

ABS (DIAGNOSTICS)

ABS

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BASIC DIAGNOSTIC PROCEDURE

ABS (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

CAUTION:

Remove foreign matter (dust, water, etc.) from the ABSCM&H/U connector during removal and installation.

NOTE:

- To check harness for broken wires or short circuits, shake it while holding it or the connector.
- Check list for interview. <Ref. to ABS-4, CHECK, Check List for Interview.>

Step	Check	Yes	No
1 CHECK PRE-INSPECTION. 1) Ask the customer when and how the trouble occurred using interview checklist. <Ref. to ABS-4, Check List for Interview.> 2) Before performing diagnosis, inspect unit which might influence the ABS problem. <Ref. to ABS-7, INSPECTION, General Description.>	Is unit that might influence the ABS problem normal?	Go to step 2.	Repair or replace each unit.
2 CHECK INDICATION OF TROUBLE CODE DISPLAY. 1) Turn ignition switch to OFF. 2) Connect the SUBARU SELECT MONITOR to data link connector. 3) Turn ignition switch to ON and SUBARU SELECT MONITOR to ON. NOTE: If the communication function of the select monitor cannot be executed normally, check the communication circuit. <Ref. to ABS-34, COMMUNICATION WITH SUBARU SELECT MONITOR IS IMPOSSIBLE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> 4) Read diagnostic trouble code (DTC). <Ref. to ABS-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 5) Record all diagnostic trouble codes (DTC) and frame data.	Is the DTC displayed?	Go to step 4.	Go to step 3.
3 PERFORM THE GENERAL DIAGNOSTICS. 1) Inspect using "General Diagnostics Table". <Ref. to ABS-101, General Diagnostics Table.> 2) Perform the clear memory mode. <Ref. to ABS-17, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 3) Perform the inspection mode. <Ref. to ABS-20, Inspection Mode.> 4) Calling up the diagnostic trouble code (DTC). <Ref. to ABS-16, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> Confirm that no DTC is displayed.	Does ABS warning light remain off?	Complete the diagnosis.	Go to step 4.

BASIC DIAGNOSTIC PROCEDURE

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Step	Check	Yes	No
4 PERFORM THE DIAGNOSIS. 1) Inspect using "Diagnostics Chart with Subaru Select Monitor".<Ref. to ABS-34, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> NOTE: For diagnostic trouble code (DTC) list, refer to "List of Diagnostics Trouble Code (DTC)". <Ref. to ABS-32, LIST, List of Diagnostics Trouble Code (DTC).> 2) Repair trouble cause. 3) Perform the clear memory mode. <Ref. to ABS-17, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Perform the inspection mode. <Ref. to ABS-20, Inspection Mode.> 5) Calling up the diagnostic trouble code (DTC). <Ref. to ABS-16, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> Confirm that no DTC is displayed.	Does ABS warning light remain off?	Complete the diagnosis.	Inspect using "Diagnostics Chart with Subaru Select Monitor". <Ref. to ABS-<Ref. to ABS-34, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>, Diagnostics Chart with Subaru Select Monitor.>

CHECK LIST FOR INTERVIEW

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2. Check List for Interview

A: CHECK

Check the following items about the vehicle's state.

1. STATE OF ABS WARNING LIGHT

ABS warning light comes on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not come on • When / how long does it come on?:		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ On after starting (Engine is running) ☐ On after starting (Engine is stop)		
Timing	☐ Immediately after ignition is ON. ☐ Immediately after ignition starts.		
	☐ When advancing	km/h to km/h	
		MPH to MPH	
	☐ While traveling at a constant speed	km/h	MPH
	☐ When decelerating	km/h to km/h	
		MPH to MPH	
	☐ When turning to right	Steering angle:	deg
		Steering time:	sec
	☐ When turning to left	Steering angle:	deg
		Steering time:	sec
☐ When moving other electrical parts			
• Parts name: • Operating condition:			

CHECK LIST FOR INTERVIEW

ABS (DIAGNOSTICS)

2. SYMPTOMS

ABS operating condition	☐ Performs no work.		
	☐ Operates only when abruptly applying brakes.	Vehicle speed:	km/h
	MPH		
	• How to step on brake pedal:		
	a) Operating time:	sec	
	b) Operating noise: ☐ Produce / ☐ Does not produce		
	• What kind of noise?	☐ Knock ☐ Gong gong ☐ Bong ☐ Buzz ☐ Gong gong buzz ☐ Others:	
	c) Reaction force of brake pedal		
		☐ Stick ☐ Press down once with a clunk ☐ Press and released ☐ Others:	
	Behavior of vehicle	a) Directional stability cannot be obtained or steering arm refuses to work when applying brakes: ☐ Yes / ☐ No	
• When:		☐ Vehicle turns to right ☐ Vehicle turns to left ☐ Spins ☐ Others:	
b) Directional stability cannot be obtained or steering arm refuses to work when accelerating: ☐ Yes / ☐ No			
• When:		☐ Vehicle turns to right ☐ Vehicle turns to left ☐ Spins ☐ Others:	
c) Brakes are out of order: ☐ Yes / ☐ No			
• What:		☐ Braking distance is long ☐ Brakes lock or drag ☐ Pedal stroke is long ☐ Pedal sticks ☐ Others:	
d) Poor acceleration: ☐ Yes / ☐ No			
• What:		☐ Fails to accelerate ☐ Engine stalls ☐ Others:	
e) Occurrence of vibration: ☐ Yes / ☐ No			
• Where			
• What kind:			
f) Occurrence of abnormal noise: ☐ Yes / ☐ No			
• Where			
• What kind:			
g) Occurrence of other phenomena: ☐ Yes / ☐ No			
• What kind:			

CHECK LIST FOR INTERVIEW

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3. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others:	
	b) Ambient temperature	°F (°C)	
	c) Road	☐ Urban area ☐ Suburbs ☐ Highway ☐ General road ☐ Ascending slope ☐ Descending slope ☐ Paved road ☐ Gravel road ☐ Muddy road ☐ Sandy place ☐ Others:	
	d) Road surface	☐ Dry ☐ Wet ☐ New-fallen snow ☐ Compressed snow ☐ Frozen slope ☐ Others:	
Condition	a) Brakes	Deceleration: g ☐ Continuous / ☐ Intermittent	
	b) Accelerator	Acceleration: g ☐ Continuous / ☐ Intermittent	
	c) Vehicle speed	km/h	MPH
		☐ Advancing ☐ Accelerating ☐ Reducing speed ☐ Low speed ☐ Turning ☐ Others:	
	d) Tire inflation pressure	Front RH tire:	kPa
		Front LH tire:	kPa
		Rear RH tire:	kPa
		Rear LH tire:	kPa
	e) Degree of wear	Front RH tire:	
		Front LH tire:	
		Rear RH tire:	
		Rear LH tire:	
	f) Genuine parts are used.: ☐ Yes / ☐ No		
	g) Chain is passed around tires.: ☐ Yes / ☐ No		
	h) T tire is used.: ☐ Yes / ☐ No		
	i) Condition of suspension alignment:		
j) Loading state:			
k) Repair parts are used.: ☐ Yes / ☐ No			
• What:			
l) Others:			

3. General Description

A: CAUTION

1. SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the ABS sensor, ABS control module and hydraulic control unit.

CAUTION:

- 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 ABS sensor, ABS control module and hydraulic control unit.

B: INSPECTION

Before performing diagnostics, check the following items which might affect ABS problems:

1. BATTERY

Measure battery voltage and specific gravity of electrolyte.

Standard voltage: 12 V, or more

Specific gravity: Above 1.260

2. GROUND

Check ABS ground (F73) bolt for proper tightening.

3. BRAKE FLUID

- 1) Check brake fluid level.
- 2) Check brake fluid leakage.

4. HYDRAULIC UNIT

Check the hydraulic unit.

- With brake tester <Ref. to ABS-8, CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH BRAKE TESTER, INSPECTION, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
- Without brake tester <Ref. to ABS-7, CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE, INSPECTION, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

5. BRAKE DRAG

Check brake drag.

6. BRAKE PAD AND ROTOR

Check brake pad and rotor.

- Front <Ref. to BR-13, INSPECTION, Front Brake Pad.> and <Ref. to BR-14, INSPECTION, Front Disc Rotor.>

- Rear <Ref. to BR-18, INSPECTION, Rear Brake Pad.> and <Ref. to BR-19, INSPECTION, Rear Disc Rotor.>

7. TIRE

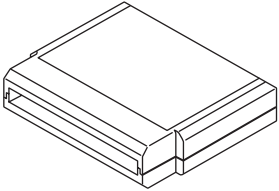
Check tire specifications, tire wear and air pressure. <Ref. to WT-2, SPECIFICATIONS, General Description.>

GENERAL DESCRIPTION

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C: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18482AA010	18482AA010	CARTRIDGE	Troubleshooting for electrical systems.
 ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.

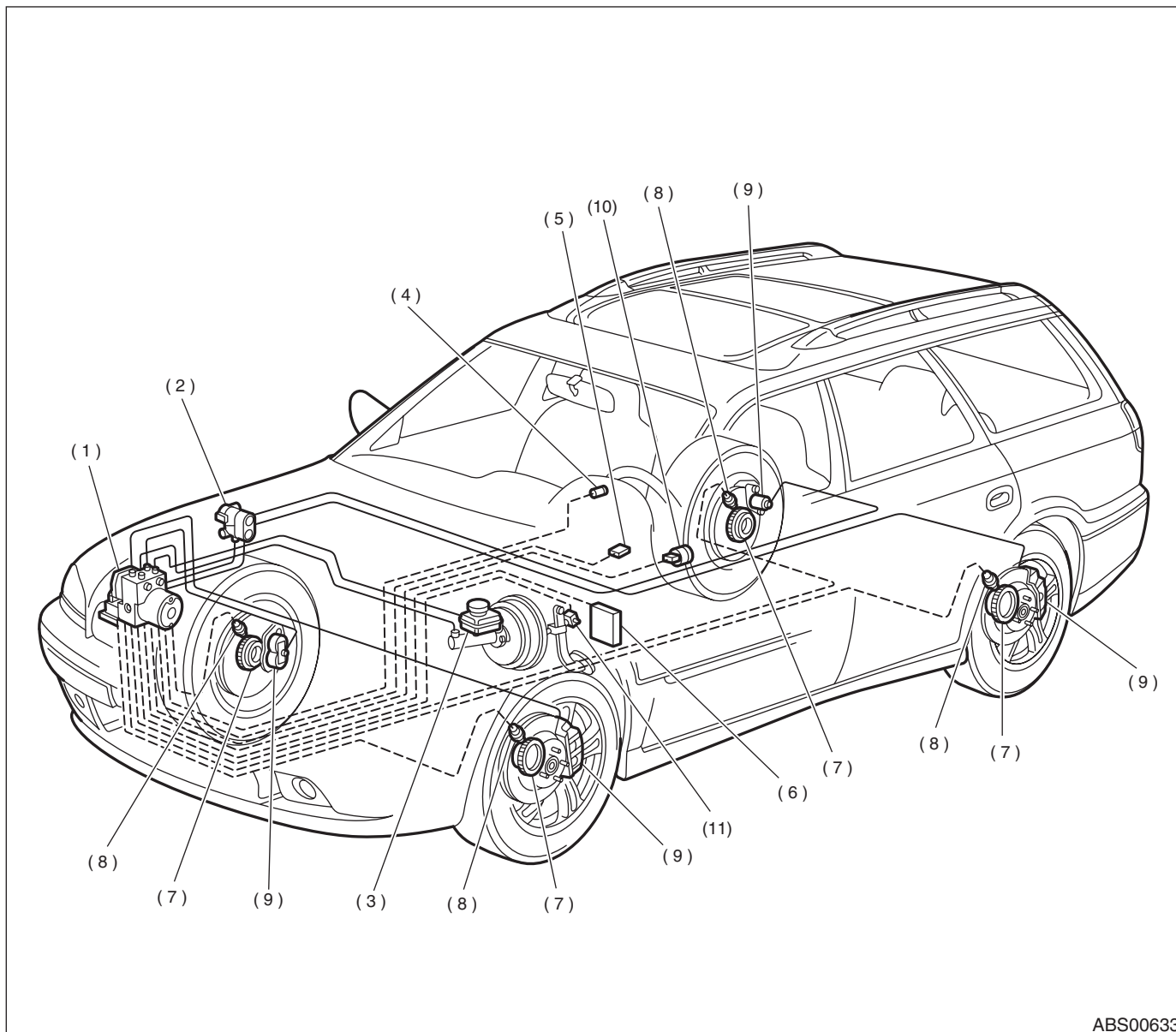
2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Circuit Tester	Used for measuring resistance, voltage and ampere.
Oscilloscope	Used for measuring sensor.

MEMO:

4. Electrical Components Location

A: LOCATION



ABS00633

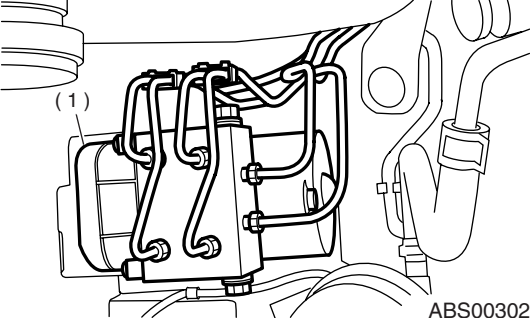
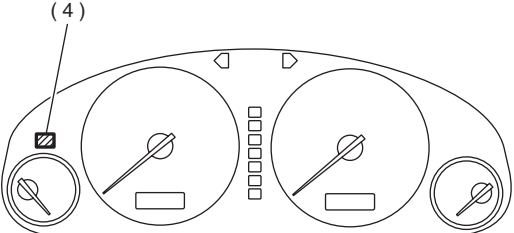
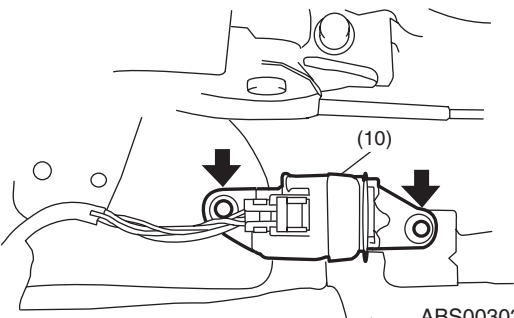
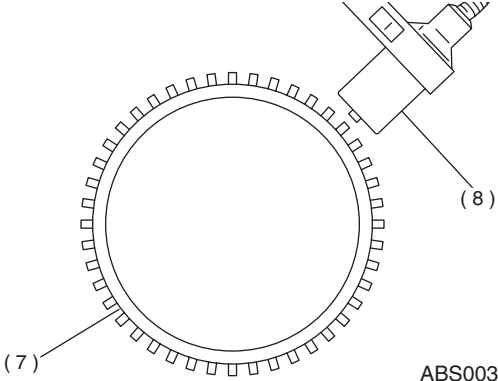
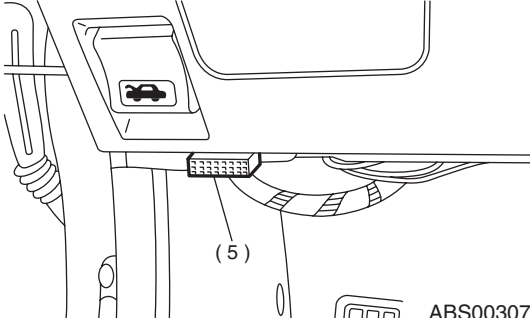
- (1) ABS control module and hydraulic control unit (ABSCM&H/U)
- (2) Proportioning valve
- (3) Master cylinder
- (4) ABS warning light

- (5) Data link connector (for Subaru select monitor)
- (6) Transmission control module (AT models)
- (7) Tone wheel

- (8) ABS sensor
- (9) Wheel cylinder
- (10) G sensor
- (11) Stop light switch

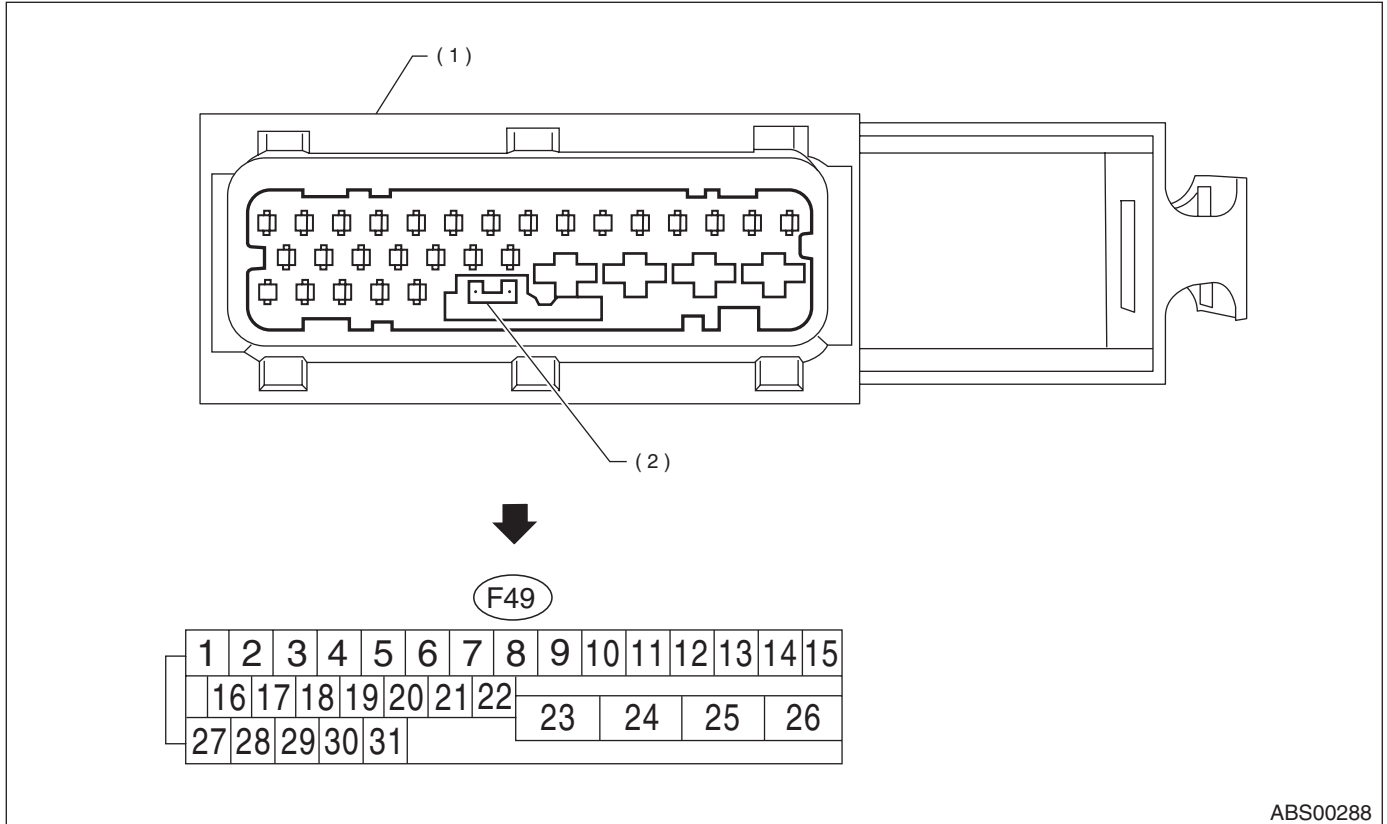
ELECTRICAL COMPONENTS LOCATION

ABS (DIAGNOSTICS)

 ABS00302	 ABS00305
 ABS00303	 ABS00306
 ABS00307	

5. Control Module I/O Signal

A: ELECTRICAL SPECIFICATION



(1) ABSCM&HU connector

(2) Connector switch

NOTE:

- The terminal numbers in the ABS control module and hydraulic control unit connector are as shown in the figure.
- When the connector is removed from the ABSCM&H/U, the connector switch closes the circuit between terminal No. 22 and No. 23. The ABS warning light illuminates.

Contents		Terminal No. (+)(-)	Input/Output signal
			Measured value and measuring conditions
ABS sensor*2 (Wheel speed sensor)	Front left wheel	9—10	0.12 — 1 V (When it is 20 Hz.)
	Front right wheel	11—12	
	Rear left wheel	7—8	
	Rear right wheel	14—15	
Valve relay power supply		24—23	10 — 15 V
Motor relay power supply		25—23	10 — 15 V
G sensor*2	power supply	30—28	4.75 — 5.25 V
	ground	28	—
	output	6—28	2.3±0.2 V when vehicle is in horizontal position.
Stop light switch*1		2—23	Less than 1.5 V when the stop light is OFF and, 10 — 15 V when the stop light is ON.
ABS warning light*2		22—23	Less than 1.5 V during 1.5 seconds when ignition switch is ON, and 10 — 15 V after 1.5 seconds.
AT ABS signal*2 (AT model only)		31—23	Less than 1.5 V when the ABS control still operates and more than 5.5 V when ABS does not operate.
ABS operation signal monitor*2		3—23	Less than 1.5 V when the ABS control still operates and more than 5.5 V when ABS does not operate.
Select monitor*2	Data is received.	20—23	Less than 1.5 V when no data is received.
	Data is sent.	5—23	4.75 — 5.25 V when no data is sent.
Power supply*1		1—23	10 — 15 V when ignition switch is ON.
Grounding line		23	—
Grounding line		26	—

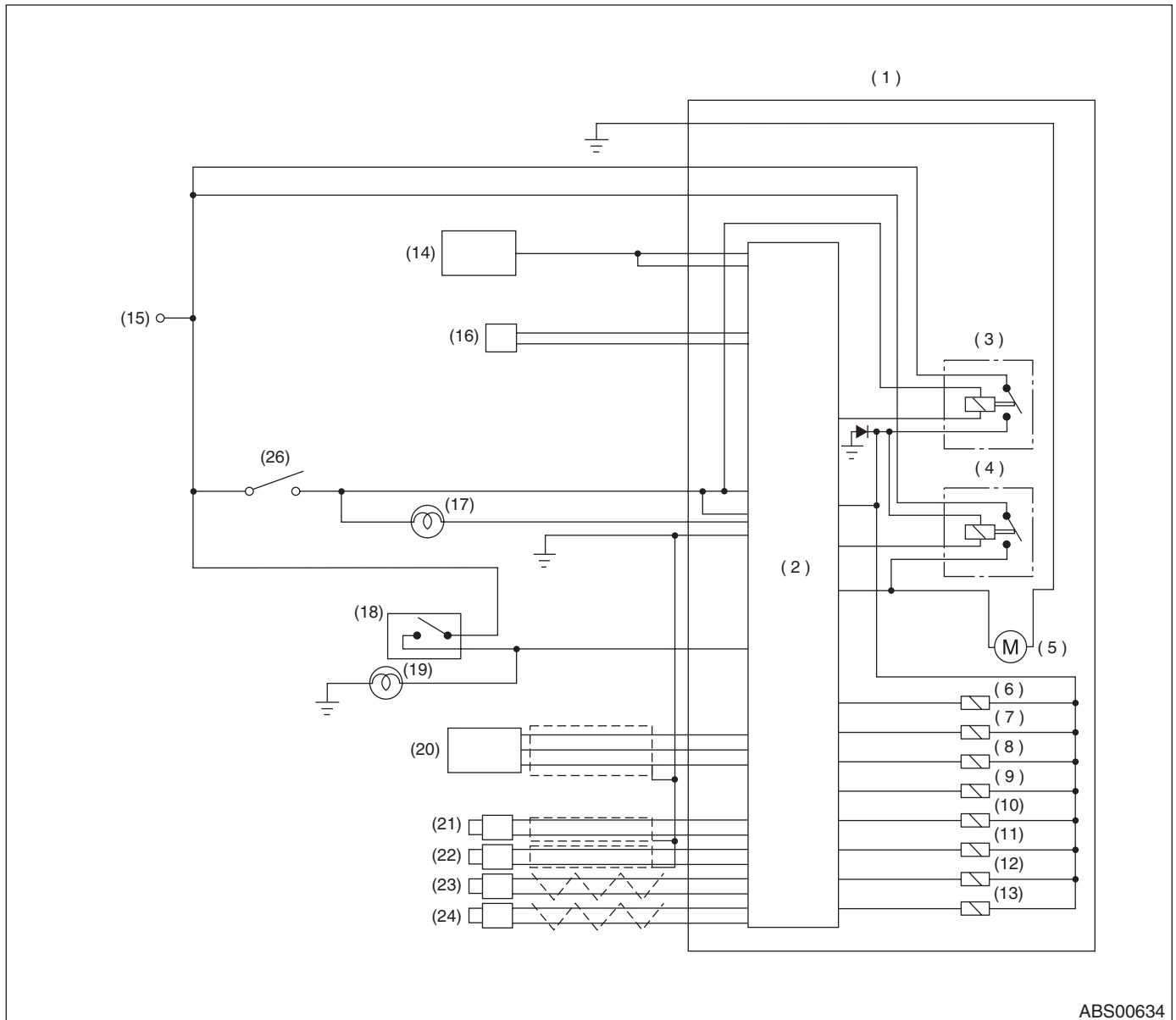
*1: Measure the I/O signal voltage after removing the connector from the ABSCM&H/U terminal.

*2: Measure the I/O signal voltage at connector (B62) or (F55).

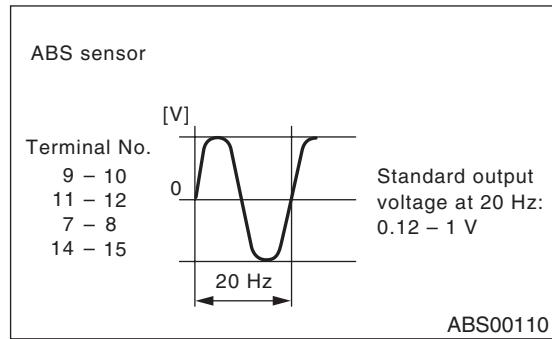
CONTROL MODULE I/O SIGNAL

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B: SCHEMATIC



- | | | |
|---|--|-----------------------------|
| (1) ABS control module and hydraulic control unit (ABSCM&H/U) | (10) Rear left inlet solenoid valve | (18) Stop light switch |
| (2) ABS control module area | (11) Rear left outlet solenoid valve | (19) Stop light |
| (3) Valve relay | (12) Rear right inlet solenoid valve | (20) G sensor |
| (4) Motor relay | (13) Rear right outlet solenoid valve | (21) Front left ABS sensor |
| (5) Motor | (14) Transmission control module (only AT model) | (22) Front right ABS sensor |
| (6) Front left inlet solenoid valve | (15) IGN | (23) Rear left ABS sensor |
| (7) Front left outlet solenoid valve | (16) Data link connector | (24) Rear right ABS sensor |
| (8) Front right inlet solenoid valve | (17) ABS warning light | (25) Battery |
| (9) Front right outlet solenoid valve | | |

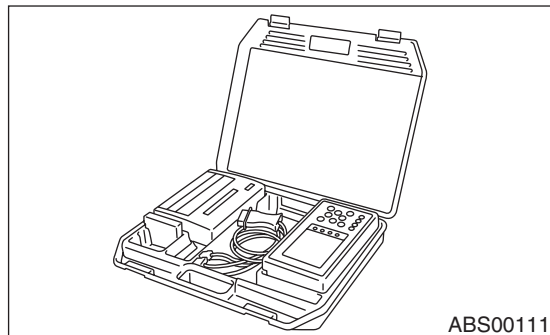
C: WAVEFORM

6. Subaru Select Monitor

A: OPERATION

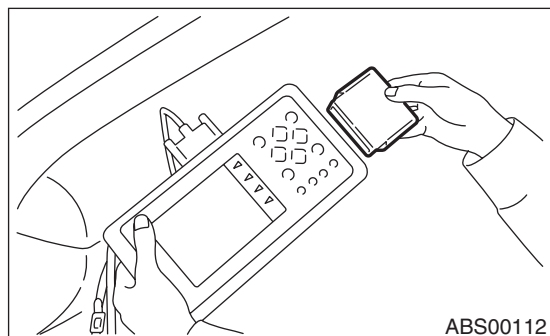
1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare Subaru Select Monitor kit.



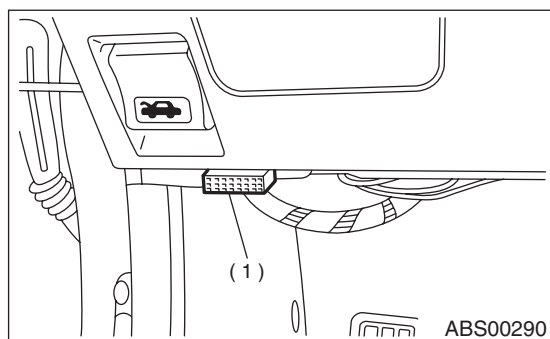
2) Connect diagnosis cable to Subaru Select Monitor.

3) Insert cartridge into Subaru Select Monitor.
<Ref. to ABS-8, SPECIAL TOOLS, PREPARATION TOOL, General Description.>



4) Connect Subaru Select Monitor to data link connector.

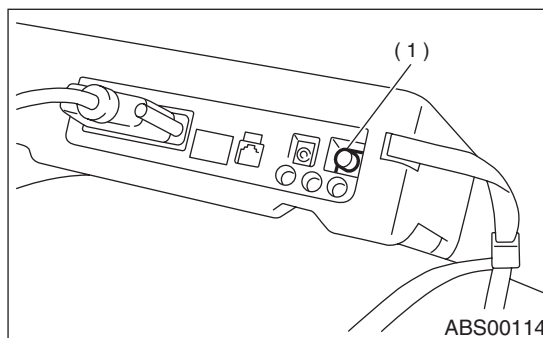
(1) Data link connector located in the lower portion of the instrument panel (on the driver's side).



(1) Data link connector

(2) Connect diagnosis cable to data link connector.

5) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(1) Power switch

6) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.

7) On the «System Selection Menu» display screen, select the {Brake Control System} and press the [YES] key.

8) Press the [YES] key after displayed the information of ABS type.

9) On the «ABS Diagnosis» display screen, select the {Diagnostic Code(s) Display} and press the [YES] key.

10) On the «Diagnostic Code(s) Display» display screen, select the {Current Diagnostic Code(s)} or {History Diagnostic Code(s)} and press the [YES] key.

NOTE:

- For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
- For detailed concerning diagnostic trouble codes, refer to the LIST OF DIAGNOSTICS TROUBLE CODE. <Ref. to ABS-32, List of Diagnostics Trouble Code (DTC).>
- A maximum of 3 DTC are displayed in order of occurrence.
- If a particular DTC is not properly stored in memory (due to a drop in ABSCM&H/U power supply, etc.) when a problem occurs, the DTC, followed by a question mark "?", appears on the select monitor display. This shows it may be an unreliable reading.

Display screen	Contents to be monitored
Latest	The most recent trouble code appears on the select monitor display.
Old	The second most recent trouble code appears on the select monitor display.
Older	The third most recent trouble code appears on the select monitor display.
Reference	The trouble code after the specified time has passed appears on the select monitor display.

2. READ CURRENT DATA

- 1) On the «Main Menu» display screen, select the {Each System Check} and press the «YES» key.
 - 2) On the «System Selection Menu» display screen, select the {Brake Control System} and press the «YES» key.
 - 3) Press the «YES» key after displayed the information of ABS type.
 - 4) On the «Brake Control Diagnosis» display screen, select the {Current Data Display & Save} and press the «YES» key.
 - 5) On the «Data Display Menu» display screen, select the {Data Display} and press the «YES» key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Display screen	Contents to be monitored	Unit of measure
FR Wheel Speed	Wheel speed detected by the Front Right ABS sensor is displayed	km/h or MPH
FL Wheel Speed	Wheel speed detected by the Front Left ABS sensor is displayed	km/h or MPH
RR Wheel Speed	Wheel speed detected by the Rear Right ABS sensor is displayed	km/h or MPH
RL Wheel Speed	Wheel speed detected by the Rear Left ABS sensor is displayed	km/h or MPH
Stop Light Switch	Stop light switch signal	ON or OFF
Stop Light Switch	Stop light switch monitor voltage is displayed.	V
G sensor output Signal	Refers to vehicle acceleration detecting by the analog G sensor. It appears on the select monitor display in volts.	V
Valve Relay Signal	Valve Relay Signal	ON or OFF
Motor Relay Signal	Motor Relay Signal	ON or OFF
ABS Signal to TCM	ABS operation signal from ABS control module to TCM	ON or OFF
ABS Warning Lamp	ON operation of the ABS warning light is displayed.	ON or OFF
Motor Relay Monitor	Operating condition of the motor relay is displayed.	ON or OFF
Valve Relay Monitor	Operating condition of the valve relay is displayed.	ON or OFF
CCM Signal	ABS operation signal from ABS control module to TCM	ON or OFF

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

3. CLEAR MEMORY MODE

- 1) On the «Main Menu» display screen, select the {2. Each System Check} and press the «YES» key.
- 2) On the «System Select Menu» display screen, select {Brake System} and press the «YES» key.
- 3) Press the «YES» key after displayed the information of ABS type.
- 4) On the «Brake Control Diagnosis» display screen, select the {Clear Memory} and press the «YES» key.

Display screen	Contents to be monitored
Clear memory?	Function of clearing trouble code.

- 5) When the “Done” and “turn ignition switch OFF” are shown on the display screen, turn the Subaru Select Monitor and ignition switch to OFF.

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

4. ABS SEQUENCE CONTROL

Display screen	Contents to be monitored	Index No.
ABS sequence control	Perform ABS sequence control by operating valve and pump motor sequentially.	<Ref. to ABS-11, ABS Sequence Control.>

SUBARU SELECT MONITOR

ABS (DIAGNOSTICS)

5. FREEZE FRAME DATA

NOTE:

- Data stored at the time of trouble occurrence is shown on display.
- Each time trouble occurs, the latest information is stored in the freeze frame data in memory.
- If freeze frame data is not properly stored in memory (due to a drop in ABSCM power supply, etc.), a DTC, preceded by a question mark "?", appears on the select monitor display. This shows it may be an unreliable reading.
- In case of no trouble code, the initial value of freeze frame data will be displayed.

Display screen	Contents to be monitored	Initial value
FR wheel speed	Wheel speed detected by the Front Right ABS sensor is displayed in km/h or mile/h.	255 km/h [158 mile/h]
FL wheel speed	Wheel speed detected by the Front Left ABS sensor is displayed in km/h or mile/h.	↑
RR wheel speed	Wheel speed detected by the Rear Right ABS sensor is displayed in km/h or mile/h.	↑
RL wheel speed	Wheel speed detected by the Rear Left ABS sensor is displayed in km/h or mile/h.	↑
ABSCM power voltage	Power (in volts) supplied to ABSCM&H/U appears on the select monitor display.	18 V
G sensor output voltage	Refers to vehicle acceleration detected by the analog G sensor. It appears on the select monitor display in volts.	5 V
Motor relay monitor	Motor relay operation monitor signal	ON
Stop light switch	Stop light switch signal	OFF
ABS signal to TCM	ABS operation signal from ABS control module to TCM	OFF
ABS-AT control	ABS operation signal from ABS control module to TCM	OFF
ABS operation signal	ABS operation signal	ON

6. ANALOG DATA ARE DISPLAYED.

Display screen	Contents to be monitored
FR wheel speed	Wheel speed detected by the Front Right ABS sensor is displayed in km/h or mile/h.
FL wheel speed	Wheel speed detected by the Front Left ABS sensor is displayed in km/h or mile/h.
RR wheel speed	Wheel speed detected by the Rear Right ABS sensor is displayed in km/h or mile/h.
RL wheel speed	Wheel speed detected by the Rear Left ABS sensor is displayed in km/h or mile/h.
Stop light switch	Stop light switch monitor voltage is displayed.
G sensor output voltage	Refers to vehicle acceleration detecting by the analog G sensor. It appears on the select monitor display in volts.

7. ON/OFF DATA ARE DISPLAYED.

Display screen	Contents to be monitored
Stop light switch	Stop light switch signal
Valve relay signal	Valve relay signal
Motor relay signal	Motor relay signal
ABS signal to TCM	ABS operation signal from ABS control module to TCM
ABS warning light	ABS warning light
Valve relay monitor	Valve relay operation monitor signal
Motor relay monitor	Motor relay operation monitor signal
CCM signal	ABS operation signal from ABS control module to TCM

7. Read Diagnostic Trouble Code (DTC)

A: OPERATION

Refer to SUBARU SELECT MONITOR for information about how to obtain and understand diagnostic trouble codes (DTC). <Ref. to ABS-16, Subaru Select Monitor.>

8. Inspection Mode

A: OPERATION

Reproduce the condition under which the problem has occurred as much as possible.

Drive the vehicle at a speed more than 40 km/h (25 MPH) for at least one minute.

9. Clear Memory Mode

A: OPERATION

Refer to SUBARU SELECT MONITOR for information about how to clear diagnostic trouble codes (DTC). <Ref. to ABS-16, Subaru Select Monitor.>

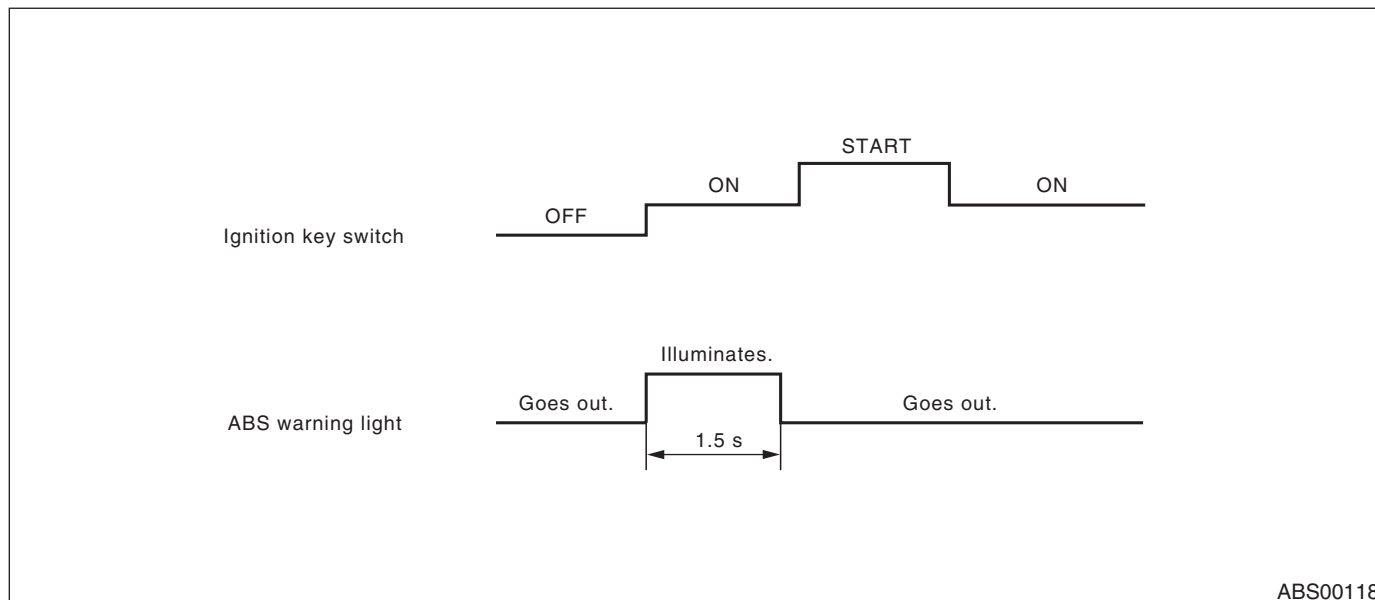
CLEAR MEMORY MODE

ABS (DIAGNOSTICS)

MEMO:

10.ABS Warning Light Illumination Pattern

A: INSPECTION



ABS00118

1) When the ABS warning light does not illuminate in accordance with this illumination pattern, there must be an electrical malfunction.

2) When the ABS warning light remains constantly OFF, repair the ABS warning light circuit or diagnosis circuit. <Ref. to ABS-24, ABS WARNING LIGHT DOES NOT COME ON., ABS Warning Light Illumination Pattern.>

NOTE:

Even though the ABS warning light does not go out 1.5 seconds after it illuminates, the ABS system operates normally when the warning light goes out while driving at approximately 12 km/h (7 MPH). However, the Anti-lock brakes do not work while the ABS warning light is illuminated.

ABS WARNING LIGHT ILLUMINATION PATTERN

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B: ABS WARNING LIGHT DOES NOT COME ON.

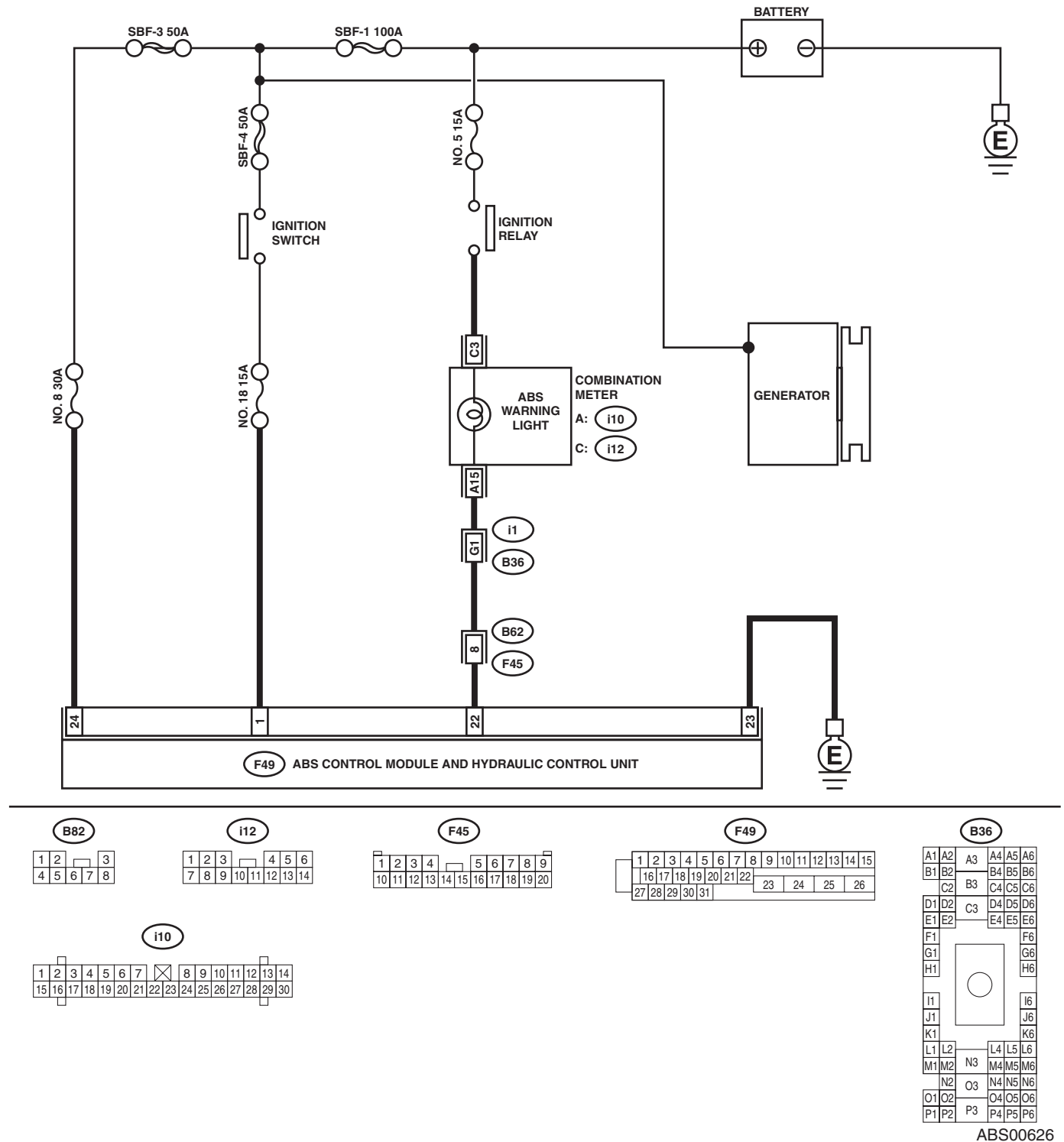
DIAGNOSIS:

- ABS warning light circuit is open or shorted.

TROUBLE SYMPTOM:

- When ignition switch is turned ON (engine OFF), ABS warning light does not come on

WIRING DIAGRAM:



ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK IF OTHER WARNING LIGHTS TURN ON. Turn ignition switch to ON (engine OFF).	Do other warning lights turn on?	Go to step 2.	Repair combination meter. -<Ref. to IDI-12, Combination Meter Assembly.>
2 CHECK ABS WARNING LIGHT BULB. 1) Turn ignition switch to OFF. 2) Remove combination meter. 3) Remove ABS warning light bulb from combination meter.	Is ABS warning light bulb OK?	Go to step 3.	Replace ABS warning light bulb. <Ref. to IDI-12, Combination Meter Assembly.>
3 CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS. 1) Disconnect connector (B62) from connector (F45). 2) Measure voltage between connector (B62) and chassis ground. Connector & terminal (B62) No. 8 (+) — Chassis ground (-):	Is the measured value less than 3 V?	Go to step 4.	Repair warning light harness.
4 CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS. 1) Turn ignition switch to ON. 2) Measure voltage between connector (B62) and chassis ground. Connector & terminal (B62) No. 8 (+) — Chassis ground (-):	Is the measured value less than 3 V?	Go to step 5.	Repair warning light harness.
5 CHECK WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Install ABS warning light bulb from combination meter. 3) Install combination meter. 4) Turn ignition switch to ON. 5) Measure voltage between connector (B62) and chassis ground. Connector & terminal (B62) No. 8 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 6.	Repair wiring harness.
6 CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS. 1) Turn ignition switch to OFF. 2) Measure voltage between connector (F45) and chassis ground. Connector & terminal (F45) No. 8 (+) — Chassis ground (-):	Is the measured value less than 3 V?	Go to step 7.	Repair wiring harness.
7 CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS. 1) Turn ignition switch to ON. 2) Measure voltage between connector (F45) and chassis ground. Connector & terminal (F45) No. 8 (+) — Chassis ground (-):	Is the measured value less than 3 V?	Go to step 8.	Repair wiring harness.
8 CHECK GROUND CIRCUIT OF ABSCM&H/U. Measure resistance between ABSCM&H/U and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω?	Go to step 9.	Repair ABSCM&H/U ground harness.
9 CHECK WIRING HARNESS. Measure resistance between connector (F45) and chassis ground. Connector & terminal (F45) No. 8 — Chassis ground:	Is the measured value less than 0.5 Ω?	Go to step 10.	Repair harness/connector.

ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connectors between combination meter and ABSCM&H/U?	Repair connector.	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

MEMO:

ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

C: ABS WARNING LIGHT DOES NOT GO OFF.

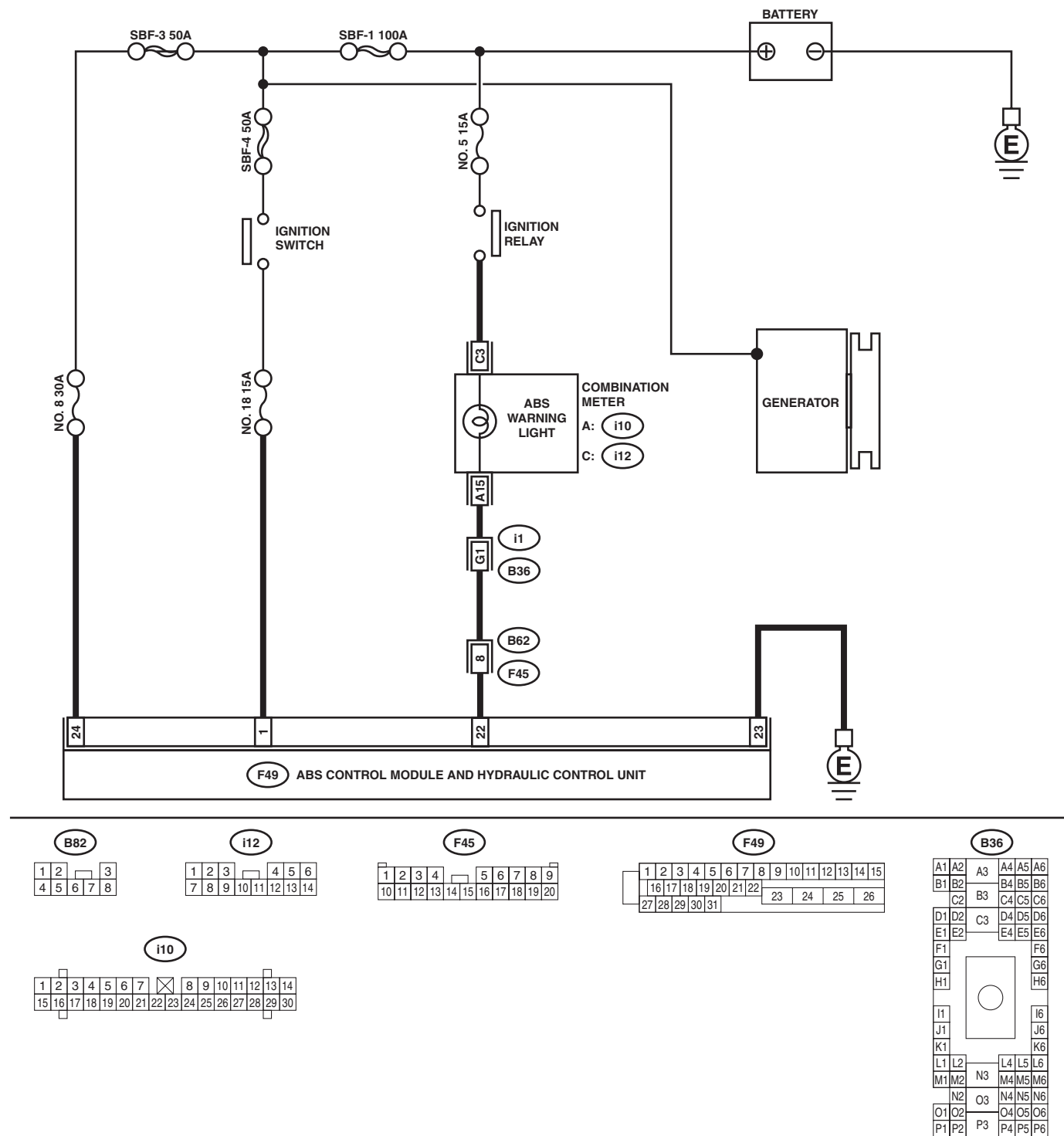
DIAGNOSIS:

- ABS warning light circuit is open or shorted.

TROUBLE SYMPTOM:

- When starting the engine and while ABS warning light is kept ON.

WIRING DIAGRAM:



ABS00626

ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INSTALLATION OF ABSCM&H/U CONNECTOR. Turn ignition switch to OFF.	Is ABSCM&H/U connector inserted into ABSCM until the clamp locks onto it?	Go to step 2.	Insert ABSCM&H/U connector into ABSCM&H/U until the clamp locks onto it.
2 CHECK DIAGNOSIS TERMINAL. Measure resistance between diagnosis terminals (B81) and chassis ground. Terminals Diagnosis terminal (A) — Chassis ground: Diagnosis terminal (B) — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 3.	Repair diagnosis terminal harness.
3 CHECK DIAGNOSIS LINE. 1) Turn ignition switch to OFF. 2) Connect diagnosis terminal (B81) to diagnosis connector (B82) No. 8. 3) Disconnect connector from ABSCM&H/U. 4) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 4 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 4.	Repair harness connector between ABSCM&H/U and diagnosis connector.
4 CHECK GENERATOR. 1) Start the engine. 2) Idle the engine. 3) Measure voltage between generator and chassis ground. Terminal Generator B terminal (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 5.	Repair generator. <Ref. to SC(H4SO)-15, Generator.>
5 CHECK BATTERY TERMINAL. Turn ignition switch to OFF.	Is there poor contact at battery terminal?	Repair battery terminal.	Go to step 6.
6 CHECK POWER SUPPLY OF ABSCM. 1) Disconnect connector from ABSCM&H/U. 2) Start engine. 3) Idle the engine. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 7.	Repair ABSCM&H/U power supply circuit.
7 CHECK WIRING HARNESS. 1) Disconnect connector (F45) from connector (B62). 2) Turn ignition switch to ON.	Does the ABS warning light turn on?	Repair front wiring harness.	Go to step 8.
8 CHECK ABSCM&H/U TERMINAL. 1) Turn ignition switch to OFF. 2) Check for damage at the ABSCM&H/U terminal.	Is there any damage on terminal?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 9.
9 CHECK ABSCM&H/U. Measure resistance between ABSCM&H/U terminals. Terminal No. 22 — No. 23:	Is the measured value more than 1 M Ω ?	Go to step 10.	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK WIRING HARNESS. Measure resistance between connector (F45) and chassis ground. Connector & terminal (F45) No. 8 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 11.	Repair harness.
11 CHECK WIRING HARNESS. 1) Connect connector to ABSCM&H/U. 2) Measure resistance between connector (F45) and chassis ground. Connector & terminal (F45) No. 8 — Chassis ground:	Is the measured value more than 1 M Ω ?	Go to step 12.	Repair harness.
12 CHECK POOR CONTACT IN ABSCM&H/U CONNECTOR.	Is there poor contact in ABSCM&H/U connector?	Repair connector.	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

ABS WARNING LIGHT ILLUMINATION PATTERN

ABS (DIAGNOSTICS)

MEMO:

LIST OF DIAGNOSTICS TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

11.List of Diagnostics Trouble Code (DTC)

A: LIST

DTC No.	Display screen	Contents of diagnosis	Index No.
—	Communication for initializing impossible	Select monitor communication failure	<Ref. to ABS-34, COMMUNICATION WITH SUBARU SELECT MONITOR IS IMPOSSIBLE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
—	No trouble code	Although no diagnostic trouble code appears on the select monitor display, the ABS warning light remains on.	<Ref. to ABS-38, NO TROUBLE CODE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	Open or short circuit in front right ABS sensor circuit	Open or short circuit in front right ABS sensor circuit	<Ref. to ABS-41, DTC 21 OPEN OR SHORT CIRCUIT IN FRONT RIGHT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	Front right ABS sensor abnormal signal	Front right ABS sensor abnormal signal	<Ref. to ABS-47, DTC 22 FRONT RIGHT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	Open or short circuit in front left ABS sensor circuit	Open or short circuit in front left ABS sensor circuit	<Ref. to ABS-41, DTC 23 OPEN OR SHORT CIRCUIT IN FRONT LEFT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	Front left ABS sensor abnormal signal	Front left ABS sensor abnormal signal	<Ref. to ABS-47, DTC 24 FRONT LEFT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25	Open or short circuit in rear right ABS sensor circuit	Open or short circuit in rear right ABS sensor circuit	<Ref. to ABS-41, DTC 25 OPEN OR SHORT CIRCUIT IN REAR RIGHT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
26	Rear right ABS sensor abnormal signal	Rear right ABS sensor abnormal signal	<Ref. to ABS-47, DTC 26 REAR RIGHT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
27	Open or short circuit in rear left ABS sensor circuit	Open or short circuit in rear left ABS sensor circuit	<Ref. to ABS-42, DTC 27 OPEN OR SHORT CIRCUIT IN REAR LEFT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
28	Rear left ABS sensor abnormal signal	Rear left ABS sensor abnormal signal	<Ref. to ABS-48, DTC 28 REAR LEFT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
29	Abnormal ABS sensor signal on any one of four sensor	Abnormal ABS sensor signal on any one of four	<Ref. to ABS-54, DTC 29 ABNORMAL ABS SENSOR SIGNAL ON ANY ONE OF FOUR SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
31	Front right inlet valve malfunction	Front right inlet valve malfunction	<Ref. to ABS-57, DTC 31 FRONT RIGHT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
32	Front right outlet valve malfunction	Front right outlet valve malfunction	<Ref. to ABS-60, DTC 32 FRONT RIGHT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
33	Front left inlet valve malfunction	Front left inlet valve malfunction	<Ref. to ABS-57, DTC 33 FRONT LEFT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
34	Front left outlet valve malfunction	Front left outlet valve malfunction	<Ref. to ABS-60, DTC 34 FRONT LEFT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
35	Rear right inlet valve malfunction	Rear right inlet valve malfunction	<Ref. to ABS-57, DTC 35 REAR RIGHT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
36	Rear right outlet valve malfunction	Rear right outlet valve malfunction	<Ref. to ABS-60, DTC 36 REAR RIGHT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTICS TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

DTC No.	Display screen	Contents of diagnosis	Index No.
37	Rear left inlet valve malfunction	Rear left inlet valve malfunction	<Ref. to ABS-58, DTC 37 REAR LEFT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
38	Rear left outlet valve malfunction	Rear left outlet valve malfunction	<Ref. to ABS-62, DTC 38 REAR LEFT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
41	ABS control module malfunction	ABS control module and hydraulic control unit malfunction	<Ref. to ABS-64, DTC 41 ABS CONTROL MODULE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
42	Power supply voltage too low	Power supply voltage too low	<Ref. to ABS-66, DTC 42 POWER SUPPLY VOLTAGE TOO LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
42	Power supply voltage too high	Power supply voltage too high	<Ref. to ABS-68, DTC 42 POWER SUPPLY VOLTAGE TOO HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
44	ABS-AT control (Non Controlled)	ABS-AT control (Non Controlled)	<Ref. to ABS-70, DTC 44 ABS-AT CONTROL (NON CONTROLLED), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
44	ABS-AT control (Controlled)	ABS-AT control (Controlled)	<Ref. to ABS-72, DTC 44 ABS-AT CONTROL (CONTROLLED), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
51	Valve relay malfunction	Valve relay malfunction	<Ref. to ABS-74, DTC 51 VALVE RELAY MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
51	Valve relay ON failure	Valve relay ON failure	<Ref. to ABS-76, DTC 51 VALVE RELAY ON FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
52	Open circuit in motor relay circuit	Open circuit in motor relay circuit	<Ref. to ABS-78, DTC 52 OPEN CIRCUIT IN MOTOR RELAY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
52	Motor relay ON failure	Motor relay ON failure	<Ref. to ABS-80, DTC 52 MOTOR RELAY ON FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
52	Motor malfunction	Motor malfunction	<Ref. to ABS-82, DTC 52 MOTOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
54	Stop light switch signal circuit malfunction	Stop light switch signal circuit malfunction	<Ref. to ABS-84, DTC 54 STOP LIGHT SWITCH SIGNAL CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
56	Open or short circuit in G sensor circuit	Open or short circuit in G sensor circuit	<Ref. to ABS-86, DTC 56 OPEN OR SHORT CIRCUIT IN G SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
56	Battery short in G sensor circuit	Battery short in G sensor circuit	<Ref. to ABS-90, DTC 56 BATTERY SHORT IN G SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
56	Abnormal G sensor high μ output	Abnormal G sensor high μ output	<Ref. to ABS-94, DTC 56 ABNORMAL G SENSOR HIGH μ OUTPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
56	Detection of G sensor stick	Detection of G sensor stick	<Ref. to ABS-98, DTC 56 DETECTION OF G SENSOR STICK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

12.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: COMMUNICATION WITH SUBARU SELECT MONITOR IS IMPOSSIBLE

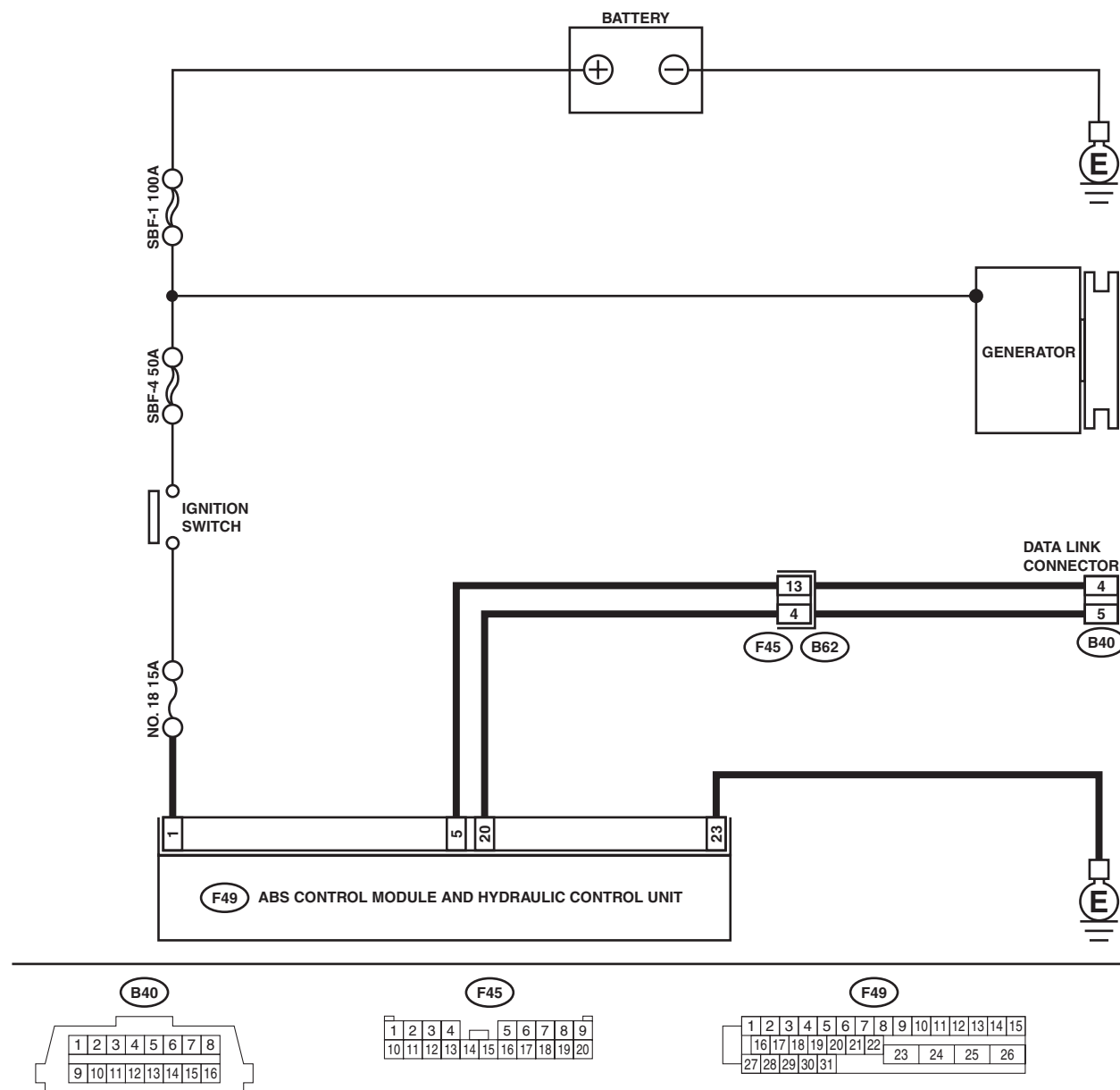
DIAGNOSIS:

- Faulty harness connector

TROUBLE SYMPTOM:

- ABS cannot communicate with Subaru Select Monitor.

WIRING DIAGRAM:



ABS00631

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK IGNITION SWITCH.	Is ignition switch to ON?	Go to step 2.	Turn ignition switch to ON, and select ABS mode using the select monitor.
2 CHECK BATTERY. 1) Turn ignition switch to OFF. 2) Measure battery voltage.	Is the measured value more than 11 V?	Go to step 3.	Charge or replace battery.
3 CHECK BATTERY TERMINAL.	Is there poor contact at battery terminal?	Repair or tighten battery terminal.	Go to step 4.
4 CHECK COMMUNICATION OF SELECT MONITOR. 1) Turn ignition switch to ON. 2) Using the select monitor, check whether communication to other systems can be executed normally.	Are the name and year of the system displayed on the select monitor?	Go to step 7.	Go to step 5.
5 CHECK COMMUNICATION OF SELECT MONITOR. 1) Turn ignition switch to OFF. 2) Disconnect ABSCM&H/U connector. 3) Check whether communication to other systems can be executed normally.	Are the name and year of the system displayed on the select monitor?	Go to step 7.	Go to step 6.
6 CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect ABSCM&H/U, cruise control module and immobilizer control module connectors. 3) Measure resistance between data link connector and chassis ground. Connector & terminal (B40) No. 5 — Chassis ground: (B40) No. 4 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 7.	Repair harness and connector between each control module and data link connector.
7 CHECK OUTPUT SIGNAL FOR ABSCM&H/U. 1) Turn ignition switch to ON. 2) Measure voltage between data link connector and chassis ground. Connector & terminal (B40) No. 5 (+) — Chassis ground (-): (B40) No. 4 (+) — Chassis ground (-):	Is the measured value more than 1 V?	Repair harness and connector between each control module and data link connector.	Go to step 8.
8 CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND DATA LINK CONNECTOR. Measure resistance between ABSCM&H/U connector and data link connector. Connector & terminal (F49) No. 20 — (B40) No. 5: (F49) No. 5 — (B40) No. 4:	Is the measured value less than 0.5 Ω?	Repair harness and connector between ABSCM&H/U and data link connector.	Go to step 9.
9 CHECK INSTALLATION OF ABSCM&H/U CONNECTOR. Turn ignition switch to OFF.	Is ABSCM&H/U connector inserted into ABSCM&H/U until the clamp locks onto it?	Go to step 10.	Insert ABSCM&H/U connector into ABSCM&H/U.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK POWER SUPPLY CIRCUIT. 1) Turn ignition switch to ON (engine OFF). 2) Measure ignition power supply voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 11.	Repair open circuit in harness between ABSCM&H/U and battery.
11 CHECK HARNESS CONNECTOR BETWEEN ABSCM&H/U AND CHASSIS GROUND. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U and transmission. 3) Measure resistance of harness between ABSCM&H/U and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 12.	Repair open circuit in harness between ABSCM&H/U and inhibitor side connector, and poor contact in coupling connector.
12 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in control module power supply, ground line and data link connector?	Repair connector.	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

B: NO TROUBLE CODE

DIAGNOSIS:

- ABS warning light circuit is shorted.

TROUBLE SYMPTOM:

- ABS warning light remains on.
- NO TROUBLE CODE displayed on the select monitor.

