STEERING SYSTEM 4-3

PRECAUTION FOR SUPPLEMENTAL RESTRAINT SYSTEM “AIRBAG”

The Supplemental Restraint System “Airbag” helps to reduce the risk or severity of injury to the driver in a frontal collision.

The Supplemental Restraint System consists of an airbag module (located in the center of the steering wheel), sensors, a control module, warning light, wiring harness and roll connector.

Information necessary to service the safety is included in the “5-5. SUPPLEMENTAL RESTRAINT SYSTEM” of this Service Manual.

WARNING:

- **To avoid rendering the Airbag system inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized SUBARU dealer.**
- **Improper maintenance, including incorrect removal and installation of the Airbag system, can lead to personal injury caused by unintentional activation of the Airbag system.**
- **All Airbag system electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the Supplemental Restraint System “Airbag”.**

1. Steering System

A: SPECIFICATIONS

Whole system	Minimum turning radius m (ft)	5.1 (16.7)
	Steering angle (Inside-Outside)	37.4°±1.5° — 32.5°±1.5°
	Steering wheel diameter mm (in)	385 (15.16)
	Overall gear ratio (Turns, lock to lock)	16.5 (3.2)
Gearbox	Type	Rack and pinion, Integral
	Backlash	0 (Automatically adjustable)
	Valve (Power steering system)	Rotary valve
Pump (Power steering system)	Type	Vane pump
	Oil tank	Installed on pump
	Output cm^3 (cu in)/rev.	7.2 (0.439)
	Relief pressure kPa (kg/cm^2, psi)	1800 cc model: 6,375 (65, 924) 2200 cc model: 7,355 (75, 1,067)
	Hydraulic fluid control	Dropping in response to increased engine revolutions
	Hydraulic fluid ℓ (US qt, Imp qt)	1,000 rpm: 7 (7.4, 6.2) 3,000 rpm: 5 (5.3, 4.4)
	Range of revolution rpm	500 — 7,500
	Revolving direction	Clockwise
Working fluid (Power steering system)	Name	ATF DEXRON II, IIE or III
	Capacity Oil tank ℓ (US qt, Imp qt) Total	0.3 (0.3, 0.3) 0.7 (0.7, 0.6)

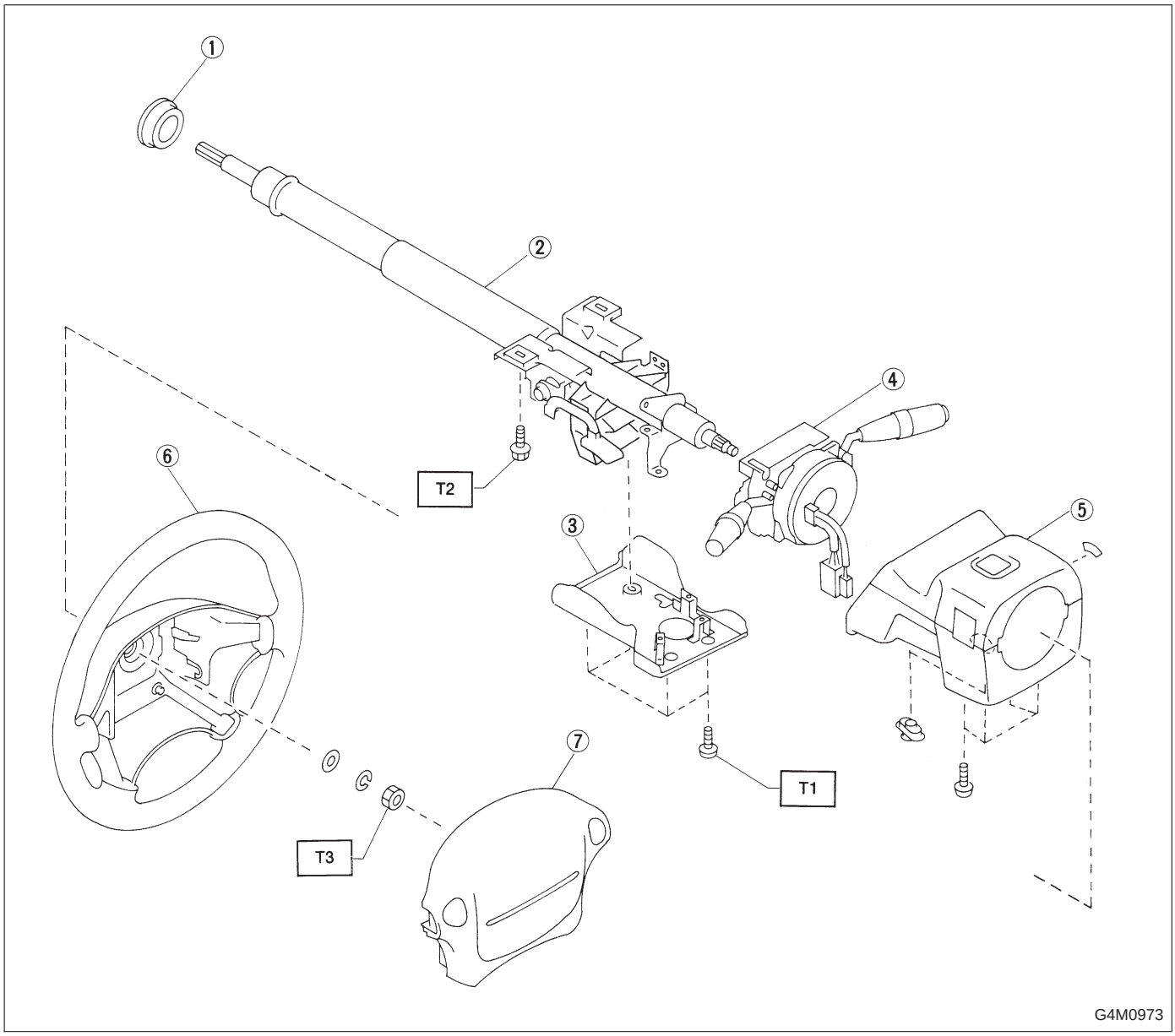
B: SERVICE DATA

Steering wheel	Free play mm (in)	17 (0.67)
Turning angle	Inner tire & wheel	37.4°±1.5°
	Outer tire & wheel	32.5°±1.5°
Steering shaft	Clearance between steering wheel and column cover mm (in)	3.0 (0.118)
Steering gearbox (Power steering system)	Sliding resistance N (kg, lb)	240.3 (24.5, 54.0) or less
	Rack shaft play in radial direction mm (in) Right-turn steering Left-turn steering	 0.15 (0.0059) or less Horizontal movement: 0.3 (0.012) or less Vertical movement: 0.15 (0.0059) or less
	Input shaft play mm (in) In radial direction In axial direction	 0.18 (0.0071) or less 0.1 (0.004) or less
	Turning resistance N (kg, lb)	Within 30 mm (1.18 in) from rack center in straight ahead position: Less than 11.18 (1.14, 2.51) Maximum allowable value: 12.7 (1.3, 2.9)
Oil pump (Power steering system)	Pulley shaft mm (in) Radial play Axial play	 0.4 (0.016) or less 0.9 (0.035) or less
	Pulley Ditch deflection mm (in) Resistance to rotation N (kg, lb)	 1.0 (0.039) or less 9.22 (0.94, 2.07) or less
	Regular pressure kPa (kg/cm^2, psi)	981 (10, 142) or less
	Relief pressure kPa (kg/cm^2, psi)	6,375 (65, 924)
Steering wheel effort (Power steering system)	At standstill with engine idling on a concrete road N (kg, lb)	31.4 (3.2, 7.1) or less
	At standstill with engine stalled on a concrete road N (kg, lb)	147 (15, 33) or less

C: RECOMMENDED POWER STEERING FLUID

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

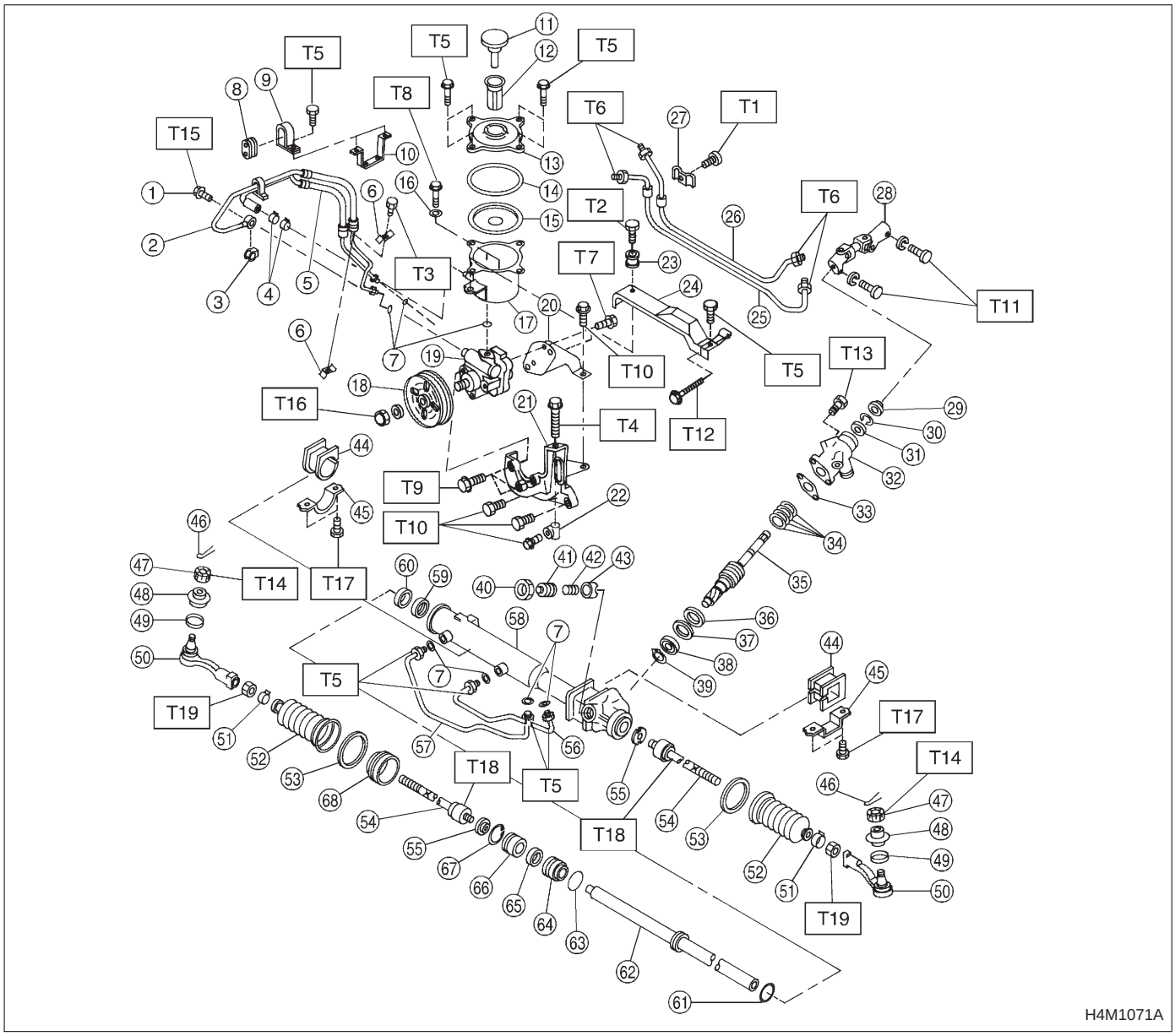
1. Steering Wheel and Column (Tilt)



① Bushing
② Steering shaft
③ Knee protector
④ Steering roll connector
⑤ Column cover
⑥ Steering wheel
⑦ Airbag module

Tightening torque: N·m (kg-m, ft-lb)
T1: 3.4±1.0 (0.35±0.1, 2.5±0.7)
T2: 25±5 (2.5±0.5, 18.1±3.6)
T3: 34±5 (3.5±0.5, 25.3±3.6)

2. Power Steering System



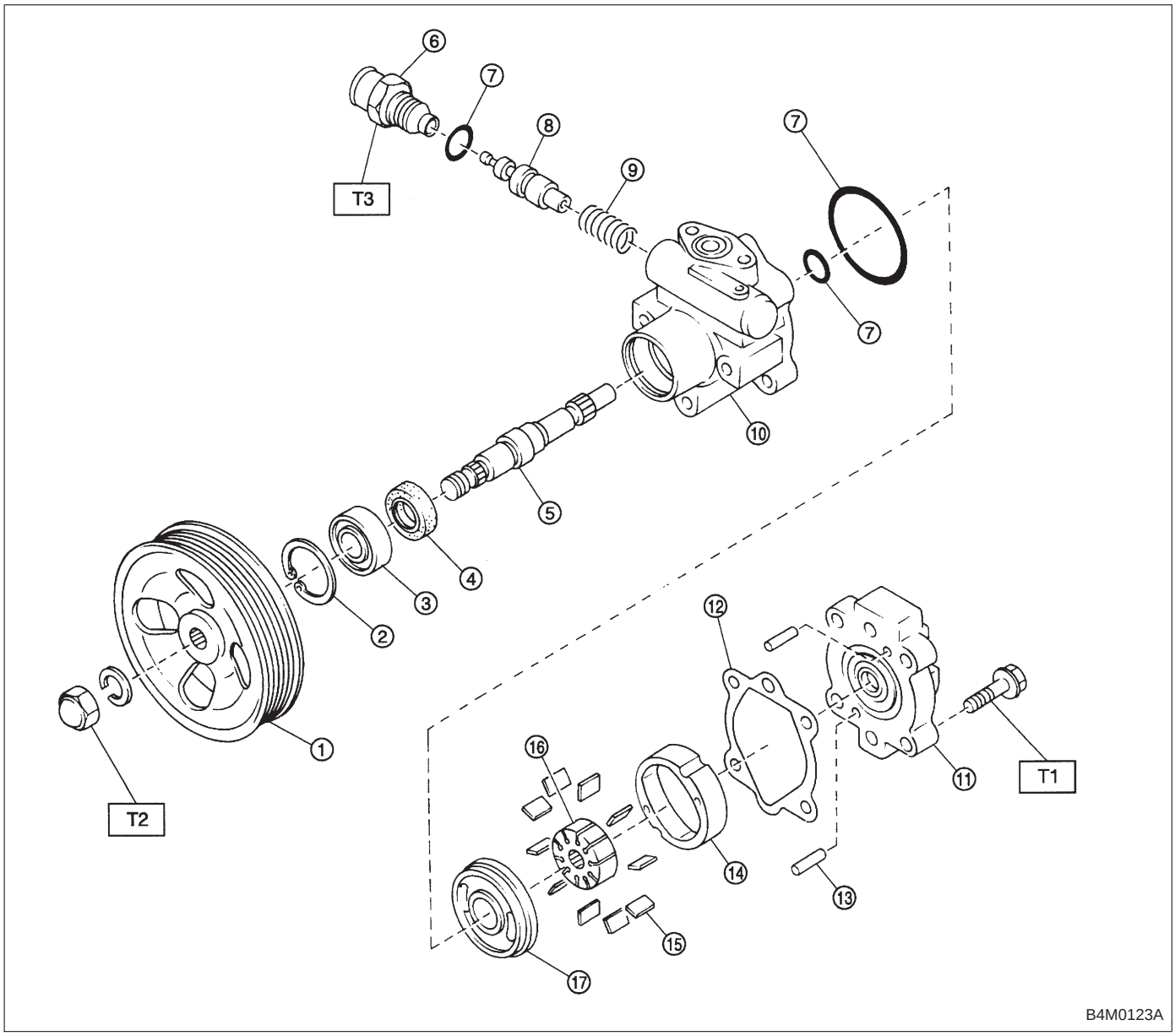
Tightening torque: N·m (kg-m, ft-lb)

- ***T1: 5.4±1.5 (0.55±0.15, 4.0±1.1)***
- ***T2: 6.4±1.0 (0.65±0.1, 4.7±0.7)***
- ***T3: 7.4±2.0 (0.75±0.20, 5.4±1.4)***
- ***T4: 8±2 (0.8±0.2, 5.8±1.4)***
- ***T5: 13±3 (1.3±0.3, 9.4±2.2)***
- ***T6: 15±5 (1.5±0.5, 10.8±3.6)***
- ***T7: 15.7±2.4 (1.60±0.24, 11.6±1.7)***
- ***T8: 18^{+5}_{0} ($1.8^{+0.5}_{0}$, $13.0^{+3.6}_{0}$)***
- ***T9: 20.1±2.5 (2.05±0.25, 14.8±1.8)***
- ***T10: 22±2 (2.2±0.2, 15.9±1.4)***
- ***T11: 24±3 (2.4±0.3, 17.4±2.2)***
- ***T12: 25±2 (2.5±0.2, 18.1±1.4)***
- ***T13: 25±5 (2.5±0.5, 18.1±3.6)***
- ***T14: 27±2 (2.75±0.2, 19.9±1.4)***
- ***T15: 39±5 (4.0±0.5, 28.9±3.6)***
- ***T16: 52±10 (5.3±1.0, 38±7)***
- ***T17: 59±12 (6.0±1.2, 43±9)***
- ***T18: 78±10 (8.0±1.0, 58±7)***
- ***T19: 83±5 (8.5±0.5, 61.5±3.6)***

COMPONENT PARTS

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

3. Power Steering Oil Pump



① Pulley
② Snap ring
③ Bearing
④ Oil seal
⑤ Shaft
⑥ Connector
⑦ O-ring
⑧ Spool valve
⑨ Spring
⑩ Front casing
⑪ Rear cover
⑫ Gasket
⑬ Knock pin
⑭ Cam ring
⑮ Vane
⑯ Rotor
⑰ Side plate

Tightening torque: N·m (kg-m, ft-lb)
T1: 16±2 (1.6±0.2, 11.6±1.4)
T2: 61±7 (6.2±0.7, 44.8±5.1)
T3: 74±5 (7.5±0.5, 54.2±3.6)

1. Supplemental Restraint System “Airbag” AIRBAG

A: PRECAUTION

Airbag system wiring harness is routed near the steering wheel, steering shaft and column.

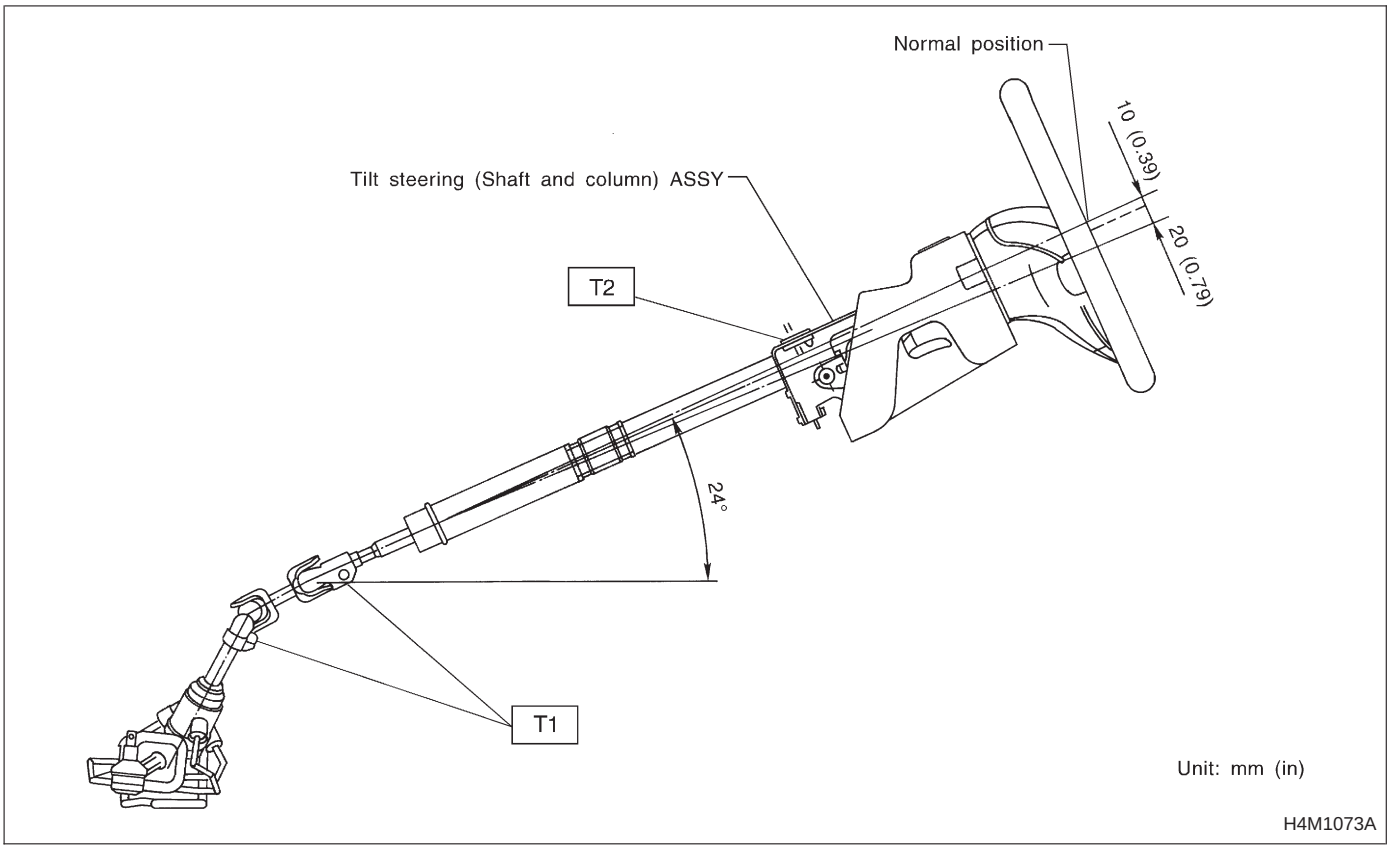
WARNING:

● All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

● Be careful not to damage Airbag system wiring harness when servicing the steering wheel, steering shaft and column.

