damage is excessive, replace the entire gearbox.
2	Dust seal	(1) Crack or damage (2) Wear	If the outer wall slips, the lip is worn out or damage is found, replace it with a new part.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust the backlash properly. By measuring the turning torque of the gearbox and sliding resistance of rack, check if the rack & pinion engage uniformly and smoothly with each other. (Refer to “Service limit”.) (2) Pull out the entire rack to allow viewing of the teeth, and check for damage. When abnormality is found in either (1) or (2), replace the entire gearbox.
4	Gearbox unit	(1) Bending of the rack shaft (2) Bending of the cylinder portion (3) Crack or damage on the aluminum portion	Replace the gearbox with a new part.
		(4) Wear or damage on rack bushing	If the free play of rack shaft in radial direction is out of the specified range, replace the gearbox with new part. (Refer to “Service limit”.)
		(5) Wear on input shaft bearing	If the free play of input shaft in radial and axial direction is out of the specified range, replace the gearbox with a new part. (Refer to “Service limit”.)
5	Boot	Crack, damage or deterioration	Replace.

No.	Parts	Inspection	Corrective action
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration of dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipe	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.

2. LIMIT

Make a measurements as follows. If it exceeds the specified service limits, adjust or replace.

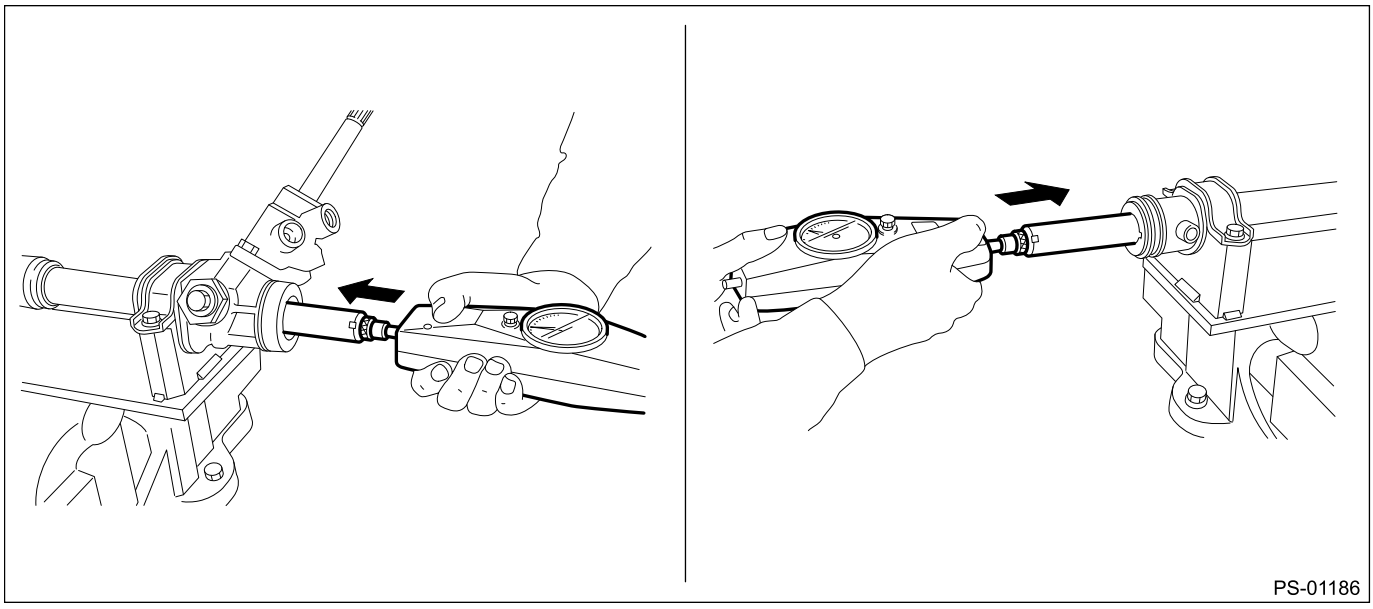
Caution:

- **When making a measurement, secure the gearbox in a vise using ST.**
- **When fixing the gearbox in a vise, apply a wooden piece on the flange portion.**

Preparation tool:

ST1: STAND (926200000)
ST2: BOSS D (34199AG000)

Rack shaft sliding resistance



Limit: 343 N (35.0 kgf, 77 lbf) or less
Left/right differential of sliding resistance: 20% or less

Rack shaft play in the radial direction

- **Right-turn steering**

  Limit

Both amplitudes: 0.4 mm (0.016 in) or less

Condition

Weighting point

L1: 10 mm (0.39 in) from rack shaft end

Rack shaft end P: 98 N (10 kgf, 22 lb)

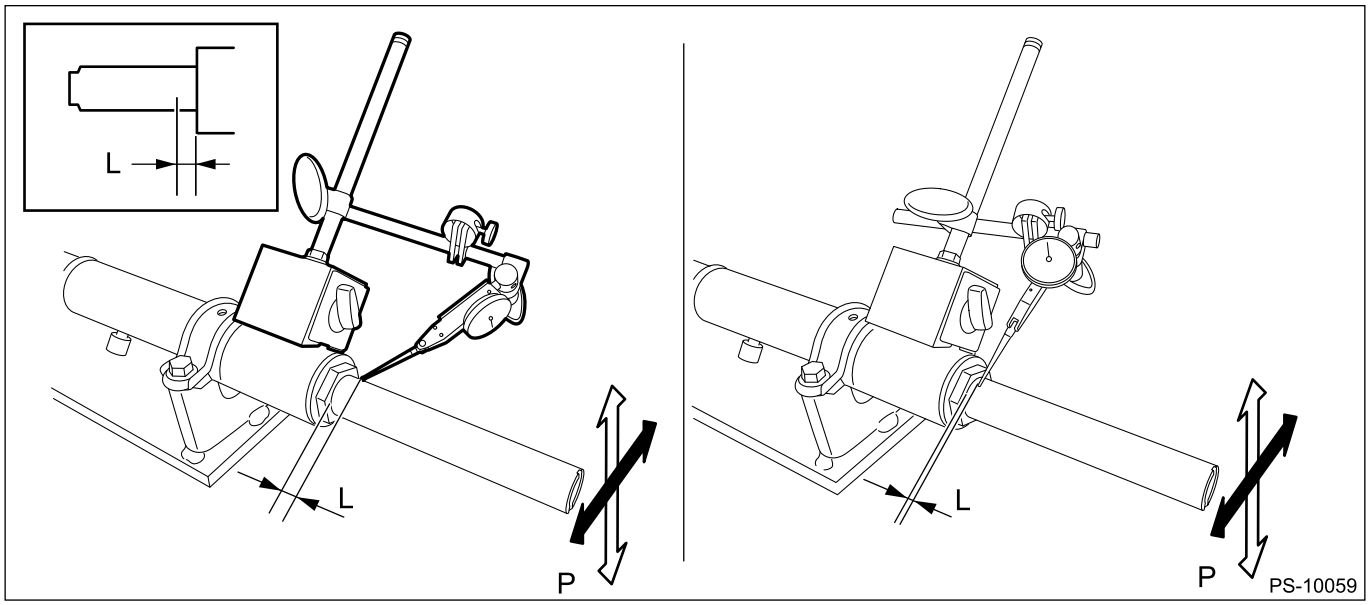
Measuring point

L2: 5 mm (0.2 in) from dust cover

Note:

<Example of magnet stand and dial gauge installation>

The location where the magnet stand is installed varies to stabilize the magnet stand.



- **Left-turn steering**

Limit

Both amplitudes: Direction ⟷: 0.6 mm (0.024 in) or less

Both amplitudes: Direction ⇦⇨: 0.4 mm (0.016 in) or less

Condition

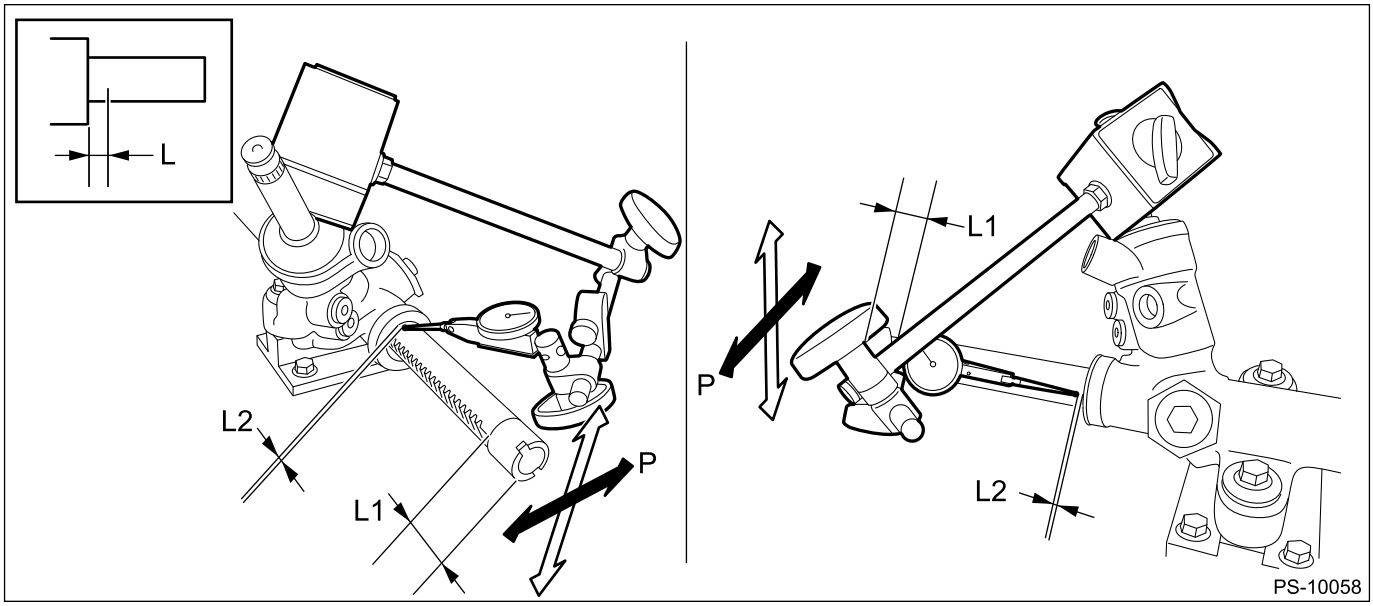
L: 5 mm (0.2 in) from dust cover

Rack shaft end P: 98 N (10 kgf, 22 lbf)

Note:

<Example of magnet stand and dial gauge installation>

The location where the magnet stand is installed varies to stabilize the magnet stand.



Input shaft play

- **In radial direction**

  Condition

  L: 5 mm (0.2 in) from dust cover

  Input shaft tip P: 98 N (10 kgf, 22 lbf)

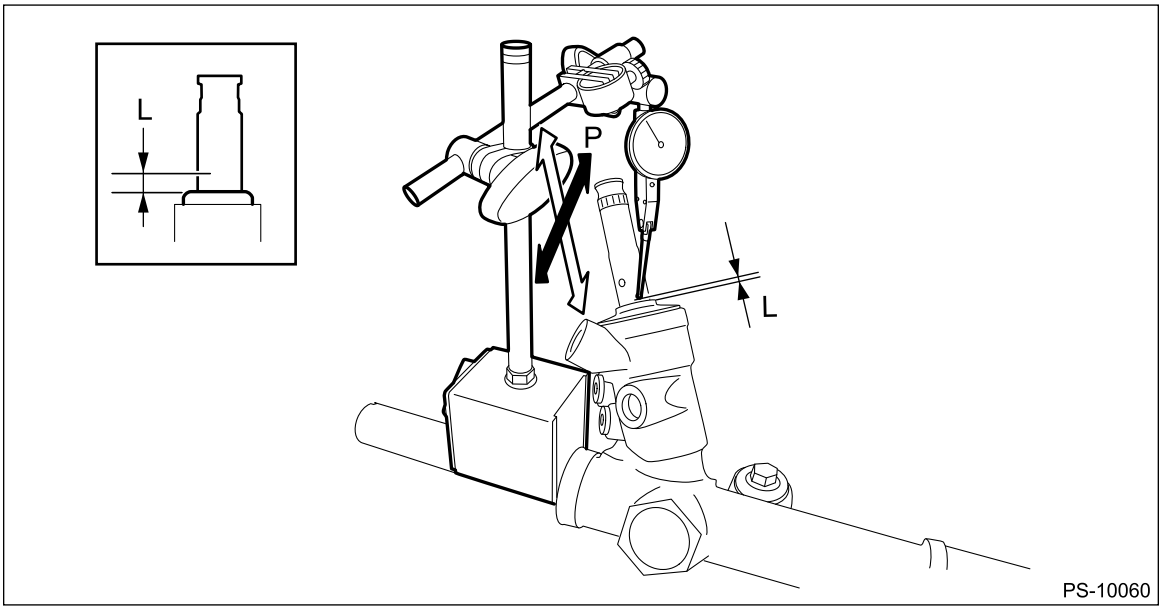
  Limit

  Both amplitudes: 0.26 mm (0.0102 in) or less

  Note:

  <Example of magnet stand and dial gauge installation>

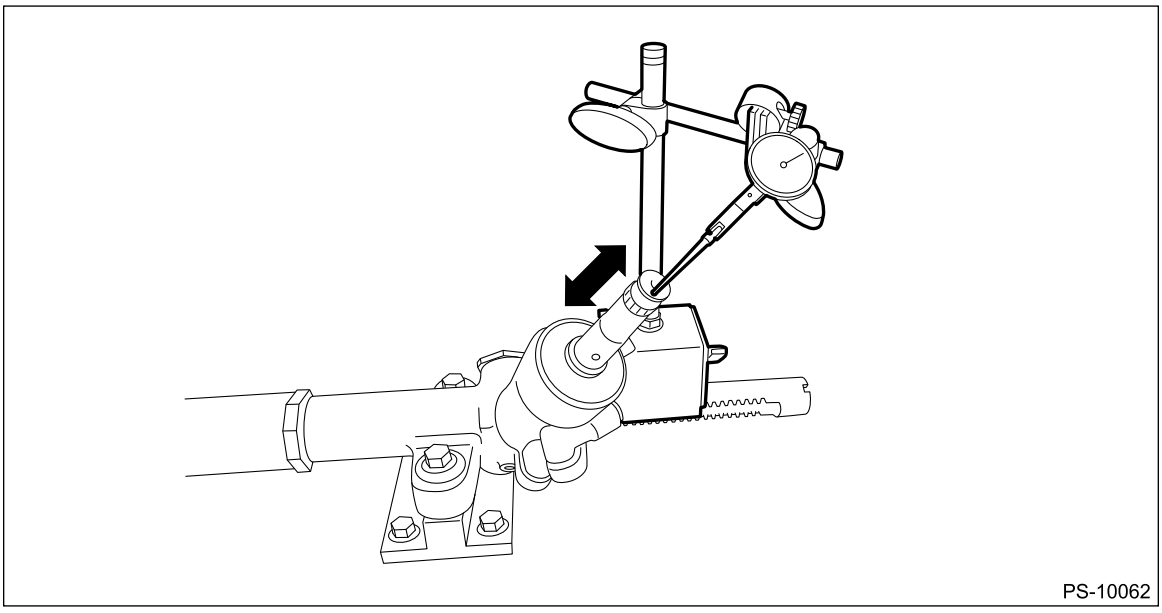
  The location where the magnet stand is installed varies to stabilize the magnet stand.



- **In axial direction**

  Limit

  Without play

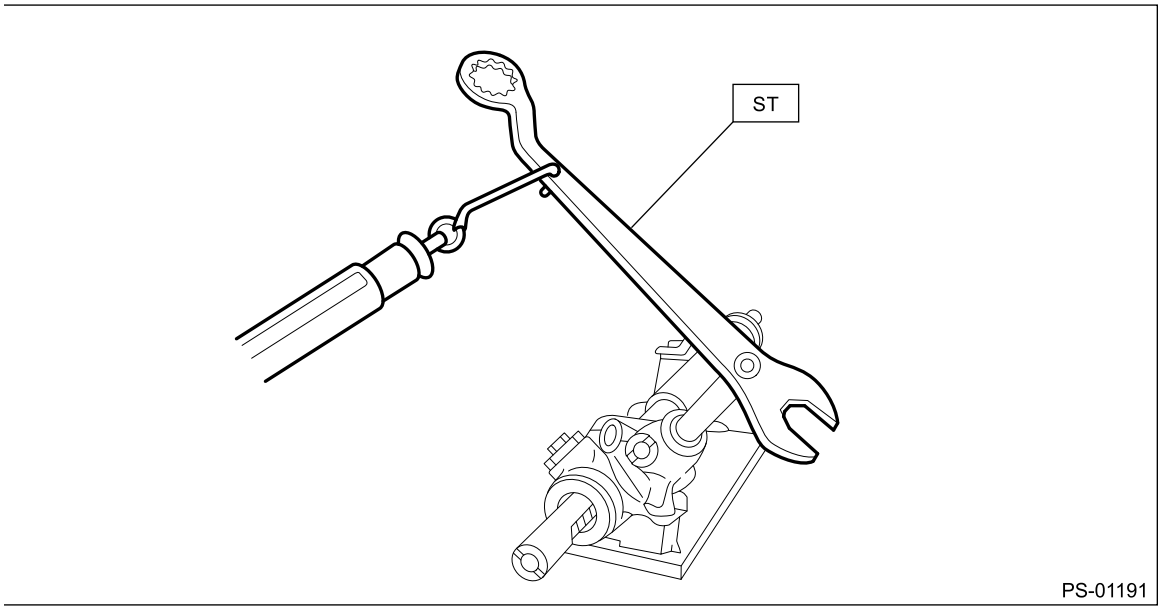


Rotational resistance of gearbox

Using the ST, measure the gearbox turning resistance.