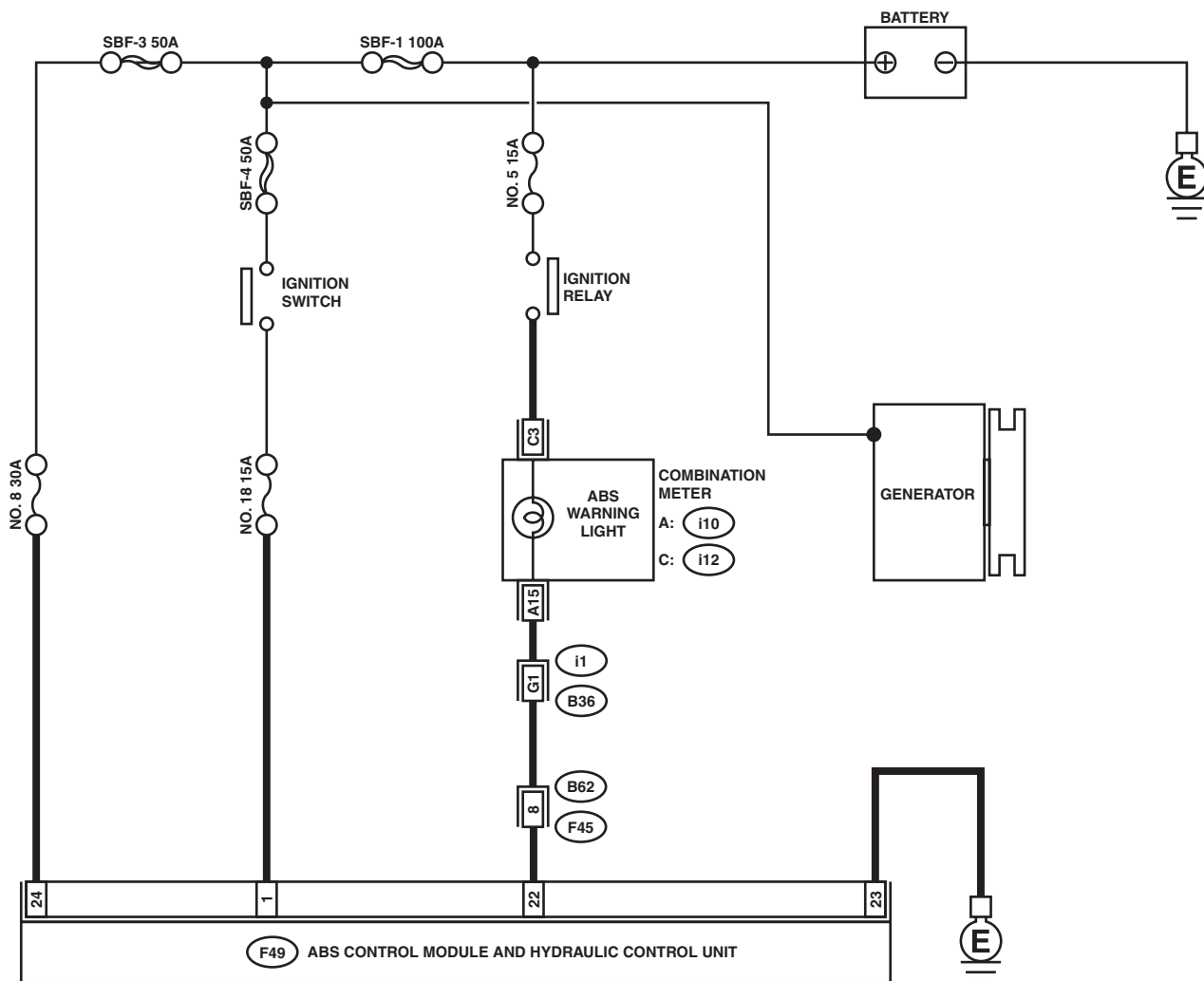
NOTE:

When the ABS warning light is OFF and “NO TROUBLE CODE” is displayed on the select monitor, the system is in normal condition.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

WIRING DIAGRAM:



B82

1	2	3
4	5	6

i12

1	2	3	4	5	6
7	8	9	10	11	12

F45

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	16	17	18	19	20	21	22								
	27	28	29	30	31										

i10

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28

B36

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6
E1	E2	E3	E4	E5	E6
F1	F2	F3	F4	F5	F6
G1	G2	G3	G4	G5	G6
H1	H2	H3	H4	H5	H6
I1	I2	I3	I4	I5	I6
J1	J2	J3	J4	J5	J6
K1	K2	K3	K4	K5	K6
L1	L2	L3	L4	L5	L6
M1	M2	M3	M4	M5	M6
N1	N2	N3	N4	N5	N6
O1	O2	O3	O4	O5	O6
P1	P2	P3	P4	P5	P6

ABS00626

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector (F45) from connector (B62). 3) Turn ignition switch to ON.	Does the ABS warning light turn on?	Repair harness.	Go to step 2.
2 CHECK PROJECTION AT ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Check for broken projection at the ABSCM&H/U terminal.	Is there any damage on ABSCM&HU terminal?	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 3.
3 CHECK ABSCM&H/U. Measure resistance between ABSCM&H/U terminals. Terminals No. 22 — No. 23:	Is the measured value more than 1 MΩ?	Go to step 4.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
4 CHECK WIRING HARNESS. Measure resistance between connectors (F45) and (F49). Connector & terminal (F45) No. 8 — (F49) No. 22:	Is the measured value less than 0.5 Ω?	Go to step 5.	Repair harness.
5 CHECK WIRING HARNESS. 1) Connect connector to ABSCM&H/U. 2) Measure resistance between connector (F45) and chassis ground. Connector & terminal (F45) No. 8 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 6.	Repair harness.
6 CHECK POOR CONTACT IN ABSCM&H/U CONNECTOR.	Is there poor contact in ABSCM&H/U connector?	Repair connector.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

C: DTC 21 OPEN OR SHORT CIRCUIT IN FRONT RIGHT ABS SENSOR CIRCUIT

NOTE:

For the diagnostic procedure, refer to DTC 27. <Ref. to ABS-42, DTC 27 OPEN OR SHORT CIRCUIT IN REAR LEFT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

D: DTC 23 OPEN OR SHORT CIRCUIT IN FRONT LEFT ABS SENSOR CIRCUIT

NOTE:

For the diagnostic procedure, refer to DTC 27. <Ref. to ABS-42, DTC 27 OPEN OR SHORT CIRCUIT IN REAR LEFT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

E: DTC 25 OPEN OR SHORT CIRCUIT IN REAR RIGHT ABS SENSOR CIRCUIT

NOTE:

For the diagnostic procedure, refer to DTC 27. <Ref. to ABS-42, DTC 27 OPEN OR SHORT CIRCUIT IN REAR LEFT ABS SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

F: DTC 27 OPEN OR SHORT CIRCUIT IN REAR LEFT ABS SENSOR CIRCUIT

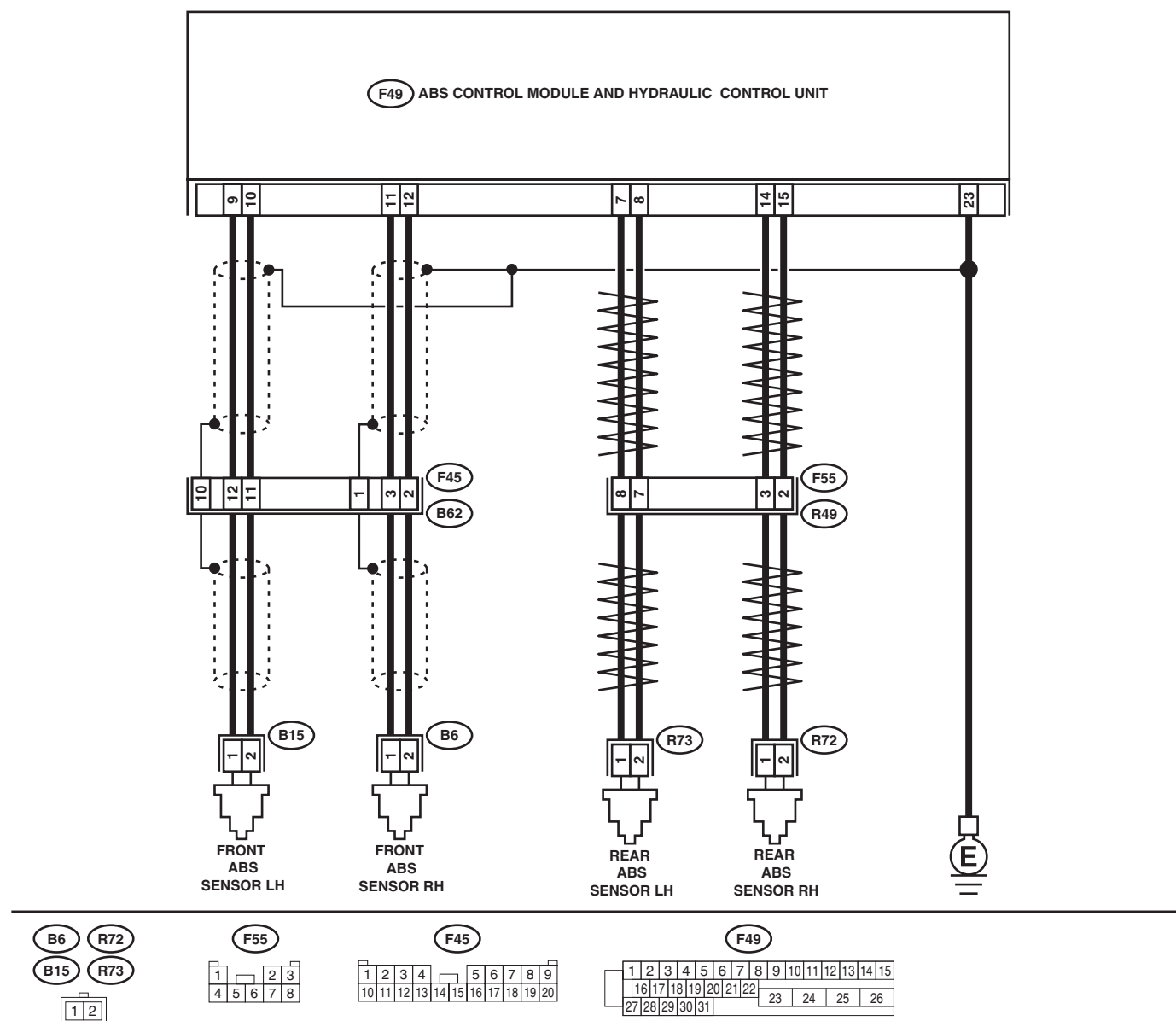
DIAGNOSIS:

- Faulty ABS sensor (Broken wire, input voltage too high)
- Faulty harness connector

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00627

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT OF ABS SENSOR USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Read the ABS sensor output corresponding to the faulty system in the select monitor data display mode.	Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?	Go to step 2.	Go to step 8.
2 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connectors between ABSCM&H/U and ABS sensor?	Repair connector.	Go to step 3.
3 CHECK INSTALLATION OF ABS SENSOR.	Are the ABS sensor installation bolts tightened to 33 N·m (3.4 kgf-m, 25 ft-lb)?	Go to step 4.	Tighten ABS sensor installation bolts securely.
4 CHECK ABS SENSOR GAP. Measure tone wheel to ABS sensor piece gap over entire perimeter of the wheel. Is the measured value within the specified range?	Is the measured value within the range indicated below? Front wheel 0.3 — 0.8 mm (0.012 — 0.031 in) and Rear wheel 0.44 — 0.94 mm (0.0173 — 0.0370 in)	Go to step 5.	Adjust the gap. NOTE: Adjust the gap using spacers (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.
5 CHECK TONE WHEEL RUNOUT. Measure tone wheel runout.	Is the measured value less than 0.05 mm (0.0020 in)?	Go to step 6.	Replace tone wheel. Front: <Ref. to ABS-21, Front Tone Wheel.> Rear: <Ref. to ABS-22, Rear Tone Wheel.>
6 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
7 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact. NOTE: Check harness and connectors between ABSCM&H/U and ABS sensor.
8 CHECK ABS SENSOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABS sensor. 3) Measure resistance of ABS sensor connector terminals. Terminal Front RH No. 1 — No. 2: Front LH No. 1 — No. 2: Rear RH No. 1 — No. 2: Rear LH No. 1 — No. 2:	Is the measured value within 1 to 1.5 kΩ?	Go to step 9.	Replace ABS sensor. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
9 CHECK BATTERY SHORT OF ABS SENSOR. 1) Disconnect connector from ABSCM&H/U. 2) Measure voltage between ABS sensor and chassis ground. Terminal <i>Front RH No. 1 (+) — Chassis ground (–):</i> <i>Front LH No. 1 (+) — Chassis ground (–):</i> <i>Rear RH No. 1 (+) — Chassis ground (–):</i> <i>Rear LH No. 1 (+) — Chassis ground (–):</i>	Is the measured value less than 1 V?	Go to step 10.	Replace ABS sensor. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.>
10 CHECK BATTERY SHORT OF ABS SENSOR. 1) Turn ignition switch to ON. 2) Measure voltage between ABS sensor and chassis ground. Terminal <i>Front RH No. 1 (+) — Chassis ground (–):</i> <i>Front LH No. 1 (+) — Chassis ground (–):</i> <i>Rear RH No. 1 (+) — Chassis ground (–):</i> <i>Rear LH No. 1 (+) — Chassis ground (–):</i>	Is the measured value less than 1 V?	Go to step 11.	Replace ABS sensor. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.>
11 CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND ABS SENSOR. 1) Turn ignition switch to OFF. 2) Connect connector to ABS sensor. 3) Measure resistance between ABSCM&H/U connector terminals. Connector & terminal <i>DTC 21 / (F49) No. 11 — No. 12:</i> <i>DTC 23 / (F49) No. 9 — No. 10:</i> <i>DTC 25 / (F49) No. 14 — No. 15:</i> <i>DTC 27 / (F49) No. 7 — No. 8:</i>	Is the measured value within 1 to 1.5 kΩ?	Go to step 12.	Repair harness/connector between ABSCM&H/U and ABS sensor.
12 CHECK BATTERY SHORT OF HARNESS. Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal <i>DTC 21 / (F49) No. 11 (+) — Chassis ground (–):</i> <i>DTC 23 / (F49) No. 9 (+) — Chassis ground (–):</i> <i>DTC 25 / (F49) No. 14 (+) — Chassis ground (–):</i> <i>DTC 27 / (F49) No. 7 (+) — Chassis ground (–):</i>	Is the measured value less than 1 V?	Go to step 13.	Repair harness between ABSCM&H/U and ABS sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
13 CHECK BATTERY SHORT OF HARNESS. 1) Turn ignition switch to ON. 2) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal <i>DTC 21 / (F49) No. 11 (+) — Chassis ground (-):</i> <i>DTC 23 / (F49) No. 9 (+) — Chassis ground (-):</i> <i>DTC 25 / (F49) No. 14 (+) — Chassis ground (-):</i> <i>DTC 27 / (F49) No. 7 (+) — Chassis ground (-):</i>	Is the measured value less than 1 V?	Go to step 14.	Repair harness between ABSCM&H/U and ABS sensor.
14 CHECK INSTALLATION OF ABS SENSOR.	Are the ABS sensor installation bolts tightened to 33 N·m (3.4 kgf-m, 25 ft-lb)?	Go to step 15.	Tighten ABS sensor installation bolts securely.
15 CHECK ABS SENSOR GAP. Measure tone wheel to ABS sensor piece gap over entire perimeter of the wheel.	Is the measured value within the range indicated below? Front wheel 0.3 — 0.8 mm (0.012 — 0.031 in) and Rear wheel 0.44 — 0.94 mm (0.0173 — 0.0370 in)	Go to step 16.	Adjust the gap. NOTE: Adjust the gap using spacers (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.
16 CHECK TONE WHEEL RUNOUT. Measure tone wheel runout.	Is the measured value less than 0.05 mm (0.0020 in)?	Go to step 17.	Replace tone wheel. Front: <Ref. to ABS-21, Front Tone Wheel.> Rear: <Ref. to ABS-22, Rear Tone Wheel.>
17 CHECK GROUND SHORT OF ABS SENSOR. 1) Turn ignition switch to ON. 2) Measure resistance between ABS sensor and chassis ground. Terminal <i>Front RH No. 1 — Chassis ground:</i> <i>Front LH No. 1 — Chassis ground:</i> <i>Rear RH No. 1 — Chassis ground:</i> <i>Rear LH No. 1 — Chassis ground:</i>	Is the measured value more than 1 MΩ?	Go to step 18.	Replace ABS sensor and ABSCM only. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.> and <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
18 CHECK GROUND SHORT OF HARNESS. 1) Turn ignition switch to OFF. 2) Connect connector to ABS sensor. 3) Measure resistance between ABSCM&H/U connector terminal and chassis ground. Connector & terminal <i>DTC 21 / (F49) No. 11 — Chassis ground:</i> <i>DTC 23 / (F49) No. 9 — Chassis ground:</i> <i>DTC 25 / (F49) No. 14 — Chassis ground:</i> <i>DTC 27 / (F49) No. 7 — Chassis ground:</i>	Is the measured value more than 1 MΩ?	Go to step 19.	Repair harness between ABSCM&H/U and ABS sensor. And replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
19 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between ABSCM&H/U and ABS sensor?	Repair connector.	Go to step 20.
20 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only.	Go to step 21.
21 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact. NOTE: Check harness and connectors between AB-SCM&H/U and ABS sensor.

G: DTC 22 FRONT RIGHT ABNORMAL ABS SENSOR SIGNAL

NOTE:

For the diagnostic procedure, refer to DTC 28. <Ref. to ABS-48, DTC 28 REAR LEFT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

H: DTC 24 FRONT LEFT ABNORMAL ABS SENSOR SIGNAL

NOTE:

For the diagnostic procedure, refer to DTC 28. <Ref. to ABS-48, DTC 28 REAR LEFT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

I: DTC 26 REAR RIGHT ABNORMAL ABS SENSOR SIGNAL

NOTE:

For the diagnostic procedure, refer to DTC 28. <Ref. to ABS-48, DTC 28 REAR LEFT ABNORMAL ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

J: DTC 28 REAR LEFT ABNORMAL ABS SENSOR SIGNAL

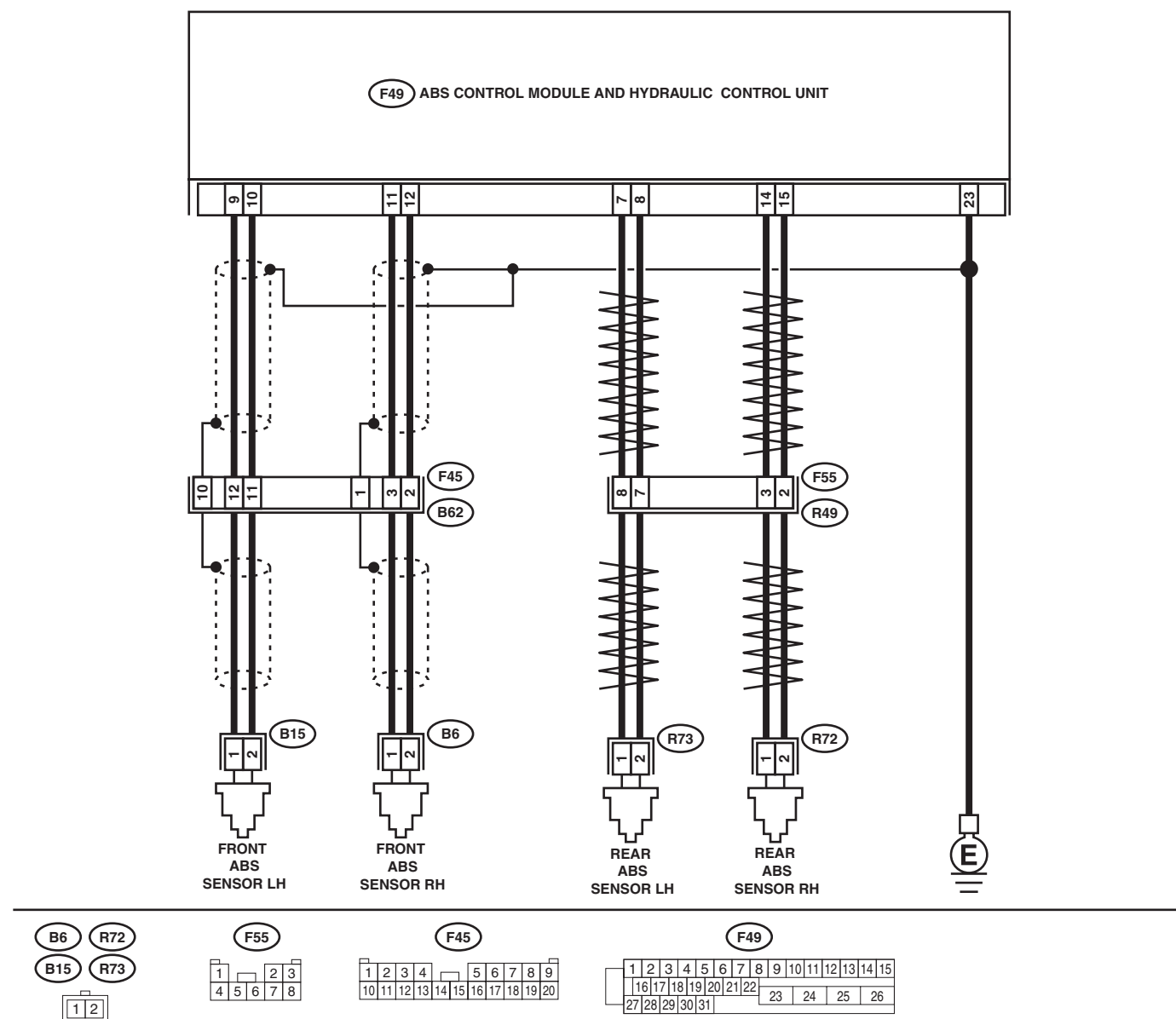
DIAGNOSIS:

- Faulty ABS sensor signal (noise, irregular signal, etc.)
- Faulty harness/connector

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00627

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1	CHECK OUTPUT OF ABS SENSOR USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Read the ABS sensor output corresponding to the faulty system in the select monitor data display mode.	Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?	Go to step 2. Go to step 8.
2	CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connectors between ABSCM&H/U and ABS sensor?	Repair connector. Go to step 3.
3	CHECK SOURCES OF SIGNAL NOISE.	Is the car telephone or the wireless transmitter properly installed?	Go to step 4. Properly install the car telephone or the wireless transmitter.
4	CHECK SOURCES OF SIGNAL NOISE.	Are noise sources (such as an antenna) installed near the sensor harness?	Install the noise sources apart from the sensor harness. Go to step 5.
5	CHECK SHIELD CIRCUIT. 1) Turn ignition switch to OFF. 2) Connect all connectors. 3) Measure resistance between shield connector and chassis ground. Connector & terminal DTC 22 / (B62) No. 1 — Chassis ground: DTC 24 / (B62) No. 10 — Chassis ground: NOTE: For the DTC 26 and 28 : Go to step 6.	Is the measured value less than 0.5 Ω?	Go to step 6. Repair shield harness.
6	CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).> Go to step 7.
7	CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC. A temporary noise interference.
8	CHECK INSTALLATION OF ABS SENSOR.	Are the ABS sensor installation bolts tightened to 33 N·m (3.4 kgf-m, 25 ft-lb)?	Go to step 9. Tighten ABS sensor installation bolts securely.
9	CHECK ABS SENSOR GAP. Measure tone wheel to ABS sensor piece gap over entire perimeter of the wheel.	Is the measured value within the range indicated below? Front wheel 0.3 — 0.8 mm (0.012 — 0.031 in) and Rear wheel 0.44 — 0.94 mm (0.0173 — 0.0370 in)	Go to step 10. Adjust the gap. NOTE: Adjust the gap using spacer (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.
10	PREPARE OSCILLOSCOPE.	Is an oscilloscope available?	Go to step 11. Go to step 12.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
11 CHECK ABS SENSOR SIGNAL. 1) Lift-up the vehicle. 2) Turn ignition switch to OFF. 3) Connect the oscilloscope to the connector. 4) Turn ignition switch to ON. 5) Rotate wheels and measure voltage at specified frequency. <Ref. to ABS-15, WAVEFORM, Control Module I/O Signal.> NOTE: When this inspection is completed, the ABS-CM&H/U sometimes stores the trouble code 29. Connector & terminal DTC 22 / (F45) No. 3 (+) — No. 2 (-): DTC 24 / (F45) No. 12 (+) — No. 11 (-): DTC 26 / (F55) No. 3 (+) — No. 2 (-): DTC 28 / (F55) No. 8 (+) — No. 7 (-):	Is the oscilloscope pattern the same as that shown in the figure?	Go to step 15.	Go to step 12.
12 CHECK CONTAMINATION OF ABS SENSOR OR TONE WHEEL. Remove disc rotor from hub in accordance with diagnostic trouble code.	Is the ABS sensor piece or the tone wheel contaminated by mud or other foreign matter?	Thoroughly remove dirt or other foreign matter.	Go to step 13.
13 CHECK DAMAGE OF ABS SENSOR OR TONE WHEEL.	Are there broken or damaged in the ABS sensor piece or the tone wheel?	Replace ABS sensor or tone wheel. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.> and Front: <Ref. to ABS-21, Front Tone Wheel.> Rear: <Ref. to ABS-22, Rear Tone Wheel.>	Go to step 14.
14 CHECK TONE WHEEL RUNOUT. Measure tone wheel runout.	Is the measured value less than 0.05 mm (0.0020 in)?	Go to step 15.	Replace tone wheel. Front: <Ref. to ABS-21, Front Tone Wheel.> Rear: <Ref. to ABS-22, Rear Tone Wheel.>
15 CHECK RESISTANCE OF ABS SENSOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABS sensor. 3) Measure resistance between ABS sensor connector terminals. Terminal Front RH No. 1 — No. 2: Front LH No. 1 — No. 2: Rear RH No. 1 — No. 2: Rear LH No. 1 — No. 2:	Is the measured value within 1 to 1.5 kΩ?	Go to step 16.	Replace ABS sensor. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
16 CHECK GROUND SHORT OF ABS SENSOR. Measure resistance between ABS sensor and chassis ground. Terminal Front RH No. 1 — Chassis ground: Front LH No. 1 — Chassis ground: Rear RH No. 1 — Chassis ground: Rear LH No. 1 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 17.	Replace ABS sensor. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.>
17 CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND ABS SENSOR. 1) Connect connector to ABS sensor. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance at ABSCM&H/U connector terminals. Connector & terminal DTC 22 / (F49) No. 11 — No. 12: DTC 24 / (F49) No. 9 — No. 10: DTC 26 / (F49) No. 14 — No. 15: DTC 28 / (F49) No. 7 — No. 8:	Is the measured value within 1 to 1.5 kΩ?	Go to step 18.	Repair harness/connector between ABSCM&H/U and ABS sensor.
18 CHECK GROUND SHORT OF HARNESS. Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal DTC 22 / (F49) No. 11 — Chassis ground: DTC 24 / (F49) No. 9 — Chassis ground: DTC 26 / (F49) No. 14 — Chassis ground: DTC 28 / (F49) No. 7 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 19.	Repair harness/connector between ABSCM&H/U and ABS sensor.
19 CHECK GROUND CIRCUIT OF ABSCM&H/U. Measure resistance between ABSCM&H/U and chassis ground. Connector & terminal (F49) No. 23 — GND:	Is the measured value less than 0.5 Ω?	Go to step 20.	Repair ABSCM&H/U ground harness.
20 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between ABSCM&H/U and ABS sensor?	Repair connector.	Go to step 21.
21 CHECK SOURCES OF SIGNAL NOISE.	Is the car telephone or the wireless transmitter properly installed?	Go to step 22.	Properly install the car telephone or the wireless transmitter.
22 CHECK SOURCES OF SIGNAL NOISE.	Are noise sources (such as an antenna) installed near the sensor harness?	Install the noise sources apart from the sensor harness.	Go to step 23.
23 CHECK SHIELD CIRCUIT. 1) Connect all connectors. 2) Measure resistance between shield connector and chassis ground. Connector & terminal DTC 22 / (B62) No. 1 — Chassis ground: DTC 24 / (B62) No. 10 — Chassis ground: NOTE: For the DTC 26 and 28: Go to step 24.	Is the measured value less than 0.5 Ω?	Go to step 24.	Repair shield harness.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step		Check	Yes	No
24	CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 25.
25	CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary noise interference.

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

K: DTC 29 ABNORMAL ABS SENSOR SIGNAL ON ANY ONE OF FOUR SENSOR

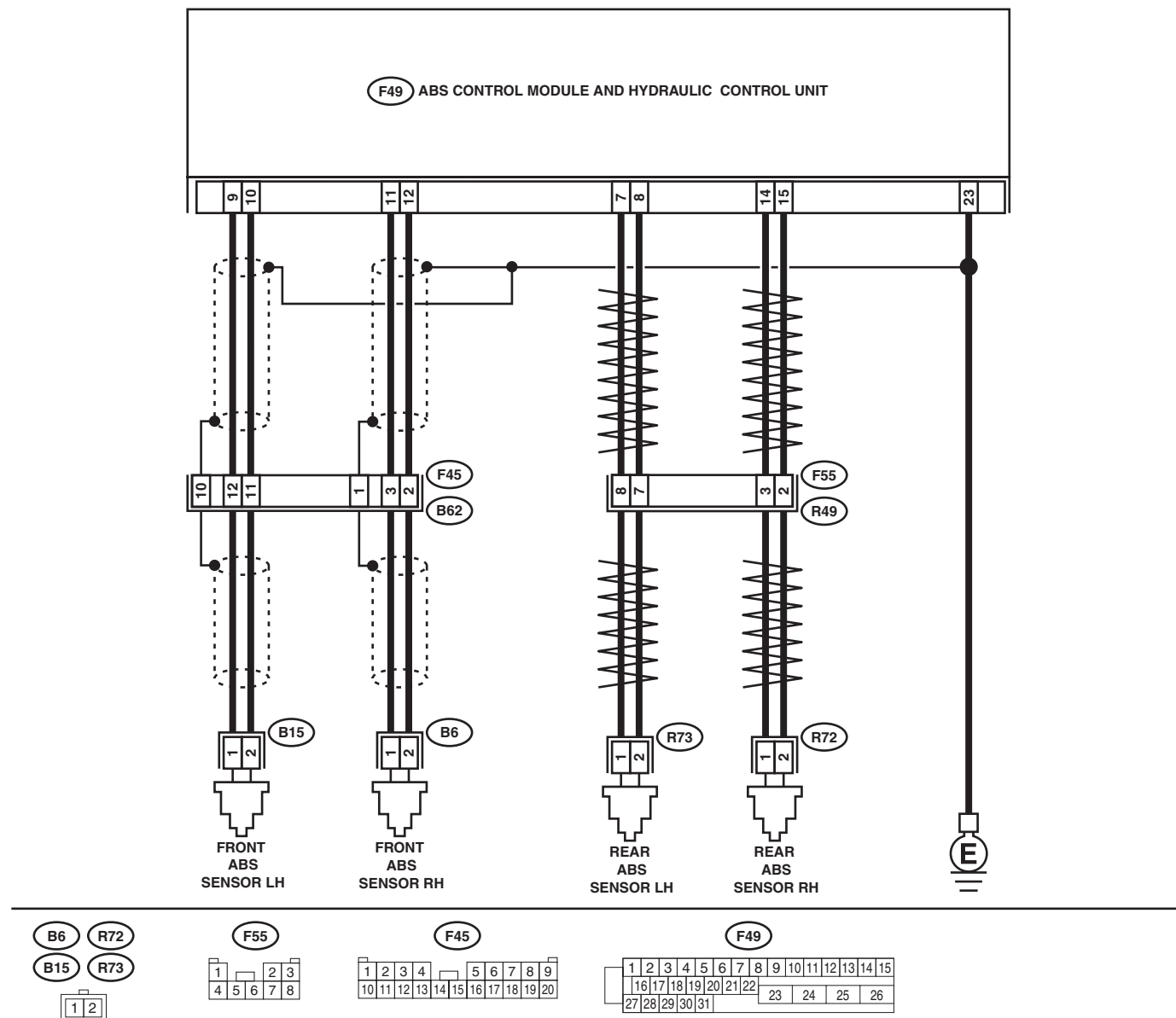
DIAGNOSIS:

- Faulty ABS sensor signal (noise, irregular signal, etc.)
- Faulty tone wheel
- Wheels turning freely for a long time

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00627

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK WHEELS FOR FREE TURNING. Check if the wheels have been turned freely for more than one minute, such as when the vehicle is jacked-up, under full-lock cornering or when tire is not in contact with road surface.	Have wheels turned freely?	The ABS is normal. Erase the diagnostic trouble code. NOTE: When the wheels turn freely for a long time, such as when the vehicle is towed or jacked-up, or when steering wheel is continuously turned all the way, this trouble code may sometimes occur.	Go to step 2.
2 CHECK TIRE SPECIFICATIONS. Turn ignition switch to OFF.	Are the tire specifications correct?	Go to step 3.	Replace tire.
3 CHECK WEAR OF TIRE.	Is the tire worn excessively?	Replace tire.	Go to step 4.
4 CHECK TIRE PRESSURE.	Is the tire pressure correct?	Go to step 5.	Adjust tire pressure.
5 CHECK INSTALLATION OF ABS SENSOR.	Are the ABS sensor installation bolts tightened to 33 N·m (3.4 kgf-m, 25 ft-lb)?	Go to step 6.	Tighten ABS sensor installation bolts securely.
6 CHECK ABS SENSOR GAP. Measure tone wheel to ABS sensor piece gap over entire perimeter of the wheel.	Is the measured value within the range indicated below? Front wheel 0.3 — 0.8 mm (0.012 — 0.031 in) and Rear wheel 0.44 — 0.94 mm (0.0173 — 0.0370 in)	Go to step 7.	Adjust the gap. NOTE: Adjust the gap using spacer (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.
7 PREPARE OSCILLOSCOPE.	Is an oscilloscope available?	Go to step 8.	Go to step 9.
8 CHECK ABS SENSOR SIGNAL. 1) Lift up the vehicle. 2) Turn ignition switch to OFF. 3) Connect the oscilloscope to the connector (B62) in accordance with trouble code. 4) Turn ignition switch to ON. 5) Rotate wheels and measure voltage at specified frequency. <Ref. to ABS-15, WAVEFORM, Control Module I/O Signal.> NOTE: When this inspection is completed, the ABS-CM&H/U sometimes stores the DTC 29. Connector & terminal (F45) No. 3 (+) — No. 2 (–) (Front RH): (F45) No. 12 (+) — No. 11 (–) (Front LH): (F55) No. 3 (+) — No. 2 (–) (Rear RH): (F55) No. 8 (+) — No. 7 (–) (Rear LH):	Is the oscilloscope pattern the same as that shown in the figure?	Go to step 12.	Go to step 9.
9 CHECK CONTAMINATION OF ABS SENSOR OR TONE WHEEL. Remove disc rotor from hub.	Is the ABS sensor piece or the tone wheel contaminated by mud or other foreign matter?	Thoroughly remove mud or other foreign matter.	Go to step 10.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK DAMAGE OF ABS SENSOR OR TONE WHEEL.	Are there broken or damaged teeth in the ABS sensor piece or the tone wheel?	Replace ABS sensor or tone wheel. Front: <Ref. to ABS-14, Front ABS Sensor.> Rear: <Ref. to ABS-17, Rear ABS Sensor.> and Front: <Ref. to ABS-21, Front Tone Wheel.> Rear: <Ref. to ABS-22, Rear Tone Wheel.>	Go to step 11.
11 CHECK TONE WHEEL RUNOUT. Measure tone wheel runout.	Is the measured value less than 0.05 mm (0.0020 in)?	Go to step 12.	Replace tone wheel. Front: <Ref. to ABS-21, Front Tone Wheel.> Rear: <Ref. to ABS-22, Rear Tone Wheel.>
12 CHECK ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform inspection mode. 5) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 13.
13 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

L: DTC 31 FRONT RIGHT INLET VALVE MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC 37. <Ref. to ABS-58, DTC 37 REAR LEFT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

M: DTC 33 FRONT LEFT INLET VALVE MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC 37. <Ref. to ABS-58, DTC 37 REAR LEFT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

N: DTC 35 REAR RIGHT INLET VALVE MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC 37. <Ref. to ABS-58, DTC 37 REAR LEFT INLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

O: DTC 37 REAR LEFT INLET VALVE MALFUNCTION

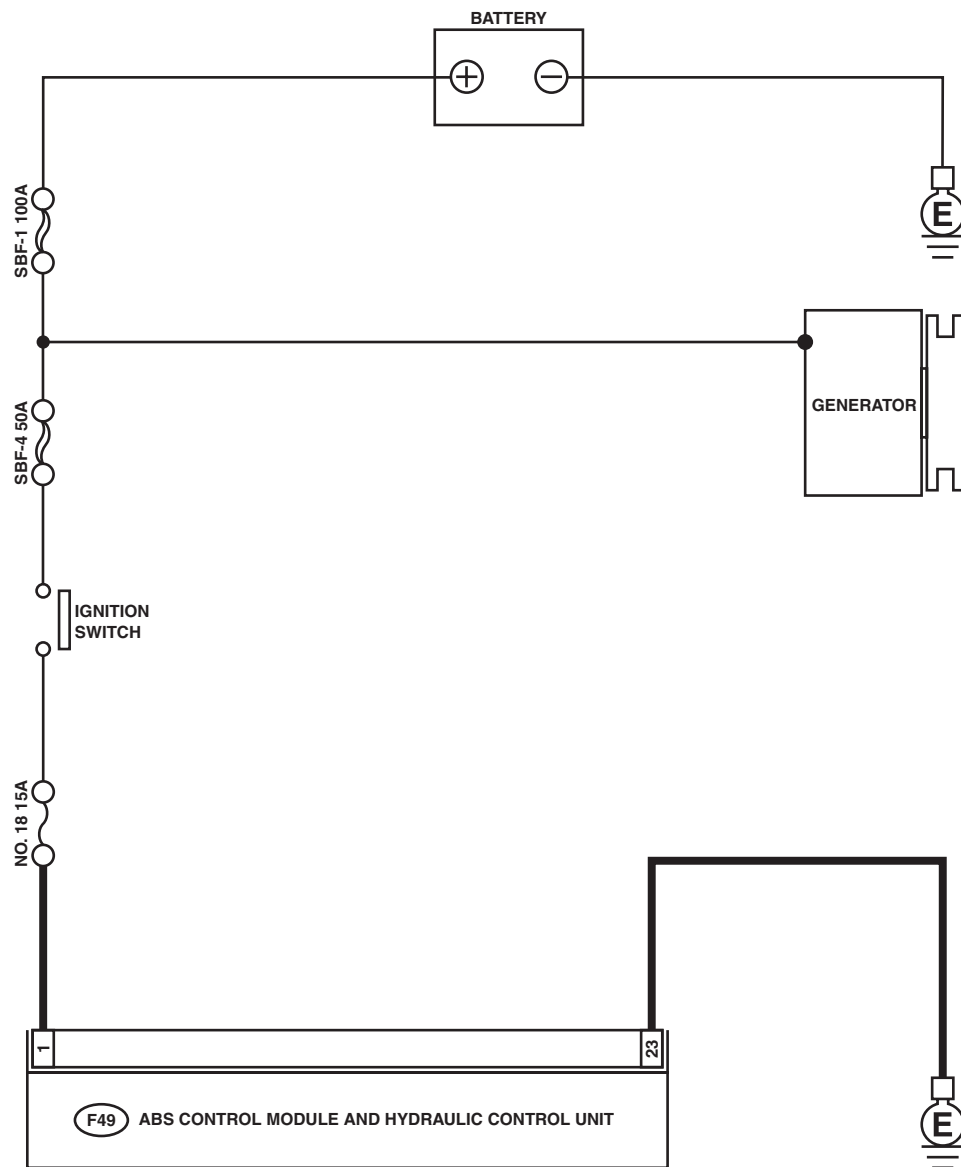
DIAGNOSIS:

- Faulty harness/connector
- Faulty inlet solenoid valve

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



F49

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22		23	24	25	26			
27	28	29	30	31										

ABS00294

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Run the engine at idle. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 2.	Repair harness connector between battery, ignition switch and ABSCM&H/U.
2 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 3.	Repair ABSCM&H/U ground harness.
3 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 4.
4 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 5.
5 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

P: DTC 32 FRONT RIGHT OUTLET VALVE MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC 38. <Ref. to ABS-62, DTC 38 REAR LEFT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Q: DTC 34 FRONT LEFT OUTLET VALVE MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC 38. <Ref. to ABS-62, DTC 38 REAR LEFT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

R: DTC 36 REAR RIGHT OUTLET VALVE MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC 38. <Ref. to ABS-62, DTC 38 REAR LEFT OUTLET VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

S: DTC 38 REAR LEFT OUTLET VALVE MALFUNCTION

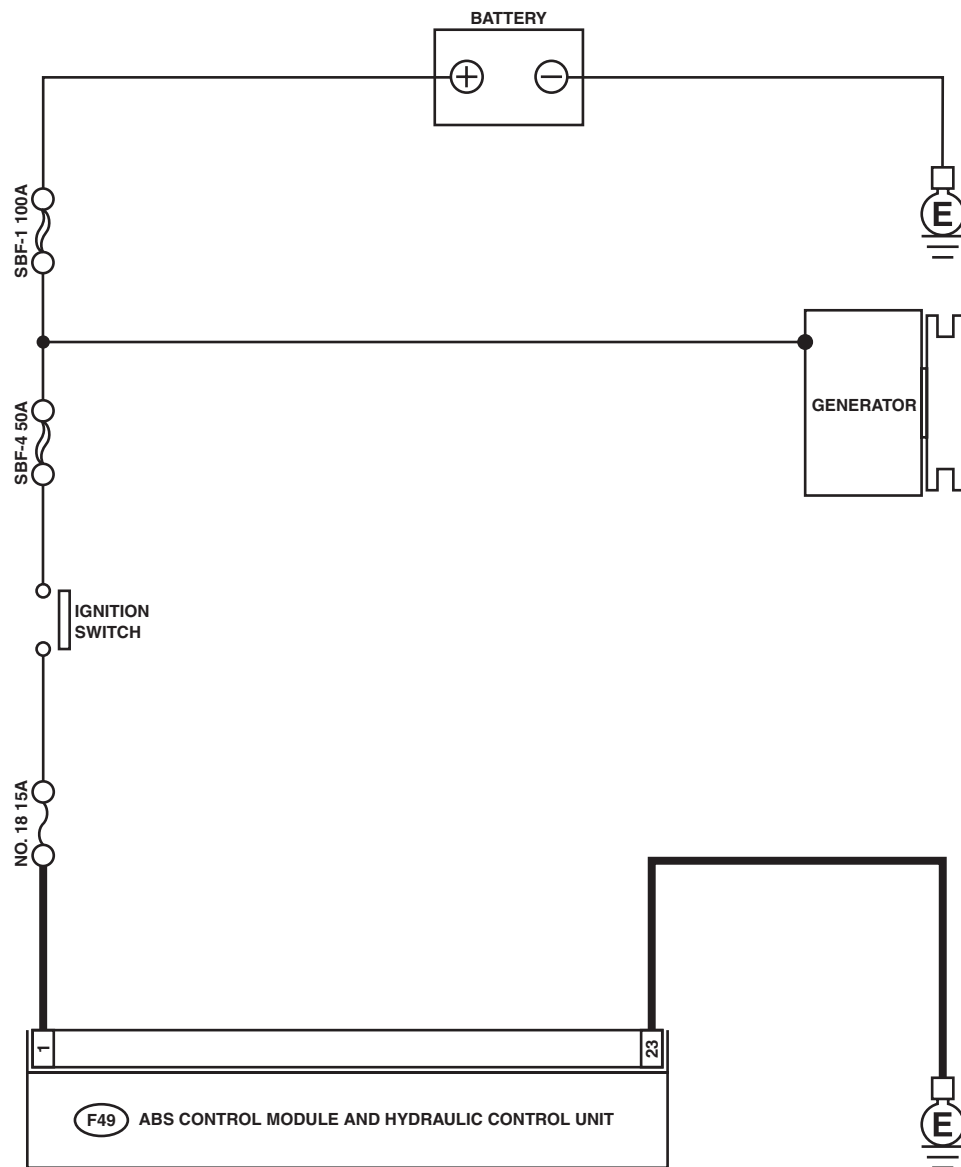
DIAGNOSIS:

- Faulty harness/connector
- Faulty outlet solenoid valve

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



F49

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22		23	24	25	26			
27	28	29	30	31										

ABS00294

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Run the engine at idle. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 2.	Repair harness connector between battery, ignition switch and ABSCM&H/U.
2 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 3.	Repair ABSCM&H/U ground harness.
3 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 4.
4 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC as in the current diagnosis still being output?	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 5.
5 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

T: DTC 41 ABS CONTROL MODULE MALFUNCTION

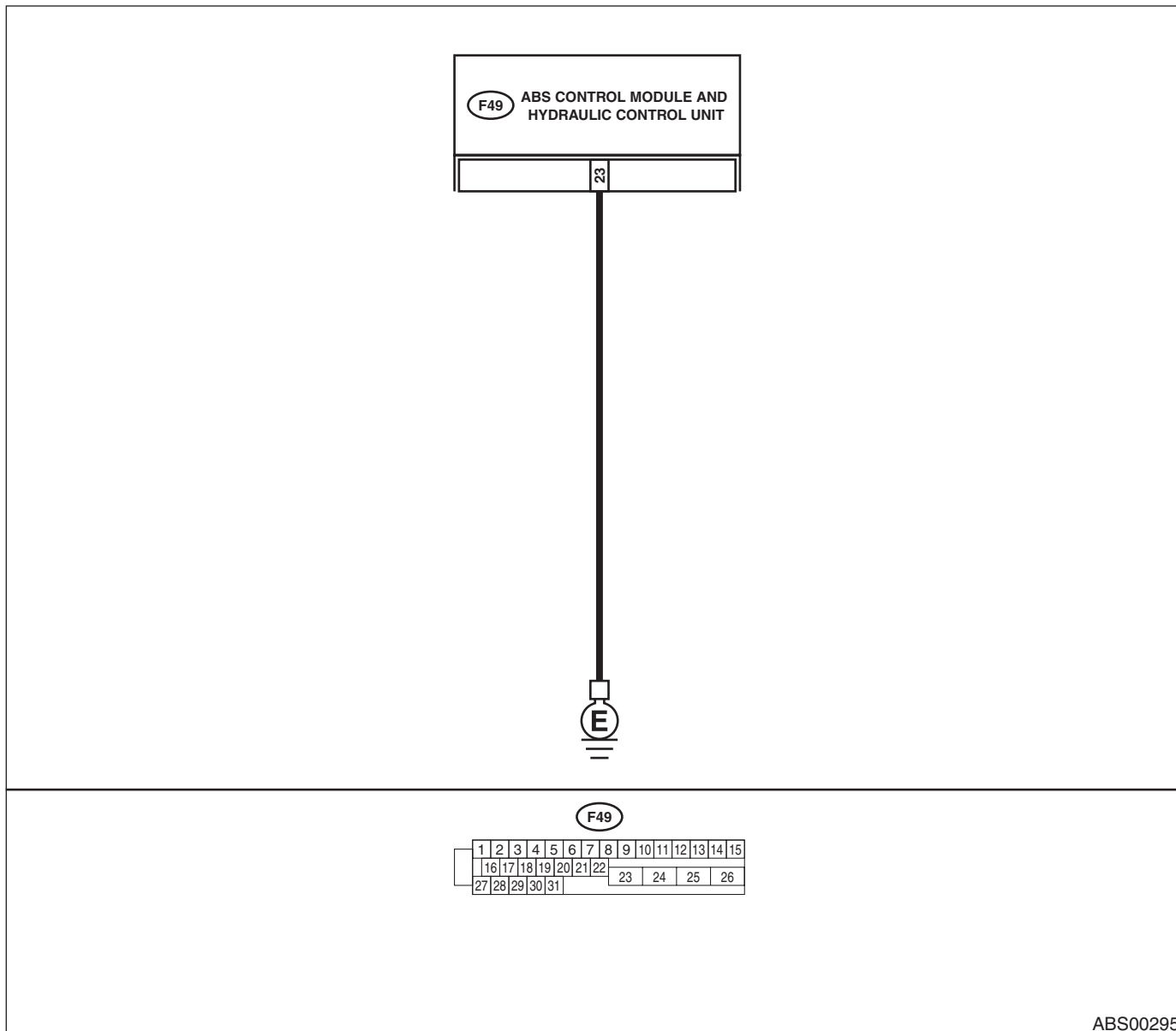
DIAGNOSIS:

- Faulty ABSCM&H/U

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00295

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance between ABSCM&H/U and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 2.	Repair ABSCM&H/U ground harness.
2 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between battery, ignition switch and ABSCM&H/U?	Repair connector.	Go to step 3.
3 CHECK SOURCES OF SIGNAL NOISE.	Is the car telephone or the wireless transmitter properly installed?	Go to step 4.	Properly install the car telephone or the wireless transmitter.
4 CHECK SOURCES OF SIGNAL NOISE.	Are noise sources (such as an antenna) installed near the sensor harness?	Install the noise sources apart from the sensor harness.	Go to step 5.
5 CHECK ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform inspection mode. 5) Read out the DTC.	Is the same DTC as in the current diagnosis still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
6 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

U: DTC 42 POWER SUPPLY VOLTAGE TOO LOW

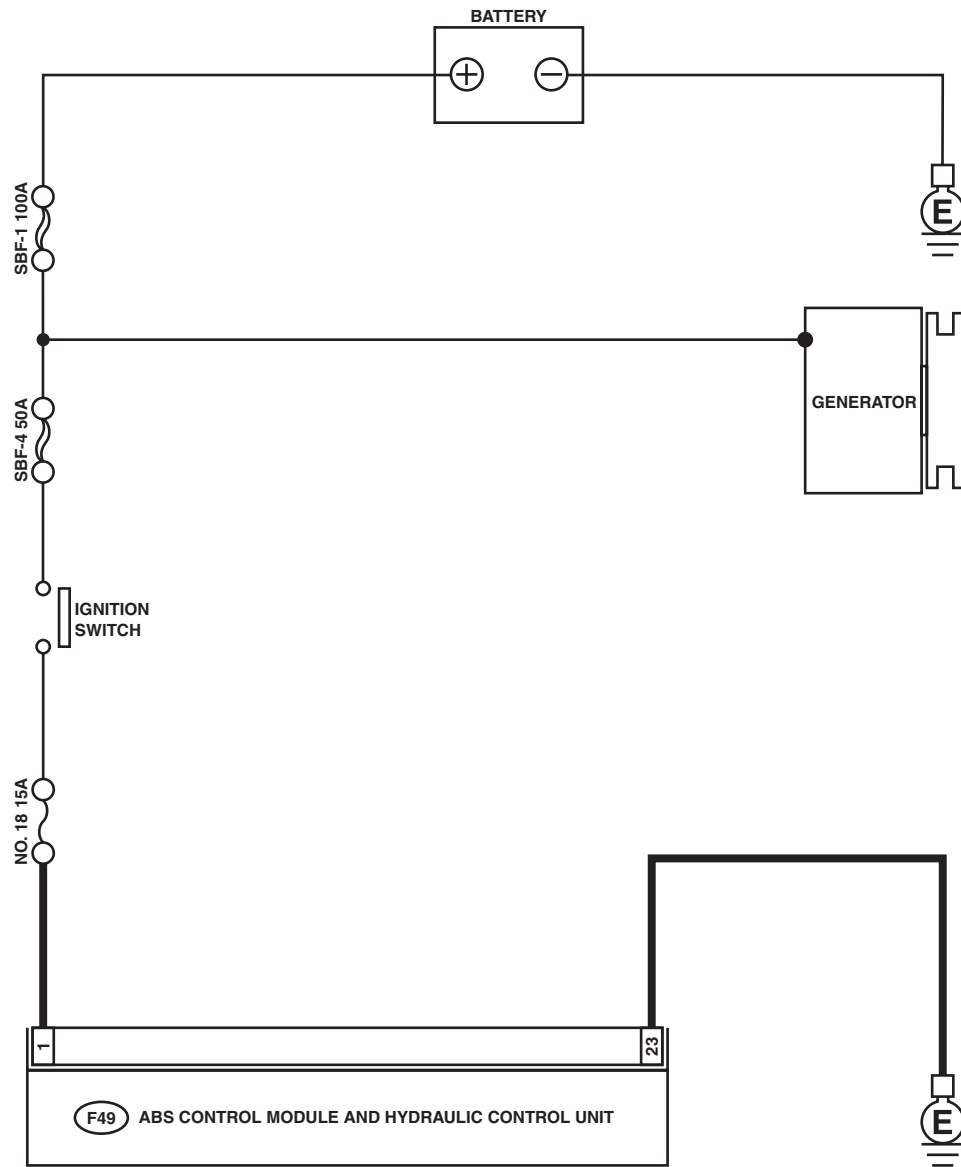
DIAGNOSIS:

- Power source voltage of the ABSCM&H/U is low.

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



F49

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26				
27	28	29	30	31										

ABS00294

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GENERATOR. 1) Start engine. 2) Idling after warm-up. 3) Measure voltage between generator B terminal and chassis ground. Terminal Generator B terminal — Chassis ground:	Is the measured value within 10 to 15 V?	Go to step 2.	Repair generator. <Ref. to SC(H4SO)-15, Generator.>
2 CHECK BATTERY TERMINAL. Turn ignition switch to OFF.	Are the positive and negative battery terminals tightly clamped?	Go to step 3.	Tighten the clamp of terminal.
3 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Disconnect connector from ABSCM&H/U. 2) Run the engine at idle. 3) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 4.	Repair harness connector between battery, ignition switch and ABSCM&H/U.
4 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 5.	Repair ABSCM&H/U ground harness.
5 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 6.
6 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
7 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

V: DTC 42 POWER SUPPLY VOLTAGE TOO HIGH

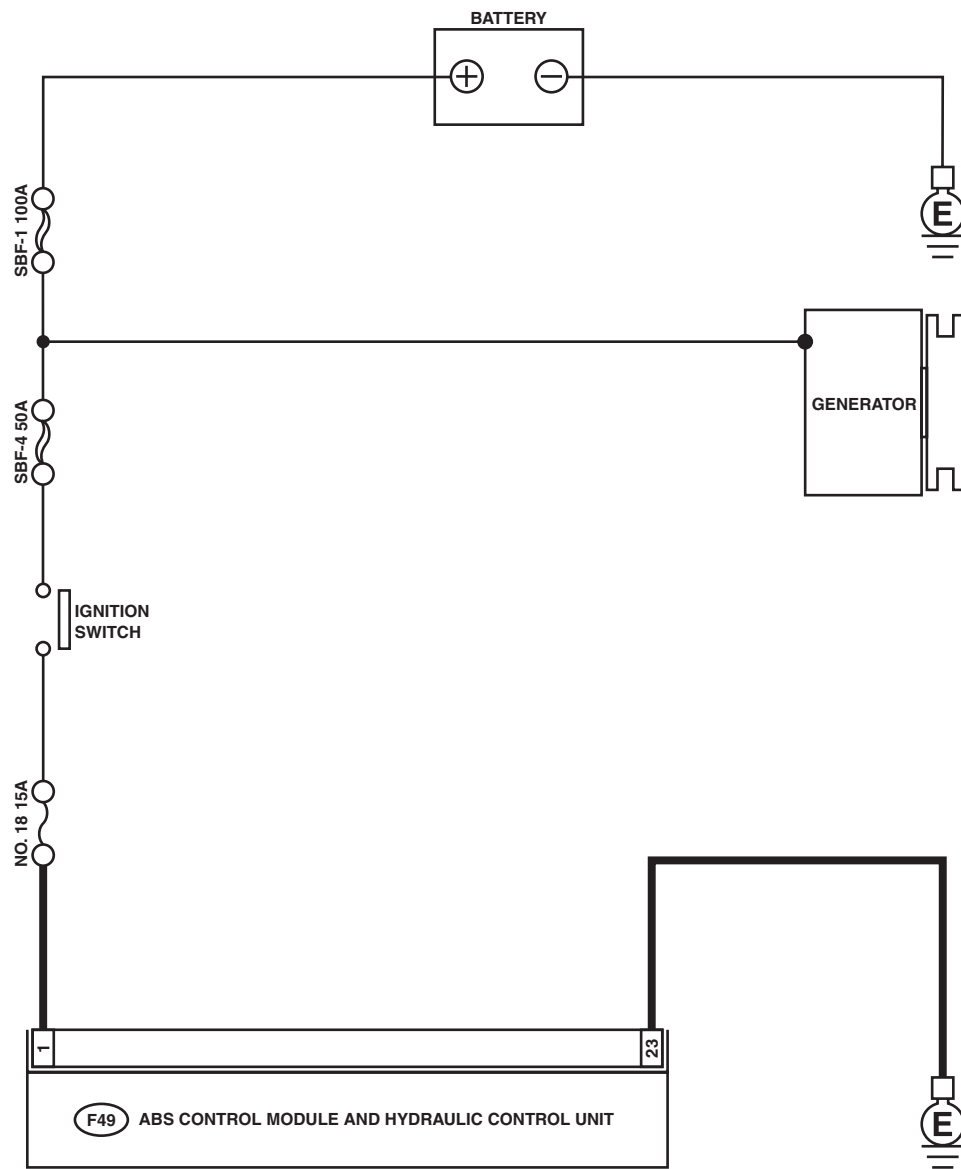
DIAGNOSIS:

- Power source voltage of the ABSCM&H/U is high.

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



F49

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26				
27	28	29	30	31										

ABS00294

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GENERATOR. 1) Start engine. 2) Idling after warm-up. 3) Measure voltage between generator B terminal and chassis ground. Terminal Generator B terminal — Chassis ground:	Is the measured value within 10 to 15 V?	Go to step 2.	Repair generator. <Ref. to SC(H4SO)-15, Generator.>
2 CHECK BATTERY TERMINAL. Turn ignition switch to OFF.	Are the positive and negative battery terminals tightly clamped?	Go to step 3.	Tighten the clamp of terminal.
3 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Disconnect connector from ABSCM&H/U. 2) Run the engine at idle. 3) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 4.	Repair harness connector between battery, ignition switch and ABSCM&H/U.
4 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 5.	Repair ABSCM&H/U ground harness.
5 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 6.
6 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
7 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

W: DTC 44 ABS-AT CONTROL (NON CONTROLLED)

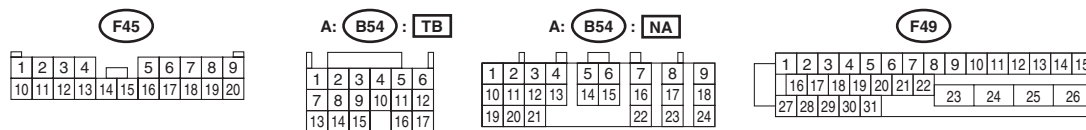
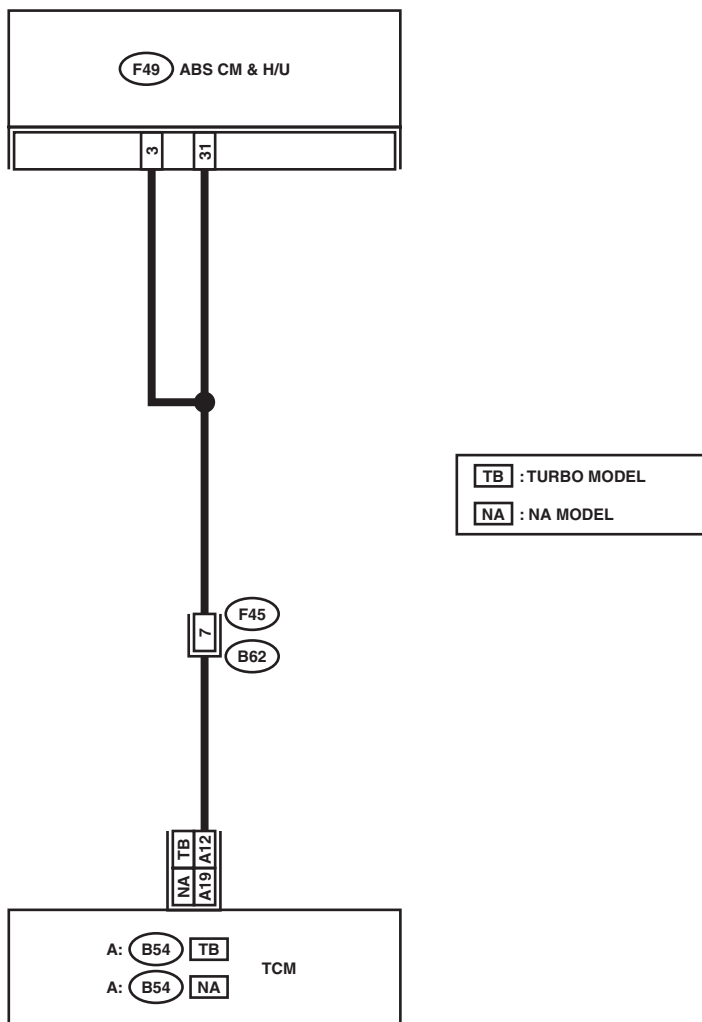
DIAGNOSIS:

- Combination of AT control faults

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SPECIFICATIONS OF THE ABSCM&H/U. Check specifications of the mark to the ABSCM&H/U. CI: AT CJ: MT	Do the vehicle specification and the specification of ABSCM&HU match?	Go to step 2.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
2 CHECK GROUND SHORT OF HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect two connectors from TCM. 3) Disconnect connector from ABSCM&H/U. 4) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 3 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 3.	Repair harness between TCM and ABSCM&H/U.
3 CHECK TCM. 1) Connect all connectors to TCM. 2) Turn ignition switch to ON. 3) Measure voltage between TCM connector terminal and chassis ground. Connector & terminal TURBO model: (B54) No. 12 (+) — Chassis ground (-): NON-TURBO model: (B54) No. 19 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 5.	Go to step 4.
4 CHECK AT.	Is the AT functioning normally?	Replace TCM.	Repair AT.
5 CHECK OPEN CIRCUIT OF HARNESS. Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 3 (+) — Chassis ground (-): (F49) No. 31 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 6.	Repair harness/connector between TCM and ABSCM&H/U.
6 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between TCM and ABSCM&H/U?	Repair connector.	Go to step 7.
7 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 8.
8 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

X: DTC 44 ABS-AT CONTROL (CONTROLLED)

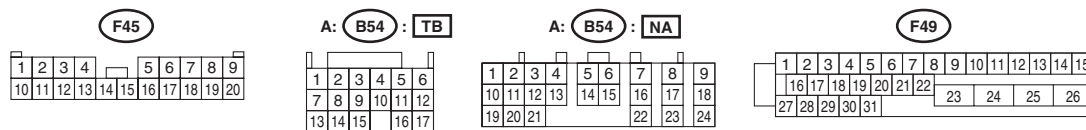
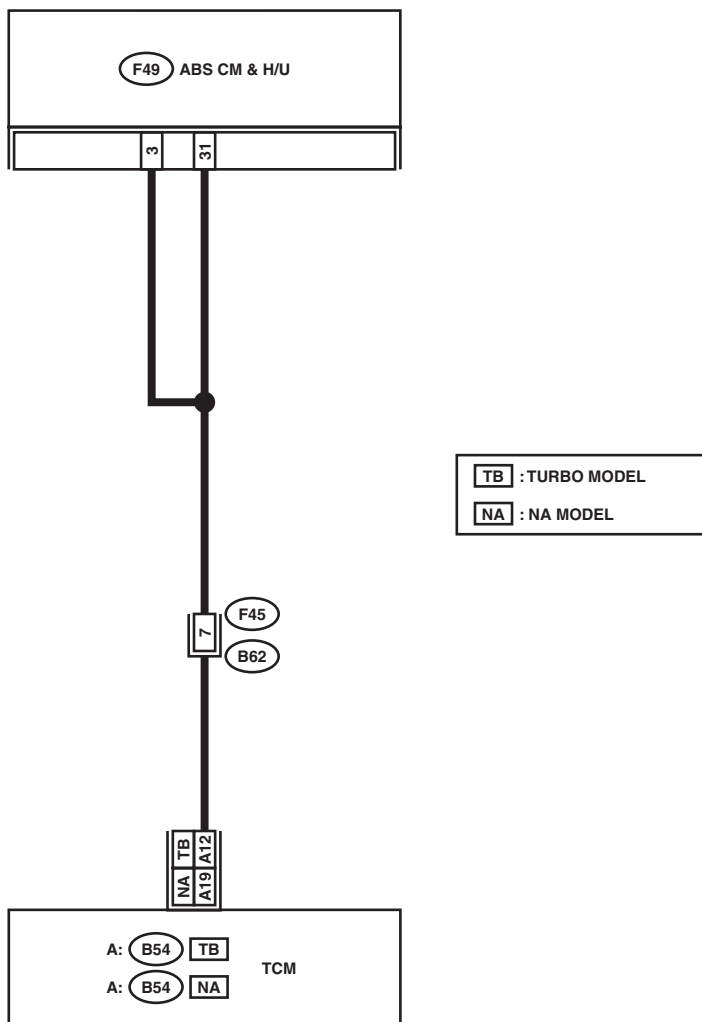
DIAGNOSIS:

- Combination of AT control faults

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00628

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK BATTERY SHORT OF HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect two connectors from TCM. 3) Disconnect connector from ABSCM&H/U. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 3 (+) — Chassis ground (-):	Is the measured value less than 1 V?	Go to step 2.	Repair harness between TCM and ABSCM&H/U.
2 CHECK BATTERY SHORT OF HARNESS. 1) Turn ignition switch to ON. 2) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 3 (+) — Chassis ground (-):	Is the measured value less than 1 V?	Go to step 3.	Repair harness between TCM and ABSCM&H/U.
3 CHECK OPEN CIRCUIT OF HARNESS. 1) Turn ignition switch to OFF. 2) Connect all connectors to TCM. 3) Turn ignition switch to ON. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 3 (+) — Chassis ground (-): (F49) No. 31 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 4.	Repair harness/connector between TCM and ABSCM&H/U.
4 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF. Is there poor contact in connectors between TCM and ABSCM&H/U?	There is no poor contact.	Go to step 5.	Repair connector.
5 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
6 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Y: DTC 51 VALVE RELAY MALFUNCTION

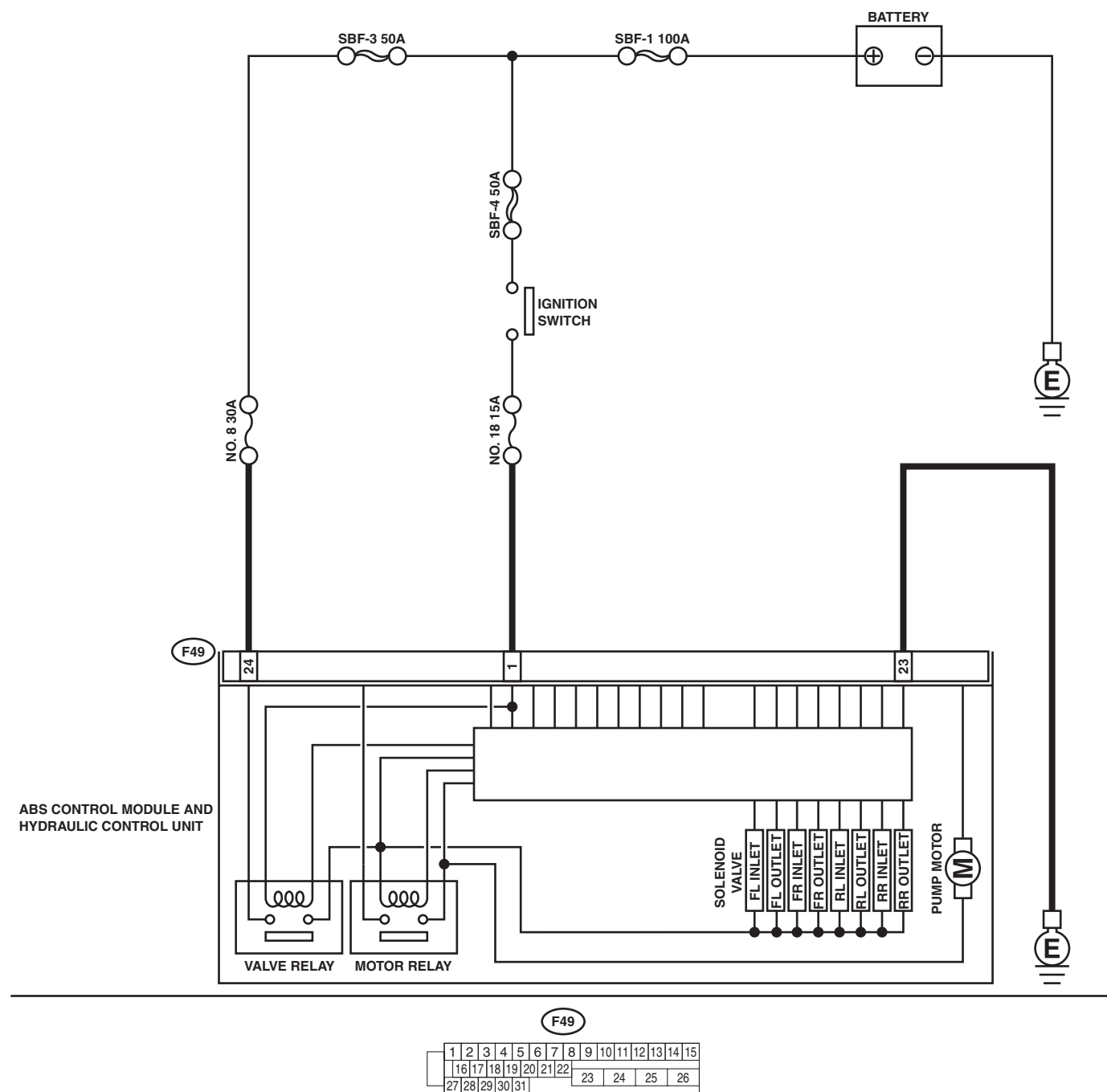
DIAGNOSIS:

- Faulty valve relay

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00297

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Run the engine at idle. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-): (F49) No. 24 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 2.	Repair harness connector between battery and ABSCM&H/U.
2 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 3.	Repair ABSCM&H/U ground harness.
3 CHECK VALVE RELAY IN ABSCM&H/U. Measure resistance between ABSCM&H/U terminals. Terminals No. 23 (+) — No. 24 (-):	Is the measured value more than 1 M Ω ?	Go to step 4.	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
4 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 5.
5 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
6 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Z: DTC 51 VALVE RELAY ON FAILURE

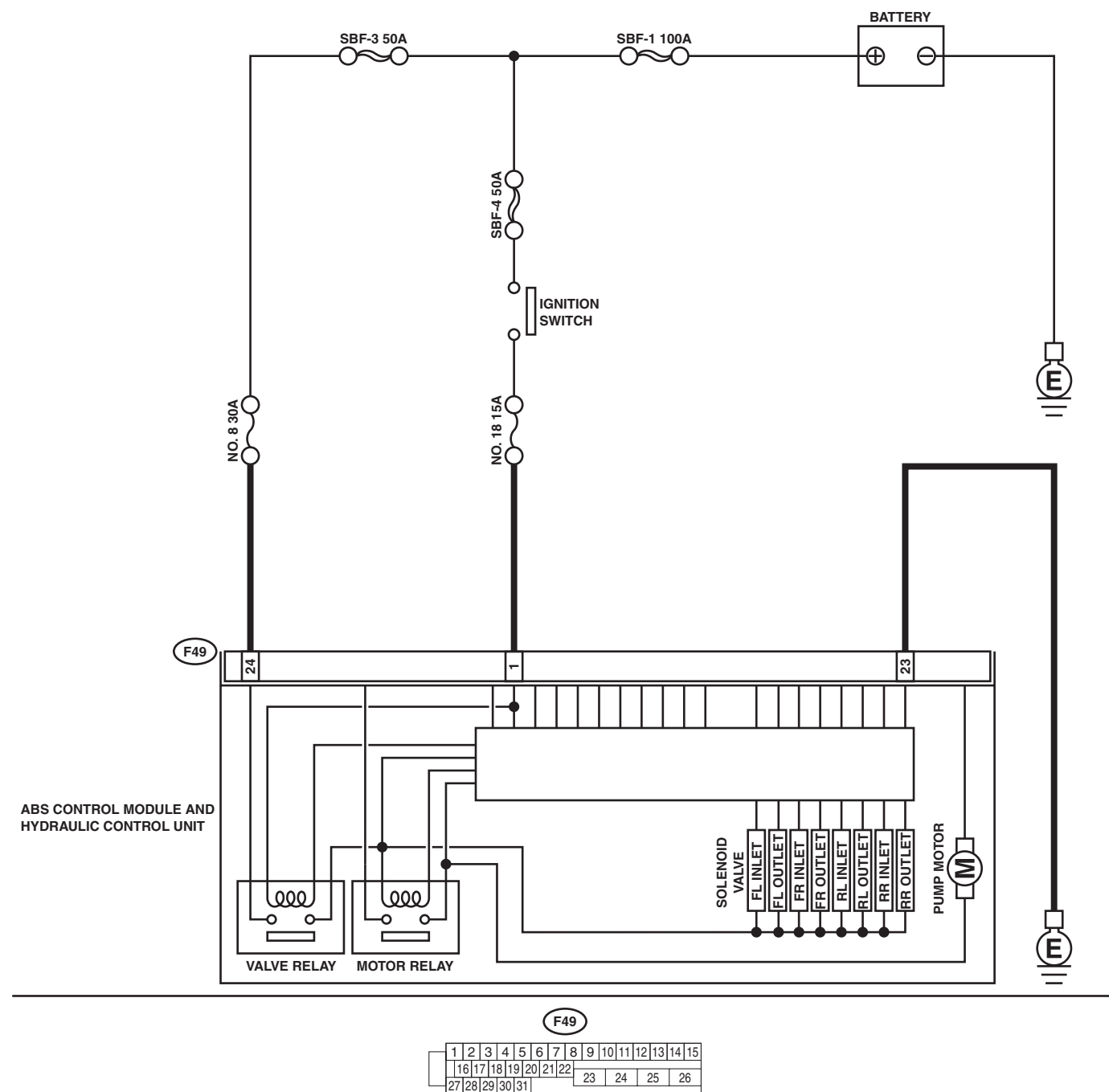
DIAGNOSIS:

- Faulty valve relay

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00297

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK VALVE RELAY IN ABSCM&H/U. Measure resistance between ABSCM&H/U terminals. Terminals No. 23 (+) — No. 24 (-):	Is the measured value more than 1 MΩ?	Go to step 2.	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
2 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connectors between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 3.
3 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 4.
4 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AA:DTC 52 OPEN CIRCUIT IN MOTOR RELAY CIRCUIT

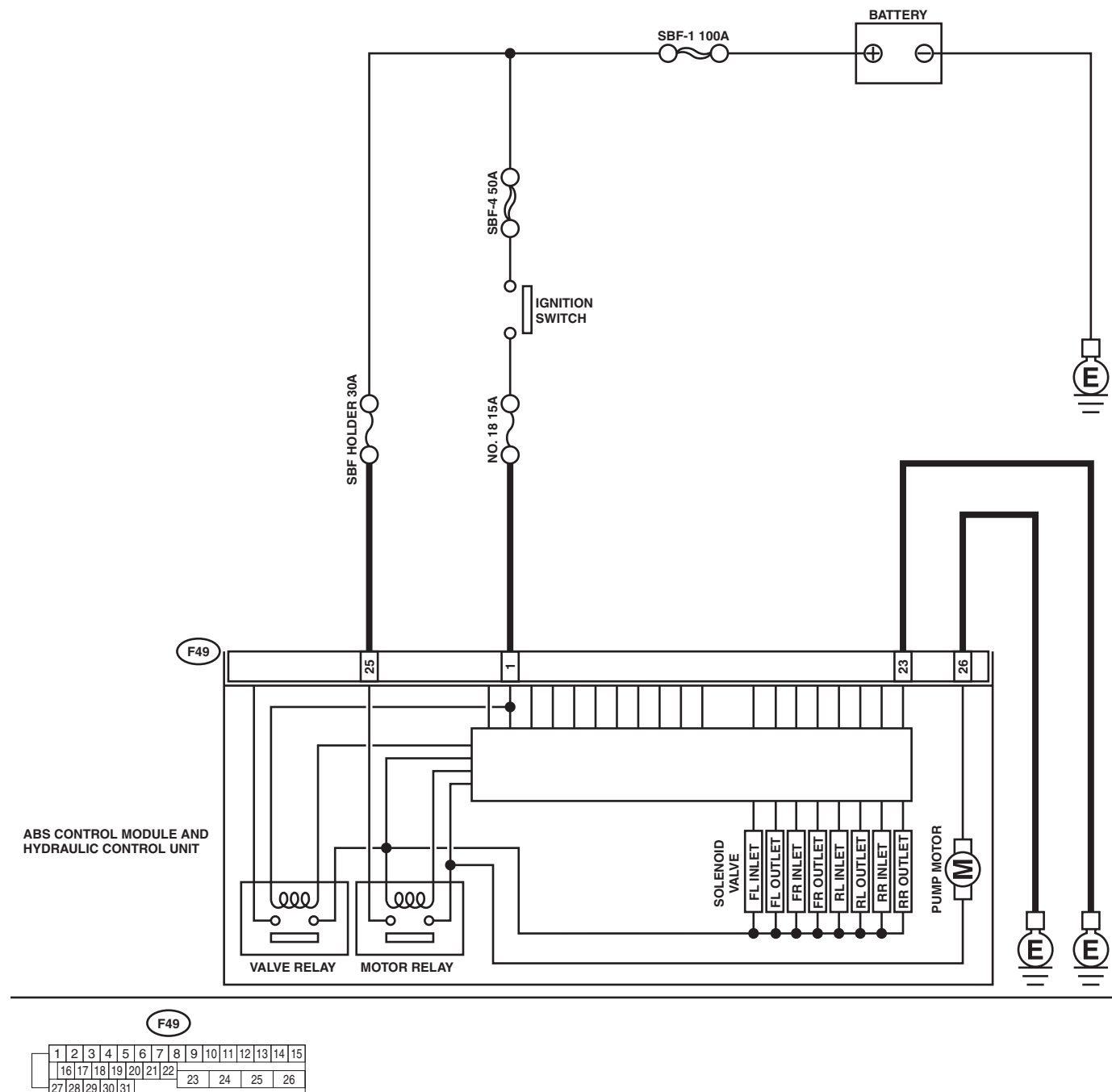
DIAGNOSIS:

- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00427

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Turn ignition switch to ON. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 25 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 2.	Repair harness/connector between battery and ABSCM&H/U and check fuse SBF7.
2 CHECK GROUND CIRCUIT OF MOTOR. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 26 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 3.	Repair ABSCM&H/U ground harness.
3 CHECK MOTOR OPERATION. Operate the sequence control. <Ref. to ABS-11, ABS Sequence Control.> NOTE: Use the diagnosis connector to operate the sequence control.	Can motor revolution noise (buzz) be heard when carrying out the sequence?	Go to step 4.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
4 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 5.
5 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
6 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AB:DTC 52 MOTOR RELAY ON FAILURE