2. Tilt Steering Column

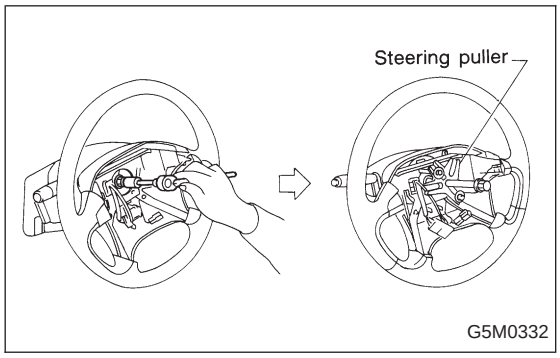
A: REMOVAL



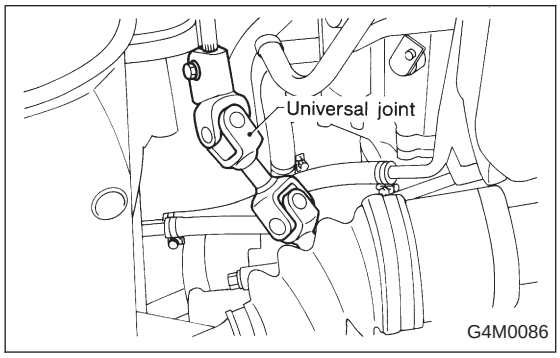
Tightening torque: N·m (kg-m, ft-lb)
T1: 24±3 (2.4±0.3, 17.4±2.2)
T2: 25±5 (2.5±0.5, 18.1±3.6)

1) Disconnect battery minus terminal.
2) Lift-up vehicle.
3) Remove airbag module. (with airbag model) <Ref. to 5-5 [W3A0].>

WARNING:
Always refer to "5-5 Supplemental Restraint System" before performing airbag module service (if so equipped). <Ref. to 5-5 [W3A0].>



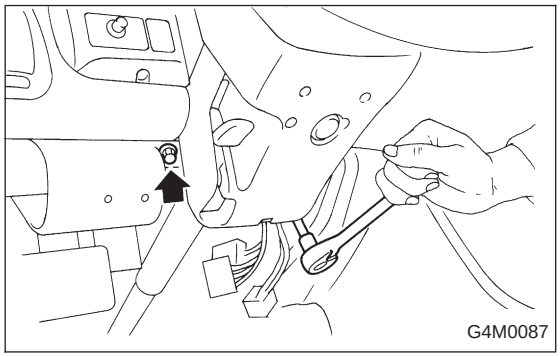
4) Remove steering wheel nut, then draw out steering wheel from shaft using steering puller.



5) Remove universal joint bolts and then remove universal joint.

CAUTION:
Scribe alignment marks on universal joint so that it can be reassembled at the original serration.

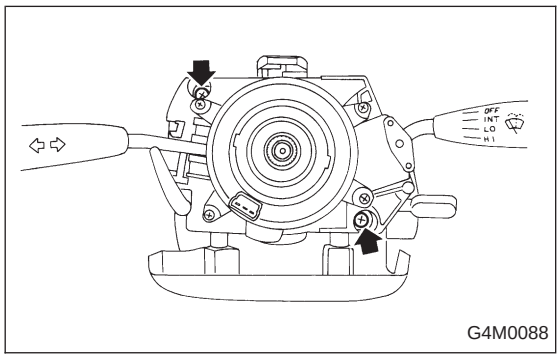
6) Remove trim panel under instrument panel.
7) Disconnect connectors for ignition switch and combination switch wiring harness under instrument panel.



8) Remove the two bolts under instrument panel securing steering shaft.
9) Pull out steering shaft assembly from hole on toe board.

CAUTION:
Be sure to remove universal joint before removing steering shaft assembly installing bolts when removing steering shaft assembly or when lowering it for servicing of other parts.

B: DISASSEMBLY

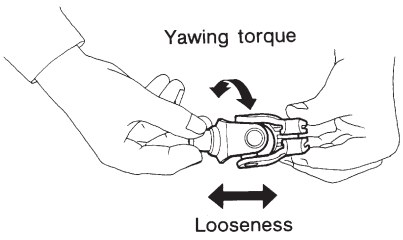
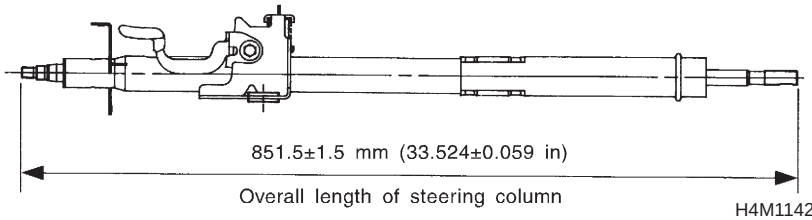


1) Remove the four screws securing upper and lower steering column covers, and the two screws securing combination switch, then remove related parts.

C: INSPECTION

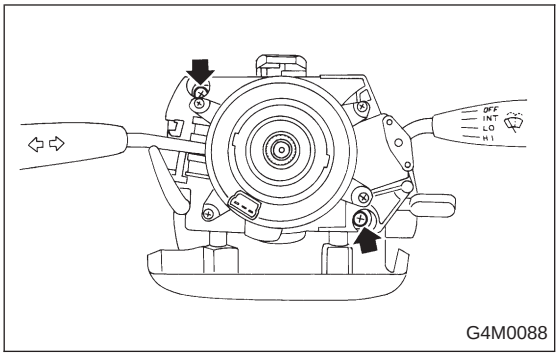
1. BASIC INSPECTION

Clean the disassembled parts with a cloth, and check for wear, damage, or any other faults. If necessary, repair or replace faulty parts.

Part name	Inspection	Corrective action
Universal joint	● Free play ● Swinging torque Yawing torque Looseness  G4M0089 **Standard value of universal joint free play: 0 mm (0 in)** **Max. value of universal joint swinging torque:** **0.3 N·m (0.03 kg-m, 0.2 ft-lb)**	Replace if faulty.
Steering column	● Overall length of steering column Measure overall length of steering column. Standard overall length of steering column:  H4M1142A	Replace steering column assembly.

2. AIRBAG MODEL INSPECTION

WARNING:
For airbag model inspection procedures, refer to 5-5 Supplemental Restraint System. <Ref. to 5-5 [W2F0] and [W2G0].>



G4M0088

D: ASSEMBLY

1) Insert combination switch to upper column shaft, and install lower column cover with tilt lever held in the lowered position. Then route ignition key harness and combination switch harness between column cover mounting bosses.
2) Fit upper column cover to lower column cover, and tighten combination switch and column cover.

Tightening torque:
1.2±0.2 N·m (0.12±0.02 kg-m, 0.9±0.1 ft-lb)

CAUTION:
Don't overtorque screw.

E: INSTALLATION

1) Insert end of steering shaft into toeboard grommet.
2) Tighten steering shaft mounting bolts under instrument panel.

Tightening torque:
25±5 N·m (2.5±0.5 kg-m, 18.1±3.6 ft-lb)

3) Connect ignition and combination switch connectors under instrument panel.
4) Connect airbag system connector at harness spool.

NOTE:
Make sure to apply double lock.

5) Install universal joint.
   (1) Align bolt hole on the long yoke side of universal joint with the cutout at the serrated section of shaft end, and insert universal joint.
   (2) Align bolt hole on the short yoke side of universal joint with the cutout at the serrated section of gearbox assembly. Lower universal joint completely.
   (3) Temporarily tighten bolt on the short yoke side. Raise universal joint to make sure the bolt is properly passing through the cutout at the serrated section.
   (4) Tighten bolt on the long yoke side, then that on the short yoke side.

Tightening torque:
24±3 N·m (2.4±0.3 kg-m, 17.4±2.2 ft-lb)

CAUTION:
● Make sure that universal joint bolts is tightened through notch in shaft serration.
● Excessively large tightening torque of universal joint bolts may lead to heavy steering wheel operation.

Standard clearance between gearbox to DOJ:
Over 15 mm (0.59 in)

6) Align center of roll connector. (with airbag model)
<Ref. to 5-5 [W6B1].>

CAUTION:
Ensure that front wheels are set in straight forward direction.

7) Set steering wheel to neutral and install it onto steering shaft.

Tightening torque:
34±5 N·m (3.5±0.5 kg-m, 25.3±3.6 ft-lb)

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

CAUTION:
Insert roll connector guide pin into guide hole on lower end of surface of steering wheel to prevent damage.
Draw out airbag system connector, horn connector and cruise control connectors from guide hole of steering wheel lower end. (with airbag model)

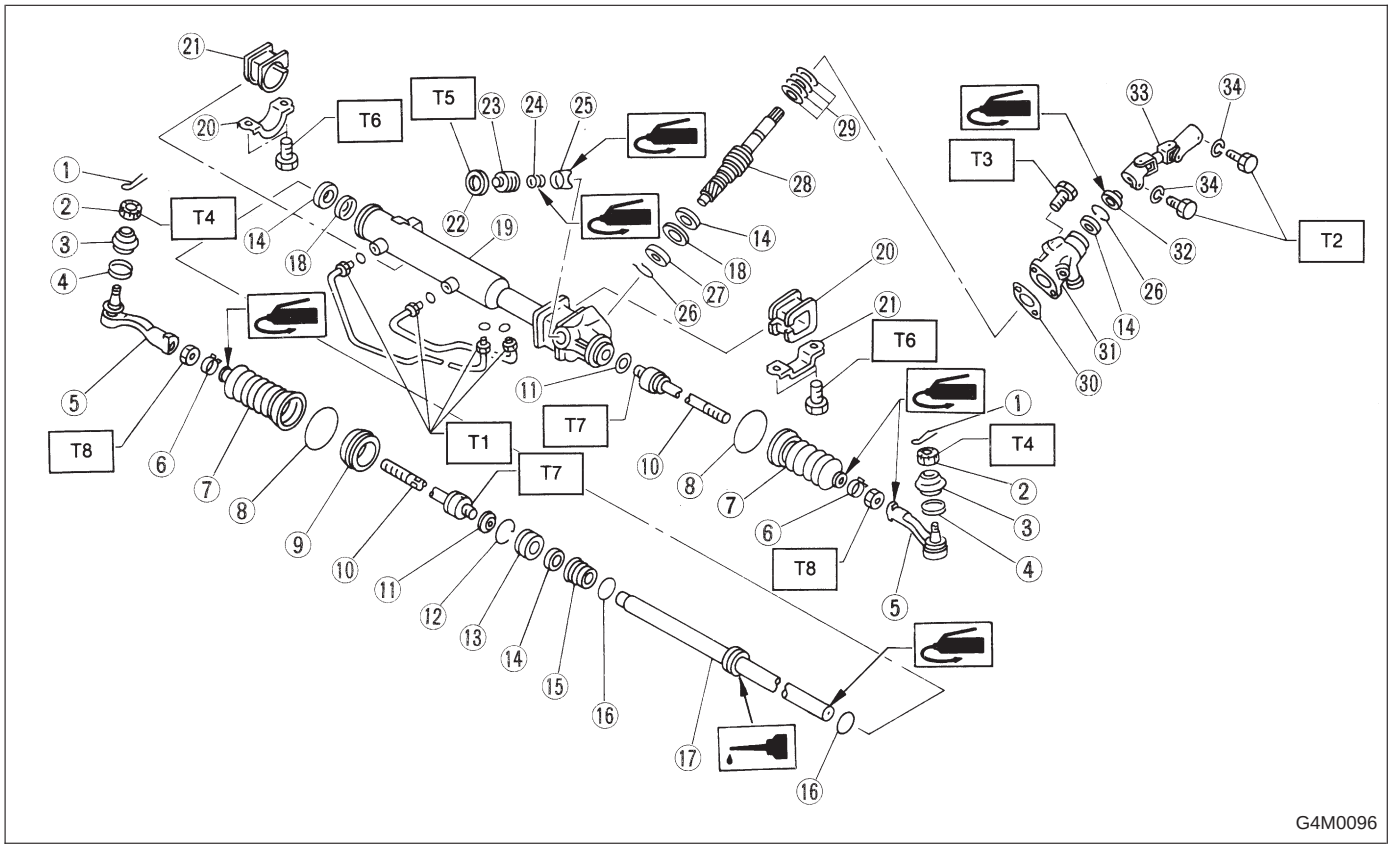
8) Install airbag module to steering wheel. (with airbag model)

WARNING:
Always refer to 5-5 Supplemental Restraint System before performing the service operation. <Ref. to 5-5 [W3A0].>

3. Steering Gearbox (Power Steering System)

A: REMOVAL

NOTE:
For disassembly and assembly of gearbox unit, refer to section Control Valve (Power Steering Gearbox).

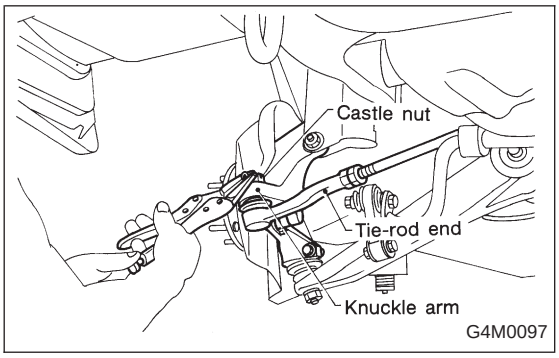


① Cotter pin
② Castle nut
③ Dust cover
④ Clip
⑤ Tie-rod end
⑥ Clip
⑦ Boot
⑧ Clip
⑨ Spacer
⑩ Tie-rod
⑪ Lock washer
⑫ Circlip
⑬ Rack stopper
⑭ Oil seal
⑮ Rack bushing
⑯ O-ring
⑰ Rack
⑱ Back-up washer
⑲ Rack housing
⑳ Adapter
㉑ Clamp
㉒ Lock nut
㉓ Adjusting screw
㉔ Spring
㉕ Sleeve
㉖ C-ring
㉗ Ball bearing
㉘ Valve
㉙ Seal ring
㉚ Packing
㉛ Valve housing
㉜ Dust seal
㉝ Universal joint
㉞ Spring washer

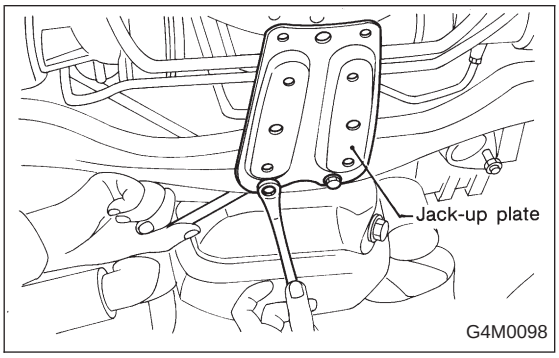
Tightening torque: N·m (kg-m, ft-lb)
T1: 13±3 (1.3±0.3, 9.4±2.2)
T2: 25±5 (2.5±0.5, 18.1±3.6)
T3: 24±3 (2.4±0.3, 17.4±2.2)
T4: 27.0±2.5
(2.75±0.25, 19.9±1.8)
T5: 39±10 (4.0±1.0, 29±7)
T6: 59±12 (6.0±1.2, 43±9)
T7: 78±10 (8.0±1.0, 58±7)
T8: 83±5 (8.5±0.5, 61.5±3.6)

1) Disconnect battery minus terminal.
2) Loosen front wheel nut.
3) Lift vehicle and remove front wheels.
4) Remove front exhaust pipe assembly.

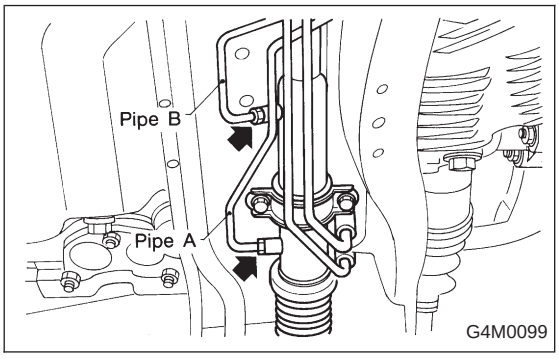
WARNING:
Be careful, exhaust pipe is hot.



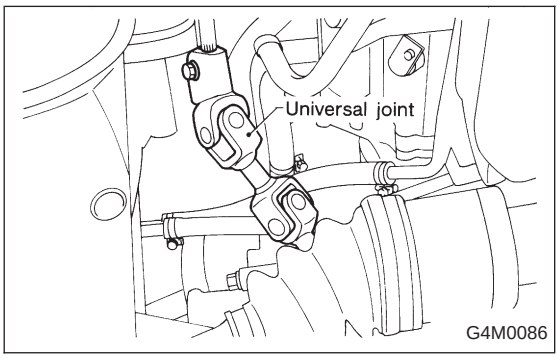
5) Using a puller, remove tie-rod end from knuckle arm after pulling off cotter pin and removing castle nut.



6) Remove jack-up plate and front stabilizer.

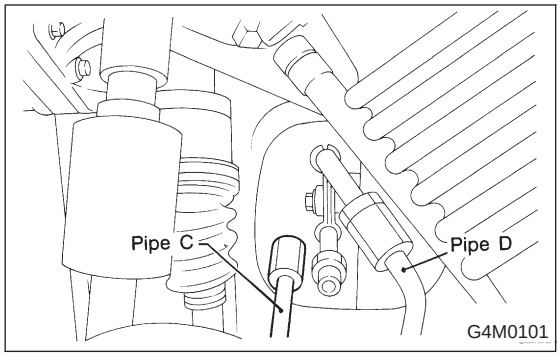


7) Remove one pipe joint at the center of gearbox, and connect vinyl hose to pipe and joint. Discharge fluid by turning steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.



8) Remove lower side bolt of universal joint, then remove upper side bolt and lift the joint upward.

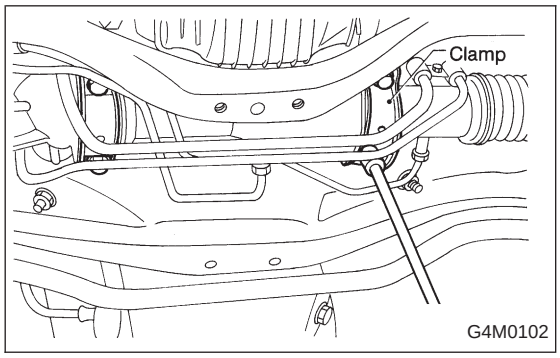
NOTE:
Place a mark on the joint and mating serration so that they can be re-installed at the original position.



9) Disconnect pipes C and D from pipe of gearbox.

CAUTION:
Be careful not to damage these pipes.

NOTE:
Disconnect upper pipe D first, and lower pipe C second.



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

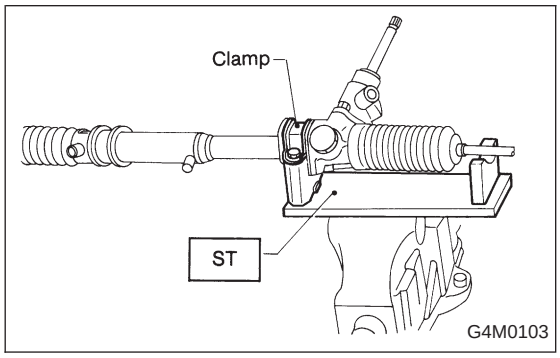
B: DISASSEMBLY

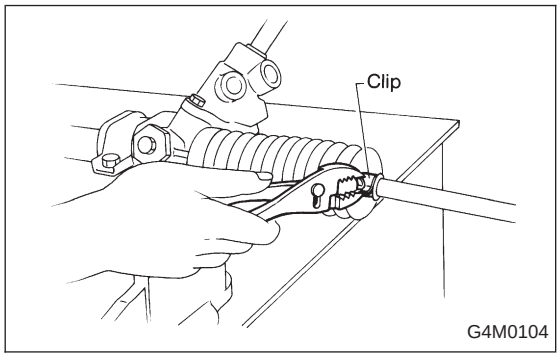
1) Disconnect four pipes from gearbox.
2) Secure gearbox removed from vehicle in vice using ST.

ST 926200000 STAND

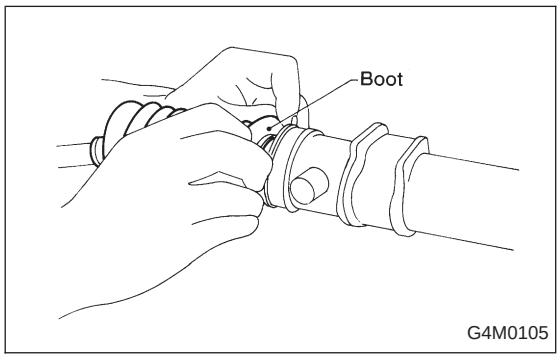
CAUTION:
Secure the gearbox in a vice using the ST as shown. Do not attempt to secure it without this ST.

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

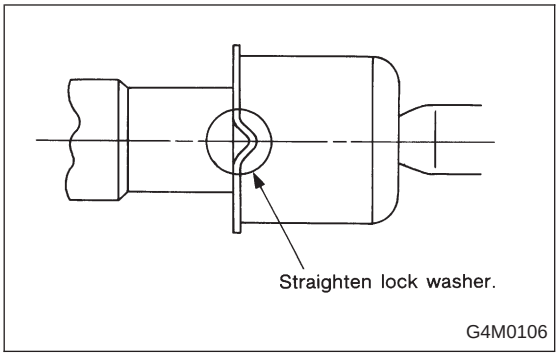




4) Remove small clip from boot using pliers, and move boot to tie-rod end side.