Preparation tool:

ST: SPANNER (34099PA100)

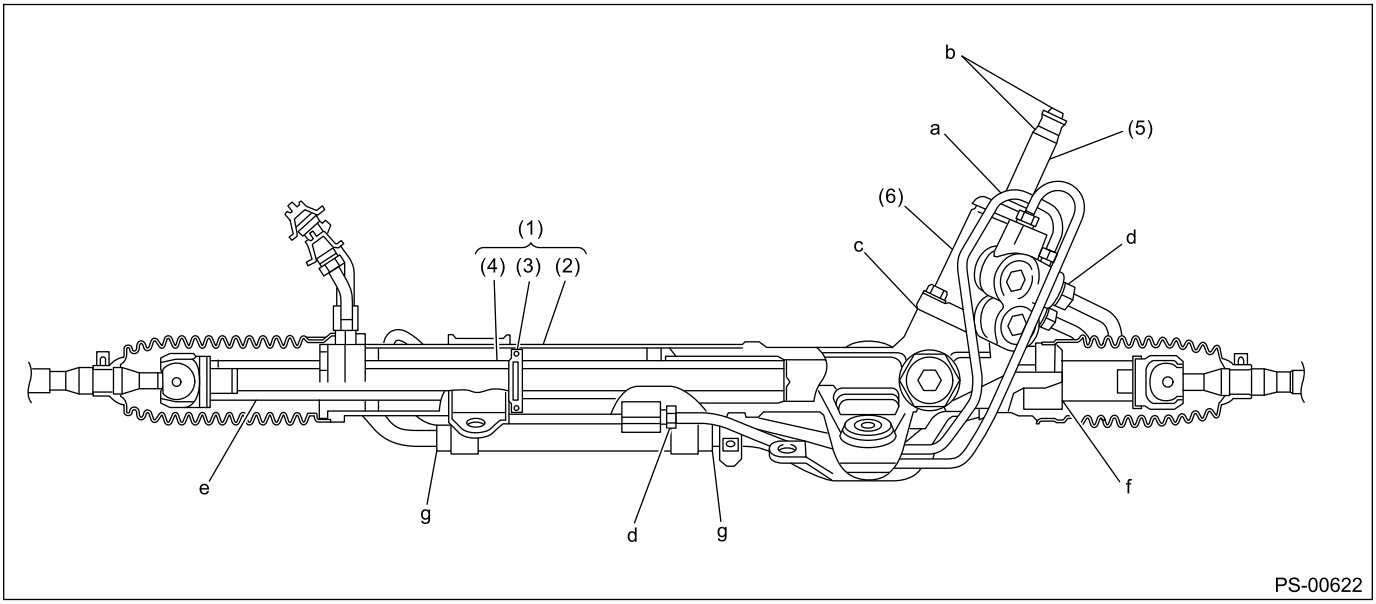


Service limit:

Maximum allowable resistance: 21 N (2.14 kgf, 4.7 lbf) or less

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

3. FLUID LEAKAGE



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

1. Lift up the vehicle.
2. If a fluid leak is found, clean the fluid completely from the suspect area, and turn the steering wheel 30 to 40 times to the left and right from lock to lock, with the engine running, and check again for leaks immediately, and also after a few hours have passed.
3. Cause and solution for oil leakage from “a”
   The oil seal is damaged. Replace the valve assembly or valve housing side oil seal assembly with a new part.
4. Cause and solution for oil leakage from “b”
   The torsion bar O-ring is damaged. Replace the valve assembly with a new part.
5. Cause and solution for oil leakage from “c”
   The oil seal is damaged. Replace the valve assembly or pinion side oil seal with a new part.
6. Cause and solution for oil leakage from “d”
   The pipe is damaged. Replace the faulty pipe or O-ring.
7. Cause and solution for oil leakage from “g”
   The hose is damaged. Replace the hose with a new part.
8. If leak is other than a, b, c, d or g, or if oil is leaking from gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove fluid from surrounding portions. Then, turn the steering wheel from lock to lock about 30 to 40 times with the engine running, then re-inspect the leaking area immediately after and several hours after this operation.
   (1) Leakage from “e”
   The cylinder seal is damaged. Replace the oil seal.
   (2) Leakage from “f”
   There are two possible causes. Perform the following step first. Remove the pipe assembly B from the valve housing, and close the circuit using ST.
   Preparation tool:

ST: PLUG (926420000)

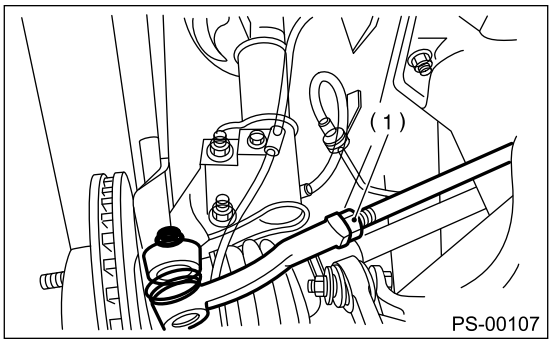
Turn the steering wheel from lock to lock approx. 30 to 40 times with the engine running, then inspect the leaked portion immediately after and several hours after this operation.

- If leakage from "f" is noted again:
  The oil seal of pinion and valve assembly is damaged. Replace the pinion & valve assembly with a new part. Or, replace the oil seal.
- If oil stops leaking from "f":
  The oil seal of rack housing is damaged. Replace the oil seal and back-up ring.

POWER ASSISTED SYSTEM (POWER STEERING) > Steering Gearbox

ADJUSTMENT

1. Adjust the front toe-in.
Ref. to FRONT SUSPENSION>Wheel Alignment>INSPECTION > FRONT WHEEL TOE-IN.

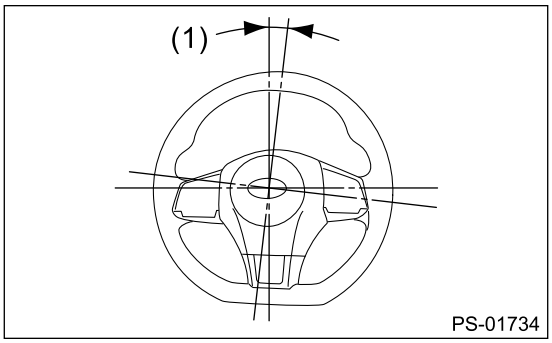


(1) Lock nut

2. Check the steering angle of the wheels.
Standard of steering angle:

Inner wheel	Outer wheel
36.3°±1.5°	32.0°±1.5°

3. If the steering wheel spokes are not horizontal when wheels are set in the straight ahead position, or error is more than 5° on the periphery of the steering wheel, correctly re-install the steering wheel.



(1) 5° or less

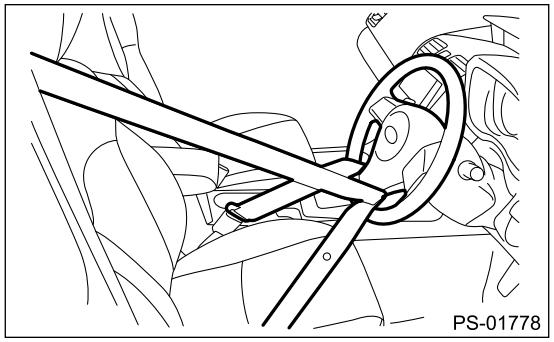
4. If the steering wheel spokes are not horizontal with vehicle set in the straight ahead position after this adjustment, correct it by turning the right and left tie-rods in the opposite direction from each other by the same angle.

REMOVAL

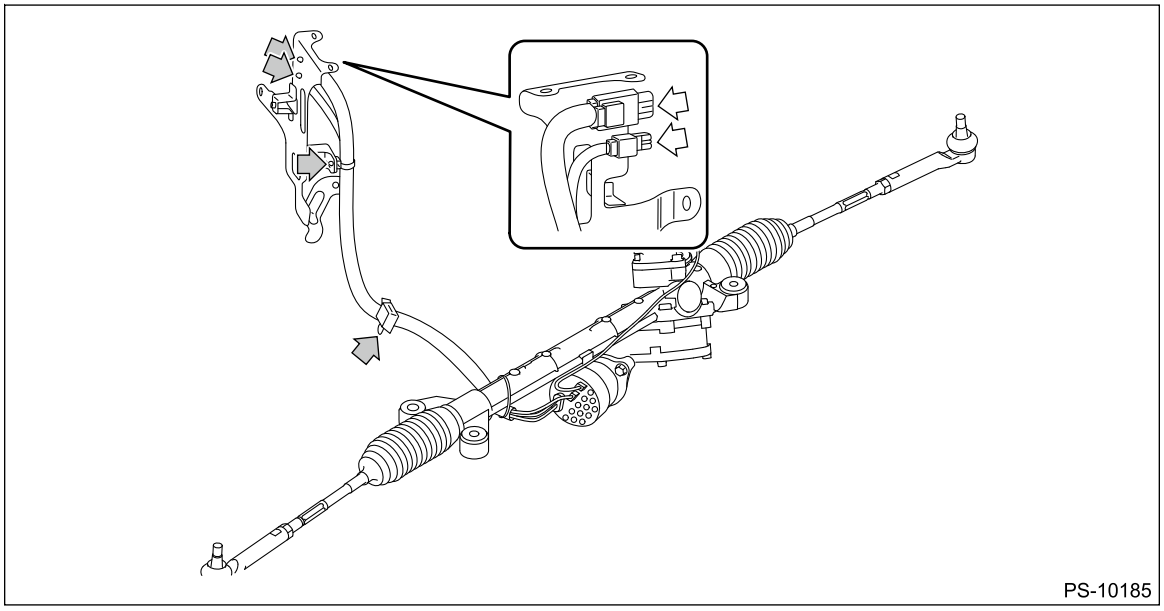
Caution:
For electric power steering model, be careful of the following items.

- **The power steering control module continues to operate after the engine stops and calculates the temperature in the control module. Therefore, before starting service of the power steering system which requires disconnection of the connector, stop the engine and allow approx. 30 minutes until the control module becomes cold.**
- **Be careful not to let any foreign matter (dust, water, oil, etc.) enter into the steering gearbox connector when removing or installing. If a foreign matter enters, completely remove it.**

1. Set the steering column and the driver's seat to the neutral position.
   Caution:
   Always place the tilt lever to the lock position after the steering column is adjusted.
2. Prevent the steering wheel from turning using the seat belt.



3. Disconnect the ground terminal from battery sensor. Ref. to NOTE>NOTE > BATTERY.
4. Disconnect the steering gearbox connector and harness clamp.

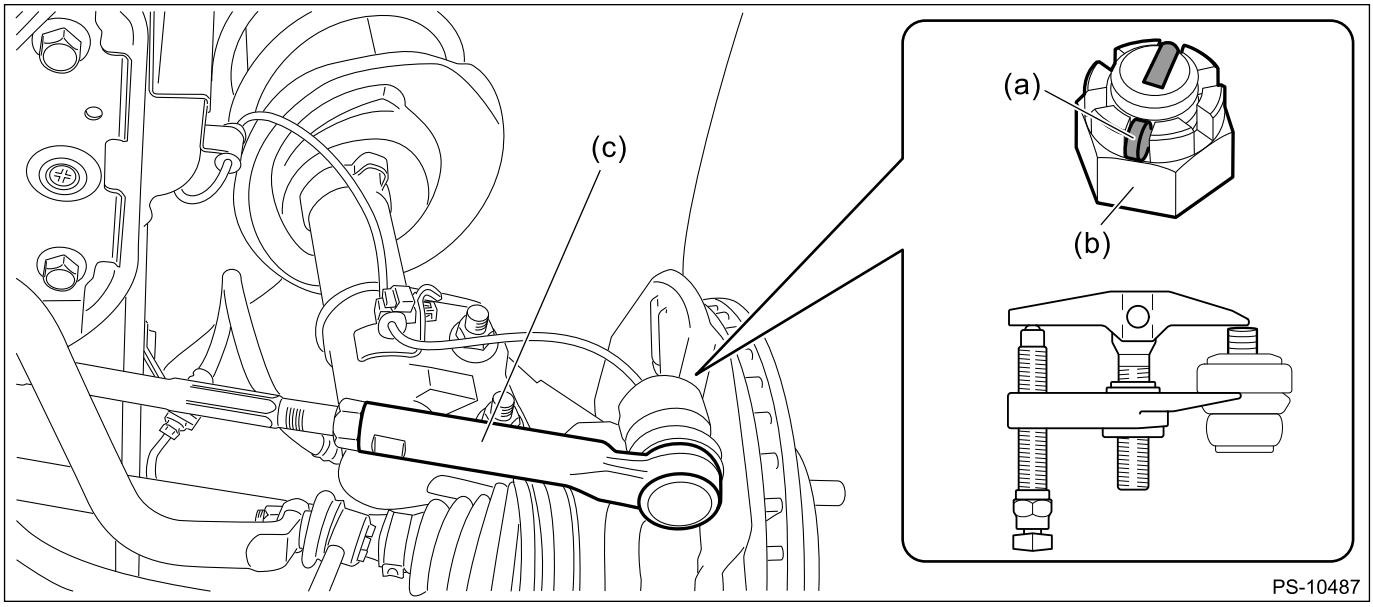


5. Lift up the vehicle, and then remove the front wheels.
6. Disconnect the tie-rod end.

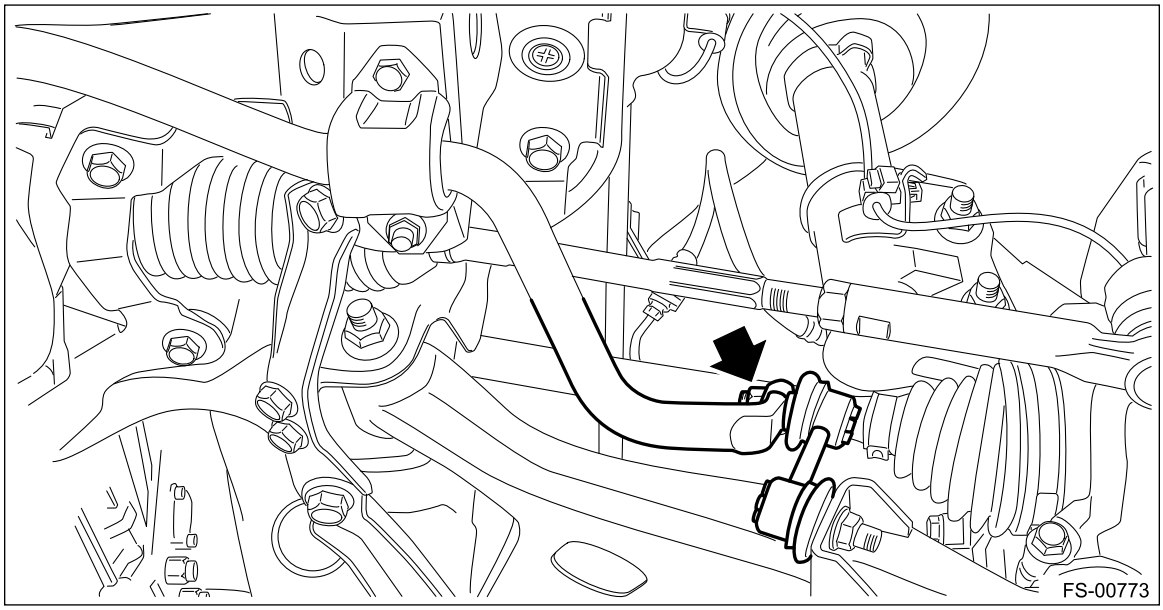
(1) Pull out the cotter pin (a).
(2) Remove the castle nut (b).
(3) Using a tie-rod ball joint puller, remove the tie-rod end (c).

Preparation tool:

Tie-rod ball joint puller



7. Disconnect the stabilizer link.

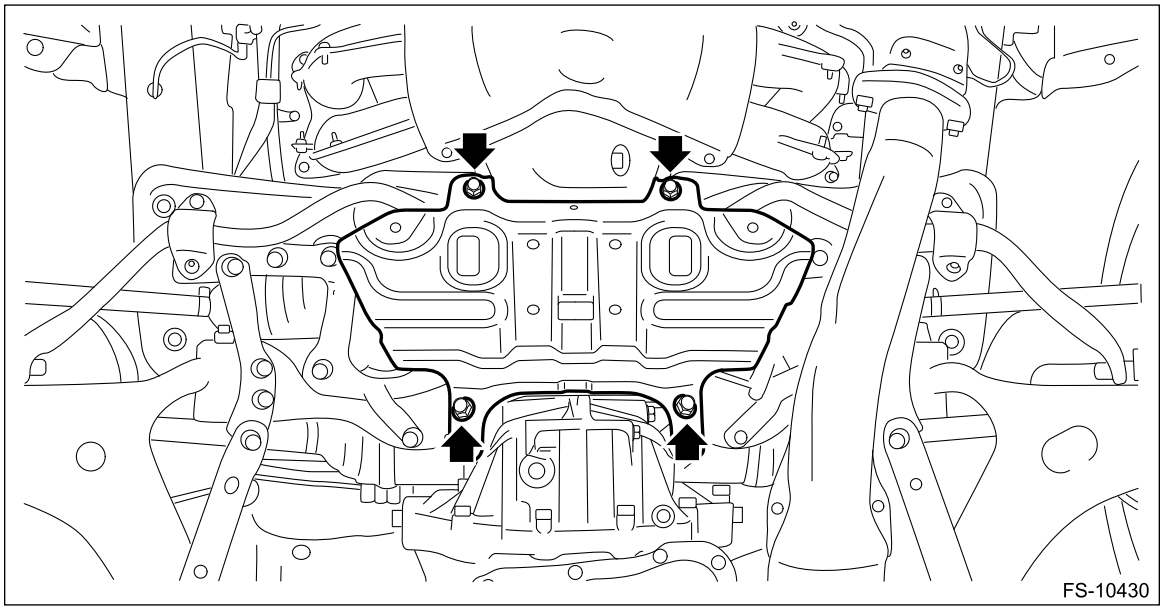


8. Remove the under cover - front. Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.

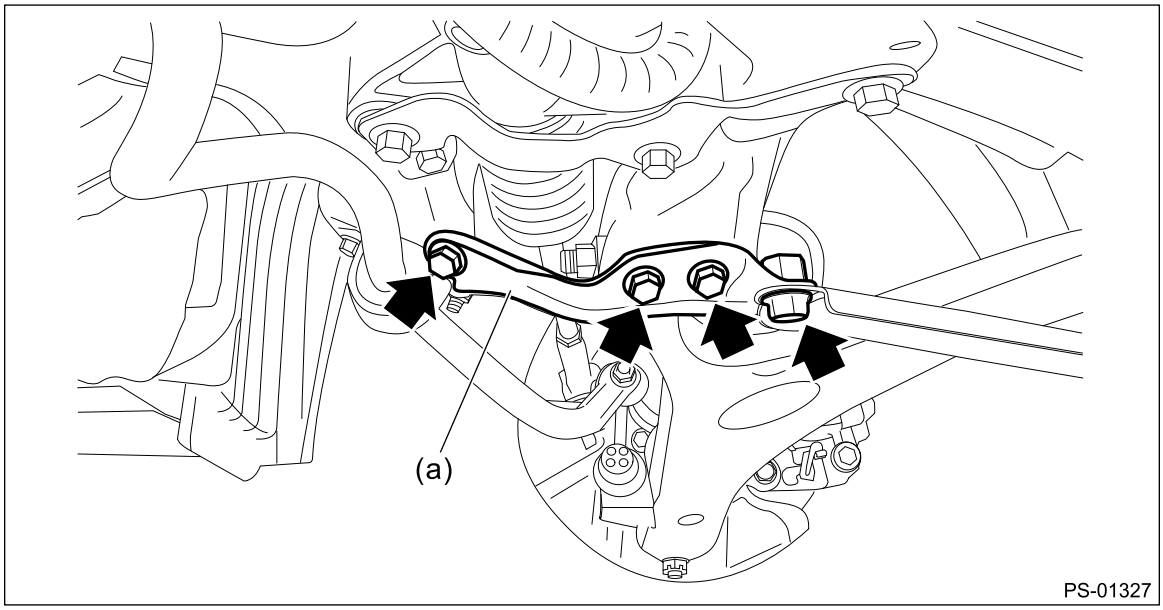
9. Remove the center exhaust pipe (rear). Ref. to EXHAUST(w/o STI)>Center Exhaust Pipe>REMOVAL.

10. Remove the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>REMOVAL.

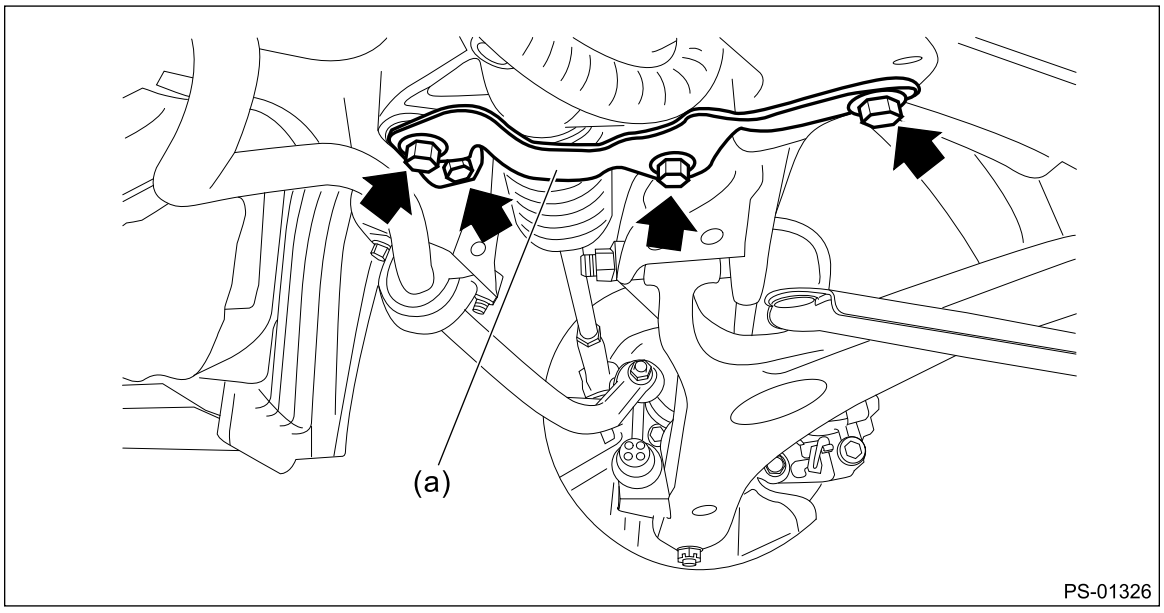
11. Remove the front crossmember support.