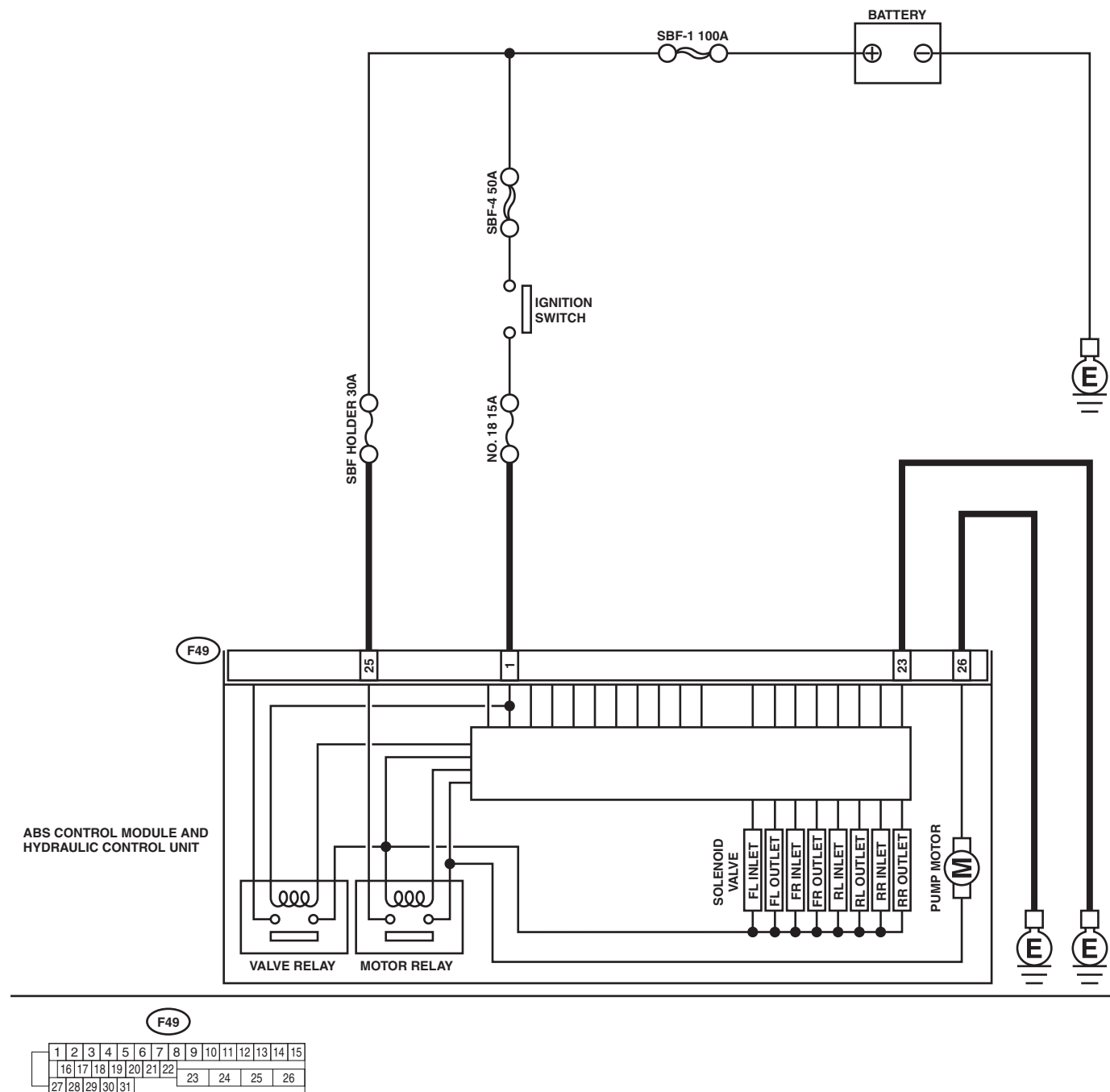
DIAGNOSIS:

- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00427

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK MOTOR RELAY IN ABSCM&H/U. Measure resistance between ABSCM&H/U terminals. Terminals No. 25 — No. 26:	Is the measured value more than 1 MΩ?	Go to step 2.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
2 CHECK MOTOR OPERATION. Operate the sequence control. <Ref. to ABS-11, ABS Sequence Control.> NOTE: Use the diagnosis connector to operate the sequence control.	Can motor revolution noise (buzz) be heard when carrying out the sequence control?	Go to step 3.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
3 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 4.
4 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 5.
5 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AC:DTC 52 MOTOR MALFUNCTION

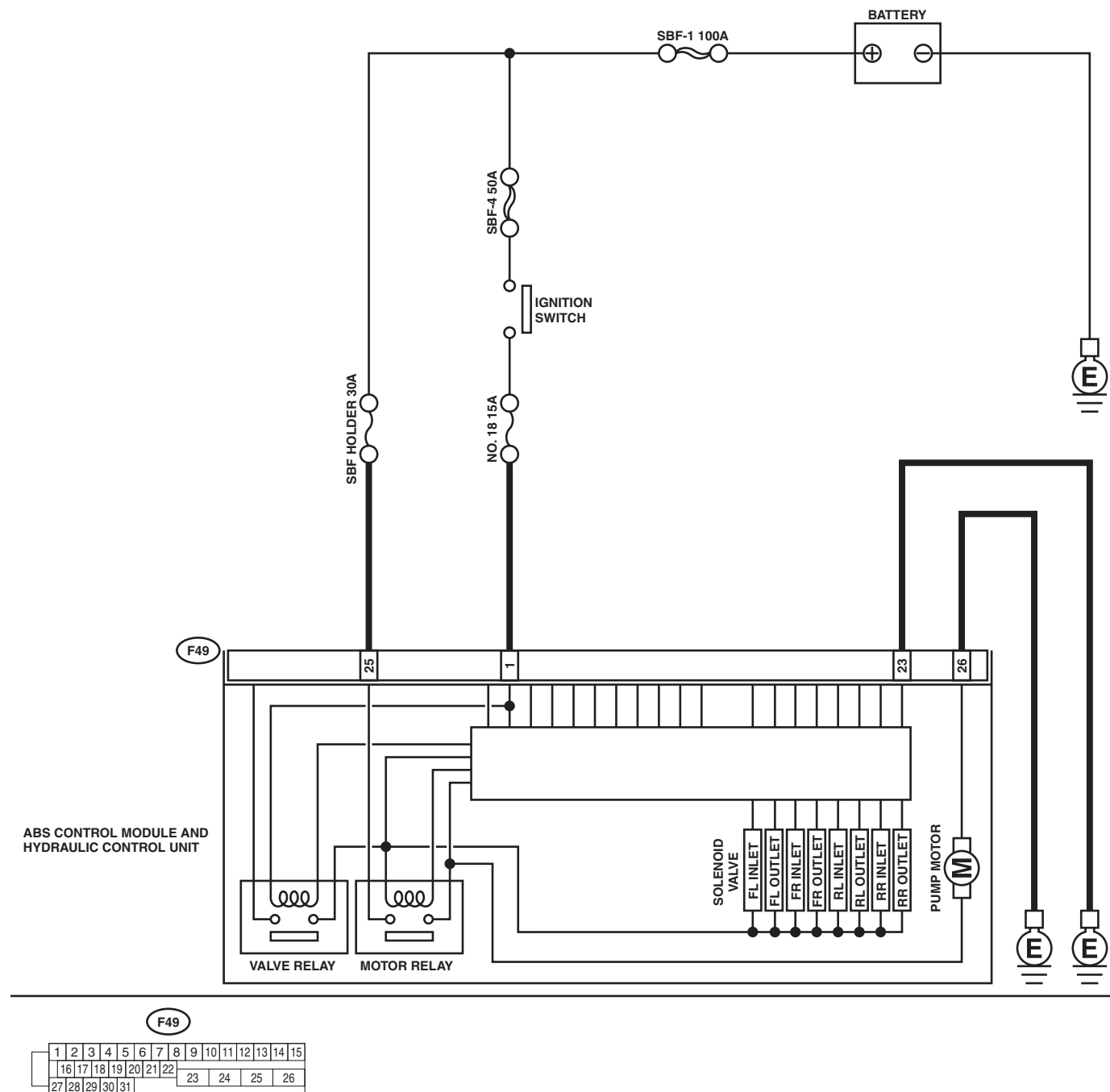
DIAGNOSIS:

- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00427

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Turn ignition switch to ON. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 25 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 2.	Repair harness/connector between battery and ABSCM&H/U and check fuse SBF7.
2 CHECK GROUND CIRCUIT OF MOTOR. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 26 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 3.	Repair ABSCM&H/U ground harness.
3 CHECK INPUT VOLTAGE OF ABSCM&H/U. 1) Run the engine at idle. 2) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 1 (+) — Chassis ground (-):	Is the measured value within 10 to 15 V?	Go to step 4.	Repair harness connector between battery, ignition switch and ABSCM&H/U.
4 CHECK GROUND CIRCUIT OF ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 23 — Chassis ground:	Is the measured value less than 0.5 Ω ?	Go to step 5.	Repair ABSCM&H/U ground harness.
5 CHECK MOTOR OPERATION. Operate the sequence control. <Ref. to ABS-11, ABS Sequence Control.> NOTE: Use the diagnosis connector to operate the sequence control.	Can motor revolution noise (buzz) be heard when carrying out the sequence control?	Go to step 6.	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
6 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair connector.	Go to step 7.
7 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 8.
8 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AD:DTC 54 STOP LIGHT SWITCH SIGNAL CIRCUIT MALFUNCTION

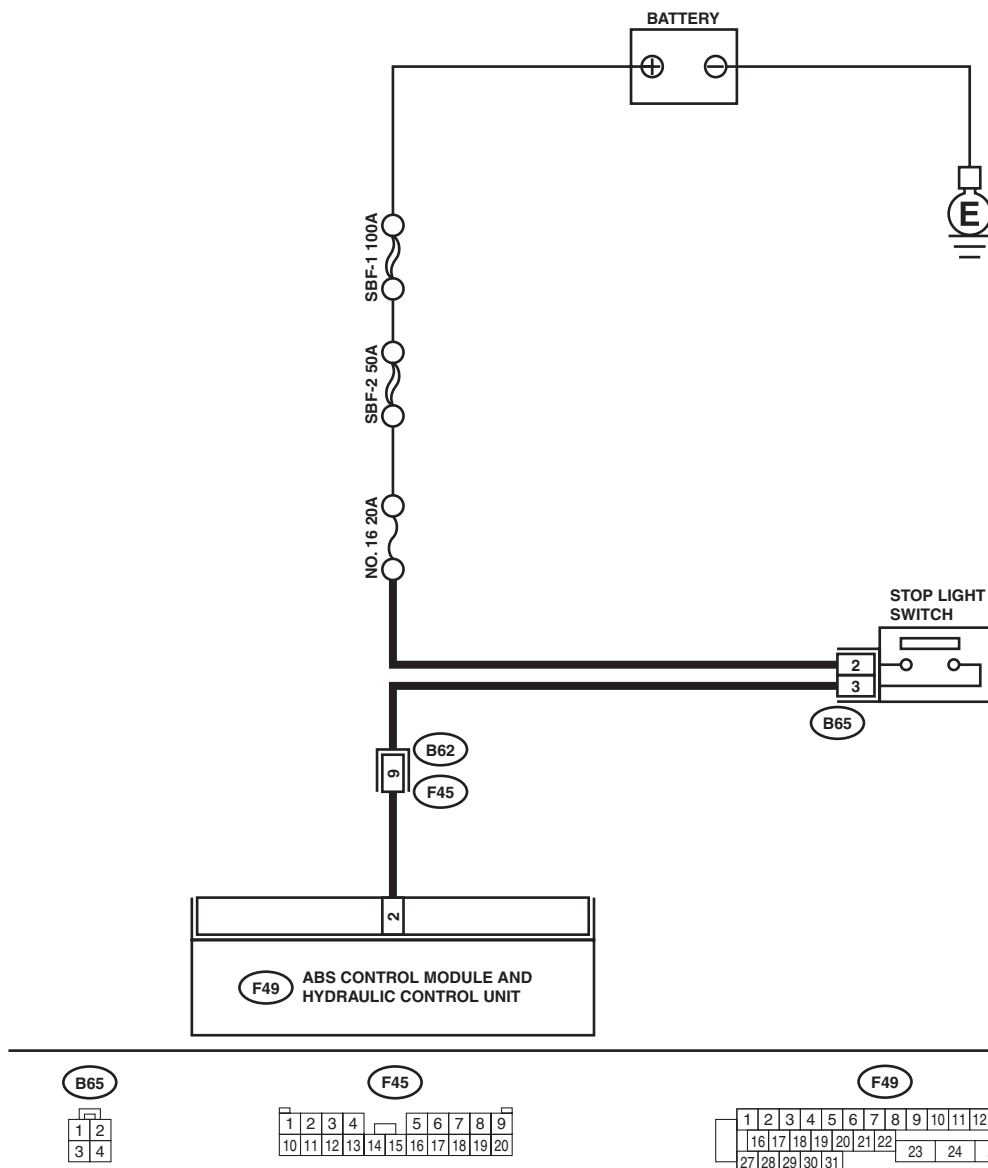
DIAGNOSIS:

- Faulty stop light switch

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00629

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT OF STOP LIGHT SWITCH USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Release the brake pedal. 3) Read the stop light switch output in the select monitor data display.	Is the reading indicated on monitor display less than 1.5 V?	Go to step 2.	Go to step 3.
2 CHECK OUTPUT OF STOP LIGHT SWITCH USING SELECT MONITOR. 1) Depress the brake pedal. 2) Read the stop light switch output in the select monitor data display.	Is the reading indicated on monitor display within 10 to 15 V?	Go to step 5.	Go to step 3.
3 CHECK IF STOP LIGHTS COME ON. Depress the brake pedal.	Do stop lights turn on?	Go to step 4.	Repair stop lights circuit.
4 CHECK OPEN CIRCUIT IN HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Depress brake pedal. 4) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 2 — Chassis ground:	Is the measured value within 10 to 15 V?	Go to step 5.	Repair harness between stop light switch and ABSCM&H/U connector.
5 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connector between stop light switch and ABSCM&H/U?	Repair connector.	Go to step 6.
6 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
7 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AE:DTC 56 OPEN OR SHORT CIRCUIT IN G SENSOR CIRCUIT

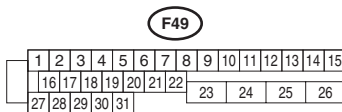
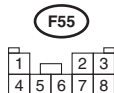
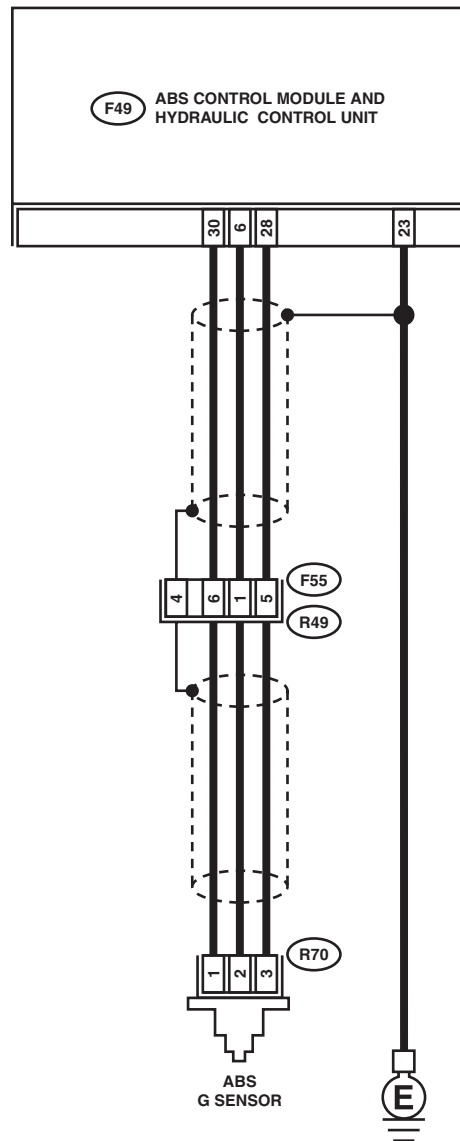
DIAGNOSIS:

- Faulty G sensor output voltage

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00630

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT OF G SENSOR USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Read the G sensor output in select monitor data display.	Is the G sensor output on the monitor display within 2.1 to 2.5 V when the G sensor is in horizontal position?	Go to step 2.	Go to step 5.
2 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 3.
3 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 4.
4 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.
5 CHECK INPUT VOLTAGE OF G SENSOR. 1) Turn ignition switch to OFF. 2) Remove console box. 3) Disconnect G sensor from body. (Do not disconnect connector.) 4) Turn ignition switch to ON. 5) Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 1 (+) — No. 3 (-):	Is the measured value within 4.75 to 5.25 V?	Go to step 6.	Repair harness/connector between G sensor and ABSCM&H/U.
6 CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance between ABSCM&H/U connector terminals. Connector & terminal (F49) No. 6 — No. 28:	Is the measured value within 3.6 to 3.8 kΩ?	Go to step 7.	Repair harness/connector between G sensor and ABSCM&H/U.
7 CHECK GROUND SHORT IN G SENSOR OUTPUT HARNESS. 1) Disconnect connector from G sensor. 2) Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 6 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 8.	Repair harness between G sensor and ABSCM&H/U.
8 CHECK G SENSOR. 1) Connect connector to G sensor. 2) Connect connector to ABSCM&H/U. 3) Turn ignition switch to ON. 4) Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 2.1 to 2.5 V when G sensor is horizontal?	Go to step 9.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
9 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 3.6 to 4.1 V when G sensor is inclined forwards to 90°?	Go to step 10.	Replace G sensor. <Ref. to ABS-23, G Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (–):	Is the measured value within 0.5 to 1.0 V when G sensor is inclined backwards to 90°?	Go to step 11.	Replace G sensor. <Ref. to ABS-23, G SENSOR, .>
11 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 12.
12 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 13.
13 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AF:DTC 56 BATTERY SHORT IN G SENSOR CIRCUIT

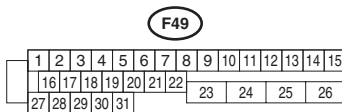
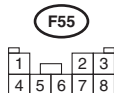
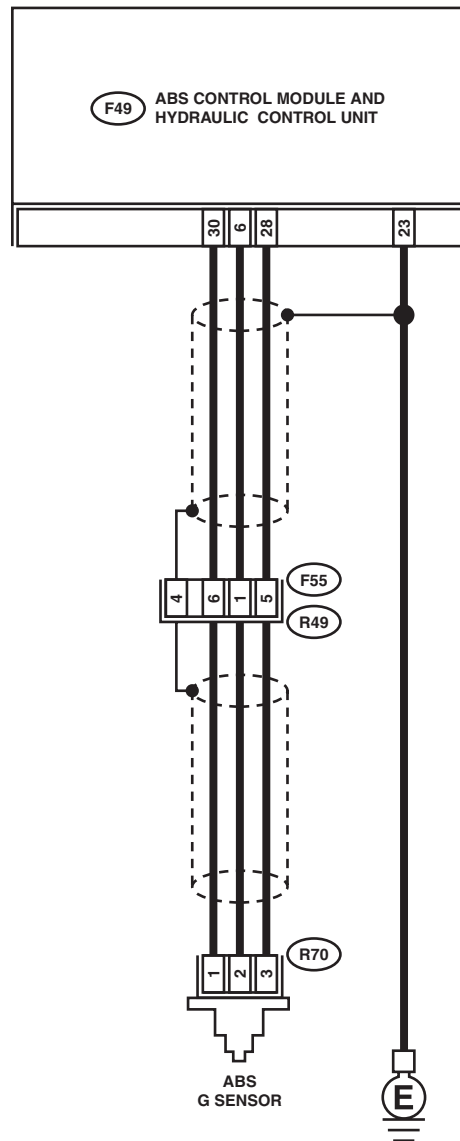
DIAGNOSIS:

- Faulty G sensor output voltage

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00630

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT OF G SENSOR USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Read the G sensor output in select monitor data display.	Is the G sensor output on the monitor display between within 2.1 to 2.5 V when the G sensor is in horizontal position?	Go to step 2.	Go to step 5.
2 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 3.
3 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 4.
4 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.
5 CHECK FREEZE FRAME DATA. 1) Select "Freeze frame data" on the select monitor. 2) Read front right wheel speed on the select monitor display.	Is the front right wheel speed on the monitor display to 0 km/h (0 MPH)?	Go to step 6.	Go to step 16.
6 CHECK FREEZE FRAME DATA. Read front left wheel speed on the select monitor display.	Is the front left wheel speed on the monitor display to 0 km/h (0 MPH)?	Go to step 7.	Go to step 16.
7 CHECK FREEZE FRAME DATA. Read rear right wheel speed on the select monitor display.	Is the rear right wheel speed on the monitor display to 0 km/h (0 MPH)?	Go to step 8.	Go to step 16.
8 CHECK FREEZE FRAME DATA. Read rear left wheel speed on the select monitor display.	Is the rear left wheel speed on the monitor display to 0 km/h (0 MPH)?	Go to step 9.	Go to step 16.
9 CHECK FREEZE FRAME DATA. Read G sensor output on the select monitor display.	Is the G sensor output on the monitor display more than 3.65 V?	Go to step 10.	Go to step 16.
10 CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance between ABSCM&H/U connector terminals. Connector & terminal (F49) No. 6 — No. 28:	Is the measured value within 3.6 to 3.8 kΩ?	Go to step 11.	Repair harness/connector between G sensor and ABSCM&H/U.
11 CHECK BATTERY SHORT OF HARNESS. 1) Turn ignition switch to OFF. 2) Remove console box. 3) Disconnect connector from G sensor. 4) Disconnect connector from ABSCM&H/U. 5) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 6 (+) — Chassis ground (-):	Is the measured value less than 1 V?	Go to step 12.	Repair harness between G sensor and ABSCM&H/U.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
12 CHECK BATTERY SHORT OF HARNESS. 1) Turn ignition switch to ON. 2) Measure voltage between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 6 (+) — Chassis ground (-):	Is the measured value less than 1 V?	Go to step 13.	Repair harness between G sensor and ABSCM&H/U.
13 CHECK POOR CONTACT IN CONNECTORS.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 14.
14 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 15.
15 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.
16 CHECK INPUT VOLTAGE OF G SENSOR. 1) Turn ignition switch to OFF. 2) Remove console box. 3) Disconnect G sensor from body. (Do not disconnect connector.) 4) Turn ignition switch to ON. 5) Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 1 (+) — No. 3 (-):	Is the measured value within 4.75 to 5.25 V?	Go to step 17.	Repair harness/connector between G sensor and ABSCM&H/U.
17 CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance between ABSCM&H/U connector terminals. Connector & terminal (F49) No. 6 — No. 28:	Is the measured value within 3.6 to 3.8 kΩ?	Go to step 18.	Repair harness/connector between G sensor and ABSCM&H/U.
18 CHECK G SENSOR. 1) Connect connector to G sensor. 2) Connect connector to ABSCM&H/U. 3) Turn ignition switch to ON. 4) Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 2.1 to 2.5 V when G sensor is horizontal?	Go to step 19.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
19 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 3.6 to 4.1 V when G sensor is inclined forwards to 90°?	Go to step 20.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
20 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 0.5 to 1.0 V when G sensor is inclined backwards to 90°?	Go to step 21.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
21 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 22.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step		Check	Yes	No
22	CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 23 .
23	CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AG:DTC 56 ABNORMAL G SENSOR HIGH μ OUTPUT

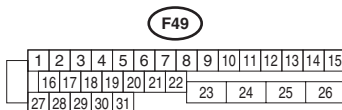
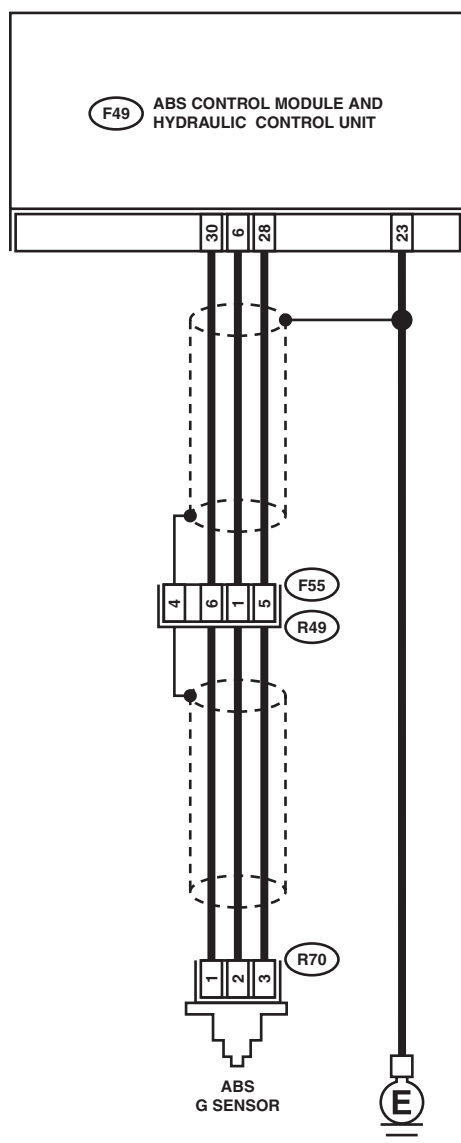
DIAGNOSIS:

- Faulty G sensor output voltage

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00630

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT OF G SENSOR USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Read G sensor output on the select monitor display.	Is the G sensor output on monitor display within 2.1 to 2.5 V when the G sensor is in horizontal position?	Go to step 2.	Go to step 6.
2 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 3.
3 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 4.
4 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.
5 CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance between ABSCM&H/U connector terminals. Connector & terminal (F49) No. 6 — No. 28:	Is the measured value within 3.6 to 3.8 kΩ?	Go to step 6.	Repair harness/connector between G sensor and ABSCM&H/U.
6 CHECK GROUND SHORT OF HARNESS. Measure resistance between ABSCM&H/U connector and chassis ground. Connector & terminal (F49) No. 28 — Chassis ground:	Is the measured value more than 1 MΩ?	Go to step 7.	Repair harness between G sensor and ABSCM&H/U. Replace ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
7 CHECK G SENSOR. 1) Remove console box. 2) Remove G sensor from vehicle. 3) Connect connector to G sensor. 4) Connect connector to ABSCM&H/U. 5) Turn ignition switch to ON. 6) Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 2.1 to 2.5 V when G sensor is horizontal?	Go to step 8.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
8 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 3.6 to 4.1 V when G sensor is inclined forwards to 90°?	Go to step 9.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
9 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 0.5 to 1.0 V when G sensor is inclined backwards to 90°?	Go to step 10.	Replace G sensor. <Ref. to ABS-23, G Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step		Check	Yes	No
10	CHECK ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform inspection mode. 5) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 11.
11	CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

AH:DTC 56 DETECTION OF G SENSOR STICK

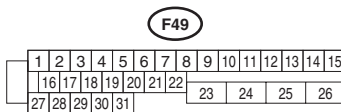
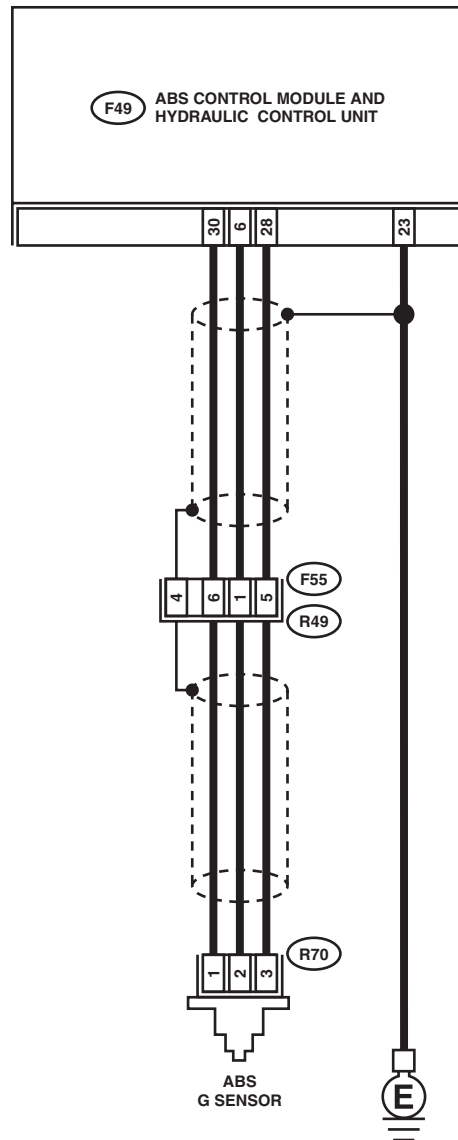
DIAGNOSIS:

- Faulty G sensor output voltage

TROUBLE SYMPTOM:

- ABS does not operate.

WIRING DIAGRAM:



ABS00630

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK WHEELS FOR FREE TURNING. Check if the wheels have been turned freely such as when the vehicle is lifted up, or operated on a rolling road.	Have wheels turned freely?	The ABS is normal. Erase the trouble code.	Go to step 2.
2 CHECK OUTPUT OF G SENSOR USING SELECT MONITOR. 1) Select "Current data display & Save" on the select monitor. 2) Read the select monitor display.	Is the G sensor output on the monitor display within 2.1 to 2.5 V when the vehicle is in horizontal position?	Go to step 3.	Go to step 8.
3 CHECK OUTPUT OF G SENSOR USING SELECT MONITOR. 1) Turn ignition switch to OFF. 2) Remove console box. 3) Remove G sensor from vehicle. (Do not disconnect connector.) 4) Turn ignition switch to ON. 5) Select "Current data display & Save" on the select monitor. 6) Read the select monitor display.	Is the G sensor output on the monitor display within 3.6 to 4.1 V when G sensor is inclined forwards to 90°?	Go to step 4.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
4 CHECK OUTPUT OF G SENSOR USING SELECT MONITOR. Read the select monitor display.	Is the G sensor output on the monitor display within 0.5 to 1.0 V when G sensor is inclined backwards to 90°?	Go to step 5.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
5 CHECK POOR CONTACT IN CONNECTORS. Turn ignition switch to OFF.	Is there poor contact in connector between ABSCM&H/U and G sensor?	Repair connector.	Go to step 6.
6 CHECK ABSCM&H/U. 1) Connect all connectors. 2) Erase the memory. 3) Perform inspection mode. 4) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
7 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.
8 CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect connector from ABSCM&H/U. 3) Measure resistance between ABSCM&H/U connector terminals. Connector & terminal (F49) No. 6 — No. 28:	Is the measured value within 3.6 to 3.8 kΩ?	Go to step 9.	Repair harness/connector between G sensor and ABSCM&H/U.
9 CHECK G SENSOR. 1) Remove console box. 2) Remove G sensor from vehicle. 3) Connect connector to G sensor. 4) Connect connector to ABSCM&H/U. 5) Turn ignition switch to ON. 6) Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 2.1 to 2.5 V when G sensor is horizontal?	Go to step 10.	Replace G sensor. <Ref. to ABS-23, G Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 3.6 to 4.1 V when G sensor is inclined forwards to 90°?	Go to step 11.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
11 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal (R70) No. 2 (+) — No. 3 (-):	Is the measured value within 0.5 to 1.0V when G sensor is inclined backwards to 90°?	Go to step 12.	Replace G sensor. <Ref. to ABS-23, G Sensor.>
12 CHECK ABSCM&H/U. 1) Turn ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform inspection mode. 5) Read out the DTC.	Is the same DTC still being output?	Replace ABSCM only. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 13.
13 CHECK ANY OTHER DTC APPEARANCE.	Are other DTC being output?	Proceed with the diagnosis corresponding to the DTC.	A temporary poor contact.

13.General Diagnostics Table

A: INSPECTION

Symptom		Probable faulty units/parts
Vehicle instability during braking	Vehicle pulls to either side.	• ABSCM&H/U (solenoid valve) • ABS sensor • Brake (caliper & piston, pads) • Wheel alignment • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections • Road surface (uneven, camber)
	Vehicle spins.	• ABSCM&H/U (solenoid valve) • ABS sensor • Brake (pads) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections
Poor braking	Long braking/stopping distance	• ABSCM&H/U (solenoid valve) • Brake (pads) • Air in brake line • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections
	Wheel locks.	• ABSCM&H/U (solenoid valve, motor) • ABS sensor • Incorrect wiring or piping connections
	Brake dragging	• ABSCM&H/U (solenoid valve) • ABS sensor • Master cylinder • Brake (caliper & piston) • Parking brake • Axle & wheels • Brake pedal play
	Long brake pedal stroke	• Air in brake line • Brake pedal play
	Vehicle pitching	• Suspension play or fatigue (reduced damping) • Incorrect wiring or piping connections • Road surface (uneven)
	Unstable or uneven braking	• ABSCM&H/U (solenoid valve) • ABS sensor • Brake (caliper & piston, pads) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections • Road surface (uneven)
Vibration and/or noise (while driving on slippery roads)	Excessive pedal vibration	• Incorrect wiring or piping connections • Road surface (uneven)
	Noise from ABSCM&H/U	• ABSCM&H/U (mount bushing) • ABS sensor • Brake piping
	Noise from front of vehicle	• ABSCM&H/U (mount bushing) • ABS sensor • Master cylinder • Brake (caliper & piston, pads, rotor) • Brake piping • Brake booster & check valve • Suspension play or fatigue
	Noise from rear of vehicle	• ABS sensor • Brake (caliper & piston, pads, rotor) • Parking brake • Brake piping • Suspension play or fatigue

GENERAL DIAGNOSTICS TABLE

ABS (DIAGNOSTICS)

MEMO:

	Page
1. General Description	2
2. ABS Control Module and Hydraulic Control Unit (ABSCM&H/U)	6
3. ABS Sequence Control	11
4. Front ABS Sensor	14
5. Rear ABS Sensor	17
6. Front Tone Wheel	21
7. Rear Tone Wheel	22
8. G Sensor	23



GENERAL DESCRIPTION

ABS

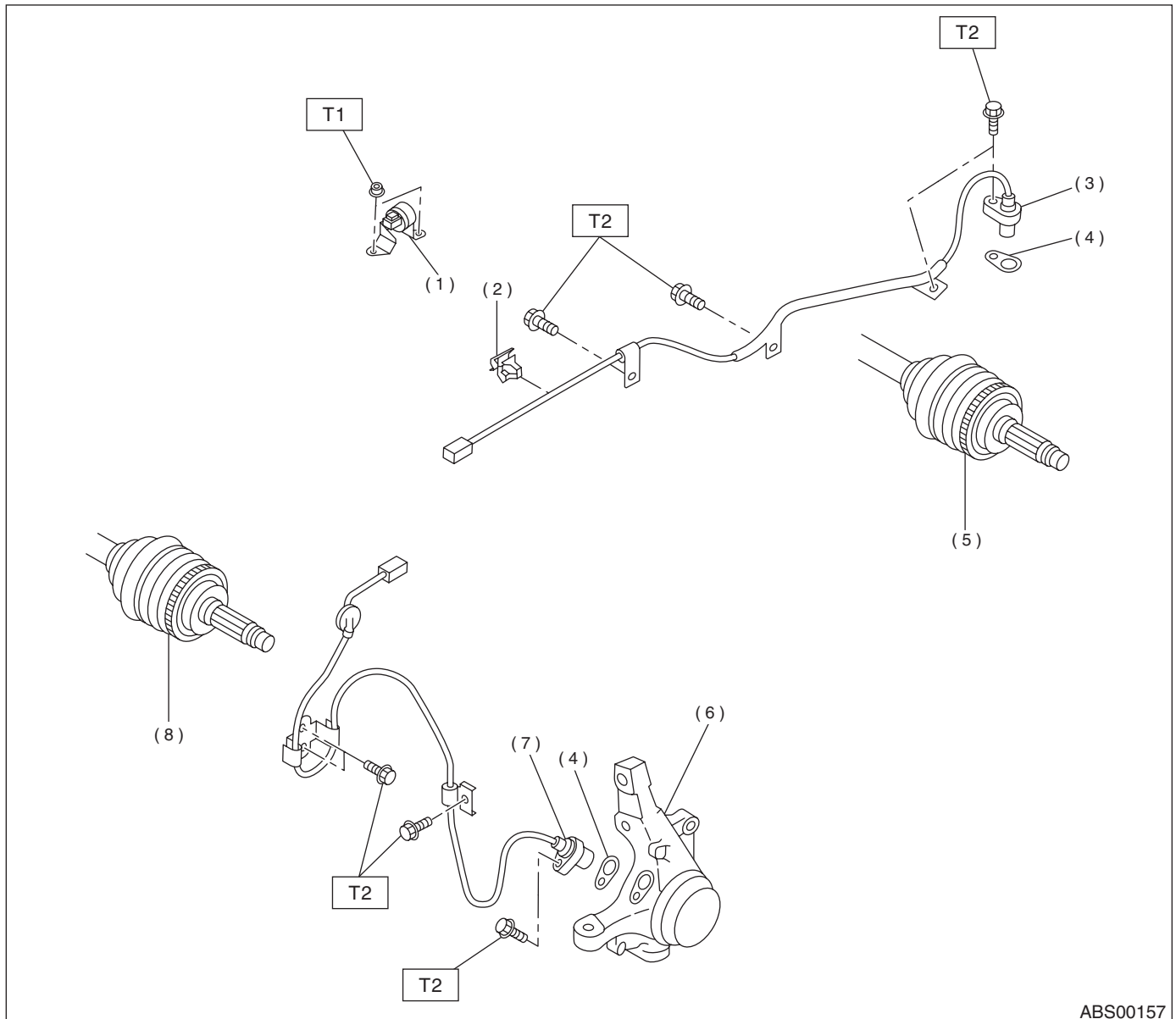
1. General Description

A: SPECIFICATIONS

Item			Standard or remarks
ABS sensor	ABS sensor gap	Front	0.3 — 0.8 mm (0.012 — 0.031 in)
		Rear	0.44 — 0.94 mm (0.0173 — 0.0370 in)
	ABS sensor resistance		1.25±0.25 kΩ
	Marks of the harness	Front LH	Brown
		Front RH	Light blue
		Rear LH	Yellow
		Rear RH	White
G sensor	G sensor voltage		2.3±0.2 V
ABS control module and hydraulic control unit (ABSCM&H/U) marks	AT		CI
	MT		CJ

B: COMPONENT

1. SENSOR



ABS00157

- | | |
|------------------------|-------------------------|
| (1) G sensor | (5) Tone wheel (Rear) |
| (2) Clip | (6) Housing |
| (3) Rear ABS sensor LH | (7) Front ABS sensor LH |
| (4) ABS spacer | (8) Tone wheel (Front) |

Tightening torque: N·m (kgf-m, ft-lb)

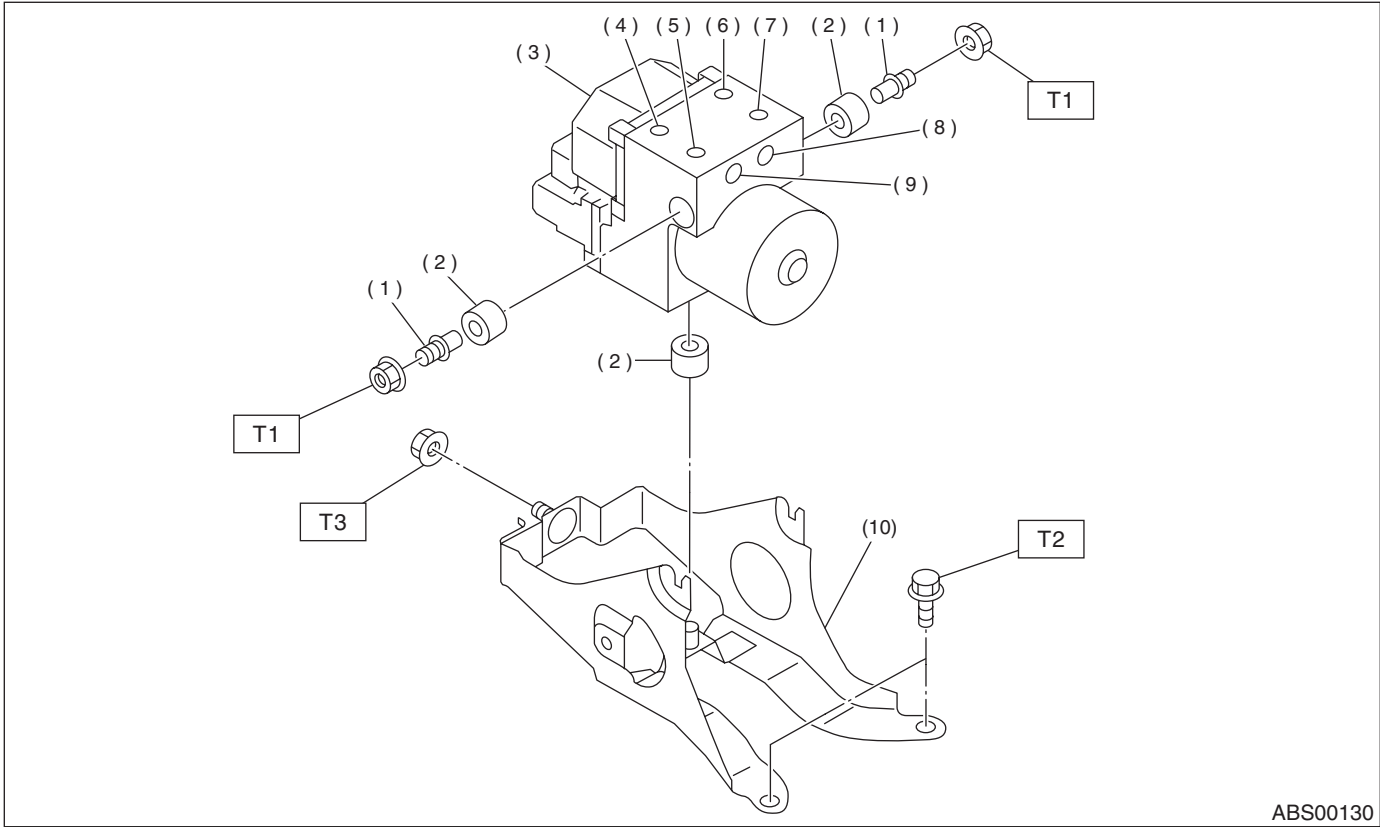
T1: 7.5 (0.77, 6)

T2: 33 (3.4, 24)

GENERAL DESCRIPTION

ABS

2. ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)



- | | |
|---|---------------------|
| (1) Stud bolt | (6) Front-RH outlet |
| (2) Damper | (7) Primary inlet |
| (3) ABS control module and hydraulic control unit | (8) Rear-LH outlet |
| (4) Front-LH outlet | (9) Rear-RH outlet |
| (5) Secondary inlet | (10) Bracket |

Tightening torque: N·m (kgf-m, ft-lb)
T1: 18 (1.8, 13.06)
T2: 33 (3.4, 24)
T3: 38 (3.9, 28)

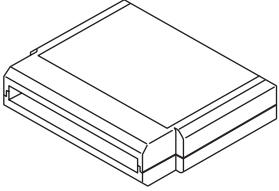
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect ground cable from battery.

D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18482AA010	18482AA010	CARTRIDGE	Troubleshooting for electrical systems.
 ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Circuit Tester	Used for measuring resistance, voltage and ampere.
Pressure Gauge	Used for measuring oil pressure.
Oscilloscope	Used for measuring sensor.

2. ABS Control Module and Hydraulic Control Unit (ABSCM&H/U)

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Remove air intake duct from engine compartment to facilitate removal of ABSCM&H/U.
- 3) Use an air gun to get rid of water around the ABSCM&H/U.

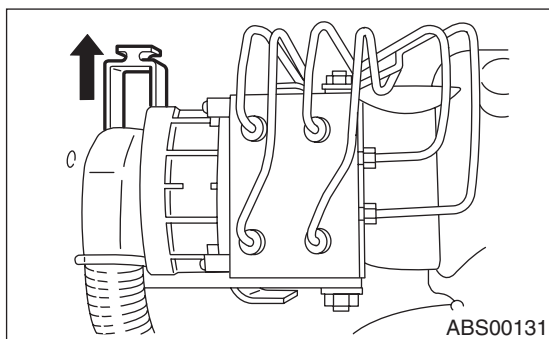
CAUTION:

The contact will be insufficient if the terminal gets wet.

- 4) Pull off the lock of the ABSCM&H/U connector to remove it.

CAUTION:

Do not pull on harness when disconnecting the connector.



CAUTION:

Be careful not to let water or other foreign matter contact the ABSCM&H/U terminal.

- 5) Unlock cable clip.
- 6) Disconnect brake pipes from ABSCM&H/U.

CAUTION:

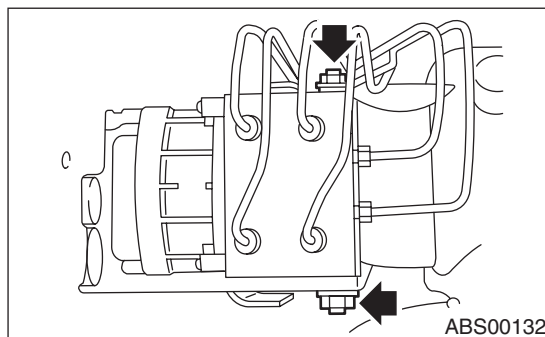
Wrap brake pipes with vinyl bag to avoid spilling brake fluid on vehicle body. Flush the vehicle completely and wipe it when applying the brake fluid to the body.

- 7) Remove ABSCM&H/U ground terminal from bracket.

- 8) Remove ABSCM&H/U from engine compartment.

CAUTION:

- Do not drop or bump ABSCM&H/U.
- Do not turn the ABSCM&H/U upside down or place it on its side.
- Be careful to prevent foreign particles from getting into ABSCM&H/U.
- Apply a coat of rust-preventive wax (Nippeco LT or GB) to bracket attaching bolt after tightening.
- Do not pull harness when disconnecting connector.



B: INSTALLATION

- 1) Install ABSCM&H/U.

CAUTION:

Confirm that the specifications of the ABSCM&H/U conforms to the vehicle specifications.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

- 2) Install ABSCM&H/U ground terminal to bracket.

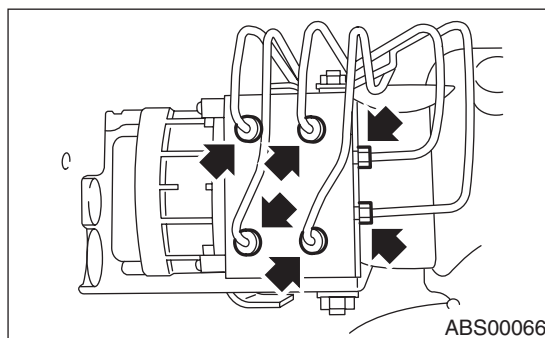
Tightening torque:

33 N·m (3.4 kgf-m, 24 ft-lb)

- 3) Connect brake pipes to their correct ABSCM&H/U connections.

Tightening torque:

15 N·m (1.5 kgf-m, 10.8 ft-lb)



- 4) Using cable clip, secure ABSCM&H/U harness to bracket.

5) Connect connector to ABSCM&H/U.

CAUTION:

- Be sure to remove all foreign matter from inside the connector before connecting.
- Ensure that the ABSCM&H/U connector is securely locked.

6) Install air intake duct.

7) Connect ground cable to battery.

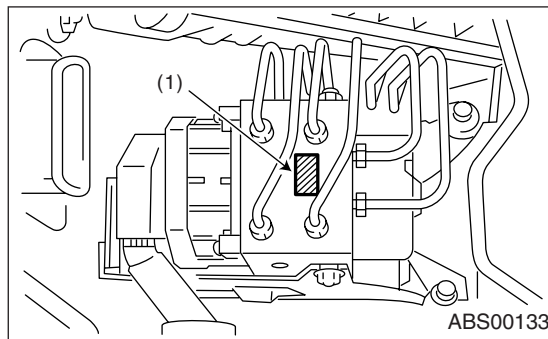
8) Bleed air from the brake system.

C: INSPECTION

1) Check connected and fixed condition of connector.

2) Check specifications of the mark with ABSCM&H/U.

Mark	Model
CI	AT (OUTBACK)
CJ	MT (OUTBACK)



(1) Mark

1. CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE

1) Lift-up vehicle and remove wheels.

2) Disconnect the air bleeder screws from the FL and FR caliper bodies.

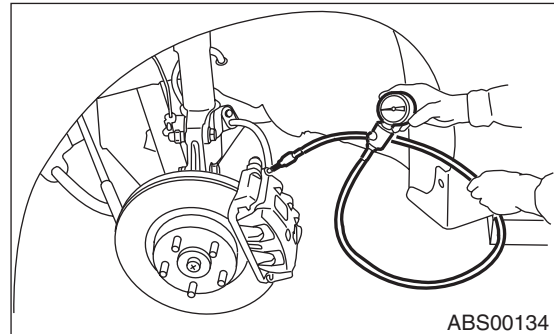
3) Connect two pressure gauges to the FL and FR caliper bodies.

CAUTION:

- Pressure gauges used exclusively for brake fluid must be used.
- Do not employ pressure gauge previously used for transmission since the piston seal is expanded which may lead to malfunction of the brake.

NOTE:

Wrap sealing tape around the pressure gauge.



4) Bleed air from the pressure gauges.

5) Perform ABS sequence control.

<Ref. to ABS-11, ABS Sequence Control.>

6) When the hydraulic unit begins to work, and first the FL side performs decompression, holding, and compression, and then the FR side performs decompression, holding, and compression.

7) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets the standard values. Also check if any irregular brake pedal tightness is felt.

	Front wheel	Rear wheel
Initial value	3,432 kPa (35 kg/cm ² , 498 psi)	3,432 kPa (35 kg/cm ² , 498 psi)
When decompressed	490 kPa (5 kg/cm ² , 71 psi) or less	490 kPa (5 kg/cm ² , 71 psi) or less
When compressed	3,432 kPa (35 kg/cm ² , 498 psi) or more	3,432 kPa (35 kg/cm ² , 498 psi) or more

8) Remove pressure gauges from FL and FR caliper bodies.

9) Remove air bleeder screws from the RL and RR caliper bodies.

10) Connect the air bleeder screws to the FL and FR caliper bodies.

11) Connect two pressure gauges to the RL and RR caliper bodies.

12) Bleed air from the pressure gauges and the FL and FR caliper bodies.

13) Perform ABS sequence control.

<Ref. to ABS-11, ABS Sequence Control.>

14) When the hydraulic unit begins to work, at first the RR side performs decompression, holding, and compression, and then the RL side performs decompression, holding, and compression.

15) Read values indicated on the pressure gauges and check if they meet the standard value.

16) After checking, remove the pressure gauges from caliper bodies.

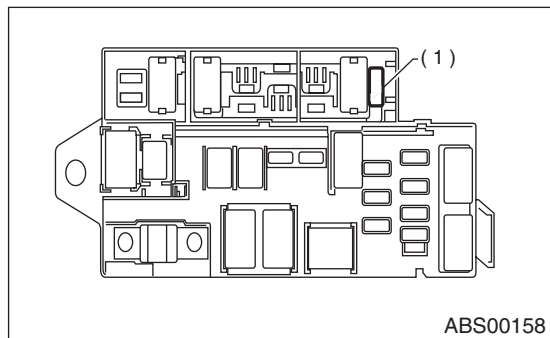
ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)

ABS

- 17) Connect the air bleeder screws to RL and RR caliper bodies.
- 18) Bleed air from brake line.

2. CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH BRAKE TESTER

- 1) In the case of AT model, install a spare fuse with the FWD connector in the main fuse box so as to simulate FWD model for checking.

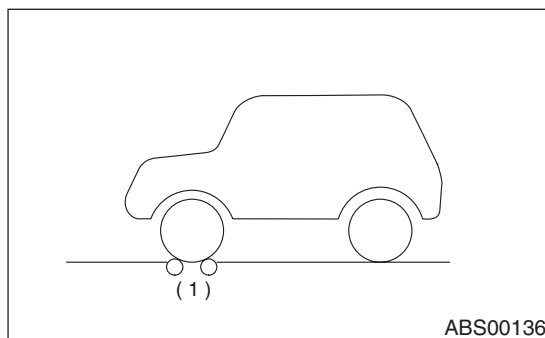


(1) FWD connector

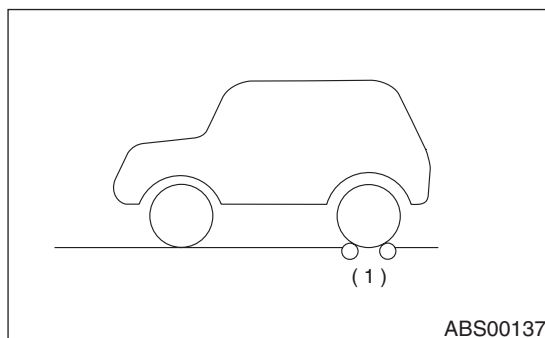
- 2) In the case of MT mode, perform measurement with the wheels other than the applicable wheels put on the free rollers because the AWD circuit cannot be forcibly cut off.

- 3) Prepare for operating ABS sequence control.
<Ref. to ABS-11, ABS Sequence Control.>

- 4) Set the front wheels or rear wheels on the brake tester and set the select lever's position at "neutral".



(1) Brake tester



(1) Brake tester

- 5) Operate the brake tester.
- 6) Perform ABS sequence control.
<Ref. to ABS-11, ABS Sequence Control.>
- 7) Hydraulic unit begins to work; and check the following working sequence.

- (1) The FL wheel performs decompression, holding, and compression in sequence, and subsequently the FR wheel repeats the cycle.
- (2) The RR wheel performs decompression, holding, and compression in sequence, and subsequently the RL wheel repeats the cycle.

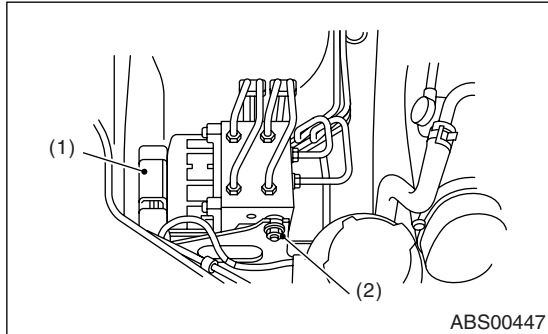
- 8) Read values indicated on the brake tester and check if the fluctuation of values, when decompressed and compressed, meet the standard values.

	Front wheel	Rear wheel
Initial value	981 N (100 kgf, 221 lb)	981 N (100 kgf, 221 lb)
When decompressed	490 N (50 kgf, 110 lb) or less	490 N (50 kgf, 110 lb) or less
When compressed	981 N (100 kgf, 221 lb) or more	981 N (100 kgf, 221 lb) or more

- 9) After checking, also check if any irregular brake pedal tightness is felt.

D: ABSCM (ABS CONTROL MODULE)

- 1) Disconnect the ground cable from battery.
- 2) Disconnect the ABSCM harness connector.
- 3) Remove the bracket mounting nut of ABSCM&H/U.



- (1) ABSCM harness connector
- (2) Bracket mounting nut

- 4) Leaving the brake pipe connected, raise the ABSCM&H/U for approx. 5 cm (2.0 in) from bracket.

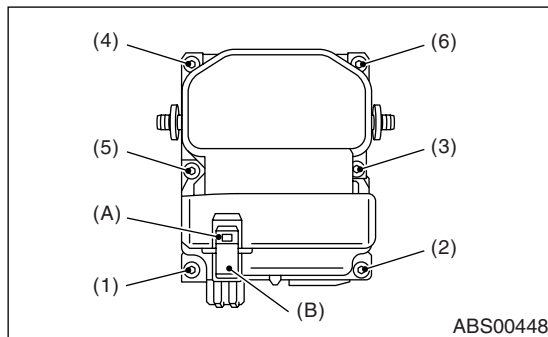
CAUTION:

Do not deform the brake pipe.

- 5) Unlock the motor power supply connector lock, and disconnect the connector.
- 6) Using TORX® BIT T20, remove the screws (1), (2), (3), (4), (5), (6) in this order.

CAUTION:

Do not reuse the screw.

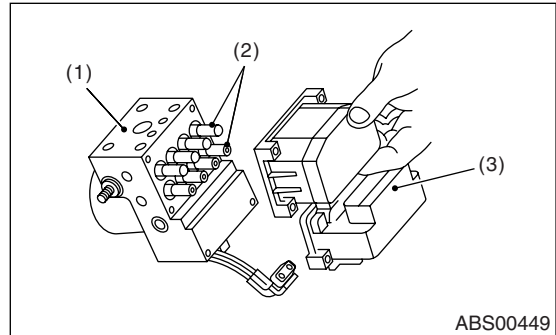


- (A) Motor power supply connector lock
- (B) Motor power supply connector

- 7) Remove the ABSCM from H/U.

CAUTION:

- Do not pry the ABSCM out, extract it straight out against H/U.
- Do not reuse the seal of ABSCM.



- (1) H/U
- (2) Valve
- (3) ABSCM

- 8) Check that H/U seal surface is free from dust and damages.

CAUTION:

- If damage is found on seal surface, replace the H/U.
- Do not apply compressed air to ABSCM&H/U for cleaning.

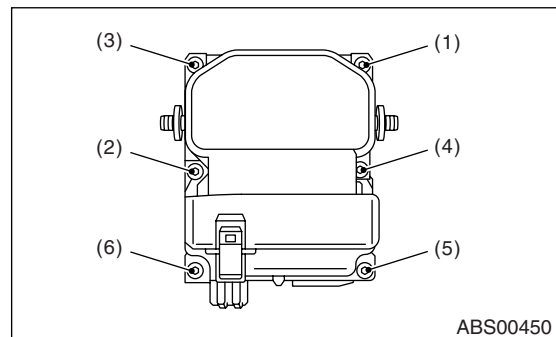
- 9) Install ABSCM straight for ward on to H/U, being careful not to scratch the valve.

- 10) Temporarily tighten the six new screws by hand.

- 11) Using TORX® BIT T20, tighten the screws (1), (2), (3), (4), (5), (6) in this order.

Tightening torque:

2.65 N·m (0.27 kgf·m, 1.95 ft·lb)



- 12) Make sure no clearance exists at the mating surface of ABSCM and H/U.

- 13) Connect the motor power supply connector to ABSCM.

CAUTION:

Securely connect the connector until connector lock sound is heard.

ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)

ABS

14) Attach the ABSCM&H/U to bracket, and then tighten with nuts.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

15) Connect the ABSCM harness connector.

16) Connect the battery ground cable to battery.

17) Turn the ignition key to ON. Check the ABS warning light turns on normally, then off.

18) Check that correct information (model year, drive system, transmission type) is displayed on the initial screen by connecting Subaru Select Monitor.

19) Start the engine and move the car to accelerate to more than 20 km/h (12.4 MPH). Check the ABS warning light does not turn on.

20) If any abnormal is found during the work of step 17) to 19), repair according to the procedure of relevant failure in "ABS (DIAGNOSTICS)" section.
<Ref. to ABS-16, OPERATION, Subaru Select Monitor.>

3. ABS Sequence Control

A: OPERATION

1) Under the ABS sequence control, after the hydraulic unit solenoid valve is driven, the operation of the hydraulic unit can be checked by means of the brake tester or pressure gauge.

2) ABS sequence control can be started by select monitor.

1. ABS SEQUENCE CONTROL WITH SELECT MONITOR

NOTE:

In the event of troubles such as “ABS cannot communicate with Select Monitor”, the sequence control will not activate. In such a case, perform trouble diagnosis. <Ref. to ABS-2, Basic Diagnostic Procedure.>

1) Connect select monitor to data link connector under driver's seat instrument panel lower cover.

2) Turn ignition switch ON.

3) Turn select monitor switch ON.

4) Put select monitor to “BRAKE CONTROL” mode.

5) When “Function check sequence” is selected, “ABS sequence control” will start.

6) The message “Press Brake Pedal Firmly” is displayed as follows:

(1) When using the brake tester, depress brake pedal with braking force of 981 N (100 kgf, 221 lb).

(2) When using the pressure gauge, depress brake pedal so as to make the pressure gauge indicate 3,432 kPa (35 kg/cm², 498 psi).

CAUTION:

Do not depress the clutch pedal.

7) When the message “Press YES” is displayed, press «YES» key.

8) Operation points will be displayed on select monitor.

B: SPECIFICATION

1. CONDITIONS FOR COMPLETION OF ABS SEQUENCE CONTROL

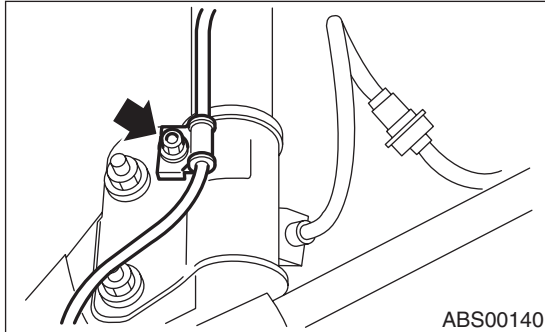
When the following conditions develop, the ABS sequence control stops and ABS operation is returned to the normal control mode.

- 1) When the speed of at least one wheel reaches 10 km/h (6 MPH).
- 2) When the brake pedal is released during sequence control and the braking lamp switch is set to off.
- 3) After completion of the sequence control.
- 4) When malfunction is detected. (When select monitor is used.)

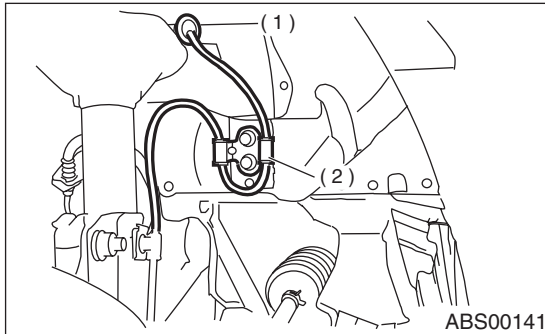
4. Front ABS Sensor

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Disconnect front ABS sensor connector located next to front strut mounting house in engine compartment.
- 3) Remove bolts which secure sensor harness to strut.



- 4) Remove bolts which secure sensor harness to body.

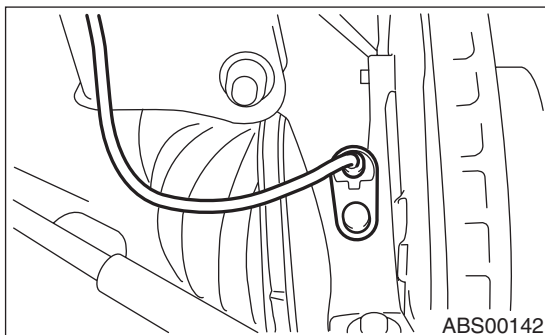


- (1) To front ABS sensor connector
- (2) Bracket

- 5) Remove bolts which secure front ABS sensor to housing, and remove front ABS sensor.

CAUTION:

- Be careful not to damage pole piece located at tip of the sensor and teeth faces during removal.
- Do not pull sensor harness during removal.

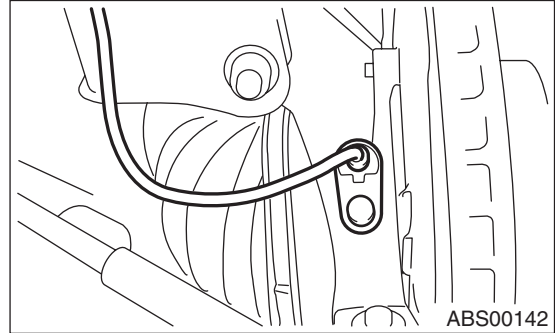


B: INSTALLATION

- 1) Temporarily install front ABS sensor on housing.

CAUTION:

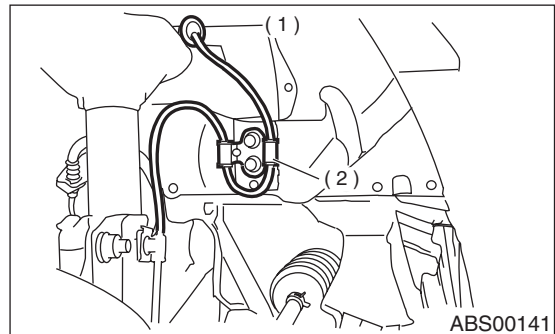
Be careful not to strike ABS sensor's pole piece and tone wheel's teeth against adjacent metal parts during installation.



- 2) Install front ABS sensor on strut and wheel apron bracket.

Tightening torque:

33 N·m (3.4 kgf-m, 24 ft-lb)

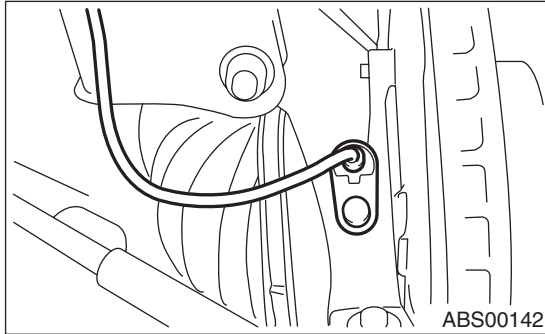


- (1) To front ABS sensor connector
- (2) Bracket

3) Place a thickness gauge between ABS sensor's pole piece and tone wheel's tooth face. After standard clearance is obtained over the entire perimeter, tighten ABS sensor on housing to specified torque.

ABS sensor standard clearance:
0.3 — 0.8 mm (0.012 — 0.031 in)

Tightening torque:
33 N·m (3.4 kgf-m, 24 ft-lb)



CAUTION:
Check the marks on the harness to make sure that no distortion exists.

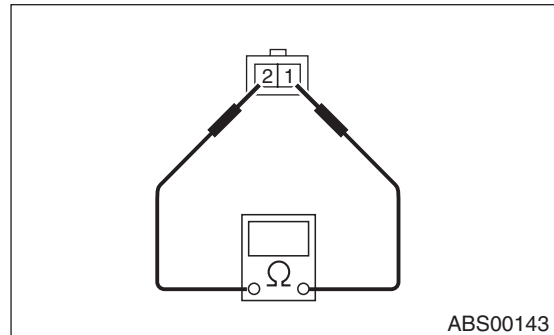
LH	RH
Brown	Light blue

NOTE:
 If the clearance is outside specifications, adjust the gap using spacer (Part No. 26755AA000).
 4) After confirmation of the ABS sensor clearance, connect connector to ABS sensor.
 5) Connect connector to battery ground cable.

C: INSPECTION

1. ABS SENSOR

- 1) Check pole piece of ABS sensor for foreign particles or damage. If necessary, clean pole piece or replace ABS sensor.
- 2) Measure ABS sensor resistance.



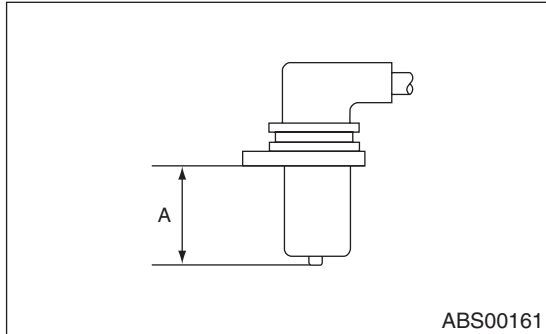
Terminal No.	Standard
1 and 2	1.25±0.25 kΩ

CAUTION:
If resistance is outside the standard value, replace ABS sensor with new one.

NOTE:
 Check ABS sensor cable for discontinuity. If necessary, replace with a new one.

2. SENSOR GAP

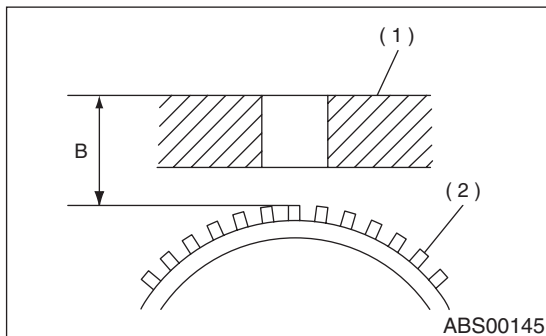
1) Measure the distance “A” between ABS sensor surface and sensor pole face.



2) Measure the distance “B” between surface where the front axle housing meets the ABS sensor, and the tone wheel.

NOTE:

Measure so that the gauge touches the tone wheel teeth top.



- (1) Axle housing
- (2) Tone wheel

3) Find the gap between the ABS sensor pole face and the surface of the tone wheel teeth by putting the measured values in the formula below and calculating.

$$\text{ABS sensor clearance} = B - A$$

ABS sensor standard clearance:

0.3 — 0.8 mm (0.012 — 0.031 in)

NOTE:

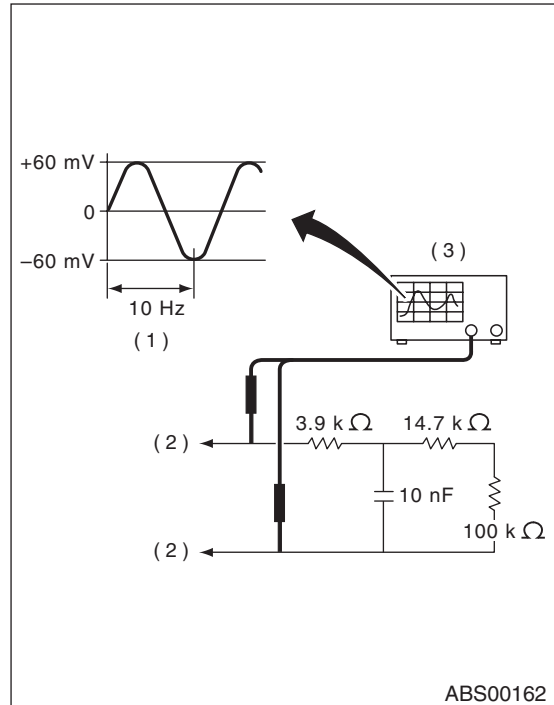
If the clearance is outside specifications, adjust the gap using spacer (Part No. 26755AA000).

3. OUTPUT VOLTAGE

Output voltage can be checked by the following method. Install resistor and condenser, then rotate wheel about 2.75 km/h (2 MPH) or equivalent.

NOTE:

Regarding terminal No., please refer to item 1. ABS SENSOR.



- (1) Standard output voltage:
Approx. 120 mV (When it is 10 Hz)
- (2) To terminal
- (3) Oscilloscope

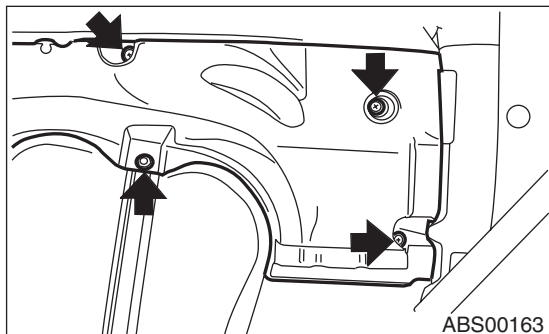
D: ADJUSTMENT

Adjust the gap using spacer (Part No. 26755AA000).

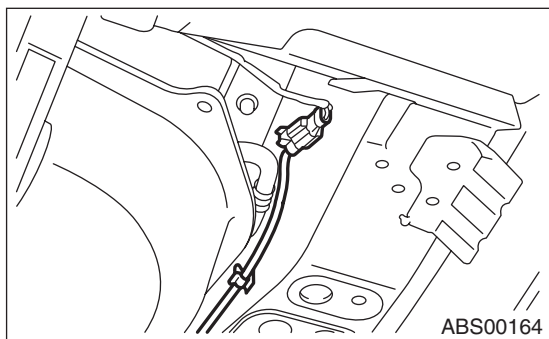
5. Rear ABS Sensor

A: REMOVAL

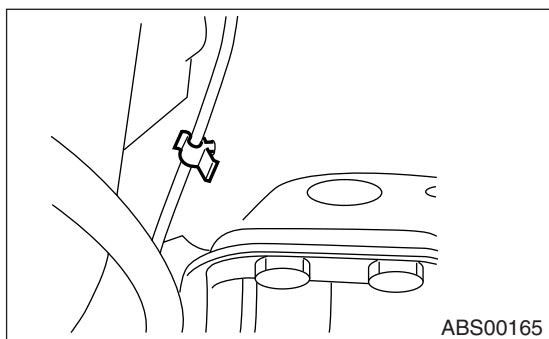
- 1) Disconnect ground cable from battery.
- 2) Lift-up the vehicle.
- 3) Remove fuel tank cover.