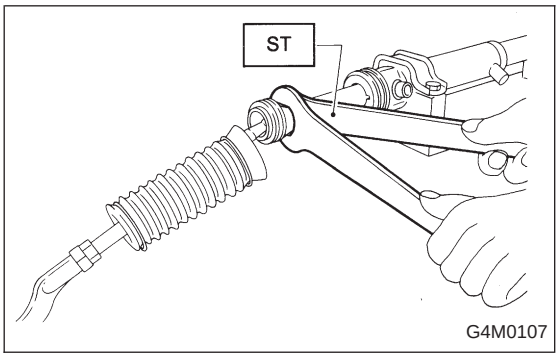


5) Remove boot together with large clips.



6) Straighten lock washer under ball joint.

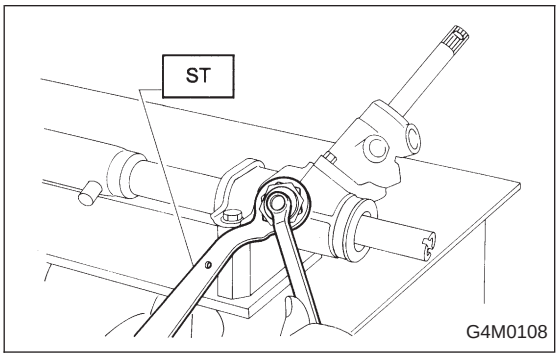
CAUTION:
● Be extremely careful not to hit surface of right hand rack; otherwise, oil leakage may result.
● Tie-rod lock washer must be replaced with a new one whenever it is removed.



7) Loosen ball joint using ST and spanner and remove tie-rod from rack.

NOTE:
When loosening ball joint, securely fix the rack using ST.

ST 925700000 WRENCH



8) Loosen lock nut using ST, and remove adjusting screw.

ST 926230000 SPANNER

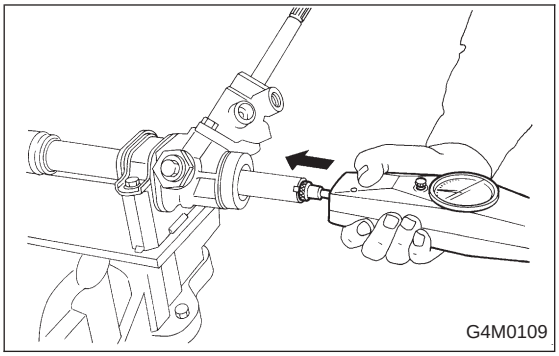
9) Remove spring and sleeve.
10) Remove dust seal.

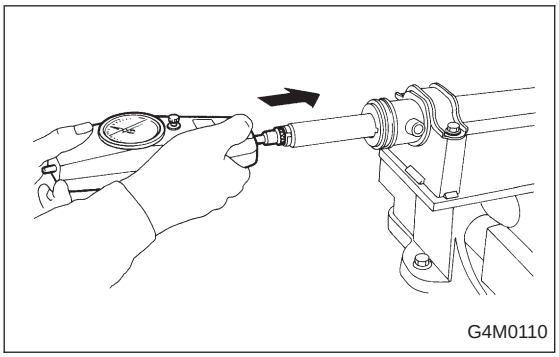
CAUTION:
Be careful not to damage housing and input shaft, or to allow foreign matters to get inside when removing dust seal.

C: INSPECTION

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

No.	Parts	Inspection	Corrective action
1	Input shaft	(1) Bend of input shaft (2) Damage on serration	If bend or damage is excessive, replace entire gearbox.
2	Dust seal	(1) Crack or damage (2) Wear	If outer wall slips, lip is worn out or damage is found, replace it with new one.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust backlash properly. By measuring turning torque of gearbox and sliding resistance of rack, check if rack and pinion engage uniformly and smoothly with each other. (Refer to “Service limit”.) (2) Keeping rack pulled out all the way so that all teeth emerge, check teeth for damage. Even if abnormality is found in either (1) or (2), replace entire gearbox.
4	Gearbox unit	(1) Bend of rack shaft (2) Bend of cylinder portion (3) Crack or damage on cast iron portion	Replace gearbox with new one.
		(4) Wear or damage on rack bush	If free play of rack shaft in radial direction is out of the specified range, replace gearbox with new one. (Refer to “Service limit”.)
		(5) Wear on input shaft bearing	If free plays of input shaft in radial and axial directions are out of the specified ranges, replace gearbox with new one. (Refer to “Service limit”.)
5	Boot	Crack, damage or deterioration	Replace.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration on dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipes	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.


G4M0109


G4M0110

1. SERVICE LIMIT

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

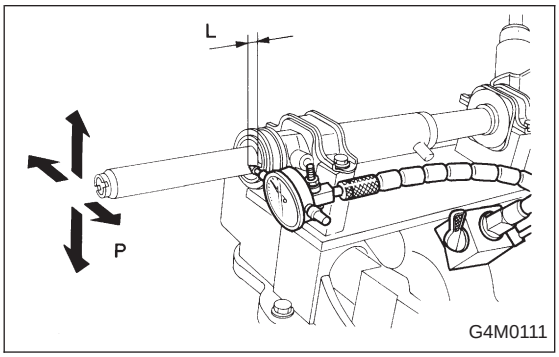
NOTE:
When making a measurement, vise gearbox by using ST. Never vise gearbox by inserting aluminum plates, etc. between vise and gearbox.

ST 926200000 STAND

Sliding resistance of rack shaft:

Service limit

240.3 N (24.5 kg, 54.0 lb) or less



G4M0111

2. RACK SHAFT PLAY IN RADIAL DIRECTION

Right-turn steering:

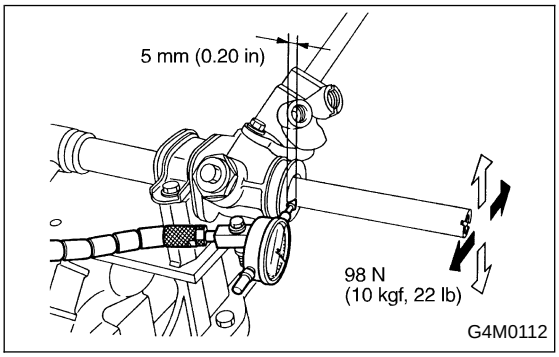
Service limit

0.15 mm (0.0059 in) or less

On condition

L: 5 mm (0.20 in)

P: 98 N (10 kg, 22 lb)



G4M0112

Left-turn steering:

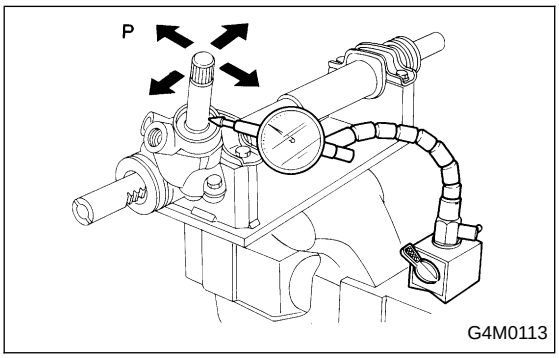
Service limit

Direction ⇦ ⇨

0.3 mm (0.012 in) or less

Direction ⬅ ➡

0.15 mm (0.0059 in) or less



G4M0113

3. INPUT SHAFT PLAY

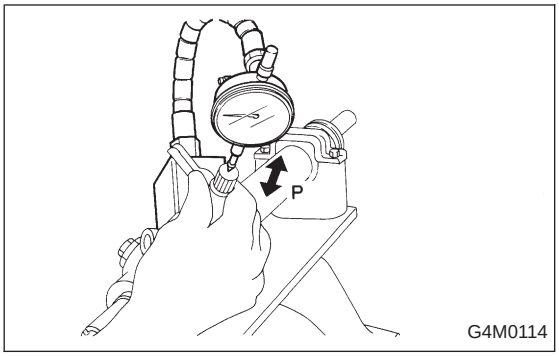
In radial direction:

Service limit

0.18 mm (0.0071 in) or less

On condition

P: 98 N (10 kg, 22 lb)



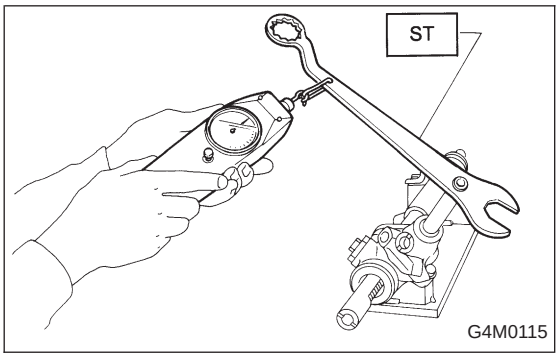
In axial direction:

Service limit

0.1 mm (0.004 in) or less

On condition

P: 20 — 49N (2 — 5 kg, 4 — 11 lb)



4. TURNING RESISTANCE OF GEARBOX

Using ST, measure gearbox turning resistance.

ST 926230000 SPANNER

Service limit:

Straight-ahead position within 30 mm (1.18 in) from rack center

Less than 11.18 N (1.14 kg, 2.51 lb)

Maximum allowable resistance

12.7 N (1.3 kg, 2.9 lb)

D: ASSEMBLY

CAUTION:
Use only SUBARU genuine grease for gearbox.

Grease:

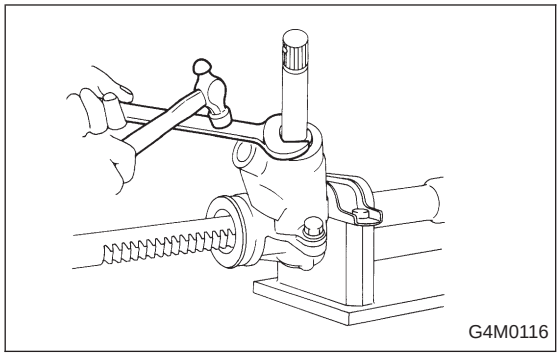
VALIANT GREASE M2
[Part No. 003608001, net 0.5 kg (1.1 lb)]

1) Apply grease to teeth of rack so that grease applied is about as high as teeth, and also apply a thin film of grease to sliding portion of rack shaft.

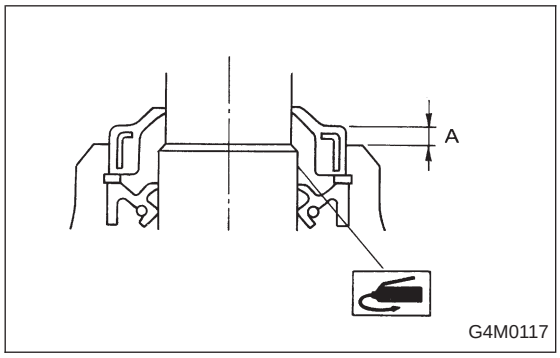
CAUTION:
● When moving rack to stroke end without tie-rod attached, prevent shocks from being applied at the end.
● Do not apply grease to threaded portion at end of rack shaft.
● Move rack shaft to stroke end two (2) or three (3) times to squeeze grease which accumulates on both ends. Remove grease to prevent it from choking air passage hole.

2) Apply grease to sleeve insertion hole.
3) Apply grease to dust seal insertion hole.

CAUTION:
Apply clean grease with clean hands. If material having a sharp edge is used for applying grease, oil seal at the inside might be damaged.

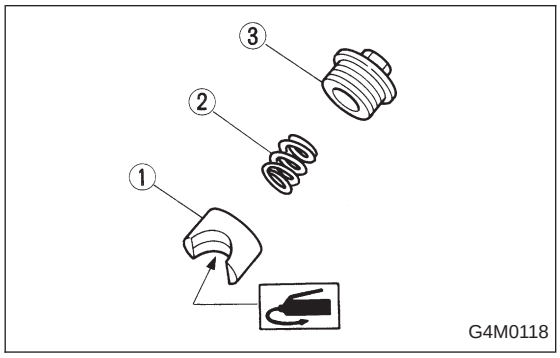

G4M0116

4) Press-fit dust seal into gearbox housing while tapping it via a spanner or the like so that stepping between gearbox and dust seal is normally 2 mm (0.08 in).



G4M0117

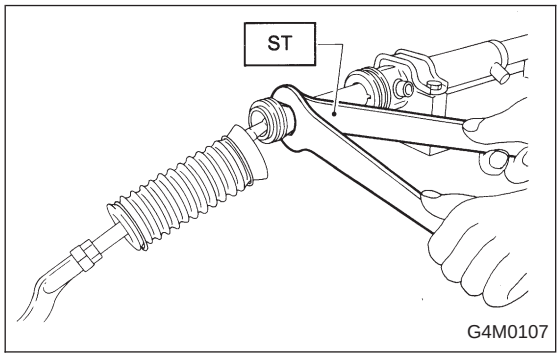
Depth: A
2 mm (0.08 in)



G4M0118

5) Apply grease to sliding surface of sleeve and spring seat, then insert sleeve into pinion housing. Fit spring into sleeve screw, pack grease inside of screw, then install the screw.

① Sleeve
② Spring
③ Adjusting screw



G4M0107

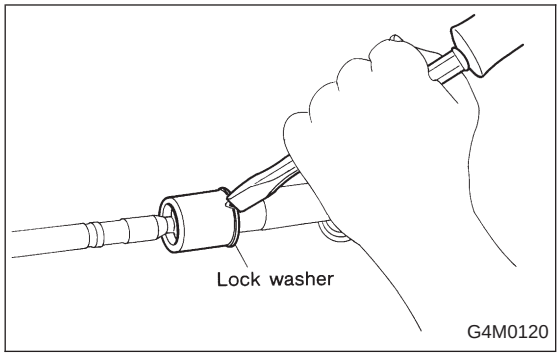
6) Fit new lock washer on screwed portion of rack end. Aligning cut portion of rack and nail of washer, screw in and tighten ball joint by using ST and spanner.

ST 925700000 WRENCH

Tightening torque (Ball joint):
78±10 N·m (8.0±1.0 kg-m, 58±7 ft-lb)

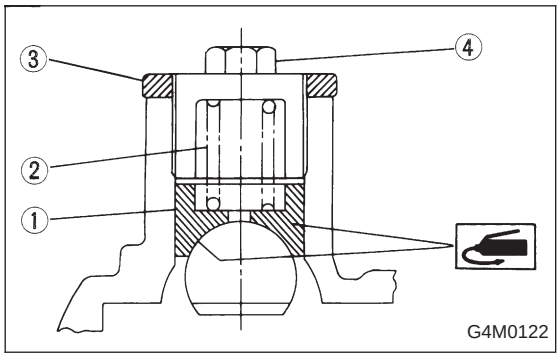
CAUTION:
Pay attention to prevent rack surface on the right side from being damaged by a tool or the like, otherwise oil leakage might be caused.

NOTE:
While tightening ball joint, hold rack with ST to prevent it from revolving.



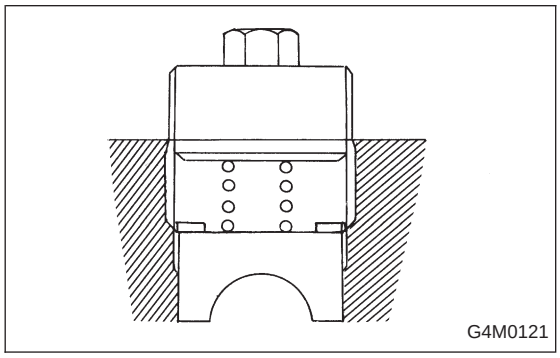
7) Bend lock washer using a chisel.

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

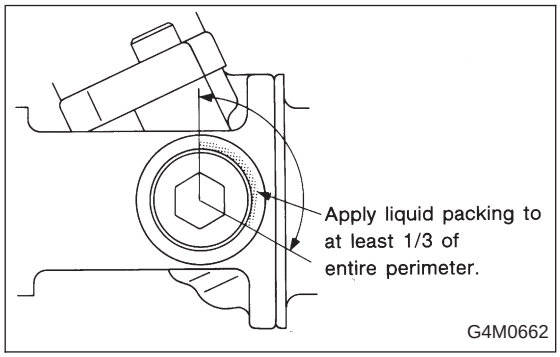


8) Rack and pinion backlash adjustment
(1) Loosen adjusting screw.
(2) Rotate input shaft so that rack is in the straight ahead direction.
(3) Apply grease to sleeve.

① Sleeve
② Spring
③ Lock nut
④ Adjusting screw



(4) Tighten adjusting screw by two threads.



(5) Apply liquid packing to at least 1/3 of entire perimeter of adjusting screw thread.

Liquid packing:
THREE BOND 1141

(6) Tighten adjusting screw to 15 N·m (1.5 kg-m, 11 ft-lb) and back off 20°.
(7) Install lock nut. While holding adjusting screw with a wrench, tighten lock nut using ST.

ST 926230000 SPANNER

Tightening torque (Lock nut):
39±10 N·m (4.0±1.0 kg-m, 29±7 ft-lb)

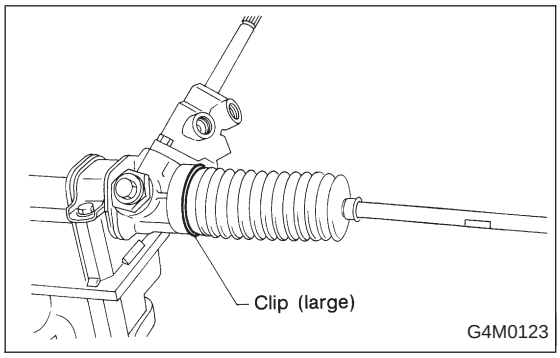
NOTE:
● Hold adjusting screw with a wrench to prevent it from turning while tightening lock nut.

● Make adjustment so that steering wheel can be rotated fully from lock to lock without binding.

9) Check for service limit as per article of “Service limit”. <Ref. to 4-3 [W3C1].> Make replacement and adjustment if necessary.

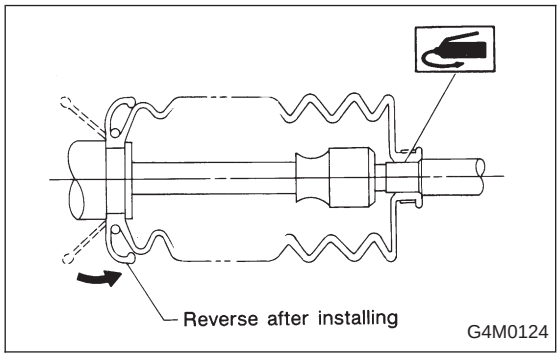
10) Install boot and mounting rubber to housing.

NOTE:
Apply grease through small hole in boot.

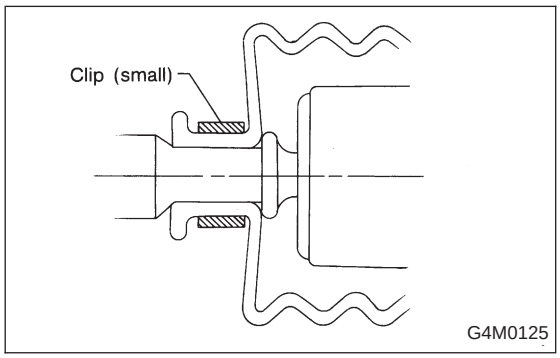


11) Fit clip (large) to boot, and then install boot to gearbox while holding boot flange.
After installing boot, fold back boot flange to the extent that large clip can not be seen.

NOTE:
● Before installing boot, be sure to apply grease to the groove of tie-rod.
● Install fitting portions of boots to the following portions in both sides of assembled steering gearbox.
1. The groove on gearbox
2. The groove on the rod
● Make sure that boot is installed without unusual inflation or deflation.



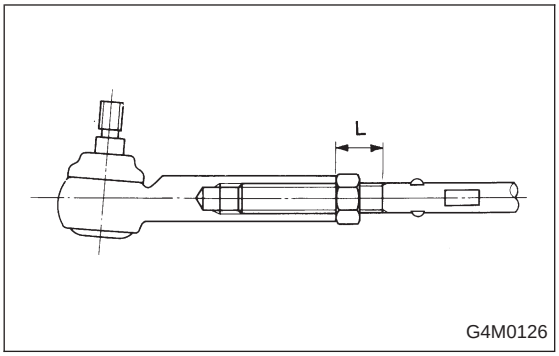
12) Turn boot until it seats well on gearbox and rubber mounting, then bend boot flange back.



13) Fix boot end with clip (small).

CAUTION:
Use screwdriver with blunted tip to prevent boot from damage, when installing.

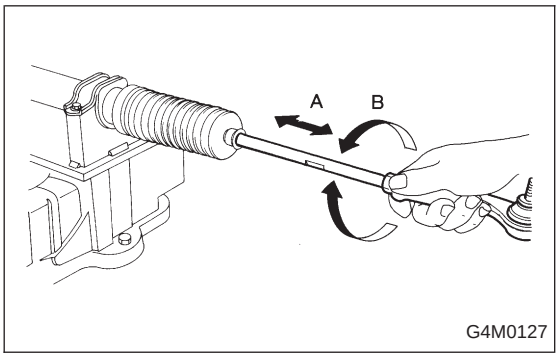
NOTE:
After installing, check boot end is positioned into groove on tie-rod.



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

Installed tie-rod length: L
15 mm (0.59 in)

NOTE:
Pay attention to difference between right and left tie-rod ends.



15) Inspect gearbox as follows:

A. Holding tie-rod end, repeat lock to lock two (2) or three (3) times as quickly as possible.

B. Holding tie-rod end, turn it slowly at a radius one (1) or two (2) times as large as possible.

After all, make sure that boot is installed in the specified position without deflation.

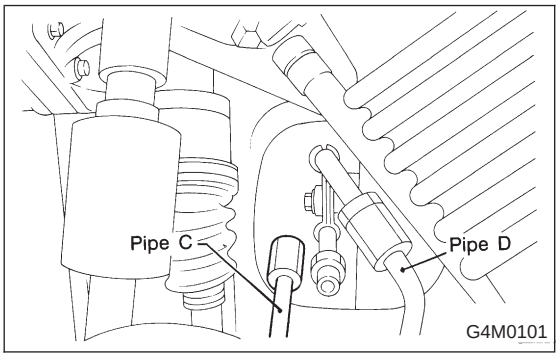
16) Remove gearbox from ST.