12. Remove the support plate - front crossmember (a).



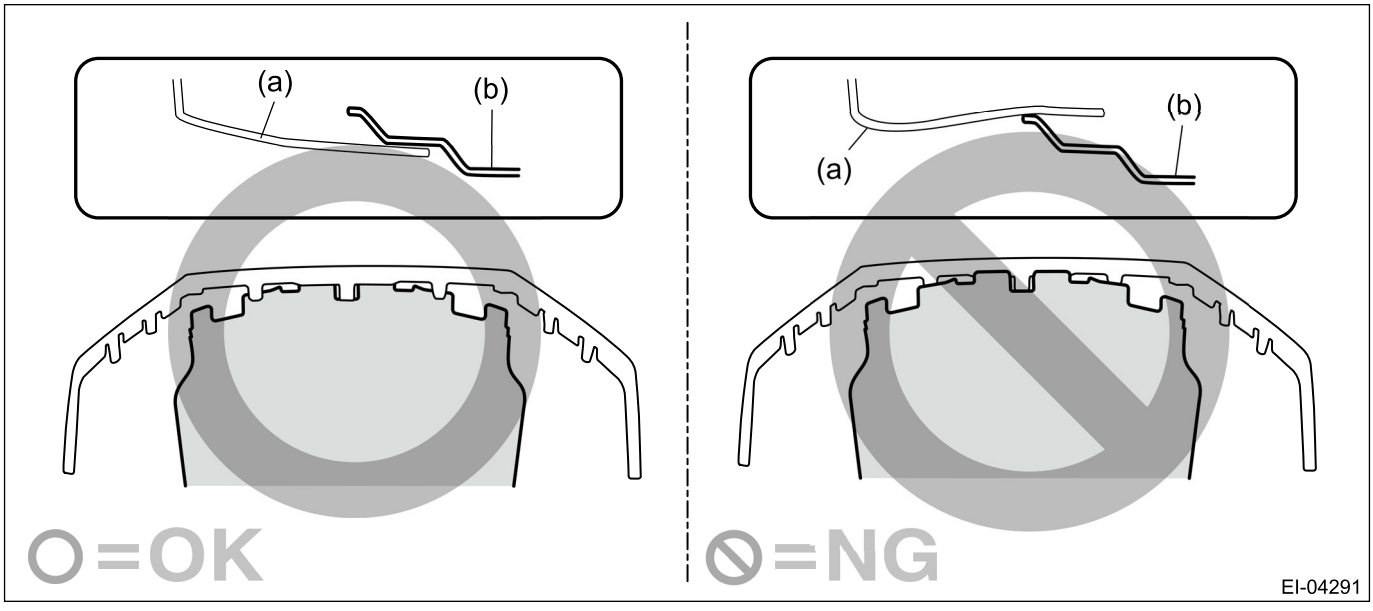
13. Remove the bolts securing the steering gearbox assembly, and remove the stiffener (a) and steering gearbox assembly.



POWER ASSISTED SYSTEM (POWER STEERING) > Electric Power Steering Gearbox

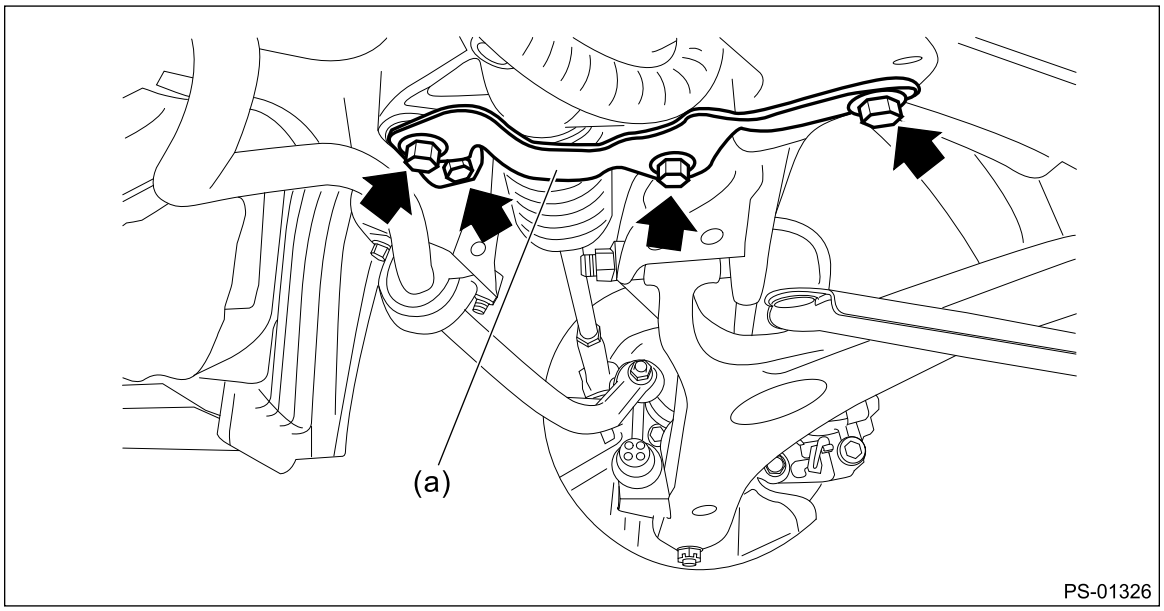
INSTALLATION

Caution:
Install the under cover - front so that the front end of the under cover (b) comes inside the bumper face - front (a).



1. Insert the steering gearbox assembly into crossmember, being careful not to damage the boot of the steering gearbox assembly.
2. Install the steering gearbox assembly to the crossmember by tightening the bolts through the stiffener (a) to the specified torque.
   Caution:
   Since the bushing mounting bolt is applied with lubricant, always use a new bolt.
   Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



3. Install the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSTALLATION.

Caution:

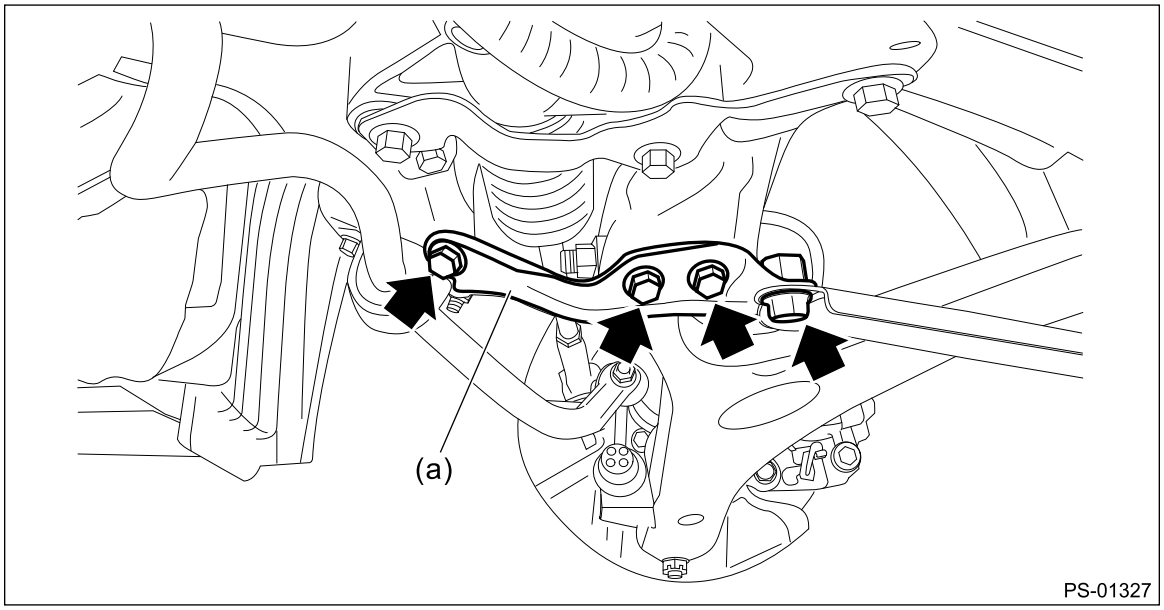
Tighten the bolts of the universal joint assembly - steering in the order of steering gearbox side and column shaft side.

4. Install the support plate - front crossmember (a).

Tightening torque:

Support plate - front crossmember: 60 N·m (6.1 kgf-m, 44.3 ft-lb)

Front support: 100 N·m (10.2 kgf-m, 73.8 ft-lb)

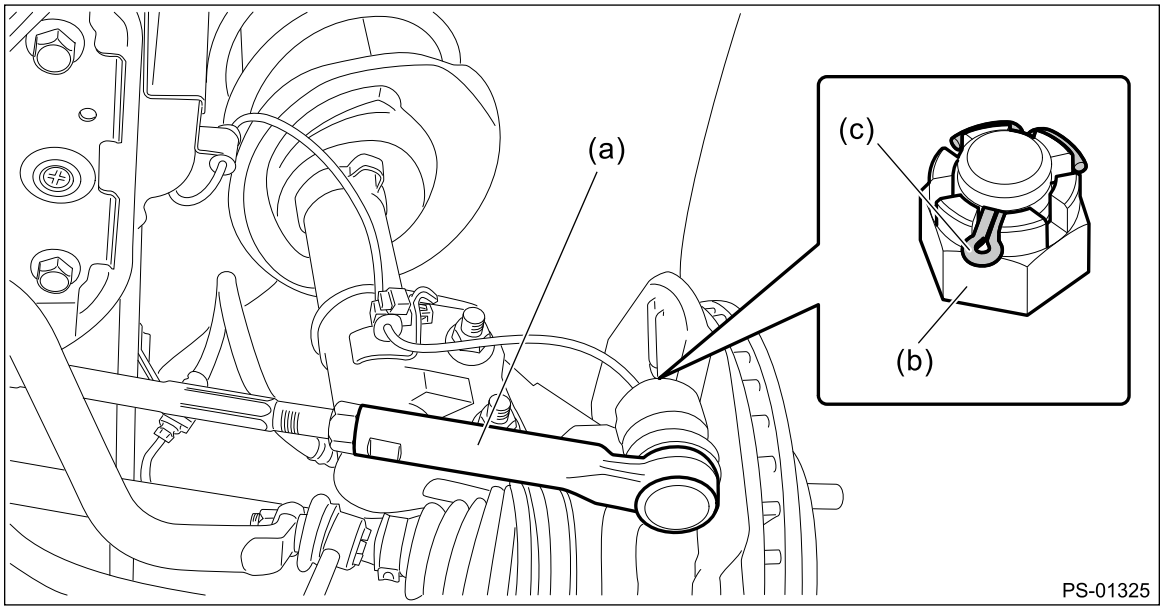


5. Install the front crossmember - support.

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

6. Install the center exhaust pipe (rear). Ref. to EXHAUST(w/o STI)>Center Exhaust Pipe>INSTALLATION.
7. Install the under cover - front. Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.
8. Connect the tie-rod ends and knuckle arm.
   (1) Connect the tie-rod end (a) to the housing assembly - front axle.
   (2) Tighten the castle nuts (b) to the specified torque.
   Caution:
   During connection, do not hit the cap at bottom of tie-rod end with a hammer.
   Castle nut tightening torque:
   27 N·m (2.8 kgf-m, 19.9 ft-lb)
   (3) Tighten within the range of 60° so that the cotter pin hole and cutout portion of the castle nut (b) are aligned.
   (4) Insert a new cotter pin (c), and bend the tip of the pin to fix it.



9. Install the stabilizer link.
   Tightening torque:
   60 N·m (6.1 kgf-m, 44.3 ft-lb)
10. Install the front wheels.
11. Lower the vehicle.
12. Tighten the wheel nuts to the specified torque.
   Tightening torque:
   120 N·m (12.2 kgf-m, 88.5 ft-lb)
13. Connect the steering gearbox connector and harness clamp.
14. Connect the ground terminal to the battery sensor. Ref. to NOTE>NOTE > BATTERY.
15. After adjusting toe-in and steering angle, tighten the lock nut on tie-rod end.

Caution:

When the wheel alignment has been adjusted, perform the following adjustment.

– Lane keep assist learning value clear (model with EyeSight): Ref. to EyeSight (DIAGNOSTICS)>Clear Active Lane Keep System Learning Value>OPERATION.

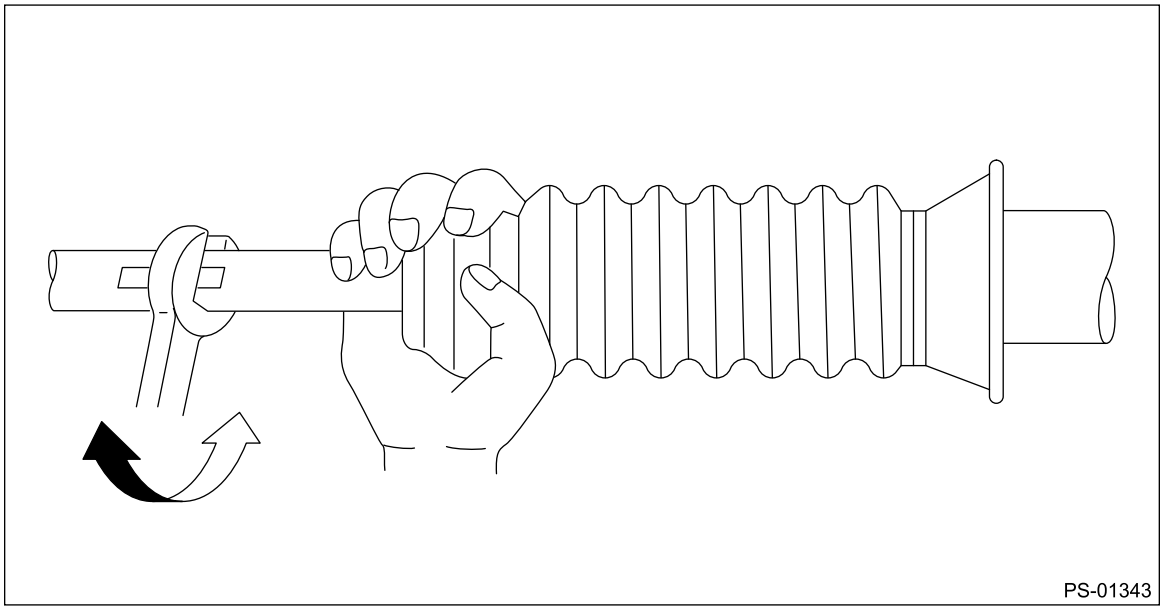
– Steering angle sensor adjustment: Ref. to VEHICLE DYNAMICS CONTROL (VDC)>VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)>ADJUSTMENT.

Tightening torque:

85 N·m (8.7 kgf-m, 62.7 ft-lb)

Note:

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



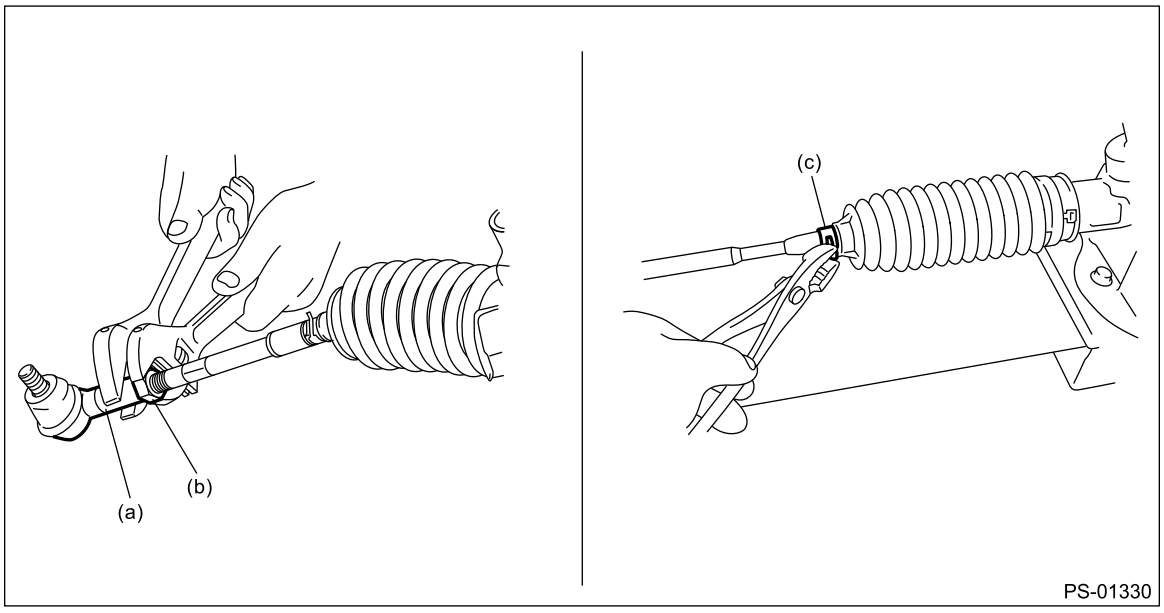
POWER ASSISTED SYSTEM (POWER STEERING) > Electric Power Steering Gearbox

DISASSEMBLY

Caution:

- **Nut for fixing the rack is on the driver's side only. When removing the tie-rod on the passenger's side, turn over the boot - steering gearbox on the driver's side, and fix the rack during operation.**
- **When fixing the steering gearbox assembly in a vise, apply a wooden piece on the flange portion.**

1. Remove the tie-rod end (a) and lock nut (b) from the steering gearbox assembly.
2. Remove the clip - boot tie-rod (c) located outside the boot - steering gearbox using the pliers, and then slide the boot - steering gearbox to the tie-rod end side.



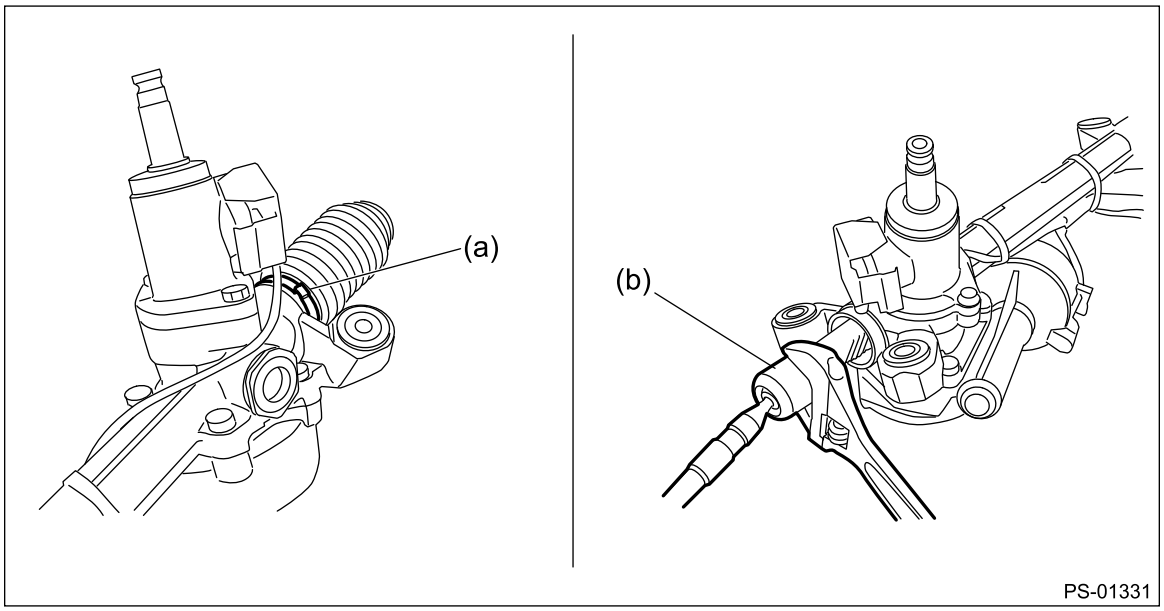
3. Remove the tie-rod (b) from the gearbox assembly.

(1) Using a flat tip screwdriver, remove the band - boot (a) from the boot - steering gearbox.

Note:

Replace the boot - steering gearbox or the band - boot (a) if there is damage, cracks or deterioration.

(2) Remove the tie-rod (b).