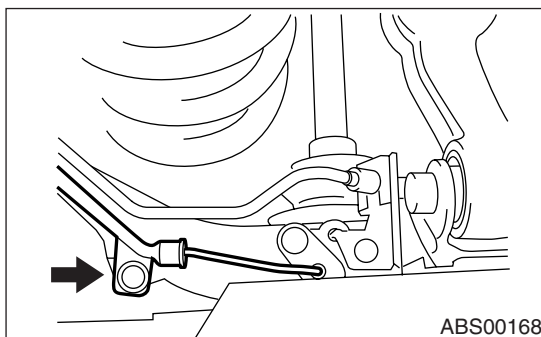
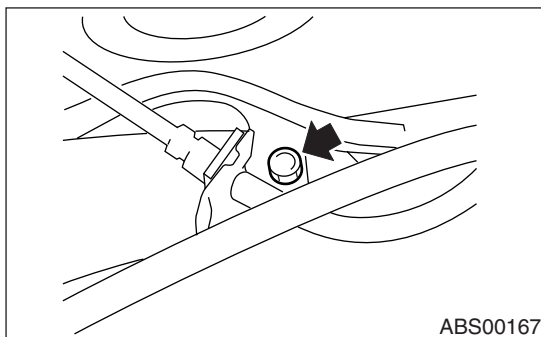
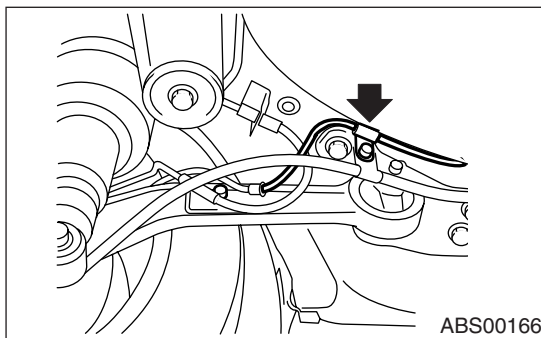
- 4) Disconnect rear ABS sensor connector.



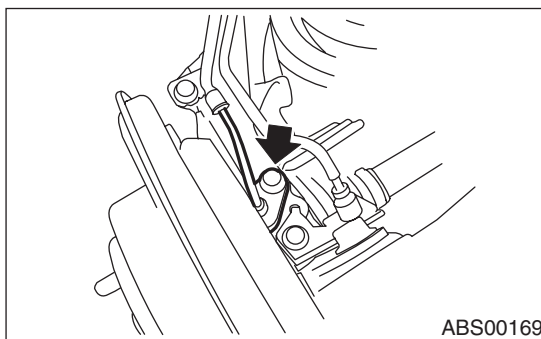
- 5) Remove rear sensor harness from clip on body side.



- 6) Remove bolts which hold rear sensor harness brackets.



- 7) Remove rear ABS sensor from rear arm.



REAR ABS SENSOR

ABS

8) When inspecting rear tone wheel, remove rear drive shaft as rear tone wheel is unitized with BJ assembly of rear drive shaft.
<Ref. to DS-37, REMOVAL, Rear Drive Shaft.>

CAUTION:

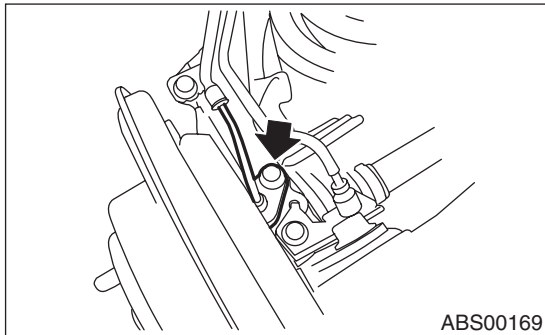
- Be careful not to damage pole piece located at tip of the sensor and teeth faces during removal.
- Do not pull sensor harness during removal.

B: INSTALLATION

- 1) Install rear drive shaft to the vehicle.
<Ref. to DS-37, INSTALLATION, Rear Drive Shaft.>
- 2) Temporarily install rear ABS sensor on rear arm.

CAUTION:

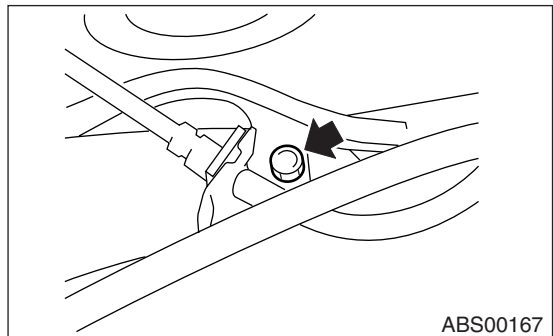
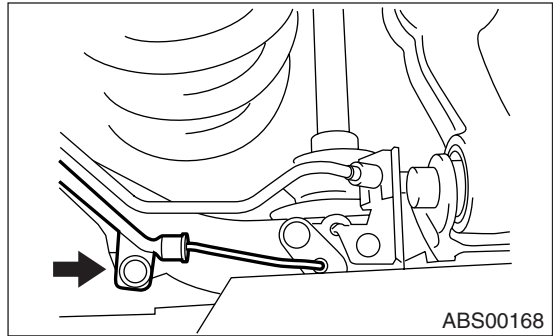
Be careful not to strike ABS sensor's pole piece and tone wheel's teeth against adjacent metal parts during installation.



- 3) Install rear sensor harness brackets in the original positions and install harness on the clip.

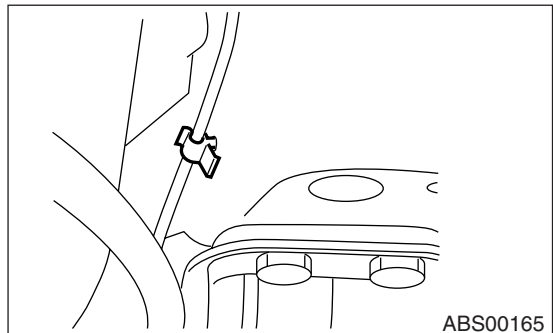
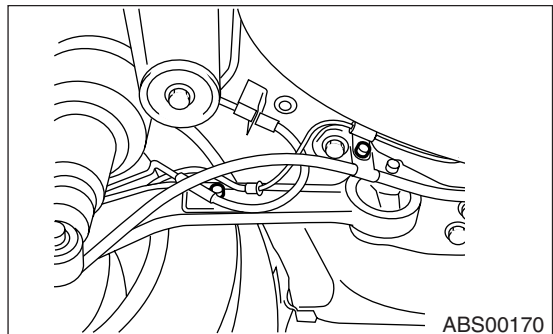
Tightening torque:

33 N·m (3.4 kgf-m, 24 ft-lb)



Tightening torque:

33 N·m (3.4 kgf-m, 24 ft-lb)



4) Place a thickness gauge between ABS sensor's and tone wheel's tooth face. After standard clearance is obtained over the entire perimeter, tighten ABS sensor on rear arm to specified torque.

ABS sensor standard clearance:

0.44 — 0.94 mm (0.0173 — 0.0370 in)

Tightening torque:

33 N·m (3.4 kgf-m, 24 ft-lb)

CAUTION:

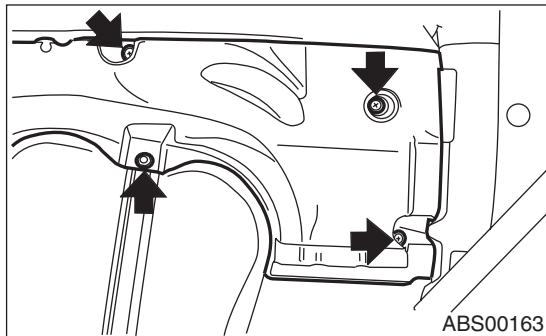
Check the marks on the harness to make sure that no distortion exists.

	LH	RH
Mark	Yellow	White

NOTE:

If the clearance is outside specifications, adjust the gap using spacer (Part No. 26755AA000).

5) After confirmation of the ABS sensor clearance, connect connector to ABS sensor and install fuel tank cover.



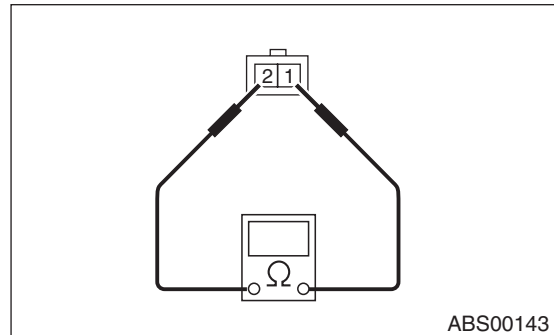
6) Connect connector to battery ground cable.

C: INSPECTION

1. ABS SENSOR

1) Check pole piece of ABS sensor for foreign particles or damage. If necessary, clean pole piece or replace ABS sensor.

2) Measure ABS sensor resistance.



Terminal No.	Standard
1 and 2	1.25±0.25 kΩ

CAUTION:

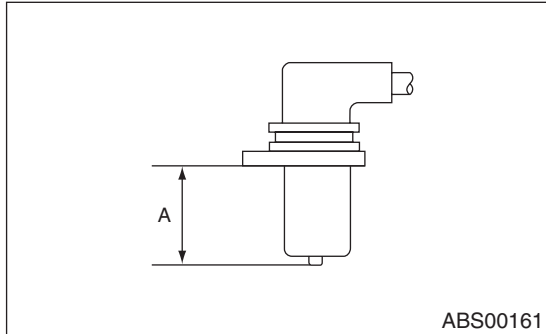
If resistance is outside the standard value, replace ABS sensor with new one.

NOTE:

Check ABS sensor cable for discontinuity. If necessary, replace with a new one.

2. SENSOR GAP

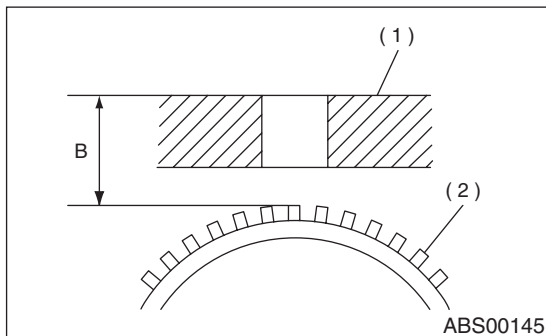
1) Measure the distance “A” between ABS sensor surface and sensor pole face.



2) Measure the distance “B” between surface where the front axle housing meets the ABS sensor, and the tone wheel.

NOTE:

Measure so that the gauge touches the tone wheel teeth top.



- (1) Axle housing
- (2) Tone wheel

3) Find the gap between the ABS sensor pole face and the surface of the tone wheel teeth by putting the measured values in the formula below and calculating.

$$\text{ABS sensor clearance} = B - A$$

ABS sensor standard clearance:

0.44 — 0.94 mm (0.0173 — 0.0370 in)

NOTE:

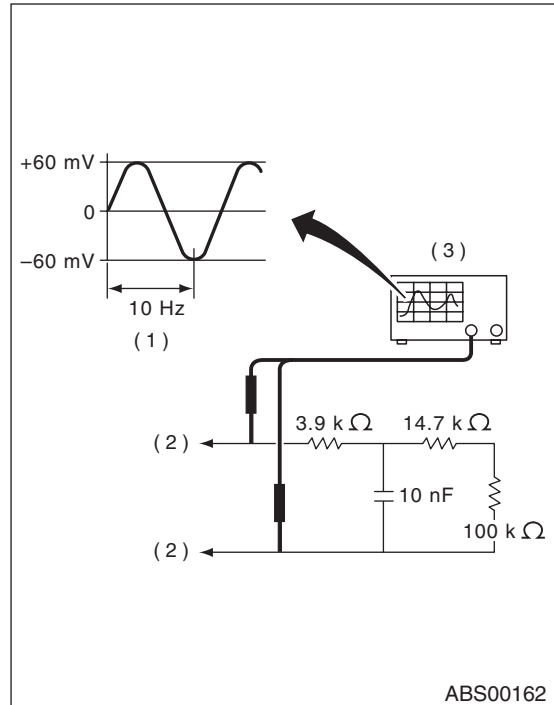
If the clearance is outside specifications, adjust the gap using spacer (Part No. 26755AA000).

3. OUTPUT VOLTAGE

Output voltage can be checked by the following method. Install resistor and condenser, then rotate wheel about 2.75 km/h (2 MPH) or equivalent.

NOTE:

Regarding terminal No., refer to item 1. ABS SENSOR.



- (1) Standard output voltage:
Approx. 120 mV (When it is 10 Hz)
- (2) To terminal
- (3) Oscilloscope

D: ADJUSTMENT

Adjust the gap using spacer (Part No. 26755AA000).

6. Front Tone Wheel

A: REMOVAL

Refer to Front Drive Shaft, because front tone wheel is integrated with front drive shaft.

<Ref. to DS-29, REMOVAL, Front Drive Shaft.>

B: INSTALLATION

Refer to Front Drive Shaft, because front tone wheel is integrated with front drive shaft.

<Ref. to DS-30, INSTALLATION, Front Drive Shaft.>

C: INSPECTION

Visually check tone wheels teeth (44 pieces) for cracks or dents. If necessary, replace tone wheel with a new one.

NOTE:

Replace BJ assembly with new one as a single unit if there are any defects found on tone wheel is unitized with BJ assembly of drive shaft.

7. Rear Tone Wheel

A: REMOVAL

Refer to Rear Drive Shaft, because rear tone wheel is integrated with rear drive shaft.

<Ref. to DS-37, REMOVAL, Rear Drive Shaft.>

B: INSTALLATION

Refer to Rear Drive Shaft, because rear tone wheel is integrated with rear drive shaft.

<Ref. to DS-37, INSTALLATION, Rear Drive Shaft.>

C: INSPECTION

Visually check tone wheels teeth (44 pieces) for cracks or dents. If necessary, replace tone wheel with a new one.

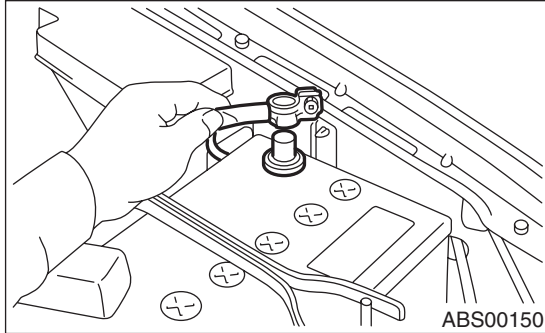
NOTE:

Replace BJ assembly with new one as a single unit if there are any defects found on tone wheel is unitized with BJ assembly of drive shaft.

8. G Sensor

A: REMOVAL

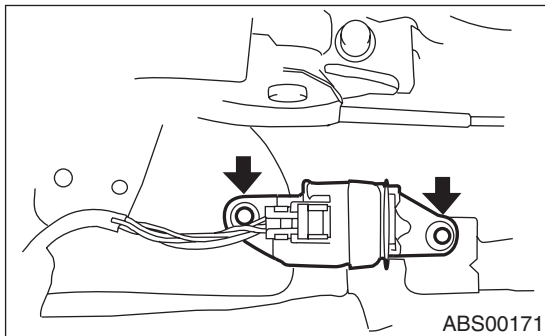
- 1) Disconnect ground cable from battery.



- 2) Remove console cover.
<Ref. to EI-36, REMOVAL, Console Box.>
- 3) Disconnect connector from G sensor.
- 4) Remove G sensor from body.

CAUTION:

Do not drop or bump G sensor.

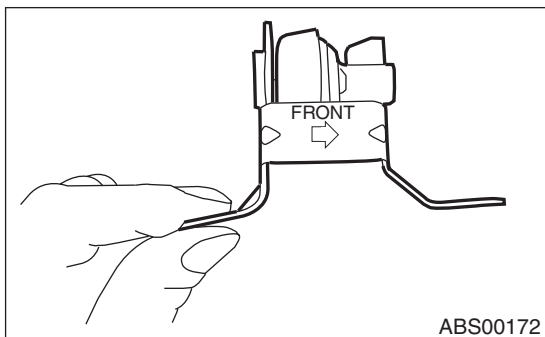


B: INSTALLATION

- 1) Install in the reverse order of removal.

NOTE:

Do not install G sensor in the wrong direction.
There is an arrow mark on the sensor showing which side faces the vehicle front.



C: INSPECTION

Step	Check	Yes	No
1 CHECK SUBARU SELECT MONITOR.	Do you have SUBARU SELECT MONITOR?	Go to step 5.	Go to step 2.
2 CHECK G SENSOR. 1) Turn ignition switch to OFF. 2) Remove G sensor from vehicle. 3) Connect connector to G sensor. 4) Turn ignition switch to ON. 5) Measure voltage between G sensor connector terminals. Connector & terminal: (R70) No. 2 (+) — No. 3 (–)	Is the voltage 2.1 — 2.5 V when G sensor is horizontal?	Go to step 3.	Replace G sensor.
3 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal: (R70) No. 2 (+) — No. 3 (–)	Is the voltage 3.6 — 4.1 V when G sensor is inclined forwards to 90°?	Go to step 4.	Replace G sensor.
4 CHECK G SENSOR. Measure voltage between G sensor connector terminals. Connector & terminal: (R70) No. 2 (+) — No. 3 (–)	Is the voltage 0.5 — 1.0 V when G sensor is inclined backwards to 90°?	G sensor is normal.	Replace G sensor.
5 CHECK G SENSOR. 1) Turn ignition switch to OFF. 2) Connect select monitor connector to data link connector. 3) Turn select monitor into {BRAKE CONTROL} mode. 4) Set the display in the {Current Data Display & Save} mode. 5) Read the G sensor output voltage.	Is the indicated reading 2.1 — 2.5 V when the vehicle is in horizontal position?	Go to step 6.	Replace G sensor.
6 CHECK G SENSOR. 1) Remove console box. 2) Remove G sensor from vehicle. (Do not disconnect connector.) 3) Read the select monitor display.	Is the indicated reading 3.6 — 4.1 V when G sensor is inclined forwards to 90°?	Go to step 7.	Replace G sensor.
7 CHECK G SENSOR. Read the select monitor display.	Is the indicated reading 0.5 — 1.0 V when G sensor is inclined backwards to 90°?	G sensor is normal.	Replace G sensor.

BRAKE

BR

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GENERAL DESCRIPTION

BRAKE

1. General Description

A: SPECIFICATIONS

Front disc brake	Size	16 inch type	
		Non-TURBO	With TURBO model
	Type	Disc (Floating type, ventilated)	
	Effective disc diameter	244 mm (9.61 in)	
	Disc thickness × Outer diameter	24 × 294 mm (0.94 × 11.57 in)	
	Effective cylinder diameter	42.8 mm (1.685 in) × 2	
	Pad dimensions (length × width × thickness)	117.8 × 50.5 × 11.0 mm (4.638 × 1.988 × 0.433 in)	
Rear disc brake	Clearance adjustment	Automatic adjustment	
	Type	Disc (Floating type)	
	Effective disc diameter	254 mm (10.0 in)	
	Disc thickness × Outer diameter	10 × 290 mm (0.39 × 11.42 in)	
	Effective cylinder diameter	38.1 mm (1.500 in)	
	Pad dimensions (length × width × thickness)	82.4 × 33.7 × 9.0 mm (3.244 × 1.327 × 0.354 in)	
Master cylinder	Clearance adjustment	Automatic adjustment	
	Type	Tandem	
	Effective diameter	26.99 mm (17/16 in)	25.4 mm (1 in)
	Reservoir type	Sealed type	
Brake booster	Brake fluid reservoir capacity	205 cm ³ (12.51 cu in)	
	Type	Vacuum brake booster assisted type	
Proportioning valve	Effective diameter	205 + 230 mm (8.07 + 9.06 in)	
	Split point	2,942 kPa (30 kg/cm ² , 427 psi)	
Brake line	Reducing ratio	0.3	
		Dual circuit system	
Brake fluid		FMVSS No. 116, DOT3 or DOT4	
CAUTION: • Avoid mixing brake fluid of different brands to prevent the fluid performance from degrading. • When brake fluid is supplemented, be careful not to allow any dust into the reservoir. • Use fresh DOT3 or 4 brake fluid when replacing or refilling the fluid.			

NOTE:

Refer to “PB section” for parking brake SPECIFICATIONS.

GENERAL DESCRIPTION

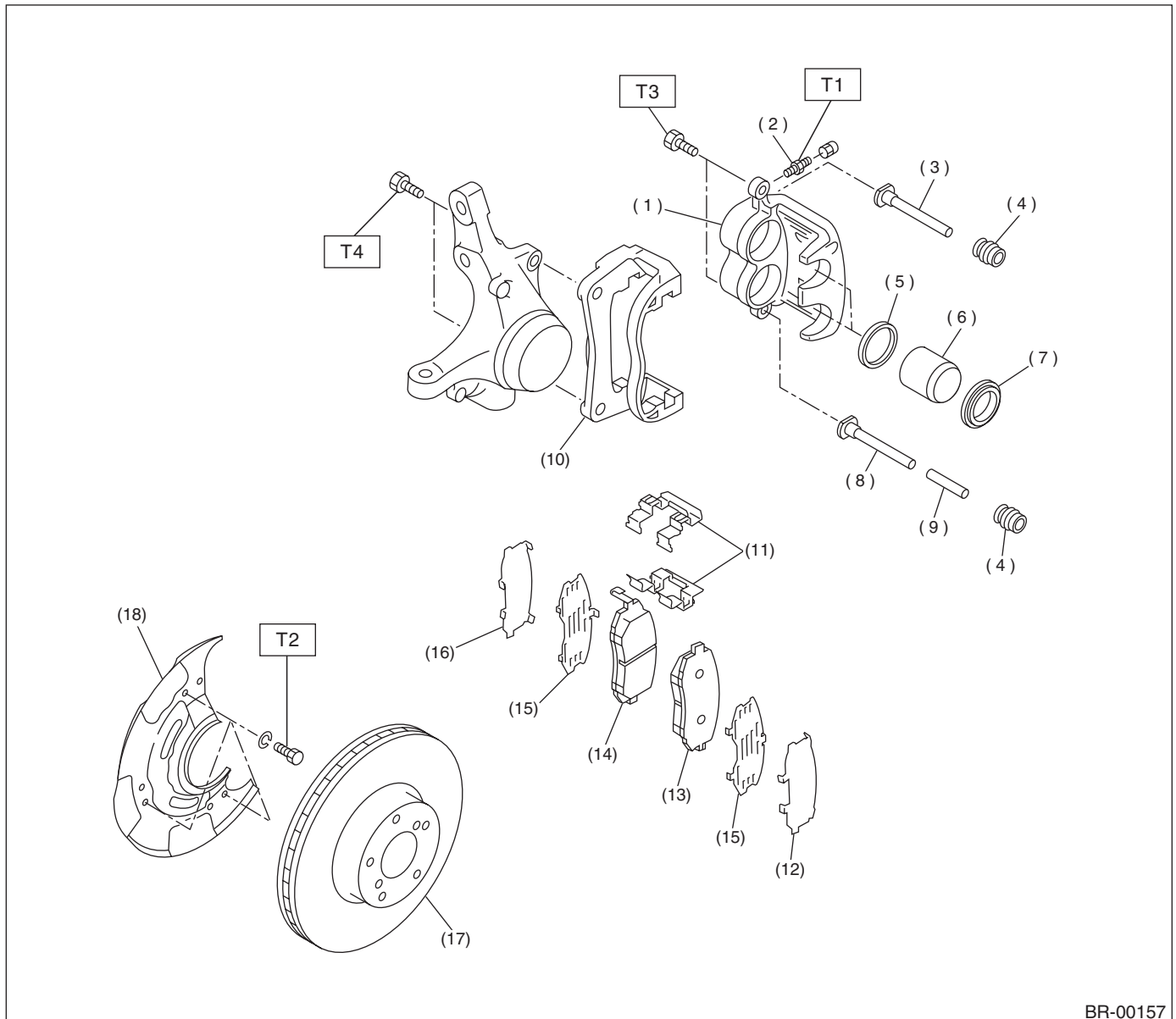
BRAKE

ITEM		STANDARD	SERVICE LIMIT
Front brake	Pad thickness (including back metal)	17 mm (0.67 in)	7.5 mm (0.295 in)
	Disc thickness	24 mm (0.94 in)	22 mm (0.87 in)
	Disc runout	—	0.075 mm (0.0030 in)
Rear brake	Pad thickness (including back metal)	14 mm (0.55 in)	6.5 mm (0.256 in)
	Disc thickness	10 mm (0.39 in)	8.5 mm (0.335 in)
	Disc runout	—	0.070 mm (0.0028 in)
Parking brake	Inside diameter	170 mm (6.69 in)	171 mm (6.73 in)
	Lining thickness	3.2 mm (0.126 in)	1.5 mm (0.059 in)
	Lever stroke	7 to 8 notches/196 N (20 kgf, 44 lb)	

		Brake pedal force	Fluid pressure
Brake booster	Brake fluid pressure with-out engine running	147 N (15 kgf, 33 lb)	588 kPa (6 kg/cm ² , 85 psi)
		294 N (30 kgf, 66 lb)	1,569 kPa (16 kg/cm ² , 228 psi)
	Brake fluid pressure with engine running and vacuum at 66.7 kPa (500 mmHg, 19.69 inHg)	147 N (15 kgf, 33 lb)	6,178 kPa (63 kg/cm ² , 896 psi)
		294 N (30 kgf, 66 lb)	9,709 kPa (99 kg/cm ² , 1,408 psi)

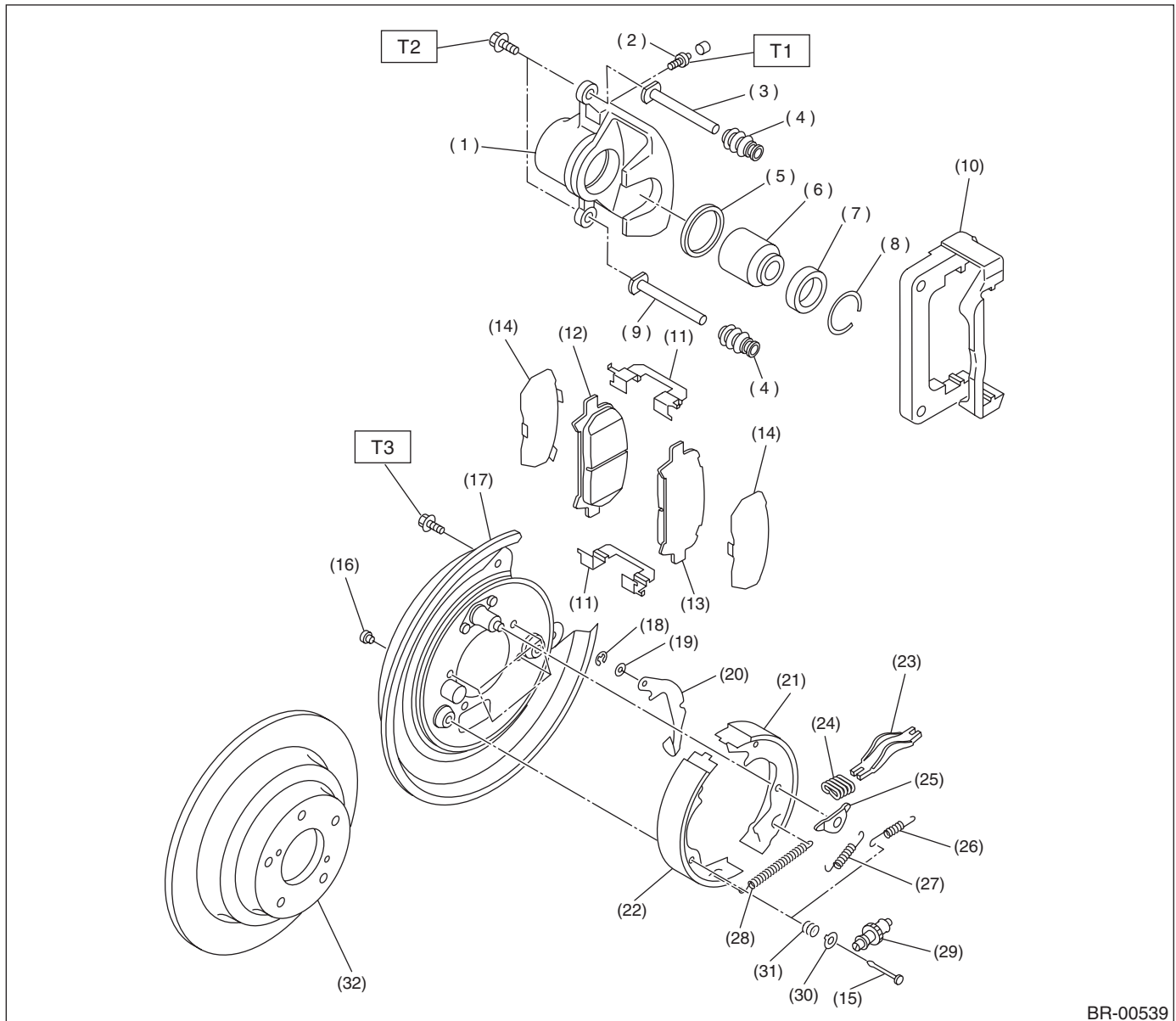
Brake pedal	Free play	1 — 3 mm (0.04 — 0.12 in) [Depress brake pedal pad with a force of less than 10 N (1 kgf, 2 lb).]
-------------	-----------	--

1. FRONT DISC BRAKE



T4: 80 (8.2, 59)

2. REAR DISC BRAKE



BR-00539

- | | | |
|-----------------------|-------------------------------------|---------------------------------|
| (1) Caliper body | (14) Shim | (27) Primary shoe return spring |
| (2) Air bleeder screw | (15) Shoe hold-down pin | (28) Adjusting spring |
| (3) Guide pin (Green) | (16) Cover | (29) Adjuster |
| (4) Pin boot | (17) Back plate | (30) Shoe hold-down cup |
| (5) Piston seal | (18) Retainer | (31) Shoe hold-down spring |
| (6) Piston | (19) Spring washer | (32) Disc rotor |
| (7) Piston boot | (20) Parking brake lever | |
| (8) Boot ring | (21) Parking brake shoe (Secondary) | |
| (9) Lock pin (Yellow) | (22) Parking brake shoe (Primary) | |
| (10) Support | (23) Strut | |
| (11) Pad clip | (24) Strut shoe spring | |
| (12) Inner pad | (25) Shoe guide plate | |
| (13) Outer pad | (26) Secondary shoe return spring | |

Tightening torque: N-m (kgf-m, ft-lb)

T1: 8 (0.8, 5.8)

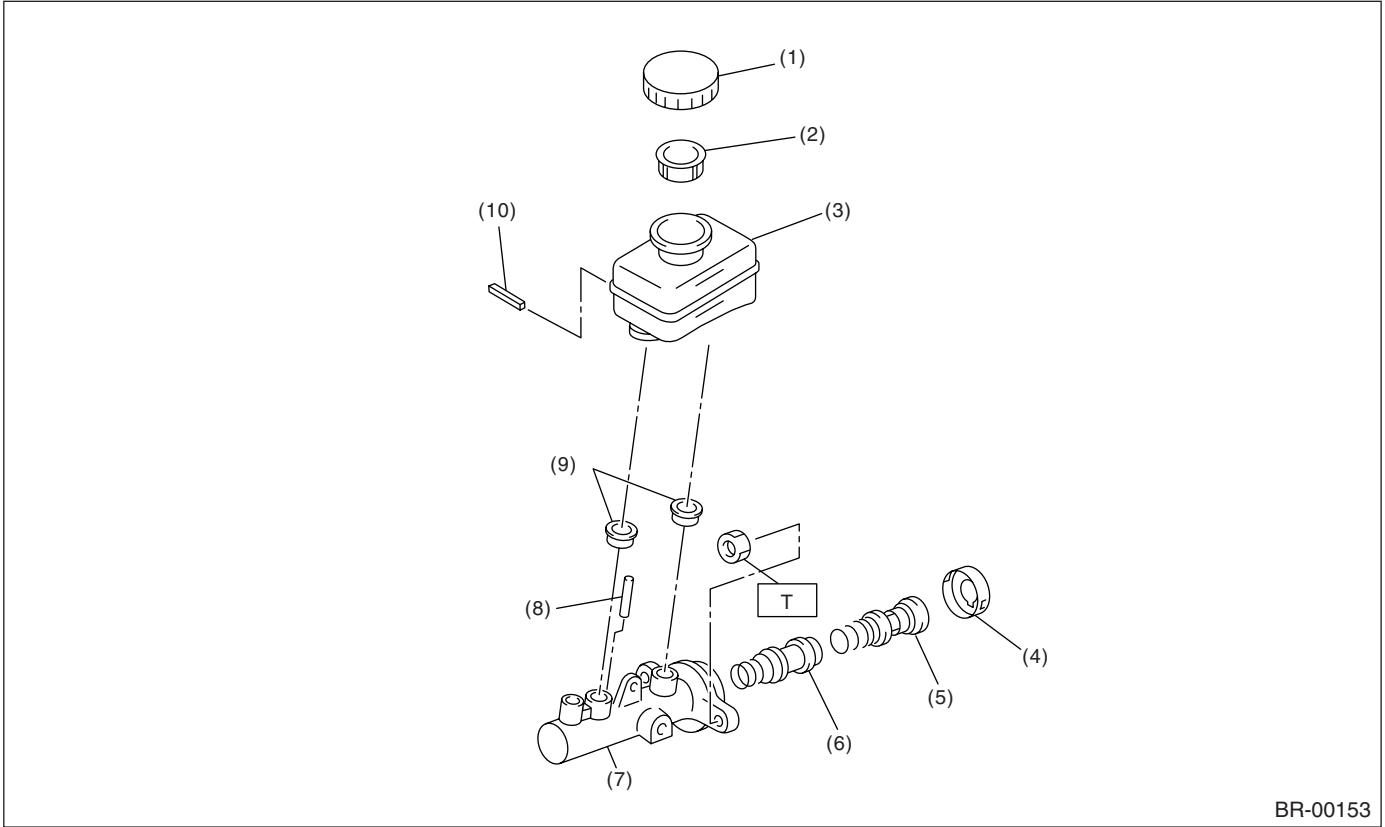
T2: 39 (4.0, 28.9)

T3: 52 (5.3, 38.3)

GENERAL DESCRIPTION

BRAKE

3. MASTER CYLINDER

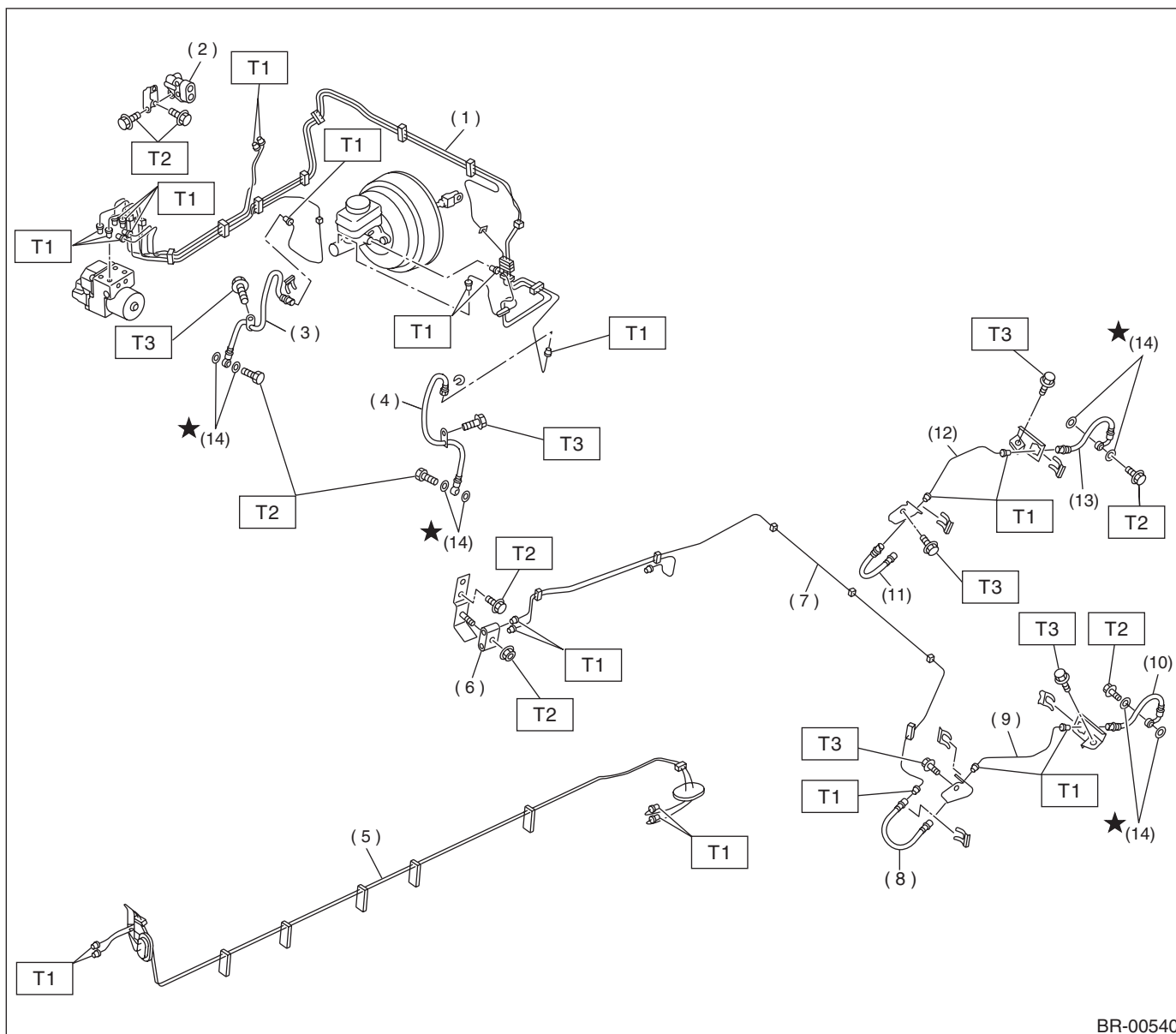


BR-00153

- | | |
|---------------------|-----------------------------|
| (1) Cap | (6) Secondary piston |
| (2) Filter | (7) Cylinder body |
| (3) Reservoir tank | (8) Cylinder pin (With ABS) |
| (4) Piston retainer | (9) Seal |
| (5) Primary piston | (10) Pin |

Tightening torque: N·m (kgf-m, ft-lb)
T: 14 (1.4, 10.1)

4. BRAKE PIPES AND HOSE



BR-00540

- | | |
|--------------------------------|------------------------------|
| (1) Front brake pipe assembly | (7) Rear brake pipe assembly |
| (2) Proportioning valve | (8) Rear brake hose LH |
| (3) Front brake hose RH | (9) Rear brake pipe LH |
| (4) Front brake hose LH | (10) Rear brake hose rear LH |
| (5) Center brake pipe assembly | (11) Rear brake hose RH |
| (6) Two-way connector | (12) Rear brake pipe RH |

- | |
|------------------------------|
| (13) Rear brake hose rear RH |
| (14) Gasket |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 15 (1.5, 10.8)

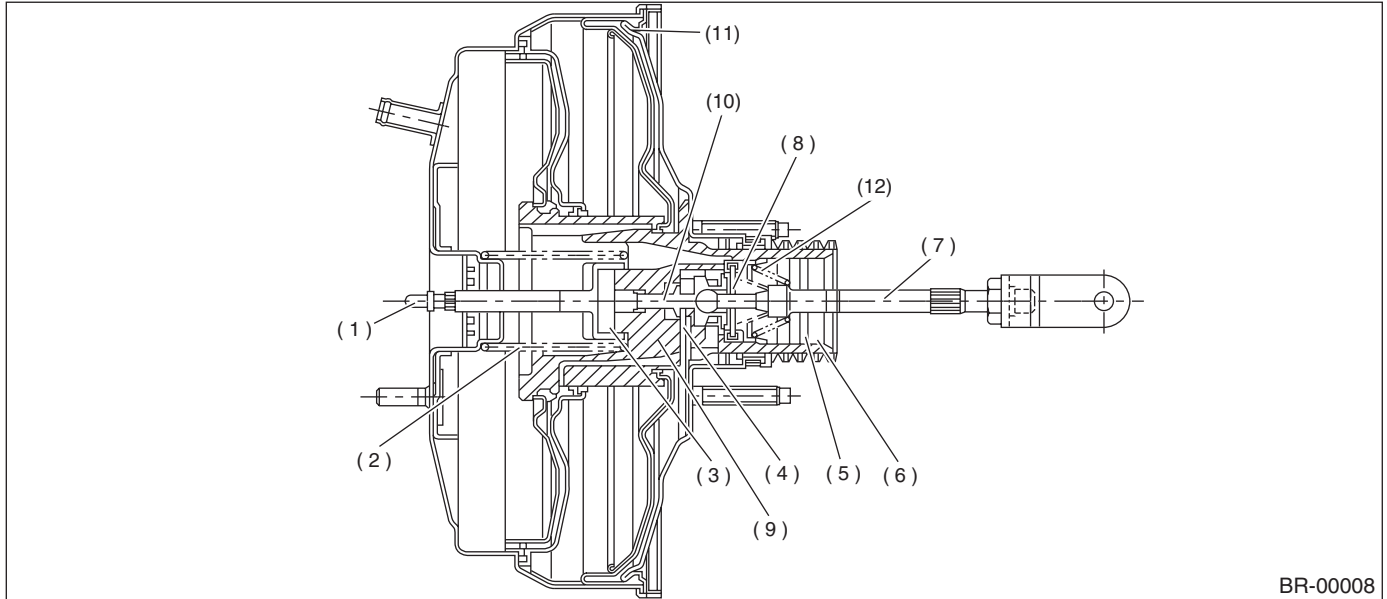
T2: 18 (1.8, 13.0)

T3: 33 (3.3, 23.8)

GENERAL DESCRIPTION

BRAKE

5. BRAKE BOOSTER

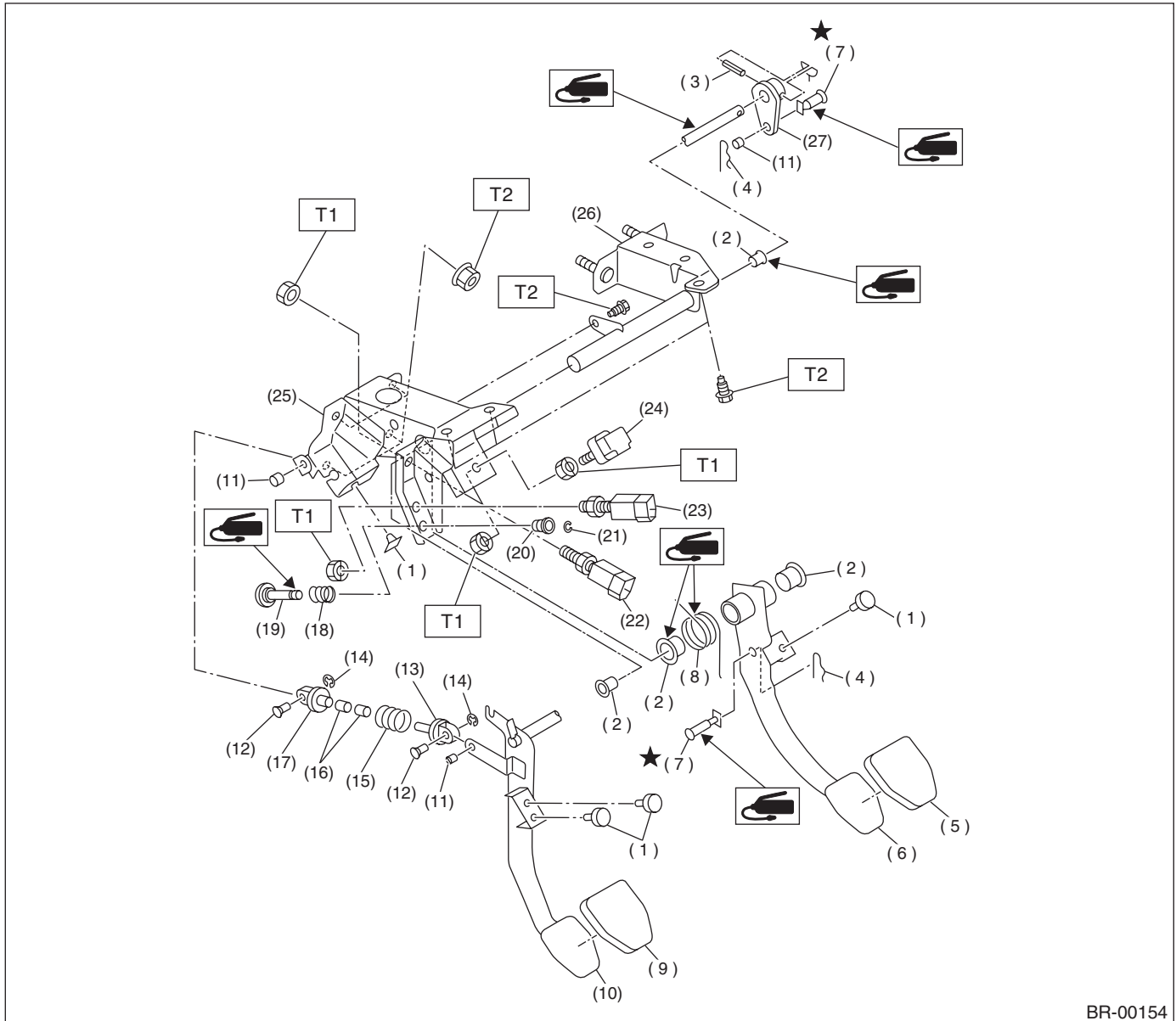


- (1) Push rod
- (2) Return spring
- (3) Reaction disc
- (4) Key

- (5) Filter
- (6) Silencer
- (7) Operating rod
- (8) Poppet valve

- (9) Valve body
- (10) Plunger valve
- (11) Diaphragm plate
- (12) Valve return spring

6. BRAKE PEDAL FOR MT MODEL



BR-00154

- | | | |
|------------------------|--|--|
| (1) Stopper | (12) Clutch clevis pin | (23) Clutch switch (With cruise control) |
| (2) Bushing | (13) Assist rod A | (24) Stop light switch |
| (3) Spring pin | (14) Clip | (25) Pedal bracket |
| (4) Snap pin | (15) Assist spring | (26) Clutch master cylinder bracket |
| (5) Brake pedal pad | (16) Assist bushing | (27) Lever |
| (6) Brake pedal | (17) Assist rod B | |
| (7) Clevis pin | (18) Spring S | |
| (8) Brake pedal spring | (19) Rod S | |
| (9) Clutch pedal pad | (20) Bushing S | |
| (10) Clutch pedal | (21) Clip | |
| (11) Bushing C | (22) Clutch switch (Starter interlock) | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 8 (0.8, 5.8)

T2: 18 (1.8, 13.0)

This exploded view diagram illustrates the assembly of a bicycle seat. The components are labeled as follows:

- (1) Seat post clamp bolt
- (2) Seat post clamp nut
- (3) Seat post clamp bracket
- (4) Seat post clamp cap
- (5) Seat post clamp sleeve
- (6) Seat post clamp plate
- (7) Seat post clamp cover
- (8) Seat post clamp base
- (9) Seat post clamp pin
- (10) Seat post clamp nut

Torque specifications are indicated by labels T1, T2, and T3, which correspond to the assembly of the seat post clamp bracket, the seat post clamp nut, and the seat post clamp pin, respectively.

- Tightening torque: N·m (kgf·m, ft·lb)**
T1: 8 (0.8, 5.8)
T2: 18 (1.8, 13.0)
T3: 29 (3.0, 21.7)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Use SUBARU genuine grease etc. or the equivalent. Do not mix grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply grease onto sliding or revolving surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of grease to avoid damage and deformation
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.
- Do not put fluid on body. If the body is tainted, wash away with water.

D: PREPARATION TOOL**1. GENERAL PURPOSE TOOLS**

TOOL NAME	REMARKS
Snap Ring Pliers	Used for removing and installing snap ring.

FRONT BRAKE PAD

BRAKE

2. Front Brake Pad

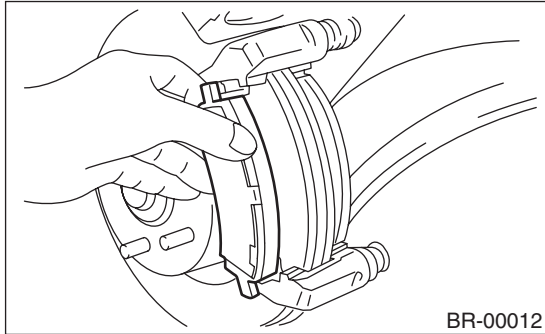
A: REMOVAL

- 1) Loosen wheel nuts, jack-up vehicle, support it with safety stands, and remove wheel.
- 2) Remove bottom bolt.
- 3) Raise caliper body and suspend it securely.

NOTE:

Do not disconnect brake hose from caliper body.

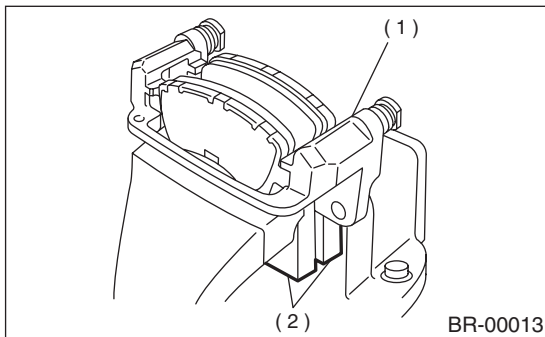
- 4) Remove pad.



NOTE:

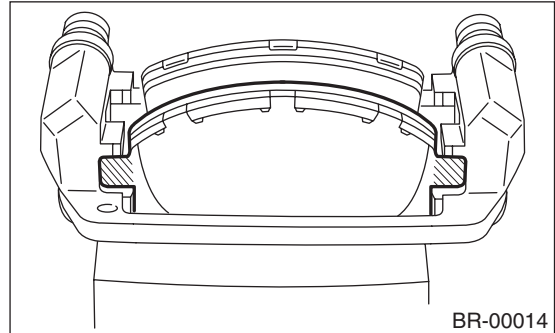
If brake pad is difficult to remove, proceed as follows:

- (1) Remove caliper body and fasten it provisionally to coil spring.
- (2) Remove support.
- (3) Place a support in a vise between wooden blocks.



- (1) Support
(2) Wooden blocks

- (4) Attach a rod of less than 12 mm (0.47 in) dia. to the shaded area of brake pad, and strike the rod with a hammer to drive brake pad out of place.

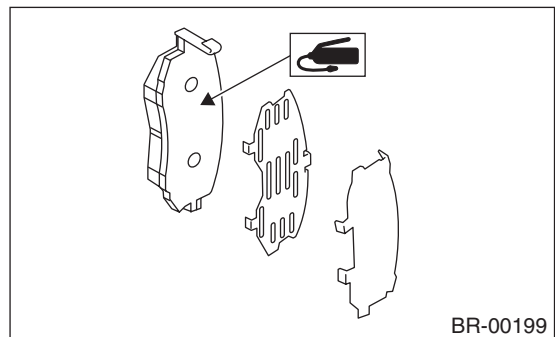


B: INSTALLATION

- 1) Apply thin coat of Molykote M7439 (Part No. 003608001) to the frictional portion between pad and pad clip.
- 2) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and pad inner shim.

CAUTION:

Do not allow oil or grease to adhere to the sliding surface of pad and disc rotor.



- 3) Check disc rotor thickness and runout.
<Ref. to BR-14, INSPECTION, Front Disc Rotor.>
- 4) Install pads on support.
- 5) Install caliper body on support.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

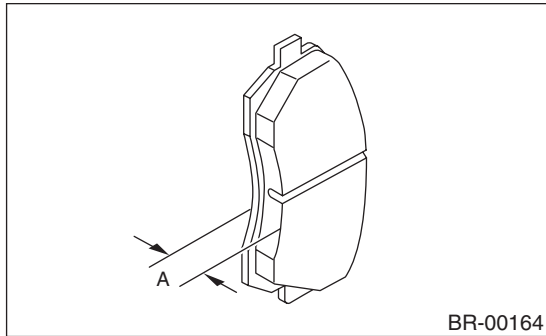
NOTE:

If it is difficult to push piston during pad replacement, loosen air bleeder to facilitate work.

- 6) Depress brake pedal several times.
- 7) Check that brake fluid level is at max. line.

C: INSPECTION

Check pad thickness A.



Pad thickness (including back metal)	Standard value	17 mm (0.67 in)
	Wear limit	7.5 mm (0.295 in)

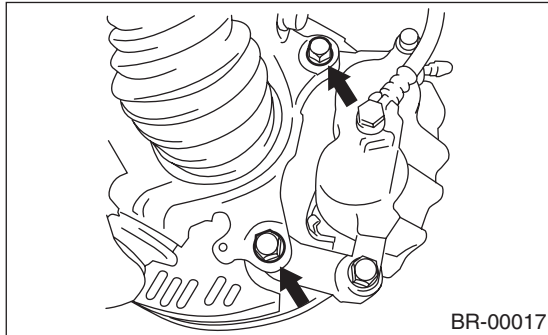
CAUTION:

- Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
- A wear indicator is provided on the inner disc brake pad of the left wheel. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
- Replace pad if there is oil or grease on it.

3. Front Disc Rotor

A: REMOVAL

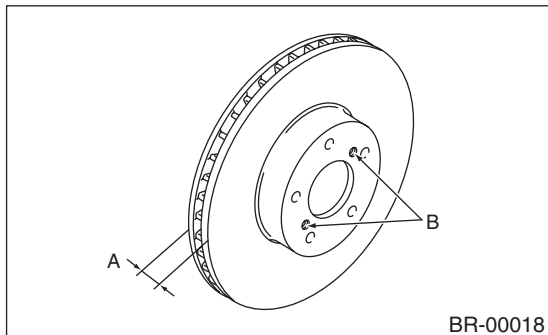
- 1) Loosen wheel nuts, jack-up vehicle, support it with safety stands, and remove wheel.
- 2) Remove caliper body from housing, and suspend it from strut using a wire.



- 3) Remove the disc rotor.

NOTE:

If disc rotor seizes up within the hub, drive disc rotor out by installing an 8-mm bolt in holes B on the rotor.



- 4) Clean mud and foreign particles from caliper body assembly and support.

B: INSTALLATION

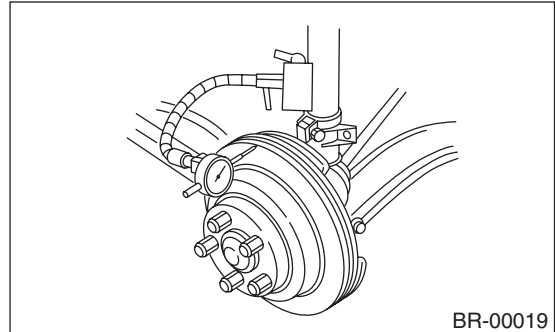
- 1) Install the disc rotor.
- 2) Install the caliper body to housing.

Tightening torque:

78 N·m (8 kgf-m, 58 ft-lb)

C: INSPECTION

- 1) Secure disc rotor by tightening the five wheel nuts.
- 2) Set a dial gauge on the disc rotor. Turn disc rotor to check runout.



NOTE:

- Make sure that dial gauge is set 10 mm (0.39 in) inward of rotor outer perimeter.
- If disc rotor runout is above standard value, inspect play of hub bearing axial direction and runout of axle hub.

<Ref. to DS-23, INSPECTION, Front Axle.>

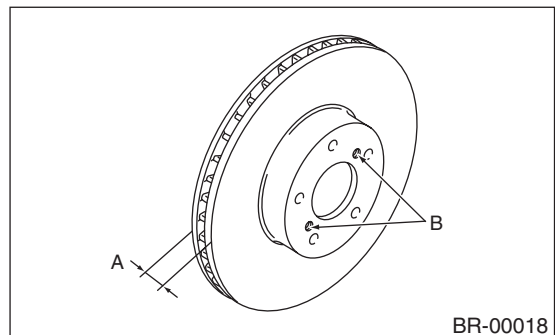
If bearing and hub are normal, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 3.

Disc rotor runout limit:

0.075 mm (0.0030 in)

- 3) Measure disc rotor thickness.

If thickness of disc rotor is below service limit, replace disc rotor.



NOTE:

Make sure that micrometer is set 10 mm (0.39 in) inward of rotor outer perimeter.

		Standard value	Service limit	Disc outer dia.
Disc rotor thickness A	16"	24.0 mm (0.945 in)	22.0 mm (0.866 in)	294 mm (11.57 in)

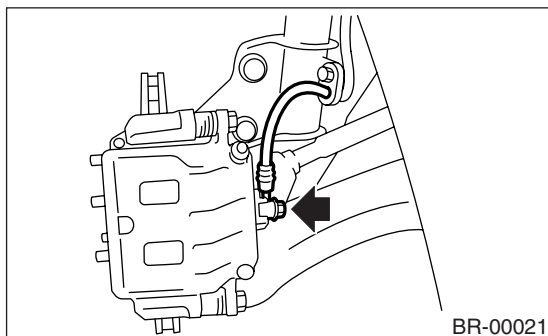
4. Front Disc Brake Assembly

A: REMOVAL

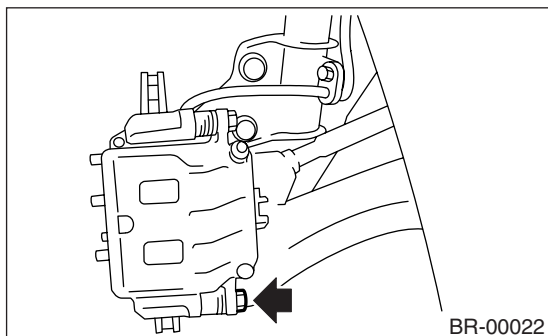
- 1) Loosen wheel nuts, jack-up vehicle, support it with safety stands, and remove wheel.
- 2) Remove union bolt and disconnect brake hose from caliper body assembly.

CAUTION:

**Do not spill brake fluid on painted surface.
Wash it off immediately.**



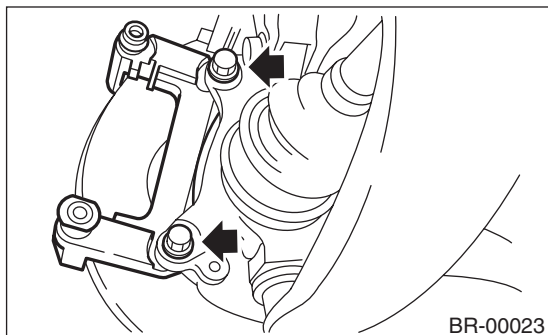
- 3) Remove bolt securing lock pin to caliper body.



- 4) Raise caliper body and move it toward vehicle center to separate it from support.
- 5) Remove support from housing.

NOTE:

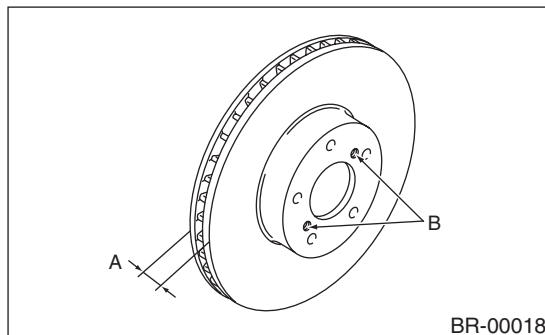
Remove support only when replacing it or the rotor. It need not be removed when servicing caliper body assembly.



- 6) Remove disc rotor from hub.

NOTE:

If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in holes B on the rotor.



- 7) Clean mud and foreign particles from caliper body assembly and support.

B: INSTALLATION

- 1) Install disc rotor on hub.
- 2) Install support on housing.

Tightening torque:

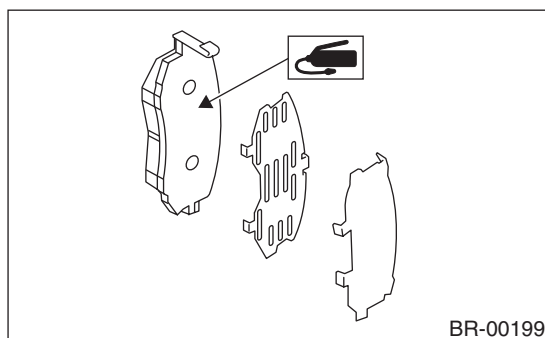
78 N·m (8 kgf-m, 58 ft-lb)

CAUTION:

- Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
- A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
- When replacing the pads, replace pads of the right and left wheels at the same time.

- 3) Apply thin coat of Molykote M7439 (Part No. 003608001) to the frictional portion between pad and pad clip.

- 4) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and inner shim.



- 5) Install pads on support.

FRONT DISC BRAKE ASSEMBLY

BRAKE

6) Install caliper body on support.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

7) Connect brake hose.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

CAUTION:

Replace brake hose gaskets with new ones.

8) Bleed air from brake system.

C: DISASSEMBLY

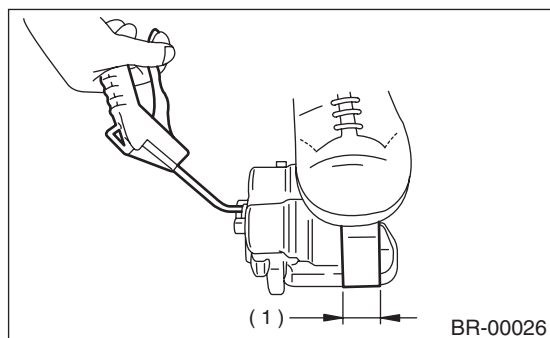
1) Clean mud and foreign particles from the caliper body assembly and support.

CAUTION:

Be careful not to allow foreign particles to enter inlet (at brake hose connector).

2) Remove the boot from piston end.

3) Place a wooden block as shown in the figure to prevent damage to the piston. Gradually supply compressed air via inlet of the brake hose to force piston out.

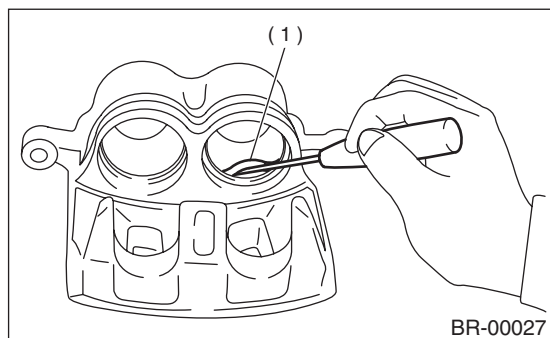


(1) Place a 30 mm (1.18 in) wide wooden block here.

4) Remove the piston seal from caliper body cylinder.

CAUTION:

Be careful not to scratch the inner surface of cylinder and piston seal groove.



(1) Piston seal

5) Remove the lock pin boot and guide pin boot.

D: ASSEMBLY

1) Clean the caliper body interior using brake fluid.

2) Apply a coat of brake fluid to the piston seal and fit piston seal in groove on caliper body.

3) Apply a coat of brake fluid to the entire inner surface of cylinder and outer surface of piston.

4) Apply a coat of specified grease to the boot and fit in groove on ends of cylinder and piston.

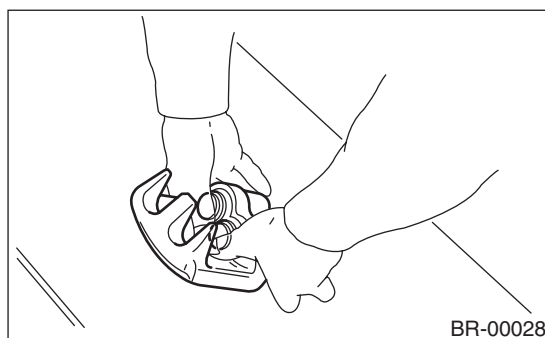
Grease:

NIGLUBE RX-2 (Part No. K0779GA102)

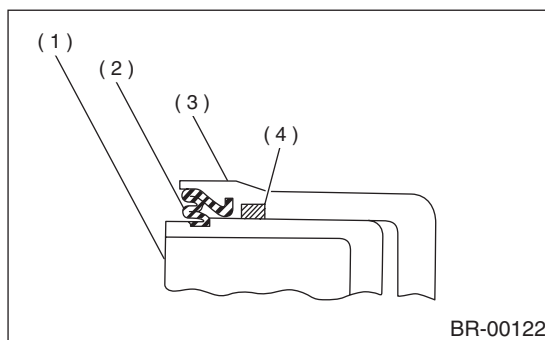
5) Insert the piston into cylinder.

CAUTION:

Do not force the piston into cylinder.



6) Position the boot in grooves on cylinder and piston.

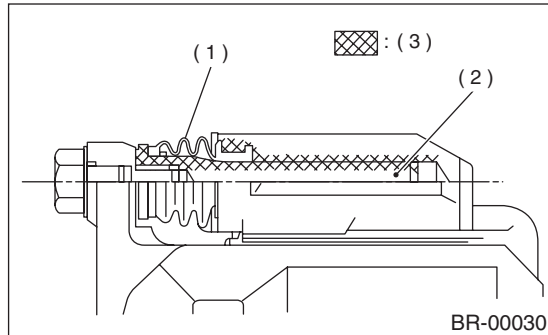


- (1) Piston
- (2) Piston boot
- (3) Caliper body
- (4) Piston seal

7) Apply a coat of specified grease to the lock pin and guide pin, outer surface, cylinder inner surface, and boot grooves.

Grease:

NIGLUBE RX-2 (Part No. K0779GA102)



- (1) Pin boot
- (2) Lock pin or guide pin
- (3) Apply grease.

8) Install the lock pin boot and guide pin boot on support.

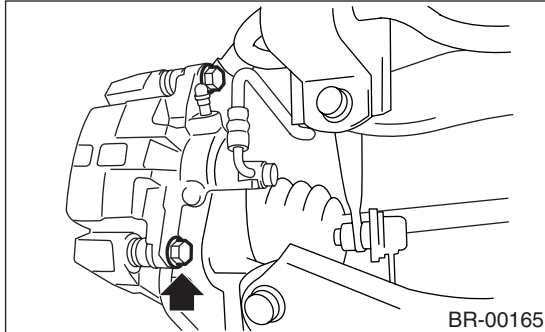
E: INSPECTION

- 1) Repair or replace the faulty parts.
- 2) Check the caliper body and piston for uneven wear, damage or rust.
- 3) Check the rubber parts for damage or deterioration.

5. Rear Brake Pad

A: REMOVAL

- 1) Loosen wheel nuts, jack-up vehicle, support it with safety stands, and remove wheel.
- 2) Remove bottom bolt.



- 3) Raise caliper body and suspend it securely.

NOTE:

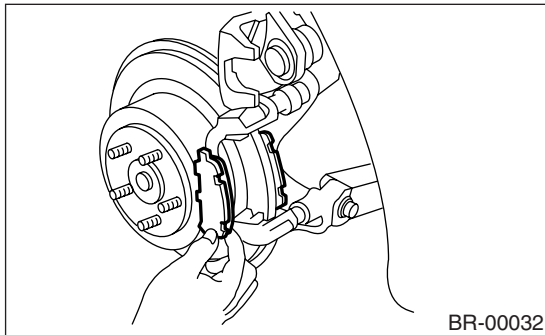
Do not disconnect brake hose from caliper body.

- 4) Remove pad from support.

NOTE:

If brake pad is difficult to remove, use the same procedure as for front disc brake pad.

<Ref. to BR-12, REMOVAL, Front Brake Pad.>



B: INSTALLATION

- 1) Apply thin coat of Molykote M7439 (Part No. 003608001) to the frictional portion between pad and pad clip.

CAUTION:

Do not allow oil or grease to adhere to the sliding surface of pad and disc rotor.

- 2) Check disc rotor thickness and runout.
<Ref. to BR-19, INSPECTION, Rear Disc Rotor.>
- 3) Install pad on support.
- 4) Install caliper body on support.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

NOTE:

If it is difficult to push piston during pad replacement, loosen air bleeder to facilitate work.

- 5) Depress brake pedal several times.

- 6) Check that brake fluid level is at max. line.

C: INSPECTION

Check pad thickness (including back metal).

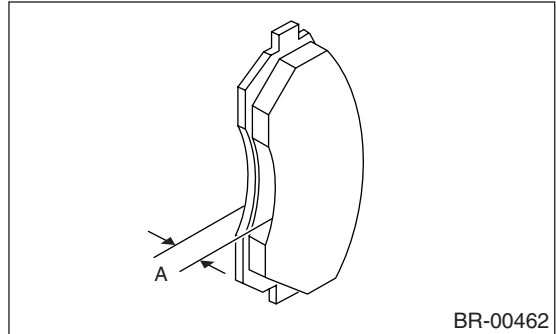
Pad thickness: A

Standard value

14.0 mm (0.551 in)

Wear limit

6.5 mm (0.256 in)



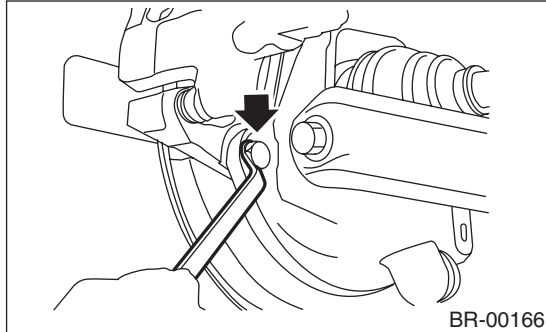
CAUTION:

- Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
- A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
- Replace pad if there is oil or grease on it.

6. Rear Disc Rotor

A: REMOVAL

- 1) Lift-up vehicle and remove wheels.
- 2) Remove the two mounting bolts and remove the disc brake assembly.

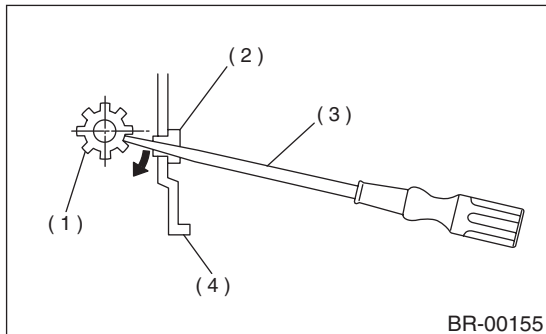


- 3) Suspend the disc brake assembly so that the hose is not stretched.
- 4) Pull down and release parking brake.
- 5) Remove the disc rotor.

NOTE:

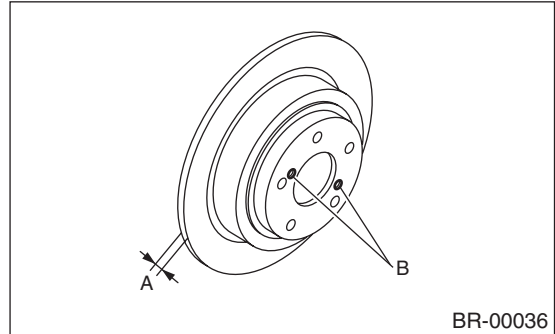
If the disc rotor is difficult to remove try the following two methods in order.

- (1) Turn adjusting screw using a slot-type screwdriver until brake shoe gets away enough from the disc rotor.



- (1) Adjusting screw
- (2) Cover
- (3) Slot-type screwdriver
- (4) Back plate

- (2) If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in holes B on the rotor.



B: INSTALLATION

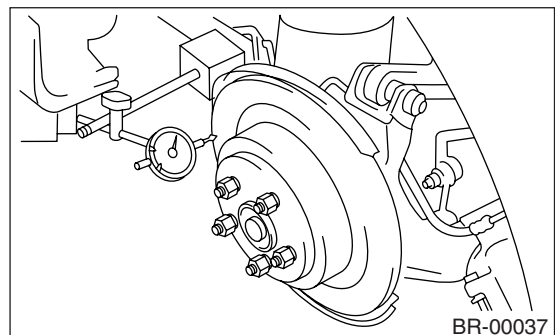
- 1) Install in the reverse order of removal.
- 2) Adjust parking brake. <Ref. to PB-10, ADJUSTMENT, Parking Brake Assembly.>

C: INSPECTION

- 1) Secure disc rotor by tightening the five wheel nuts.
- 2) Set a dial gauge on the disc rotor. Turn disc rotor to check runout.

CAUTION:

Securely fix disc rotor to hub.



NOTE:

- Make sure that dial gauge is set 10 mm (0.39 in) inward of rotor outer perimeter.
- If disc rotor runout is above standard value, inspect play of hub bearing axial direction and runout of axle hub.

<Ref. to DS-28, INSPECTION, Hub Unit Bearing.>
If the runout of disc rotor exceeds the limit, check for abnormal free play at hub bearing and runout in the thrust direction. If the hub bearing is okay, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 3.