ST 926200000 STAND

17) Install four pipes on gearbox.

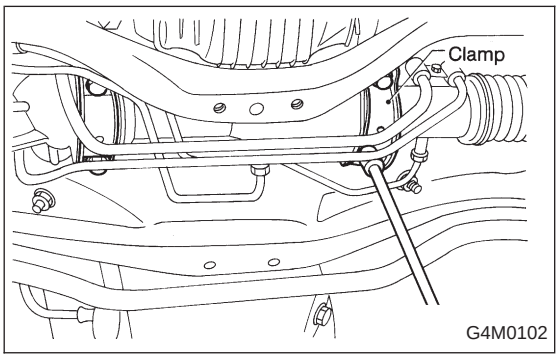
(1) Connect pipes A and B to four pipe joints of gearbox. Connect upper pipe B first, and lower pipe A.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)



(2) Connect pipes C and D to gearbox.
Connect lower pipe C first, and upper pipe D second.

Tightening torque:
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)



E: INSTALLATION

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

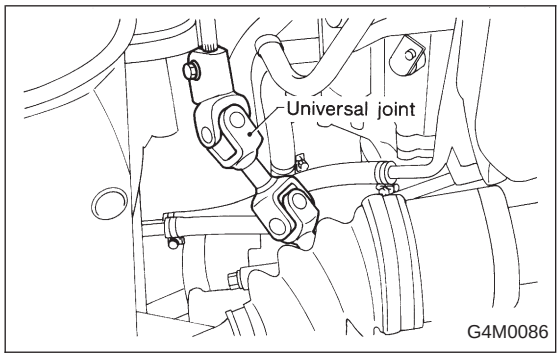
Tightening torque:
59±12 N·m (6.0±1.2 kg-m, 43±9 ft-lb)

3) How to install the joint.

(1) Push the long yoke of the joint, all the way into the serrated portion of the steering shaft, setting the bolt hole in the cutout.

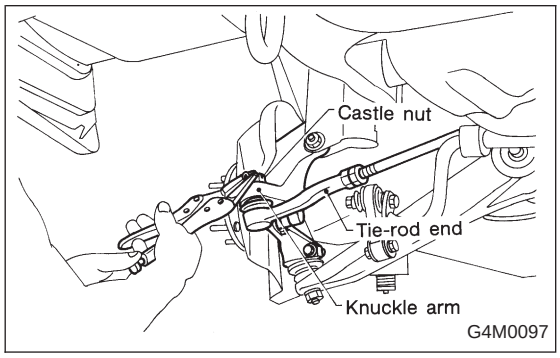
(2) Then pull the short yoke all way out of the serrated portion of the gear box, setting the bolt hole in the cutout.

(3) Insert the bolt through the short yoke, pull the joint and confirm that the bolt is on cutout of the gearbox.



(4) Fasten the short yoke side with a spring washer and bolt, then fasten the long yoke side.

Tightening torque:
24±3 N·m (2.4±0.3 kg-m, 17.4±2.2 ft-lb)



4) Connect tie-rod end and knuckle arm, and tighten with castle nut. Fit cotter pin into the nut and bend the pin to lock.

Castle nut tightening torque:
Tighten to 27.0±2.5 N·m (2.75±0.25 kg-m, 19.9±1.8 ft-lb), and tighten further within 60° until cotter pin hole is aligned with a slot in the nut.

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

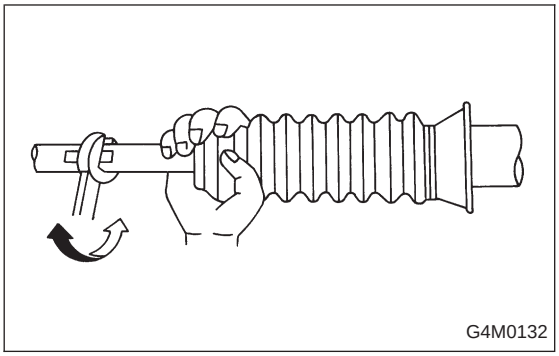
5) Install front stabilizer to vehicle.
6) Install front exhaust pipe assembly.
<Ref. to 2-9 [W1B0].>
7) Install tires.
8) Tighten wheel nuts to the specified torque.

Tightening torque:
88±10 N·m (9.0±1.0 kg-m, 65±7 ft-lb)

9) Connect ground cable to battery.
10) Pour fluid into oil tank, and bleed air. <Ref. to 4-3 [W7A0].>
11) Check for fluid leaks.
12) Install jack-up plate.

WARNING:
Be careful, exhaust manifold is hot.

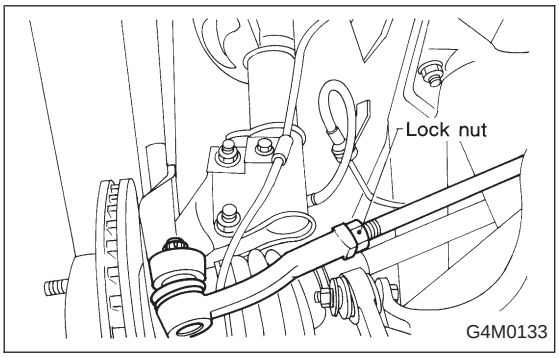
13) Lower vehicle.
14) Check fluid level in oil tank.


G4M0132

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

Tightening torque:
83±5 N·m (8.5±0.5 kg-m, 61.5±3.6 ft-lb)

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



G4M0133

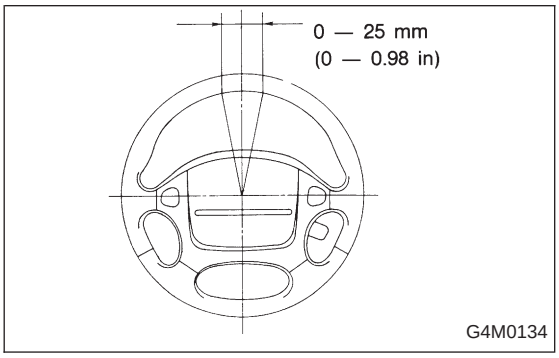
F: ADJUSTMENT

1) Adjust front toe.

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

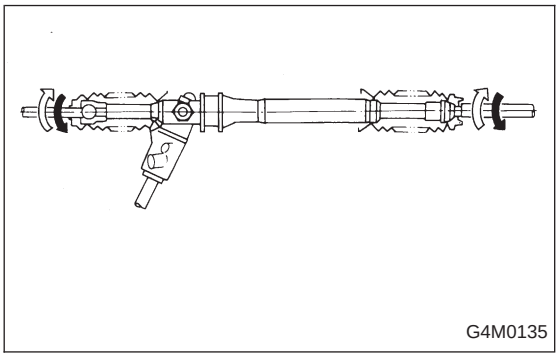
2) Adjust steering angle of wheels.

Inner wheel: 37.4°±1.5°
Outer wheel: 32.5°±1.5°



G4M0134

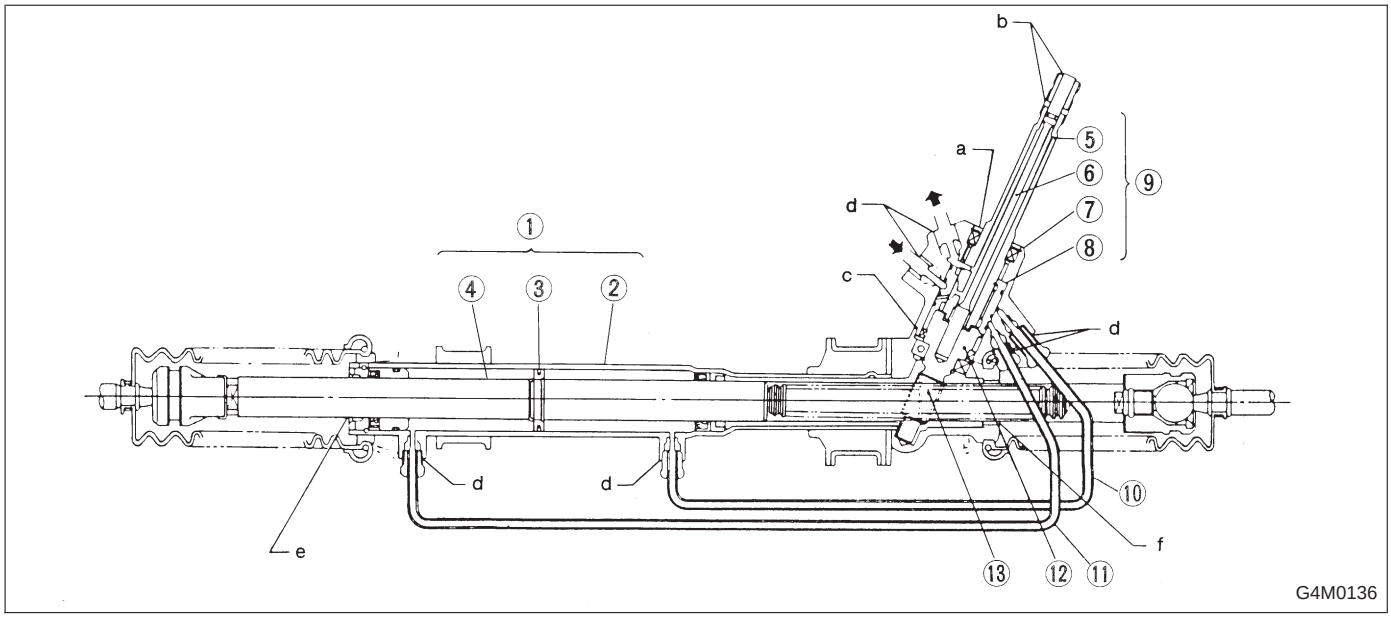
3) If steering wheel spokes are not horizontal when wheels are set in the straight ahead position, and error is more than 5° on the periphery of steering wheel, correctly re-install the steering wheel.


G4M0135

4) If 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 same direction by the same turns.

4. Control Valve (Power Steering Gearbox)

A: CHECKING OIL LEAKING POINTS



① Power cylinder
② Cylinder
③ Rack piston
④ Rack axle
⑤ Input shaft
⑥ Torsion bar
⑦ Valve housing
⑧ Valve body
⑨ Control valve
⑩ Pipe B
⑪ Pipe A
⑫ Pinion
⑬ Pinion axle

1. OIL LEAKING POINTS

1) If leak point is other than a, b, c, or d, perform check step 5 in “OIL LEAK CHECK PROCEDURE AND REPLACEMENT PARTS” before dismounting gearbox from vehicle. <Ref. to 4-3 [W4A2].> If gearbox is dismounted without confirming where the leak is, it must be mounted again to locate the leak point.
2) Even if the location of the leak can be easily found by observing the leaking condition, it is necessary to thoroughly remove the oil from the suspected portion and turn the steering wheel from lock to lock about 30 to 40 times with engine running, then make comparison of the suspected portion between immediately after and several hours after this operation.
3) Before starting oil leak repair work, be sure to clean the gearbox, hoses, pipes, and surrounding parts. After completing repair work, clean these areas again.

2. OIL LEAK CHECK PROCEDURE AND REPLACEMENT PARTS

NOTE:
Parts requiring replacement are described in the smallest unit of spare parts including damaged parts and spare parts damaged. In actual disassembly work, accidental damage as well as inevitable damage to some related parts must be taken into account, and spare parts for them must also be prepared. However, it is essential to pinpoint the cause of trouble, and limit the number of replacement parts as much as possible.

1) Leakage from “a”
The oil seal is damaged. Replace valve assembly with a new one.
2) Leakage from “b”
The torsion bar O-ring is damaged. Replace valve assembly with a new one.

3) Leakage from “c”
The oil seal is damaged. Replace valve assembly with a new one.
4) Leakage from “d”
The pipe is damaged. Replace the faulty pipe or O-ring.
5) If leak is other than a, b, c, or d, and if oil is leaking from the gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove oil from the surrounding portions. Then, turn the steering wheel from lock to lock 30 to 40 times with the engine running, then make comparison of the leaked portion immediately after and several hours after this operation.

(1) Leakage from “e”
The cylinder seal is damaged. Replace rack bush with a new one.
(2) Leakage from “f”
There are two possible causes. Take following step first. Remove the pipe assembly B from the valve housing, and close the circuit with ST.

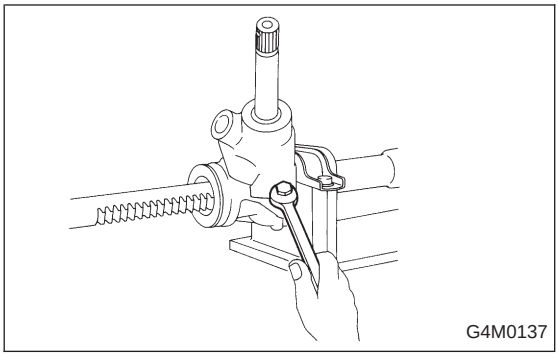
ST 926420000 PLUG

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

CAUTION:
- **If leakage from “f” is noted again:**

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

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

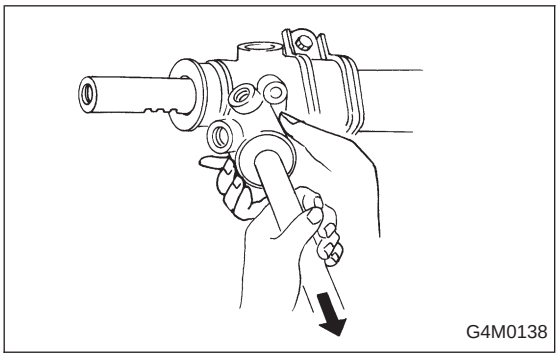

G4M0137

B: DISASSEMBLY

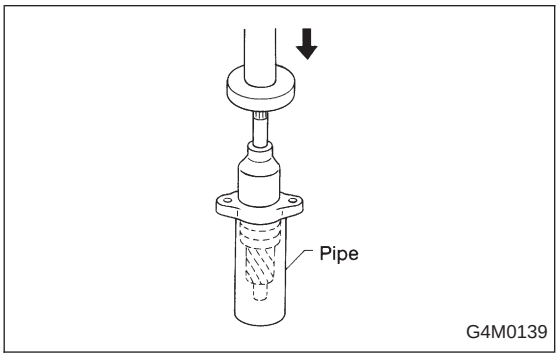
NOTE:
This section focuses on the disassembly and reassembly of control valve. For the inspection and adjustment and the service procedures for associated parts, refer to “Steering Gearbox” <Ref. to 4-3 [W3A0].>

1. VALVE ASSEMBLY

1) Loosen two bolts securing valve assembly.


G4M0138

2) Carefully draw out input shaft and remove valve assembly.

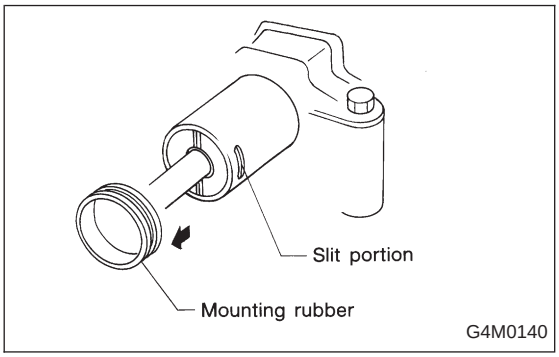


G4M0139

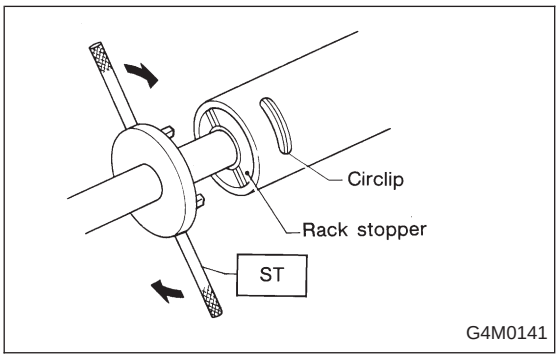
3) Draw out pinion and valve assembly from valve housing, as necessary, using pipe of I.D. 44 to 46 mm (1.73 to 1.81 in) and a press.

2. RACK ASSEMBLY

1) Slide mounting rubber to expose slit.



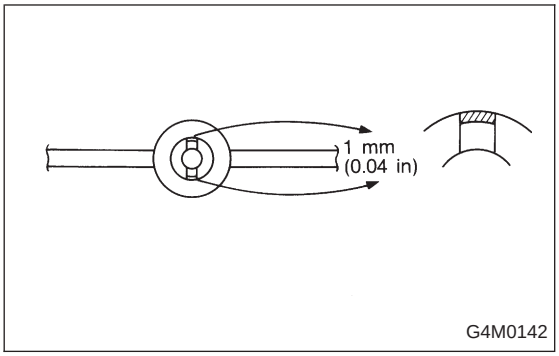
G4M0140



G4M0141

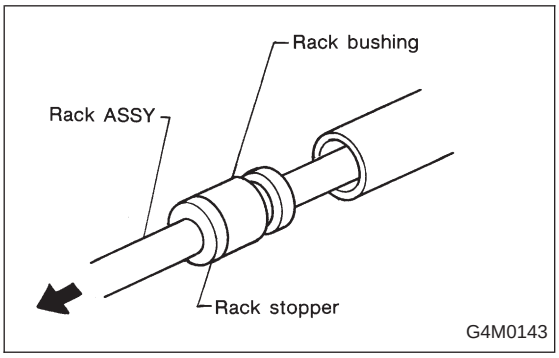
2) Rotate rack stopper in the direction of arrow using ST until the end of circlip comes out of stopper, then rotate it in the opposite direction, and pull out circlip.

ST 926340001 WRENCH



NOTE:
If ST is used, grind area (shown in figure) by 1 mm (0.04 in) in advance.

ST 926340000 WRENCH



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

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

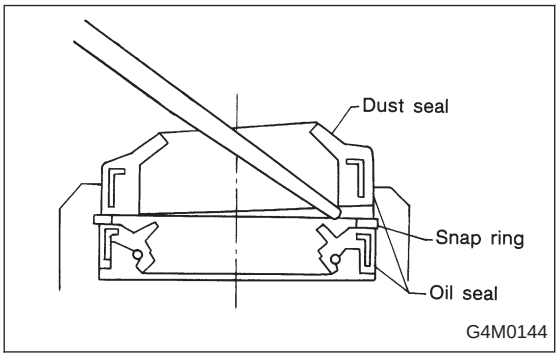
4) Remove rack bushing and rack stopper from rack assembly.

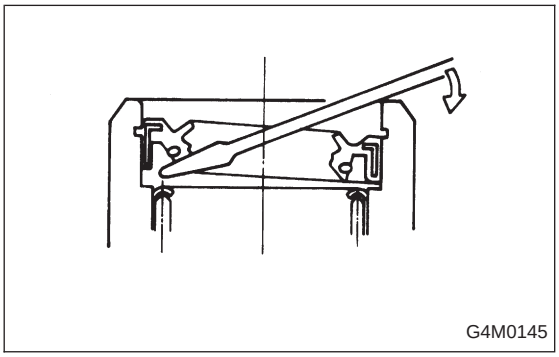
CAUTION:
Do not reuse removed rack bushing and circlip.

C: REPLACEMENT OF SEAL AND PACKING

1. VALVE HOUSING OIL SEAL

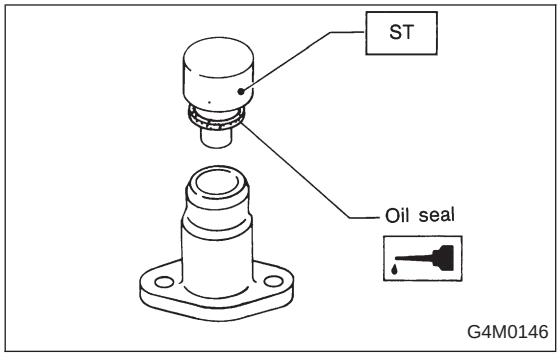
1) Pry off dust seal using screwdriver.
2) Remove snap ring using snap ring pliers.





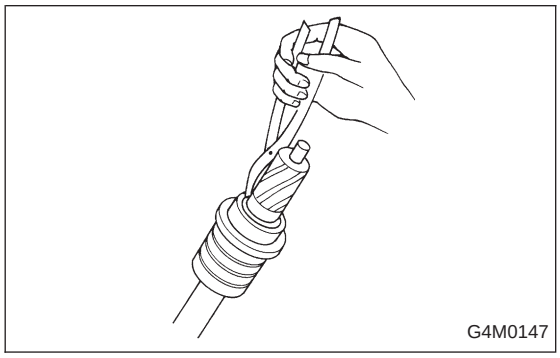
3) Pry off oil seal using screwdriver.

CAUTION:
After removing, check inside surface of valve housing for damage. If oil seal contacting surface is damaged, replace valve housing with a new one.



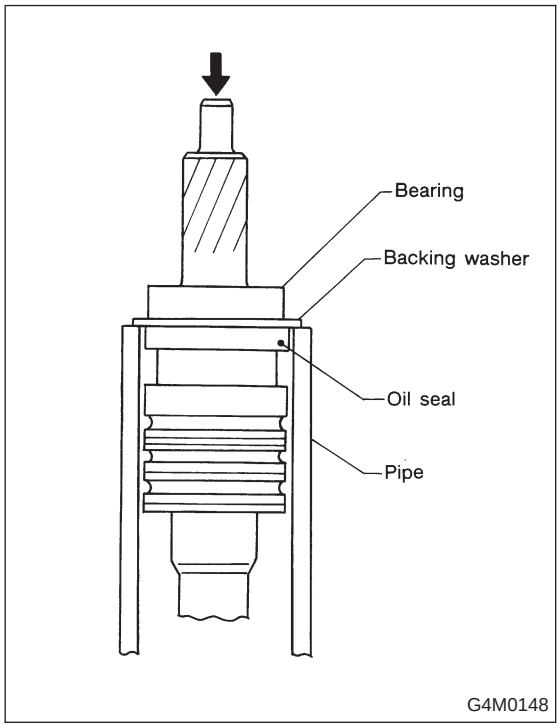
4) Press-fit oil seal into valve housing using ST and press.
ST 927610000 INSTALLER
NOTE:
Before fitting, coat oil seal fully with specified power steering fluid.