POWER ASSISTED SYSTEM (POWER STEERING) > Electric Power Steering Gearbox

ASSEMBLY

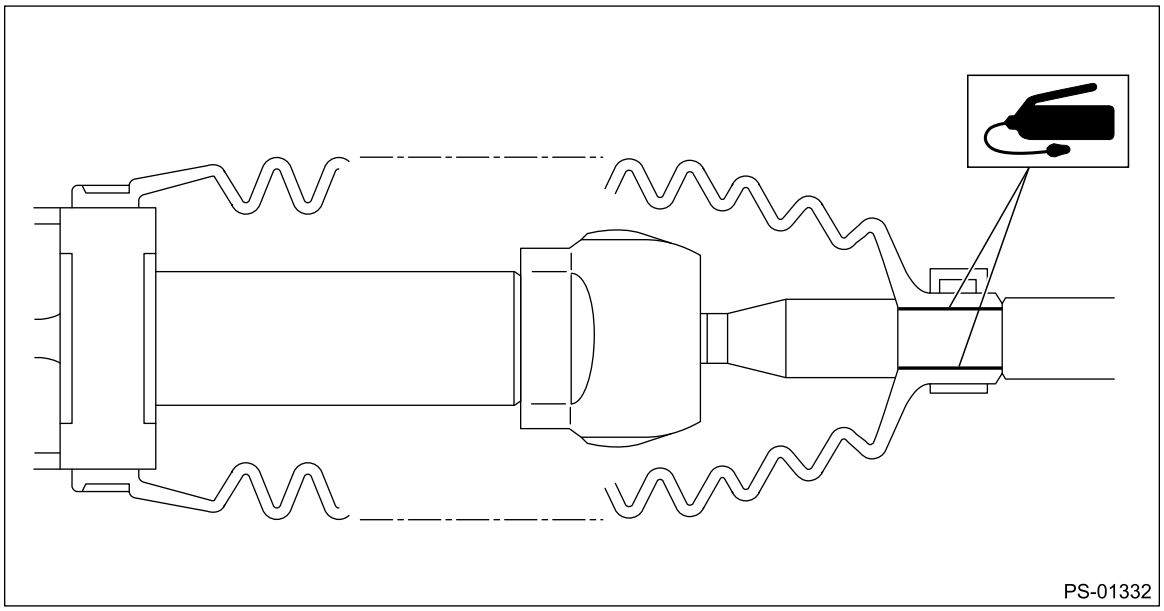
1. Install the tie-rod into rack.

Tightening torque:

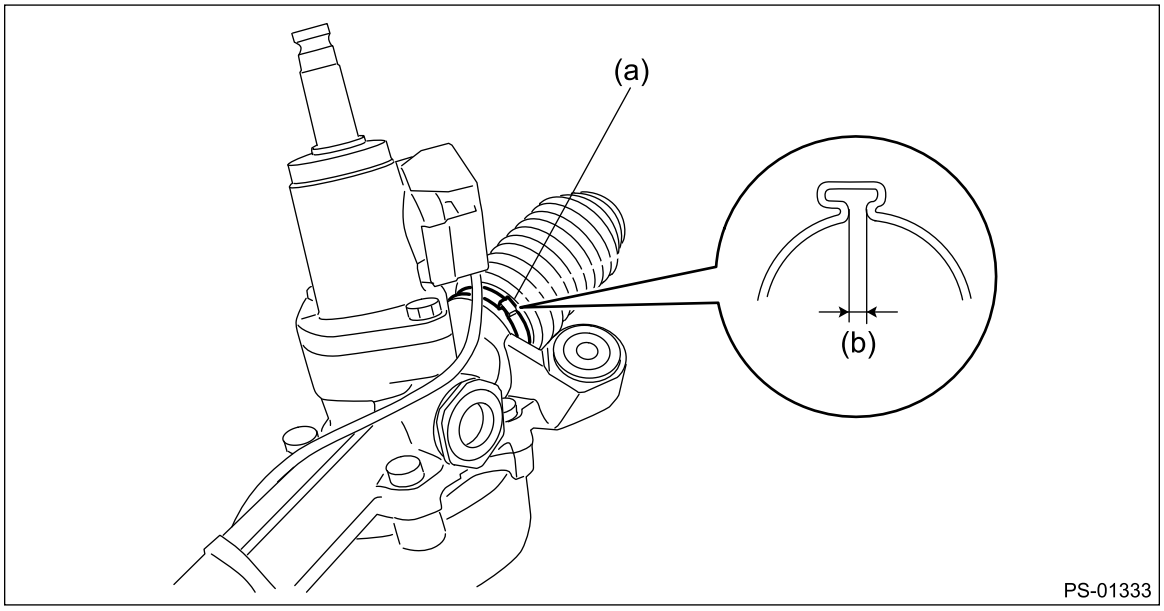
90 N·m (9.2 kgf-m, 66.4 ft-lb)

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

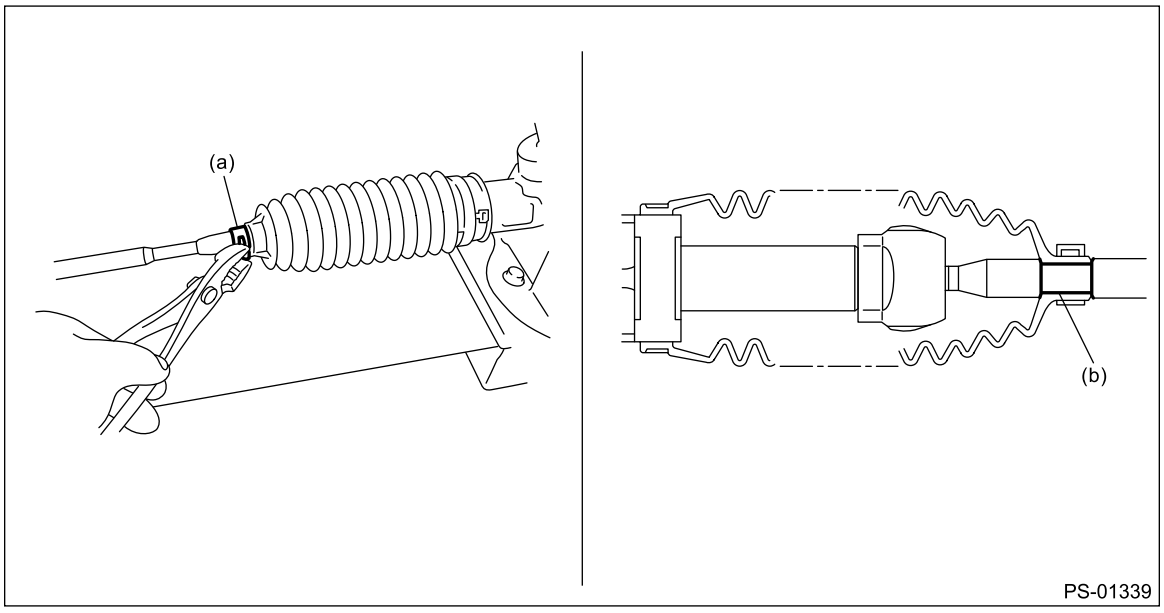
2. Apply a coat of grease to the tie-rod groove, and then install the boot - steering gearbox to the housing.
   Note:
   Make sure that the boot - steering gearbox is installed without unusual inflation or deflation.



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



4. Fix the end of the boot - steering gearbox with clip - boot tie-rod (a).
5. After installation, check that the end of the boot - steering gearbox is installed to the groove (b) of the tie-rod.



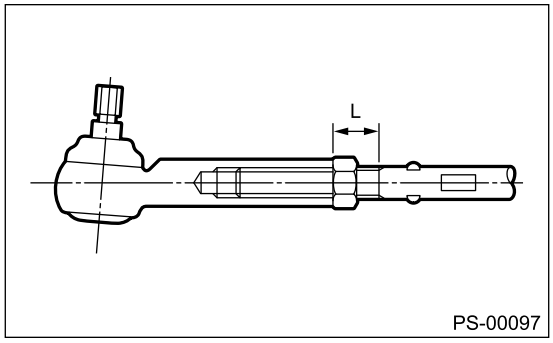
6. If the tie-rod end has been removed, screw in lock nut and tie-rod end to the screwed portion of tie-rod, and tighten the lock nut at a position as shown in the figure.

Tightening torque:

85 N·m (8.7 kgf-m, 62.7 ft-lb)

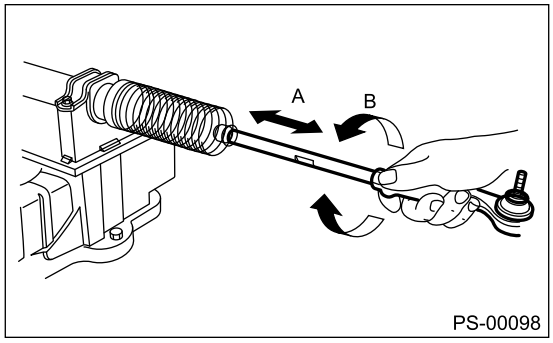
Installed tie-rod length L:

29 mm (1.14 in)



7. Inspect the steering gearbox assembly as follows:

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



8. Remove the steering gearbox assembly from ST.

INSPECTION

1. UNIT INSPECTION

Check components for wear, damage or other faults. Adjust or replace if necessary.

2. LIMIT

Make a measurements as follows. If it exceeds the specified service limits, adjust or replace.

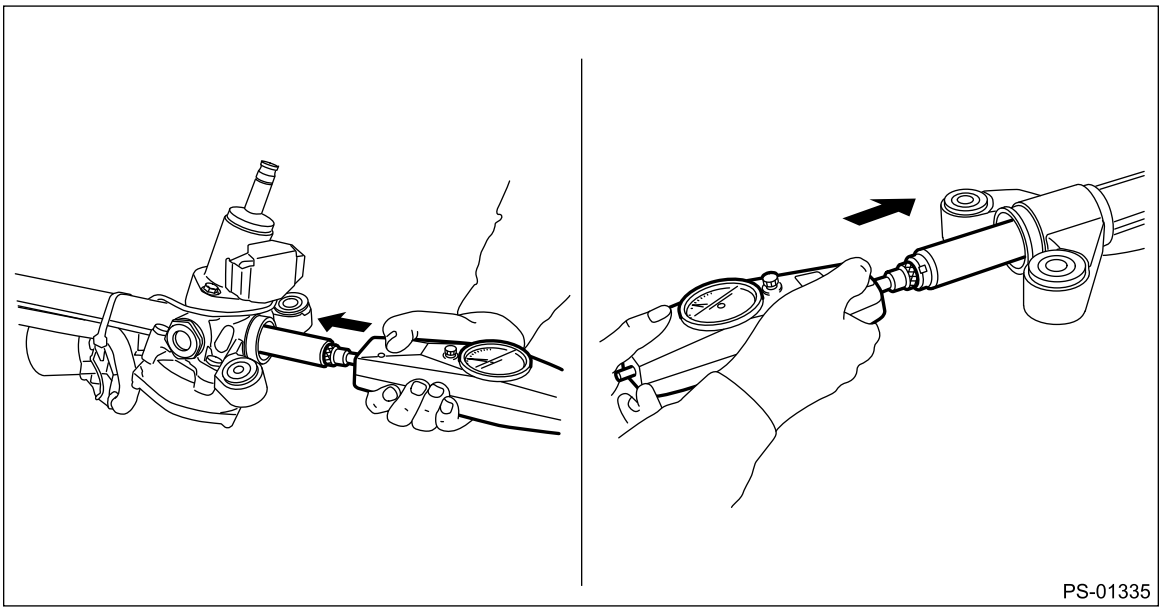
Note:

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

Rack shaft sliding resistance:

Limit: 360 N (37 kgf, 81 lbf) or less

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



3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

Note:

- **When fixing the steering gearbox assembly in a vise, apply a wooden piece on the flange portion.**
- **When fixing the magnet stand in the steering gearbox assembly, perform the following procedure.**
  - **– Fix the iron plate on the flange portion using a c-clamp, and place the magnet stand on the iron plate.**
  - **– Use bolts and nuts to fix directly on the flange portion of the steering gearbox assembly. (Secure the gauge firmly on the gearbox body. (Avoid the input shaft and the rack shaft.))**

Right-turn steering:

Service limit:

Both amplitudes: 0.6 mm (0.024 in) or less

Left-turn steering:

Service limit:

Both amplitudes: 0.6 mm (0.024 in) or less

Condition:

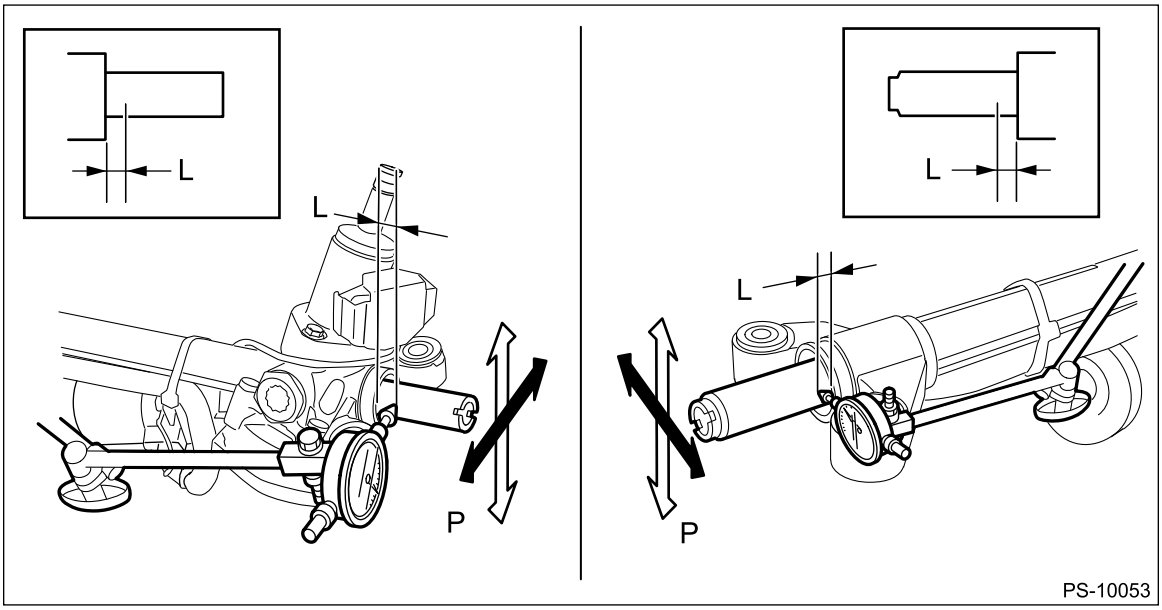
L: 5 mm (0.20 in) from dust cover

Rack shaft end P: 98 N (10 kgf, 22 lbf)

Note:

<Example of magnet stand and dial gauge installation>

The location where the magnet stand is installed varies to stabilize the magnet stand.



4. INPUT SHAFT PLAY

Note:

- **When fixing the steering gearbox assembly in a vise, apply a wooden piece on the flange portion.**
- **When fixing the magnet stand in the steering gearbox assembly, perform the following procedure.**
  - **– Fix the iron plate on the flange portion using a c-clamp, and place the magnet stand on the iron plate.**
  - **– Use bolts and nuts to fix directly on the flange portion of the steering gearbox assembly. (Secure the gauge firmly on the gearbox body. (Avoid the input shaft and the rack shaft.))**

In radial direction:

Limit: Both amplitudes: 0.6 mm (0.024 in) or less

Condition: Input shaft tip P = 98 N (10 kgf, 22 lbf)

In axial direction:

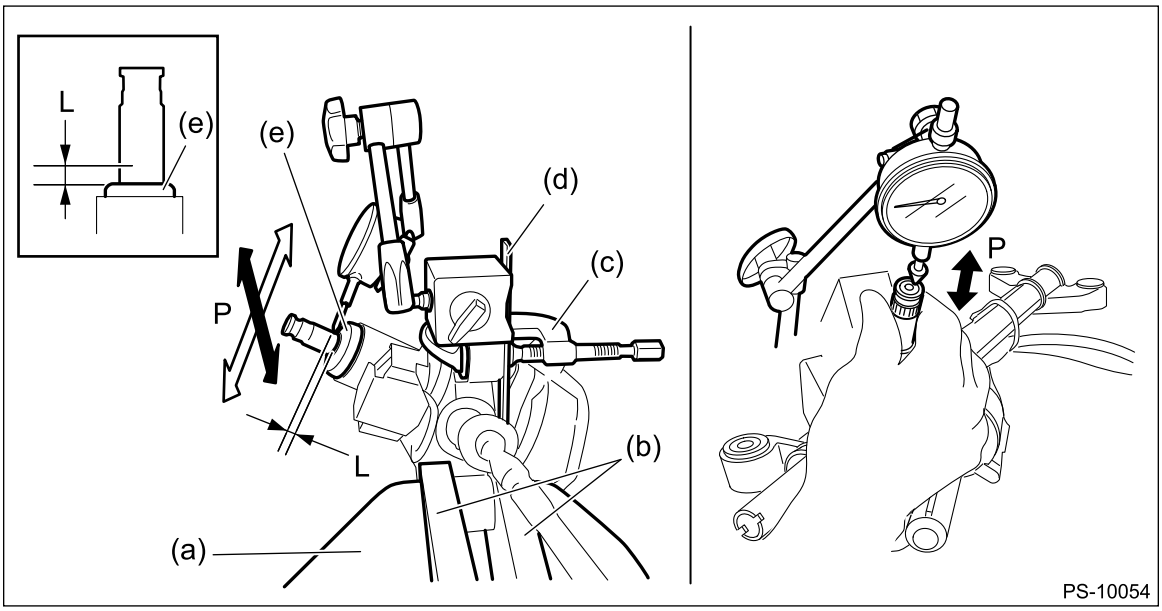
Limit: 0.27 mm (0.0106 in) or less

Condition: Input shaft tip P = 20 — 49 N (2 — 5 kgf, 4 — 11 lbf)

Note:

<Example of magnet stand and dial gauge installation>

The location where the magnet stand is installed varies to stabilize the magnet stand.