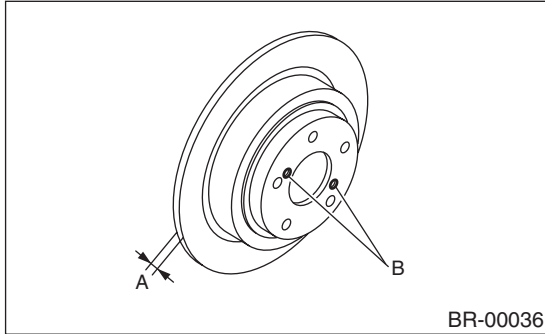
Disc rotor runout limit:

0.070 mm (0.0028 in)

REAR DISC ROTOR

BRAKE

3) Measure disc rotor thickness. If the thickness of disc rotor is below service limit, replace the disc rotor.



NOTE:

Make sure that micrometer is set 10 mm (0.39 in) inward of rotor outer perimeter.

Disc rotor thickness: A

Standard value

10 mm (0.39 in)

Service limit

8.5 mm (0.335 in)

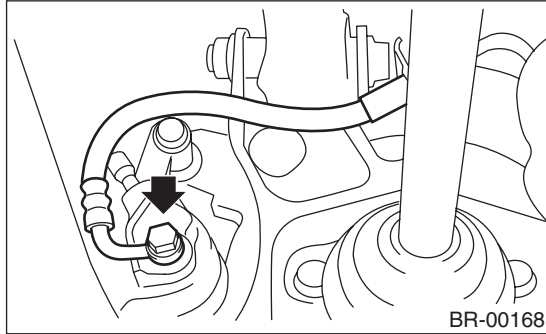
7. Rear Disc Brake Assembly

A: REMOVAL

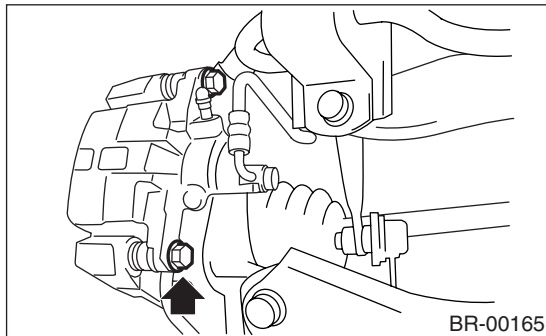
- 1) Lift-up vehicle and remove wheels.
- 2) Disconnect brake hose from caliper body assembly.

CAUTION:

Do not spill brake fluid on painted surface.
Wash it off immediately.



- 3) Remove bolt securing lock pin to caliper body.



- 4) Raise caliper body and move it toward vehicle center to separate it from support.
- 5) Remove support from back plate.

NOTE:

Remove support only when replacing it or the rotor. It need not be removed when servicing caliper body assembly.

- 6) Clean mud and foreign particles from caliper body assembly and support.

CAUTION:

Be careful not to allow foreign particles to enter inlet (at brake hose connector).

B: INSTALLATION

- 1) Install disc rotor on hub.
- 2) Install support on back plate.

Tightening torque:

78 N·m (8.0 kgf-m, 58 ft-lb)

CAUTION:

- Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
 - A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
 - Replace pads if there is oil or grease on them.
- 3) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and pad clip.

CAUTION:

Do not allow oil or grease to adhere to the sliding surface of pad and disc rotor.

- 4) Install pads on support.
- 5) Install caliper body on support.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

- 6) Connect brake hose.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

CAUTION:

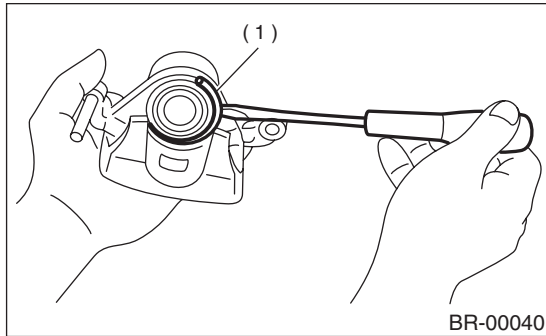
- The brake hose must be connected without any twist.
 - Replace brake hose gaskets with new ones.
- 7) Bleed air from brake system.
<Ref. to BR-33, Air Bleeding.>

REAR DISC BRAKE ASSEMBLY

BRAKE

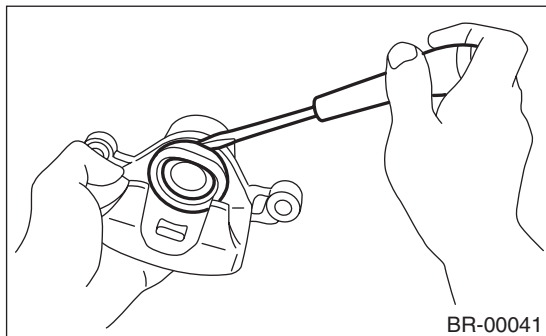
C: DISASSEMBLY

1) Remove the boot ring.



(1) Boot ring

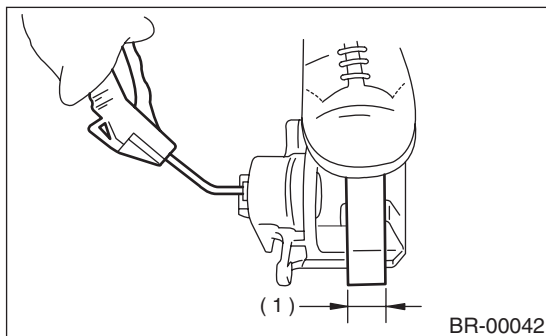
2) Remove the piston boot.



3) Gradually supply compressed air via inlet of caliper body to force piston out.

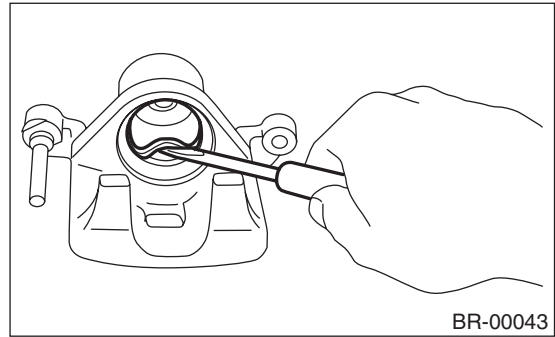
CAUTION:

- Place a wooden block as shown in Figure to prevent damage to piston.
- Do not apply excessively high-pressure.



(1) Place a 30 mm (1.18 in) wide wooden block here.

4) Remove piston seal from caliper body cylinder.



5) Remove lock pin sleeve and boot from caliper body.

6) Remove guide pin boot.

D: ASSEMBLY

- 1) Clean caliper body interior using brake fluid.
- 2) Apply a coat of brake fluid to piston seal and fit piston seal in groove on caliper body.
- 3) Apply a coat of brake fluid to the entire inner surface of cylinder and outer surface of piston.
- 4) Insert piston into cylinder.

CAUTION:

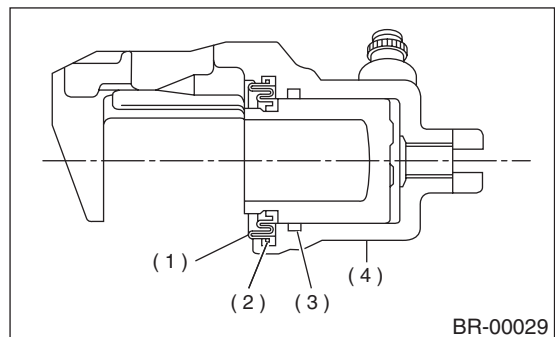
Do not force piston into cylinder.

5) Apply a coat of specified grease to boot and fit in groove on ends of cylinder and piston.

Grease:

NIGLUBE RX-2 (Part No. 003606000)

6) Install the piston boot to the caliper body, and attach boot ring.

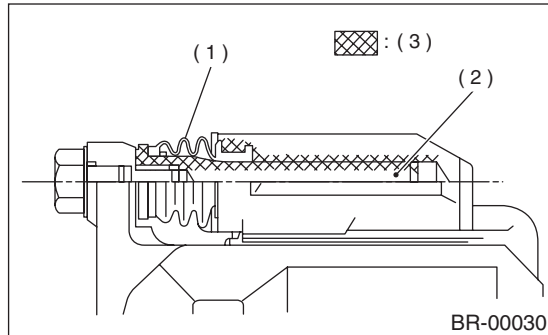


- (1) Piston boot
- (2) Piston
- (3) Piston seal
- (4) Caliper body

7) Apply a coat of specified grease to guide pin, outer surface, sleeve outer surface, cylinder inner surface, and boot grooves.

Grease:

NIGLUBE RX-2 (Part No. 003606000)



- (1) Pin boot
- (2) Lock pin or guide pin
- (3) Apply grease.

8) Install guide pin boot on caliper body.
9) Install lock pin boot on caliper body and insert lock pin sleeve into place.

E: INSPECTION

- 1) Repair or replace faulty parts.
- 2) Check caliper body and piston for uneven wear, damage or rust.
- 3) Check rubber parts for damage or deterioration.

8. Master Cylinder

A: REMOVAL

- 1) Thoroughly drain brake fluid from reservoir tank.
- 2) Disconnect fluid level indicator harness connector.
- 3) Remove brake pipes from master cylinder.
- 4) Remove master cylinder mounting nuts, and take out master cylinder from brake booster.

CAUTION:

Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the painted surface; wash it off quickly if spilt.

B: INSTALLATION

To install the master cylinder to the body, reverse the sequence of removal procedure.

Tightening torque:

Master cylinder mounting nut

14 N·m (1.4 kgf-m, 10.1 ft-lb)

Piping flare nut

15 N·m (1.5 kgf-m, 10.8 ft-lb)

CAUTION:

Be sure to use recommended brake fluid.

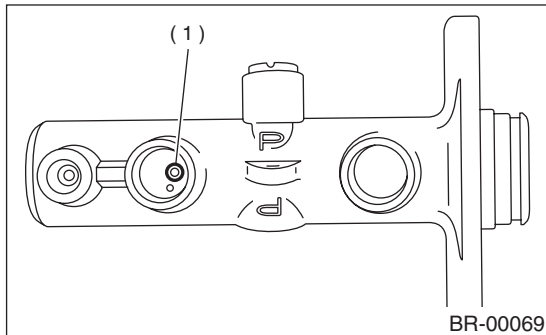
C: DISASSEMBLY

1. PRECAUTIONS FOR DISASSEMBLING

- 1) Remove mud and dirt from the surface of brake master cylinder.
- 2) Prepare tools necessary for disassembly operation, and arrange them neatly on work bench.
- 3) Clean work bench.

2. DISASSEMBLING PROCEDURE

- 1) Remove pin with drift pin which secures reserve tank to master cylinder.
- 2) Remove cylinder pin with magnetic pick-up tool while pushing in primary piston.

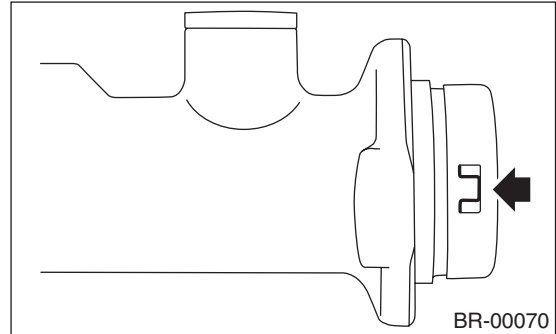


(1) Cylinder pin

- 3) Pry up the pawl and remove the piston retainer.

NOTE:

Piston may jump out from master cylinder.



- 4) Extract primary piston assembly and secondary piston assembly.

CAUTION:

- Do not disassemble the piston assembly; otherwise, the spring set value may be changed.
- Use brake fluid or methanol to wash inside wall of cylinder, pistons and piston cups. Be careful not to damage parts when washing. If methanol is used for washing, do not dip rubber parts, such as piston cups, in it for more than 30 seconds; otherwise, they may become swelled.

D: ASSEMBLY

1. PRECAUTIONS FOR ASSEMBLING

- 1) When assembling, be sure to use recommended brake fluid.
- 2) Ensure that the inside wall of cylinder, pistons, and piston cups are free from dirt when assembling.
- 3) Be extremely careful not to damage, scratch, or dent cylinder inside wall, pistons, and piston cups.
- 4) Do not drop parts. Never attempt to use any part that has been dropped accidentally.

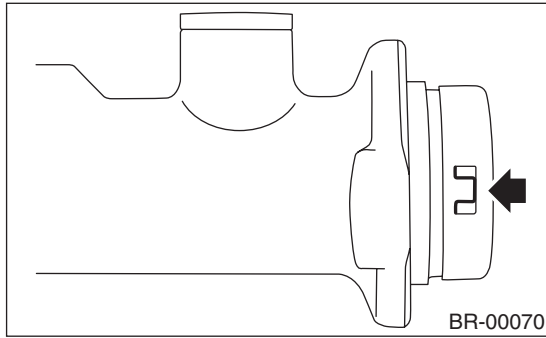
2. ASSEMBLING PROCEDURE

- 1) Assembling piston assembly:

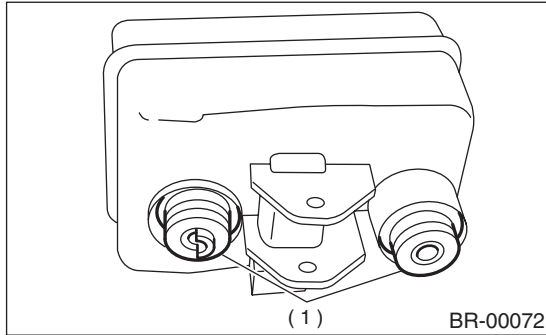
Apply recommended brake fluid to inside wall of cylinder, and to outer surface of piston assembly, and install piston assemblies carefully into cylinder.

- 2) Assembling cylinder pin:

3) Press the pawl and install the piston retainer into the master cylinder.



4) Install seal to reservoir tank.



(1) Seal

5) Install pin with drift pins which secures reservoir tank to master cylinder.

E: INSPECTION

If any damage, deformation, wear, swelling, rust, and other faults are found on the primary piston assembly, secondary piston assembly, supply valve stopper, or gasket, replace the faulty part.

CAUTION:

- The primary and secondary pistons must be replaced as complete assemblies.
- The service limit of the clearance between each piston and the master cylinder inner dia. is 0.11 mm (0.0043 in).
- When handling parts, be extremely careful not to damage or scratch the parts, or let any foreign matter get on them.

BRAKE BOOSTER

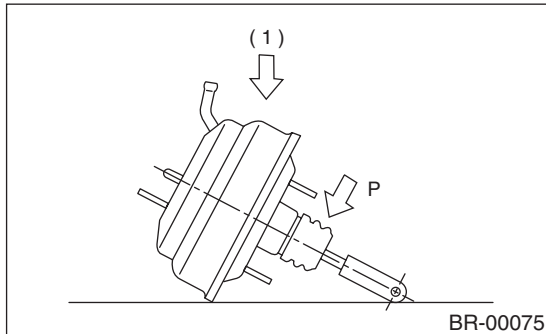
BRAKE

9. Brake Booster

A: REMOVAL

CAUTION:

If external force is applied from above when brake booster is placed in this position, the resin portion as indicated by "P", may be damaged.



(1) Force

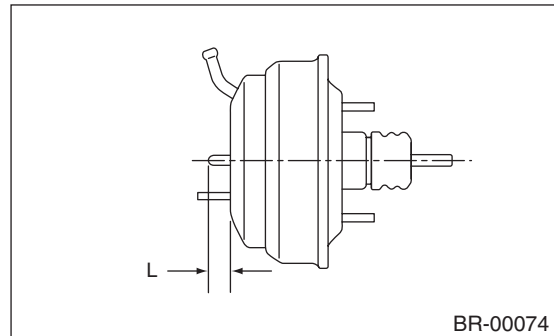
- 1) Pull up parking brake lever, and block tires.
- 2) Disconnect ground cable from battery.
- 3) Remove or disconnect the following parts at engine compartment.
 - (1) Disconnect connector for brake fluid level indicator.
 - (2) Remove brake pipes from master cylinder.
 - (3) Remove master cylinder installing nuts.
 - (4) Disconnect vacuum hose from brake booster.
- 4) Remove the following parts from the pedal bracket.
 - (1) Snap pin and clevis pin
 - (2) Four brake booster installing nuts
- 5) Remove brake booster while shunning brake pipes.

NOTE:

- Be careful not to drop brake booster. Brake booster should be discarded if it has been dropped.
- Use special care when handling operating rod. If excessive force is applied to operating rod, sufficient to cause a change in the angle in excess of $\pm 3^\circ$, it may result in damage to the power piston cylinder.
- Use care when placing brake booster on the floor.
- Do not change the push rod length. If it has been changed, reset the projected length "L" to the standard length.

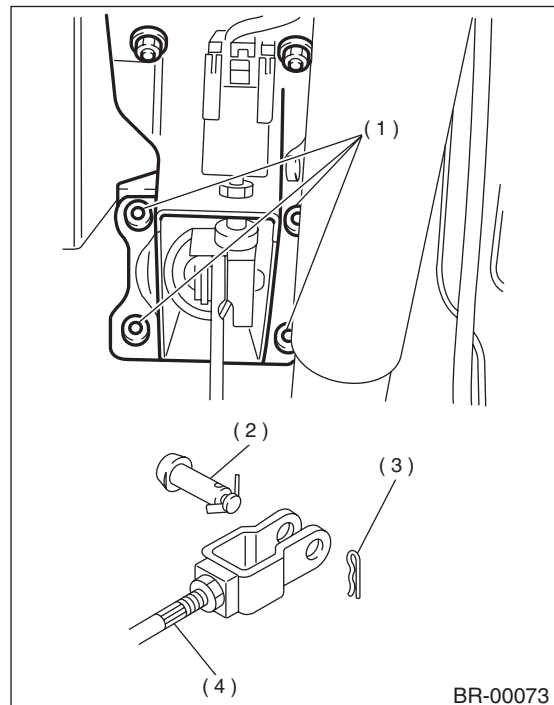
Standard:

$L = 10 \text{ mm (0.39 in)}$



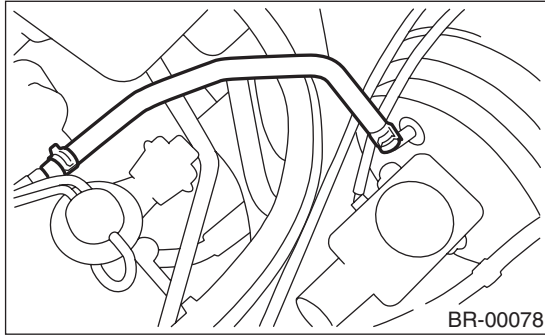
B: INSTALLATION

- 1) Mount brake booster in position.
- 2) Connect operating rod to brake pedal with clevis pin and snap pin.



- (1) Nuts
- (2) Clevis pin
- (3) Snap pin
- (4) Operating rod

- 3) Connect vacuum hose to brake booster.

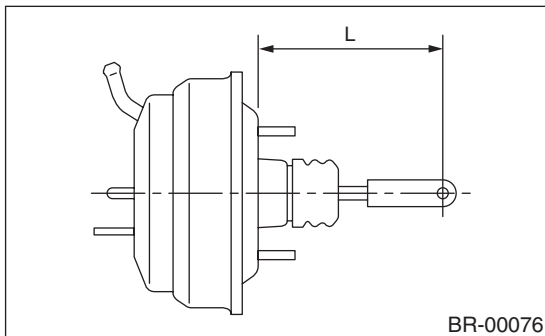


- 4) Mount master cylinder onto brake booster.
5) Connect brake pipes to master cylinder.
6) Connect electric connector for brake fluid level indicator.
7) Adjust operating rod of brake booster.

Standard: L

145.3 mm (5.72 in)

If it is not in specified value, adjust it by adjusting brake booster operating rod.



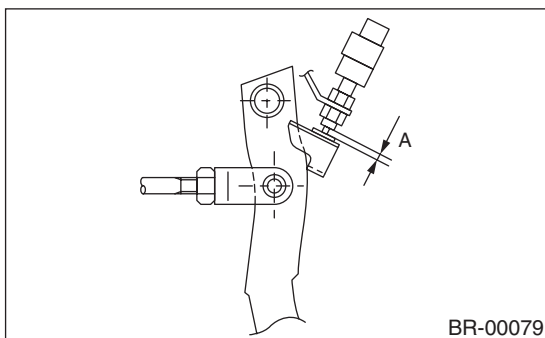
- 8) Measure the clearance between threaded end of stop light switch and stopper.
If it is not in specified value, adjust it by adjusting position of stop light switch.

CAUTION:

Be careful not to rotate stop light switch.

Stop light switch clearance: A

0.3 mm (0.012 in)



- 9) Apply grease to operating rod connecting pin to prevent it from wearing.

- 10) Bleed air from brake system.

Tightening torque (Air bleeder screw):

8 N·m (0.8 kgf-m, 5.8 ft-lb)

- 11) Conduct road tests to ensure brakes do not drag.

C: INSPECTION

1. OPERATION CHECK (WITHOUT GAUGES)

CAUTION:

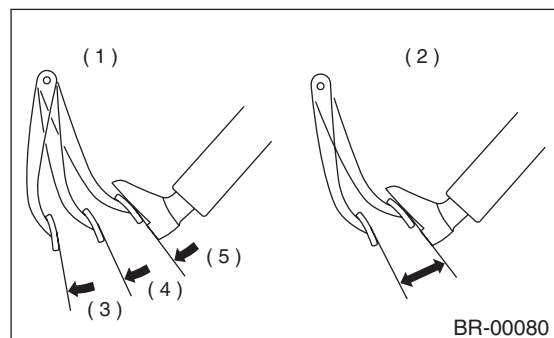
When checking operation, be sure to securely apply the hand brake.

• Checking without gauges

This method cannot determine the exact portion which has failed, but it can provide a rough understanding of the nature of the failure if checking is conducted in accordance with the following procedures.

• Air tightness check

Start engine, and run it for 1 to 2 minutes, then turn it off. Depress brake pedal several times applying the same pedal force as that used in ordinary braking operations. The pedal stroke should be greatest on the 1st depression, and it should become smaller with each successive depression. If no change occurs in the pedal height while in a depressed state, brake booster is faulty.



- (1) OK
- (2) NOT OK
- (3) 1st
- (4) 2nd
- (5) 3rd

NOTE:

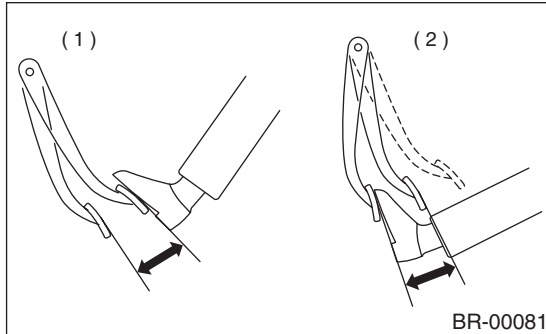
- In the event of defective operation, inspect the condition of the check valve and vacuum hose.
- Replace them if faulty and conduct the test again.
- If no improvement is observed, check precisely with gauges.

BRAKE BOOSTER

BRAKE

• Operation check

1) With engine off, depress brake pedal several times applying the same pedal force and make sure that the pedal height does not vary with each depression of the pedal.



- (1) When engine is stopped
- (2) When engine is started

2) With brake pedal depressed, start engine.
3) As engine starts, brake pedal should move slightly toward the floor. If no change occurs in the pedal height, brake booster is faulty.

NOTE:

If faulty, check precisely with gauges.

• Loaded air tightness check

Depress brake pedal while engine is running, and turn off engine while the pedal is still depressed. Keep the pedal depressed for 30 seconds; if no change occurs in the pedal height, brake booster is functioning normally; if the pedal height increases, it is faulty.

NOTE:

If faulty, check precisely with gauges.

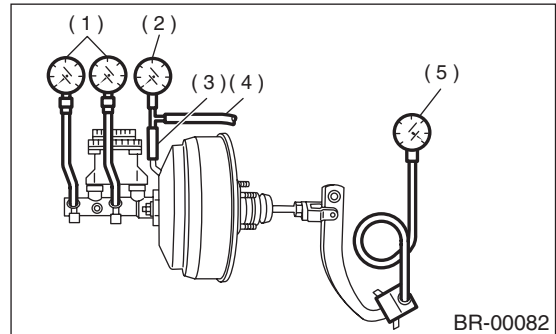
2. OPERATION CHECK (WITH GAUGES)

CAUTION:

When checking operation, be sure to securely apply the hand brake.

• Checking with gauges

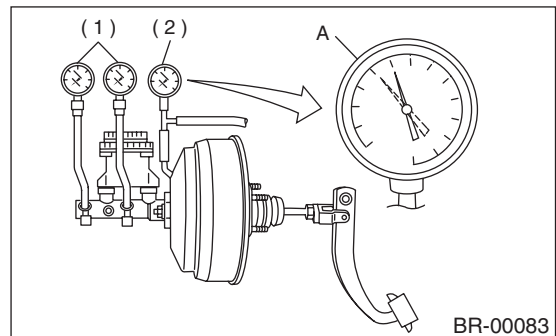
Connect gauges as shown in Figure. After bleeding air from pressure gauges, proceed to each check.



- (1) Pressure gauge
- (2) Vacuum gauge
- (3) Adapter hose
- (4) Vacuum hose
- (5) Pedal force gauge

• Air tightness check

1) Start engine and keep it running until a vacuum of 66.7 kPa (500 mmHg, 19.69 inHg) = point A is indicated on vacuum gauge. Do not depress brake pedal.



- (1) Pressure gauge
- (2) Vacuum gauge

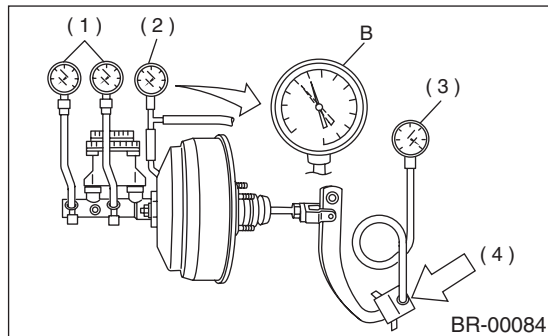
2) Stop engine and watch the gauge. If the vacuum drop range is less than 3.3 kPa (25 mmHg, 0.98 inHg) within 15 seconds after stopping engine, brake booster is functioning properly.

If defective, the cause may be one of those listed below.

- Check valve malfunction
- Leak from vacuum hose
- Leak from the shell jointed portion or stud bolt welded portion

- Damaged diaphragm
- Leak from valve body seal and bearing portion
- Leak from plate and seal assembly portion
- Leak from poppet valve assembly portion
- **Loaded air tightness check**

1) Start engine and depress brake pedal with pedal force of 196 N (20 kgf, 44 lb). Keep engine running until a vacuum of 66.7 kPa (500 mmHg, 19.69 inHg) = point B is indicated on vacuum gauge while the pedal is still depressed.



- (1) Pressure gauge
- (2) Vacuum gauge
- (3) Pedal force gauge
- (4) Depress

2) Stop engine and watch vacuum gauge.
If the vacuum drop range is less than 3.3 kPa (25 mmHg, 0.98 inHg) within 15 seconds after stopping engine, brake booster is functioning properly.
If defective, refer to "AIR TIGHTNESS CHECK".
<Ref. to BR-27, INSPECTION, Brake Booster.>

- **Lack of boosting action check**

Turn off engine, and set the vacuum gauge reading at "0". Then, check the fluid pressure when brake pedal is depressed. The pressure must be greater than the standard value listed.

Brake pedal force	147 N (15 kgf, 33 lb)	294 N (30 kgf, 66 lb)
Fluid pressure	588 kPa (6 kg/cm ² , 85 psi)	1,569 kPa (16 kg/cm ² , 228 psi)

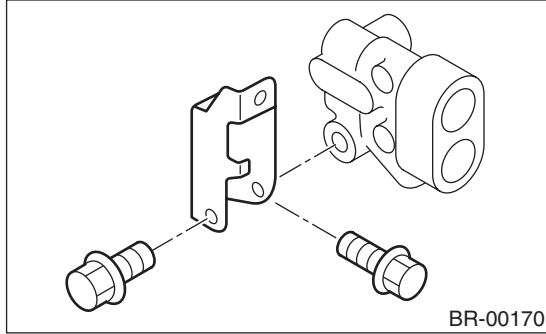
- **Boosting action check**

Set the vacuum gauge reading at 66.7 kPa (500 mmHg, 19.69 inHg) by running engine. Then, check the fluid pressure when brake pedal is depressed. The pressure must be greater than the standard value listed.

Brake pedal force	147 N (15 kgf, 33 lb)	294 N (30 kgf, 66 lb)
Fluid pressure	6,178 kPa (63 kg/cm ² , 896 psi)	9,709 kPa (99 /cm ² , 1,408 psi)

10. Proportioning Valve

A: REMOVAL



- 1) Pull up parking brake lever, and block the tires.
- 2) Remove brake pipe from proportioning valve at four places.
- 3) Remove proportioning valve from its bracket.

CAUTION:

Do not disassemble or adjust the proportioning valve. (The proportioning valve must be replaced as an assembly.)

B: INSTALLATION

- 1) Install proportioning valve to bracket.
- 2) Connect brake pipes correctly to proportioning valve.
- 3) Bleed air, then check each joint of brake pipe for oil leaks.

Tightening torque:

Proportioning valve to brake pipe flare nut:

15 N·m (1.5 kgf-m, 10.8 ft-lb)

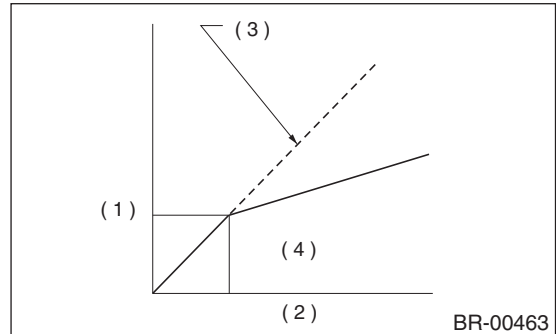
Proportioning valve to bracket:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

C: INSPECTION

- 1) Install oil pressure gauges to measure the master cylinder fluid pressure (front wheel brake fluid pressure) and rear wheel cylinder fluid pressure.
- 2) Bleed air from oil pressure gauges.
- 3) Check the master cylinder fluid pressure and rear wheel cylinder fluid pressure.

The standard values are shown in Figure.



- (1) Rear wheel cylinder fluid pressure: P3
- (2) Master cylinder fluid pressure: P2
- (3) In case of failure in one circuit
- (4) When both circuits are normal

4) For the oil pressure in case of split point, refer to "SPECIFICATIONS".

<Ref. to BR-2, SPECIFICATIONS, General Description.>

11.Brake Fluid

A: INSPECTION

- 1) Check that brake fluid level remains between "MIN" and "MAX". If out of the specified range, refill or drain fluid. If fluid level becomes close to "MIN", refill fluid.
- 2) Check fluid for discoloration. If fluid color has excessively changed, drain the fluid and refill with new fluid.

B: REPLACEMENT

CAUTION:

- Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the painted surface; wash it off quickly if spilt.
- To always maintain the brake fluid characteristics, replace the brake fluid according to maintenance schedule or earlier than that when used in severe condition.
- The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
- Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
- Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
- Be careful not to allow dirt or dust to get into the reservoir tank.

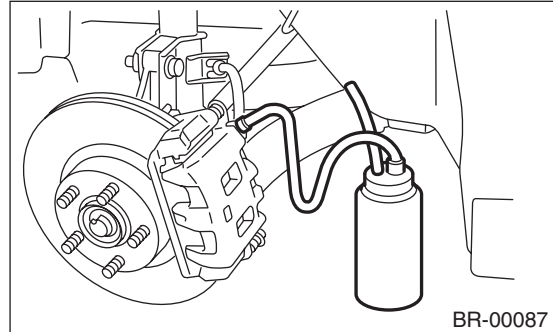
NOTE:

- During bleeding operation, keep the brake reservoir tank filled with brake fluid to eliminate entry of air.
 - Brake pedal operation must be very slow.
 - For convenience and safety, two people should do the work.
 - The amount of brake fluid required is approximately 500 ml (16.9 US fl oz, 17.6 Imp fl oz) for total brake system.
- 1) Either jack-up vehicle and place a safety stand under it, or lift up vehicle.
 - 2) Remove both front and rear wheels.
 - 3) Draw out the brake fluid from master cylinder with syringe.
 - 4) Refill reservoir tank with recommended brake fluid.

Recommended brake fluid:

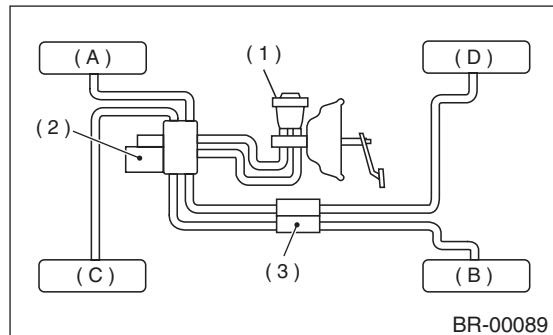
FMVSS No. 116, fresh DOT3 or 4 brake fluid

- 5) Install one end of a vinyl tube onto the air bleeder and insert the other end into a container to collect the brake fluid.



CAUTION:

Brake fluid replacement sequence; (A) Front right → (B) Rear left → (C) Front left → (D) Rear right



- (1) Master cylinder
- (2) Hydraulic unit
- (3) Proportioning valve

- 6) Instruct your co-worker to depress the brake pedal slowly two or three times and then hold it depressed.
- 7) Loosen bleeder screw approximately 1/4 turn until a small amount of brake fluid drains into container, and then quickly tighten screw.
- 8) Repeat steps 6) and 7) above until there are no air bubbles in drained brake fluid and new fluid flows through vinyl tube.

NOTE:

Add brake fluid as necessary while performing the air bleed operation, in order to prevent the tank from running short of brake fluid.

- 9) After completing the bleeding operation, hold brake pedal depressed and tighten screw and install bleeder cap.

Tightening torque (Bleeder screw):

8 N·m (0.8 kgf-m, 5.8 ft-lb)

- 10) Bleed air from each wheel cylinder using the same procedures as described in steps 6) through 7) above.

BRAKE FLUID

BRAKE

11) Depress brake pedal with a force of approximately 294 N (30 kgf, 66 lb) and hold it there for approximately 20 seconds. At this time check pedal to see if it shows any unusual movement.

Visually inspect bleeder screws and brake pipe joints to make sure that there is no fluid leakage.

12) Install wheels, and drive vehicle for a short distance between 2 to 3 km (1 to 2 miles) to make sure that brakes are operating properly.

12. Air Bleeding

A: PROCEDURE

CAUTION:

- The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
- Cover bleeder with waste cloth when loosening it to prevent brake fluid from being splashed over surrounding parts.
- Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
- Be careful not to allow dirt or dust to get into the reservoir tank.
- Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the painted surface; wash it off quickly if spilt.

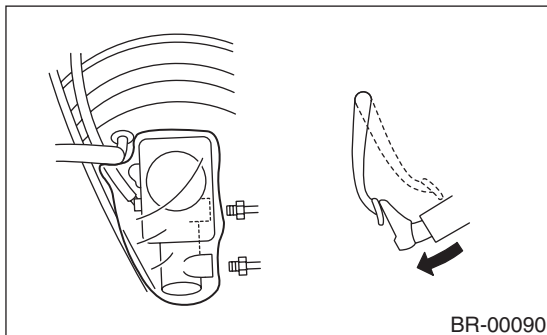
NOTE:

- Start with the brakes (wheels) connected to the secondary chamber of the master cylinder.
- The time interval between two brake pedal operations (from the time when the pedal is released to the time when it is depressed another time) should be approximately 3 seconds.
- The air bleeder on each brake should be released for 1 to 2 seconds.

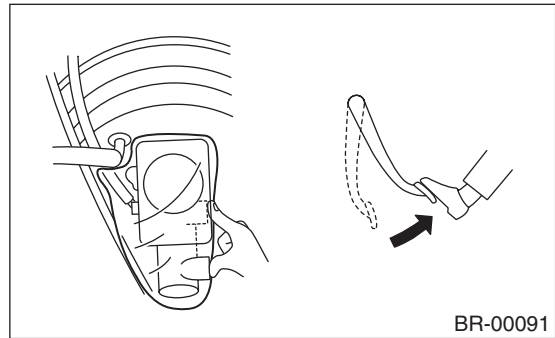
1. MASTER CYLINDER

NOTE:

- If master cylinder is disassembled or reservoir tank is empty, bleed master cylinder.
 - During bleeding operation, keep the brake reservoir tank filled with brake fluid to eliminate entry of air.
 - Brake pedal operation must be very slow.
 - For convenience and safety, two people should do the work.
- 1) Loosen wheel nuts, jack-up vehicle, support it with safety stands, and remove wheel.
 - 2) Disconnect brake line at primary and secondary sides.
 - 3) Put plastic bag cover on the master cylinder.
 - 4) Carefully depress and hold brake pedal.



- 5) Close outlet plug with your finger, and release brake pedal.



- 6) Repeat above steps 4) and 5) until master cylinder is completely bled.
- 7) Install brake pipes to master cylinder.

Tightening torque:

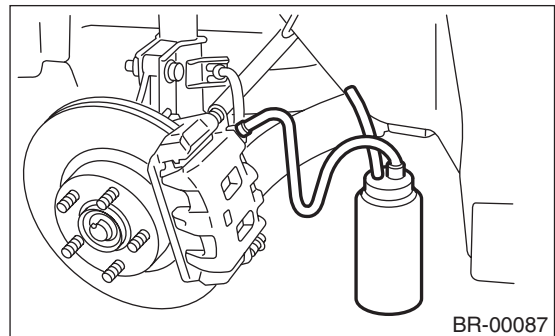
8 N·m (0.8 kgf-m, 5.8 ft-lb)

- 8) Cleanly wash away brake fluid spilt on master cylinder etc.
- 9) Bleed air from brake system. <Ref. to BR-33, BRAKE LINE, PROCEDURE, Air Bleeding.>

2. BRAKE LINE

NOTE:

- During bleeding operation, keep the brake reservoir tank filled with brake fluid to eliminate entry of air.
 - Brake pedal operation must be very slow.
 - For convenience and safety, two people should do the work.
- 1) Make sure that there is no leak from joints and connections of the brake system.
 - 2) Fit one end of vinyl tube into the air bleeder and put the other end into a brake fluid container.

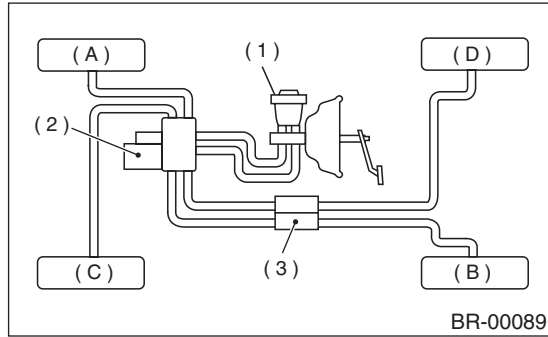


AIR BLEEDING

BRAKE

CAUTION:

Brake fluid replacement sequence; (A) Front right → (B) Rear left → (C) Front left → (D) Rear right



- (1) Master cylinder
- (2) Hydraulic unit
- (3) Proportioning valve

3) Slowly depress the brake pedal and keep it depressed. Then, open the air bleeder to discharge air together with the fluid.

Release air bleeder for 1 to 2 seconds.

Next, with the bleeder closed, slowly release the brake pedal.

Repeat these steps until there are no more air bubbles in the vinyl tube.

Allow 3 to 4 seconds between two brake pedal operations.

CAUTION:

Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.

NOTE:

Brake pedal operating must be very slow.

4) Tighten air bleeder securely when no air bubbles are visible.

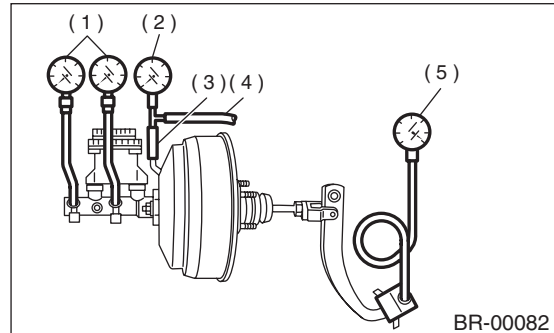
Air bleeder tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)

5) Perform these steps for the brakes connecting to the secondary chamber of master cylinder, first, and then for the ones connecting to primary chamber. With all procedures completed, fully depress the brake pedal and keep it in that position for approximately 20 seconds to make sure that there is no leak evident in the entire system.

6) Check the pedal stroke.

While the engine is idling, depress the brake pedal with a 490 N (50 kgf, 110 lb) load and measure the distance between the brake pedal and steering wheel. With the brake pedal released, measure the distance between the pedal and steering wheel again. The difference between the two measurements must be more than specified.



- (1) Pressure gauge
- (2) Vacuum gauge
- (3) Adapter hose
- (4) Vacuum hose
- (5) Pedal force gauge

Specified pedal stroke:

95 mm (3.74 in)

When depressing brake pedal with a 490 N (50 kgf, 110 lb) load.

7) If the distance is more than specifications, there is a possibility that air is in the brake line. Bleed brake line until pedal stroke meets the specification.

8) Operate hydraulic control unit in the sequence control mode.

With ABS: <Ref. to ABS-11, ABS Sequence Control.>

9) Recheck the brake stroke.

10) If the distance is more than specifications, there is a possibility air is in the inside of the hydraulic unit. Repeat above steps 2) to 9) above until pedal stroke meets the specification.

11) Add brake fluid to the required level (MAX. level) of reservoir tank.

12) As a final step, test run the vehicle at low speed and apply brakes relatively hard 2 to 3 times to ensure that brakes provide normal braking action on all four wheels without dragging and uneven braking.

13.Brake Hose

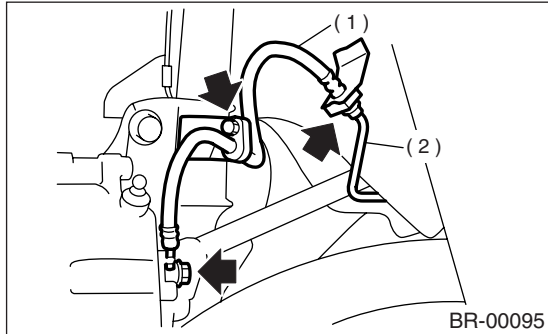
A: REMOVAL

1. FRONT BRAKE HOSE

1) Separate brake pipe from brake hose.

NOTE:

Always use flare nut wrench and be careful not to deform flare nut.



(1) Brake hose

(2) Brake pipe

2) Pull out clamp to remove brake hose.

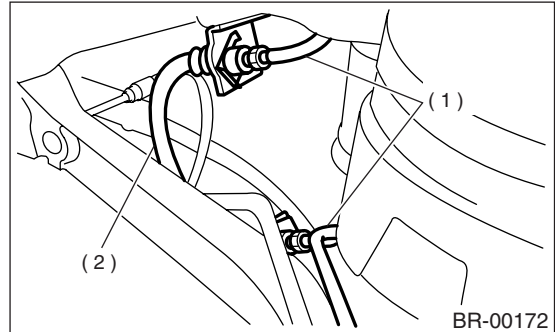
3) Remove bolt at strut and union bolt.

2. REAR BRAKE HOSE

1) Separate brake pipe from brake hose.

NOTE:

Always use flare nut wrench and be careful not to deform flare nut.



(1) Brake pipe

(2) Brake hose



(1) Brake pipe

2) Pull out clamp to remove brake hose.

B: INSTALLATION

1. FRONT BRAKE HOSE

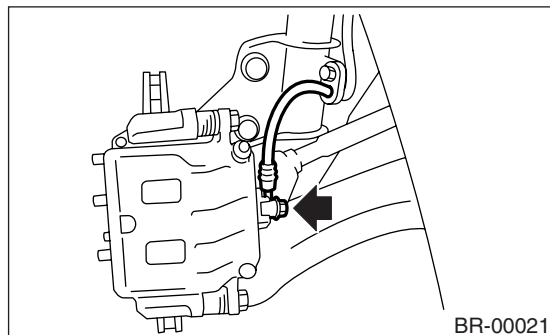
NOTE:

Replace a gasket with a new one.

- 1) Route end of brake hose (on caliper side) through hole in brake hose bracket at strut location.
- 2) Tighten end of brake hose at caliper using a union bolt.

Tightening torque (Union bolt):

18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 3) Secure middle fitting of brake hose to bracket at strut location using a clamp.
- 4) Position disc in straight-forward direction and route brake hose through hole in bracket on wheel apron side.

CAUTION:

Be sure brake hose is not twisted.

- 5) Temporarily tighten flare nut to connect brake pipe and hose.
- 6) Fix brake hose with clamp at wheel apron bracket.
- 7) While holding hexagonal part of brake hose fitting with a wrench, tighten flare nut to the specified torque.

Tightening torque (Brake pipe flare nut):

15 N·m (1.5 kgf-m, 10.8 ft-lb)

- 8) Bleed air from the brake system.

2. REAR BRAKE HOSE

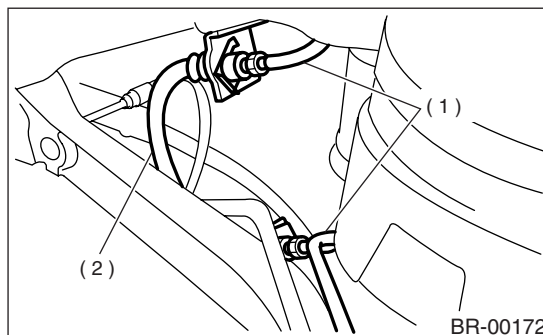
NOTE:

Replace a gasket with a new one.

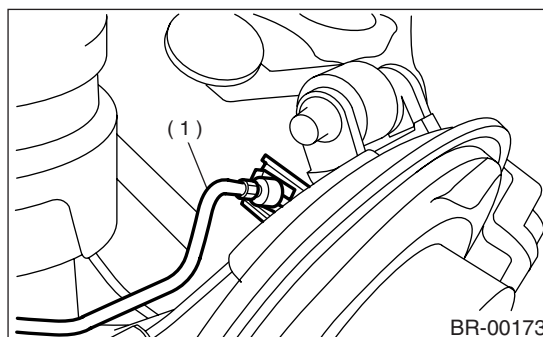
- 1) Pass brake hose through the hole of bracket, and lightly tighten flare nut to connect brake pipe.
- 2) Insert clamp upward to fix brake hose.
- 3) While holding hexagonal part of brake hose fitting with a wrench, tighten flare nut to the specified torque.

Tightening torque (Brake pipe flare nut):

15 N·m (1.5 kgf-m, 10.8 ft-lb)



- (1) Brake pipe
- (2) Brake hose



- (1) Brake pipe

- 4) Bleed air from the brake system.

C: INSPECTION

Ensure there are no cracks, breakage, or damage on hoses. Check joints for fluid leakage. If any cracks, breakage, damage or leakage is found, repair or replace hose.

14.Brake Pipe

A: REMOVAL

NOTE:

Airbag system wiring harness is routed near the center brake pipe.

CAUTION:

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage airbag system wiring harness when servicing the center brake pipe.
- When removing the brake pipe, make sure that it is not bent.

B: INSTALLATION

NOTE:

Airbag system wiring harness is routed near the center brake pipe.

CAUTION:

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage airbag system wiring harness when servicing the center brake pipe.
- When installing the brake pipe, make sure that it is not bent.
- After installing the brake pipe and hose, bleed the air.
- After installing the brake hose, make sure that it does not touch the tire or suspension assembly, etc.

Brake pipe tightening torque:

15 N·m (1.5 kgf-m, 10.8 ft-lb)

C: INSPECTION

Ensure there are no cracks, breakage, or damage on pipes. Check joints for fluid leakage. If any cracks, breakage, damage or leakage is found, repair or replace pipe.

NOTE:

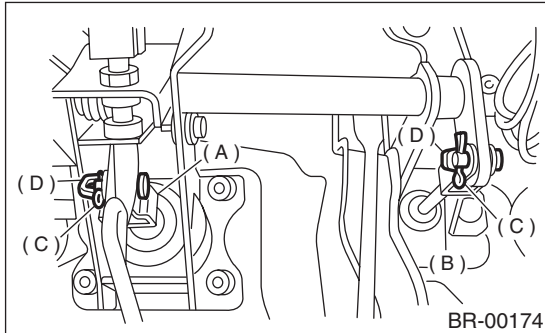
Use a mirror when inspecting low-visible part or back side.

15.Brake Pedal

A: REMOVAL

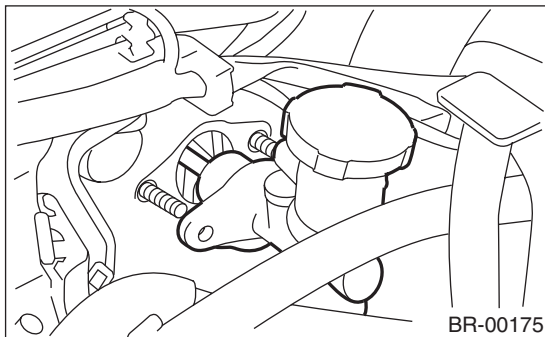
1. MT MODEL

- 1) Pull up parking brake lever and block tires.
- 2) Disconnect ground cable from battery.
- 3) Remove steering column.
<Ref. to PS-20, REMOVAL, Tilt Steering Column.>
- 4) Disconnect connectors from stop light and clutch switches.
- 5) Remove snap pins which secure lever to push rod and operating rod.
- 6) Remove clevis pins which secure lever to push rod and operating rod.



- (A) Operating rod
- (B) Push rod
- (C) Snap pin
- (D) Clevis pin

- 7) Remove nut which secures clutch master cylinder.

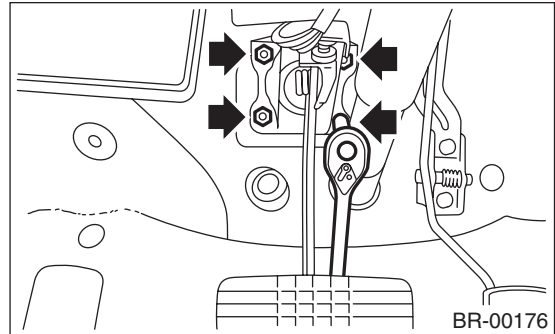


- 8) Remove bolts and nuts which secure brake and clutch pedals, and remove pedal assembly.

2. AT MODEL

- 1) Pull up parking brake lever.
- 2) Disconnect ground cable from battery.
- 3) Remove instrument panel lower cover from instrument panel.
- 4) Remove clevis pin which secures brake pedal to brake booster operating rod. Also disconnect stop light switch connector.

- 5) Remove AT unit from brake panel (2 nuts).
- 6) Remove two bolts and four nuts which secure brake pedal to pedal.



B: INSTALLATION

- 1) Install in the reverse order of removal.

CAUTION:

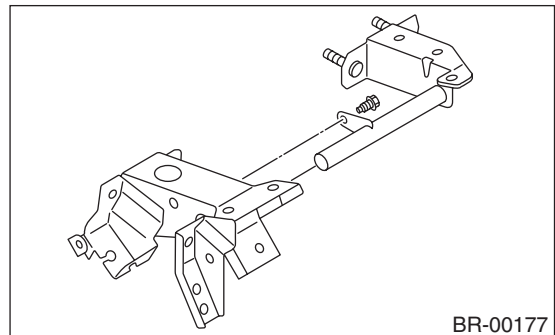
- If cable clamp is damaged, replace it with a new one.
- Never fail to cover outer cable end with boot.
- Be careful not to kink accelerator cable.
- Always use new clevis pins.

- 2) Adjustment of clutch pedal <Ref. to BR-39, ASSEMBLY, Brake Pedal.>
- 3) Inspect after pedal installation <Ref. to BR-40, INSPECTION, Brake Pedal.>

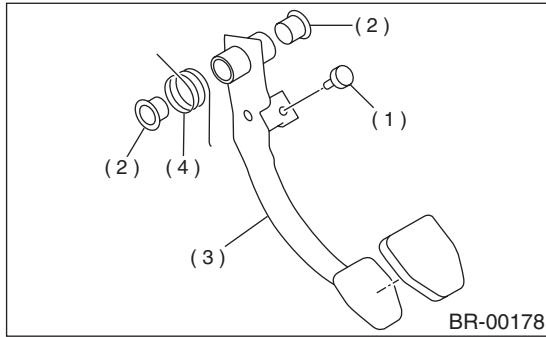
C: DISASSEMBLY

1. MT MODEL

- 1) Remove the brake switch.
<Ref. to BR-41, REMOVAL, Stop Light Switch.>
- 2) Remove the clutch pedal.
<Ref. to CL-23, DISASSEMBLY, Clutch Pedal.>
- 3) Remove the clutch master cylinder bracket.



4) Remove bushing, spring and stopper.

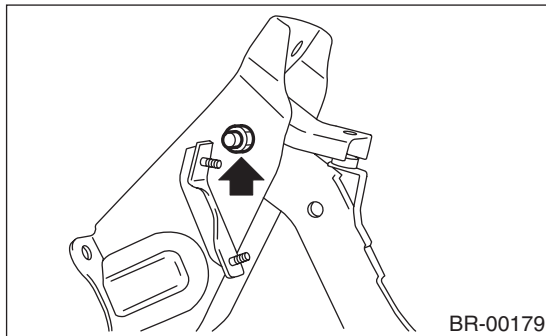


- (1) Stopper
- (2) Bushing
- (3) Brake pedal
- (4) Brake pedal spring

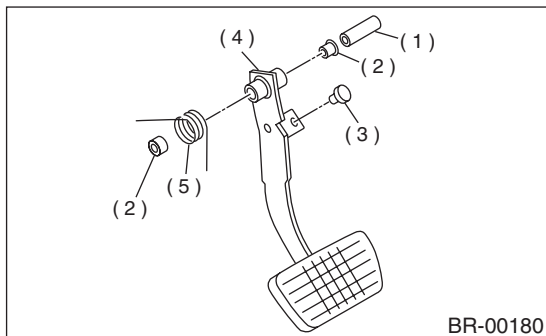
5) Remove the brake pedal pad.

2. AT MODEL

- 1) Remove the brake switch.
- 2) Unbolt, and then remove the brake pedal.



3) Remove bushing, spacer and spring.



- (1) Spacer
- (2) Bushing
- (3) Stopper
- (4) Brake pedal
- (5) Brake pedal spring

4) Remove the brake pedal pad.

D: ASSEMBLY

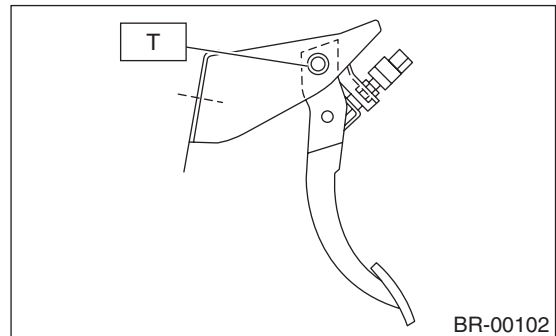
- 1) Attach stop light switch, etc. to pedal bracket temporarily.
- 2) Clean inside of bores of clutch pedal and brake pedal, apply grease, and set bushings into bores.
- 3) Align bores of pedal bracket, clutch pedal and brake pedal, attach brake pedal return spring and clutch pedal effort reducing spring (vehicle with hill holder), and then install pedal bolt.

NOTE:

Clean up inside of bushings and apply grease before installing spacer.

Tightening torque:

T: 29 N·m (3.0 kgf-m, 21.7 ft-lb)



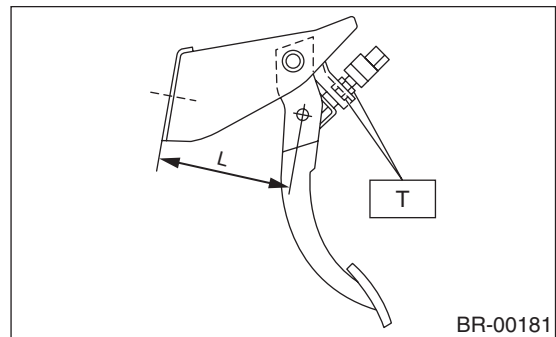
4) Set brake pedal position by adjusting position of stop light switch.

Pedal position: L

126.4 mm (4.98 in)

Tightening torque:

T: 8 N·m (0.8 kgf-m, 5.8 ft-lb)



BRAKE PEDAL

BRAKE

E: INSPECTION

1) Move brake and clutch pedal pads in the lateral direction with a force of approximately 10 N (1 kgf, 2 lb) to ensure pedal deflection is in specified range.

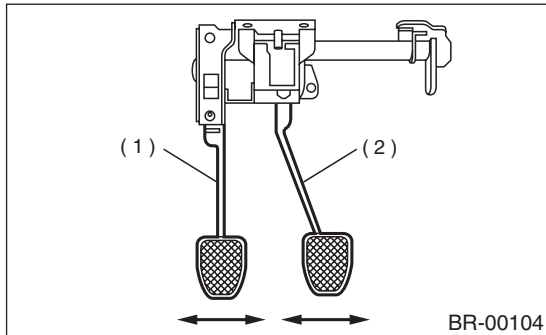
CAUTION:

If excessive deflection is noted, replace bushings with new ones.

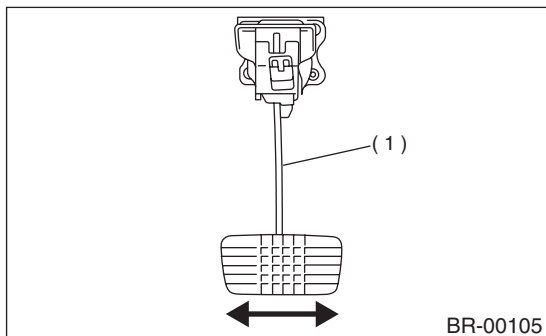
Deflection of brake and clutch pedal:

Service limit

5.0 mm (0.197 in) or less



- (1) Clutch pedal
- (2) Brake pedal



- (1) Brake pedal

2) Check position of pedal pad.

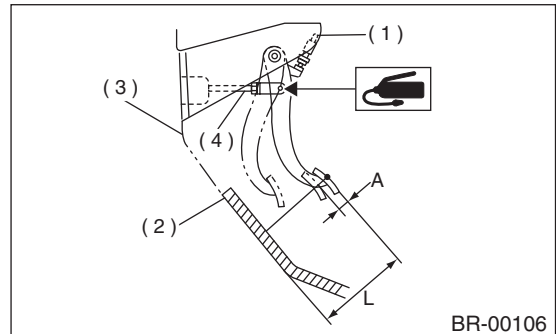
Pedal height: L

AT: 158 mm (6.22 in)

MT: 153 mm (6.02 in)

Brake pedal free play: A

1 — 3 mm (0.04 — 0.12 in) [Depress brake pedal pad with a force of less than 10 N (1 kgf, 2 lb).]



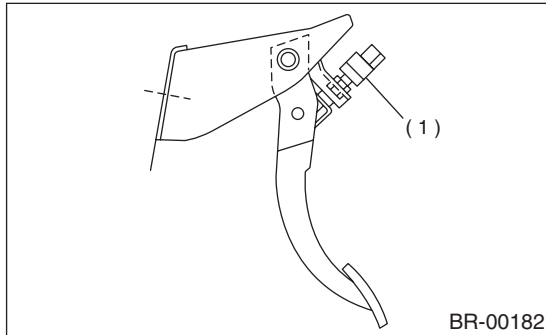
- (1) Stop light switch
- (2) Mat
- (3) Toe board
- (4) Brake booster operating rod

3) If it is not in specified value, adjust it by adjusting brake booster operating rod length.

16.Stop Light Switch

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Disconnect stop light switch connector.
- 3) Loosen nuts, and unscrew stop light switch to remove.



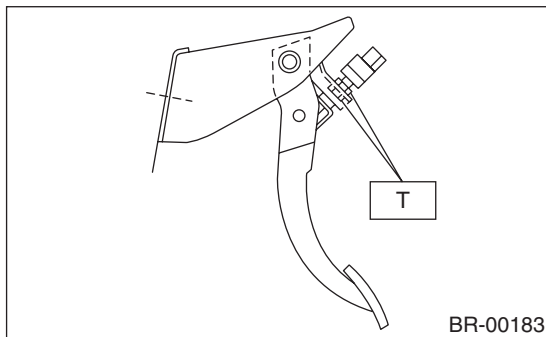
(1) Stop light switch

B: INSTALLATION

- 1) Screw the stop light switch onto a bracket and secure it temporarily with a nut.
 - 2) Adjust stop light switch position, and then tighten the nut.
- <Ref. to BR-42, ADJUSTMENT, Stop Light Switch.>

Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)

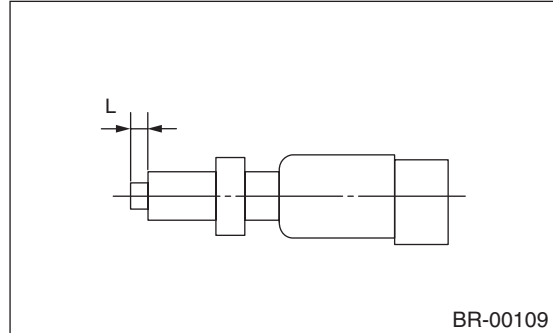


C: INSPECTION

- 1) If stop light switch does not operate properly (or if it does not stop at the specified position), replace with a new one.

Specified position: L

$2^{+1.5}_{-0} \text{ mm } (0.079^{+0.059}_{-0} \text{ in})$



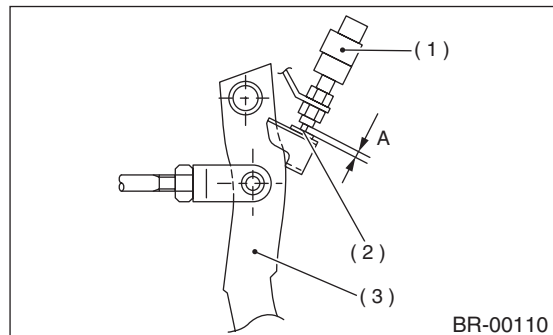
- 2) Measure the clearance between threaded end of stop light switch and stopper.

CAUTION:

Be careful not to rotate stop light switch.

Stop light switch clearance: A

0.3 mm (0.012 in)



- (1) Stop light switch
- (2) Stopper
- (3) Brake pedal

- 3) If it is not in specified value, adjust it by adjusting position of stop light switch.

CAUTION:

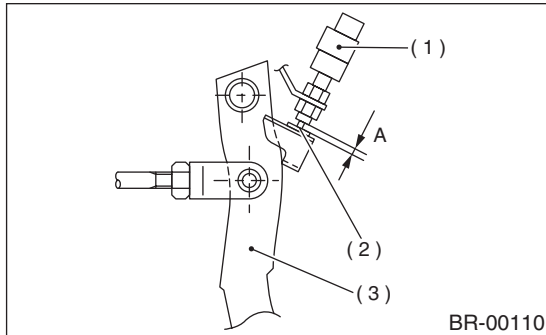
Be careful not to rotate stop light switch.

STOP LIGHT SWITCH

BRAKE

D: ADJUSTMENT

Loosen the lock nut, and adjust stop light switch position until the clearance (A) between threaded end of the stop light switch and the stopper becomes 0.3 mm (0.012 in). Then, tighten the lock nut.



- (1) Stop light switch
- (2) Stopper
- (3) Brake pedal

17. General Diagnostics

A: INSPECTION

	Trouble and possible cause	Corrective action
1. Insufficient braking	(1) Fluid leakage from the hydraulic mechanism	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
	(2) Entry of air into the hydraulic mechanism	Bleed the air.
	(3) Excessively wide shoe clearance	Adjust the clearance.
	(4) Wear, deteriorated surface material, adhering water or fluid on the lining	Replace, grind or clean.
	(5) Improper operation of master cylinder, disc caliper, brake booster or check valve	Correct or replace.
2. Unstable or uneven braking	(1) Fluid on the lining or rotor	Eliminate cause of fluid leakage, clean, or replace.
	(2) Rotor eccentricity	Correct or replace the rotor.
	(3) Improper lining contact, deteriorated surface material, improper inferior material, or wear	Correct by grinding, or replace.
	(4) Deformed back plate	Correct or replace.
	(5) Improper tire inflation	Inflate to correct pressure.
	(6) Disordered wheel alignment	Adjust alignment.
	(7) Loosened back plate or the support installing bolts	Retighten.
	(8) Loosened wheel bearing	Retighten to normal tightening torque or replace.
	(9) Trouble in the hydraulic system	Replace the cylinder, brake pipe or hose.
	(10) Uneven effect of the parking brake	Check, adjust, or replace the rear brake and cable system.
3. Excessive pedal stroke	(1) Entry of air into the hydraulic mechanism	Bleed the air.
	(2) Excessive play in the master cylinder push rod	Adjust.
	(3) Fluid leakage from the hydraulic mechanism	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
	(4) Improperly adjusted shoe clearance	Adjust.
	(5) Improper lining contact or worn lining	Correct or replace.
4. Brake dragging or improper brake return	(1) Insufficient pedal play	Adjust play.
	(2) Improper master cylinder return	Clean or replace the cylinder.
	(3) Clogged hydraulic system	Replace.
	(4) Improper return or adjustment of parking brake	Correct or adjust.
	(5) Weakened spring tension or breakage of shoe return spring	Replace the spring.
	(6) Excessively narrow shoe clearance	Adjust the clearance.
	(7) Improper disc caliper operation	Correct or replace.
	(8) Improper adjusted wheel bearing	Adjust or replace.
5. Brake noise (1) (creak sound)	(1) Hardened or deteriorated lining	Replace the shoe assembly or pad.
	(2) Worn lining	Replace the shoe assembly or pad.
	(3) Loosened back plate or the support installing bolts	Retighten.
	(4) Loose wheel bearing	Retighten to normal tightening torque.
	(5) Dirty rotor	Clean the rotor, or clean and replace the brake assembly.
6. Brake noise (2) (hissing sound)	(1) Worn lining	Replace the shoe assembly or pad.
	(2) Improper installed shoe or pad	Correct or replace the shoe assembly or pad.
	(3) Loose or bent rotor	Retighten or replace.
7. Brake noise (3) (click sound)	(1) Excessively worn pad or the support	Replace the pad or the support.
	(2) Excessively worn shoe ridge	Replace the back plate.
	(3) Lack of oil on the shoe ridge surface and anchor	Add more grease.

GENERAL DIAGNOSTICS

BRAKE

MEMO:

DIFFERENTIALS

DI

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GENERAL DESCRIPTION

DIFFERENTIALS

1. General Description

A: SPECIFICATIONS

When replacing a rear differential assembly, select the correct one according to the following table.

NOTE:

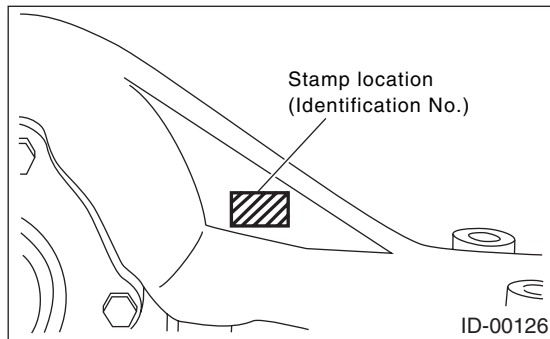
Using the different rear differential assembly causes the drive line and tires to “drag” or emit abnormal noise.

MODEL	2.5 L Non-turbo	
	MT	AT
	T-type	VA-type
Rear differential type	J (with LSD)	XS (with LSD)
Gear	Hypoid gear	
Gear ratio (Number of gear teeth)	4.111 (37/9)	4.444 (40/9)
Oil capacity	0.8 ℓ (0.8 US qt, 0.7 Imp qt)	
Rear differential gear oil	GL-5	

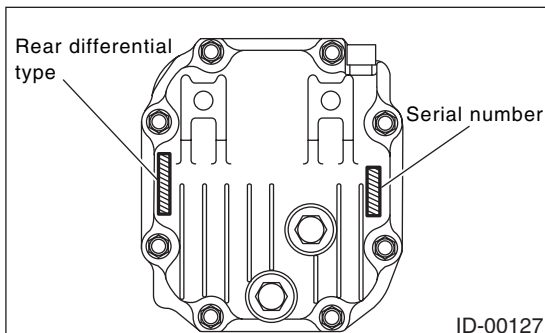
MODEL	2.5 L turbo	
	MT	AT
	T-type	
Rear differential type	F (with LSD)	
Gear	Hypoid gear	
Gear ratio (Number of gear teeth)	4.444 (40/9)	
Oil capacity	0.8 ℓ (0.8 US qt, 0.7 Imp qt)	
Rear differential gear oil	GL-5	

• Identification

Except non-TURBO AT model



Non-TURBO AT model

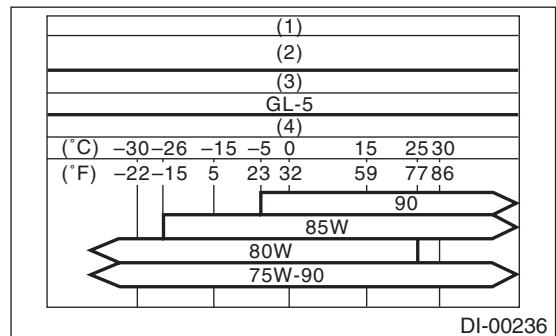


• Rear differential gear oil

Recommended oil

NOTE:

Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.