5) Fit snap ring in snap ring groove using snap ring pliers.
CAUTION:
Be careful not to scratch oil seal with snap ring pliers.
NOTE:
Rotate snap ring to check for proper installation.



2. PINION AND VALVE ASSEMBLY

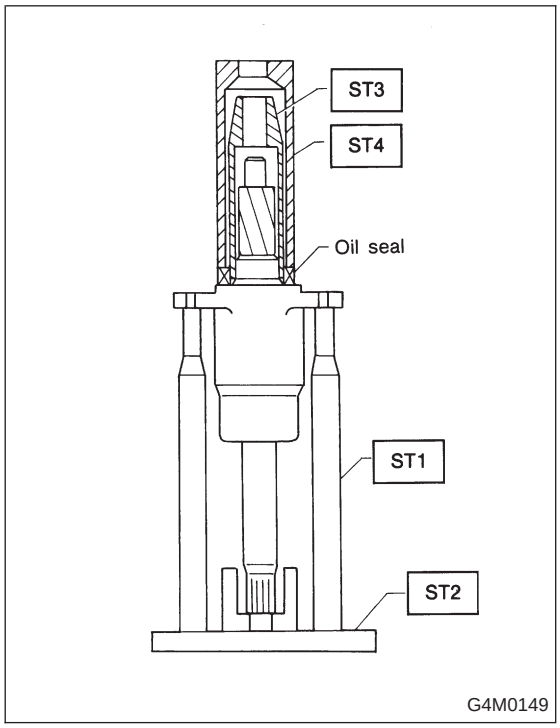
1) Remove snap ring using snap ring pliers.
CAUTION:
- **Do not reuse removed snap ring.**
- **Be careful not to scratch pinion and valve assembly.**



2) Press out bearing together with backing washer using pipe of I.D. 38.5 to 39.5 mm (1.516 to 1.555 in) and press.
CAUTION:
Do not reuse removed bearing.
3) Remove oil seal.
CAUTION:
Do not reuse removed oil seal.

4) Fit pinion and valve assembly into valve housing.

NOTE:
Apply specified power steering fluid to outer diameter surface of input shaft and outer surface of valve body seal ring, and pay special attention not to damage seal when inserting pinion and valve assembly.



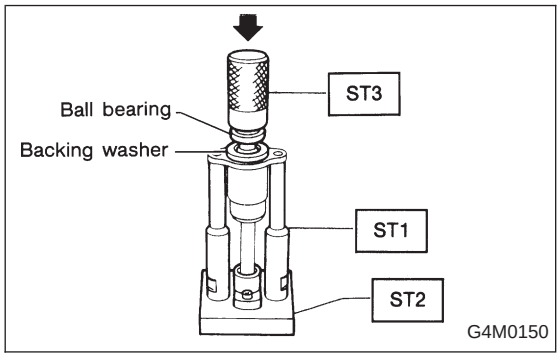
5) Secure valve assembly to ST1 and ST2.

6) Put ST3 over pinion, and insert oil seal, then force-fit oil seal into housing using ST4.

NOTE:
- Apply specified power steering fluid to oil seal and ST3, being careful not to damage oil seal lip.
- Push oil seal until ST3 contacts housing end face.

7) Remove ST3, and fit backing washer.

ST1	926370000	INSTALLER A
ST2	927630000	STAND BASE
ST3	926360000	INSTALLER A
ST4	927620000	INSTALLER B



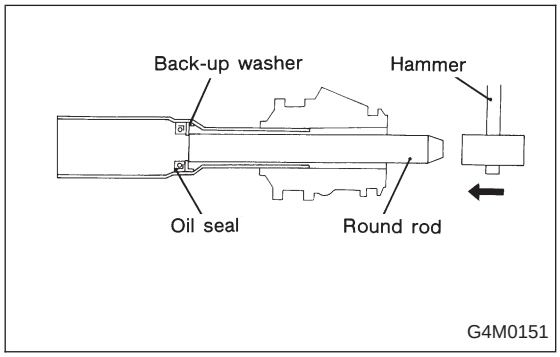
8) Force-fit ball bearing using ST3.

ST1	926370000	INSTALLER A
ST2	927630000	STAND BASE
ST3	927640000	INSTALLER B

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

9) Install snap ring using snap ring pliers.

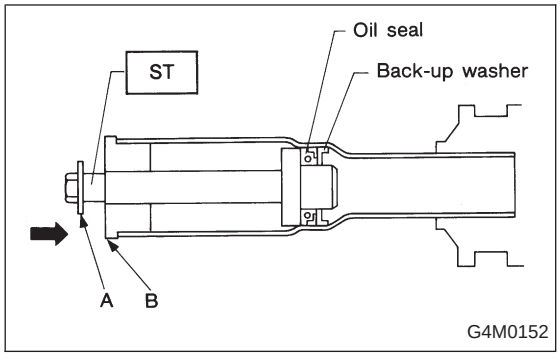
NOTE:
Rotate snap ring to check for proper installation.



3. RACK HOUSING OIL SEAL AND BACK-UP WASHER

1) Insert a round rod [26 — 27 mm (1.02 — 1.06 in) dia.] from pinion housing side and remove oil seal and back-up washer by hammering the rod.

NOTE:
- Discard removed oil seal and back-up washer.
- Apply the unchamfered end of remover to back-up washer.

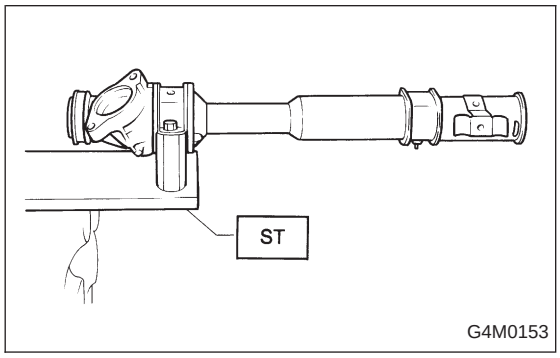


2) Force-fit oil seal and back-up washer using ST.

ST 927650000 INSTALLER

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

NOTE:
- Apply specified power steering fluid to oil seal.
- Pay special attention not to install back-up washer and oil seal in wrong direction.
- Push oil seal until the stepped portion of A contacts end face of B.



D: ASSEMBLY

1. RACK ASSEMBLY

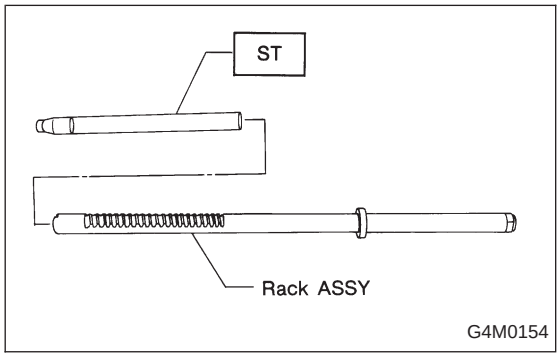
CAUTION:
Use only SUBARU genuine grease for gearbox.

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

1) Fixing rack housing
Fix rack housing in vice using ST.

ST 926200000 STAND

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



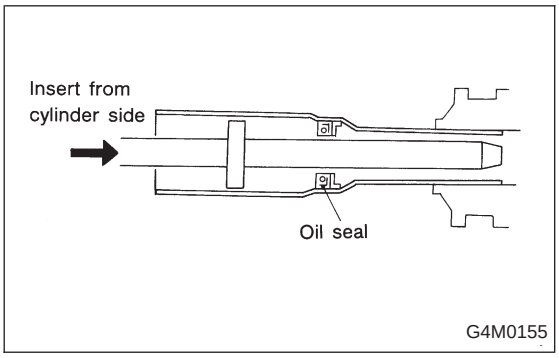
2) Fit ST over toothed portion of rack assembly, and check for binding or unsmooth insertion. If any deformation is noted on flats at the end of rack, shape by using file, and wash with cleaning fluid.

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

ST 926390001 COVER and REMOVER

CAUTION:
- **Be careful not to block air passage with grease. Remove excessive grease.**

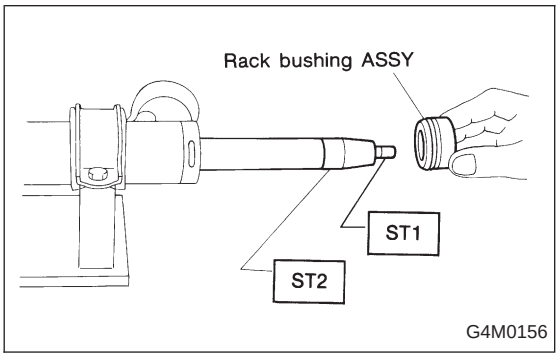
● After fitting cover, check air passage hole for clogging. If clogged, open by removing grease from the hole.
● Check rack shaft for damage.
● Apply specified power steering fluid to this ST and surface of piston ring to prevent seal from being damaged.



4) Insert rack assembly into rack housing from cylinder side, and remove ST after it has passed completely through oil seal.

NOTE:
Before inserting rack assembly, apply a coat of specified power steering fluid to surfaces of ST and rack piston.

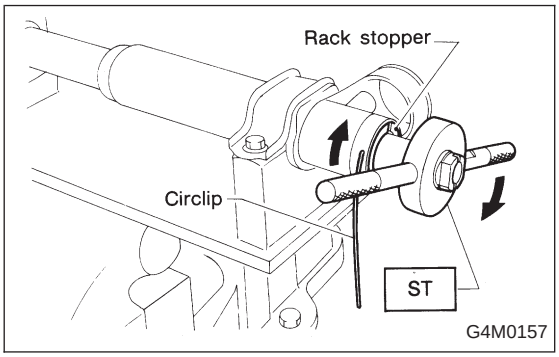
ST 926390001 COVER AND REMOVER



5) Fit ST1 and ST2 over the end of rack, and install rack bushing.

ST1 926400000 GUIDE
ST2 927660000 GUIDE

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



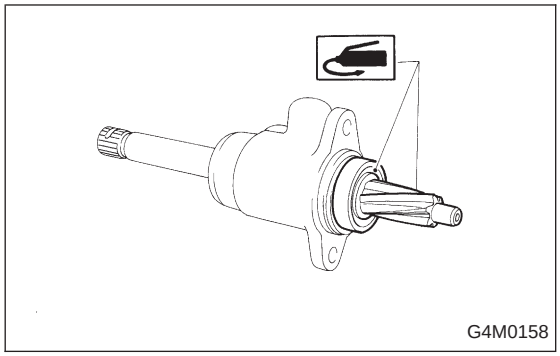
6) Insert rack stopper into cylinder tube until internal groove (on cylinder side) is aligned with external groove (on rack stopper). Turn rack stopper with ST so that rack stopper hole is seen through cylinder slits.
7) Insert rack stopper into rack housing, and wrap circlip using ST to secure rack stopper in position.

ST 926340001 WRENCH

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

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

8) Fit mounting rubber onto rack housing.

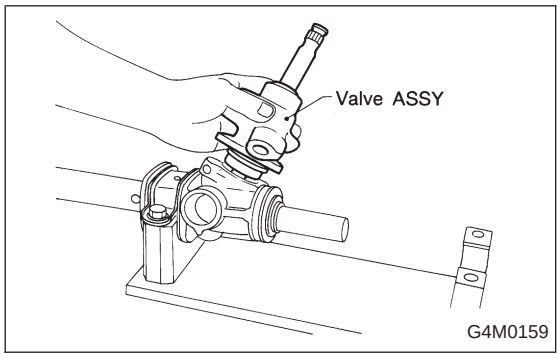

G4M0158

2. VALVE ASSEMBLY

CAUTION:
Use only SUBARU genuine grease for gearbox.

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

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



G4M0159

2) Install packing on valve assembly. Insert valve assembly into place while facing rack teeth toward pinion.

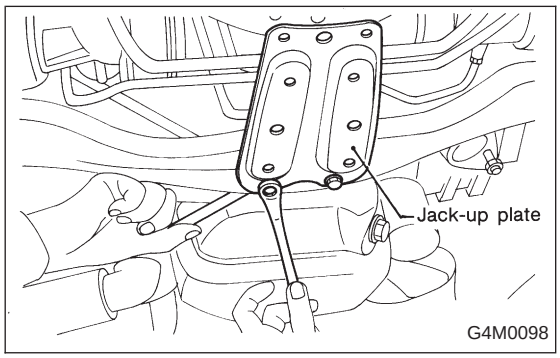
CAUTION:
Be sure to use a new packing.

NOTE:
Do not allow packing to be caught when installing valve assembly.

3) Tighten bolts alternately to secure valve assembly.

Tightening torque:
25±5 N·m (2.5±0.5 kg-m, 18.1±3.6 ft-lb)

CAUTION:
Be sure to alternately tighten bolts.

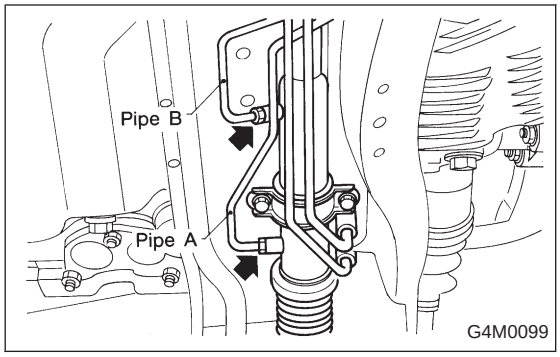


G4M0098

5. Pipe Assembly (Power Steering System)

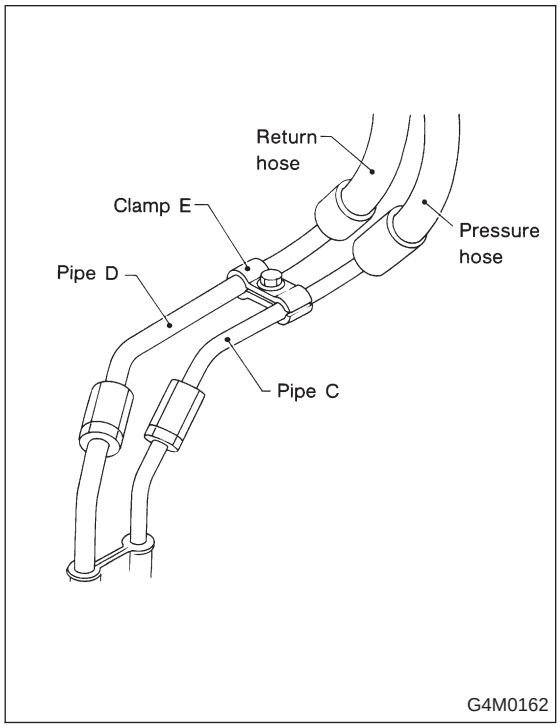
A: REMOVAL

1) Disconnect battery minus terminal.

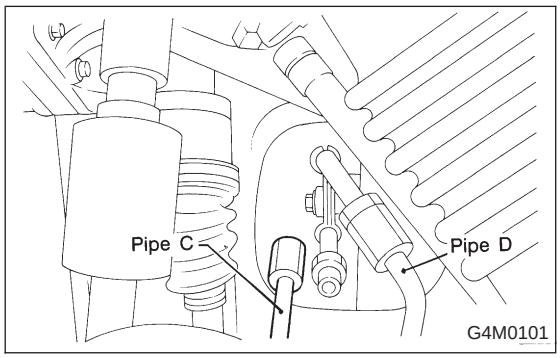


2) Lift vehicle and remove jack-up plate.
3) Remove one pipe joint at the center of gearbox, and connect vinyl hose to pipe and joint. Discharge fluid by turning steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.

CAUTION:
Improper removal and installation of parts often causes fluid leak trouble. To prevent this, clean the surrounding portions before disassembly and reassembly, and pay special attention to keep dirt and other foreign matter from mating surfaces.

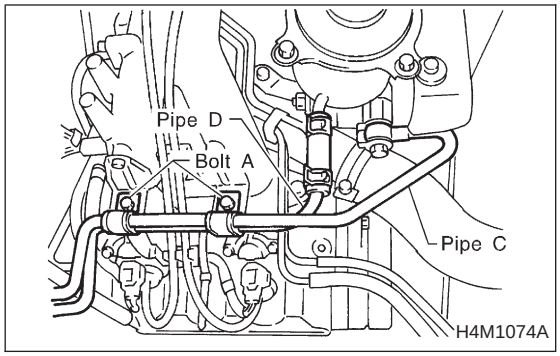


4) Remove clamp E from pipes C and D.



5) Disconnect pipe C from pipe (on the gearbox side).

CAUTION:
● When disconnecting pipe C, use two wrenches to prevent deformities.
● Be careful to keep pipe connections free from foreign matter.



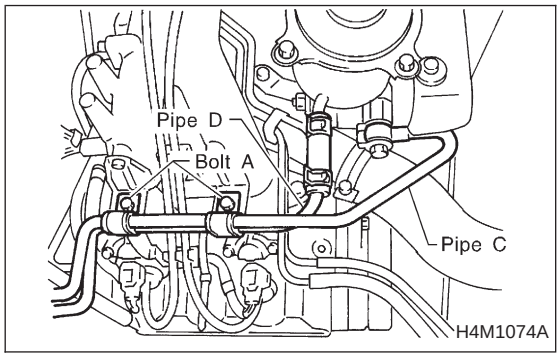
6) Remove bolt A.
Disconnect pipe C from oil pump. Disconnect pipe D from oil tank.

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

B: CHECK

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

Part name	Inspection	Remedy
Pipe	● O-ring fitting surface for damage ● Nut for damage ● Pipe for damage	Replace with new one.
Clamp B	● Clamps for weak clamping force	Replace with new one.
Clamp C		
Clamp E		
Hose	● Flared surface for damage ● Flare nut for damage ● Outer surface for cracks ● Outer surface for wear ● Clip for damage ● End coupling or adapter for degradation	Replace with new one.



C: ASSEMBLY

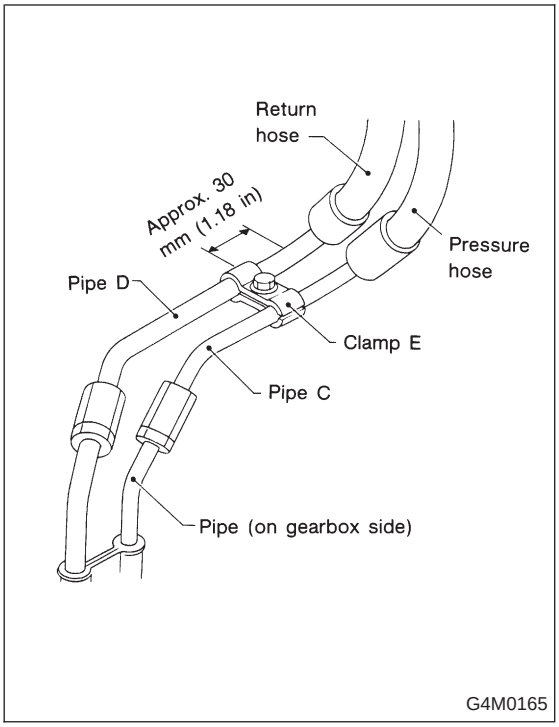
1) Interconnect pipes C and D.

Tightening torque:
Joint nut
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)

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

2) Tighten bolt A.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)



3) Temporarily connect pipes C and D to pipes (on the gearbox side).
4) Temporarily install clamp E on pipes C and D.

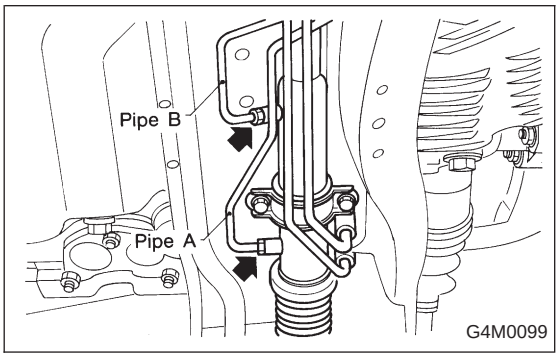
CAUTION:
Ensure that the "8" letter side of clamp E is on the pipe C side.

5) Tighten joint nut.

Tightening torque:
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)

6) Tighten clamp E firmly.

Tightening torque:
5.4±1.5 N·m (0.55±0.15 kg-m, 4.0±1.1 ft-lb)

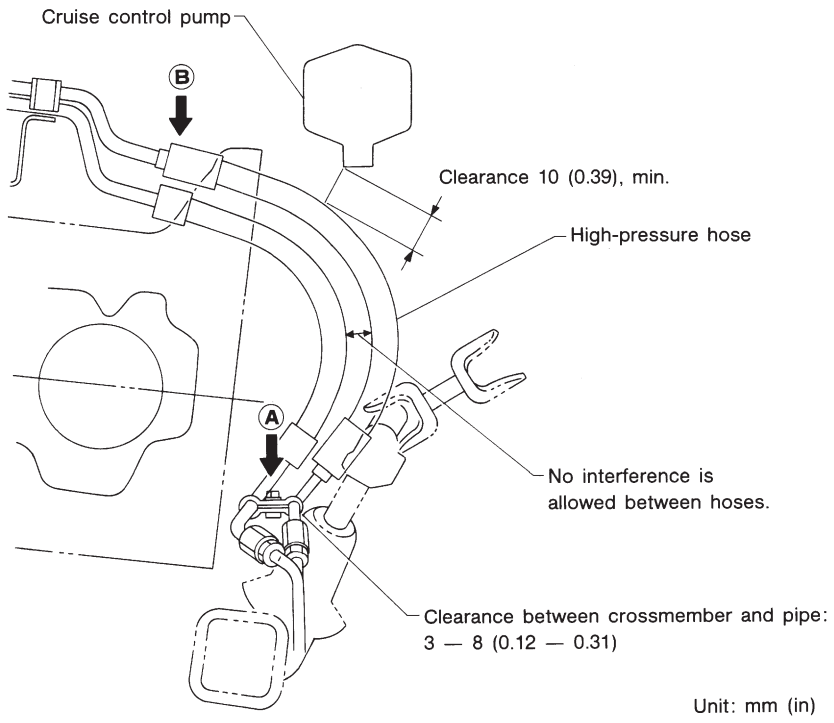


7) Connect pipes A and B to four pipe joints of gearbox. Connect upper pipe B first, and lower pipe A second.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

8) Install jack-up plate.
9) Connect battery minus terminal.
10) Feed the specified fluid and discharge air.