(a) Vise
(b) Wooden block
(c) C-clamp
(d) Iron plate
(e) Dust cover

5. ROTATIONAL RESISTANCE OF GEARBOX

1. Using the ST, measure the rotational resistance of the steering gearbox assembly.

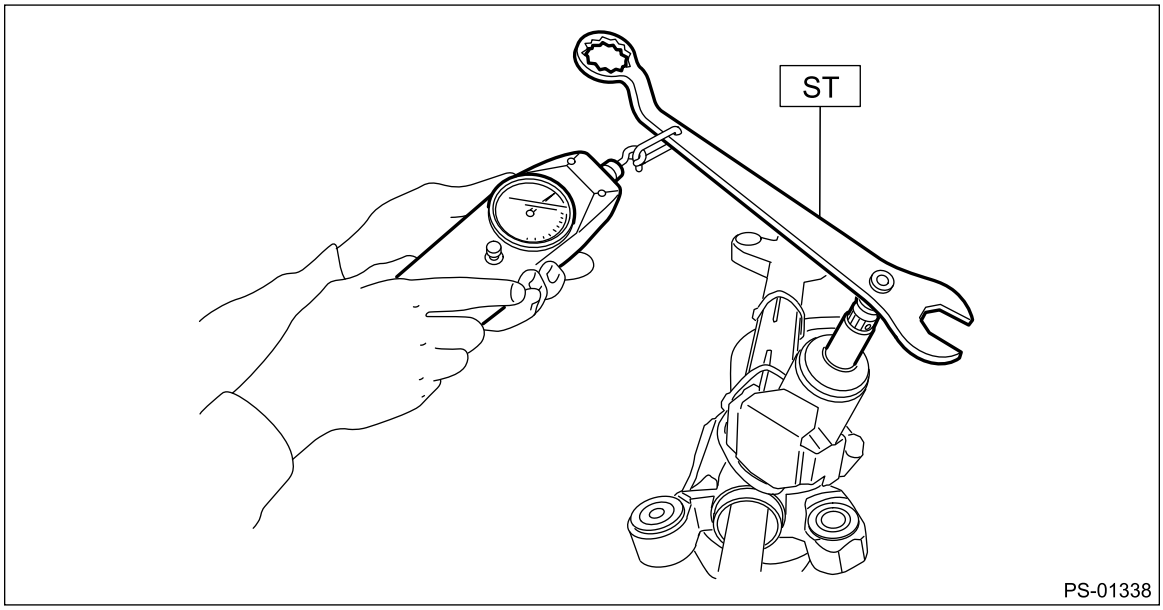
Preparation tool:

ST: SPANNER (34099PA100)

Service limit:

Maximum allowable resistance: 18 N (1.8 kgf, 4 lbf) or less

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



1. GEARBOX BACKLASH ADJUSTMENT

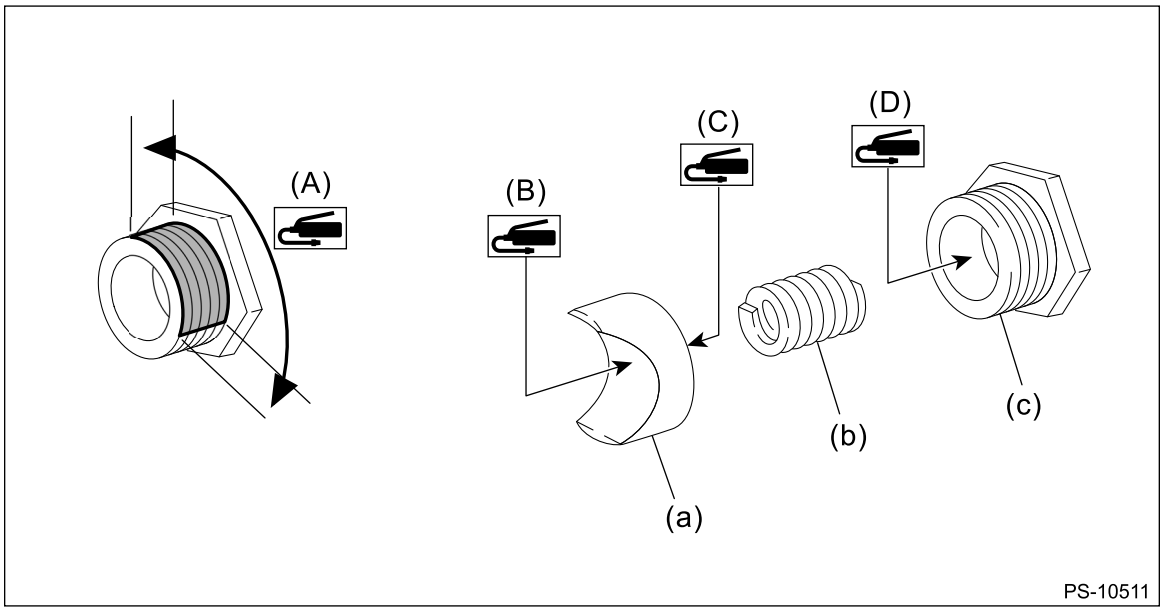
1. Remove the steering gearbox assembly. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox>REMOVAL.
2. Loosen the lock nut and adjusting screw.
3. Apply a coat of grease to the sliding surface (B) of the pad - pressure (a) and seating surface (C) of spring - gearbox (b), and then insert the pad - pressure (a) into steering body.
4. Charge the adjusting screw (c) with grease (D), and then insert the spring - gearbox (b) into adjusting screw. Then install on the steering body.

   Grease:

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

   Liquid gasket:

   THREE BOND 1102



6. Tighten the adjusting screw to 20 N·m (2 kgf-m, 14.8 ft-lb), then loosen it.
7. Tighten the adjusting screw to 20 N·m (2 kgf-m, 14.8 ft-lb), then loosen it.
8. Tighten the adjusting screw to 20 N·m (2 kgf-m, 14.8 ft-lb), then loosen it by 30°.
9. While fixing the adjusting screw, tighten the lock nuts.

   Preparation tool:

   Monkey type torque wrench available for width across flat 39 mm (1.5 in) operation.

   Tightening torque:

   45 N·m (4.6 kgf-m, 33.2 ft-lb)

2. FRONT WHEEL ALIGNMENT ADJUSTMENT

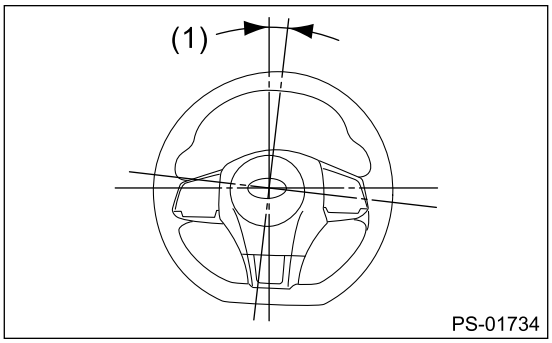
1. Adjust the front toe-in. Ref. to FRONT SUSPENSION>Wheel Alignment>ADJUSTMENT > FRONT WHEEL TOE-IN.
2. Check the steering angle of the wheels.

   Standard of steering angle:

Wheel size	17-inch	18-inch
Inner wheel	37.5°±1.5°	36.4°±1.5°

Wheel size	17-inch	18-inch
Outer wheel	32.9°±1.5°	32.0°±1.5°

3. When the steering wheel is in the following condition, perform the steering wheel installation over again.
- When wheels are set in the straight ahead position, the steering wheel spokes are not horizontal.
- Error is more than 5° on the periphery of the steering wheel.



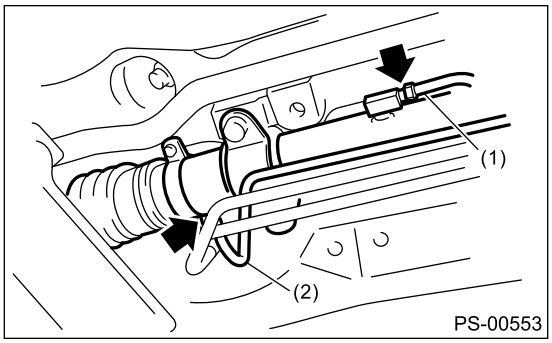
(1) 5° or less

4. If the steering wheel spokes are not horizontal with vehicle set in the straight ahead position after this adjustment, correct it by turning the right and left tie-rods in the opposite direction from each other by the same angle. Also check that there are no abnormal steering effort, failure of the steering wheel to return or other faults.

POWER ASSISTED SYSTEM (POWER STEERING) > Pipe Assembly

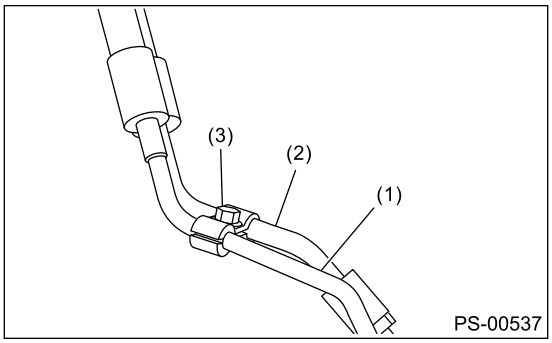
REMOVAL

1. Disconnect the ground terminal from battery.
2. Remove the under cover. Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.
3. Lift up the vehicle, and remove the front crossmember support plate. Ref. to FRONT SUSPENSION>Front Crossmember Support Plate.
4. Remove the one pipe joint at the center of the gearbox, and connect the vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



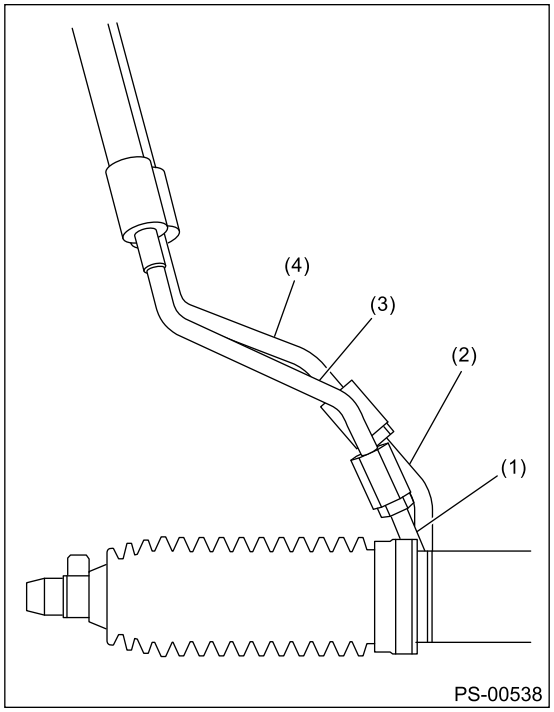
(1) Pipe A
(2) Pipe B

5. Remove the clamp E from return hose and pressure hose.



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

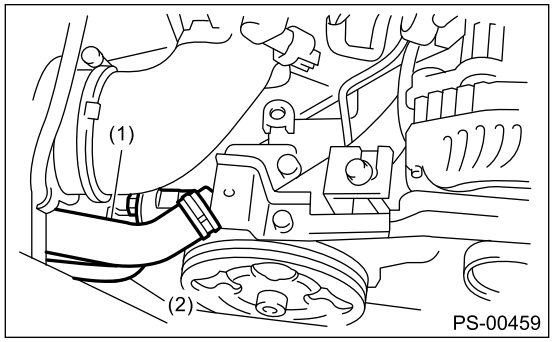
6. Disconnect the return hose from return pipe and disconnect the pressure hose from feed pipe.



(1) Feed pipe
(2) Return pipe
(3) Pressure hose
(4) Return hose

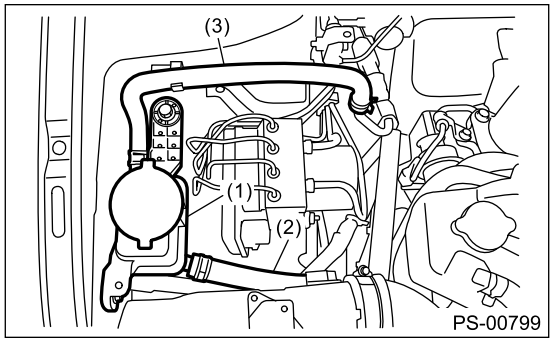
7. Remove the air intake duct. Ref. to INTAKE (INDUCTION)(STI)>Air Intake Duct>REMOVAL.

8. Disconnect the suction hose and pressure hose from oil pump.



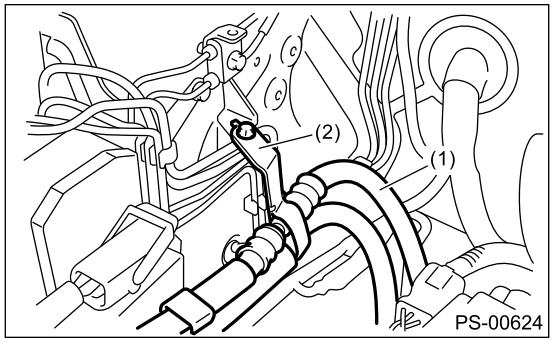
(1) Suction hose
(2) Pressure hose

9. Disconnect the suction hose and return hose from the reservoir tank.



(1) Reservoir tank
(2) Suction hose
(3) Return hose

10. Remove the hose bracket and take out the hose assembly from vehicle.

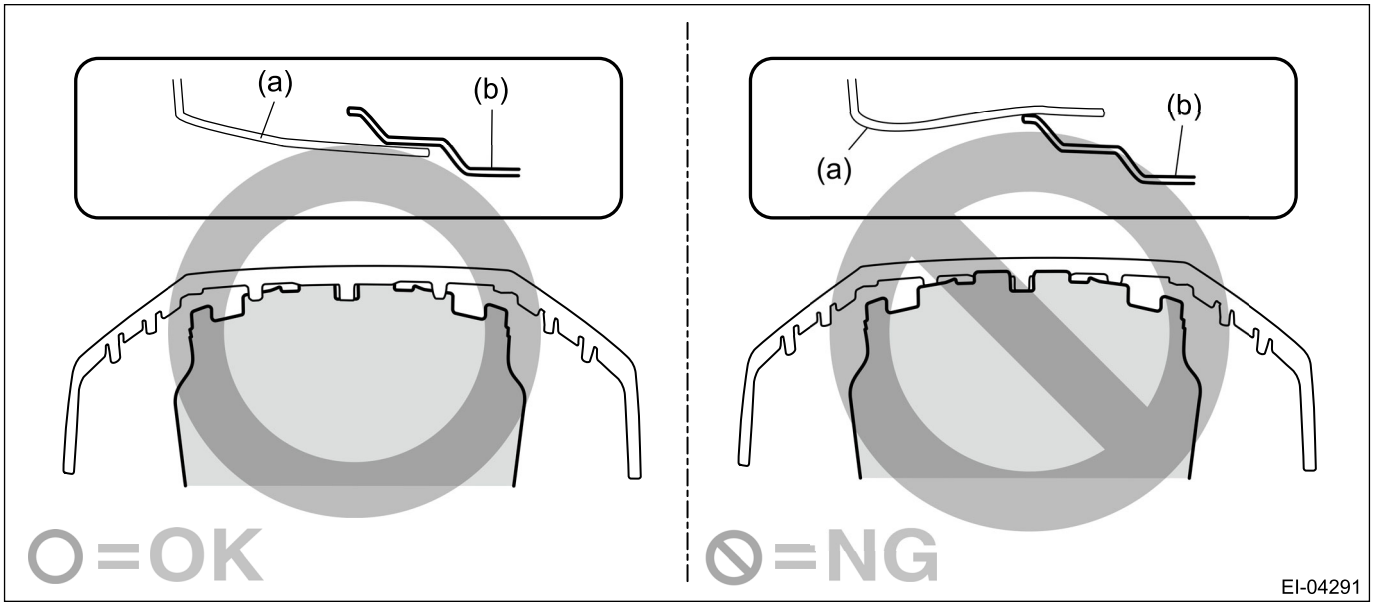


(1) Hose ASSY
(2) Hose bracket

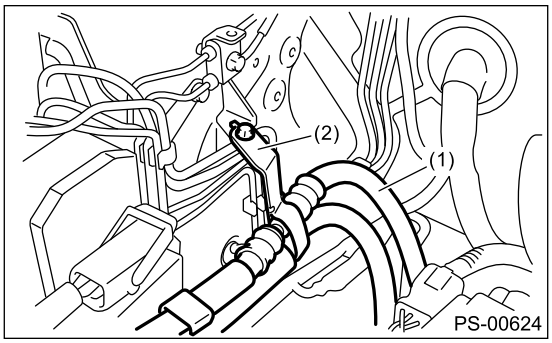
POWER ASSISTED SYSTEM (POWER STEERING) > Pipe Assembly

INSTALLATION

Caution:
Install the under cover - front so that the front end of the under cover (b) comes inside the bumper face - front (a).

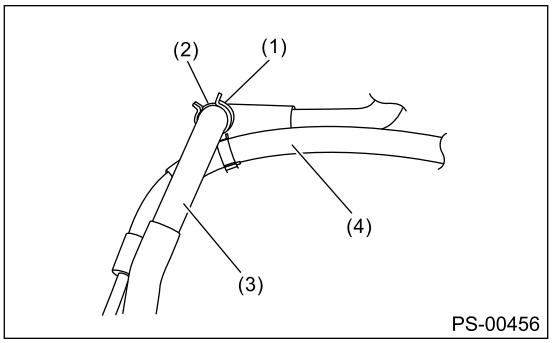


1. Temporarily tighten the hose bracket bolt.



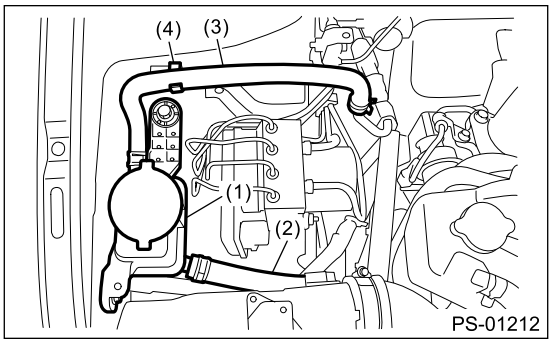
(1) Hose ASSY
(2) Hose bracket

2. Install the plastic clip to the pressure hose and suction hose.
Caution:
Align the installation position of the plastic clip with the protector edge of the suction hose.



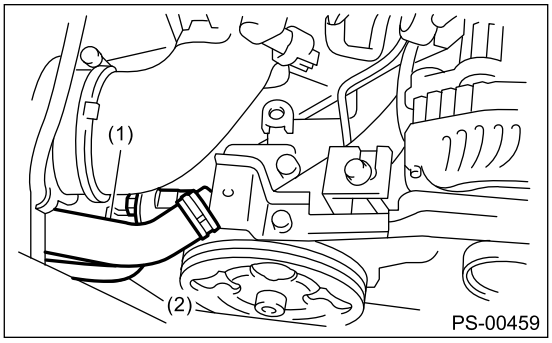
(1) Plastic clip
(2) Protector
(3) Suction hose
(4) Pressure hose

3. Connect the suction hose and return hose to the reservoir tank.
Caution:
Firmly insert the plastic clip of return hose to the bracket.



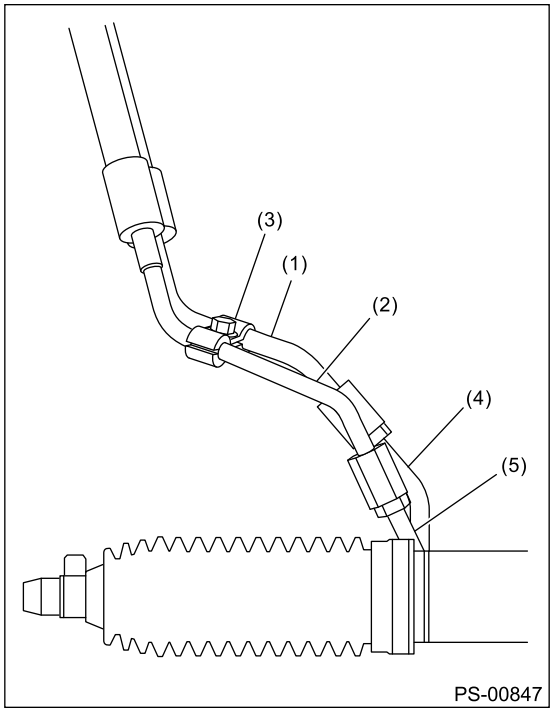
(1) Reservoir tank
(2) Suction hose
(3) Return hose
(4) Plastic clip

4. Tighten the hose bracket bolt.
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)
5. Connect the suction hose and pressure hose to the oil pump. Tighten the eyebolt of pressure hose.
Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)



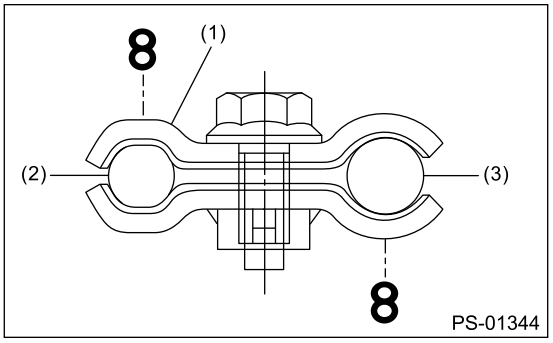
(1) Suction hose
(2) Pressure hose

6. Temporarily connect the pressure hose to feed pipe and return hose to return pipe. Temporarily tighten the bolt of clamp E.



(1) Return hose
(2) Pressure hose
(3) Clamp E
(4) Return pipe
(5) Feed pipe

Note:
Make sure that the character "8" on each clamp is positioned on the opposite side, as shown in the figure.