- (1) Item
- (2) Rear differential gear oil
- (3) API Classification
- (4) SAE Viscosity No. and Application Temperature

GENERAL DESCRIPTION

DIFFERENTIALS

1. SERVICE DATA

Front and rear bearing preload at companion flange bolt hole N (kgf, lb)	T-type	18.1 — 38.8 (1.8 — 4.0, 4.1 — 8.7)
	VA-type	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
Side gear backlash mm (in)	T-type	0.10 — 0.20 (0.0039 — 0.0079)
	VA-type	0.05 — 0.15 (0.0020 — 0.0059)
Side bearing standard width mm (in)		20.00 (0.7874)
Crown gear to drive pinion backlash mm (in)	T-type	0.10 — 0.20 (0.0039 — 0.0079)
	VA-type	0.10 — 0.15 (0.0039 — 0.0059)
Crown gear runout on its back surface mm (in)	T-type only	0.05 (0.0020) or less

GENERAL DESCRIPTION

DIFFERENTIALS

2. ADJUSTING PARTS

• VA-type

Item	Part No.	Length or thickness
Preload adjusting spacer	32288AA040	52.3 mm (2.059 in)
	32288AA050	52.5 mm (2.067 in)
	31454AA100	52.6 mm (2.071 in)
	32288AA060	52.7 mm (2.075 in)
	31454AA110	52.8 mm (2.079 in)
	32288AA070	52.9 mm (2.083 in)
	31454AA120	53.0 mm (2.087 in)
	32288AA080	53.1 mm (2.091 in)
	32288AA090	53.3 mm (2.098 in)
Preload adjusting washer	38336AA000	1.500 mm (0.0591 in)
	38336AA120	1.513 mm (0.0596 in)
	38336AA010	1.525 mm (0.0600 in)
	38336AA130	1.538 mm (0.0606 in)
	38336AA020	1.550 mm (0.0610 in)
	38336AA140	1.563 mm (0.0615 in)
	38336AA030	1.575 mm (0.0620 in)
	38336AA150	1.588 mm (0.0625 in)
	38336AA040	1.600 mm (0.0630 in)
	38336AA160	1.613 mm (0.0635 in)
	38336AA050	1.625 mm (0.0640 in)
	38336AA170	1.638 mm (0.0645 in)
	38336AA060	1.650 mm (0.0650 in)
	38336AA180	1.663 mm (0.0655 in)
	38336AA070	1.675 mm (0.0659 in)
	38336AA190	1.688 mm (0.0665 in)
	38336AA080	1.700 mm (0.0669 in)
	38336AA200	1.713 mm (0.0674 in)
	38336AA090	1.725 mm (0.0679 in)
	38336AA210	1.738 mm (0.0684 in)
	38336AA100	1.750 mm (0.0689 in)
	38336AA220	1.763 mm (0.0694 in)
	38336AA110	1.775 mm (0.0699 in)
Pinion height adjusting shim	32295AA200	0.150 mm (0.0059 in)
	32295AA210	0.175 mm (0.0069 in)
	32295AA220	0.200 mm (0.0079 in)
	32295AA230	0.225 mm (0.0089 in)
	32295AA240	0.250 mm (0.0098 in)
	32295AA250	0.275 mm (0.0108 in)
Side gear thrust washer (Without LSD)	803135011	0.925 — 0.950 mm (0.0364 — 0.0374 in)
	803135012	0.950 — 0.975 mm (0.0374 — 0.0384 in)
	803135013	0.975 — 1.000 mm (0.0384 — 0.0394 in)
	803135014	1.000 — 1.025 mm (0.0394 — 0.0404 in)
	803135015	1.025 — 1.050 mm (0.0404 — 0.0413 in)

GENERAL DESCRIPTION

DIFFERENTIALS

• T-type

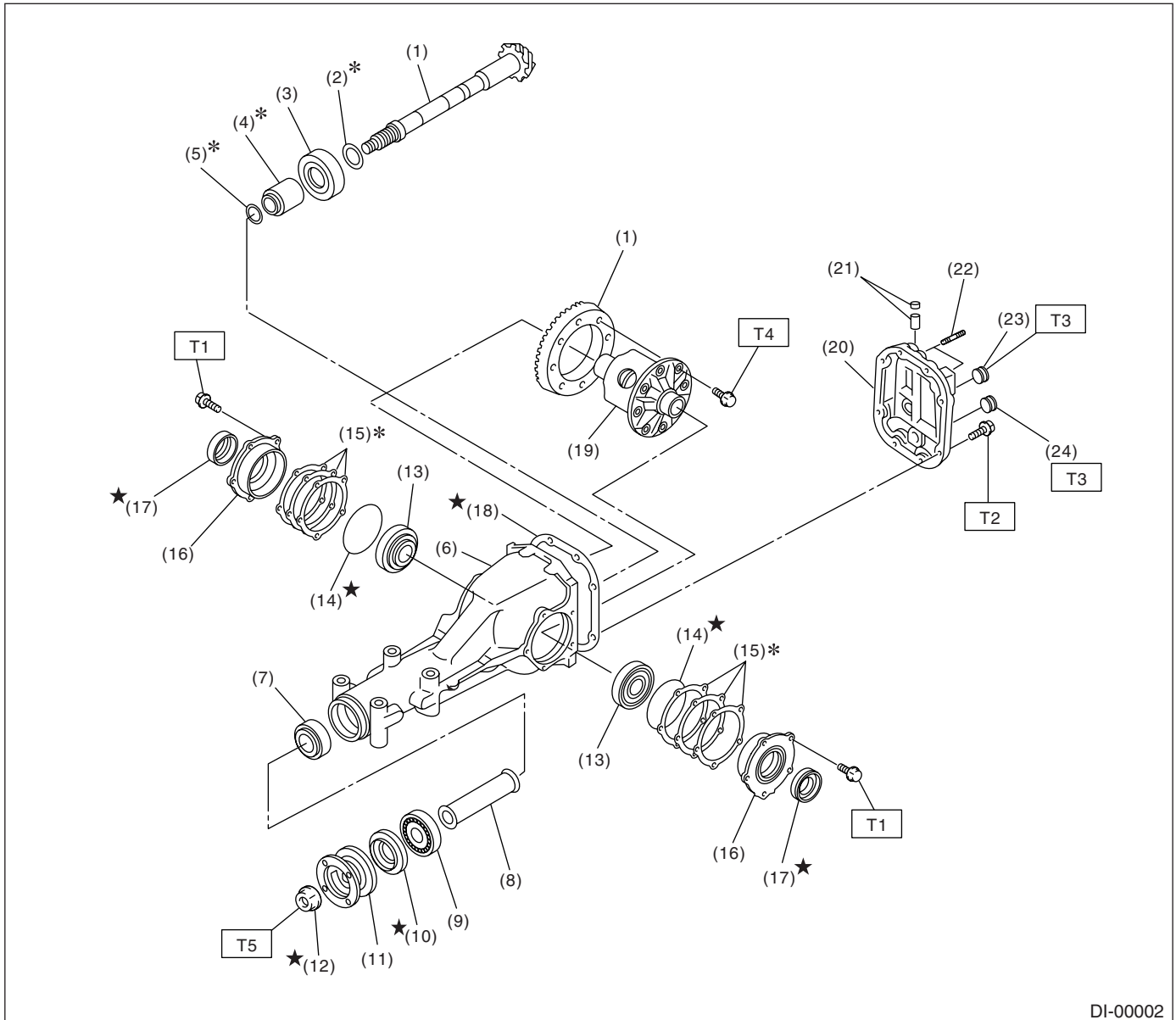
Item	Part No.	Length or thickness
Preload adjusting spacer	383695201	56.2 mm (2.213 in)
	383695202	56.4 mm (2.220 in)
	383695203	56.6 mm (2.228 in)
	383695204	56.8 mm (2.236 in)
	383695205	57.0 mm (2.244 in)
	383695206	57.2 mm (2.252 in)
Preload adjusting washer	383705200	2.59 mm (0.1020 in)
	383715200	2.57 mm (0.1012 in)
	383725200	2.55 mm (0.1004 in)
	383735200	2.53 mm (0.0996 in)
	383745200	2.51 mm (0.0988 in)
	383755200	2.49 mm (0.0980 in)
	383765200	2.47 mm (0.0972 in)
	383775200	2.45 mm (0.0965 in)
	383785200	2.43 mm (0.0957 in)
	383795200	2.41 mm (0.0949 in)
	383805200	2.39 mm (0.0941 in)
	383815200	2.37 mm (0.0933 in)
	383825200	2.35 mm (0.0925 in)
	383835200	2.33 mm (0.0917 in)
	383845200	2.31 mm (0.0909 in)
Pinion height adjusting shim	383495200	3.09 mm (0.1217 in)
	383505200	3.12 mm (0.1228 in)
	383515200	3.15 mm (0.1240 in)
	383525200	3.18 mm (0.1252 in)
	383535200	3.21 mm (0.1264 in)
	383545200	3.24 mm (0.1276 in)
	383555200	3.27 mm (0.1287 in)
	383565200	3.30 mm (0.1299 in)
	383575200	3.33 mm (0.1311 in)
	383585200	3.36 mm (0.1323 in)
	383595200	3.39 mm (0.1335 in)
	383605200	3.42 mm (0.1346 in)
	383615200	3.45 mm (0.1358 in)
	383625200	3.48 mm (0.1370 in)
	383635200	3.51 mm (0.1382 in)
	383645200	3.54 mm (0.1394 in)
	383655200	3.57 mm (0.1406 in)
	383665200	3.60 mm (0.1417 in)
	383675200	3.63 mm (0.1429 in)
	383685200	3.66 mm (0.1441 in)
Side gear thrust washer (Without LSD)	383445201	0.75 — 0.80 mm (0.0295 — 0.0315 in)
	383445202	0.80 — 0.85 mm (0.0315 — 0.0335 in)
	383445203	0.85 — 0.90 mm (0.0335 — 0.0354 in)
Side bearing retainer shim	383475201	0.20 mm (0.0079 in)
	383475202	0.25 mm (0.0098 in)
	383475203	0.30 mm (0.0118 in)
	383475204	0.40 mm (0.0157 in)
	383475205	0.50 mm (0.0197 in)

GENERAL DESCRIPTION

DIFFERENTIALS

B: COMPONENT

1. REAR DIFFERENTIAL FOR T-TYPE WITH LSD



DI-00002

- | | |
|--|---------------------------------|
| (1) Pinion crown gear and drive pinion set | (11) Companion flange |
| (2) Pinion height adjusting shim | (12) Self-locking nut |
| (3) Rear bearing | (13) Side bearing |
| (4) Bearing preload adjusting spacer | (14) O-ring |
| (5) Bearing preload adjusting washer | (15) Side bearing retainer shim |
| (6) Differential carrier | (16) Side bearing retainer |
| (7) Front bearing | (17) Side oil seal |
| (8) Collar | (18) Gasket |
| (9) Pilot bearing | (19) Differential case ASSY |
| (10) Front oil seal | (20) Rear cover |
| | (21) Air breather cap |

- (22) Stud bolt
(23) Oil filler plug
(24) Oil drain plug

Tightening torque: N-m (kgf-m, ft-lb)

T1: 10.5 (1.1, 8.0)

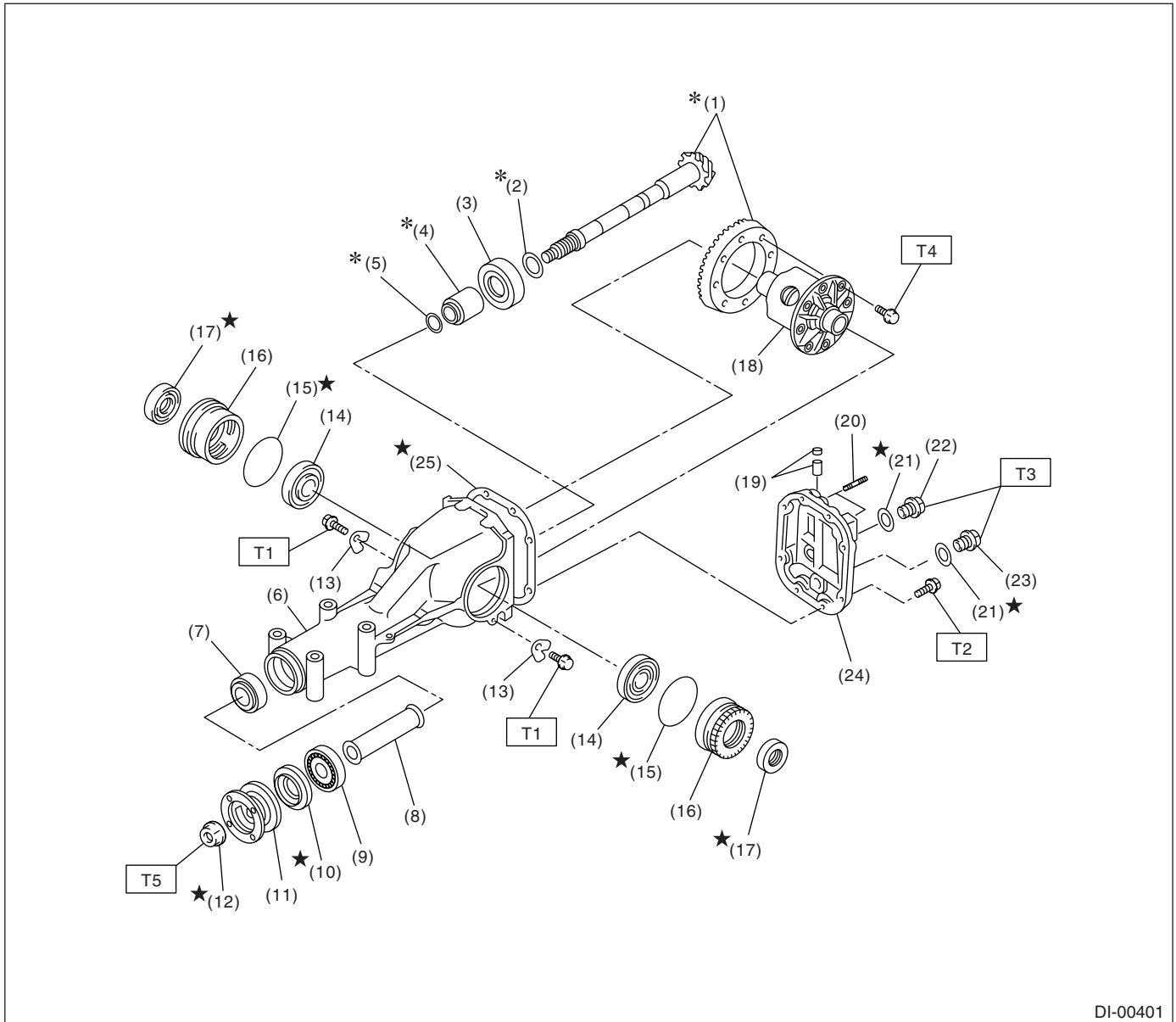
T2: 29.5 (3.0, 22.0)

T3: 49.0 (5.00, 36.2)

T4: 103 (11, 76)

T5: 181.5 (19, 134)

2. REAR DIFFERENTIAL FOR VA-TYPE WITH LSD



DI-00401

- | | |
|--|-----------------------------|
| (1) Pinion crown gear and drive pinion set | (11) Companion flange |
| (2) Pinion height adjusting shim | (12) Self-locking nut |
| (3) Rear bearing | (13) Lock plate |
| (4) Bearing preload adjusting spacer | (14) Side bearing |
| (5) Bearing preload adjusting washer | (15) O-ring |
| (6) Differential carrier | (16) Axle shaft holder |
| (7) Front bearing | (17) Side oil seal |
| (8) Collar | (18) Differential case ASSY |
| (9) Pilot bearing | (19) Air breather cap |
| (10) Front oil seal | (20) Stud bolt |
| | (21) Gasket |

Tightening torque: N-m (kgf-m, ft-lb)

T1: 25 (2.5, 18.1)

T2: 25 (2.5, 18.1)

T3: 34 (3.5, 25.3)

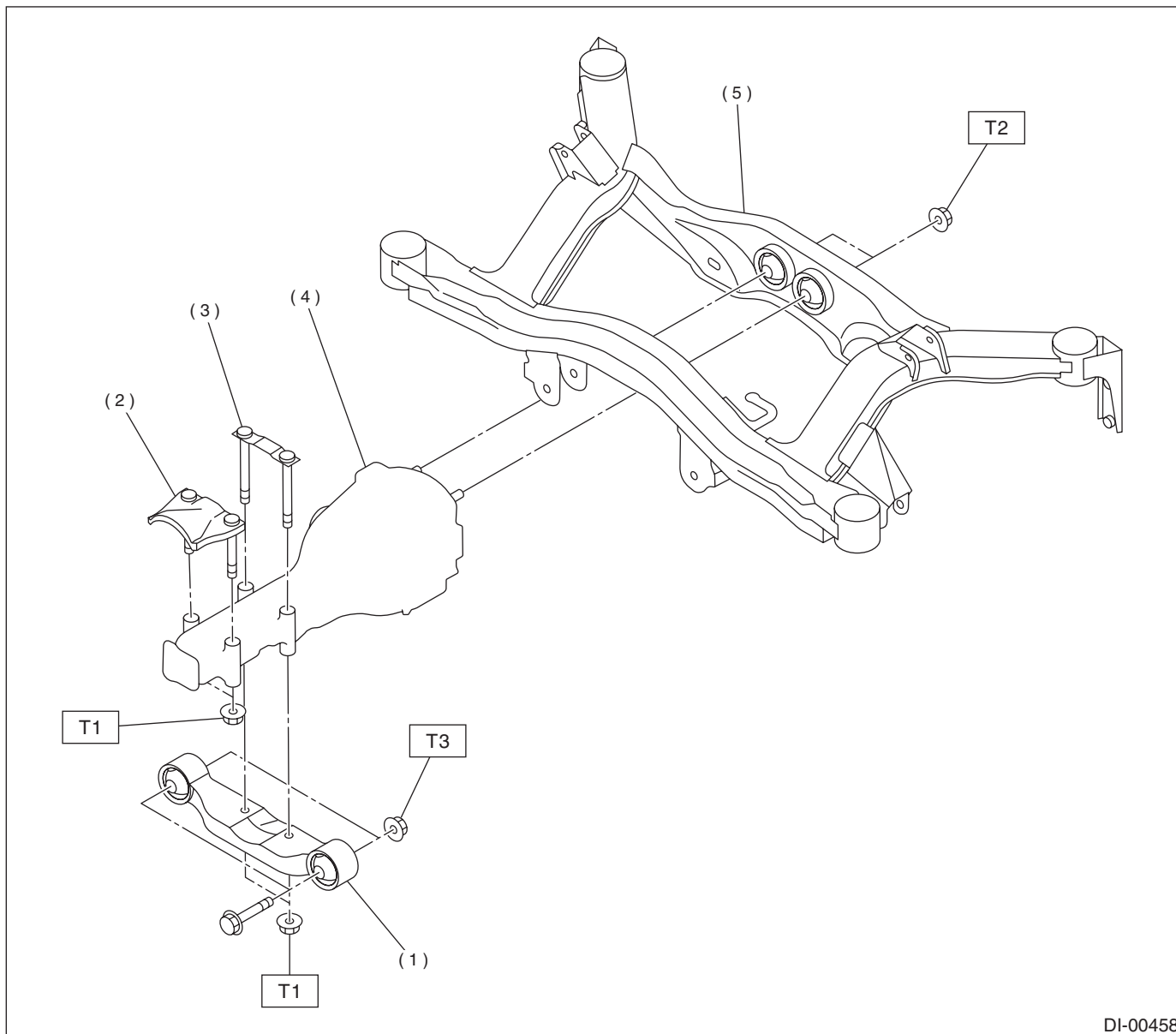
T4: 62 (6.3, 45.6)

T5: 191 (19.5, 141)

GENERAL DESCRIPTION

DIFFERENTIALS

3. REAR DIFFERENTIAL MOUNTING SYSTEM



DI-00458

- | | |
|------------------------------------|----------------------------|
| (1) Rear differential front member | (4) Rear differential ASSY |
| (2) Protector | (5) Sub frame |
| (3) Rear differential member plate | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 65 (6.6, 48)

T2: 70 (7.1, 51)

T3: 110 (11.2, 81)

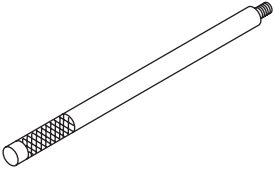
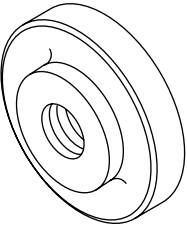
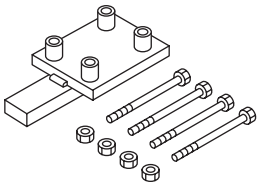
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.

- Use SUBARU genuine gear oil, grease etc. or the equivalent. Do not mix gear oil, grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply gear oil onto sliding or revolution surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of gear oil to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.
- Avoid damaging the mating face of the case.

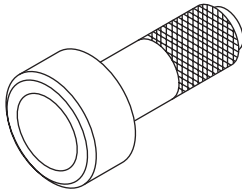
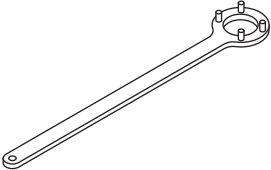
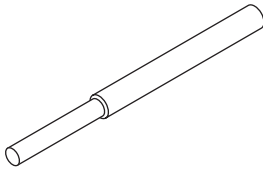
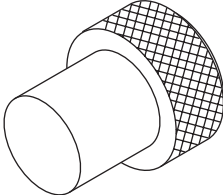
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398477701	398477701	HANDLE	Used for installing front and rear bearing cone.
 ST-398477702	398477702	DRIFT	Used press-fitting the bearing cone of differential carrier (front).
 ST-398217700	398217700	ATTACHMENT SET	Stand for rear differential carrier disassembly and assembly.

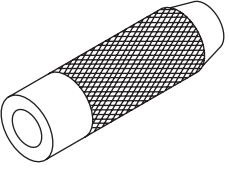
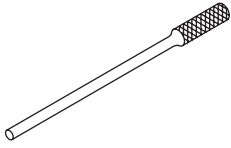
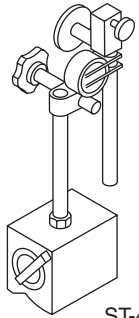
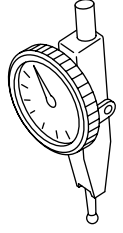
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498447120	498447120	INSTALLER	Used for installing front oil seal.
 ST-498427200	498427200	FLANGE WRENCH	Used for stopping rotation of companion flange when loosening and tightening self-lock nut.
 ST-398467700	398467700	DRIFT	Used for removing pinion, pilot bearing and front bearing cone.
 ST-399780104	399780104	WEIGHT	Used for installing front bearing cone, pilot bearing companion flange.

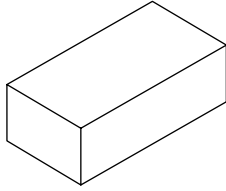
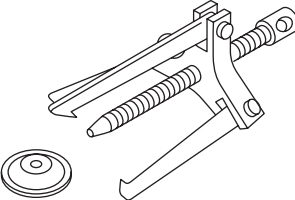
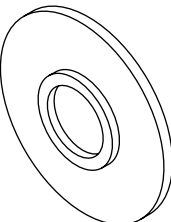
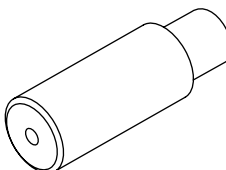
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-899580100	899580100	INSTALLER	Used for press-fitting the front bearing cone, pilot bearing.
 ST-899904100	899904100	STRAIGHT PIN REMOVER	Used for driving out differential pinion shaft lock pin.
 ST-498247001	498247001	MAGNET BASE	• Used for measuring backlash between side gear and pinion, and hypoid gear. • Used with DIAL GAUGE (498247100).
 ST-498247100	498247100	DIAL GAUGE	• Used measuring backlash between side gear and pinion, hypoid gear. • Used with MAGNET BASE (498247001).

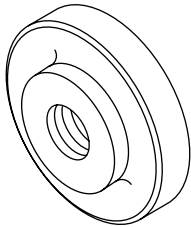
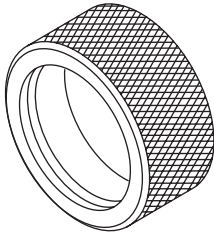
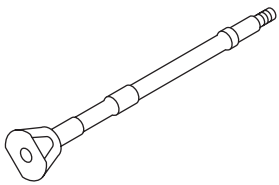
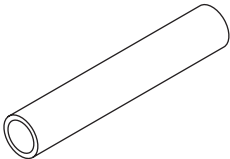
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398507704	398507704	BLOCK	Used for adjusting pinion height and preload.
 ST-399703600	399703600	PULLER ASSY	Use for removing companion flange.
 ST-398177700	398177700	INSTALLER	- Used for installing rear bearing cone. - For T-type.
 ST-398457700	398457700	ATTACHMENT	- Used for removing side bearing retainer. - For T-type.

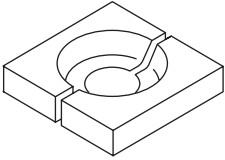
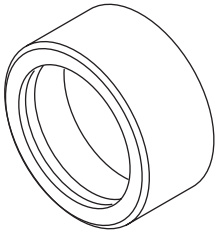
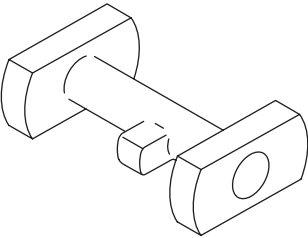
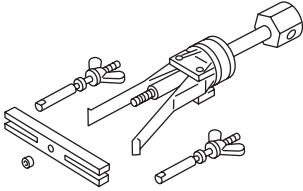
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398477703	398477703	DRIFT 2	- Used for press-fitting the bearing race (rear) of differential carrier. - For T-type.
 ST-398437700	398437700	DRIFT	- Used for installing side oil seal. - For T-type.
 ST-398507702	398507702	DUMMY SHAFT	- Used for adjusting pinion height and preload. - For T-type.
 ST-398507703	398507703	DUMMY COLLAR	- Used for adjusting pinion height and preload. - For T-type.

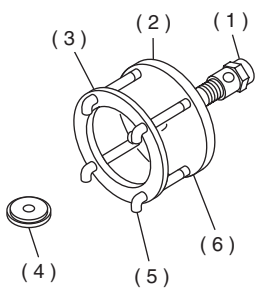
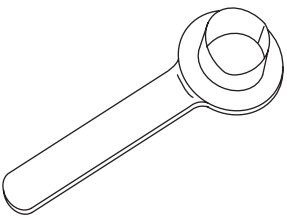
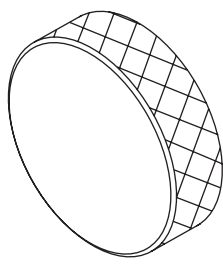
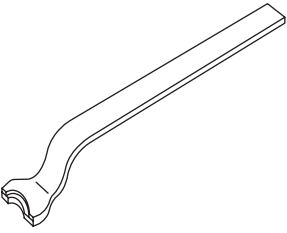
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398517700	398517700	REPLACER	- Used for removing rear bearing cone. - For T-type.
 ST-398487700	398487700	DRIFT	- Used for press-fitting the side bearing cone. - For T-type.
 ST-398507701	398507701	GAUGE	- Used for adjusting pinion height. - For T-type.
 ST-398527700	398527700	PULLER ASSY	- Used for removing oil seal and side bearing cup. - For T-type.

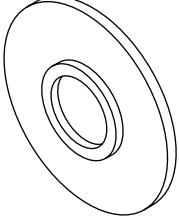
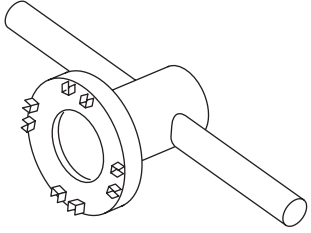
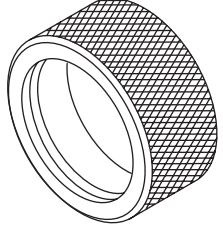
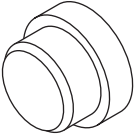
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-399527700	399527700	PULLER SET	- Used for extracting side bearing cone. (1) BOLT (899521412) (2) PULLER (399527702) (3) HOLDER (399527703) (4) ADAPTER (398497701) (5) BOLT (899520107) (6) NUT (021008000) - For T-type.
 ST28099PA090	28099PA090	OIL SEAL PRO- TECTOR	- Used for installing rear drive shaft into rear differential. - For protecting oil seal.
 ST-398237700	398237700	GAUGE	- Used for installing side bearing. - For T-type.
 ST28099PA100	28099PA100	DRIVE SHAFT REMOVER	- Used for removing rear drive shaft from rear differential. - For T-type.

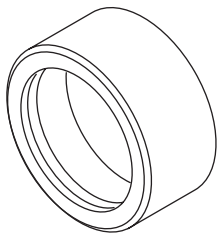
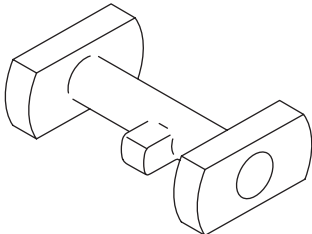
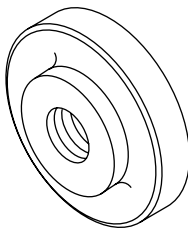
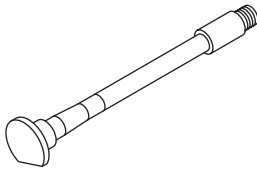
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498175500	498175500	INSTALLER	- Used for installing rear bearing cone. - For VA-type.
 ST-499785500	499785500	WRENCH ASSY	- Used for removing and installing side oil seal holder. - For VA-type.
 ST-498447100	498447100	INSTALLER	- Used for installing oil seal. - For VA-type.
 ST-399520105	399520105	SEAT	- Used for removing side bearing cone. - Used with PULLER SET (899524100). - For VA-type.

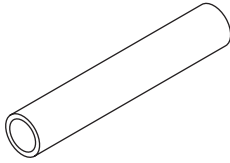
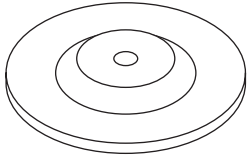
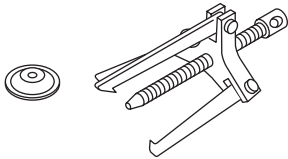
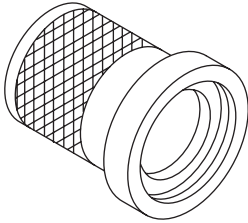
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498485400	498485400	DRIFT	- Used for installing side bearing cone. - For VA-type.
 ST-498505501	498505501	GAUGE	- Used for adjusting pinion height. - For VA-type.
 ST-498447110	498447110	BEARING OUTER RACE DRIFT	- Used for press-fitting the bearing race (front) of differential carrier. - For VA-type.
 ST-498447150	498447150	DUMMY SHAFT	- Used for adjusting pinion height and pre-load. - For VA-type.

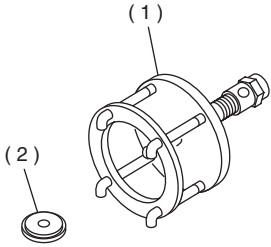
GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST32285AA000	32285AA000	DUMMY COLLAR	- Used for adjusting pinion height and pre-load. - For VA-type.
 ST-499705404	499705404	SEAT	- Used for removing side bearing race. - Used with PULLER ASSY (499705401). - For VA-type.
 ST-499705401	499705401	PULLER ASSY	- Used for removing side bearing race. - Used with SEAT (499705404). - For VA-type.
 ST-899874100	899874100	INSTALLER	- Used for installing companion flange. - For VA-type.

GENERAL DESCRIPTION

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-899524100	899524100	DIFFERENTIAL BEARING PULLER SET	- Used for removing side bearing cone of differential. - For VA-type. (1) Puller (2) Cap

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Transmission Jack	Used for assembly/disassembly of rear differential.
Puller	Used for removal of side bearing retainer. (T-type)
Thickness Gauge	Used for measuring clearance.
Tire Lever	Used for removal of rear drive shaft. (VA-type)

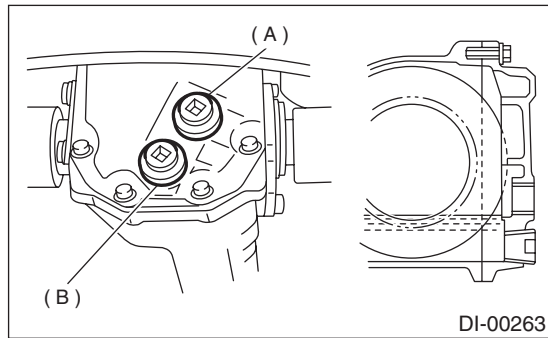
2. Differential Gear Oil

A: INSPECTION

1) Take out filler plug, and replace gear oil if it is contaminated or deteriorated. <Ref. to DI-20, REPLACEMENT, Differential Gear Oil.>

2) Check gear oil level is up to the bottom part of filler bolt. If the level is low, refill up to the bottom of filler bolt.

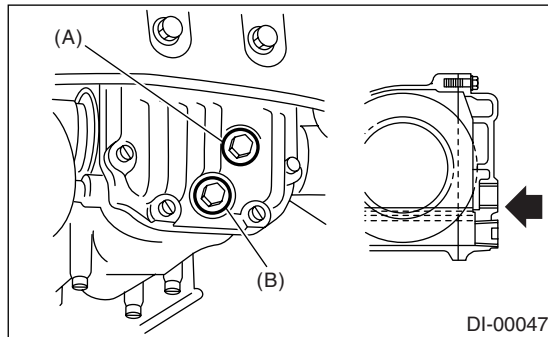
- T-type



(A) Filler plug

(B) Drain plug

- VA-type



(A) Filler plug

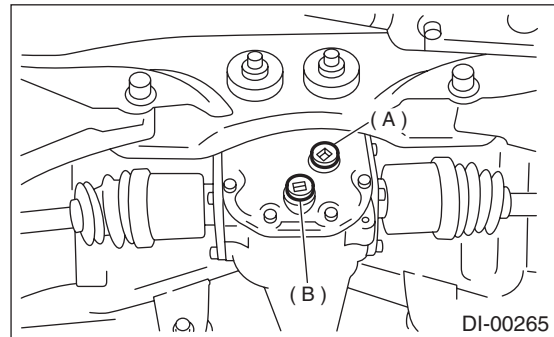
(B) Drain plug

B: REPLACEMENT

- 1) Jack-up vehicle and support it with sturdy racks.
- 2) Remove the oil drain plug and filler plug, and drain the gear oil.

CAUTION:

Be careful not to burn your hands, because gear oil becomes extremely hot after running.



(A) Filler plug

(B) Drain plug

- 3) Tighten oil drain plug.

NOTE:

- Apply fluid gasket to drain plug for T-type.
- VA-type uses a new aluminum gasket.

Fluid gasket:

THREE BOND 1105 (Part No.: 004403010) or equivalent

Tightening torque:

T-type;

49.0 N·m (5.0 kgf-m, 36.2 ft-lb)

VA-type;

34 N·m (3.5 kgf-m, 25.3 ft-lb)

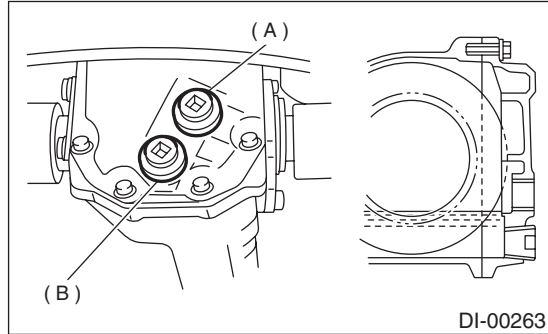
4) Fill differential carrier with gear oil to the upper plug level.

CAUTION:

Carefully refill gear oil while watching the level.
Excess or insufficient oil must be avoided.

Oil capacity:

0.8 ℓ (0.8 US qt, 0.7 Imp qt)



(A) Filler plug

(B) Drain plug

5) Install filler plug.

NOTE:

- Apply fluid gasket to filler plug for T-type.
- VA-type uses a new aluminum gasket.

Fluid gasket:

THREE BOND 1105 (Part No.: 004403010)
or equivalent

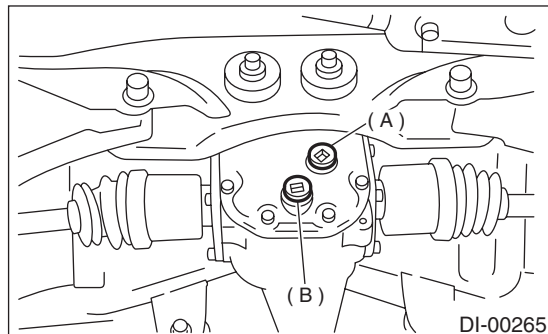
Tightening torque:

T-type;

49.0 N·m (5.0 kgf-m, 36.2 ft-lb)

VA-type;

34 N·m (3.5 kgf-m, 25.3 ft-lb)



(A) Filler plug

(B) Drain plug

3. Front Differential

A: NOTE

1. AT MODEL

For front differential of automatic transmission, refer to “AT” section. <Ref. to 4AT-117, Front Differential.>

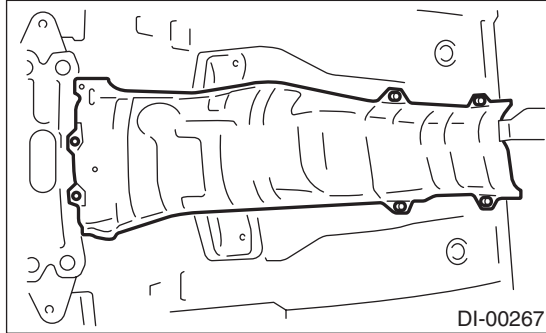
2. MT MODEL

For front differential of manual transmission, refer to “MT” section. <Ref. to 5MT-69, Front Differential Assembly.>

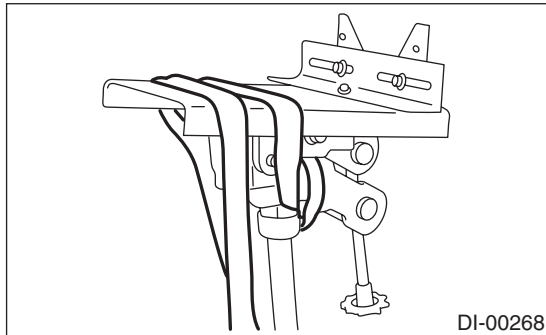
4. Rear Differential for T-type

A: REMOVAL

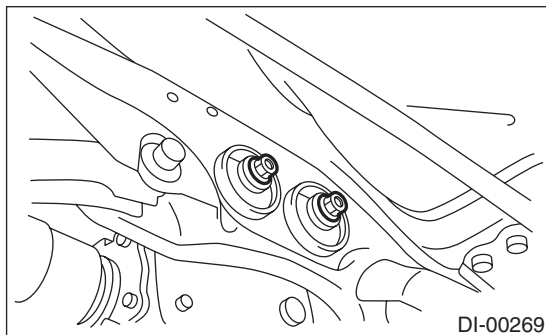
- 1) Disconnect ground cable from battery.
- 2) Move select lever or gear shift lever to "N".
- 3) Release the parking brake.
- 4) Jack-up vehicle and support it with sturdy racks.
- 5) Remove rear exhaust pipe and muffler.
- 6) Remove heat shield cover.



- 7) Remove propeller shaft.
<Ref. to DS-15, REMOVAL, Propeller Shaft.>
- 8) Remove rear differential protector (if equipped).
- 9) Prepare a transmission jack and a band.

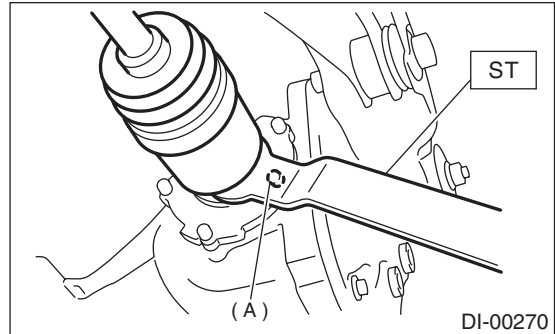


- 10) Loosen self-locking nuts connecting rear differential to rear crossmember.



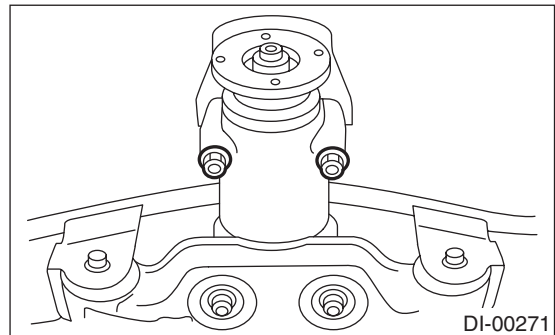
- 11) Remove DOJ of rear drive shaft from rear differential using ST.

ST 28099PA100 DRIVE SHAFT REMOVER

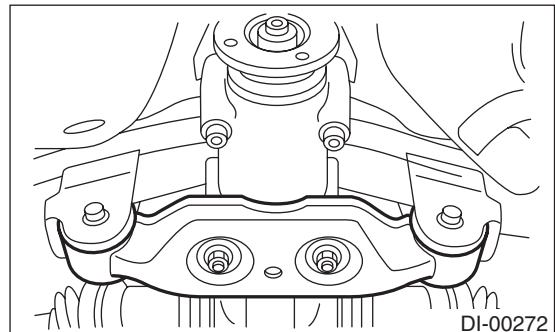


(A) Bolt

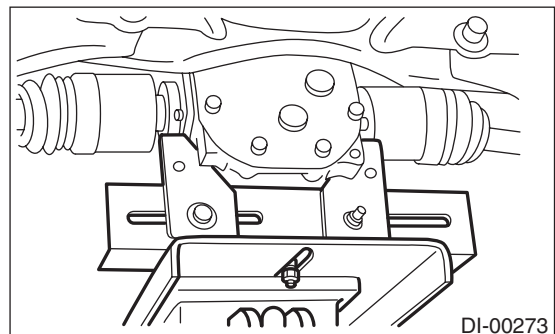
- 12) Remove protector nuts.



- 13) Remove rear differential front member.



- 14) Support rear differential with transmission jack.



REAR DIFFERENTIAL FOR T-TYPE

DIFFERENTIALS

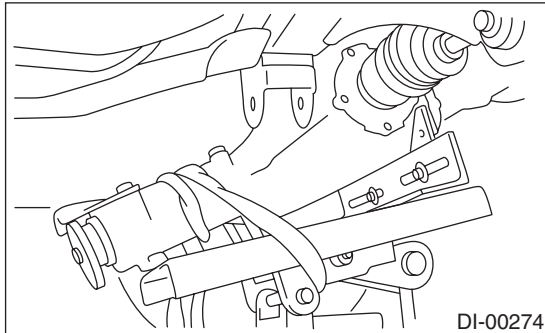
15) Be sure to secure differential to transmission jack by hand.

16) Remove self-locking nuts connecting rear differential to crossmember.

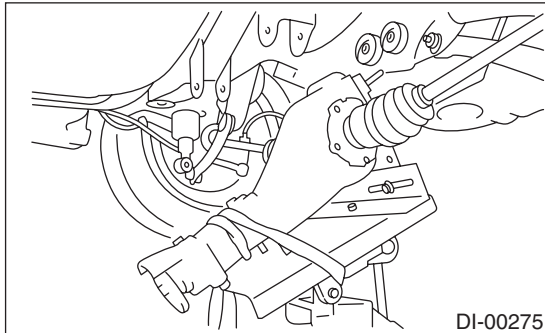
17) Remove rear differential stud bolt from rear crossmember bushing.

NOTE:

Carefully adjust angle and position of transmission jack and jack stand as required during stud bolt removal.



18) After removing rear differential stud bolt from rear crossmember, lower transmission jack stand. Do not allow rear drive shaft to strike lateral link bolt.

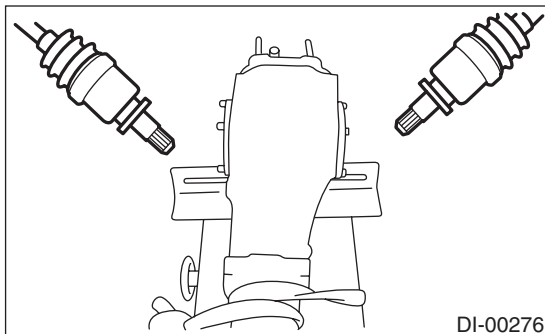


19) Pull out axle shaft from rear differential.

NOTE:

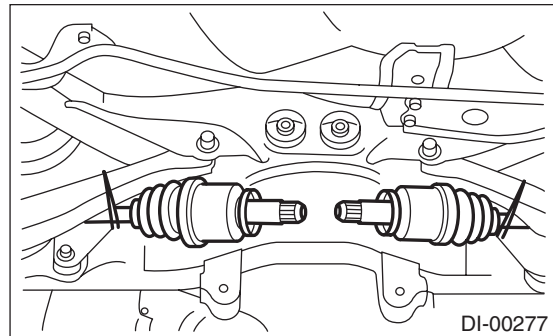
If axle shaft is difficult to remove from rear differential, use ST to remove it.

ST 28099PA100 DRIVE SHAFT REMOVER

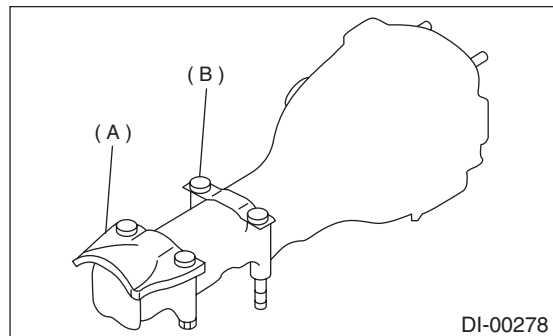


20) Take down transmission jack.

21) Secure rear drive shaft to lateral link use wire.



22) Remove protector and rear differential member plate from rear differential.

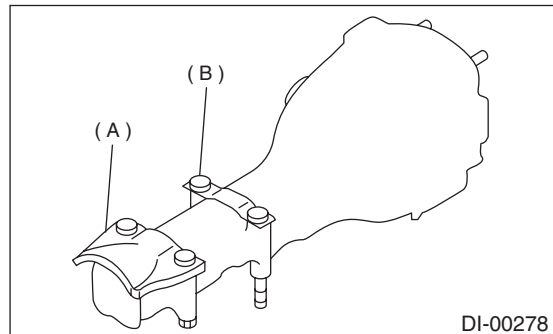


(A) Protector

(B) Rear differential member plate

B: INSTALLATION

1) Install protector and rear differential member plate to rear differential.



(A) Protector

(B) Rear differential member plate

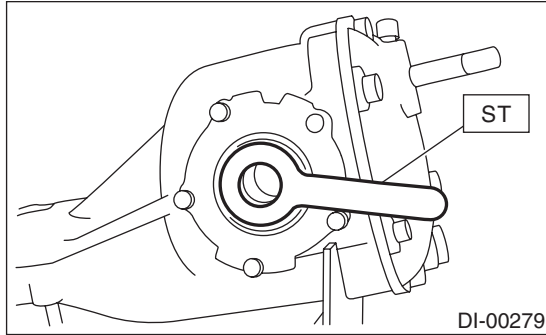
2) Set rear differential to transmission jack.

NOTE:

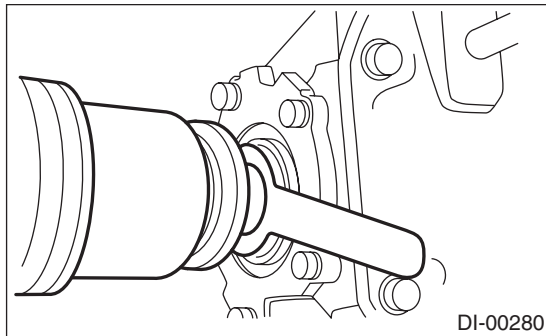
Secure rear differential to transmission jack using a band.

3) Install ST to rear differential.

ST 28099PA090 OIL SEAL PROTECTOR



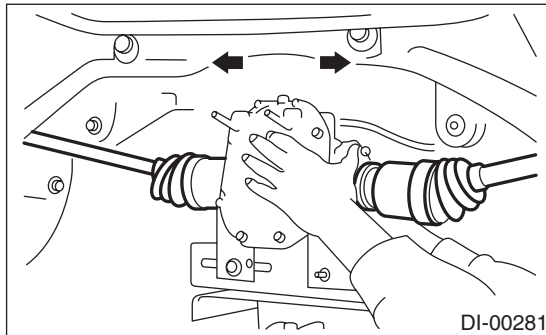
4) Insert the spline shaft until the spline portion is inside the side oil seal.



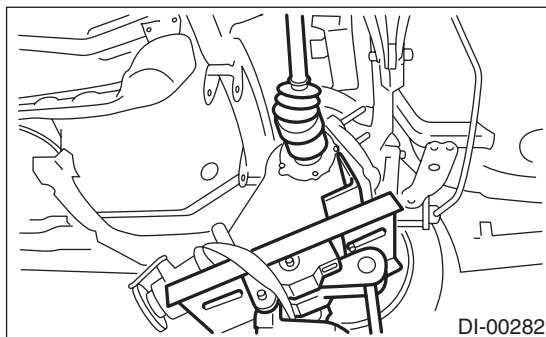
5) Remove ST from rear differential.

ST 28099PA090 OIL SEAL PROTECTOR

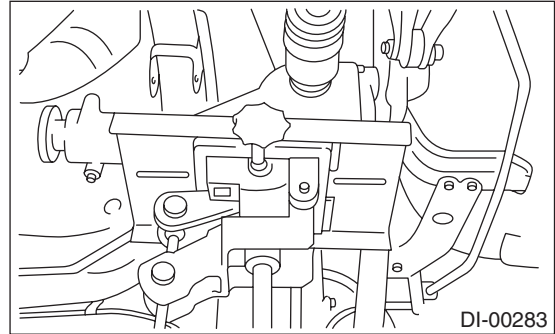
6) Completely insert axle shaft into rear differential by pressing rear differential.



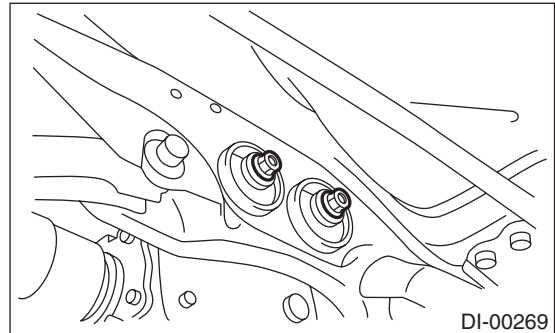
7) Adjust transmission jack as required so rear differential stud bolt is properly inserted into rear crossmember bushing.



8) After rear differential stud bolt has been inserted into rear crossmember bushing, raise transmission jack to make jack rear differential level.



9) Temporarily tighten rear crossmember self-locking nuts.



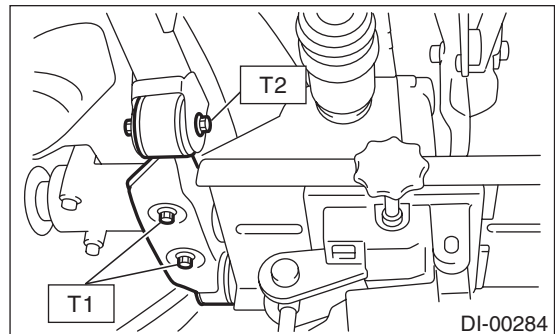
10) Remove band from rear differential. Raise rear differential just enough to move transmission jack away from it.

11) Install rear differential front member.

Tightening torque:

T1: 65 N·m (6.6 kgf-m, 48 ft-lb)

T2: 110 N·m (11.2 kgf-m, 81 ft-lb)



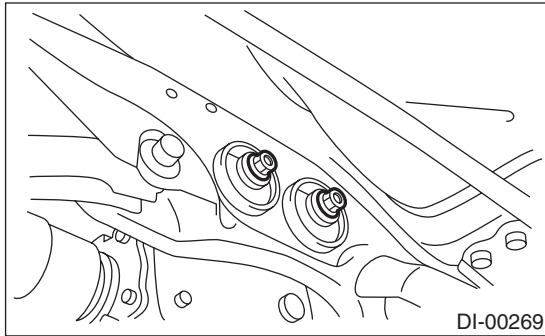
REAR DIFFERENTIAL FOR T-TYPE

DIFFERENTIALS

12) Tighten self-locking nuts.

Tightening torque:

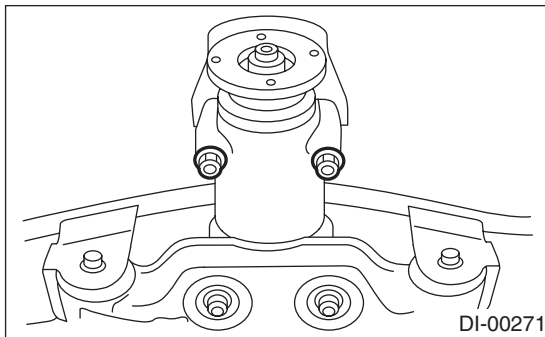
70 N·m (7.1 kgf-m, 51 ft-lb)



13) Tighten protector nut.

Tightening torque:

65 N·m (6.6 kgf-m, 48.0 ft-lb)



14) Take down transmission jack.

15) Install propeller shaft.

<Ref. to DS-16, INSTALLATION, Propeller Shaft.>

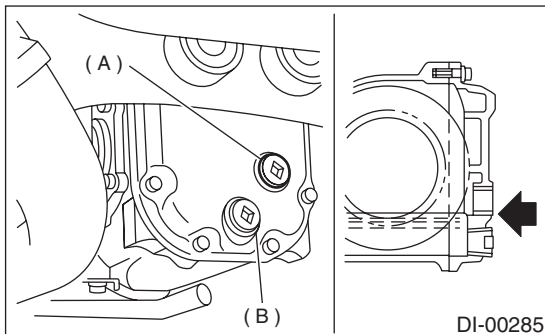
16) Install heat shield cover.

17) Install rear exhaust pipe and muffler.

18) After installing rear differential carrier on vehicle, remove filler plug and replenish gear oil up to upper level mark.

Oil capacity:

0.8 ① (0.8 US qt, 0.7 Imp qt)



- (A) Filler plug
(B) Drain plug

19) Tighten filler plug.

NOTE:

Apply fluid gasket to plug.

Fluid gasket:

THREE BOND 1105 (Part No. 04403010) or equivalent

Tightening torque:

49.0 N·m (5.0 kgf-m, 36.2 ft-lb)

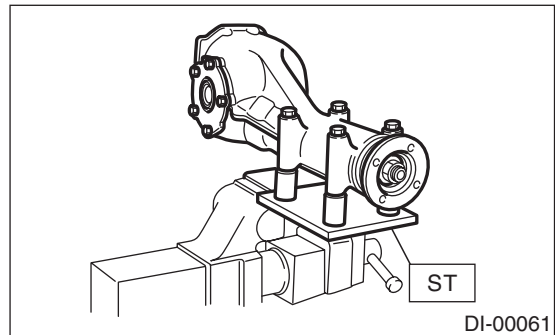
C: DISASSEMBLY

To detect real cause of trouble, inspect the following items before disassembling.

- Tooth contact of crown gear and pinion, and backlash
- Runout of crown gear at its back surface
- Turning resistance of drive pinion

1) Set ST on vise and install the differential assembly to ST.

ST 398217700 ATTACHMENT

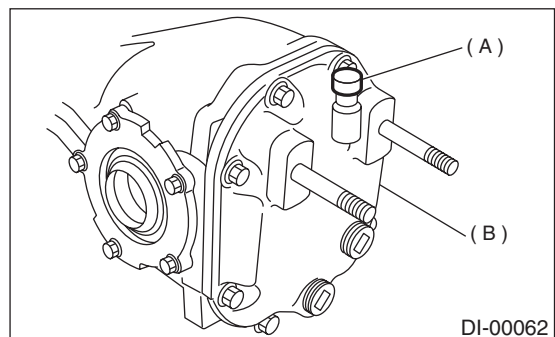


2) Drain gear oil by removing plug.

3) Remove the air breather cap.

NOTE:

- Do not attempt to remove the air breather cap unless necessary.
- When the air breather cap is removed, replace it with a new one.

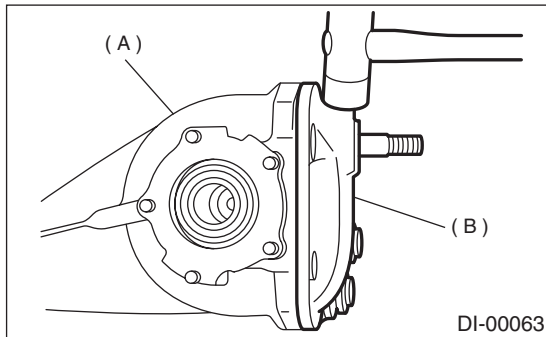


- (A) Air breather cap
(B) Rear cover

4) Remove rear cover by loosening bolts.

NOTE:

Remove rear cover while tapping it lightly with plastic hammer, if it is hard to remove.



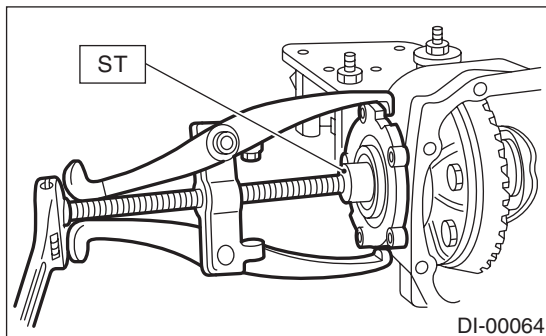
(A) Rear cover
(B) Differential carrier

5) Make right and left side bearing retainers in order to identify them at reassembly. Remove side bearing retainer attaching bolts, set ST to differential case, and extract right and left side bearing retainers with a puller.

NOTE:

Each shim, which is installed to adjust the side bearing preload, should be kept together with its mating retainer.

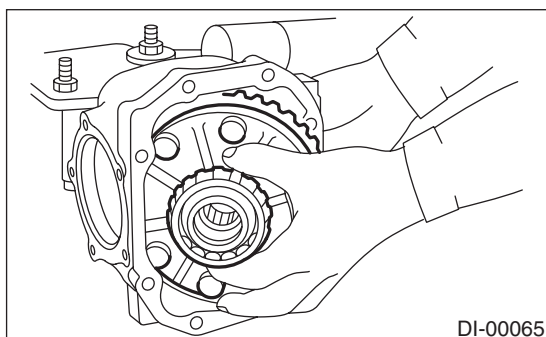
ST 398457700 ATTACHMENT



6) Pull out differential case assembly from differential carrier.

CAUTION:

Be careful not to hit the teeth against the case.

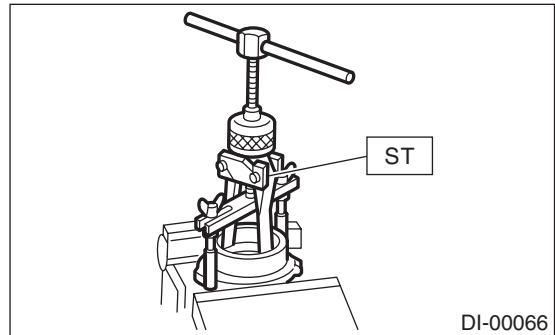


7) Remove O-ring from side bearing retainer.

8) Remove oil seal from side bearing retainer.

9) Remove bearing cup from side bearing retainer using ST.

ST 398527700 PULLER ASSY

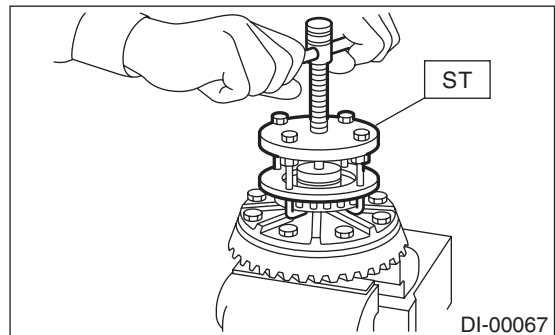


10) Extract bearing cone with ST.

NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Set puller so that its claws catch the edge of the bearing cone.
- Never mix up the right and left hand bearing races and cones.

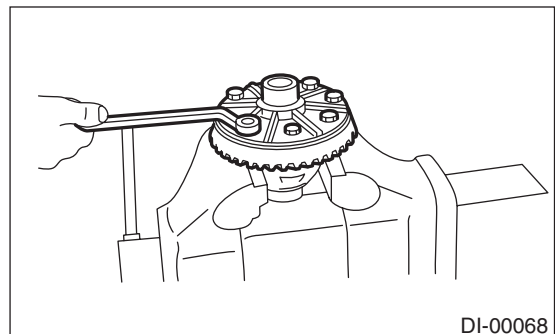
ST 399527700 PULLER SET



11) Remove crown gear by loosening crown gear bolts.

NOTE:

Further disassembling is not allowed.

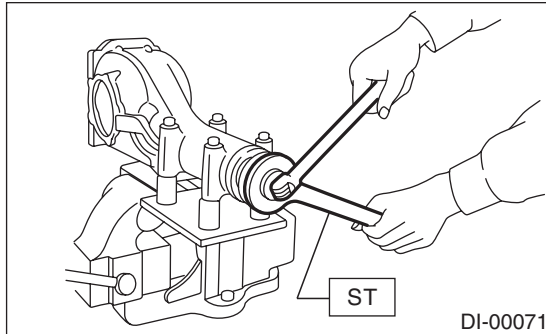


REAR DIFFERENTIAL FOR T-TYPE

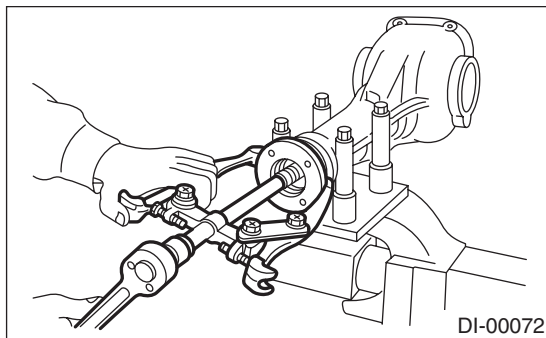
DIFFERENTIALS

12) Hold companion flange with ST and remove drive pinion nut.

ST 498427200 FLANGE WRENCH



13) Extract the companion flange with a puller.

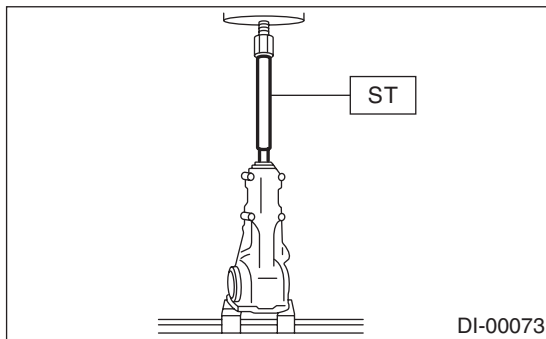


14) Press the end of drive pinion shaft and extract it together with rear bearing cone, preload adjusting spacer and washer.

NOTE:

Hold the drive pinion so as not to drop it.

ST 398467700 DRIFT

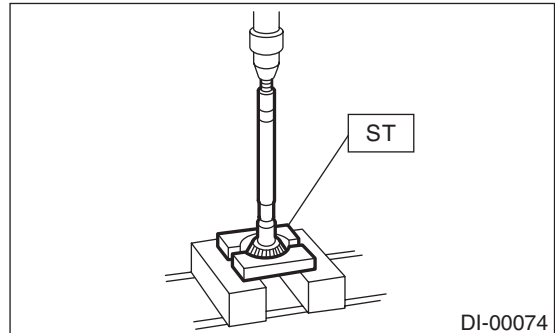


15) Remove rear bearing cone from drive pinion by supporting cone with ST.

NOTE:

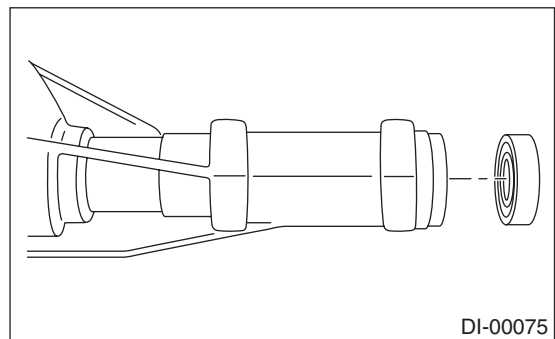
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



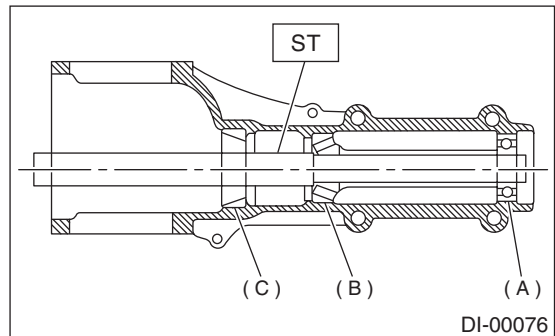
16) Remove front oil seal from differential carrier using ST.

ST 398527700 PULLER ASSY



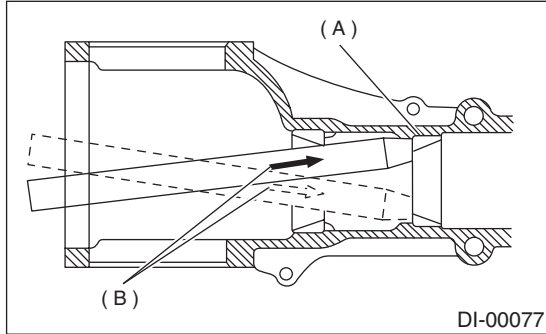
17) Remove pilot bearing together with front bearing cone using ST.

ST 398467700 DRIFT



- (A) Pinion bearing
- (B) Front bearing
- (C) Rear bearing cup

18) When replacing bearings, tap front bearing cup and rear bearing cup in this order out of case by using a brass bar.

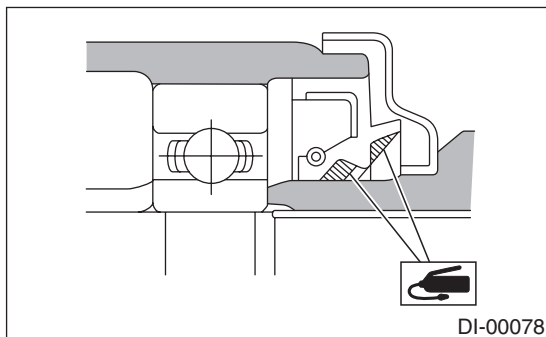


- (A) 2 cutouts along diagonal lines
(B) Tap alternately with brass bar.

D: ASSEMBLY

NOTE:

- Assemble in the reverse order of disassembling.
- Check and adjust each part during assembly.
- Keep the shims and washers in order, so that they are not misinstalled.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the right and left hand races of the bearings.
- Replace the oil seal with new one at every disassembly. Apply chassis grease between the lips when installing the oil seal.



- Use new O-ring and gasket.

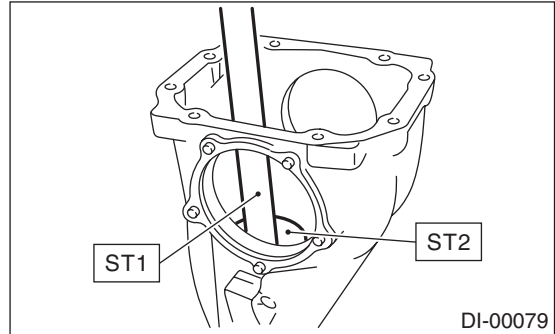
1) Adjusting preload for front and rear bearings

- Adjust the bearing preload with spacer and washer between front and rear bearings.
- Pinion height adjusting washer are not affected by this adjustment.
- The adjustment must be carried out without oil seal inserted.

(1) Press rear bearing race rear into differential carrier with ST1 and ST2.

ST1 398477701 HANDLE

ST2 398477703 DRIFT 2



(2) Install rear bearing race (front) in differential carrier using ST1 and ST2.

ST1 398477701 HANDLE

ST2 398477702 DRIFT

(3) Measure and record the thickness of pinion height adjusting washer.

NOTE:

The used washer can be used after checking that it is not deformed when the tooth contact of drive gear and driven gear is correct during pre-disassembly.

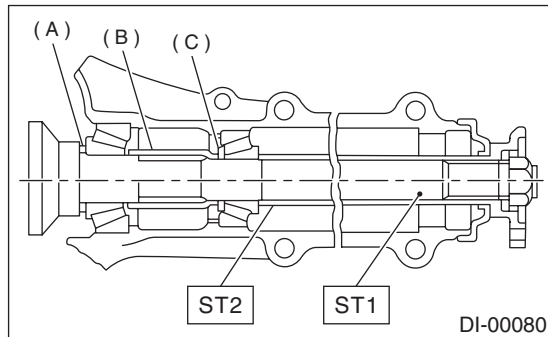
(4) Insert ST1 into carrier with pinion height adjusting washer and new rear bearing cone fitted onto it.

REAR DIFFERENTIAL FOR T-TYPE

DIFFERENTIALS

(5) Then install preload adjusting spacer and washer, front bearing cone, ST2, companion flange, and washer and drive pinion nut.

ST1 398507702 DUMMY SHAFT
ST2 398507703 DUMMY COLLAR



- (A) Pinion height adjusting shim
- (B) Preload adjusting spacer
- (C) Preload adjusting washer

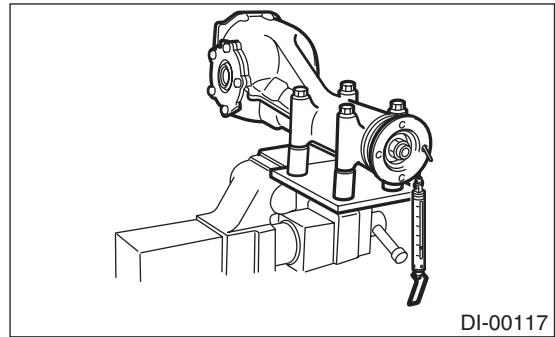
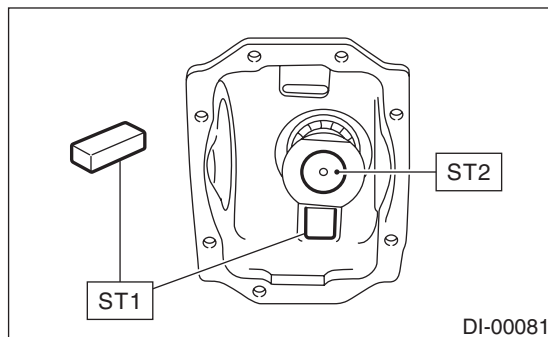
(6) Turn ST1 with hand to make it seated, and tighten drive pinion nut while measuring the preload with spring balance. Select preload adjusting washer and spacer so that the specified preload is obtained when nut is tightened to the specified torque.

NOTE:

- Use a new lock nut.
- Be careful not to give excessive preload.
- When tightening the drive pinion nut, lock ST2 with ST1 as shown in the figure.

ST1 398507704 BLOCK
ST2 398507702 DUMMY SHAFT

Tightening torque:
181.5 N·m (19 kgf·m, 134 ft-lb)



Preload adjusting washer	Part No.	Thickness mm (in)
	383705200	2.59 (0.1020)
	383715200	2.57 (0.1012)
	383725200	2.55 (0.1004)
	383735200	2.53 (0.0996)
	383745200	2.51 (0.0988)
	383755200	2.49 (0.0980)
	383765200	2.47 (0.0972)
	383775200	2.45 (0.0965)
	383785200	2.43 (0.0957)
	383795200	2.41 (0.0949)
	383805200	2.39 (0.0941)
	383815200	2.37 (0.0933)
	383825200	2.35 (0.0925)
Preload adjusting spacer	Part No.	Length mm (in)
	383695201	56.2 (2.213)
	383695202	56.4 (2.220)
	383695203	56.6 (2.228)
	383695204	56.8 (2.236)
	383695205	57.0 (2.244)
	383695206	57.2 (2.252)

Front and rear bearing preload

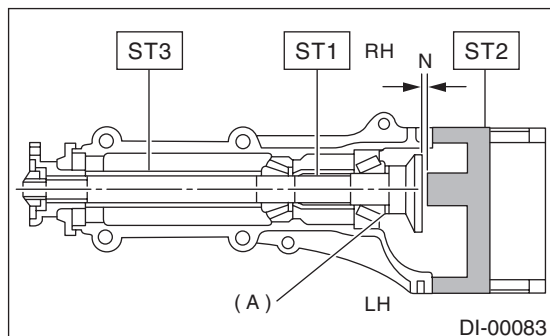
For new bearing:
18.1 — 38.8 N (1.8 — 4.0 kgf, 4.1 — 8.71 lb)
at companion flange bolt hole

2) Adjusting drive pinion height

Adjust drive pinion height with shim installed between rear bearing cone and the back of pinion gear.

(1) Set ST2.

ST1 398507702 DUMMY SHAFT
ST2 398507701 DIFFERENTIAL CARRIER GAUGE
ST3 398507703 DUMMY COLLAR



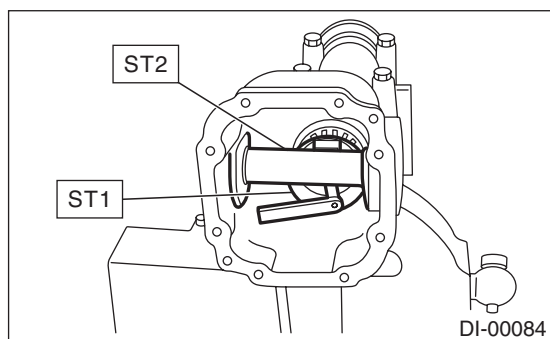
(A) Pinion height adjusting shim

(2) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the case and ST2.

ST1 398507702 DUMMY SHAFT
ST2 398507701 DIFFERENTIAL CARRIER GAUGE



(3) Obtain the thickness of pinion height adjusting shim to be inserted from the following formula, and replace the temporarily installed shim with this one.

$$T = T_o + N - (H \times 0.01) - 0.20 \text{ mm (0.0079 in)}$$

NOTE:

Use copies of this page.

T	Thickness of pinion height adjusting shim mm (in)	
T _o	Thickness of shim temporarily inserted mm (in)	
N	Reading of thickness gauge mm (in)	
H	Figure marked on drive pinion head	
Memo:		

(Example of calculation)

$$T_o = 2.20 + 1.20 = 3.40 \text{ mm}$$

$$N = 0.23 \text{ mm}$$

$$H = + 1$$

$$T = 3.40 + 0.23 - 0.01 - 0.20 = 3.42$$

$$\text{Result: Thickness} = 3.42 \text{ mm}$$

Therefore use the shim 383605200.