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



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

If clearance between cruise control pump and power steering hose is less than 10 mm (0.39 in), proceed as follows:

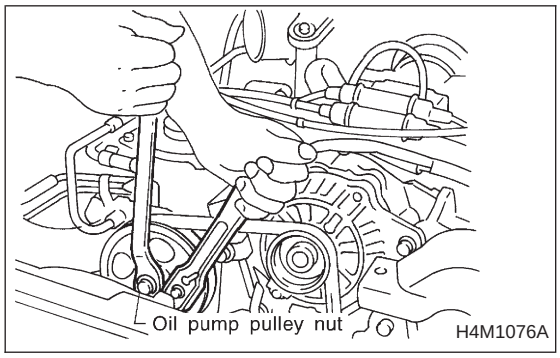
(1) Move clamped section Ⓐ (refer to figure above) down to a point where pipe is close to crossmember (pipe-to-crossmember clearance: 10 mm (0.39 in), min.).

(2) Check that clearance between cruise control pump and power steering hose is at least 10 mm (0.39 in). If it is not, bend section Ⓑ down until a clearance of at least 10 mm (0.39 in) is obtained.

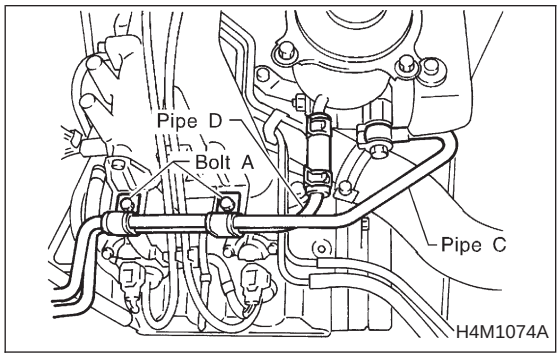
6. Oil Pump (Power Steering System)

A: REMOVAL

1) Remove ground cable from battery.
2) Drain the working fluid about 0.3 ℓ (0.3 US qt, 0.3 Imp qt) from oil tank.
3) Remove pulley belt cover bracket.

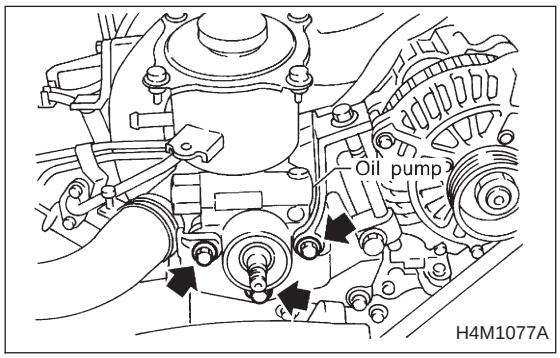


4) Loosen oil pump pulley nut, then remove bolts which secure alternator.
5) Loosen pulley belt(s).
6) Remove the nut and detach oil pump pulley.



7) Disconnect pipe C from oil pump. Disconnect pipe D from oil tank.

CAUTION:
● Do not allow fluid from the hose end to come into contact with pulley belt.
● To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.
● Except when only oil tank needs to be inspected, detach oil tank and oil pump as a unit. Then separate one from the other on a work bench to prevent oil from spilling on any part of the engine.



8) Remove three bolts from the front side of oil pump and detach the pump.
9) Remove three bolts from the lower side of bracket and detach the bracket.

CAUTION:
The bracket does not need to be removed unless it is damaged.

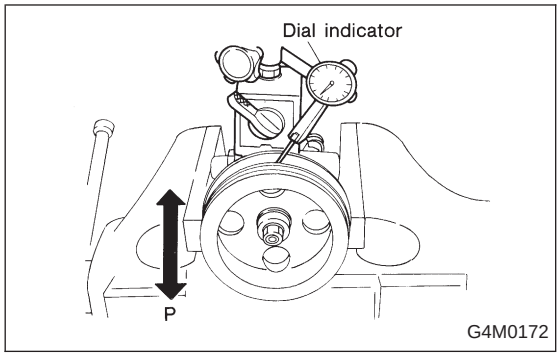
10) Place oil pump in a vise, remove two bolts from the upper side of oil tank and detach oil tank.

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

B: CHECK

● In accordance with the following table, check all removed parts for wear and damage, and make repair or replacement if necessary.

No.	Parts	Inspection	Corrective action
1	Oil pump (Exterior)	(1) Crack, damage or oil leakage	Replace oil pump with a new one.
		(2) Play of pulley shaft	Measure radial play and axial play. If any of these exceeds the service limit, replace oil pump with a new one. <Ref. to 4-3 [W6B1].>
2	Pulley	(1) Damage	Replace it with a new one.
		(2) Bend	Measure V ditch deflection. If it exceeds the service limit, replace pulley with a new one. <Ref. to 4-3 [W6B1].>
3	Cap	Crack or damage	Replace it with a new one.
4	Strainer	(1) Clogging with dirt	Wash it.
		(2) Breakage	Replace it with a new one.
5	Oil pump (Interior)	(1) Defect or burning of vane pump	Check resistance to rotation of pulley. If it is past the service limit, replace oil pump with a new one. <Ref. to 4-3 [W6B1].>
		(2) Bend in the shaft or damage to bearing	Oil pump emits a noise that is markedly different in tone and loudness from a sound of a new oil pump when turning with a string put around its pulley, replace oil pump with a new one.
6	O-ring	Crack or deterioration	Replace it with a new one.
7	Oil tank	Crack, damage or oil leakage	Replace it with a new one.
8	Bracket	Crack	Replace it with a new one.



1. SERVICE LIMIT

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

CAUTION:

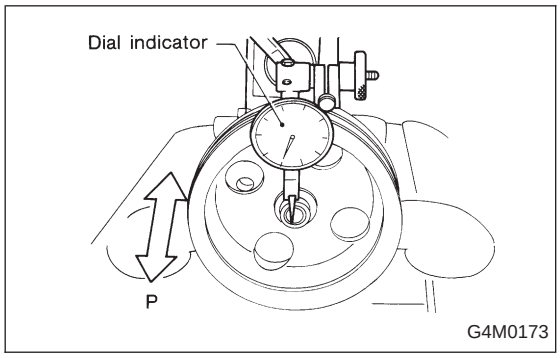
● Fix oil pump on a vise to make a measurement. At this time, hold oil pump with the least possible force between two wood pieces.

● Do not set outside of flow control valve or pulley on a vise; otherwise outside or pulley might be deformed. Select properly sized wood pieces.

Play of pulley shaft

Service limit:

Radial play (Direction ⟷)
0.4 mm (0.016 in) or less
Axial play (Direction ⟺)
0.9 mm (0.035 in) or less

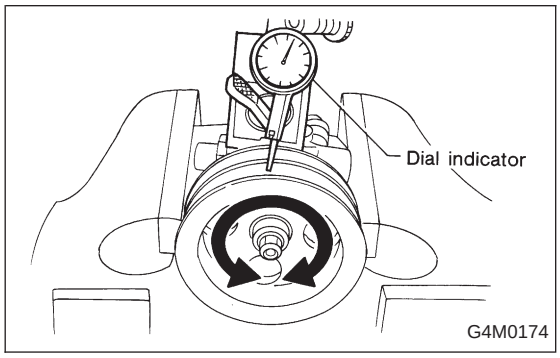


Ditch deflection of pulley

Service limit:

1.0 mm (0.039 in) or less

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

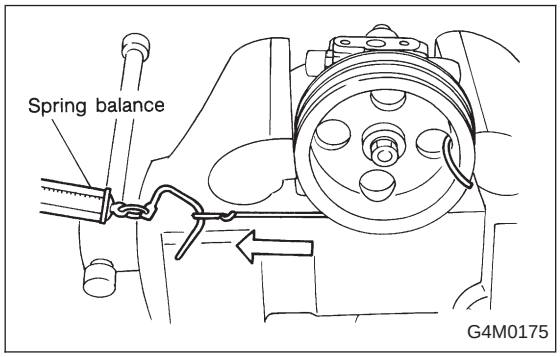


Resistance to rotation of pulley

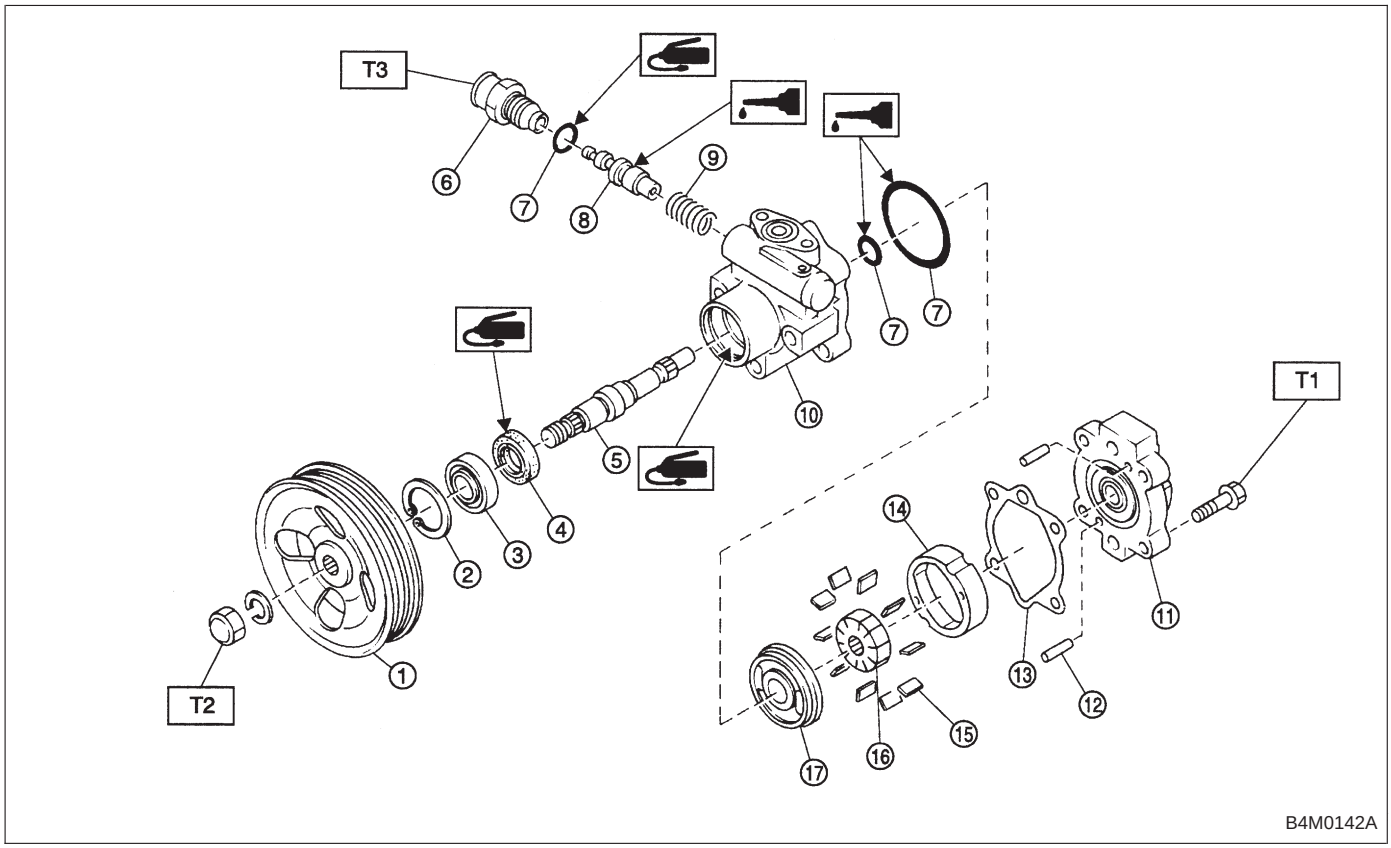
Service limit:

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

NOTE:
● A rather higher value may be indicated when pulley starts turning.
● Measure the load during rotation and make a judgment.

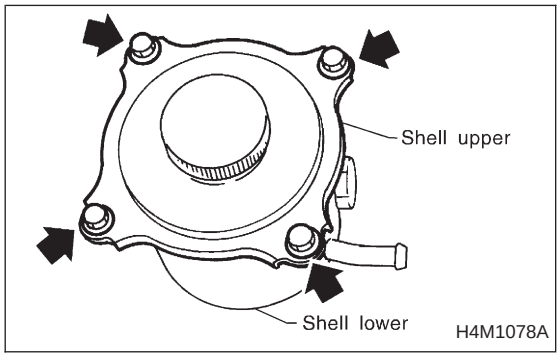


C: DISASSEMBLY



① Pulley
② Snap ring
③ Bearing
④ Oil seal
⑤ Shaft
⑥ Connector
⑦ O-ring
⑧ Spool valve
⑨ Spring
⑩ Front casing
⑪ Rear cover
⑫ Knock pin
⑬ Seal washer
⑭ Cam ring
⑮ Vane
⑯ Rotor
⑰ Side plate

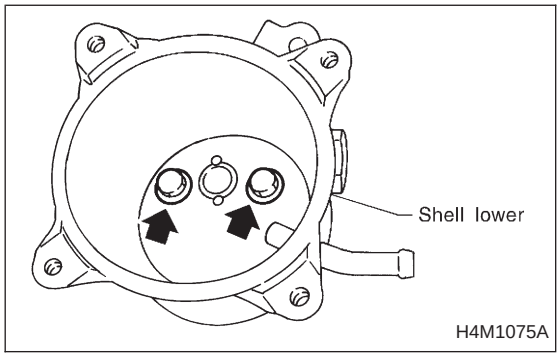
Tightening torque: N·m (kg-m, ft-lb)
T1: 16±2 (1.6±0.2, 11.6±1.4)
T2: 61±7 (6.2±0.7, 45.0±5.2)
T3: 74±5 (7.5±0.5, 54.2±3.6)



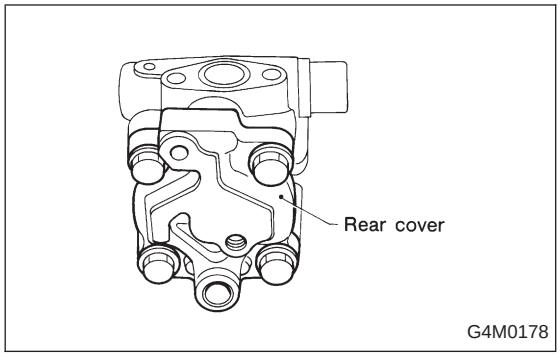
1) Oil pump body

(1) Place oil pump in a vise, and remove shell upper and baffle from shell lower.

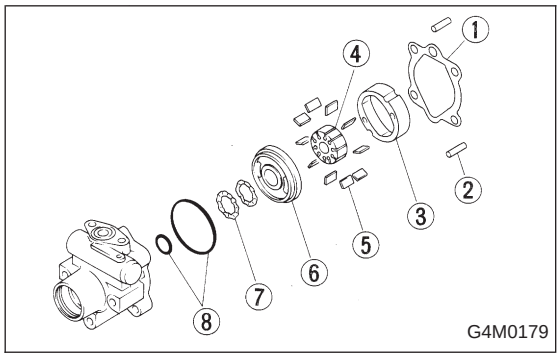
CAUTION:
Do not clamp oil pump too hard; otherwise oil pump may be dented.



(2) Remove shell lower from oil pump.
(3) Remove stay from oil pump.



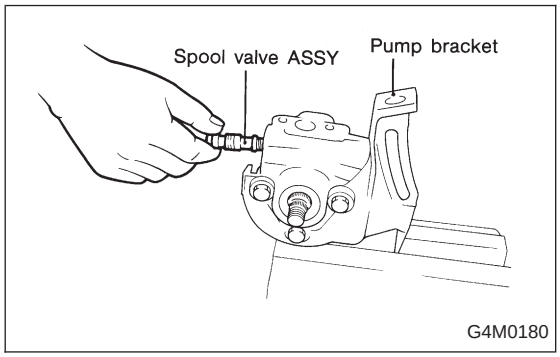
(4) Remove four bolts which secure rear cover.



(5) Remove the following parts from front casing.

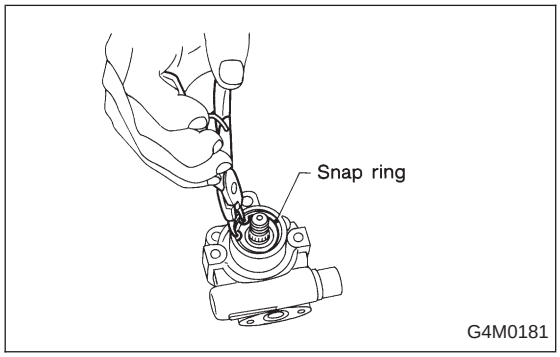
① Seal washer
② Knock pin .....2 ea.
③ Cam ring
④ Rotor
⑤ Vane .....10 ea.
⑥ Side plate
⑦ Wave washer.....2 ea.
⑧ O-ring .....2 ea.

CAUTION:
Discard old seal washer; replace with a new one.

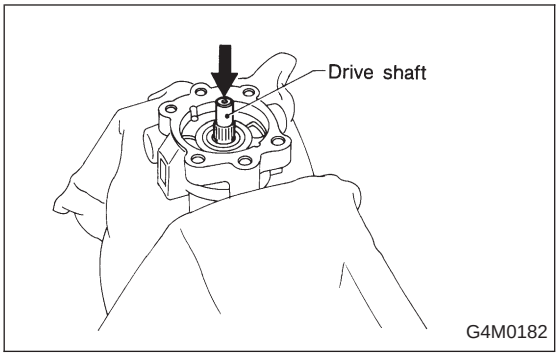


2) Control valve
Slightly loosen outlet connector, and remove connector. Remove the following parts for pump casing.

- Spool valve assembly
- Flow control spring
- Connector
- O-ring

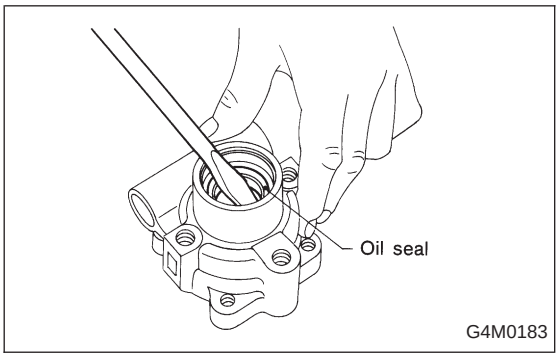


3) Shaft
(1) Remove snap ring from front casing.



(2) Remove shaft using a hand press.

CAUTION:
● Discard old shaft assembly; replace with a new one.
● Be careful not to scratch or dent casing's surface which serves as a seal.



(3) Pry oil seal off using a screwdriver.

CAUTION:
Be careful not to scratch inner surface of casing.

D: INSPECTION

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

Part name	Description	Remedy
1. Front casing	1) Damage on body surfaces 2) Excessive wear on hole, into which spool valve is inserted. 3) Wear and damage on cartridge assembly mounting surface 4) Wear and damage on surfaces in contact with shaft and oil seal	Replace with a new one together with spool valve as selective fit is made.
2. Rear cover	1) Damage on body surfaces 2) Wear and damage on sliding surfaces	Replace with a new one.
3. Shaft	1) Shaft bend 2) Wear and damage on surfaces in contact with bushing and oil seal 3) Wear and damage on rotor mounting surfaces 4) Bearing damage	Replace with a new one.
4. Side plate	Wear and damage on sliding surfaces	Replace with a new one.
5. Cam ring	Ridge wear on sliding surfaces	If damage is serious, replace with a new cartridge assembly.
6. Vane	Excessive wear on nose radius and side surfaces	
7. Rotor	1) Wear and damage on sliding surfaces 2) Ridge wear on vane sliding grooves (If light leaks with vane in slit against light source)	
	3) Damage resulting from snap ring removal	Correct with oil stone. If damage is serious, replace with a new cartridge assembly.
8. Spool valve	Damage or burrs on sliding surface periphery	Replace with a new one together with front casing as selective fit is made.
9. Connector	Damage on threads	Replace with a new one.
10. Spring	Damage	Replace with a new one.
11. Bolts and nuts	Damage on threads	Replace with a new one.

E: ASSEMBLY

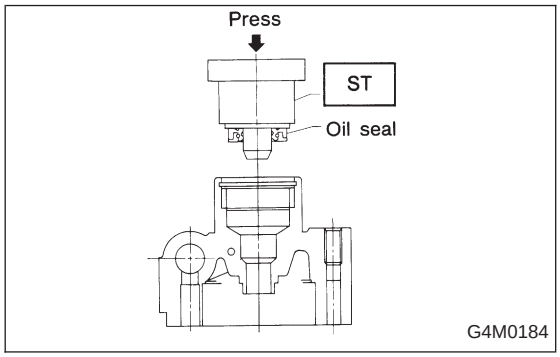
1) Reassembly precautions

(1) Whenever O-rings, oil seals, and snap rings are removed, they must be replaced with new ones.
(2) Thoroughly wash parts and allow to dry. They must be kept free from cleaning oil and dust.
(3) Reassembly procedure must be performed in clean place. Ensure that parts are kept away from waste threads or other dust particles.
(4) Cleaning oil tends to stay inside the front casing. Remove it completely by blowing compressed air.
(5) Ensure that parts are free from rust. (Use specified power steering fluid for rust prevention after cleaning and drying.)
(6) Reverse the sequence of disassembly procedures.