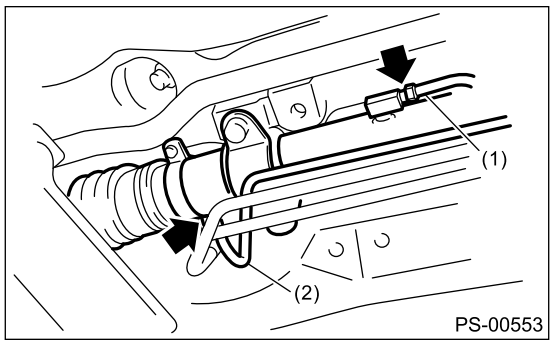
(1) Clamp E
(2) Pressure hose
(3) Return hose

7. Tighten clamp E.
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

8. Tighten the pressure hose to feed pipe and return hose to return pipe.
Tightening torque:

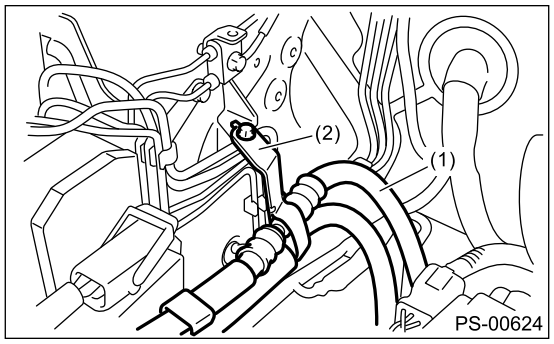
15 N·m (1.5 kgf-m, 11.1 ft-lb)

9. Connect pipes A and B to the four pipe joints of the gearbox.
   Tightening torque:
   Cylinder side: 27 N·m (2.8 kgf-m, 19.9 ft-lb)
   Gear housing side: 17 N·m (1.7 kgf-m, 12.5 ft-lb)



(1) Pipe A
(2) Pipe B

10. Install the front crossmember support plate and jack-up plate.
11. Install the under cover. Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.
12. Lower the vehicle.
13. Tighten the bolts which hold the hose bracket.
    Tightening torque:
    10 N·m (1 kgf-m, 7.4 ft-lb)



(1) Hose ASSY
(2) Hose bracket

14. Install the air intake duct. Ref. to INTAKE (INDUCTION)(STI)>Air Intake Duct>INSTALLATION.
15. Connect the battery ground terminal.
16. Fill with the specified fluid.
    Caution:
    Never start the engine before filling with fluid; otherwise the vane pump may become seized.
17. Finally, check the clearance between pipes or hoses as shown in the figure indicated in "General Diagnostic Table". Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION > CLEARANCE CHECK (HYDRAULIC TYPE).

POWER ASSISTED SYSTEM (POWER STEERING) > Pipe Assembly

INSPECTION

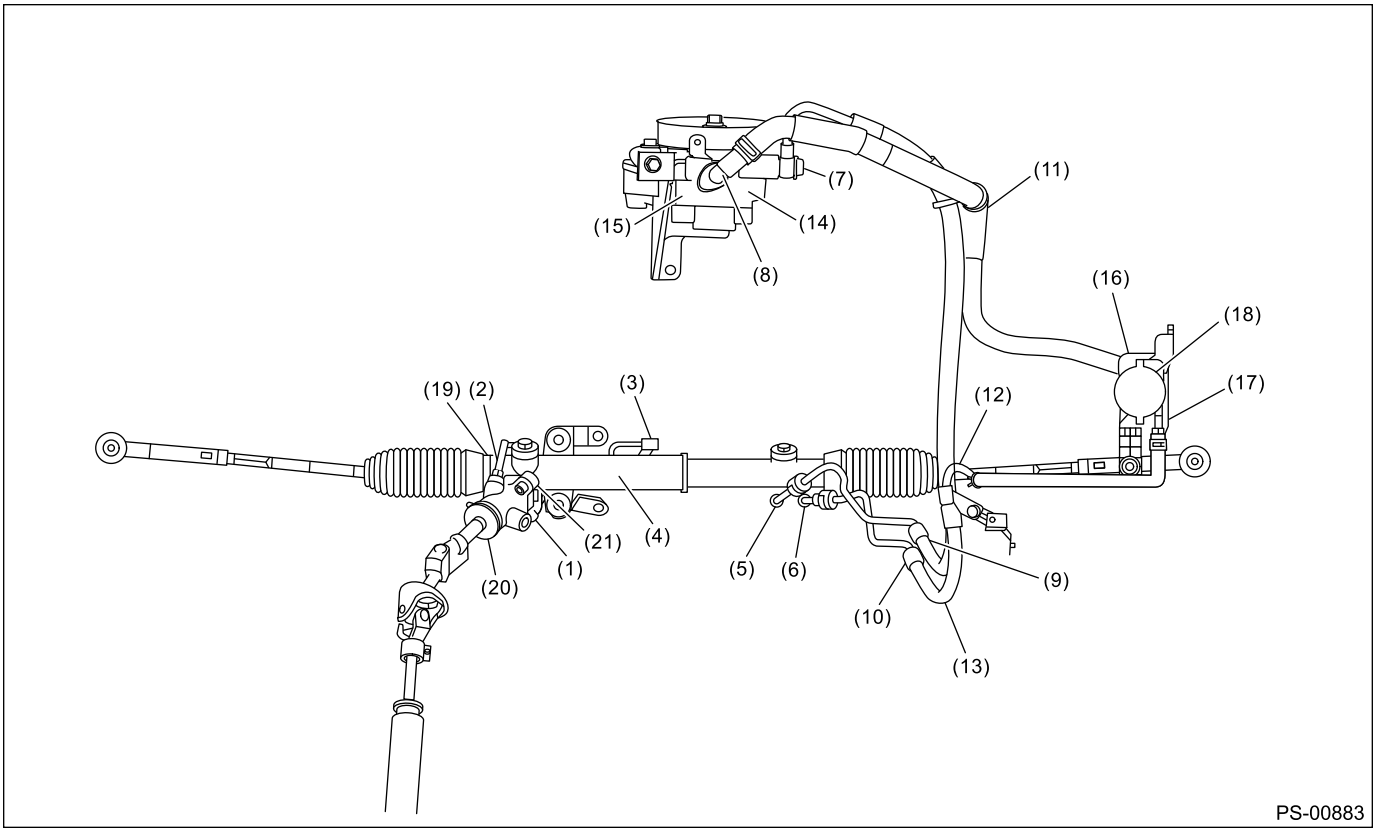
Check all disassembled parts for wear, damage or other problems. Repair or replace the defective parts as necessary.

Part	Maintenance parts	Corrective action
Pipe	• O-ring fitting surface damage • Nut damage • Pipe damage	Replace with a new part.
Hose	• Flare surface damage • Flare nut damage • Outer surface cracks • Outer surface wear • Clip damage • End coupling or adapter deformation	Replace with a new part.

Caution:
Although the surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. Wipe off hoses immediately if any of these come into contact with the hoses.
Since resistances for heat or low temperature brittleness are gradually declining according to time accumulation of hot or cold conditions for the hoses and their service lives are shortening accordingly, it is necessary to perform careful inspection frequently when the vehicle is used in hot weather areas, cold weather areas and a driving condition in which many steering operations are required in short time.
Continuous discharge of the relief valve for 5 seconds or more will reduce the service lives of hoses, oil pump, fluid, etc., due to over heating.

Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct customers.
	Malfunction of the relief valve	Replace the oil pump.
	Poor cold characteristic of fluid	Replace fluid.
Disconnection of the return hose	Improper connection	Repair.
	Loosening of the clip	Replace the hose and clip.
	Poor cold characteristic of fluid	Replace fluid.
Fluid slightly leaking out of hose	Wrong layout, tensioned	Replace the hose.
	Excessive play of engine due to deterioration of engine mounting rubber	Replace the parts if defective.
	Improper stop position of pitching stopper	Replace the parts if defective.
Crack on hose	Excessive holding time of relief status	Replace. Instruct customers.
	Power steering fluid, engine oil, electrolyte adhere on the hose surface	Replace. Be careful during service work.

Note:
There are conditions in which a fluid leak is diagnosed, but is not actually leaking. This is because the fluid spilt during the last maintenance was not completely wiped off. Be sure to wipe off spilt fluid thoroughly after maintenance.

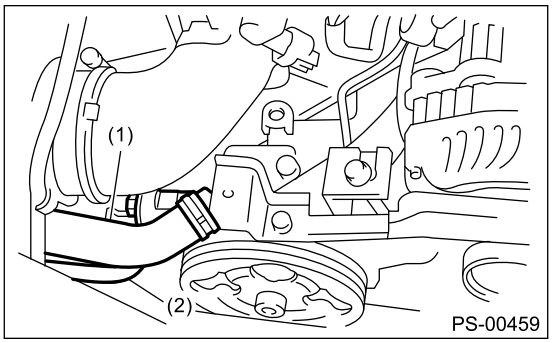


Fluid leaking area	Possible cause	Corrective action
Leakage from the connections of pipes and hoses, numbered (1) through (8) in the figure	Insufficient tightening of flare nut, adhesion of dirt, damage to flare or flare nut or eyebolt	Loosen and retighten. Replace if ineffective.
	Improper installation of hose or clamp	Replace.
	Damaged O-ring or gasket	Replace the O-ring, gasket pipe or hose with new part, if still no improvement, replace the gearbox or oil pump as well.
Leakage from hose (9) through (13) in the figure	Crack or damage in hose	Replace with a new part.
	Crack or damage in hose hardware	Replace with a new part.
Leakage from surrounding of aluminum portion of oil pump, (14) and (15) in the figure	Damaged O-ring	Replace the oil pump.
	Damaged gasket	Replace the oil pump.
Leakage from oil tank, (16) and (17) in the figure	Crack in oil tank	Replace the oil tank.

Fluid leaking area	Possible cause	Corrective action
Leakage from filler neck of (18)	Damaged cap packing	Replace the cap.
	Crack in root of filler neck	Replace the oil tank.
	Fluid level too high	Adjust the fluid level.
Leakage from power cylinder of gearbox area (19) in the figure	Damaged oil seal	Replace the oil seal.
Leakage from (20), (21) in the figure and control valve of gearbox	Damaged packing or oil seal	Replace the faulty parts.
	Damage in control valve	Replace the control valve.

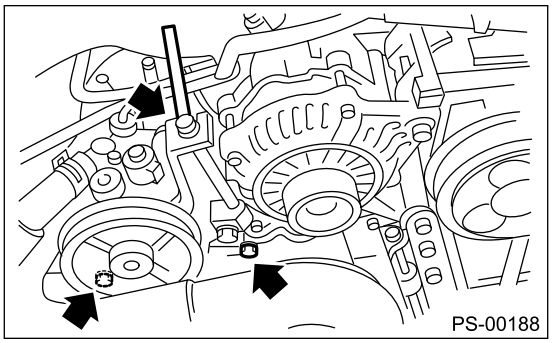
REMOVAL

1. Disconnect the ground cable from battery.
2. Remove the V-belts (front side belt). Ref. to MECHANICAL(STI)>V-belt>REMOVAL.
3. Disconnect the connector from power steering pump switch.
4. Disconnect the pressure hose and suction hose from the oil pump.
   Caution:
   - **Do not allow fluid to come into contact with the pulley belt.**
   - **To prevent foreign matter from entering the hose and pipe, cover the open ends with clean cloth.**

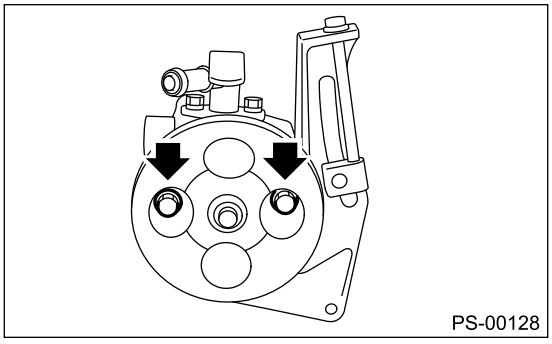


(1) Suction hose
(2) Pressure hose

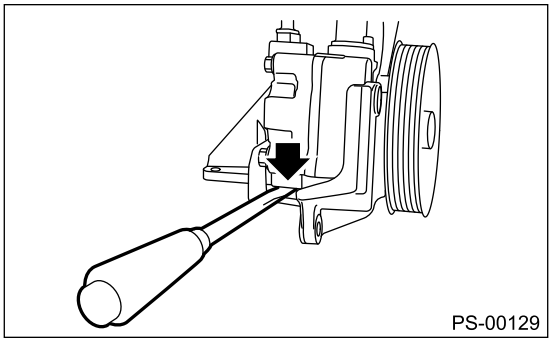
5. Remove the installation bolt of the power steering pump bracket.



6. Place the oil pump bracket in a vise, and remove the two bolts from the front side of the oil pump.
   Caution:
   When securing the oil pump bracket in a vice, hold the oil pump bracket with the least possible force between two pieces of wood.



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



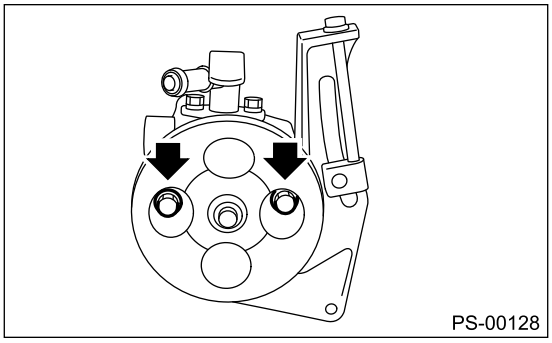
POWER ASSISTED SYSTEM (POWER STEERING) > Oil Pump

INSTALLATION

1. Install the oil pump to bracket.
2. Tighten the bolts which hold the oil pump to the bracket.

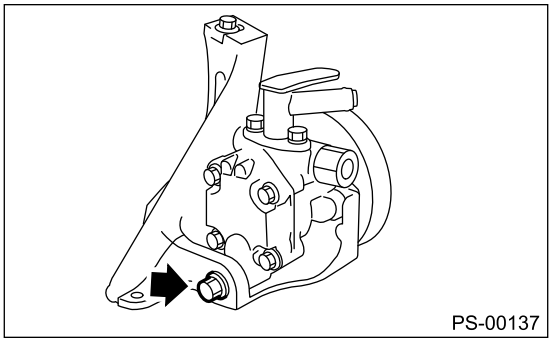
   Tightening torque:

   16 N·m (1.6 kgf-m, 11.8 ft-lb)



   Tightening torque:

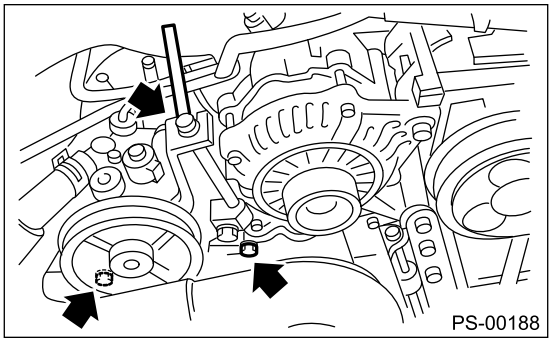
   48 N·m (4.9 kgf-m, 35.4 ft-lb)



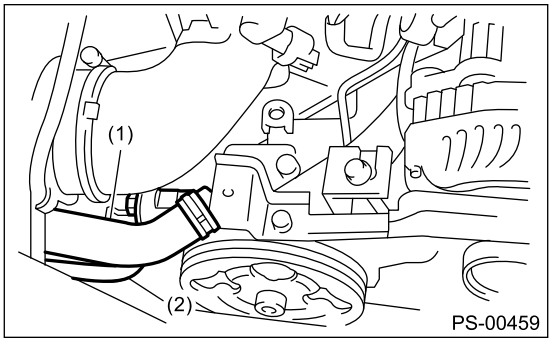
3. Attach the installation bolts of the power steering pump bracket.

   Tightening torque:

   Refer to "COMPONENT" of "General Description". Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Description>COMPONENT > OIL PUMP.



4. Connect the pressure hose and suction hose.
   Caution:
   Be careful when installing; If the hose is twisted it may come into contact with other parts.
   Tightening torque:
   Eyebolt
   40 N·m (4.1 kgf-m, 29.5 ft-lb)



(1) Suction hose
(2) Pressure hose

5. Connect the power steering pump switch to the connector.
6. After installing the oil pump, fill the oil pump with fluid while rotating the pulley by hand and bleed the air from the oil pump.
   Caution:
   Always fill the oil pump with the fluid to prevent abnormal noise and seizure of the oil pump.
7. Install the V-belts (front side belt). Ref. to MECHANICAL(STI)>V-belt>INSTALLATION.
8. Connect the battery ground terminal.
9. Fill with the specified power steering fluid. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Power Steering Fluid.
   Caution:
   Never start the engine before filling with fluid; otherwise the vane pump may become seized.

POWER ASSISTED SYSTEM (POWER STEERING) > Oil Pump

INSPECTION

1. BASIC INSPECTION

Perform the following inspection procedures and replace faulty parts.

No.	Parts	Inspection	Corrective action
1	Oil pump (exterior)	(1) Crack, damage or oil leakage	Replace the oil pump with a new part.
		(2) Play of pulley shaft	Measure the radial play and axial play. If any of these exceeds the service limit, replace the oil pump with a new part.
2	Pulley	(1) Damage	Replace the oil pump with a new part.
		(2) Bend	Measure the V groove deflection. If it exceeds the service limit, replace the oil pump with a new part.
3	Oil pump (interior)	(1) Faulty or seized of vane pump	Check the rotating resistance of pulley. If it exceeds the service limit, replace the oil pump with a new part.
		(2) Bend in the shaft or damage to bearing	If the a string is wrapped on the pulley and rotated, and the oil pump emits a noise that is markedly different in tone and loudness from a sound of a new oil pump, replace the oil pump with a new part.
4	O-ring	Cracking or deterioration	Replace with a new part.
5	Bracket	Cracks	Replace with a new part.

2. SERVICE LIMIT

Make a measurements as follows. If it exceeds the service limit, replace with a new part.

Caution:

- **When securing the oil pump in a vice, hold the oil pump with the least possible force between two pieces of wood.**
- **Do not set the outside of flow control valve or pulley on a vise; otherwise outside or pulley might be deformed. Select properly sized wood pieces.**

1. Play of the pulley shaft

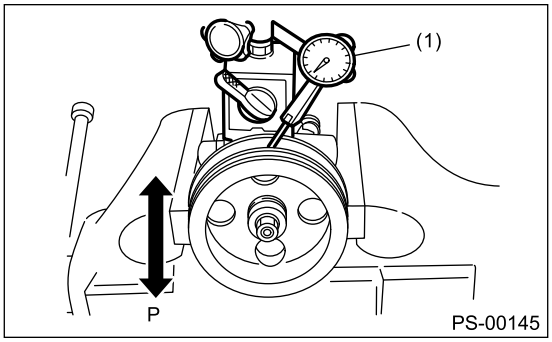
Condition:

P: When applying a force of 9.8 N (1 kgf, 2.2 lbf)

Service limit:

Play in the radial direction (direction ⬅➡)

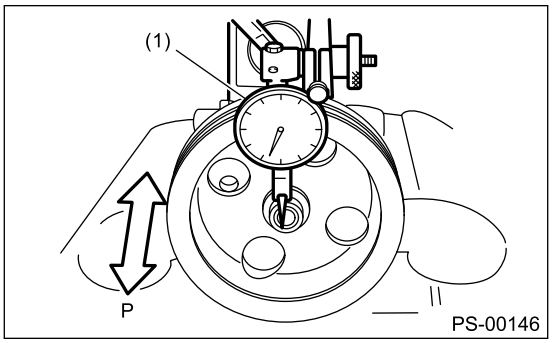
0.2 mm (0.008 in) or less



(1) Dial gauge

Axial play (direction ⇦ ⇨)

0.9 mm (0.035 in) or less



(1) Dial gauge

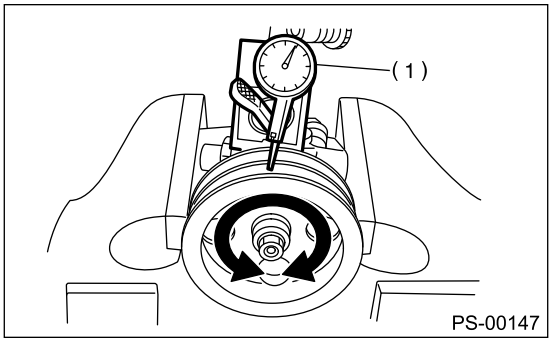
2. Deflection of the pulley groove

Service limit:

1 mm (0.039 in) or less

Note:

Read the value on one surface of V groove, set the dial gauge on the other surface, and read the value of the dial gauge.