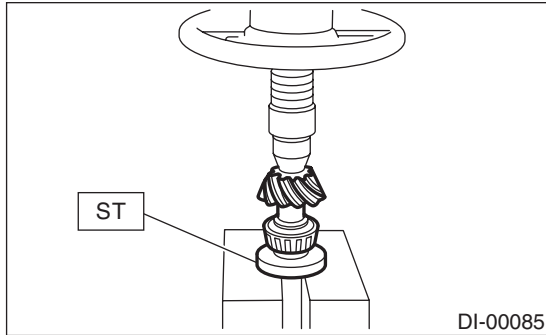
Pinion height adjusting shim	
Part No.	Thickness mm (in)
383495200	3.09 (0.1217)
383505200	3.12 (0.1228)
383515200	3.15 (0.1240)
383525200	3.18 (0.1252)
383535200	3.21 (0.1264)
383545200	3.24 (0.1276)
383555200	3.27 (0.1287)
383565200	3.30 (0.1299)
383575200	3.33 (0.1311)
383585200	3.36 (0.1323)
383595200	3.39 (0.1335)
383605200	3.42 (0.1346)
383615200	3.45 (0.1358)
383625200	3.48 (0.1370)
383635200	3.51 (0.1382)
383645200	3.54 (0.1394)
383655200	3.57 (0.1406)
383665200	3.60 (0.1417)
383675200	3.63 (0.1429)
383685200	3.66 (0.1441)

REAR DIFFERENTIAL FOR T-TYPE

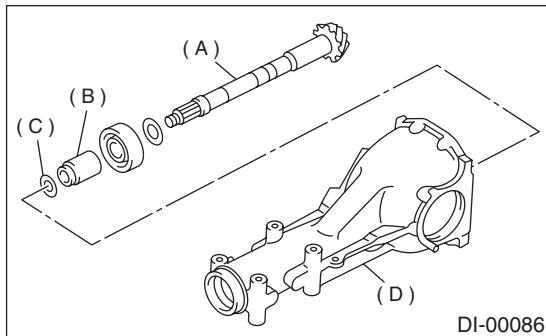
DIFFERENTIALS

3) Install the selected pinion height adjusting shim on drive pinion, and press the rear bearing cone into position with ST.

ST 398177700 INSTALLER



4) Insert drive pinion into differential carrier, install the previously selected bearing preload adjusting spacer and washer.



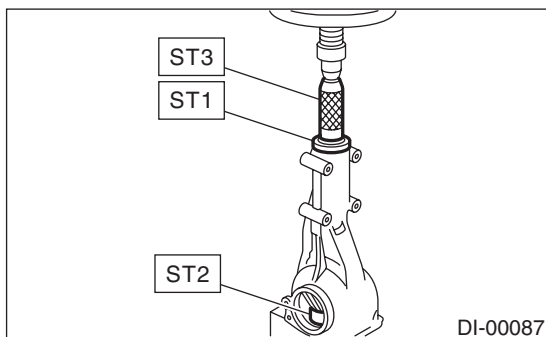
- (A) Drive pinion
- (B) Bearing adjusting spacer
- (C) Bearing adjusting washer
- (D) Differential carrier

5) Press-fit front bearing cone into case with ST1, ST2 and ST3.

ST1 398507703 DUMMY COLLAR

ST2 399780104 WEIGHT

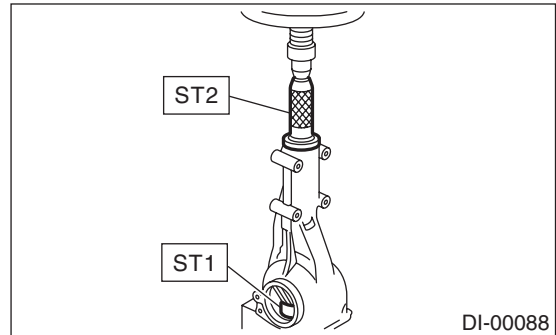
ST3 899580100 INSTALLER



6) Insert spacer, then press-fit pilot bearing with ST1 and ST2.

ST1 399780104 WEIGHT

ST2 899580100 INSTALLER

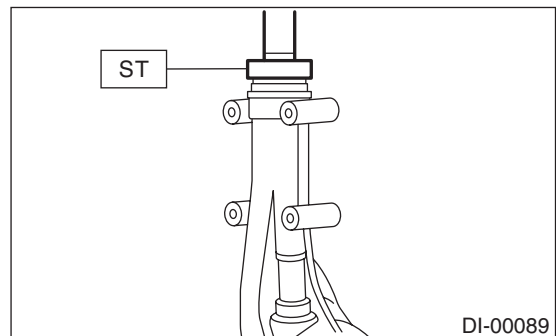


7) Fit a new oil seal with ST.

NOTE:

- Press-fit until end of oil seal is 1 mm (0.04 in) inward from end of carrier.
- Apply grease between the oil seal lips.

ST 498447120 OIL SEAL INSTALLER



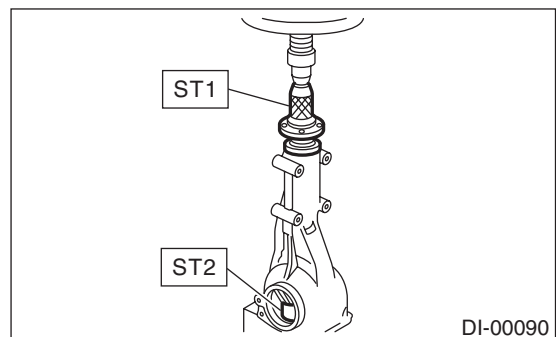
8) Press-fit companion flange with ST1 and ST2.

NOTE:

Be careful not to damage bearing.

ST1 899874100 INSTALLER

ST2 399780104 WEIGHT



9) Apply Lock Tite to the thread of drive pinion shaft and the seats of new self-locking nuts.

Lock Tite:

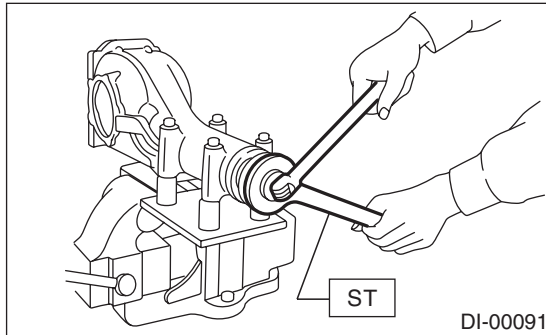
THREE BOND 1324 (Part No. 004403042)

10) Install new self-locking nut. Then fix and tighten companion flange with ST.

ST 498427200 FLANGE WRENCH

Tightening torque:

181.5 N·m (19 kgf-m, 134 ft-lb)



11) Install crown gear on differential case.

NOTE:

- Before installing bolts, apply Lock Tite to bolt threads.

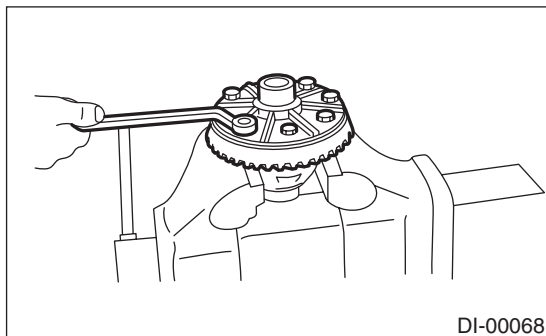
Lock Tite:

THREE BOND 1324 (Part No. 004403042) or equivalent

- Tighten diagonally while tapping the bolt heads.

Tightening torque:

103 N·m (11 kgf-m, 76 ft-lb)

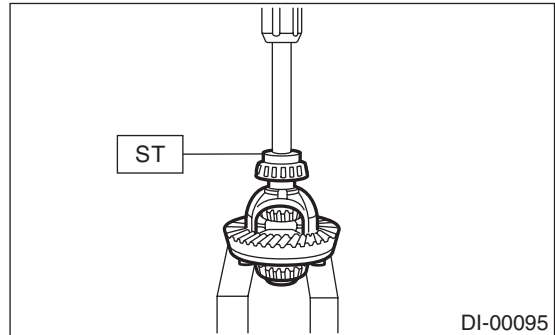


12) Press side bearing onto differential case with ST.

ST 398237700 DRIFT

NOTE:

When replacing bearing cone, replace it with roller bearing as a set.



13) Install bearing lace to side bearing retainer.

NOTE:

- Press in while be careful not to scratch bearing lace and side bearing retainer.
- When replacing bearing lace, replace it with roller bearing as a set.

14) Using ST, press in new oil seal to side bearing retainer.

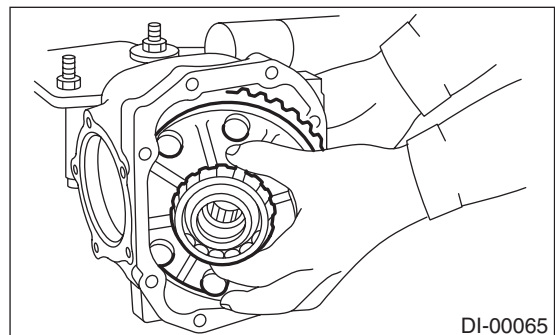
ST 398437700 DRIFT

NOTE:

Apply thin oil gear oil on the mating surface of side bearing retainer and oil seal.

15) Adjusting side bearing retainer shims

- (1) The driven gear backlash and side bearing preload can be determined by the side bearing retainer shim thickness.
- (2) Install the differential case assembly into differential carrier in the reverse order of disassembly.



REAR DIFFERENTIAL FOR T-TYPE

DIFFERENTIALS

- (3) Install side retainer shims to the left and right retainers from which they were removed.

NOTE:

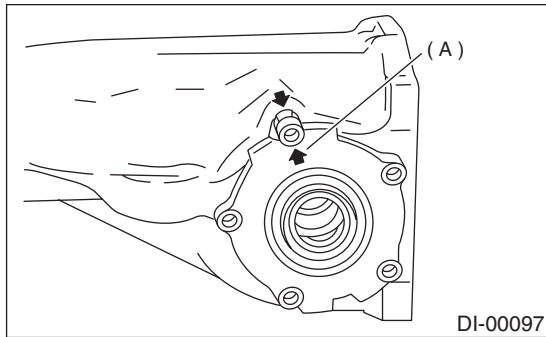
Replace broken or corroded side retainer shim with new one of same thickness.

Side bearing retainer shim	
Part No.	Thickness mm (in)
383475201	0.20 (0.0079)
383475202	0.25 (0.0098)
383475203	0.30 (0.0118)
383475204	0.40 (0.0157)
383475205	0.50 (0.0197)

- (4) Align arrow marked on differential carrier with that marked on side retainer during installation.

NOTE:

Be careful that side bearing outer race is not damaged by bearing roller.

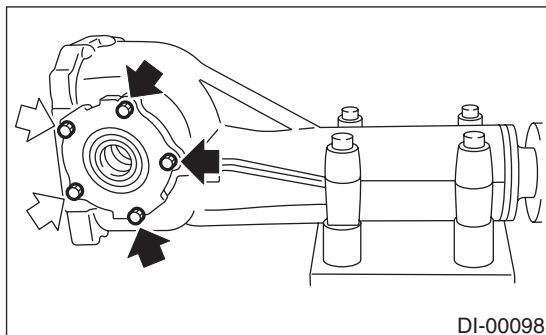


(A) Arrow mark

- (5) Tighten side bearing retainer bolts.

Tightening torque:

10.5 N·m (1.1 kgf-m, 8.0 ft-lb)



- (6) Measure the crown gear-to-drive pinion backlash. Set magnet base on differential carrier. Align contact point of dial gauge with tooth face of crown gear, and move crown gear while holding drive pinion still. Read value indicated on dial gauge.

If the measured backlash is not within the specified range, adjust side bearing retainer shims as follows:

Backlash is over 0.2 mm (0.008 in):

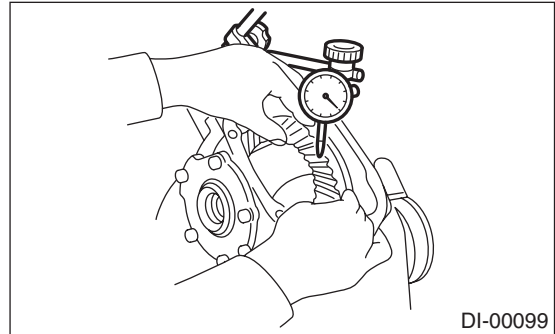
Reduce the shim thickness of crown gear back-side and increase crown gear tooth-side.

Backlash is less than 0.1 mm (0.004 in):

Increase the shim thickness of crown gear back-side and reduce crown gear tooth-side.

Backlash:

0.10 — 0.20 mm (0.0039 — 0.0079 in)



- (7) At the same time, measure the turning resistance of drive pinion. Compare with the resistance when differential case is not installed, if the increase of the resistance is not within the specified range, adjust thickness of side bearing retainer shims so that the back- and tooth-sides are the same thickness.

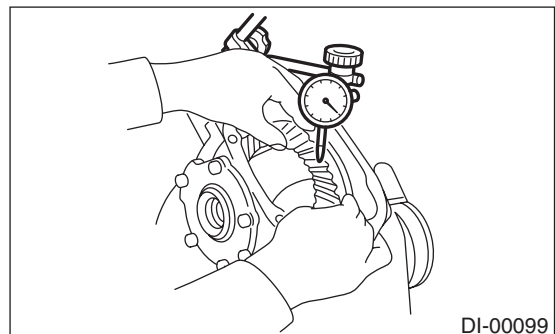
Turning resistance increase:

20.7 — 54.4 N (2.1 — 5.5 kgf, 4.7 — 12.2 lb)

- 16) Re-check crown gear-to-pinion backlash.

Backlash:

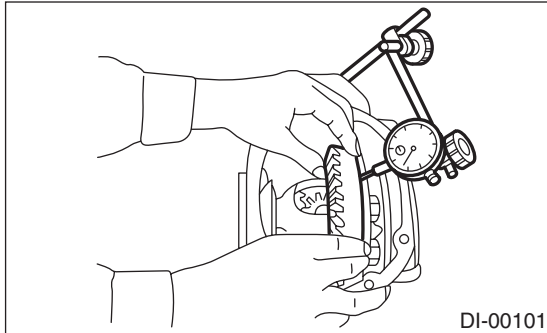
0.10 — 0.20 mm (0.0039 — 0.0079 in)



17) Check the crown gear runout on its back surface, and make sure pinion and crown gear rotate smoothly.

Limit of runout:

Less than 0.05 mm (0.0020 in)



18) Checking and adjusting tooth contact of crown gear

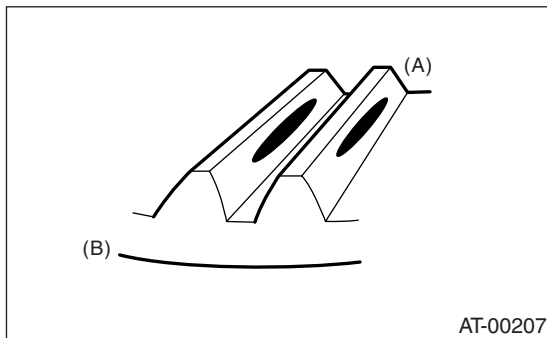
- (1) Apply an even coat of red lead on both sides of three or four teeth on the crown gear. Check the contact pattern after rotating crown gear several revolutions back and forth until a definite contact pattern appears on the crown gear.
- (2) When the contact pattern is incorrect, readjust according to the instructions given in "TOOTH CONTACT PATTERN".

NOTE:

Be sure to wipe off red lead completely after adjustment is completed.

- Correct tooth contact

Checking item: Tooth contact pattern is slightly shifted toward to toe side under no-load rotation. (When loaded, contact pattern moves toward heel)

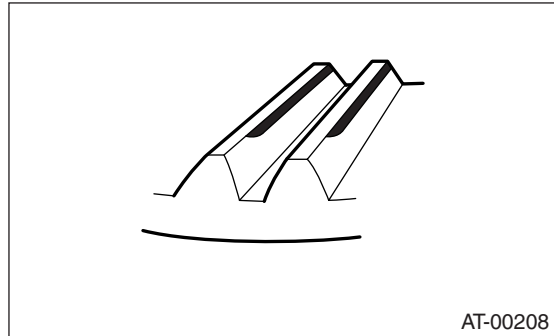


- (A) Toe side
(B) Heel side

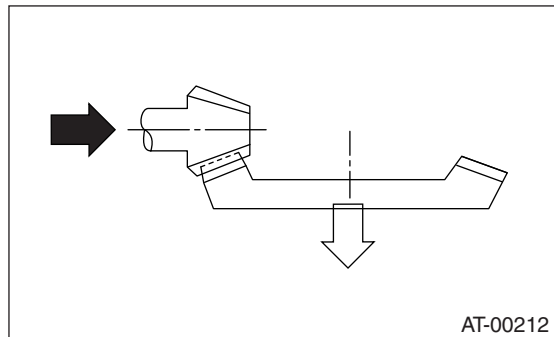
- Face contact

Checking item: Backlash is too large.

Contact pattern



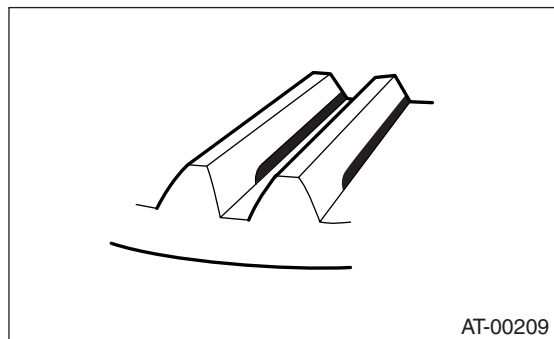
Corrective action: Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to crown gear.



- Flank contact

Checking item: Backlash is too small.

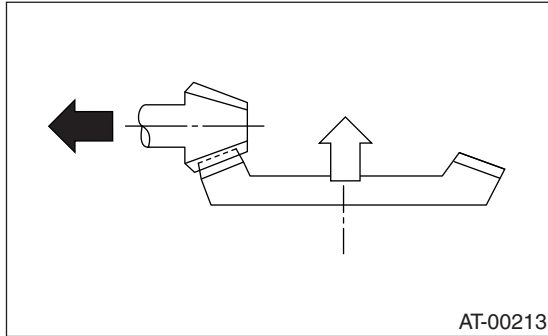
Contact pattern



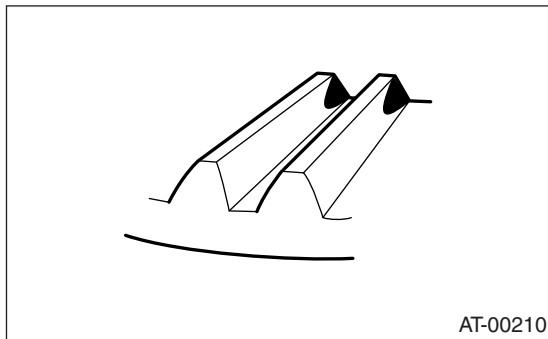
REAR DIFFERENTIAL FOR T-TYPE

DIFFERENTIALS

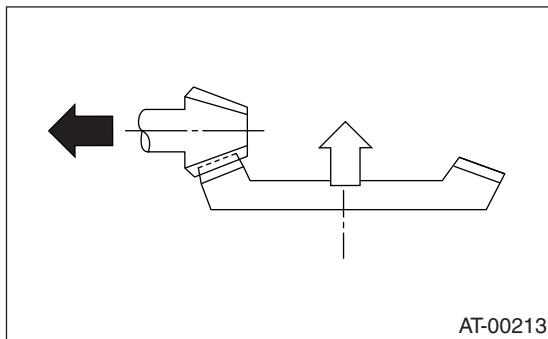
Corrective action: Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.



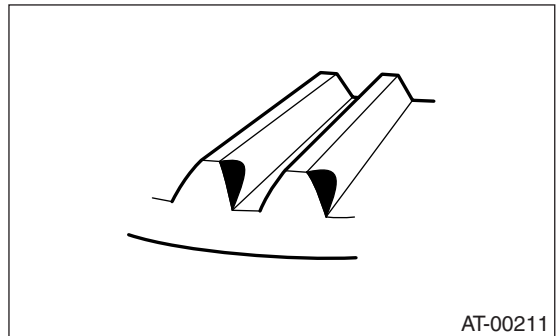
• Toe contact (Inside end contact)
Checking item: Contact area is small.
Contact pattern



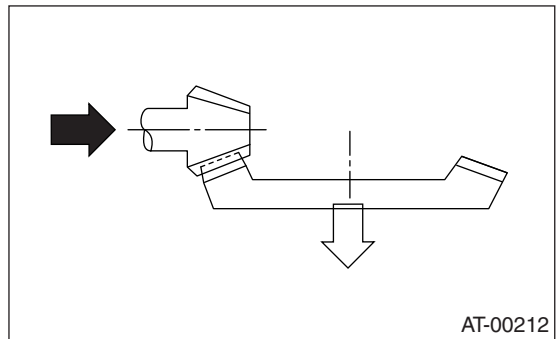
Corrective action: Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.



• Heel contact (Outside end contact)
Checking item: Contact area is small.
Contact pattern



Corrective action: Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to crown gear.

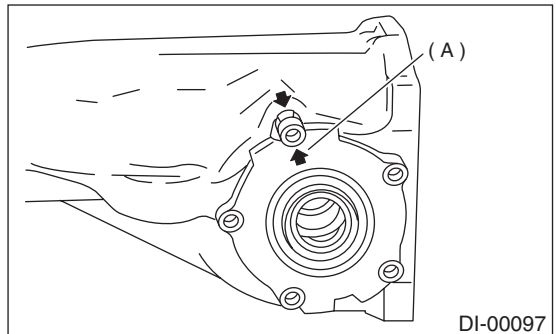


19) If proper tooth contact is not obtained, once again adjust the drive pinion height changing RH and LH side bearing retainer shims and the hypoid gear backlash.

20) Remove left and right side retainer.

21) Install left and right side bearing retainer, new O-rings and side retainer shims.

22) Align the arrow mark on differential carrier with the mark on side retainer during installation.



(A) Arrow mark

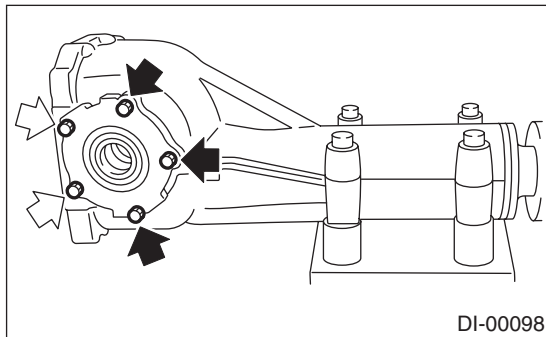
23) Tighten the side bearing retainer bolts.

Lock Tite:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

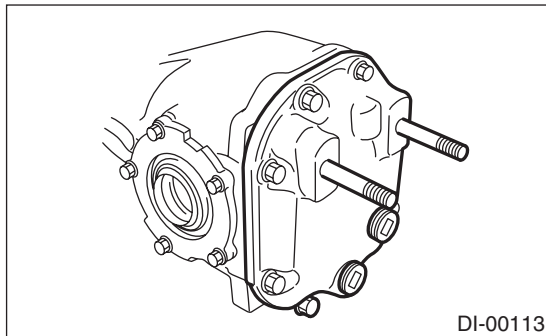
10.3 N·m (1.05 kgf-m, 7.6 ft-lb)



24) Install new gasket and rear cover, and tighten bolts to specified torque.

Tightening torque:

29 N·m (3.0 kgf-m, 21.7 ft-lb)



E: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage, or other defects. Repair or replace defective parts as necessary.

1) Crown gear and drive pinion

- If abnormal tooth contact is evident, find out the cause and adjust to give correct tooth contact at assembly. Replace the gear if excessively worn or incapable of adjustment.
- If crack, score, or seizure is evident, replace as a set. Slight damage of tooth can be corrected by oil stone or the like.

2) Side gear and pinion mate gear

- Replace if crack, score, or other defects are evident on tooth surface.
- Replace if thrust washer contacting surface is worn or seized. Slight damage of the surface can be corrected by oil stone or the like.

3) Bearing

Replace if seizure, peeling, wear, rust, dragging during rotation, abnormal noise or other defect is evident.

4) Thrust washers of side gear and pinion mate gear

Replace if seizure, flaw, abnormal wear or other defect is evident.

5) Oil seal

Replace if deformed or damaged, and at every disassembling.

6) Differential carrier

Replace if the bearing bores are worn or damaged.

7) Differential case

Replace if its sliding surfaces are worn or cracked.

8) Companion flange

Replace if the oil seal lip contacting surfaces have flaws.

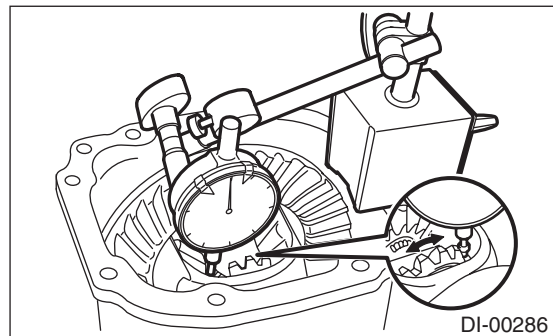
1. SIDE GEAR BACKLASH

Using a dial gauge, check the backlash of the side gear.

Side gear backlash:

0.1 — 0.2 mm (0.004 — 0.008 in)

If side gear backlash is not within the specification, adjust clearance as specified by selecting side gear thrust washer.



REAR DIFFERENTIAL FOR T-TYPE

DIFFERENTIALS

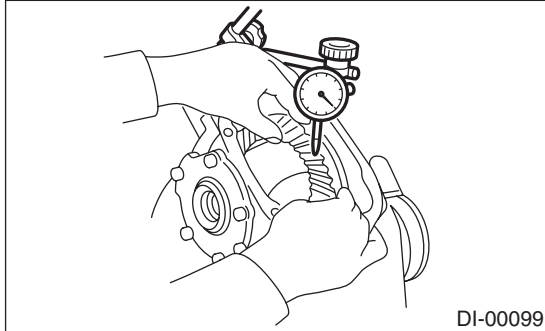
2. CROWN GEAR BACKLASH

Using a dial gauge, check the backlash of the crown gear.

Crown gear backlash:

0.1 — 0.2 mm (0.004 — 0.008 in)

If crown gear backlash is not within the specification, adjust the side bearing preload or repair if necessary.



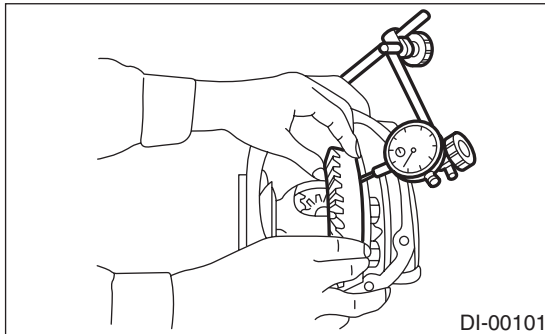
3. CROWN GEAR RUNOUT

Using a dial gauge, check the crown gear runout.

Crown gear runout:

Less than 0.05 mm (0.0020 in)

If the crown gear runout exceeds 0.05 mm (0.0020 in), replace the crown gear.



4. TOOTH CONTACT BETWEEN CROWN GEAR AND DRIVE PINION

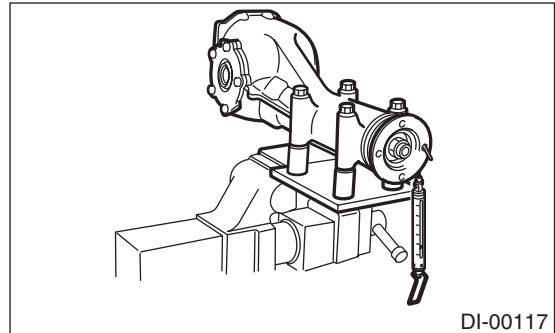
Inspect tooth contact between crown gear and driven pinion. <Ref. to DI-29, ASSEMBLY, Rear Differential for T-type.>

5. TOTAL PRELOAD

Measure the starting torque or starting preload.

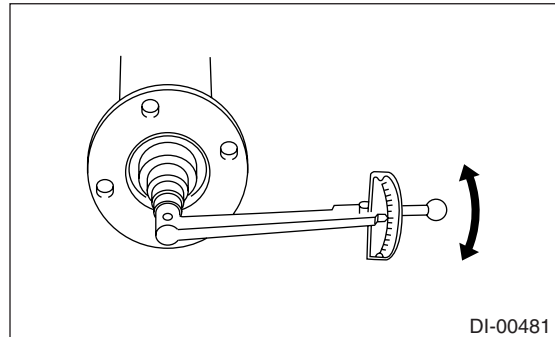
Starting preload:

20.7 — 54.4 N (2.1 — 5.5 kgf, 4.7 — 12.2 lb)



Starting torque:

0.67 — 1.47 N·m (0.07 — 0.15 kgf·m, 0.49 — 1.08 ft·lb)



F: ADJUSTMENT

1. SIDE GEAR BACKLASH

Adjust side gear backlash.

<Ref. to DI-29, ASSEMBLY, Rear Differential for T-type.>

2. CROWN GEAR BACKLASH

Adjust crown gear backlash.

<Ref. to DI-29, ASSEMBLY, Rear Differential for T-type.>

3. TOOTH CONTACT BETWEEN CROWN GEAR AND DRIVE PINION

Adjust the tooth contact between crown gear and drive pinion gear.

<Ref. to DI-29, ASSEMBLY, Rear Differential for T-type.>

4. TOTAL PRELOAD

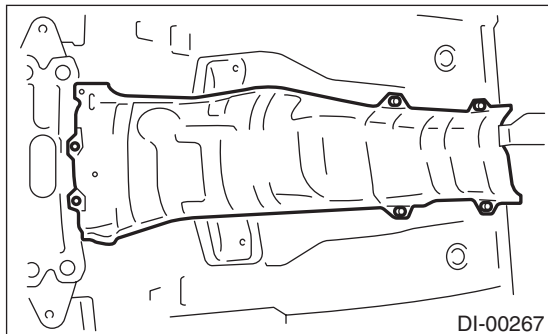
Adjust side bearing shim.

<Ref. to DI-29, ASSEMBLY, Rear Differential for T-type.>

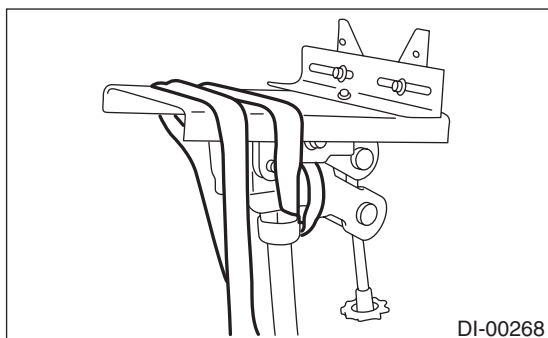
5. Rear Differential for VA-type

A: REMOVAL

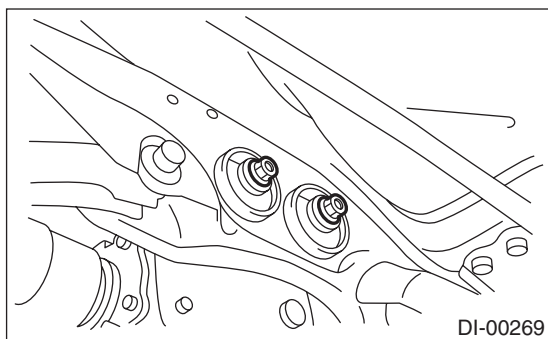
- 1) Disconnect ground cable from battery.
- 2) Move select lever or gear shift lever to "N".
- 3) Release the parking brake.
- 4) Jack-up vehicle and support it with sturdy racks.
- 5) Remove rear exhaust pipe and muffler.
- 6) Remove heat shield cover.



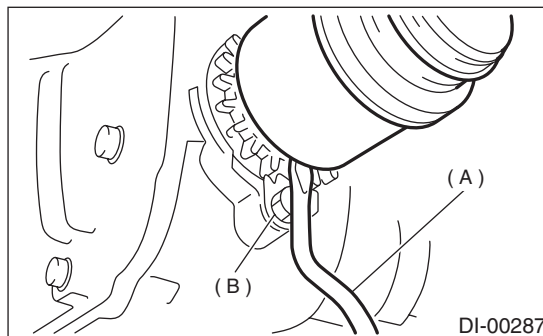
- 7) Remove propeller shaft.
<Ref. to DS-15, REMOVAL, Propeller Shaft.>
- 8) Prepare a transmission jack and a band.



- 9) Loosen self-locking nuts connecting rear differential to rear crossmember.

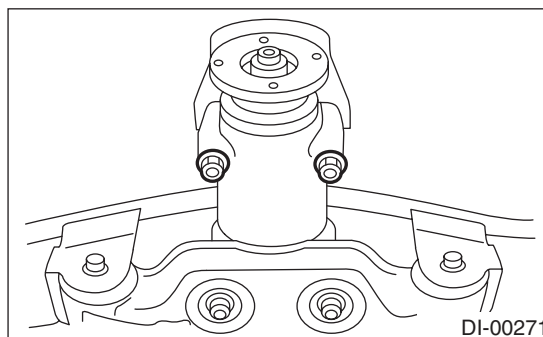


- 10) Remove DOJ of rear drive shaft from rear differential.

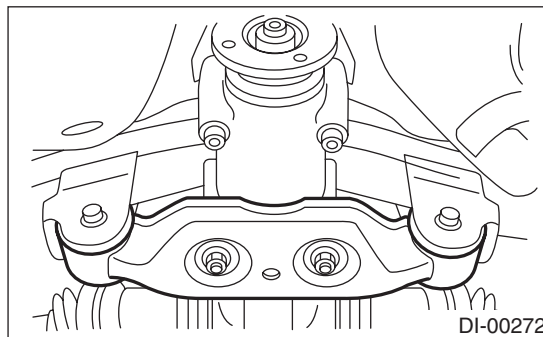


- (A) Tire lever
(B) Bolt

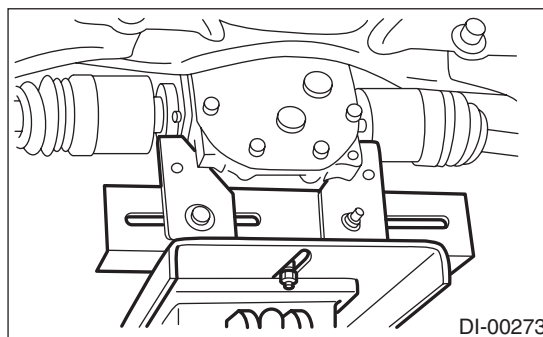
- 11) Remove protector nuts.



- 12) Remove nuts which secure rear differential front member.



- 13) Support rear differential with transmission jack.



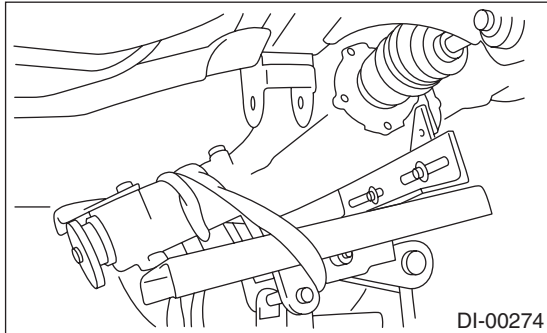
REAR DIFFERENTIAL FOR VA-TYPE

DIFFERENTIALS

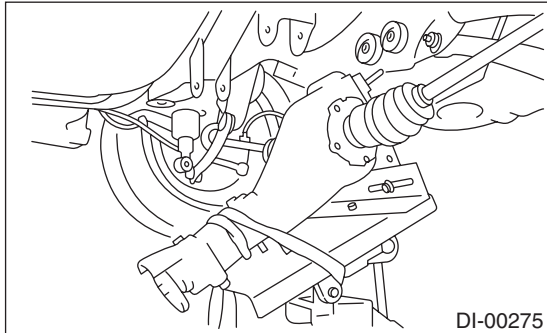
- 14) Remove rear differential front member.
- 15) Fix rear differential at band.
- 16) Remove self-locking nuts connecting rear differential to rear crossmember.
- 17) Remove rear differential stud bolt from rear crossmember bushing.

NOTE:

Carefully adjust angle and position of transmission jack and jack stand as required during stud bolt removal.



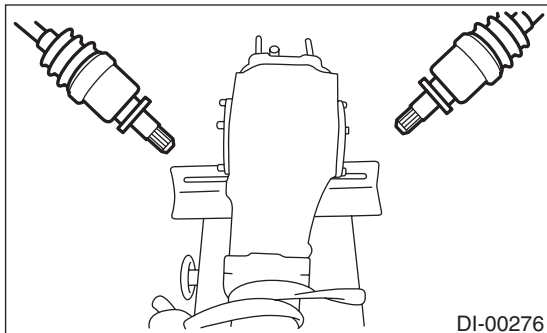
- 18) After removing rear differential stud bolt from rear crossmember, lower transmission jack stand. Do not allow rear drive shaft to strike lateral link bolt.



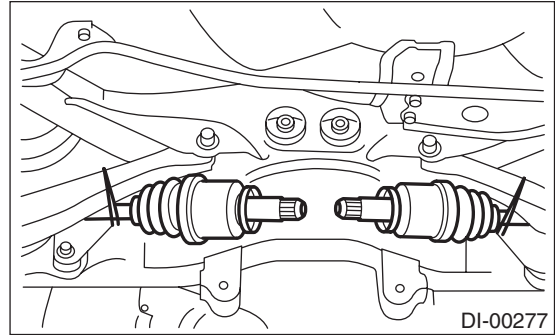
- 19) Pull out axle shaft from rear differential.

NOTE:

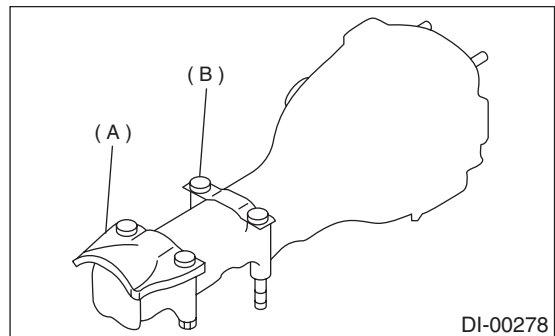
If axle shaft is difficult to remove from rear differential, use a tire lever to remove it.



- 20) Take down transmission jack.
- 21) Secure rear drive shaft to lateral link using wire.



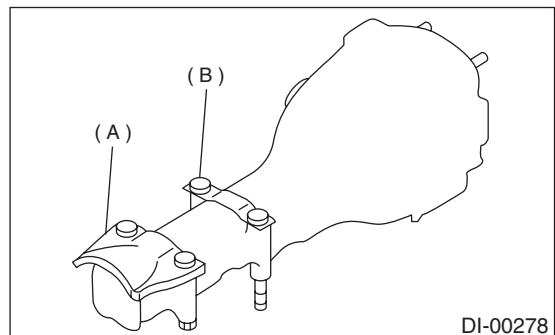
- 22) Remove protector and rear differential member plate from rear differential.



- (A) Protector
- (B) Rear differential member plate

B: INSTALLATION

- 1) Insert protector and plate to rear differential.



- (A) Protector
- (B) Rear differential member plate

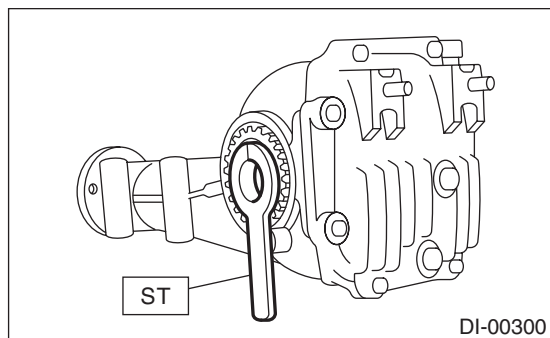
- 2) Set rear differential to transmission jack.

NOTE:

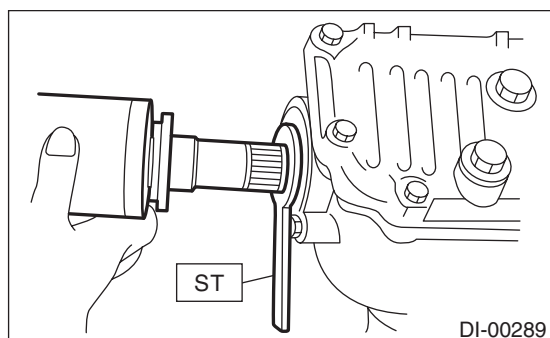
Secure rear differential to transmission jack using a band.

3) Install ST to rear differential.

ST 28099PA090 OIL SEAL PROTECTOR



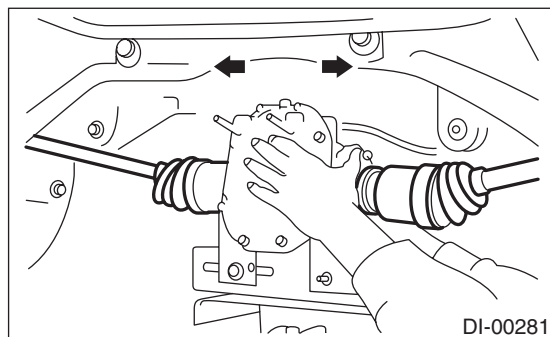
4) Insert the spline shaft until the spline portion is inside the side oil seal.



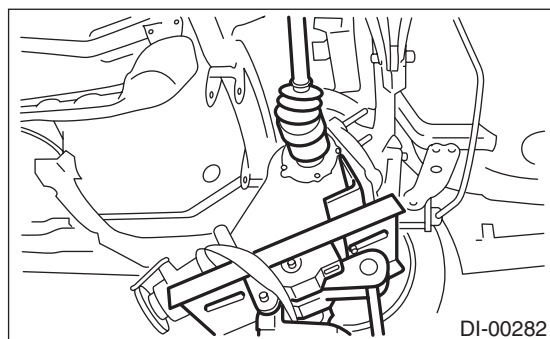
5) Remove ST from rear differential.

ST 28099PA090 OIL SEAL PROTECTOR

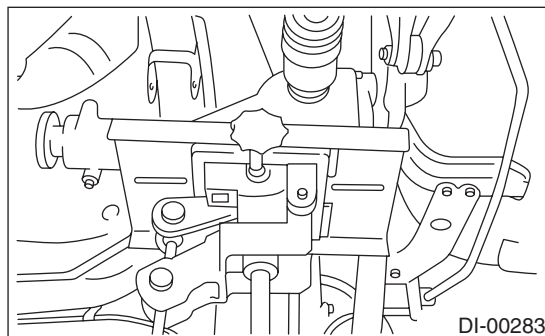
6) Completely insert axle shaft into rear differential by pressing rear differential.



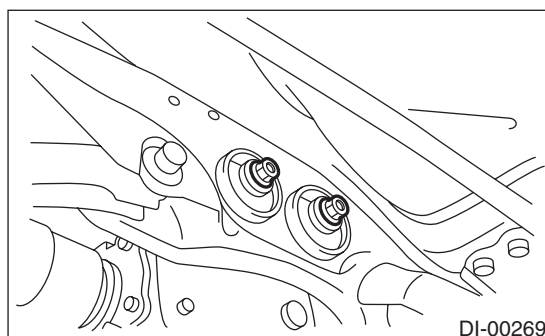
7) Adjust transmission jack as required so rear differential stud bolt is properly inserted into rear crossmember bushing.



8) After rear differential stud bolt has been inserted into rear crossmember bushing, raise transmission jack to make jack rear differential level.



9) Temporarily tighten rear crossmember self-locking nuts.



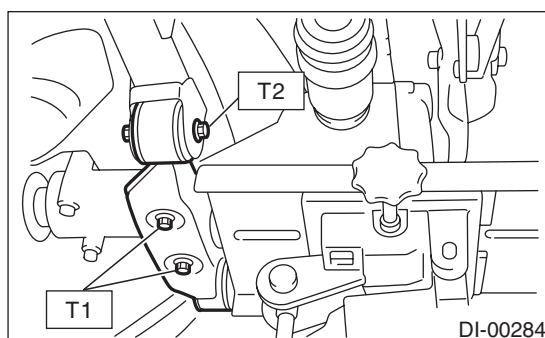
10) Remove band from rear differential. Raise rear differential just enough to move transmission jack away from it.

11) Install rear differential front member.

Tightening torque:

T1: 65 N·m (6.6 kgf-m, 48 ft-lb)

T2: 110 N·m (11.2 kgf-m, 81 ft-lb)



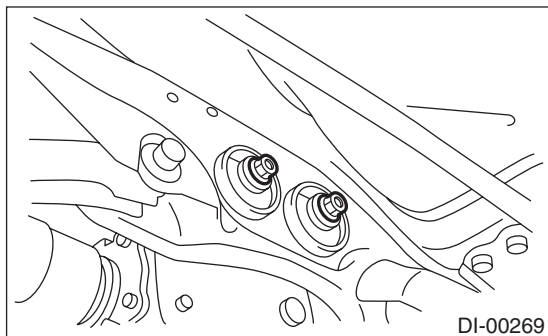
REAR DIFFERENTIAL FOR VA-TYPE

DIFFERENTIALS

12) Tighten self-locking nuts.

Tightening torque:

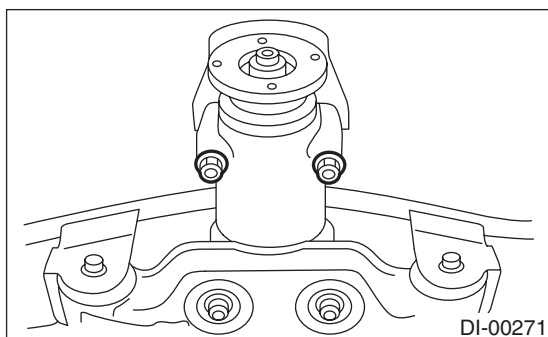
70 N·m (7.1 kgf-m, 51 ft-lb)



13) Tighten protector nut.

Tightening torque:

65 N·m (6.6 kgf-m, 48.0 ft-lb)



14) Take down transmission jack.

15) Install propeller shaft.

<Ref. to DS-16, INSTALLATION, Propeller Shaft.>

16) Install heat shield cover.

17) Install rear exhaust pipe and muffler.

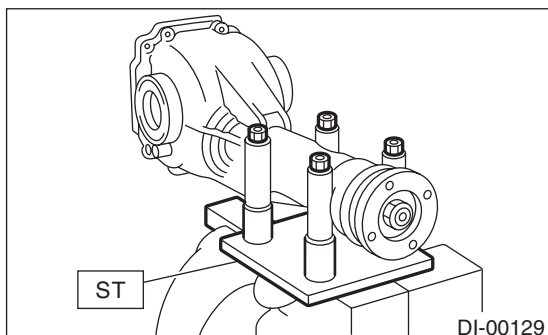
C: DISASSEMBLY

To detect real cause of trouble, inspect the following items before disassembling.

- Tooth contact of crown gear and pinion, and backlash
- Runout of crown gear at its back surface
- Turning resistance of drive pinion

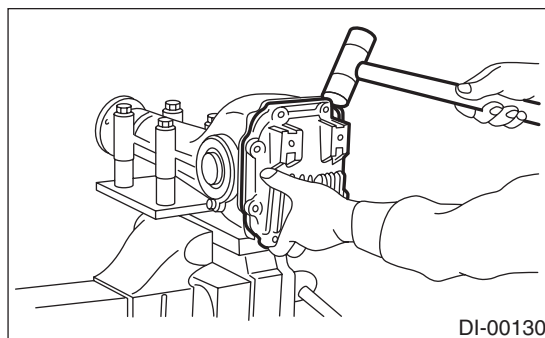
1) Set ST on vise and install the differential assembly to ST.

ST 398217700 ATTACHMENT



2) Drain gear oil by removing plug.

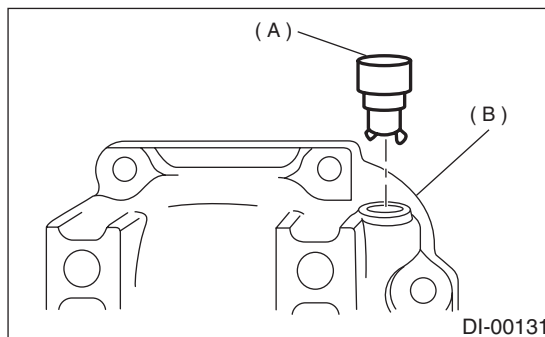
3) Remove rear cover by loosening retaining bolts.



4) Replace air breather cap.

NOTE:

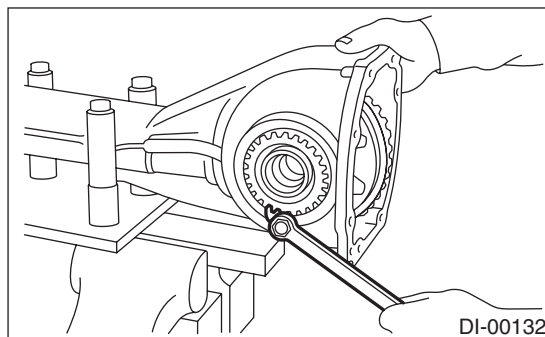
Do not attempt to replace the air breather cap unless necessary.



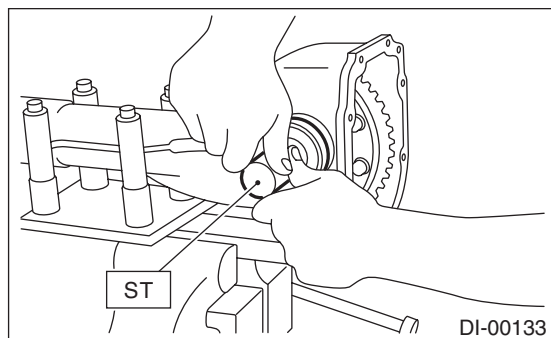
(A) Air breather cap

(B) Rear cover

5) Remove right and left lock plates.



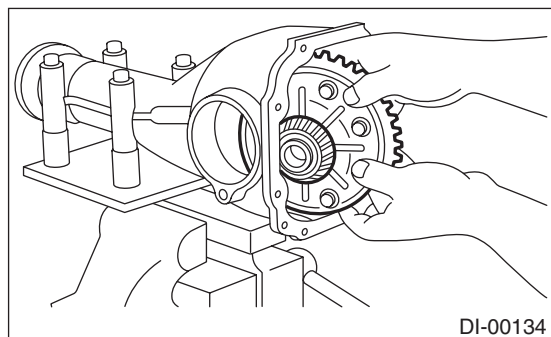
- 6) Remove right and left holders with ST.
ST 499785500 WRENCH



- 7) Pull out differential assembly from differential case.

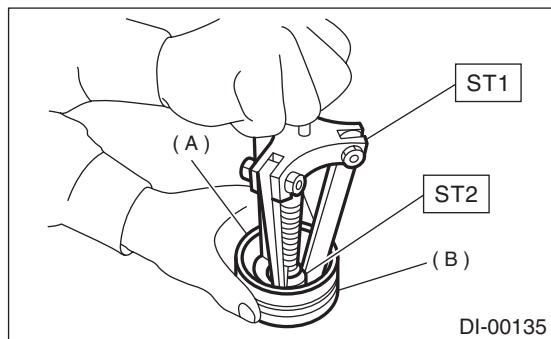
NOTE:

Be careful not to hit the teeth against the case.



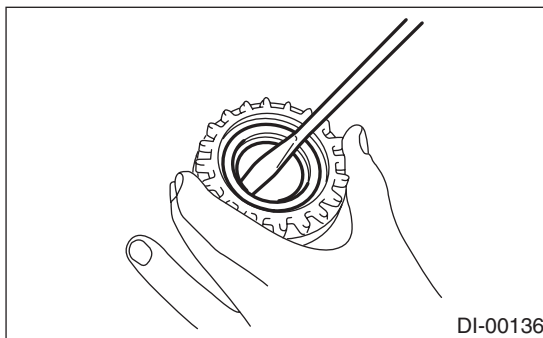
- 8) Remove bearing race from right and left holders with ST1 and ST2.

ST1 499705401 PULLER ASSY
ST2 499705404 SEAT



- (A) Bearing race
(B) Holder

- 9) Remove oil seal from right and left holders with screwdriver.

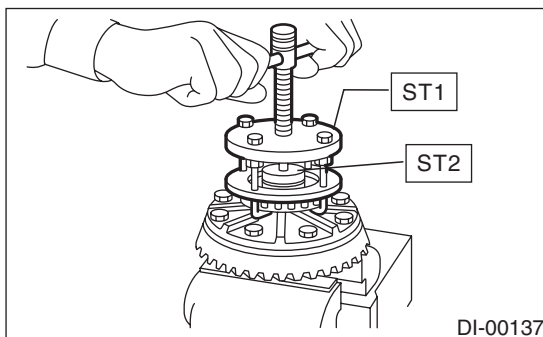


- 10) Extract bearing cone with ST1 and ST2.

NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Set puller so that its claws catch the edge of the bearing cone.
- Never mix up the right and left hand bearing races and cones.

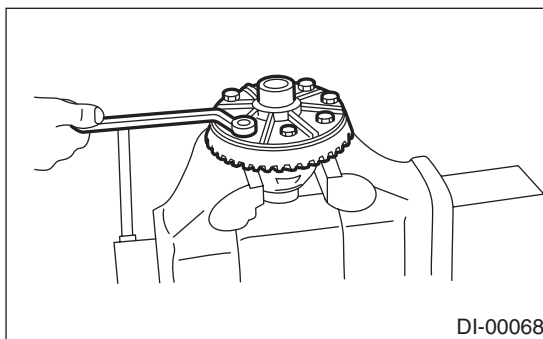
ST1 899524100 PULLER SET
ST2 399520105 SEAT



- 11) Remove crown gear by loosening crown gear bolts.

NOTE:

Further disassembling is not allowed.

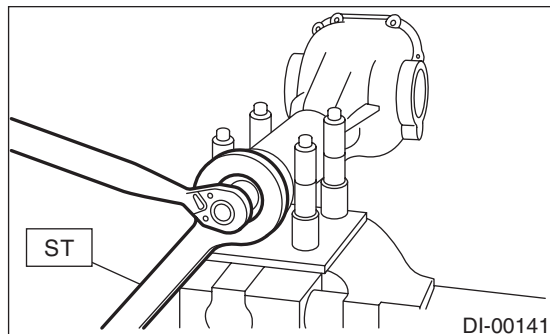


REAR DIFFERENTIAL FOR VA-TYPE

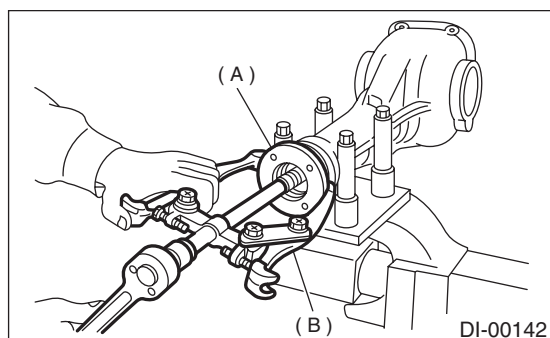
DIFFERENTIALS

12) Hold companion flange with ST and remove self-locking nut.

ST 498427200 FLANGE WRENCH



13) Extract the companion flange with a puller.



(A) Companion flange

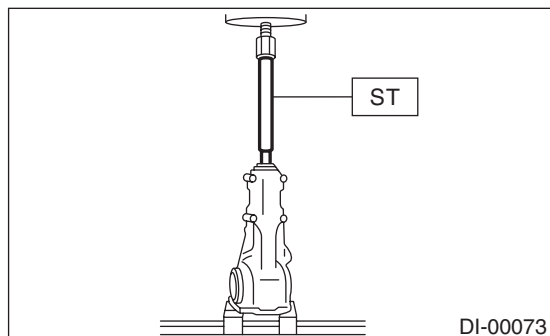
(B) Puller

14) Press the end of drive pinion shaft and extract it together with rear bearing cone, preload adjusting spacer and washer.

NOTE:

Hold the drive pinion so as not to drop it.

ST 398467700 DRIFT

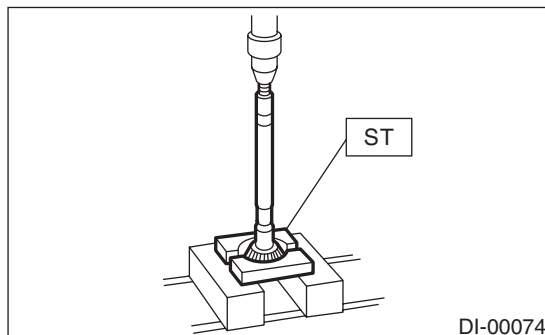


15) Remove rear bearing cone from drive pinion by supporting cone with ST.

NOTE:

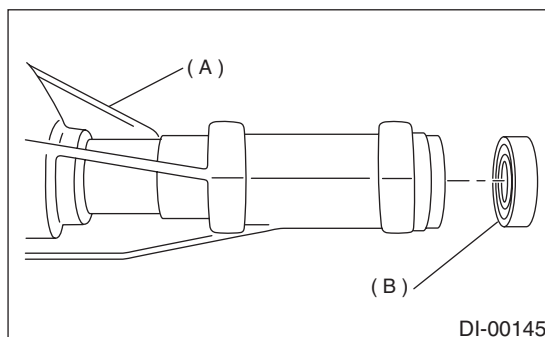
Place ST so that its center-recessed side faces the pinion gear.

ST 498515500 REPLACER



16) Remove front oil seal from differential carrier using ST.

ST 398527700 PULLER ASSY

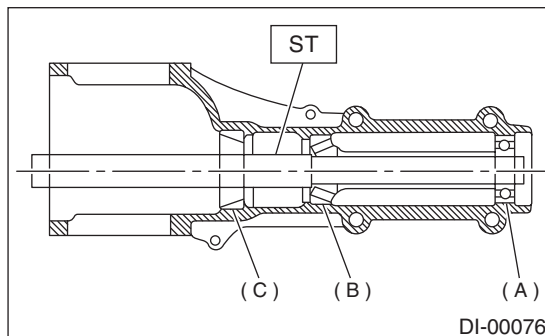


(A) Differential carrier

(B) Front oil seal

17) Remove pilot bearing together with front bearing cone using ST.

ST 398467700 DRIFT

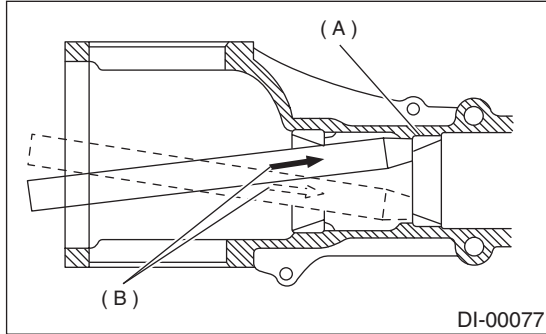


(A) Pilot bearing

(B) Front bearing

(C) Rear bearing cup

18) When replacing bearings, tap front bearing cup and rear bearing cup in this order out of case by using a brass bar.

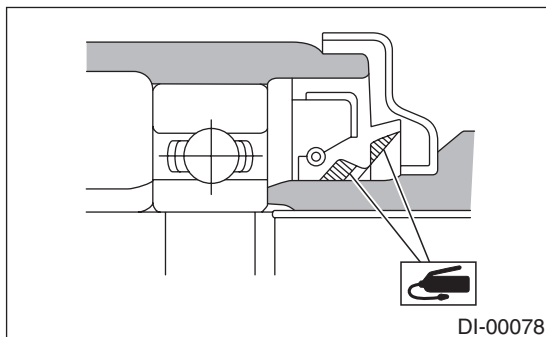


- (A) 2 cutouts along diagonal lines
(B) Tap alternately with brass bar.

D: ASSEMBLY

NOTE:

- Assemble in the reverse order of disassembling.
- Check and adjust each part during assembly.
- Keep the shims and washers in order, so that they are not misinstalled.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the right and left hand races of the bearings.
- Replace the oil seal with new one at every disassembly. Apply chassis grease between the lips when installing the oil seal.



- Use new O-ring and gasket.
- 1) Adjust preload for front and rear bearings.
- Adjust the bearing preload with spacer and washer between front and rear bearings.
 - Pinion height adjusting washer are not affected by this adjustment.
 - The adjustment must be carried out without oil seal inserted.

(1) Press rear bearing race (rear) into differential carrier with ST1 and ST2.

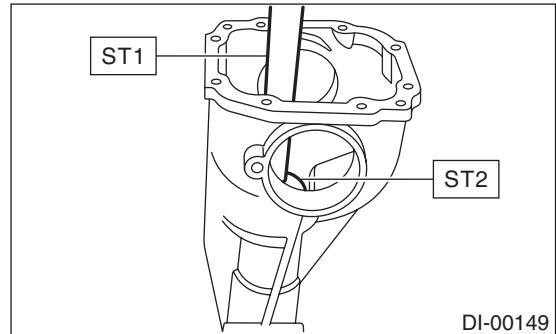
ST1 398477701 HANDLE

ST2 398477702 DRIFT

(2) Press front bearing race (front) into differential carrier with ST1 and ST2.

ST1 398477701 HANDLE

ST2 498447110 DRIFT



(3) Insert new front bearing cone.

(4) Measure and record the thickness of pinion height adjusting washer.

NOTE:

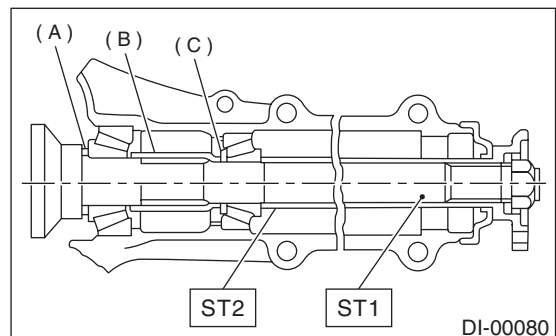
The used washer can be used after checking that it is not deformed when the tooth contact of drive gear and driven gear is correct during pre-disassembly.

(5) Insert ST1 into case with pinion height adjusting shim and new rear bearing cone fitted onto it.

(6) Then install preload adjusting spacer and washer, front bearing cone, ST2, companion flange, and washer and self-locking nut.

ST1 498447150 DUMMY SHAFT

ST2 32285AA000 DUMMY COLLAR



- (A) Pinion height adjusting shim
(B) Preload adjusting spacer
(C) Preload adjusting washer

REAR DIFFERENTIAL FOR VA-TYPE

DIFFERENTIALS

(7) Turn ST1 with hand to make it seated, and tighten drive pinion nut while measuring the preload with spring balance. Select preload adjusting washer and spacer so that the specified preload is obtained when nut is tightened to the specified torque.

NOTE:

Use a new self-locking nut.

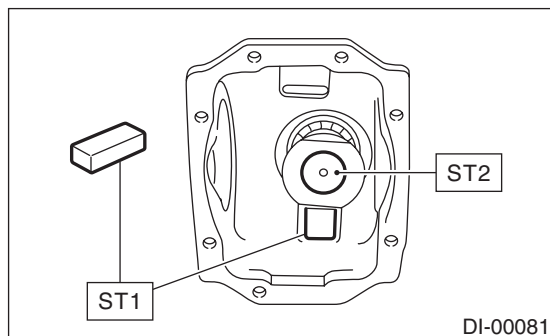
- Measure the preload in direction of tangent.
- Be careful not to give excessive preload.
- When tightening the drive pinion nut, lock ST2 with ST1 as shown in the figure.

ST1 398507704 BLOCK

ST2 498447150 DUMMY SHAFT

Tightening torque:

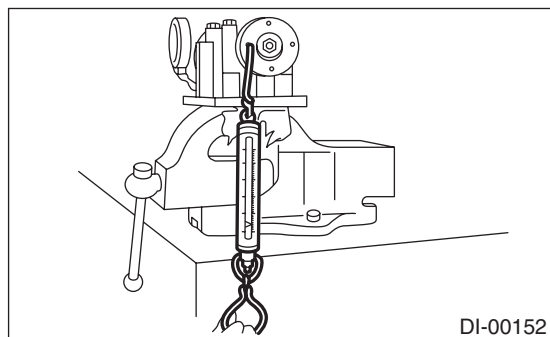
191 N·m (19.5 kgf-m, 141 ft-lb)



Front and rear bearing preload

For new bearing:

12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lb)
at companion flange bolt hole



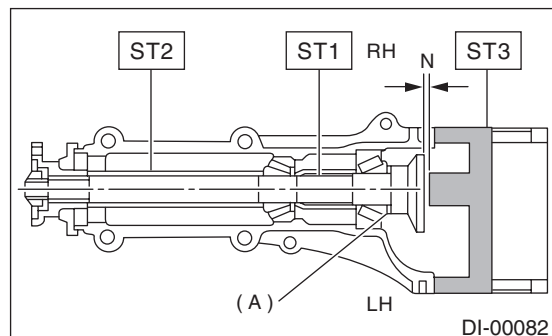
Preload adjusting washer	Part No.	Thickness mm (in)
	38336AA000	1.500 (0.0591)
	38336AA120	1.513 (0.0596)
	38336AA010	1.525 (0.0600)
	38336AA130	1.538 (0.0606)
	38336AA020	1.550 (0.0610)
	38336AA140	1.563 (0.0615)
	38336AA030	1.575 (0.0620)
	38336AA150	1.588 (0.0625)
	38336AA040	1.600 (0.0630)
	38336AA160	1.613 (0.0635)
	38336AA050	1.625 (0.0640)
	38336AA170	1.638 (0.0645)
	38336AA060	1.650 (0.0650)
	38336AA180	1.663 (0.0655)
	38336AA070	1.675 (0.0659)
	38336AA190	1.688 (0.0665)
	38336AA080	1.700 (0.0669)
	38336AA200	1.713 (0.0674)
	38336AA090	1.725 (0.0679)
	38336AA210	1.738 (0.0684)
	38336AA100	1.750 (0.0689)
	38336AA220	1.763 (0.0694)
	38336AA110	1.775 (0.0699)
Preload adjusting spacer	Part No.	Length mm (in)
	32288AA040	52.3 (2.059)
	32288AA050	52.5 (2.067)
	31454AA100	52.6 (2.071)
	32288AA060	52.7 (2.075)
	31454AA110	52.8 (2.079)
	32288AA070	52.9 (2.083)
	31454AA120	53.0 (2.087)
	32288AA080	53.1 (2.091)
	32288AA090	53.3 (2.098)

2) Adjusting drive pinion height

Adjust drive pinion height with shim installed between rear bearing cone and the back of pinion gear.

(1) Set ST3.

ST1 498447150 DUMMY SHAFT
ST2 32285AA000 DUMMY COLLAR
ST3 498505501 DIFFERENTIAL CARRIER GAUGE



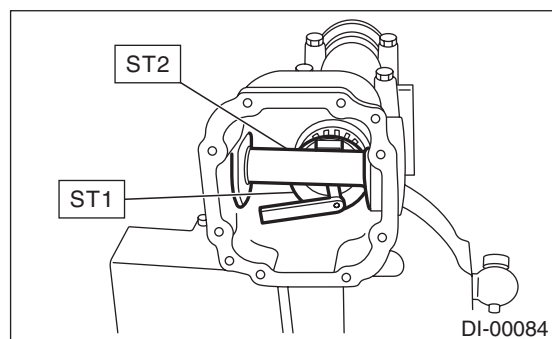
(A) Pinion height adjusting shim

(2) Measure the clearance N between the end of ST3 and the end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the case and ST3.

ST1 498447150 DUMMY SHAFT
ST2 498505501 DIFFERENTIAL CARRIER GAUGE



(3) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed shim with this one.

NOTE:

Use 1 to 3 shims as required for adjustment.

$$T = T_o + N - 0.05 \text{ (mm)}$$

where

T = Thickness of pinion height adjusting shim (mm)

T_o = Thickness of shim originally installed (mm)

N = Reading of thickness gauge (mm)

H = Figure marked on drive pinion head

(Example of calculation)

$$T_o = 0.15 \text{ mm}$$

$$N = 0.1 \text{ mm}$$

$$T = 0.15 + 0.1 - 0.05 = 0.2 \text{ mm}$$

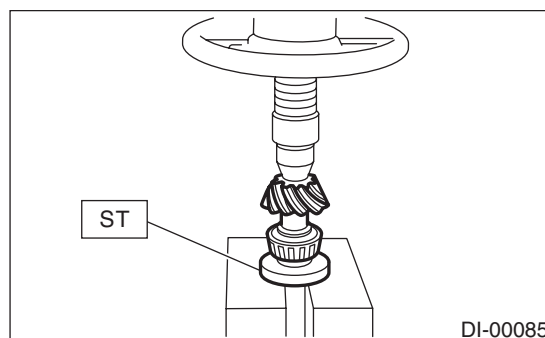
$$\text{Result: Thickness} = 0.2 \text{ mm}$$

Therefore use the 32295AA220.

Pinion height adjusting shim	
Part No.	Thickness mm (in)
32295AA200	0.150 (0.0059)
32295AA210	0.175 (0.0069)
32295AA220	0.200 (0.0079)
32295AA230	0.225 (0.0089)
32295AA240	0.250 (0.0098)
32295AA250	0.275 (0.0108)

3) Install the selected pinion height adjusting shim on drive pinion, and press the rear bearing cone into position with ST.

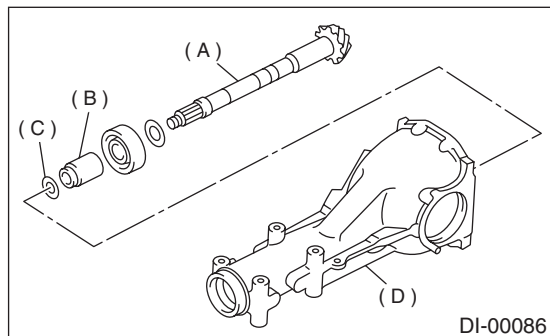
ST 498175500 INSTALLER



REAR DIFFERENTIAL FOR VA-TYPE

DIFFERENTIALS

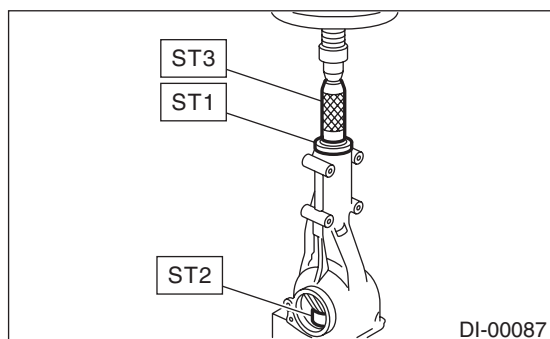
4) Insert drive pinion into differential carrier, install the previously selected bearing preload adjusting spacer and washer.



- (A) Drive pinion
- (B) Bearing preload adjusting spacer
- (C) Bearing preload adjusting washer
- (D) Differential carrier

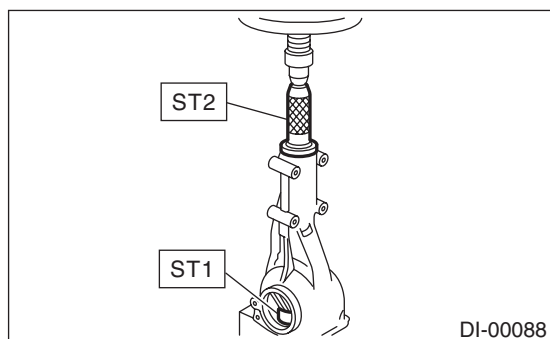
5) Press-fit front bearing cone into carrier with ST1, ST2 and ST3.

ST1 32285AA000 DUMMY COLLAR
ST2 399780104 WEIGHT
ST3 899580100 INSTALLER



6) Insert spacer, then press-fit pilot bearing with ST1 and ST2.

ST1 399780104 WEIGHT
ST2 899580100 INSTALLER

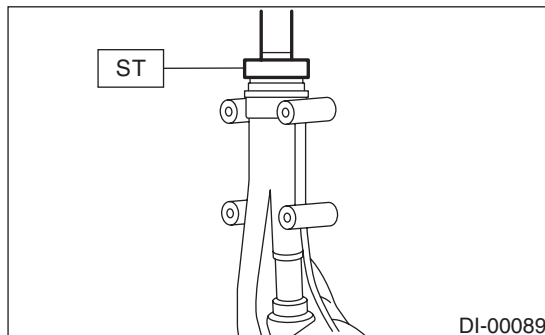


7) Fit a new oil seal with ST.

NOTE:

- Press-fit until end of oil seal is 1 mm (0.04 in) inward from end of carrier.
- Apply grease between the oil seal lips.

ST 498447120 OIL SEAL INSTALLER

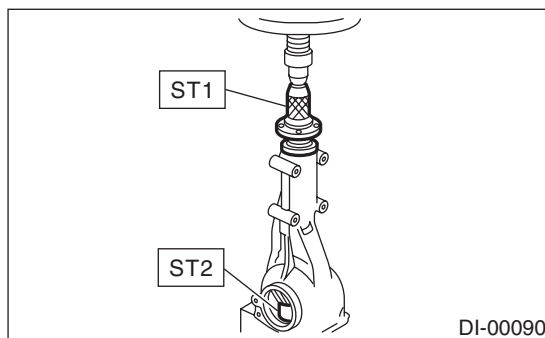


8) Press-fit companion flange with ST1 and ST2.

NOTE:

Be careful not to damage bearing.