2) Shaft

(1) Apply grease to oil seal and inner surface of front casing (at bearing location).

CAUTION:
Make sure that the front body internal surfaces are free from damage.

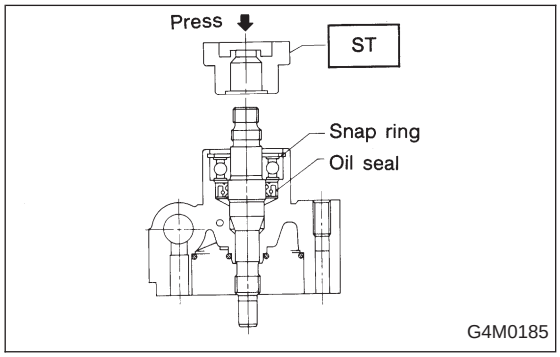


(2) Using ST, press-fit oil seal into front body.

ST 340099AA000 INSTALLER

CAUTION:
When press-fitting, use care to prevent damage to surface mating with rear body.

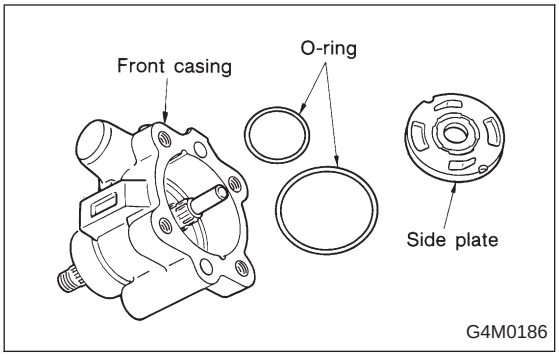
NOTE:
Orient oil seal toward correct direction.



(3) Using ST, press-fit shaft assembly into front body and mount snap ring.

ST 340099AA020 INSTALLER

NOTE:
Turn snap ring to ensure that it fits right into the groove.

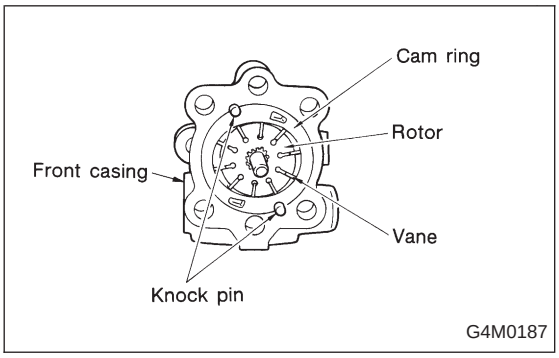


3) Cartridge assembly

(1) Apply specified power steering fluid to O-rings and fit them into front casing.

(2) Install side plate to front casing.

CAUTION:
Use care not to let side plate gall.

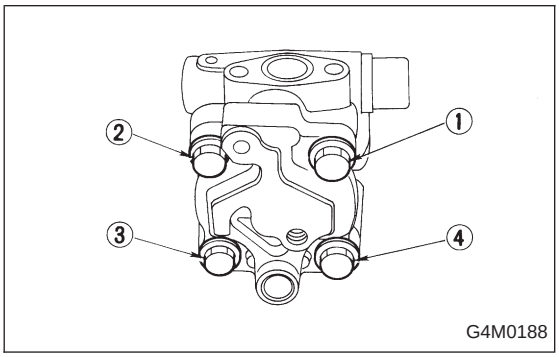


(3) Mount rotor onto shaft.

(4) Install 10 vanes into rotor with their nose radius facing toward cam ring.

(5) Install cam ring to front casing, securing with knock pins.

CAUTION:
Do not use hammer to fit knock pins in position.



4) Rear cover

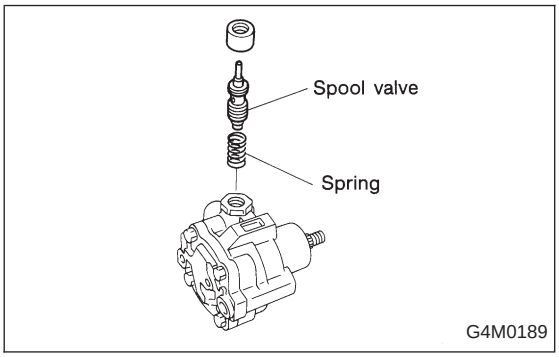
(1) Mount seal washer on front casing.

(2) With knock pin positions aligned, install rear cover.

Tightening torque:
16±2 N·m (1.6±0.2 kg-m, 11.6±1.4 ft-lb)

CAUTION:

Loosely tighten bolts in the sequence ①, ③, ②, and ④ shown in figure. Then, tighten in the same sequence.



5) Spool Valve

(1) Install spring into front casing. Then, with spool valve dipped in specified hydraulic oil, install it into the front casing.

(2) Using a 5-mm dia. round bar, ensure that valve moves smoothly.

(3) Set O-ring, with grease applied to it, onto connector and secure connector to front casing.

Tightening torque:
74±5 N·m (7.5±0.5 kg-m, 54.2±3.6 ft-lb)

CAUTION:
- **Use care to prevent damage to O-ring at installation.**
- **When tightening connector, ensure that O-ring does not protrude or get caught.**

6) Check

(1) When reassembly procedures have been completed, turn shaft by hand to ensure it turns smoothly. If it binds or other unusual conditions are evident, disassemble again and check for foreign matter trapped on sliding surfaces and improper installation. Eliminate the cause of trouble.

(2) Check followings by referring to “CHECK” article.

- Excessive play in pulley shaft
- Ditch deflection of pulley
- Resistance to rotation of pulley
- Measurement of generated oil pressure

F: INSTALLATION

1) Install bracket on engine.

Tightening torque:
22±2 N·m (2.2±0.2 kg-m, 15.9±1.4 ft-lb)

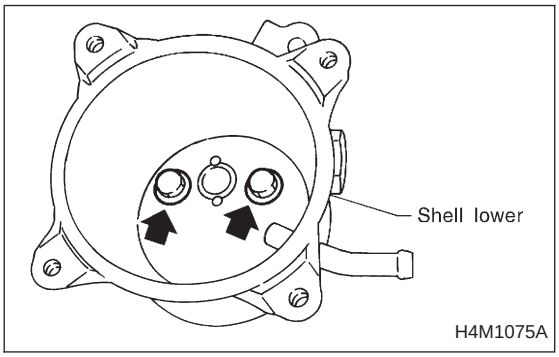
2) Install oil pump on oil tank as follows outside the vehicle:

NOTE:
Prior to installation, make sure that all oil is removed from oil pump, oil tank and pipe.

(1) Place oil pump in a vise and install stay to oil pump.

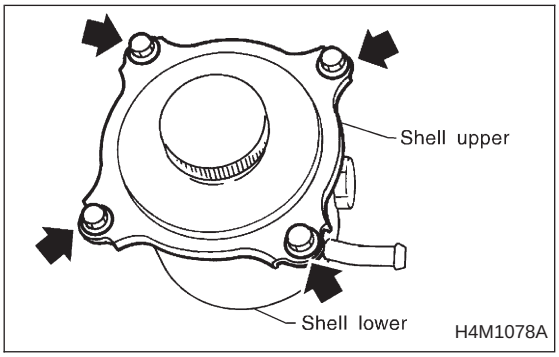
CAUTION:
Do not place oil pump directly in vise; use soft pads and hold oil pump lightly to protect it.

Tightening torque:
15.7±2.4 N·m (1.60±0.24 kg-m, 11.6±1.7 ft-lb)



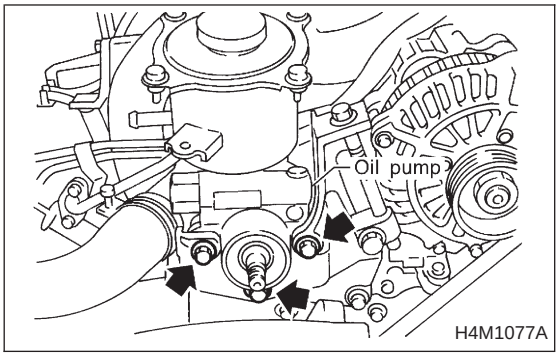
(2) Install shell lower to oil pump.

Tightening torque:
18^{+5}_{0} N·m ($1.8^{+0.5}_{0}$ kg-m, $13.0^{+3.6}_{0}$ ft-lb)



(3) Install shell upper and baffle to shell lower.

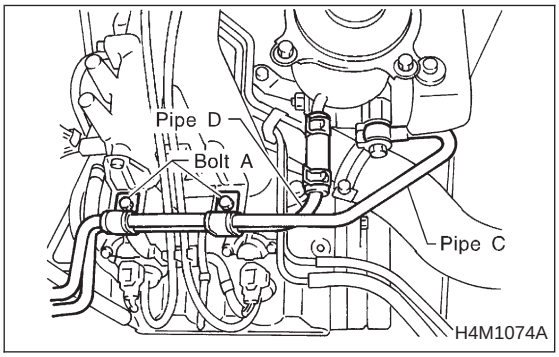
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)



3) Install oil pump, previously assembled to oil tank, on bracket.

Tightening torque:
20.1±2.5 N·m (2.05±0.25 kg-m, 14.8±1.8 ft-lb)

4) Place oil pump pulley and tighten pulley nut temporarily.



5) Interconnect pipes C and D.

Tightening torque:
Joint nut
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)

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

6) Install pulley belt to oil pump.
7) Tighten oil pump pulley nut to the specified torque.

Tightening torque:
52±10 N·m (5.3±1.0 kg-m, 38±7 ft-lb)

8) Check pulley belt tension. <Ref. to 1-5 [01A0].>
9) Tighten bolt belt tension.

Tightening torque:
8±2 N·m (0.8±0.2 kg-m, 5.8±1.4 ft-lb)

10) Install pulley belt cover bracket.
11) Connect minus terminal of battery.
12) Feed the specified fluid and discharge air.

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

7. Power Steering Fluid

A: RECOMMENDED AIR BLEEDING AND POWER STEERING FLUID

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

1) Feed the specified fluid with its level being about 4 cm (1.6 in) lower than the mouth of tank.
2) Continue to turn steering wheel slowly from lock to lock until bubbles stop appearing in the tank while keeping the fluid at that level.

3) In case air is absorbed to deliver bubbles into piping because the fluid level is lower, leave it about half an hour and then do the step 2) all over again.

4) Start, and idle the engine.

5) Continue to turn steering wheel slowly from lock to lock again until bubbles stop appearing in the tank while keeping the fluid at that level.

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

6) In case bubbles do not stop appearing in the tank, leave it about half an hour and then do the step 5) all over again.

7) Stop the engine, and take out safety stands after jacking up vehicle again.

Then lower the vehicle, and idle the engine.

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

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

(1) The fluid level changes over 3 mm (0.12 in).
(2) Bubbles remain on the upper surface of the fluid.
(3) Grinding noise is generated from oil pump.

10) Check the fluid leakage at flare nuts after turning steering wheel from lock to lock with engine running.

CAUTION:

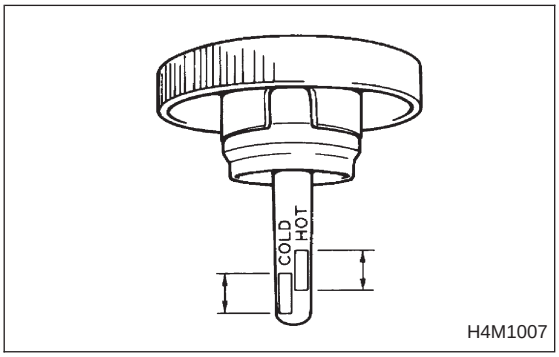
- **Before checking, wipe off any fluid on flare nuts and piping.**
- **In case the fluid leaks from flare nut, it is caused by dust (or the like) and/or damage between flare and tapered seat in piping.**
- **So remove the flare nut, tighten again it to the specified torque after cleaning flare and tapered seat. If flare or tapered seat is damaged, replace it with a new one.**

11) Inspect fluid level on flat and level surface with engine “OFF” by indicator of filler cap.

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

Fluid capacity:

0.7 ℓ (0.7 US qt, 0.6 Imp qt)



(1) Check at temperature 21°C (70°F) on reservoir surface of oil pump, read the fluid level on the “COLD” side.

(2) Check at temperature 60°C (140°F) on reservoir surface of oil pump, read the fluid level on the “HOT” side.

1. Power Steering

A: STEERING CONDITION

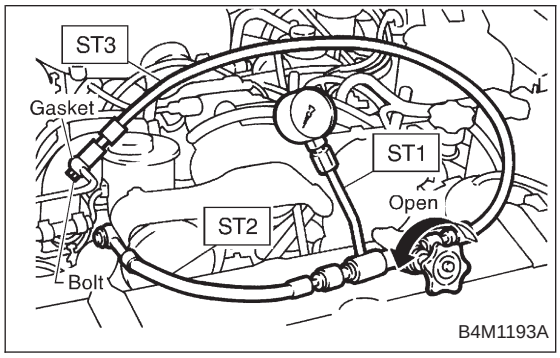
Trouble	Possible cause	Corrective action
• Heavy steering effort in all ranges • Heavy steering effort at stand still • Steering wheel surges when turning.	1. Pulley belt • Unequal length of pulley belts • Adhesion of oil and grease • Loose or damage of pulley belt • Poor uniformity of pulley belt cross section • Pulley belt touches to pulley bottom • Poor revolution of pulleys except oil pump pulley • Poor revolution of oil pump pulley	Adjust or replace.
	2. Tire and rim • Improper tires out of specification • Improper rims out of specification • Tires not properly inflated*1	Replace or reinflate.
	3. Fluid • Low fluid level • Aeration • Dust mix • Deterioration of fluid • Poor warming-up of fluid *2	Refill, bleed air, replace or instruct customer.
	4. Idling speed • Lower idling speed • Excessive drop of idling speed at start or at turning steering wheel *3	Adjust or instruct customer.
	5. Measure hydraulic pressure. <Ref. to 4-3 [K1B0].>	Replace problem parts.
	6. Measure steering effort. <Ref. to 4-3 [K1C0].>	Adjust or replace.
• Vehicle leads to one side or the other. • Poor return of steering wheel to center • Steering wheel surges when turning.	1. Fluid line • Folded hose • Flattened pipe	Reform or replace.
	2. Tire and rim • Flat tire • Mix use of different tires • Mix use of different rims • Abnormal wear of tire • Unbalance of remained grooves • Unbalance of tire pressure	Fix or replace.
	3. Front alignment • Improper or unbalance caster • Improper or unbalance toe-in • Loose connection of suspension	Adjust or retighten.
	4. Others • Damaged joint assembly • Unbalanced height • One-sided weight	Replace, adjust or instruct customer.
	5. Measure steering effort. <Ref. to 4-3 [K1C0].>	Adjust or replace.

***1 If tires and/or rims are wider, the load to power steering system is the more. Accordingly, in a condition, for example before fluid warms-up, relief valve may work before maximum turning angle. In this case, steering effort may be heavy. When measured hydraulic pressure is normal, there is no abnormal thing.**
***2 In cold weather, steering effort may be heavy due to increased flow resistance of cold fluid. After warming-up engine, turn steering wheel from stop to stop several times to warm-up fluid. Then if steering effort reduces normally, there is no abnormal thing.**
***3 In cold weather or with insufficient warm-up of engine, steering effort may be heavy due to excessive drop of idling when turning steering wheel. In this case, it is recommended to start the vehicle with increasing engine speed than usual. Then if steering effort reduces normally, there is no abnormal thing.**

B: MEASUREMENT OF HYDRAULIC PRESSURE

CAUTION:
● Be sure to complete all items aforementioned in "STEERING CONDITION", prior to measuring hydraulic pressure. Otherwise, pressure can not be measured correctly. <Ref. to 4-3 [K1A0].>
● Do not leave the valve of pressure gauge closed or hold the steering wheel at stop end for 5 seconds or more in any case, as the oil pump may be damaged due to long keep of these conditions.
● Put cotton cloth waste at a place where fluid drops before pressure gauge is installed. Wipe off split fluid thoroughly after the measurement.

NOTE:
Keep engine idling during the measurement.



1B1	MEASURE REGULAR PRESSURE.

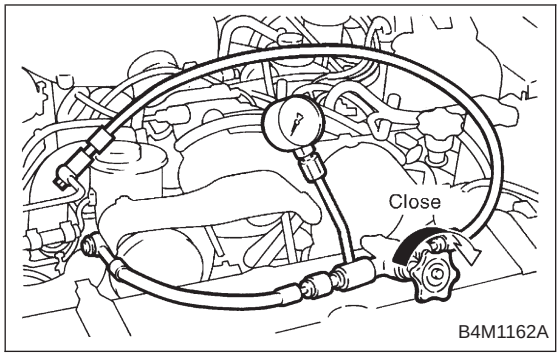
1) Install STs to power steering pump.
   (1) Drain the power steering fluid about 0.35 ℓ (0.4 US qt, 0.3 Imp qt) from oil tank.
   (2) Remove two bolts securing power steering pipes to engine.
   (3) Install ST1, 2 and 3 between power steering pump and pipes using gasket (Part No. 34621AC020) and bolt (Part No. 34620AC010).
   (4) Replenish power steering fluid up to specified level.
2) Open valve, and start the engine.
3) Measure regular pressure.

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

CHECK ***: Is pressure 981 kPa (10 kg/cm^2, 142 psi) or less?***

YES : Go to step **1B2**.

NO : Trouble may be due to crushed pipe or hose, leakage from fluid line, foreign particles in fluid line, etc. Replace faulty parts with new ones.



1B2	MEASURE RELIEF PRESSURE.

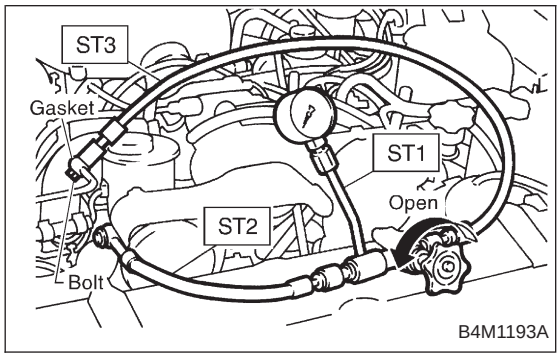
1) Using STs, measure relief pressure.
2) Close valve.

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

CHECK ***: Is 1800 cc model's pressure 6,178 — 6,767 kPa (63 — 69 kg/cm^2, 896 — 981 psi), and 2200 cc model's pressure 7,159 — 7,748 kPa (73 — 79 kg/cm^2, 1,038 — 1,123 psi)?***

YES : Go to step **1B3**.

NO : Trouble may be due to malfunctioning relief valve, fluid leaking into oil pump interior, abnormal wear of pump vanes, etc. Replace faulty parts with new ones.



1B3	MEASURE WORKING PRESSURE.

1) Using STs, measure working pressure.

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

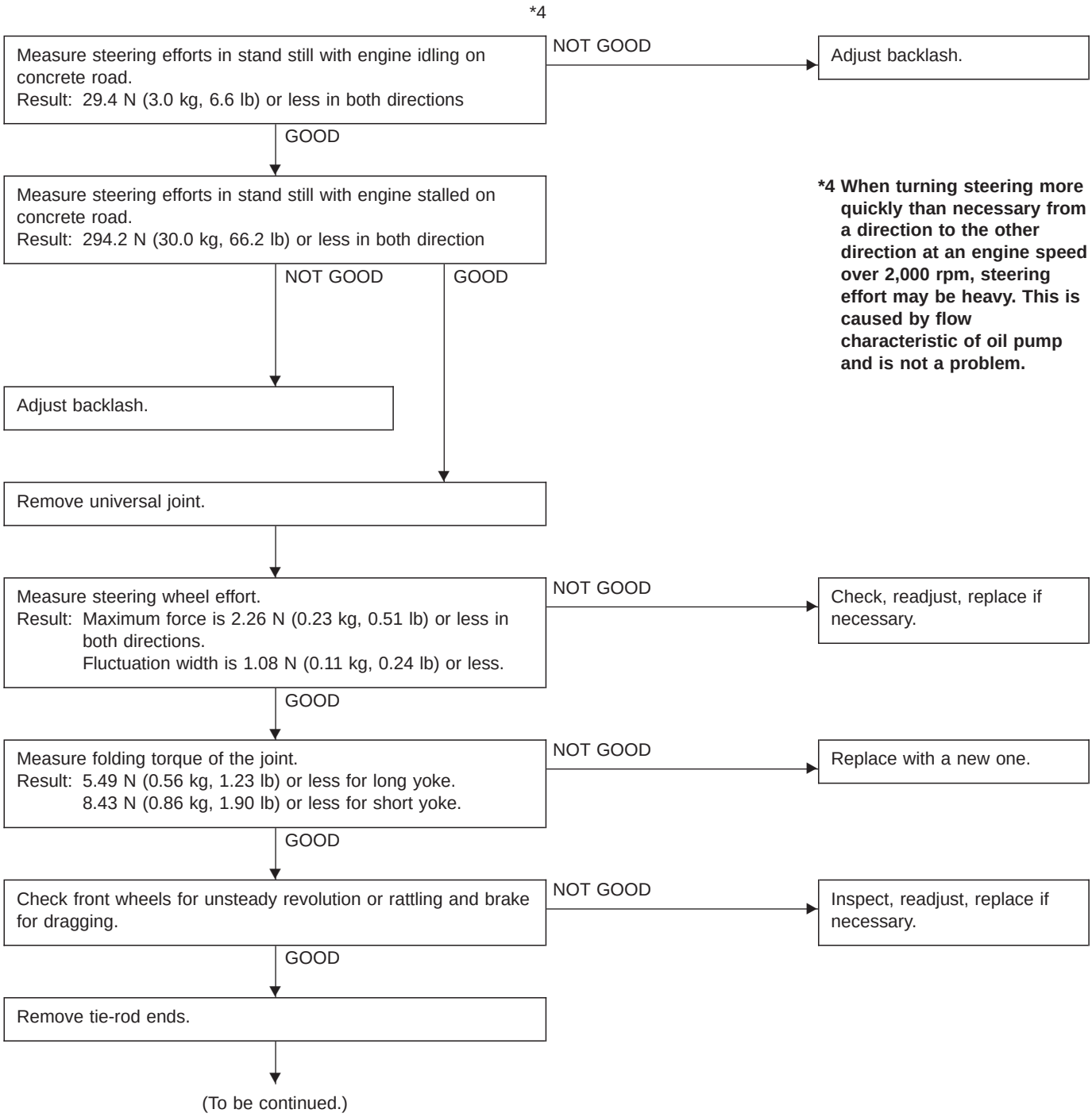
2) Open valve.
3) Measure working pressure of control valve by turning wheel from stop to stop.