(1) Dial gauge

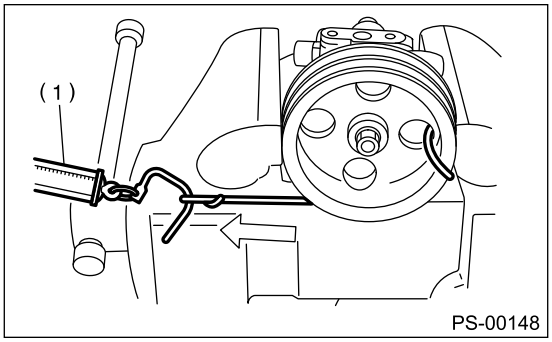
3. Rotating resistance of pulley

Service limit:

Maximum load: 9.22 N (0.94 kgf, 2.07 lbf) or less

Note:

- **A rather higher value may be indicated when pulley starts turning.**
- **Measure the load during rotation to make a judgment.**



(1) Spring scale

3. HYDRAULIC PRESSURE

Note:

- **To measure hydraulic pressure correctly, be sure to complete all the items in "INSPECTION", prior to performing the measurement. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION.**
- **Do not leave the valve of pressure gauge closed or hold the steering wheel at lock for 5 seconds or more in any case, this can damage the oil pump.**
- **Before attaching a pressure gauge, place cloth at locations where fluid is expected to spill. Wipe off any spilt fluid completely after the measurement.**

1. Regular pressure measurement

(1) Connect the ST.

Preparation tool:

ST1: PRESSURE GAUGE (925711000)

ST2: ADAPTER HOSE B (34099AC020)

ST3: ADAPTER HOSE A (34099AC010)

(2) Remove the air intake duct. Ref. to INTAKE (INDUCTION)(STI)>Air Intake Duct>REMOVAL.

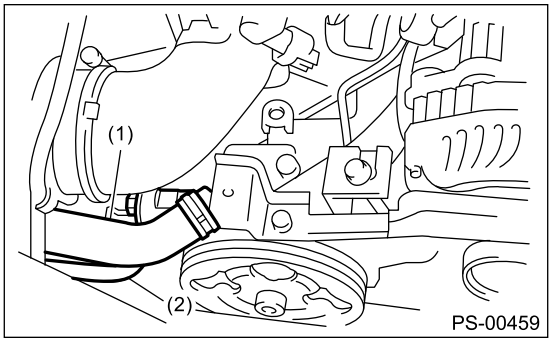
(3) Disconnect the pressure hose from the pump.

(4) Using the gasket and bolt, install the ST2 to the pump instead of the pressure hose.

Preparation items:

Genuine part: Gasket (34621AC021)

Genuine part: Bolt (34620AC010)



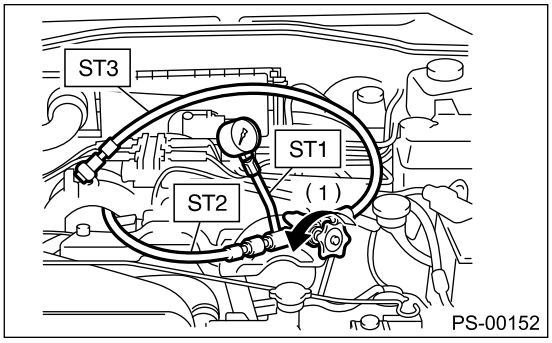
(1) Suction hose

(2) Pressure hose

(5) Attach the ST3 to the end of pressure hose which is removed from pump.
(6) Replenish power steering fluid up to the specified level.
(7) Open the valve, and start the engine.
(8) Measure the regular pressure.

Preparation tool:

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



(1) Valve

Service limit:

981 kPa (10 kgf/cm^2, 142 psi) or less

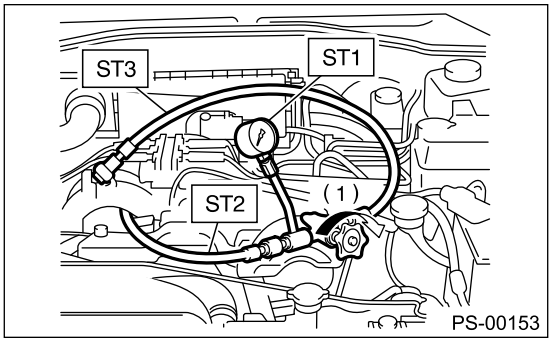
(9) If it is not within the specification, replace the faulty part for the following problems. (Pipe or hose clogged, leaks from fluid line, and mixture of foreign matter in fluid line)

2. Measure the relief pressure.

(1) Using the ST, measure the relief pressure.
(2) Close the valve.
(3) Measure the relief pressure.

Preparation tool:

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



(1) Valve

Service limit:

8,300 — 9,000 kPa (85 — 92 kgf/cm^2, 1,203 — 1,305 psi)

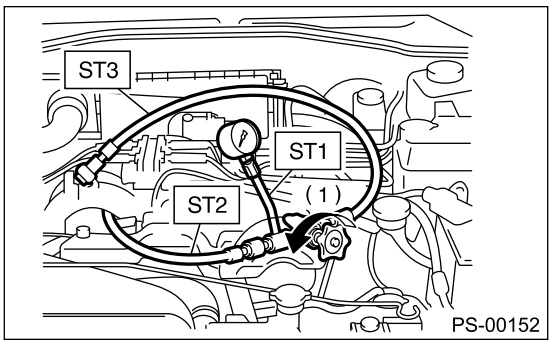
(4) If the torque is not within specified range, replace the oil pump.

3. Measure the operating pressure.

(1) Using the ST, measure the operating pressure.
(2) Open the valve.
(3) Measure the operating pressure of control valve by turning steering wheel from stop to stop.

Preparation tool:

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



(1) Valve

Service limit:

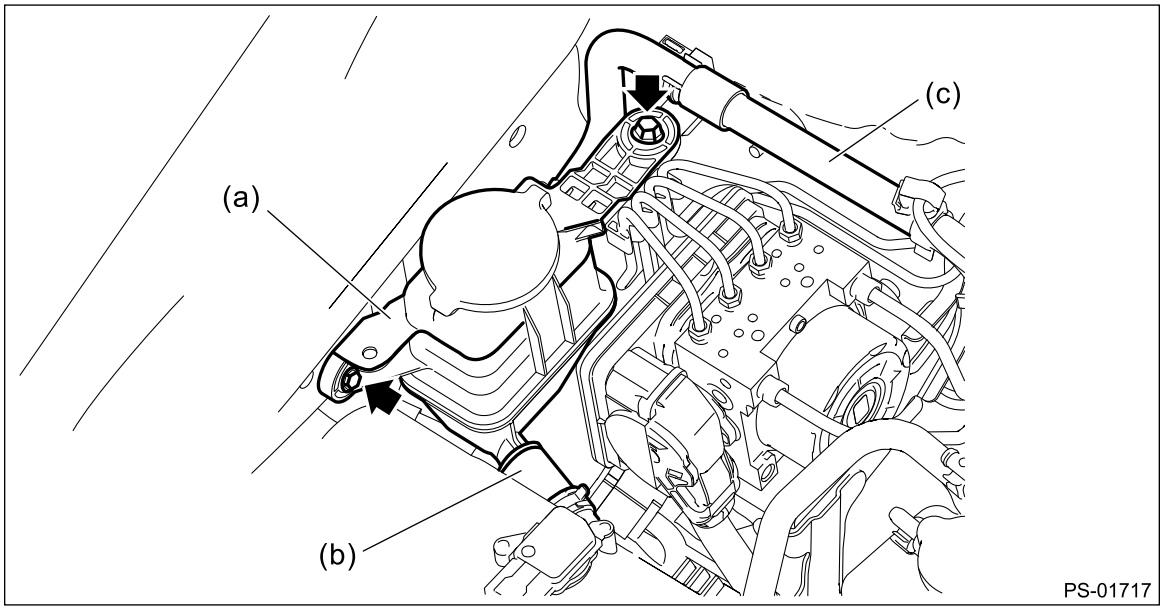
8,300 — 9,000 kPa (85 — 92 kgf/cm^2, 1,203 — 1,305 psi)

(4) If it is out of specification, measure the steering effort. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION > MEASUREMENT OF STEERING EFFORT (HYDRAULIC TYPE).
If it is not within specification, replace the control valve itself or control valve and pinion as a single unit, using new parts.

POWER ASSISTED SYSTEM (POWER STEERING) > Reservoir Tank

REMOVAL

1. Drain the power steering fluid.
2. Disconnect the hose - suction and the hose - return.
   Caution:
   Plug the ends of the hose and pipe to prevent foreign matter from entering.
3. Remove the bolt and remove the reservoir - tank assembly.



(a) Reservoir - tank ASSY (b) Hose - suction (c) Hose - return

POWER ASSISTED SYSTEM (POWER STEERING) > Reservoir Tank

INSTALLATION

1. Install the reservoir - tank assembly.
   Tightening torque:
   13 N·m (1.3 kgf-m, 9.6 ft-lb)
2. Connect the hose - suction and the hose - return to the reservoir - tank assembly.
3. Replenish power steering fluid up to the specified level. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Power Steering Fluid>INSPECTION.

POWER ASSISTED SYSTEM (POWER STEERING) > Reservoir Tank

INSPECTION

Check the reservoir - tank assembly for cracks, breakage or damage. If a failure is found, replace the reservoir - tank assembly.

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering Fluid

SPECIFICATION

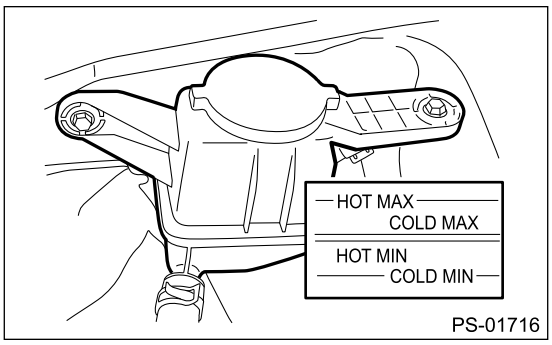
Recommended power steering fluid:

SUBARU ATF or ATF DEXRON III

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering Fluid

INSPECTION

1. Check the power steering fluid for deterioration or contamination. If the fluid is highly deteriorated or contaminated, drain it and refill with new fluid.
2. Check the joints and units for oil leakage. If any oil leaks are found, repair or replace the applicable part.
3. Inspect the fluid level of the reservoir - tank assembly with vehicle on level surface and engine stopped.
   If the level is at "MIN." point or below, add fluid to keep the level in the specified range of the indicator. If at "MAX." point or above, drain fluid by using a syringe or the like.
   (1) When the power steering fluid temperature is 20°C (68°F), check the fluid level on the "COLD" side.
   (2) When the power steering fluid temperature is 80°C (176°F), check the fluid level on the "HOT" side.



POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering Fluid

REPLACEMENT

1. Lift up the vehicle.
2. Drain the power steering fluid.
   (1) Remove the pipe joint of the gearbox, and connect the vinyl hose to the pipe and the joint.
   (2) Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise.
3. Add the specified fluid to the reservoir - tank assembly at "MAX" level.
4. Continue to turn the steering wheel slowly from lock to lock until the bubbles stop appearing on oil surface while keeping the fluid at the level in the step 3).
5. If the steering wheel is turned in a low fluid level condition, air will be sucked into the pipe. If air has entered, leave it for about half an hour and then repeat step 4) again.
6. Start the engine and let it idle.
7. Continue to turn the steering wheel slowly from lock to lock again until the bubbles stop appearing on oil surface, while keeping the fluid at the level in step 3).

Normally bubbles will stop appearing after turning the steering wheel from lock to lock three times.

8. In case bubbles do not stop appearing in the tank, leave it for about half an hour and then repeat from step 3) again.
9. Lower the vehicle, and then idle the engine.
10. Continue to turn the steering wheel from lock to lock until the bubbles stop appearing and change of the fluid level is within 3 mm (0.12 in).
11. In case the following happens, leave it about half an hour and then perform step 7) to 10) again.
    (1) The fluid level changes by 3 mm (0.12 in) or more.
    (2) Bubbles remain on the upper surface of the fluid.
    (3) Grinding noise is generated from oil pump.
12. Check the fluid leakage after turning steering wheel from lock to lock with engine running.

POWER ASSISTED SYSTEM (POWER STEERING) > Power Steering Control Module

NOTE

Power steering control module is integrated with the electric power steering gearbox assembly. For the operation procedure, refer to “Electric Power Steering Gearbox”. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

INSPECTION

- Hydraulic type

Trouble	Possible cause	Corrective action
• Steering effort is heavy in all ranges. • Steering effort is heavy at stand still. • Steering wheel vibrates when turning.	1. Pulley belt • Unequal length of pulley belts • Contact with oil or grease • Looseness or damage of the pulley belt • Poor uniformity of the pulley belt cross section • Pulley belt touches to pulley bottom • Poor revolution of pulleys (except oil pump pulley) • Poor revolution of oil pump pulley	Adjust or replace the faulty parts.
	2. Tire and wheel • Improper tire out of specifications∗1 • Improper wheel out of specifications∗1 • Tires not properly inflated	Replace or reinflate the tire and wheel. Instruct customers.
	3. Fluid • Low fluid level • Air entry in fluid • Dust entry in fluid • Fluid deterioration • Inadequate warm up of fluid∗2	Refill the fluid, bleed air, replace or instruct customer.
	4. Idle speed • Lower idle speed • Excessive drop of idle speed at start or when turning the steering wheel∗3	Adjust the idle speed or instruct customer.
	5. Measure the hydraulic pressure. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Oil Pump>INSPECTION.	Replace the faulty parts.
	6. Measure the steering wheel effort. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION > MEASUREMENT OF STEERING EFFORT (HYDRAULIC TYPE).	Adjust or replace.
	7. Fluid line • Fluid leakage from fluid line	Repair or replace.
• Vehicle leads to one side or the other. • Returning force of steering wheel to center is poor. • Steering wheel vibrates when turning.	1. Tire and wheel • Flat tire • Mixed use of different tires • Mixed use of different wheels • Abnormal wear of tire • Unequal tread remaining • Unequal pressure of tire	Adjust, repair or replace the tire and wheel.

Trouble	Possible cause	Corrective action
	2. Front wheel alignment • Improper or unequal caster • Improper or unequal toe-in • Loose suspension connections	Adjust or retighten.
	3. Others • Damaged joint assembly • Unbalance of ground clearance • Unbalance of load	Replace or adjust the faulty parts, or instruct customer.
	4. Measure the steering wheel effort. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION > MEASUREMENT OF STEERING EFFORT (HYDRAULIC TYPE).	Adjust or replace the faulty parts.

∗1 If the tires or wheels are wider than standard, the load to power steering system is increased. Accordingly, in a condition, for example before fluid warms-up, relief valve may work before reaching maximum turning angle. In this situation, steering effort may become relatively heavy. When the measured hydraulic pressure is normal, there is no abnormal thing.
∗2 In cold weather, steering effort may be heavy due to increased flow resistance of cold fluid. After warming-up engine, turn the steering wheel from stop to stop several times to warm up fluid. If steering effort reduces normally, function is normal.
∗3 In cold weather or with insufficient warm up of the engine, steering effort may be heavy due to excessive drop of idling when turning the steering wheel. Start the vehicle with increasing engine speed than usual. If the steering effort returns to normal, the function operates normally.

- Electric type

Trouble	Possible cause	Corrective action
• Steering effort is heavy in all ranges. • Steering effort is heavy at stand still. • Steering wheel vibrates when turning.	1. Tire and wheel • Improper tire out of specifications • Improper wheel out of specification • Tires not properly inflated	Replace or reinflate the tire and wheel.
	2. Measure the steering wheel effort. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION > MEASUREMENT OF STEERING EFFORT (ELECTRIC TYPE).	Adjust or replace the faulty parts.
• Vehicle leads to one side or the other. • Returning force of steering wheel to center is poor. • Steering wheel vibrates when turning.	1. Tire and wheel • Flat tire • Mixed use of different tires • Mixed use of different wheels • Abnormal wear of tire • Unequal tread remaining • Unequal pressure of tire	Adjust, repair or replace the tire and wheel.
	2. Front wheel alignment • Improper or unequal caster • Improper or unequal toe-in	Adjust or retighten.

Trouble	Possible cause	Corrective action
	• Loose suspension connections	
	3. Measure the steering wheel effort. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>General Diagnostic Table>INSPECTION > MEASUREMENT OF STEERING EFFORT (ELECTRIC TYPE).	Adjust or replace the faulty parts.

Note:
When performing repeated steering operation with the vehicle at standstill, the steering effort may be temporarily heavy because the heat generated in the system activates the power steering protection control. This is not a malfunction caused by the steering system. After a while, it will return to normal steering effort. (In this case, the steering warning light will not come on and there will be no DTC.)

1. NOISE & VIBRATION (HYDRAULIC TYPE)

Caution:
Do not keep the relief valve operated for five seconds or more at any time or inner parts of the oil pump may be damaged due to rapid increase of fluid temperature.
Note:

- **A grinding noise may be heard immediately after the engine start in extremely cold conditions. In this case, if the noise goes off during warm up there is no abnormal function in the system. This is due to the fluid characteristics in extremely cold condition.**
- **The oil pump normally makes a small whining noise due to its mechanism. Even if a noise is heard when steering wheel is turned at stand still, there is no abnormal function in the system provided that the noise eliminates when the vehicle is driving.**
- **When turning the steering wheel with the brake applied when the vehicle is parked, a screeching noise may be generated by the brake disc and pads. This is not a fault in the steering system.**
- **There may be a small vibration around the steering devices when turning the steering wheel at standstill, even though the component parts are operating properly.**
  Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e., road surface and tire surface, engine speed and turning speed of steering wheel, fluid temperature and braking condition.
  These conditions do not indicate a problem in the system.
  Confirm vibration by applying the parking brake on a concrete surface and turning the steering wheel from slowly to rapidly, in steps.

Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Do not keep this condition for 5 seconds or more.)	Normal
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is defective.	Replace the oil pump.

Trouble	Possible cause	Corrective action
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check the clearance. Correct if necessary. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Pipe Assembly>INSPECTION.
	Looseness of the installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Looseness of oil pump pulley or other pulley(s)	Retighten.
	Looseness of linkage, play of steering, improper tightening (looseness) of suspension joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace faulty parts in the gearbox or oil pump.
Knocking When turning steering wheel in both directions with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Insufficient tightening or play in the tie-rod or tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Air in vane pump	Inspect and retighten the fluid line connection. Refill the fluid and vent air.
	Vane pump seizing	Replace the oil pump.
	Oil pump pulley bearing seized	Replace the oil pump.
	Folded hose, flattened pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Improper adjustment of pulley belt Damaged or over tensioned pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Runout or dirty V-groove surface of oil pump pulley	Clean or replace.
Sizzling noise (continuous) While engine is running.	Fluid aeration	Fix the faulty part causing aeration. Replace the fluid and vent air.
	Damaged pipe of gearbox	Replace the pipe.
	Faulty inside of hose or pipe Flattened hose or pipe	Repair or replace.
	Abnormal inside of oil tank	Replace.
	Removed oil tank cap	Install cap.

Trouble	Possible cause	Corrective action
Whistle (continuous) While engine is running.	Faulty pipe of gearbox or faulty hose	Replace the faulty parts of the gearbox or the hose.
Whine or growl (intermittent or continuous) While engine is running (with/without steering turned).	Looseness of oil pump, oil pump bracket attachment	Retighten.
	Fault inside of oil pump or hose	Replace the oil pump or hose, if the noise can be heard when vehicle is running as well as being stopped.
	Torque converter growl, air conditioner compression growl	Remove the power steering pulley belt and check.
Grinding noise (intermittent) While engine is running (with the steering turned).	Fault inside of gearbox	Replace the faulty parts of gearbox.
	Faulty bearing of the column assembly - steering	Apply grease or replace.
	Occurs when turning the steering wheel with brakes (service or parking) applied.	If the noise goes off when brake is released, it is normal.
Vibration While engine is running (with/without steering turned).	Engine speed is too low.	Adjust, and notify customer.
	Air in vane pump	Repair faulty part. Vent air.
	Damaged valve in oil pump or gearbox	Replace the faulty parts in gearbox and oil pump.
	Excessive play in steering, looseness of suspension parts	Retighten.