CHECK ***: Is 1800 cc model's pressure 6,178 — 6,767 kPa (63 — 69 kg/cm^2, 896 — 981 psi), and 2200 cc model's pressure 7,159 — 7,748 kPa (73 — 79 kg/cm^2, 1,038 — 1,123 psi)?***

YES : Measure steering force. <Ref. to 4-3 [K1C0].>

NO : Control valve is inoperative. Replace control valve itself or control valve and pinion as a single unit with new ones.

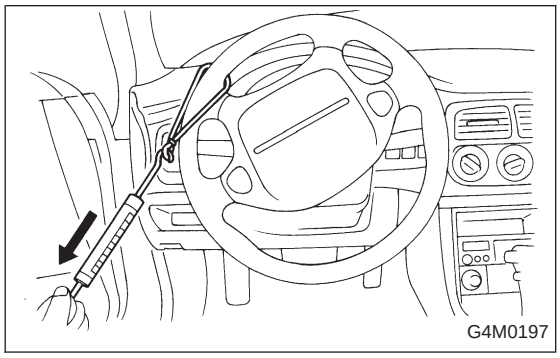
C: MEASUREMENT OF STEERING EFFORT

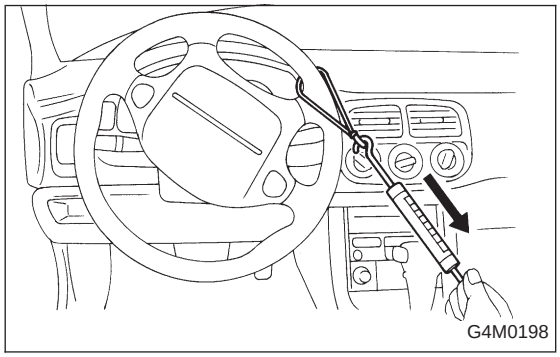


***4 When turning steering more quickly than necessary from a direction to the other direction at an engine speed over 2,000 rpm, steering effort may be heavy. This is caused by flow characteristic of oil pump and is not a problem.**

Check tie-rod ends, tie-rods and ball joints of suspension for unsteady revolution or rattling.
NOT GOOD → Inspect, replace if necessary.
GOOD ↓

Measure rotating and sliding resistance of gearbox.
Result: Rotating resistance is 11.18 N (1.14 kg, 2.51 lb) or less around center position and 1.79 N (1.61 kg, 3.55 lb) or less in all positions within 20% difference between clockwise and counterclockwise.
Sliding resistance is 304 N (31 kg, 68 lb) or less with 20% difference between left and right directions.
NOT GOOD → Readjust backlash, if ineffective replace bad parts.


G4M0197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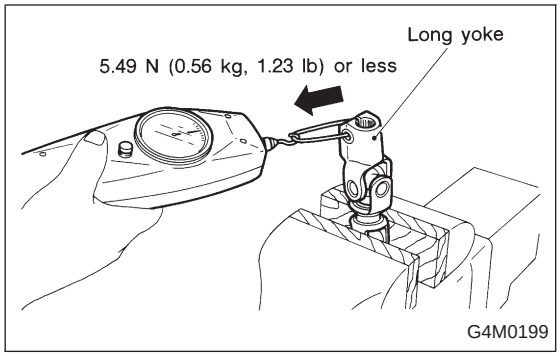
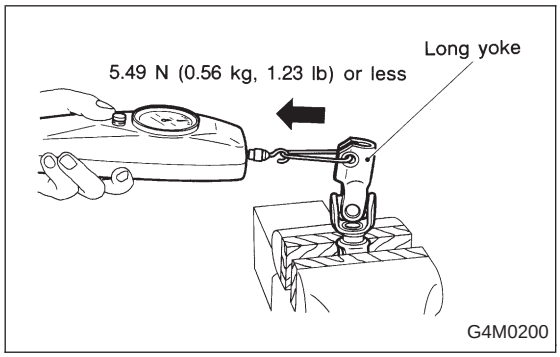
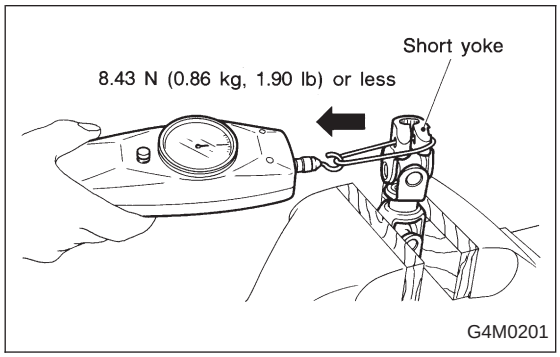
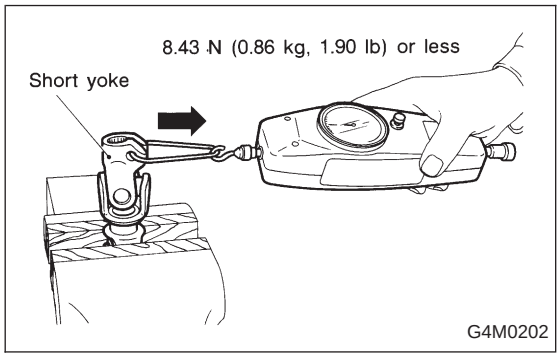
1) Measurement of steering effort is as shown in the figures.

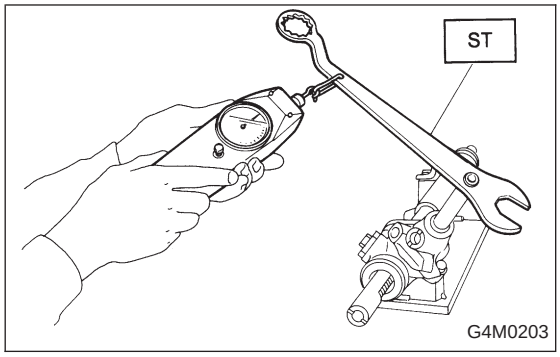








2) Measurement of folding torque of universal joint is as shown in the figures.



3) Using ST, measure resistances of gearbox.

ST 926230000 SPANNER

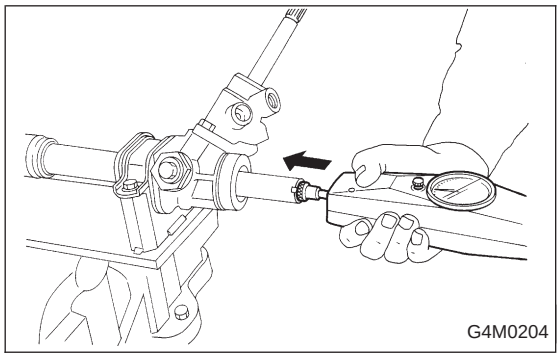
Rotating resistance:

Straight-ahead position within 30 mm (1.18 in) from rack center;

Less than 11.18 N (1.14 kg, 2.51 lb)

Maximum allowable torque;

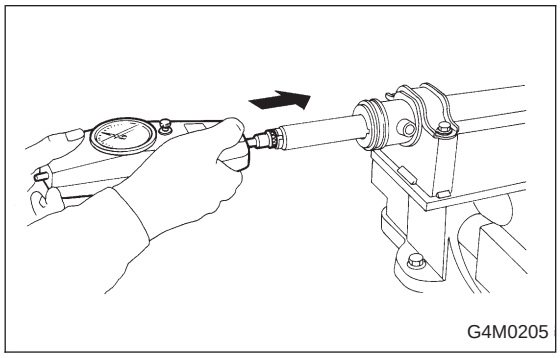
15.7 N (1.6 kg, 3.5 lb)



Sliding resistance:

Right-turn steering;

304 N (31 kg, 68 lb) or less

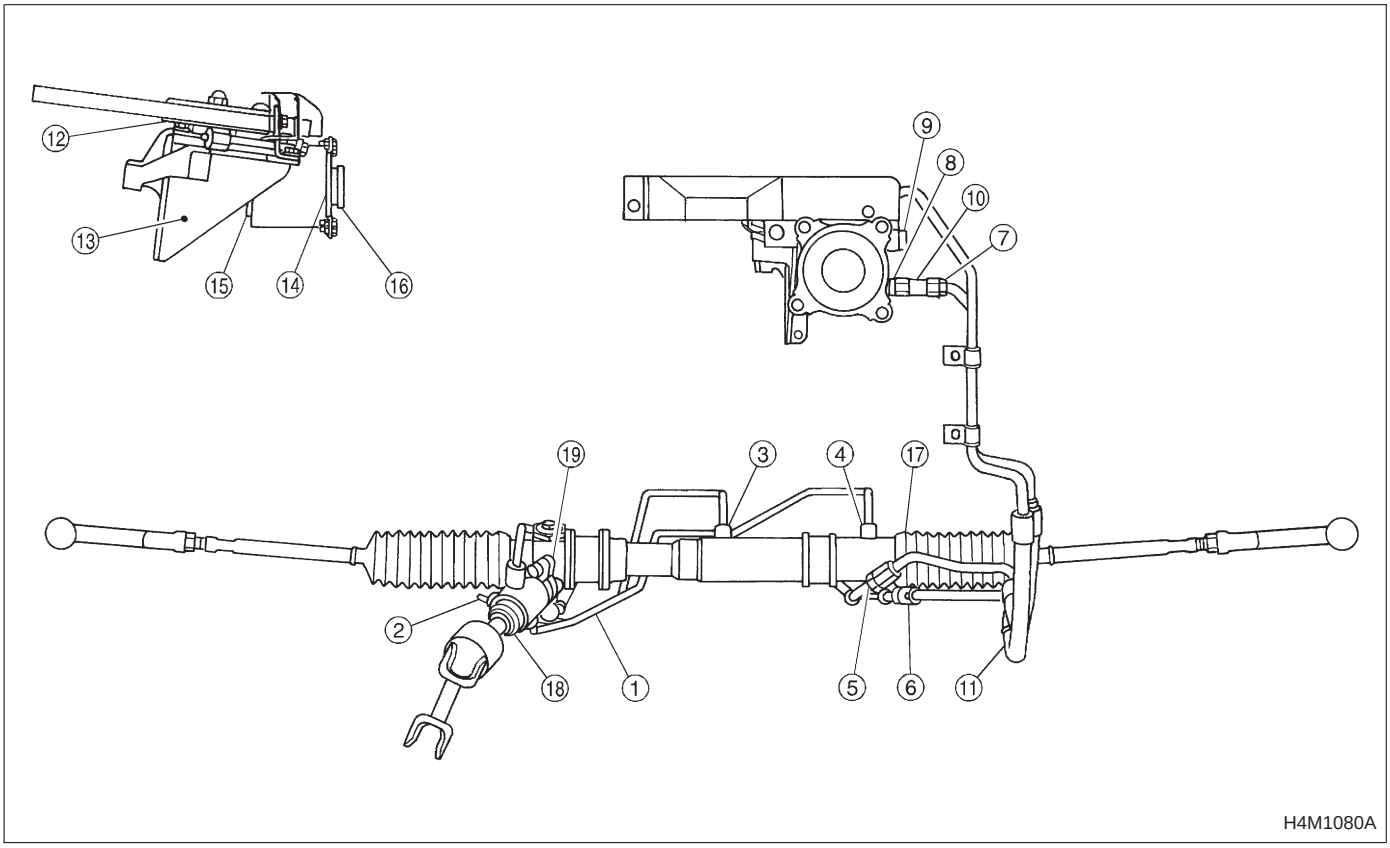


Left-turn steering;

304 N (31 kg, 68 lb) or less

D: FLUID LEAKAGE

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



Fluid leaking area	Possible cause	Corrective action
Leakage from connecting portions of pipes and hoses, numbered with ① through ⑨ in figure	Insufficient tightening of flare nut, catching dirt or the like, damage to flare or flare nut	Loosen and retighten, if ineffective, replace.
	Poor insertion of hose, poor clamping	Retighten or replace clamp.
	Damaged O-ring	Replace O-ring pipe or hose with new one, if ineffective, replace gearbox also.
Leakage from hose ⑩ and ⑪ in figure	Crack or damage in hose	Replace with a new one.
	Crack or damage in hose hardware	Replace with a new one.
Leakage from surrounding of cast iron portion of oil pump ⑫ and ⑬ in figure	Damaged O-ring	Replace O-ring.
	Damaged gasket	Replace gasket.
Leakage from oil tank ⑭ and ⑮ in figure	Crack in oil tank, ⑭	Replace oil tank.
	Damaged O-ring, ⑮	Replace O-ring.
Leakage from filler neck ⑯	Damaged cap packing	Replace cap.
	Crack in root of filler neck	Replace oil tank.
	High fluid level *1	Adjust fluid level.
Leakage from surrounding of power cylinder of gearbox ⑰ in figure	Damaged oil seal	Replace oil seal.
Leakage from control valve of gearbox ⑱ and ⑲ in figure	Damaged packing or oil seal	Replace problem parts.
	Damage in control valve	Replace control valve.

***1 Fluid level is specified at optimum position (range) for ordinary use. Accordingly, if the vehicle is used often under hard conditions such as on very rough roads or in mountainous areas, fluid may bleed out from cap air vent hole. This is not a problem. If a customer complains strongly and is not likely to be satisfied with the leakage, lower the fluid level to the extent that fluid will not bleed out under the conditions described, and have the customer check the fluid level and its quality more frequency than usual.**

E: NOISE AND VIBRATION

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

NOTE:

- Grinding noise may be heard immediately after the engine start in extremely cold condition. In this case, if the noise goes off during warm-up there is no abnormal function in the system. This is due to the fluid characteristic in extremely cold condition.
- Oil pump makes whine or growl noise slightly due to its mechanism. Even if the noise can be heard when steering wheel is turned at stand still there is no abnormal function in the system provided that the noise eliminates when the vehicle is running.
- When stopping with service brake and/or parking brake applied, power steering can be operated easily due to its light steering effort. If doing so, the disk rotates slightly and makes creaking noise. The noise is generated by creaking between the disk and pads. If the noise goes off when the brake is released, there is no abnormal function in the system.
- There may be a little vibration around the steering devices when turning steering wheel at standstill, even though the component parts are properly adjusted and have no defects.

Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e., road surface and tire surface, engine speed and turning speed of steering wheel, fluid temperature and braking condition.
This phenomena does not indicate there is some abnormal function in the system.
The vibration can be known when steering wheel is turned repeatedly at various speeds from slow to rapid step by step with parking brake applied on concrete road and in “D” range for automatic transmission vehicle.

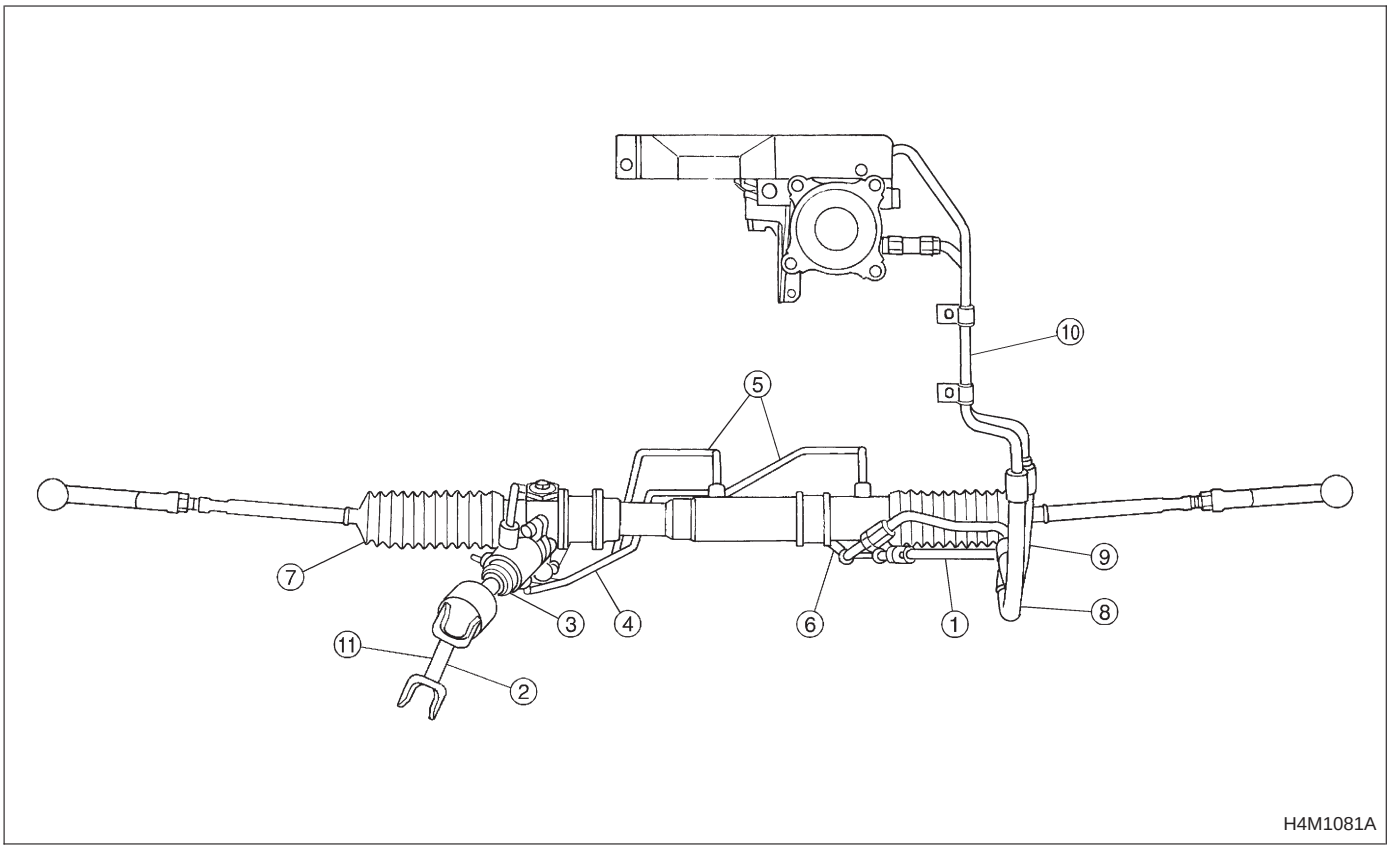
Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Don’t keep this condition over 5 seconds.)	Normal
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is faulty.	Defective Replace oil pump.
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check clearance. Correct if necessary. <Ref. to 4-3 [K1F0].>
	Loosened installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Loosened installation of oil pump pulley or other pulley(s)	Retighten.
	Loosened linkage or play of steering or suspension Loosened tightening of joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace the gearbox or oil pump.
Knocking When turning steering wheel in both direction with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Loosened tightening or play of tie-rod, tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Vane pump aeration	Inspect and retighten fluid line connection. Refill fluid and vent air.
	Vane pump seizing	Replace oil pump.
	Pulley bearing seizing of oil pump	Replace oil pump.
	Folded hose, flat pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Maladjustment of pulley belt Damaged or charged pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Run out or soilage of V-groove surface of oil pump pulley	Clean or replace.
Sizzling noise (continuous) While engine is running.	Fluid aeration	Fix wrong part causing aeration. Replace fluid and vent air.
	Damaged pipe of gearbox	Replace pipe.
	Abnormal inside of hose or pipe Flat hose or pipe	Rectify or replace.
	Abnormal inside of oil tank	Replace.
	Removed oil tank cap	Install cap.
Whistle (continuous) While engine is running.	Abnormal pipe of gearbox or abnormal inside of hose	Replace bad parts of gearbox or hose.

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

F: CLEARANCE TABLE

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

Location	Minimum allowance mm (in)	Location	Minimum allowance mm (in)
① Crossmember — Pipe	5 (0.20)	⑦ Exhaust pipe — Gearbox bolt	15 (0.59)
② DOJ — Shaft or joint	14 (0.55)	⑧ Side frame — Hose A and B	15 (0.59)
③ DOJ — Valve housing	11 (0.43)	⑨ Cruise control pump — Hose A and B	15 (0.59)
④ Pipe — Pipe	2 (0.08)	⑩ Pipe portion of hose A — Pipe portion of hose B	1.5 (0.059)
⑤ Stabilizer — Pipe	5 (0.20)	⑪ AT cooling hose — Joint	20 (0.79)
⑥ Exhaust pipe — Pipe	15 (0.59)	—	—



G: BREAKAGE OF HOSES

CAUTION:
Although surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. It is very important to keep the hoses free from before mentioned fluids and to wipe out immediately when the hoses are adhered with the fluids.
Since 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 area and/or a driving condition in which many steering operations are required in short time. Particularly continuous work of relief valve over 5 seconds causes to reduce service lives of the hoses, the oil pump, the fluid, etc. due to over heat.
So, avoid to keep this kind of condition when servicing as well as driving.

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