2. NOISE & VIBRATION (ELECTRIC TYPE)

Note:

- **When turning the steering wheel with the brake applied when the vehicle is parked, a screeching noise may be generated by the brake disc and pads. This is not a fault in the steering system.**
- **There may be a small vibration around the steering devices when turning the steering wheel at standstill, even though the component parts are operating properly.**

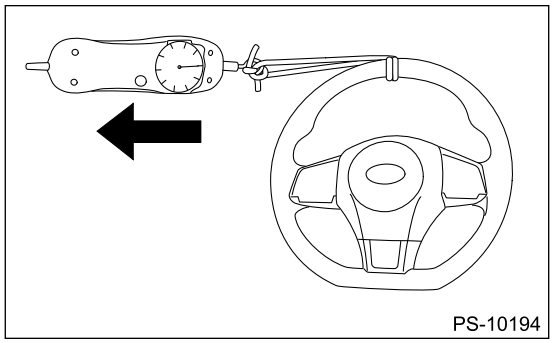
Trouble	Possible cause	Corrective action
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check the clearance. Correct if necessary.
	Looseness of linkage, play of steering, improper tightening (looseness) of suspension joint or steering column	Retighten or replace.

Trouble	Possible cause	Corrective action
	Noise emitted from inside of the gearbox	Replace the gearbox assembly.
Knocking When turning steering wheel in both directions with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust the backlash. When the noise remains after adjustment, replace the gearbox assembly.
	Insufficient tightening or play in the tie-rod or tie-rod end	Retighten or replace.
Grinding noise (intermittent) While engine is running. (While operating the steering.)	Fault inside of gearbox	Replace the gearbox assembly.
	Faulty bearing of the column assembly - steering	Apply grease or replace.
	Occurs when turning the steering wheel with brakes (service or parking) applied.	If the noise goes off when brake is released, it is normal.
Vibration While engine is running. (with/without steering turned)	Excessive play in steering, looseness of suspension parts	Retighten.

3. MEASUREMENT OF STEERING EFFORT (HYDRAULIC TYPE)

1. CHECK STEERING EFFORT.

1. Stop the vehicle on paved road.
2. Start the engine.
3. Run the engine at idle.
4. Install a spring scale on the steering wheel.
5. Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.



Note:
When turning the steering more quickly than necessary from a direction to the other direction at an engine speed of 2,000 r/min or higher, steering effort may be heavy. This is caused by flow characteristic of the fluid in the oil pump and is not a defect.

Is the steering effort less than 31 N (3.2 kgf, 7 lbf)?

Yes	Steering effort is normal.
No	Go to 2.

2. CHECK STEERING EFFORT.

1. Stop the engine and lift up the vehicle.
2. Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.

Is the steering effort less than 15 N (1.53 kgf, 3.4 lbf)?

Yes	Go to 3.
No	Perform the backlash adjustment.

3. CHECK STEERING WHEEL EFFORT.

1. Remove the universal joint assembly - steering.
2. Measure the steering wheel effort.

Is the steering effort less than 2.26 N (0.23 kgf, 0.51 lbf)?

Yes	Go to 4.
No	Replace the column assembly - steering.

4. CHECK STEERING WHEEL EFFORT.

Measure the steering wheel effort.

Is the difference of steering effort between right and left less than 20%?

Yes	Go to 5.
No	Replace the column assembly - steering.

5. CHECK UNIVERSAL JOINT ASSEMBLY - STEERING.

Measure the swing torque of the joint (yoke on the column assembly - steering side). Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSPECTION.

Is the swing torque of the universal joint assembly - steering less than 7.3 N (0.74 kgf, 1.64 lbf)?

Yes	Go to 6.
No	Replace the universal joint assembly - steering.

6. CHECK UNIVERSAL JOINT ASSEMBLY - STEERING.

Measure the swing torque of the joint (yoke of gearbox side). Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSPECTION.

Is the swing torque of the universal joint assembly - steering less than 3.8 N (0.39 kgf, 0.86 lbf)?

Yes	Go to 7.
No	Replace the universal joint assembly - steering.

7. CHECK FRONT WHEEL.

Check the front wheels.

Does the front wheels have unsteady revolution or rattling, or does the brake drag?

Yes	Inspect, readjust and replace if necessary.
No	Go to 8.

8. CHECK TIE-ROD ENDS.

Remove the tie-rod ends from housing.

Does the tie-rod ends have unsteady revolution or rattling?

Yes	Inspect and replace if necessary.
No	Go to 9.

9. CHECK GEARBOX.

Measure the rotating of gearbox.
Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Gearbox>INSPECTION > LIMIT.

Is the rotating resistance of steering gearbox less than 21 N (2.1 kgf, 4.7 lbf)? Is the difference between clockwise and counterclockwise less than 20%?

Yes	Go to 10.
No	Readjust the backlash, and if ineffective, replace the faulty parts.

10. CHECK GEARBOX.

Measure the sliding of gearbox.
Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Gearbox>INSPECTION > LIMIT.

Is the sliding resistance of the steering gearbox less than 343 N (35 kgf, 77 lbf)? Is the difference between the right and left sliding resistances less than 20%?

Yes	Steering effort is normal. Check the suspension.
No	Readjust the backlash, and if ineffective, replace the faulty parts.

4. MEASUREMENT OF STEERING EFFORT (ELECTRIC TYPE)

1. CHECK STEERING WARNING LIGHT.

Does the steering warning light illuminate?

Yes	Using Subaru Select Monitor, read the DTC and inspect according to it. For detailed operation procedures, refer to “Application help”.
No	Go to 2.

2. CHECK STEERING WARNING LIGHT.

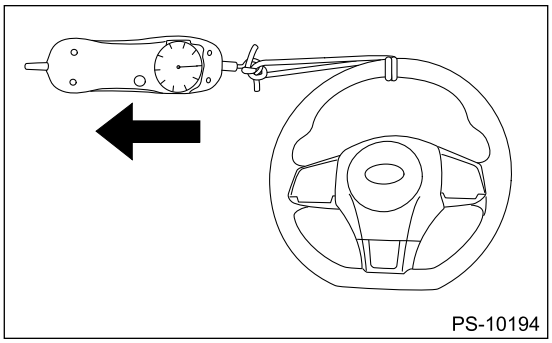
1. Display the data of «EPS operating condition» using Subaru Select Monitor.
2. Connect the Subaru Select Monitor, and turn the steering wheel. (One lock to lock)

Is the «EPS operating condition» normal without displaying any DTC code?

Yes	Go to 3.
No	If the «EPS operating condition» is “Assist limitation”, stop the engine for approx. 30 minutes and perform the procedures from step 1 again.

3. CHECK STEERING EFFORT.

1. Stop the vehicle on paved road.
2. Set the tire air pressure to the specification.
3. Start the engine.
4. Run the engine at idle.
5. Install a spring scale on the steering wheel.
6. Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.



Is the steering effort less than 31 N (3.2 kgf, 7.0 lbf)?

Yes	Go to 4.
No	Go to 8.

4. CHECK STEERING EFFORT.

1. Stop the engine.
2. Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.

Is the steering effort less than 294.2 N (30 kgf, 66.2 lbf)?

Yes	Go to 5.
No	Perform the inspection or adjustment around the suspension part.

5. CHECK TORQUE SENSOR OUTPUT VALUE.

1. Using Subaru Select Monitor, display the data of «Torque sensor main output» and «Torque sensor sub output».
2. Read the voltage value of torque sensor.
   Note:
   When measuring, place the steering wheel at the center position.

Is the voltage 2.425 — 2.575 V?

Yes	Go to 6.
No	Replace the gearbox assembly. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

6. CHECK TORQUE SENSOR OUTPUT VALUE.

1. Remove the universal joint assembly - steering.
2. Using Subaru Select Monitor, display the data of «Torque sensor main output» and «Torque sensor sub output».
3. Read the voltage value of torque sensor.

Is the voltage 2.425 — 2.575 V?

Yes	Go to 7.
No	Replace the gearbox assembly. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

7. CHECK TORQUE SENSOR OUTPUT VALUE.

1. Remove the universal joint assembly - steering.
   Note:
   Check that the universal joint assembly - steering moves up and down smoothly without installing the bolt. Then tighten the bolts first on the gearbox side and then on the column shaft side.
2. Using Subaru Select Monitor, display the data of «Torque sensor main output» and «Torque sensor sub output».
3. Read the voltage value of torque sensor.

Is the voltage 2.425 — 2.575 V?

Yes	Go to 8.
No	Check the universal joint assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

8. CHECK STEERING WHEEL EFFORT.

1. Remove the universal joint assembly - steering.
2. Measure the steering wheel effort.

Is the steering effort less than 2.26 N (0.23 kgf, 0.51 lbf)?

Yes	Go to 9.
No	Replace the column assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

9. CHECK STEERING WHEEL EFFORT.

Measure the steering wheel effort.

Is the difference of steering effort between right and left less than 20%?

Yes	Go to 10.
No	Replace the column assembly - steering. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Steering Column.

10. CHECK UNIVERSAL JOINT ASSEMBLY - STEERING.

Measure the swing torque of joint. (Yoke of column assembly - steering side) Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSPECTION.

Is the swing torque of the universal joint assembly - steering less than 8.1 N (0.81 kgf, 1.84 lbf)?

Yes	Go to 11.
No	Replace the universal joint assembly - steering with a new part. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint.

11. CHECK UNIVERSAL JOINT ASSEMBLY - STEERING.

Measure the swing torque of joint. (Yoke of gearbox side) Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint>INSPECTION.

Is the swing torque of the universal joint assembly - steering less than 6.8 N (0.68 kgf, 1.54 lbf)?

Yes	Go to 12.
No	Replace the universal joint assembly - steering with a new part. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Universal Joint.

12. CHECK FRONT WHEEL.

Check the front wheels.

Does the front wheels have unsteady revolution or rattling, or does the brake drag?

Yes	Inspect, readjust and replace if necessary.
No	Go to 13.

13. CHECK TIE-ROD ENDS.

Remove the tie-rod ends.

Does the tie-rod ends of suspension have unsteady revolution or rattling?

Yes	Inspect and replace if necessary.
No	Go to 14.

14. CHECK BALL JOINT.

Remove the ball joint.

Does the ball joints of suspension have unsteady revolution or rattling?

Yes	Inspect and replace if necessary.
No	Go to 15.

15. CHECK GEARBOX.

Measure the rotating of gearbox.
Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox>INSPECTION > LIMIT.

Is the rotational resistance of steering gearbox less than 18 N (1.8 kgf, 4.0 lbf)? Is the difference between clockwise and counterclockwise less than 20%?

Yes	Go to 16.
No	Replace the gearbox assembly. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

16. CHECK GEARBOX.

Measure the sliding of gearbox.

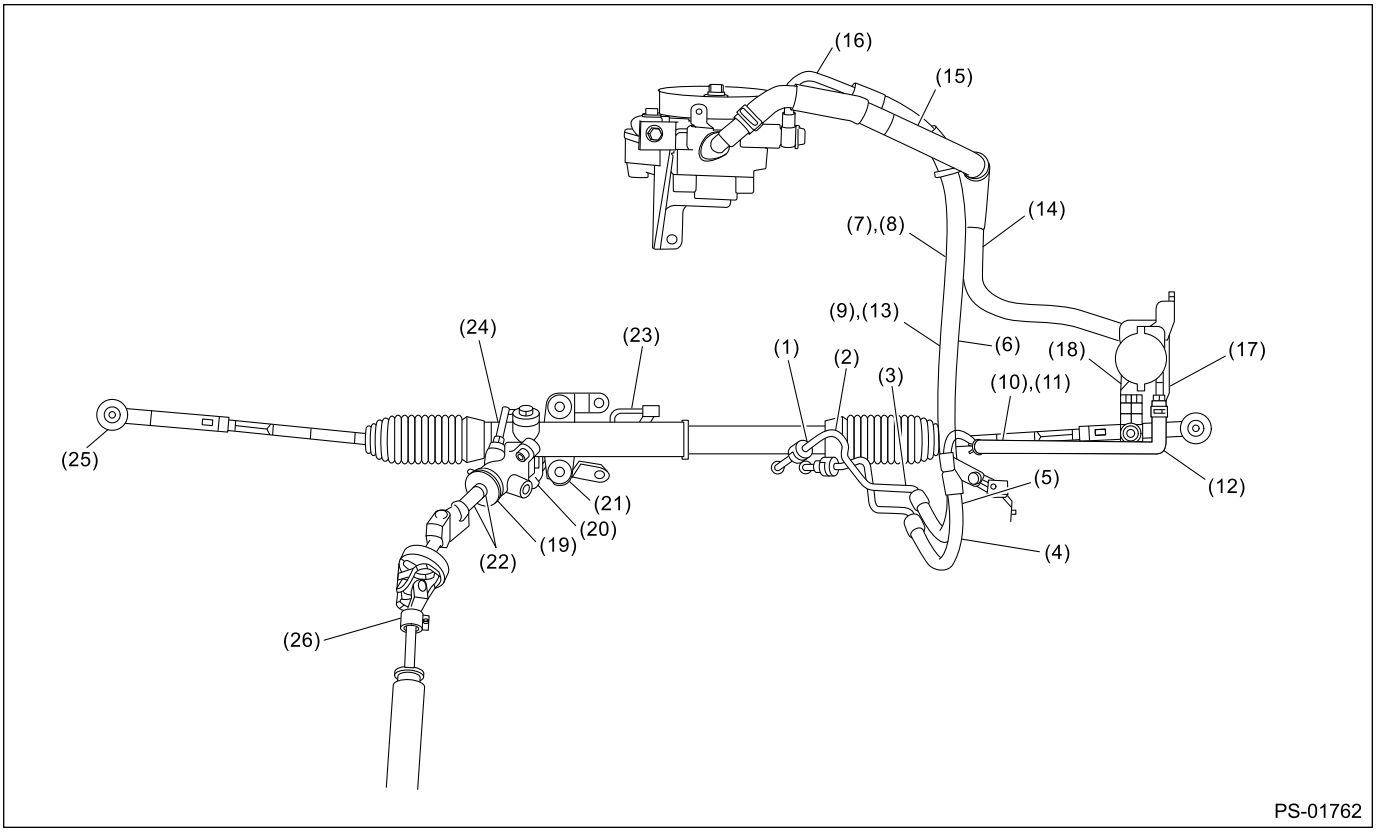
Is the sliding resistance of the steering gearbox less than 360 N (36.7 kgf, 80.9 lbf)? Is the difference between the right and left sliding resistances less than 20%?

Yes	Steering effort is normal.
No	Replace the gearbox assembly. Ref. to POWER ASSISTED SYSTEM (POWER STEERING)>Electric Power Steering Gearbox.

5. CLEARANCE CHECK (HYDRAULIC TYPE)

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

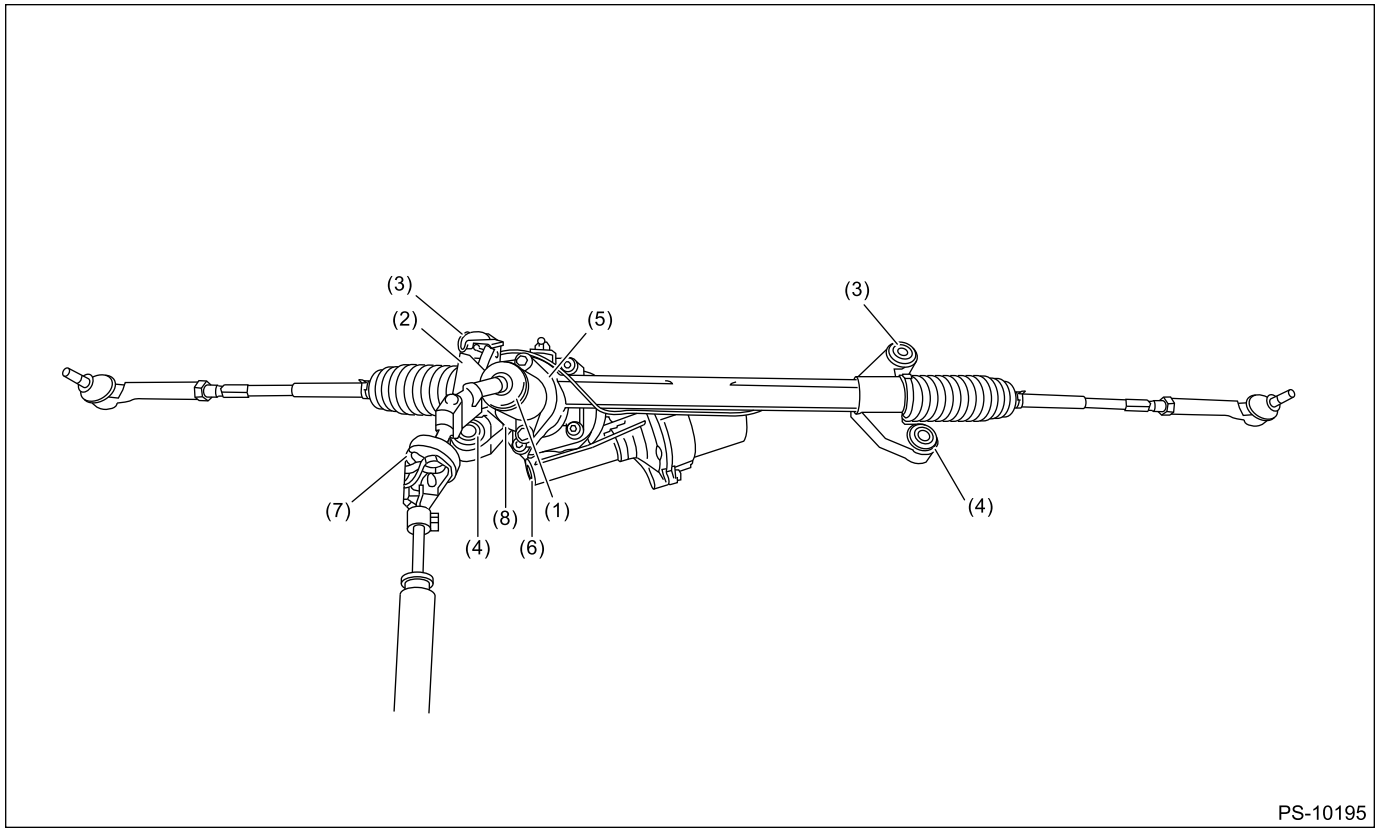
Location	Minimum allowance mm (in)
(1) Crossmember to hose ASSY	3 (0.12)
(2) Front exhaust pipe to hose ASSY	15 (0.59)
(3) Front frame side to hose ASSY	10 (0.39)
(4) Master cylinder to return hose	10 (0.39)
(5) Master cylinder to hose clip	10 (0.39)
(6) VDC H/U to hose ASSY	5 (0.20)
(7) Air cleaner to hose ASSY	5 (0.20)
(8) Air boot to hose ASSY	10 (0.39)
(9) Air cleaner hose to hose ASSY	10 (0.39)
(10) Brake pipe to return hose	10 (0.39)
(11) Front suspension bracket to return hose	5 (0.20)
(12) Front wheel apron to return hose	5 (0.20)
(13) VDC H/U bracket to suction hose	5 (0.20)
(14) Air cleaner case to suction hose	5 (0.20)
(15) Air intake duct to suction hose	10 (0.39)
(16) Air duct to suction hose	10 (0.39)
(17) Front wheel apron to reservoir tank	5 (0.20)
(18) VDC H/U to reserve tank	5 (0.20)
(19) Valve housing to DOJ (MT model)	12 (0.47)
(20) Valve housing to crossmember (hole)	1 (0.04)
(21) Cannon mount to crossmember	There must be no contact
(22) Pipe to crossmember	5 (0.20)
(23) Pipe to stabilizer	15 (0.59)
(24) Pipe to exhaust pipe	18 (0.71)
(25) Tie-rod end to brake dust cover	2.5 (0.10)
(26) Universal joint column side yoke to master cylinder (closest point of approach when the universal joint turns by 360°)	5 (0.20)



6. CLEARANCE CHECK (ELECTRIC TYPE)

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 mm (in)
(1) Stub housing to DOJ (MT model)	15 (0.59)
(2) Torque sensor to crossmember	5 (0.20)
(3) Cannon mount to crossmember	There must be no contact
(4) Cannon mount to crossmember	There must be no contact
(5) Stub housing to engine mount	12 (0.47)
(6) Reduction motor housing to exhaust pipe	12 (0.47)
(7) Universal joint column side yoke to master cylinder (closest point of approach when the universal joint turns by 360°)	5 (0.20)
(8) Wheel housing to exhaust pipe	13 (0.51)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