ST1 899874100 INSTALLER
ST2 399780104 WEIGHT



9) Apply Lock Tite to the thread of drive pinion shaft and the seats of new self-locking nuts.

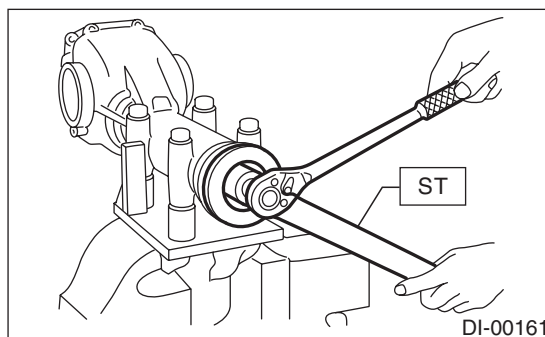
Lock Tite:

THREE BOND 1324 (Part No. 004403042)

10) Install self-locking nut. Then tighten it with ST.
ST 398427200 FLANGE WRENCH

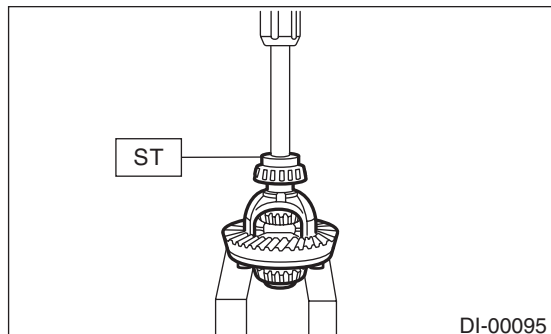
Tightening torque:

191 N·m (19.5 kgf-m, 141 ft-lb)

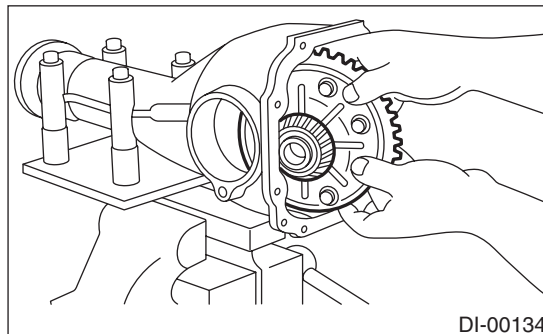


11) Press side bearing cone onto differential case with ST.

ST 498485400 DRIFT



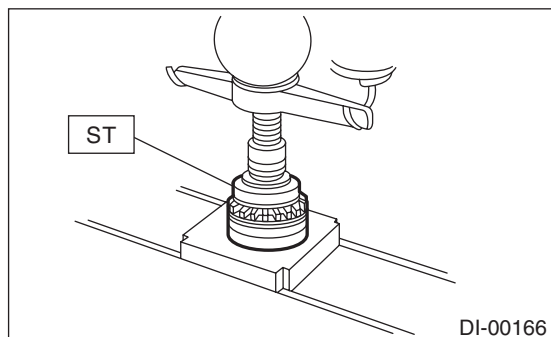
(3) Install the differential case assembly into differential carrier in the reverse order of disassembly.



12) Assemble holders.

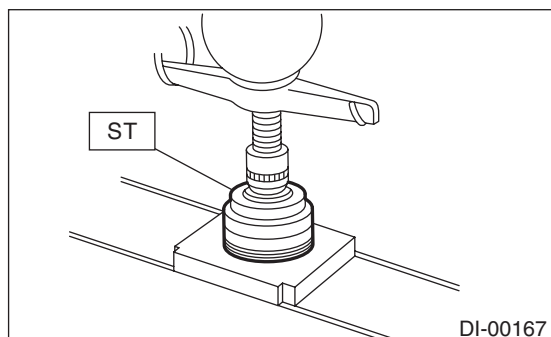
(1) Install oil seal into right and left holders.

ST 498447100 INSTALLER



(2) Install bearing race into right and left holders.

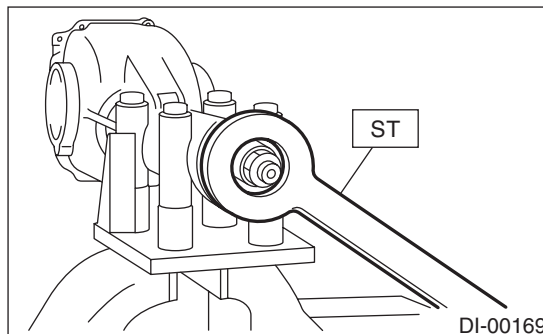
ST 398477702 BEARING OUTER RACE DRIFT



13) Perform adjustment of backlash of pinion crown gear set and adjustment of preload of differential side bearing.

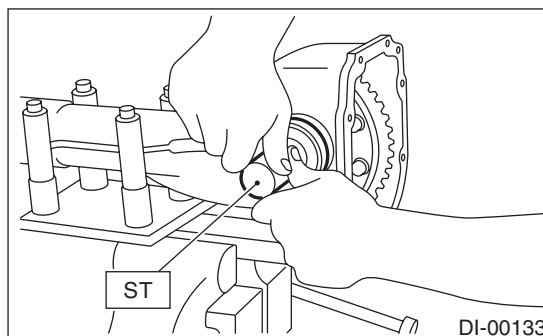
(1) Turn drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Screw in side (left-side) holder until light contact is made with ST.

ST 499785500 WRENCH



(3) Back off side (left-side) holder approximately 1 1/2 teeth of holder, and tighten left-side holder by approximately 2 teeth (approximately 1 1/2 + 1/2 teeth).

[Back off amount of side (left-side) holder + 1/2 tooth.]

This + 1/2 tooth gives preload.

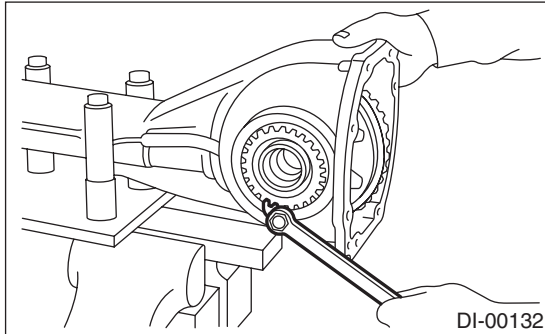
REAR DIFFERENTIAL FOR VA-TYPE

DIFFERENTIALS

- (4) Temporarily tighten lock plate.

NOTE:

Turn over lock plate to displace holder 1/2 tooth.



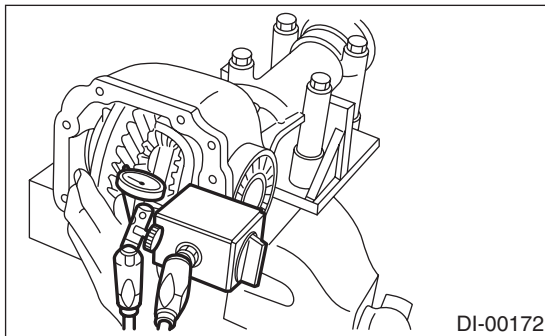
- (5) Measure the crown gear-to-drive pinion backlash. Set magnet base on differential carrier. Align contact point of dial gauge with tooth face of crown gear, and move crown gear while holding drive pinion still. Read value indicated on dial gauge.

NOTE:

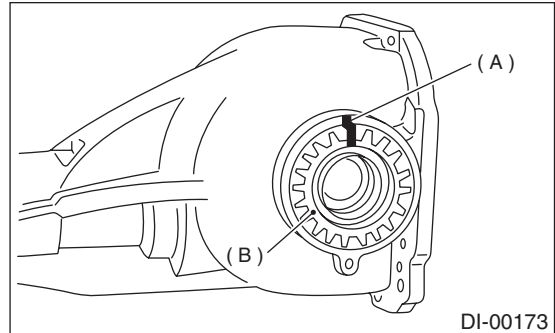
If measured backlash is not within specified range, repeat procedures for pinion crown gear set backlash adjustment and differential side bearing preload adjustment.

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



- 14) Draw a matching mark on both differential carrier and holder. Remove holder one side at a time. Replace in the original position after inserting an O-ring and applying grease to threaded portion.



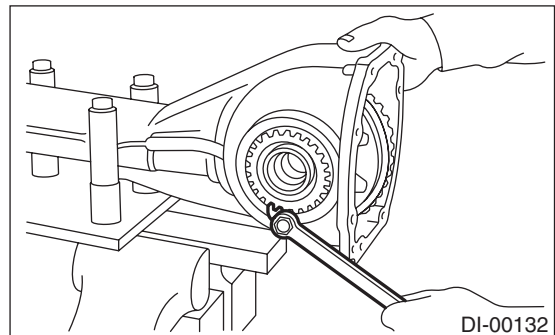
(A) Matching mark

(B) Holder

- 15) Tighten bolt of lock plate to specified torque.

Tightening torque:

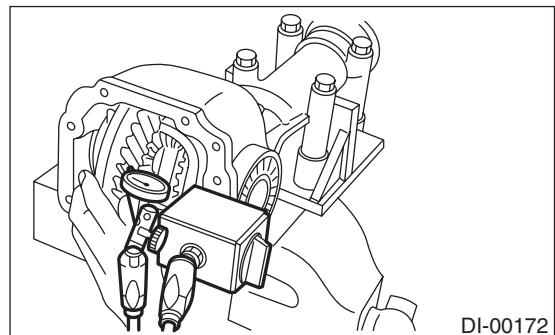
25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 16) Re-check crown gear-to-pinion backlash.

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



17) Checking and adjusting tooth contact of crown gear.

(1) Apply an even coat of red lead on both sides of three or four teeth on the crown gear. Check the contact pattern after rotating crown gear several revolutions back and forth until a definite contact pattern appears on the crown gear.

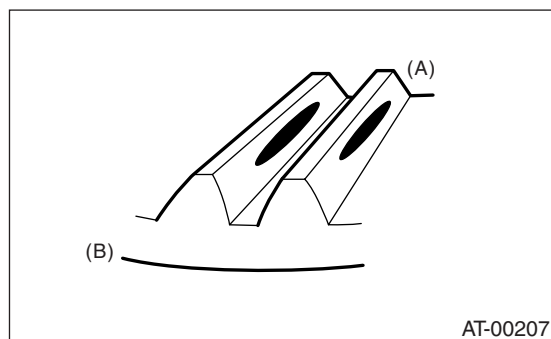
(2) When the contact pattern is incorrect, readjust according to the instructions given in "TOOTH CONTACT PATTERN".

NOTE:

Be sure to wipe off red lead completely after adjustment is completed.

- Correct tooth contact

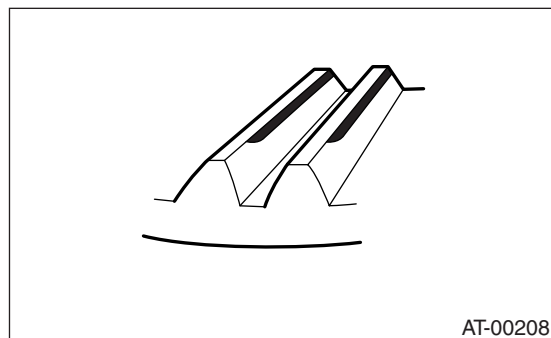
Checking item: Tooth contact pattern is slightly shifted toward to toe side under no-load rotation. (When loaded, contact pattern moves toward heel)



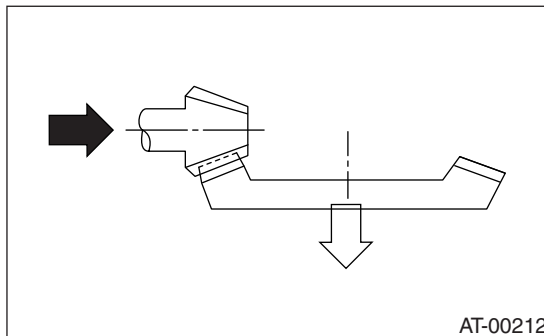
(A) Toe side
(B) Heel side

- Face contact

Checking item: Backlash is too large.
Contact pattern

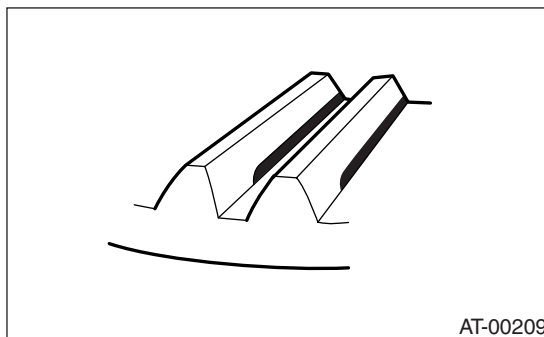


Corrective action: Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to crown gear.

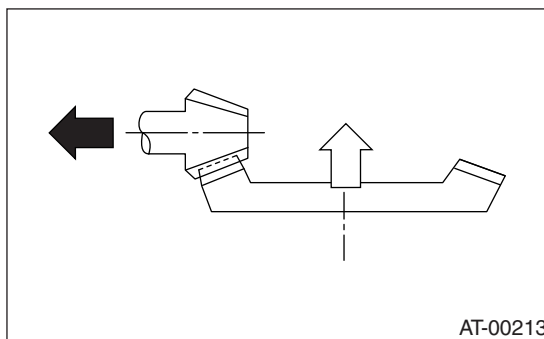


- Flank contact

Checking item: Backlash is too small.
Contact pattern



Corrective action: Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.

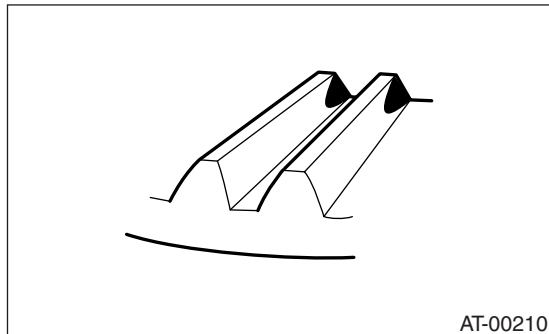


REAR DIFFERENTIAL FOR VA-TYPE

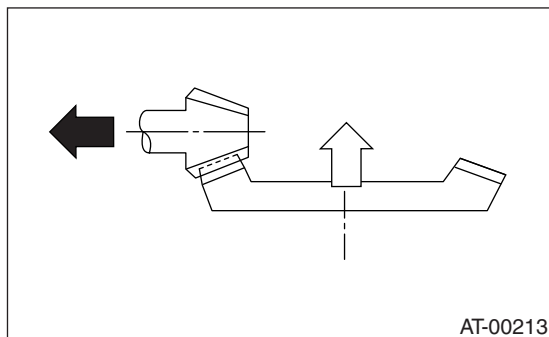
DIFFERENTIALS

- Toe contact (Inside end contact)

Checking item: Contact area is small.
Contact pattern

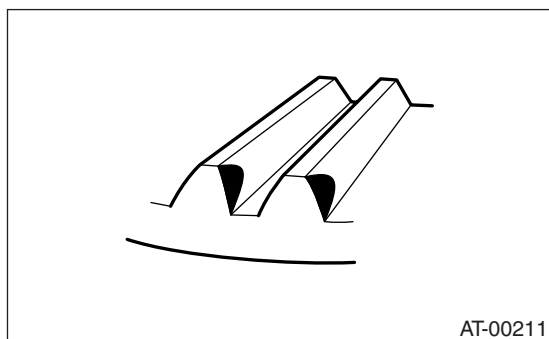


Corrective action: Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.

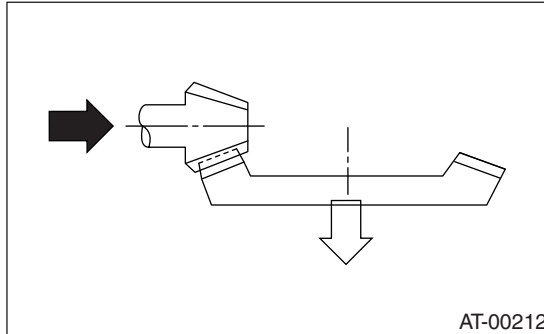


- Heel contact (Outside end contact)

Checking item: Contact area is small.
Contact pattern



Corrective action: Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to crown gear.



NOTE:

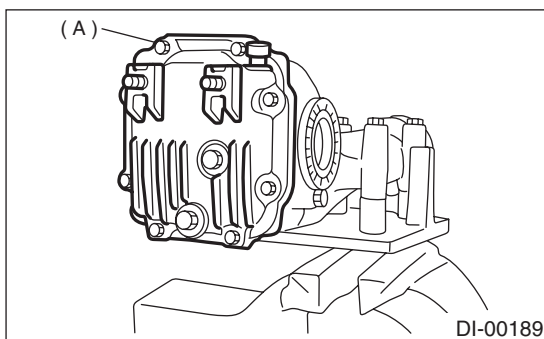
Be sure to wipe off red lead completely after adjustment is completed.

18) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

19) Install new gasket and rear cover, and tighten bolts to specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



(A) Rear cover

E: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage, or other defects. Repair or replace defective parts as necessary.

1) Crown gear and drive pinion

- If abnormal tooth contact is evident, find out the cause and adjust to give correct tooth contact at assembly. Replace the gear if excessively worn or incapable of adjustment.
- If crack, score, or seizure is evident, replace as a set. Slight damage of tooth can be corrected by oil stone or the like.

2) Side gear and pinion mate gear

- Replace if crack, score, or other defects are evident on tooth surface.
- Replace if thrust washer contacting surface is worn or seized. Slight damage of the surface can be corrected by oil stone or the like.

3) Bearing

Replace if seizure, peeling, wear, rust, dragging during rotation, abnormal noise or other defect is evident.

4) Thrust washers of side gear and pinion mate gear

Replace if seizure, flaw, abnormal wear or other defect is evident.

5) Oil seal

Replace if deformed or damaged, and at every disassembling.

6) Differential carrier

Replace if the bearing bores are worn or damaged.

7) Differential case

Replace if its sliding surfaces are worn or cracked.

8) Companion flange

Replace if the oil seal lip contacting surfaces have flaws.

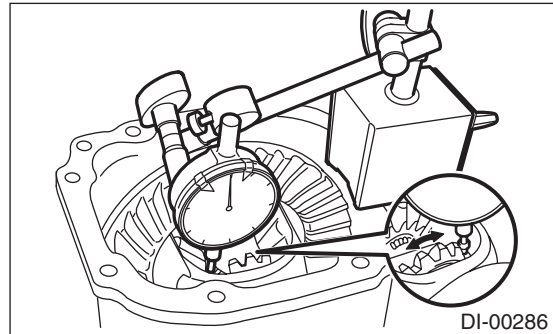
1. SIDE GEAR BACKLASH

Using a dial gauge, check the backlash of the side gear.

Side gear backlash:

0.05 — 0.15 mm (0.0020 — 0.0059 in)

If side gear backlash is not within the specification, adjust clearance as specified by selecting side gear thrust washer.



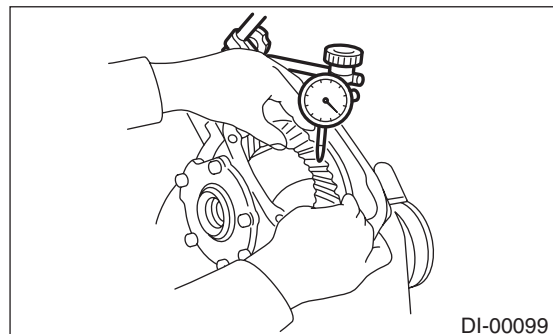
2. CROWN GEAR BACKLASH

Using a dial gauge, check the backlash of the crown gear.

Crown gear backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)

If crown gear backlash is not within the specification, adjust the side bearing preload or repair if necessary.



3. TOOTH CONTACT BETWEEN CROWN GEAR AND DRIVE PINION

Inspect tooth contact between crown gear and drive pinion.

<Ref. to DI-45, ASSEMBLY, Rear Differential for VA-type.>

F: ADJUSTMENT

1. SIDE GEAR BACKLASH

Adjust side gear backlash.

<Ref. to DI-45, ASSEMBLY, Rear Differential for VA-type.>

2. CROWN GEAR BACKLASH

Adjust crown gear backlash.

<Ref. to DI-45, ASSEMBLY, Rear Differential for VA-type.>

3. TOOTH CONTACT BETWEEN CROWN GEAR AND DRIVE PINION

Adjust the tooth contact between crown gear and drive pinion gear.

<Ref. to DI-45, ASSEMBLY, Rear Differential for VA-type.>

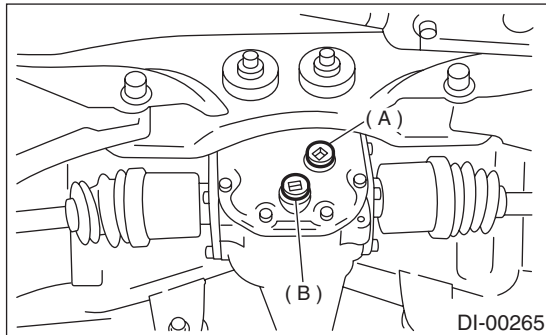
6. Rear Differential Front Oil Seal

A: INSPECTION

Check front oil seal portion for oil leakage, if any leak is found, replace the oil seal and inspect propeller shaft.

B: REPLACEMENT

- 1) Disconnect ground cable from battery.
- 2) Move select lever or gear shift lever to "N".
- 3) Release the parking brake.
- 4) Remove oil drain plug, and drain gear oil.



- (A) Filler plug
(B) Drain plug

- 5) Install oil drain plug.

NOTE:

- Apply fluid gasket to oil drain plug for T-type.
- VA-type uses a new aluminum gasket.

Fluid packing:

**THREE BOND 1105 (Part No.:004403010)
or equivalent**

Tightening torque:

T-type;

49 N·m (5.0 kgf-m, 36.2 ft-lb)

VA-type;

34 N·m (3.5 kgf-m, 25.3 ft-lb)

- 6) Jack-up rear wheels and support the vehicle body with sturdy racks.

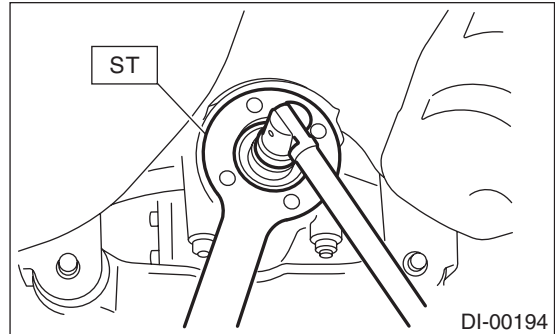
- 7) Remove rear exhaust pipe and muffler.

- 8) Remove heat shield cover.

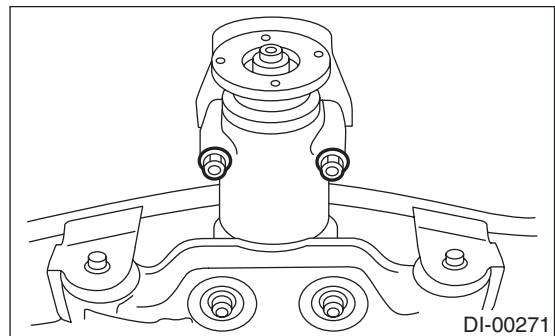
- 9) Remove propeller shaft from body. <Ref. to DS-15, REMOVAL, Propeller Shaft.>

- 10) Remove self-locking nut while holding companion flange with ST.

ST 498427200 FLANGE WRENCH

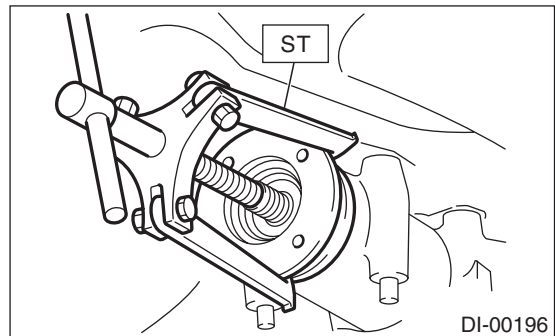


- 11) Remove protector nuts.



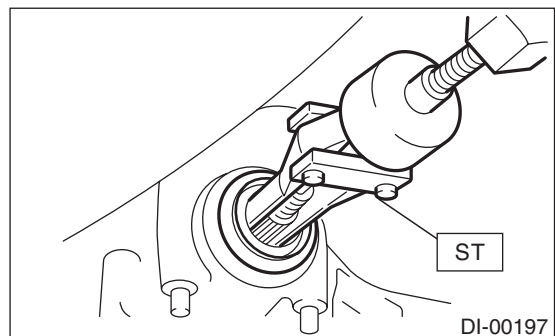
- 12) Extract companion flange using ST.

ST 399703600 PULLER ASSY



- 13) Remove oil seal using ST.

ST 398527700 PULLER ASSY

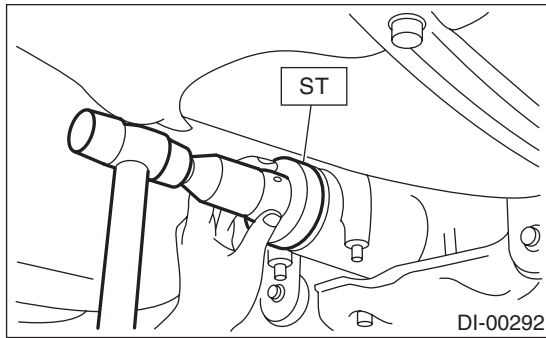


REAR DIFFERENTIAL FRONT OIL SEAL

DIFFERENTIALS

14) Fit a new oil seal using ST.

ST 498447120 OIL SEAL INSTALLER



15) Install companion flange using a plastic hammer.

16) Apply Lock Tite to the thread of drive pinion shaft and the seats of new self-locking nuts.

Lock Tite:

THREE BOND 1324 (Part No. 004403042)

17) Tighten new self-locking nut within the specified torque range so that the turning resistance of companion flange becomes the same as that before replacing oil seal.

ST 498427200 FLANGE WRENCH

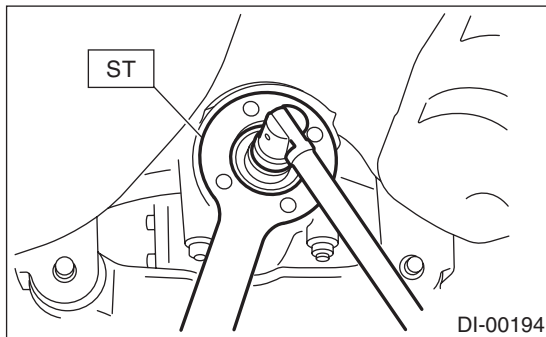
Tightening torque:

T-type

181 N·m (18.5 kgf-m, 134 ft-lb)

VA-type

191 N·m (19.5 kgf-m, 141 ft-lb)

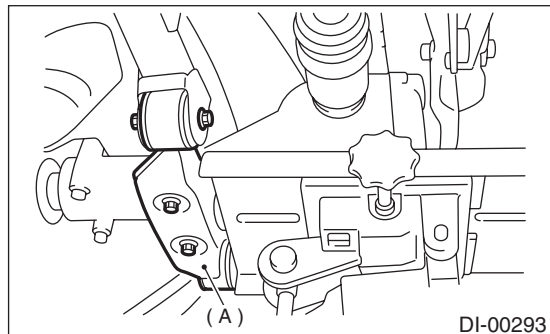


18) Reassembling procedure hereafter is the reverse of the disassembling.

7. Rear Differential Front Member

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Jack-up the vehicle.
- 3) Using a transmission jack, support rear differential, and remove rear differential front member.



(A) Rear differential front member

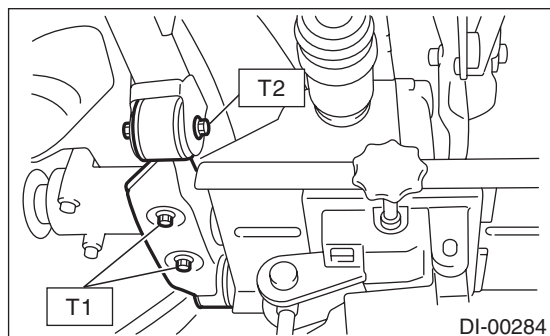
B: INSTALLATION

- 1) Install rear differential front member.

Tightening torque:

T1: 65 N·m (6.6 kgf-m, 48 ft-lb)

T2: 110 N·m (11.2 kgf-m, 81 ft-lb)



C: INSPECTION

- 1) Check rear differential front member for damage, bend, or corrosion.
If damage, bend, or corrosion is excessive, replace rear differential front member.
- 2) Check bushings of rear differential front member for cracking, hardening, or damage.
If cracking, hardening, or damage is excessive, replace rear differential front member.

GENERAL DIAGNOSTIC TABLE

DIFFERENTIALS

8. General Diagnostic Table

A: INSPECTION

Symptom or trouble	Possible cause	Remedy
1. Oil leakage	Worn, scratched, or incorrectly seated front or side oil seal. Scored, battered, or excessively worn sliding surface of companion flange.	Repair or replace.
	Clogged or damaged air breather.	Clean, repair or replace.
	Loose bolts on side retainer, or incorrectly fitted O-ring.	Tighten bolts to specified torque. Replace O-ring.
	Loose rear cover attaching bolts or damaged gasket.	Tighten bolts to specified torque. Replace gasket and apply liquid packing.
	Loose oil filler or drain plug.	Retighten and apply liquid packing.
	Wear, damage or incorrectly fitting for side retainer and oil seal.	Repair or replace.
2. Seizure NOTE: Seized or damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	Insufficient backlash for hypoid gear.	Readjust or replace.
	Excessive preload for side, rear, or front bearing.	Readjust or replace.
	Insufficient or improper oil used.	Replace seized part and fill with specified oil to specified level.
3. Damage NOTE: Damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	Improper backlash for hypoid gear.	Replace.
	Insufficient or excessive preload for side, rear, or front bearing.	Readjust or replace.
	Excessive backlash for differential gear.	Replace gear or thrust washer.
	Loose bolts and nuts such as crown gear bolt.	Retighten.
	Damage due to overloading.	Replace.
4. Noises when starting or shifting gears NOTE: Noises may be caused by differential assembly, universal joint, wheel bearing, etc. Find out what is actually making noise before disassembly.	Excessive backlash for hypoid gear.	Readjust.
	Excessive backlash for differential gear.	Replace gear or thrust washer.
	Insufficient preload for front or rear bearing.	Readjust.
	Loose drive pinion nut.	Tighten to specified torque.
	Loose bolts and nuts such as side bearing retainer attaching bolt.	Tighten to specified torque.
5. Noises when cornering	Damaged differential gear.	Replace.
	Excessive wear or damage of thrust washer.	Replace.
	Broken pinion mate shaft.	Replace.
	Seized or damaged side bearing.	Replace.
6. Gear noises NOTE: Since noises from engine, muffler, transmission, propeller shaft, wheel bearings, tires, and body are sometimes mistaken for noises from differential assembly, be careful in checking them. Inspection methods to locate noises include coasting, accelerating, cruising, and jacking-up all four wheels. Perform these inspections according to condition of trouble. When listening to noises, shift gears into four wheel drive and fourth speed position, trying to pick up only differential noise.	Improper tooth contact of hypoid gear.	Readjust or replace hypoid gear set.
	Improper backlash for hypoid gear.	Readjust.
	Scored or chipped teeth of hypoid gear.	Replace hypoid gear set.
	Seized hypoid gear.	Replace hypoid gear set.
	Improper preload for front or rear bearings.	Readjust.
	Seized, scored, or chipped front or rear bearing.	Replace.
	Seized, scored, or chipped side bearing.	Replace.
	Vibrating differential carrier.	Replace.

DRIVE SHAFT SYSTEM

DS

	Page
1. General Description	2
2. Propeller Shaft	15
3. Front Axle.....	18
4. Hub Unit Bearing.....	24
5. Front Drive Shaft.....	29
6. Rear Drive Shaft.....	37
7. General Diagnostic Table.....	41

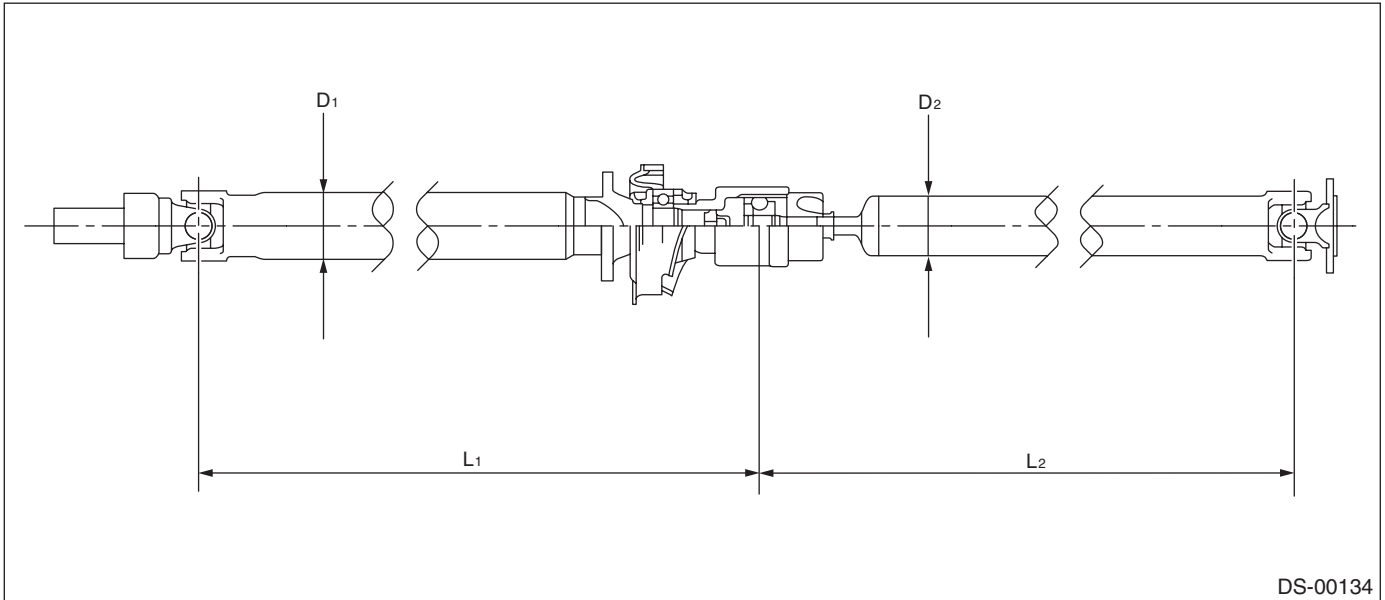


GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

1. General Description
A: SPECIFICATIONS
1. PROPELLER SHAFT

Propeller shaft type		DOJ type
Front propeller shaft Joint-to-joint length: L ₁ mm (in)	AT	629 (24.76)
	MT	688 (27.09)
Rear propeller shaft Joint-to-joint length: L ₂ mm (in)	773 (30.43)	
Outside diameter of tube: mm (in)	D ₁	63.5 (2.500)
	D ₂	57.0 (2.244)

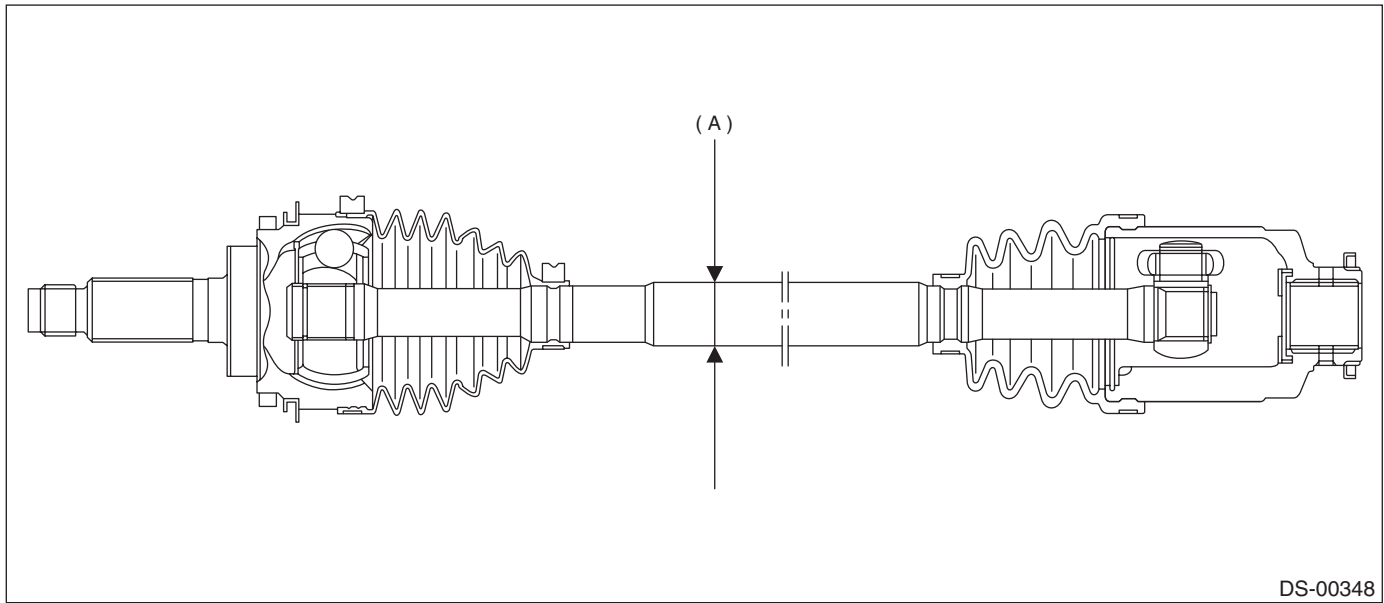


DS-00134

2. FRONT DRIVE SHAFT ASSEMBLY

• Non-TURBO model

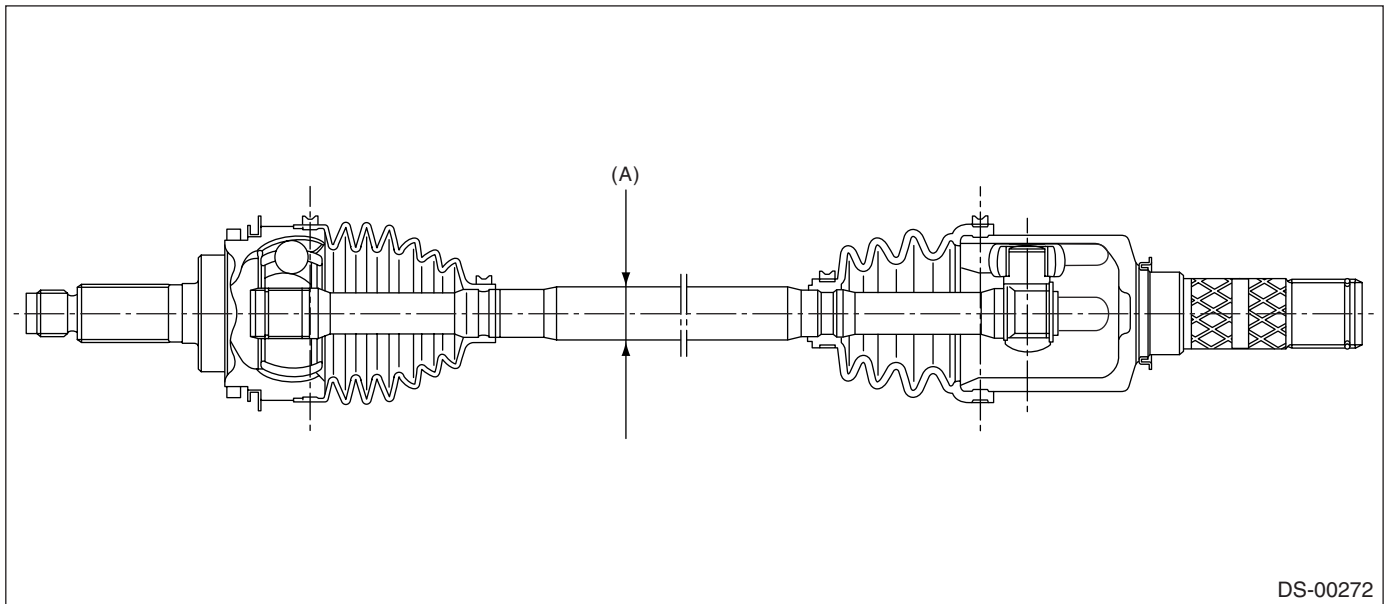
ϕ D mm (in)	
MT	AT
26 (1.02)	24.9 (0.98)



(A) ϕ D mm (in)

• TURBO model

ϕ D mm (in)
24.9 (0.98)

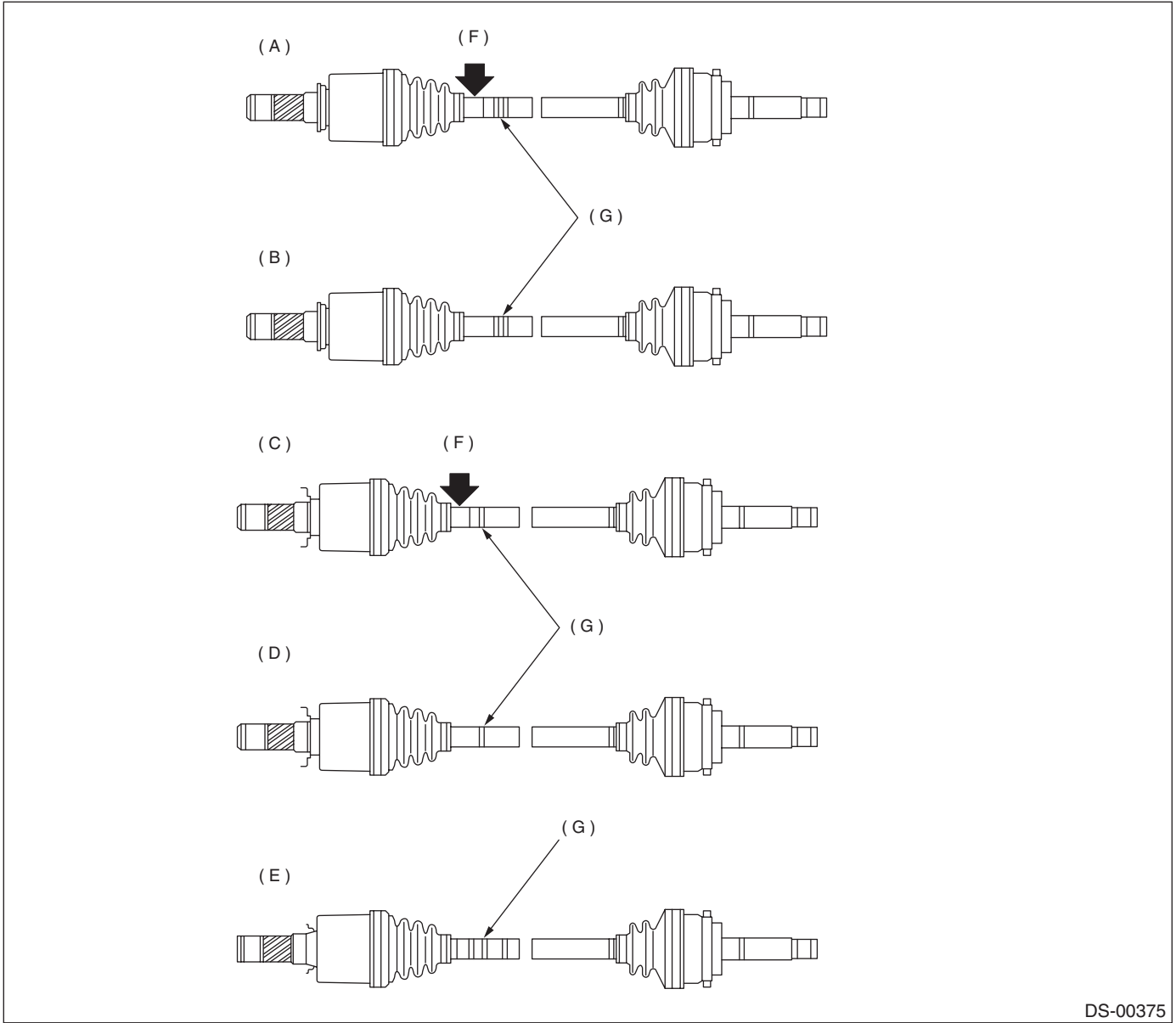


GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

3. REAR DRIVE SHAFT ASSEMBLY

Model	SHAFT
	No. of identification, protrusion on shaft
Turbo	2 (Two)
Non-turbo (MT)	1 (One)
Non-turbo (AT)	3 (Three)

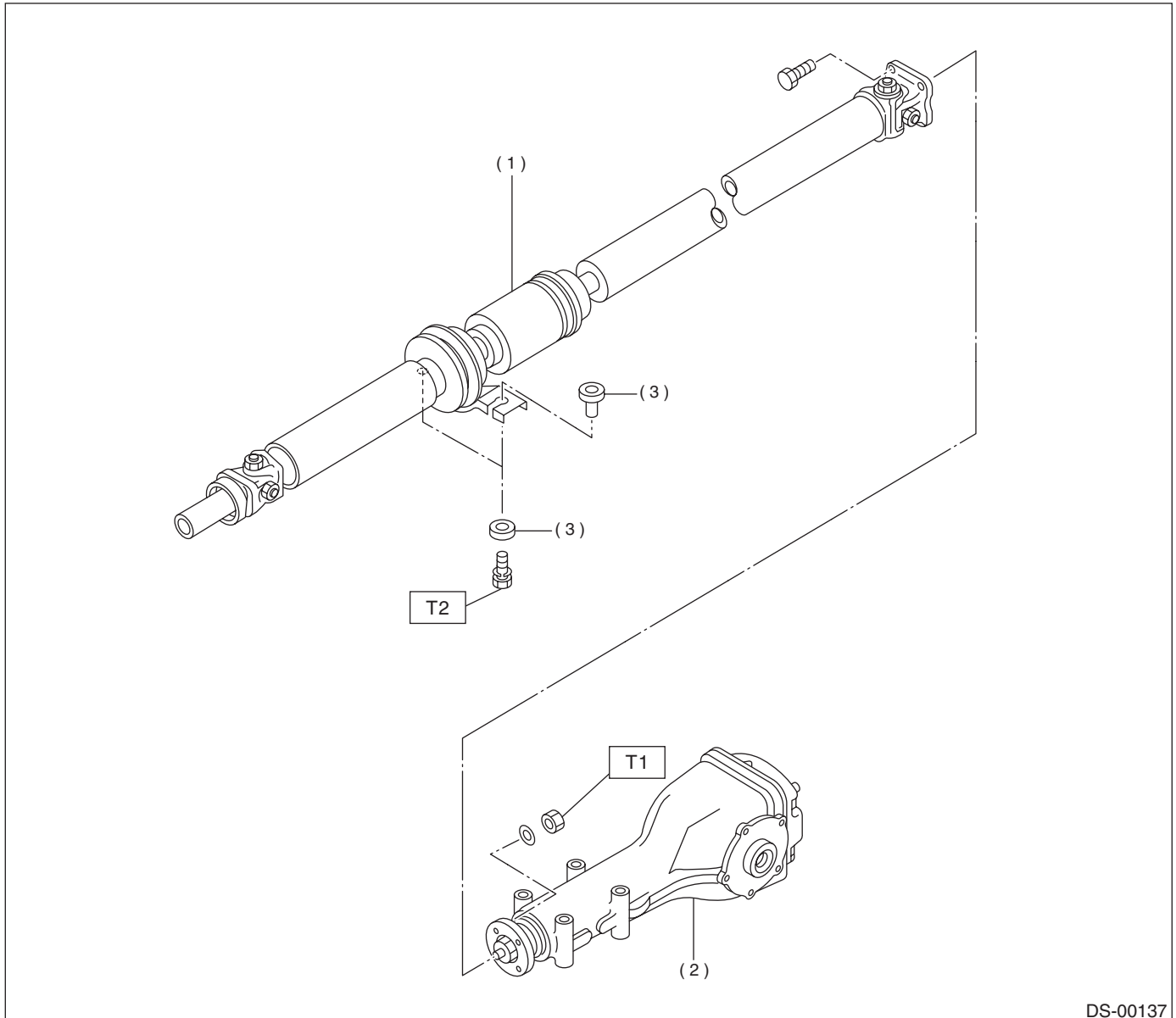


DS-00375

- (A) Turbo model RH
- (B) Turbo model LH
- (C) Non-turbo (MT) model RH
- (D) Non-turbo (MT) model LH
- (E) Non-turbo (AT) model
- (F) Indication mark of RH
- (G) Identification protrusion

B: COMPONENT

1. PROPELLER SHAFT



DS-00137

- (1) Propeller shaft
- (2) Rear differential
- (3) Bushing

Tightening torque: N·m (kgf-m, ft-lb)

T1: 31 (3.2, 23.1)

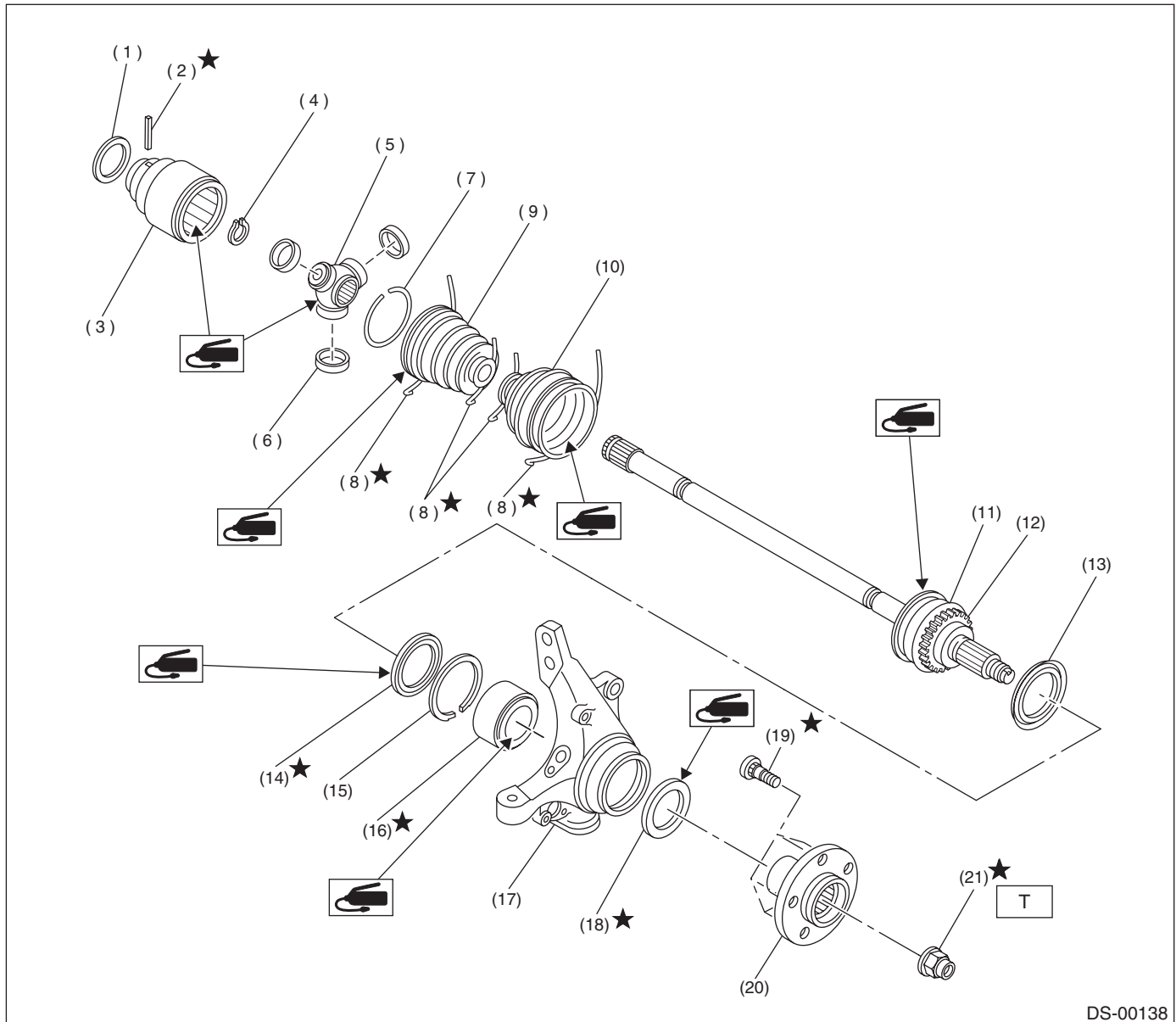
T2: 52 (5.3, 38.3)

GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

2. FRONT AXEL

• Non-TURBO model



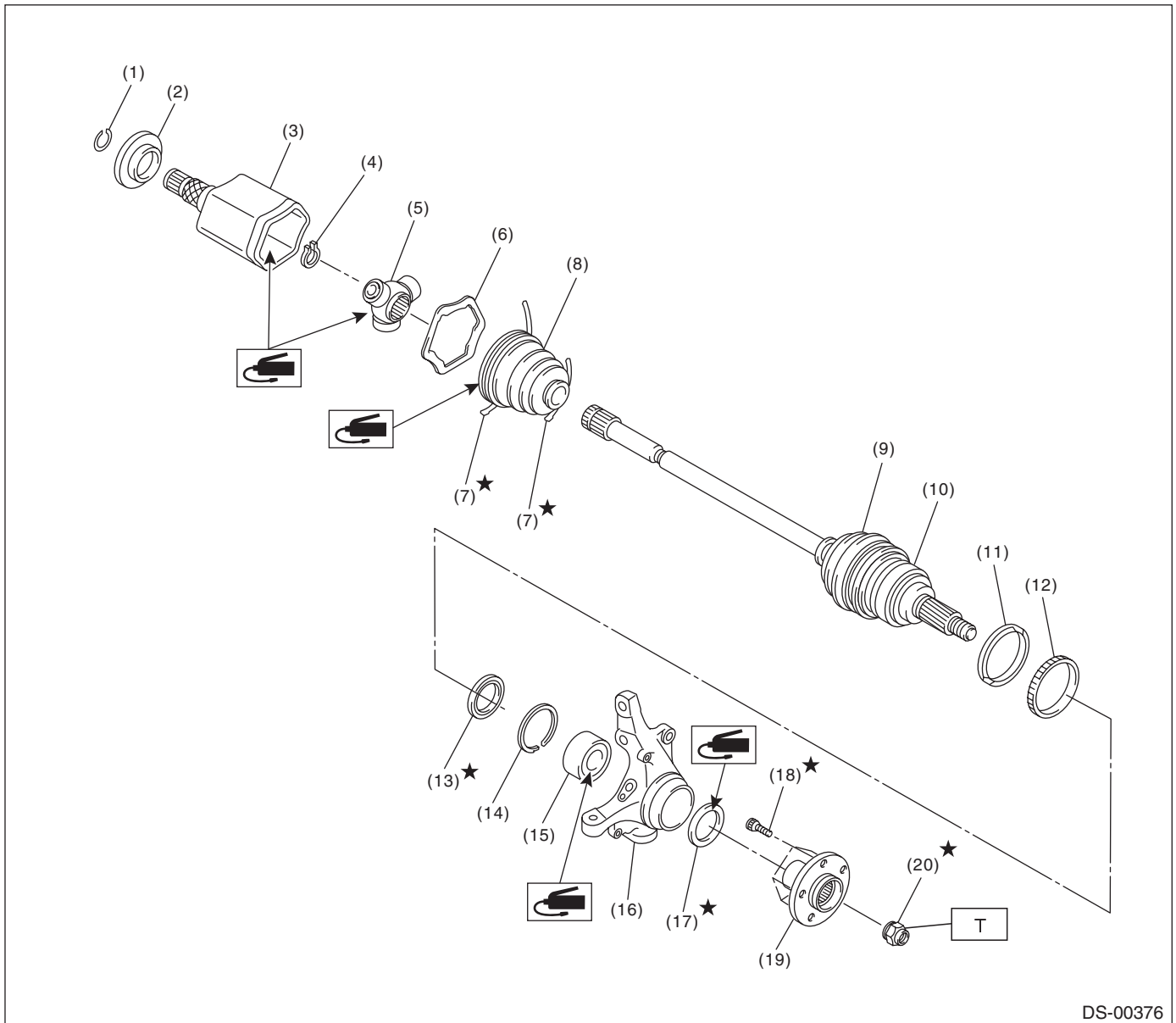
- (1) Baffle plate (SFJ)
- (2) Spring pin
- (3) Outer race (SFJ)
- (4) Snap ring
- (5) Trunnion
- (6) Free ring
- (7) Circlip
- (8) Boot band
- (9) Boot (SFJ)

- (10) Boot (BJ)
- (11) BJ ASSY
- (12) Tone wheel
- (13) Baffle plate
- (14) Oil seal (IN)
- (15) Snap ring
- (16) Bearing
- (17) Housing
- (18) Oil seal (OUT)

- (19) Hub bolt
- (20) Hub
- (21) Axle nut (Olive color)

Tightening torque: N·m (kgf-m, ft-lb)
T: 220 (22, 162)

• TURBO model



- (1) Spring pin
- (2) Baffle plate (AAR)
- (3) Outer race (AAR)
- (4) Snap ring
- (5) Trunnion
- (6) Retainer
- (7) Boot band
- (8) Boot (AAR)

- (9) Boot (AC)
- (10) AC ASSY
- (11) Tone wheel
- (12) Baffle plate
- (13) Oil seal (IN)
- (14) Snap ring
- (15) Bearing
- (16) Housing

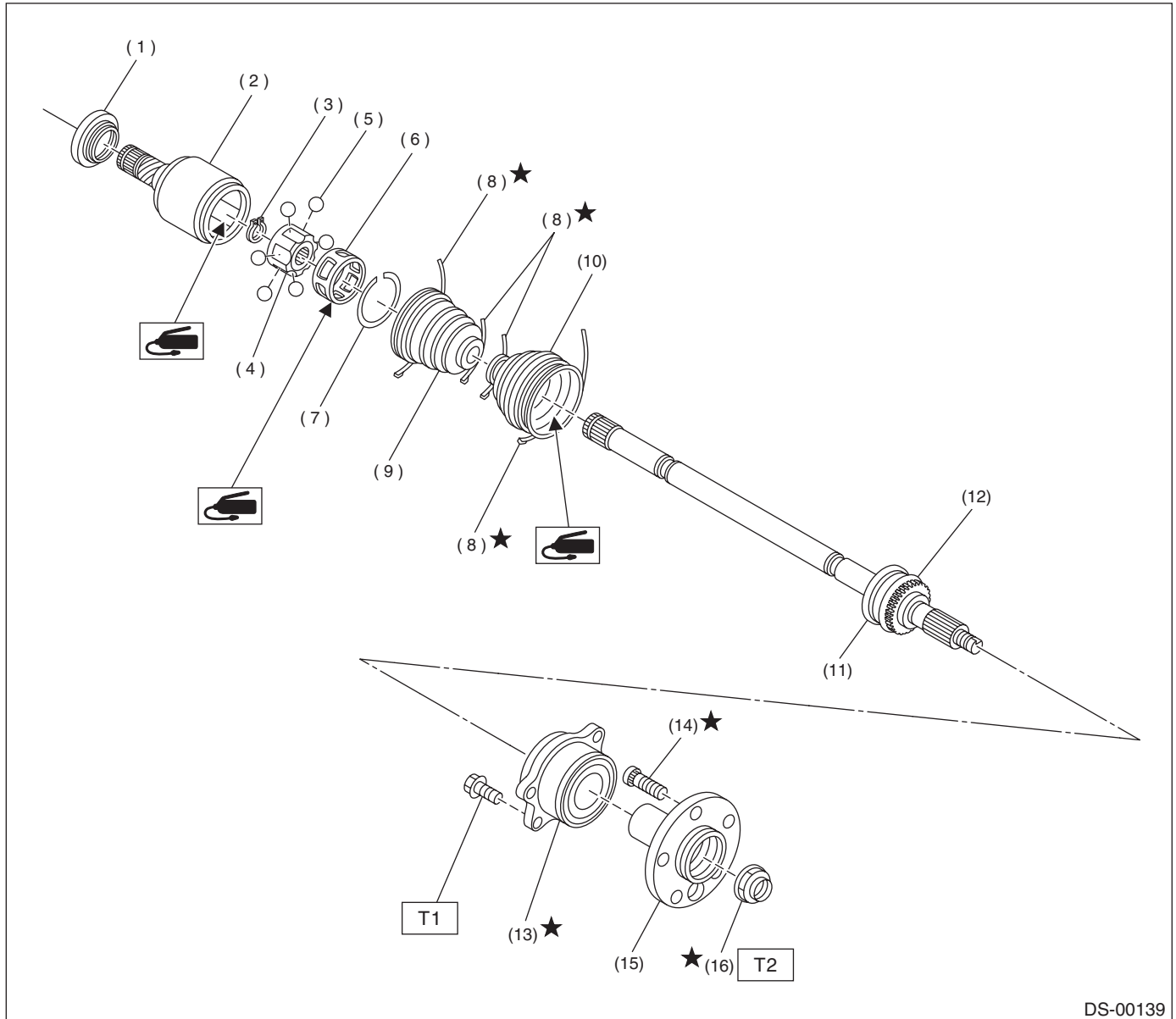
- (17) Oil seal (OUT)
- (18) Hub bolt
- (19) Hub
- (20) Axle nut

Tightening torque: N·m (kgf-m, ft-lb)
T: 220 (22, 162)

GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

3. REAR AXLE



DS-00139

- (1) Baffle plate (DOJ)
- (2) Outer race (DOJ)
- (3) Snap ring
- (4) Inner race
- (5) Ball
- (6) Cage
- (7) Circlip

- (8) Boot band
- (9) Boot (DOJ)
- (10) Boot (BJ)
- (11) BJ ASSY
- (12) Tone wheel
- (13) Hub unit bearing
- (14) Hub bolt

- (15) Hub
- (16) Axle nut (Olive color)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 66 (6.7, 48.5)

T2: 240 (24, 177)

C: CAUTION

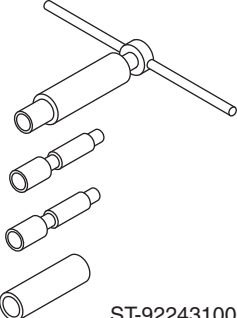
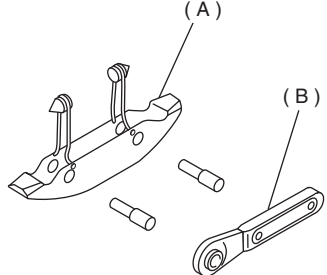
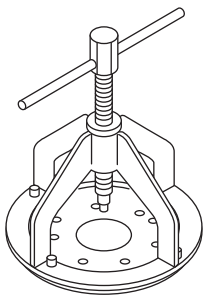
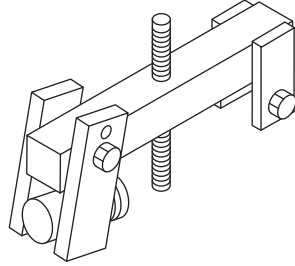
- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Use SUBARU genuine grease etc. or the equivalent. Do not mix grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply grease onto sliding or revolution surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of grease to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.

GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

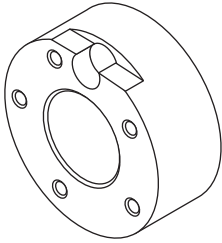
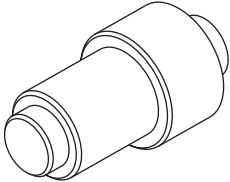
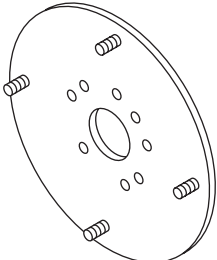
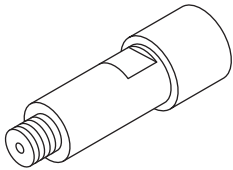
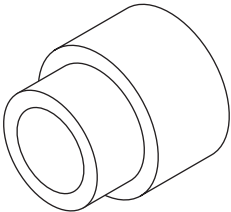
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-922431000	922431000	AXLE SHAFT INSTALLER	- Used for installing axle shaft into housing. - Used with ADAPTER (927390000).
 ST-925091000	925091000	BAND TIGHTENING TOOL	- Used for tightening boot band. (A) Jig for band (B) Ratchet wrench
 ST-926470000	926470000	AXLE SHAFT PULLER	Used for removing axle shaft.
 ST-927060000	927060000	HUB REMOVER	- Used for removing front hub. - Used with HUB STAND (927080000).

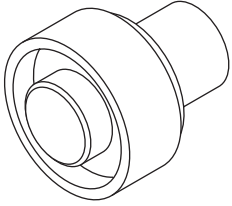
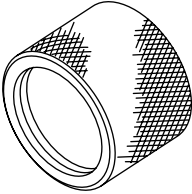
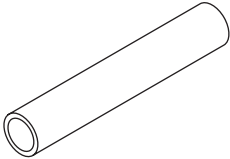
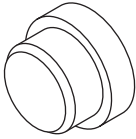
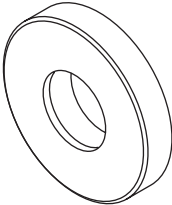
GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927080000	927080000	HUB STAND	Used for disassembling and assembling hub bolt in hub.
 ST-927100000	927100000	BEARING PULLER	- Used for disassembling and assembling front housing bearing. - Used with HOUSING STAND (927400000).
 ST-927140000	927140000	AXLE SHAFT PULLER PLATE	Same as plate 2 included in AXLE SHAFT PULLER (926470000).
 ST-927390000	927390000	ADAPTER	Used as an adapter for AXLE SHAFT INSTALLER (922431000).
 ST-927400000	927400000	HOUSING STAND	- Used for disassembling and assembling front housing bearing. - Used with BEARING PULLER (927100000).

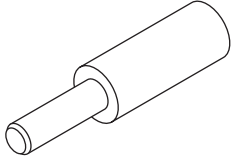
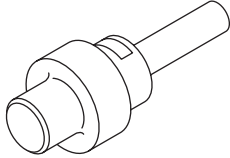
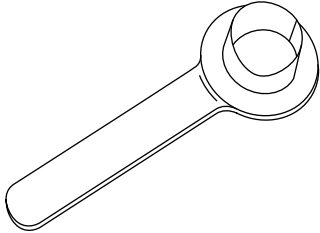
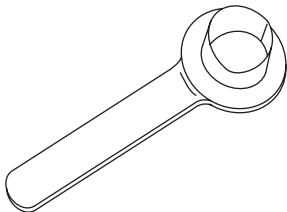
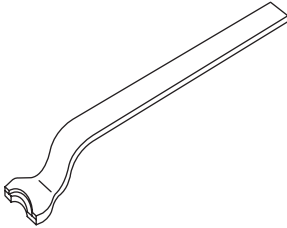
GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927410000	927410000	OIL SEAL INSTALLER	- Used for installing oil seal into front housing. - Used with HOUSING STAND (927400000).
 ST18675AA000	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing differential side retainer oil seal.
 ST-398507703	398507703	DUMMY COLLAR	Used for removing hub ASSY from hub unit.
 ST-399520105	399520105	SEAT	Used for removing inner race from hub ASSY.
 ST28499AE000	28499AE000	BEARING SPACER	Used for installing hub unit into hub ASSY.

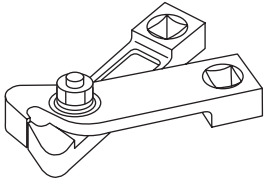
GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927120000	927120000	HUB INSTALLER	Used for installing hub.
 ST-927450000	927450000	HUB INSTALLER	- Used for installing hub unit into hub ASSY. - Used with BEARING SPACER (28499AE000) and HUB STAND (927080000).
 ST28399SA010	28399SA010	OIL SEAL PRO- TECTOR	- Used for installing front drive shaft into front differential. - For protecting oil seal.
 ST28099PA090	28099PA090	OIL SEAL PRO- TECTOR	- Used for installing rear drive shaft into rear differential. - For protecting oil seal.
 ST28099PA100	28099PA100	DRIVE SHAFT REMOVER	Used for removing rear drive shaft from rear differential.

GENERAL DESCRIPTION

DRIVE SHAFT SYSTEM

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST28099AC000	28099AC000	BOOT BAND PLIERS	Used for tightening front BJ boot band.

2. GENERAL PURPOSE TOOLS

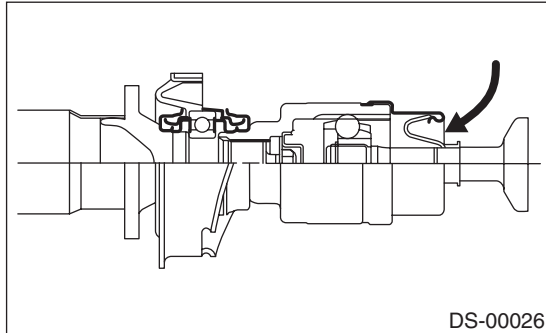
TOOL NAME	REMARKS
Puller	Used for removing ball joint from knuckle arm.
Dial Gauge	Used for inspecting propeller shaft run-out.
Snap Ring Pliers	Used for installing and removing snap ring.

2. Propeller Shaft

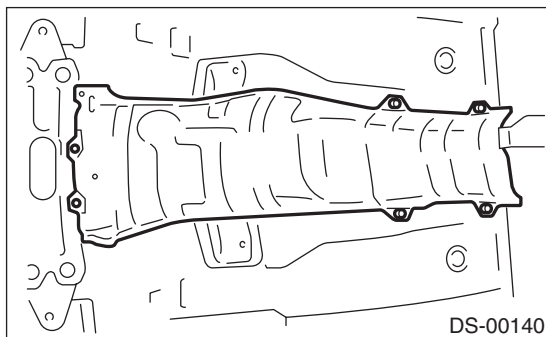
A: REMOVAL

NOTE:

- Before removing propeller shaft, wrap metal parts with a cloth or rubber material.
- In case of DOJ type, before removing propeller shaft, wrap metal parts (installed at the rubber boot of center DOJ) with a cloth or rubber material, as shown in the figure. Rubber boot may be damaged due to interference with adjacent metal parts while bending the DOJ during removal.



- 1) Disconnect ground cable from battery.
- 2) Move select lever or gear shift lever to "N".
- 3) Release the parking brake.
- 4) Jack-up vehicle and support it with safety stands.
- 5) Remove center exhaust pipes.
- 6) Remove rear exhaust pipe and muffler.
- 7) Remove heat shield cover.

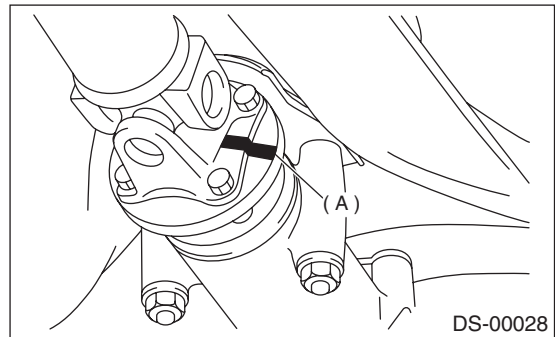


- 8) Put matching marks on propeller shaft and rear differential.

- 9) Remove the four bolts which hold propeller shaft to rear differential.

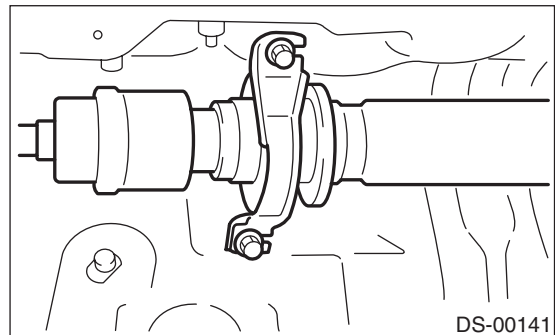
NOTE:

Remove all but one bolt.



(A) Matching mark

- 10) Remove the two bolts which hold center bearing to vehicle body.



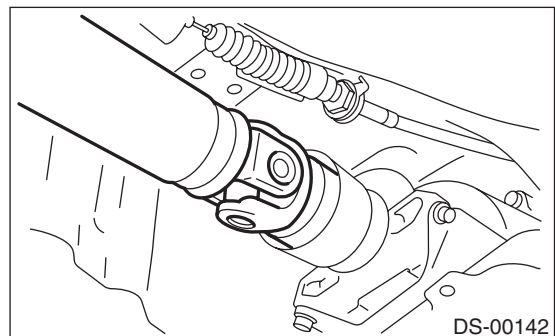
- 11) Remove propeller shaft from transmission.

CAUTION:

Be careful not to damage oil seals and the mating surface of sleeve yoke.

NOTE:

- Be sure to use an empty oil can to catch oil flowing out when removing propeller shaft.
- Be sure to plug the opening in transmission after removal of propeller shaft.



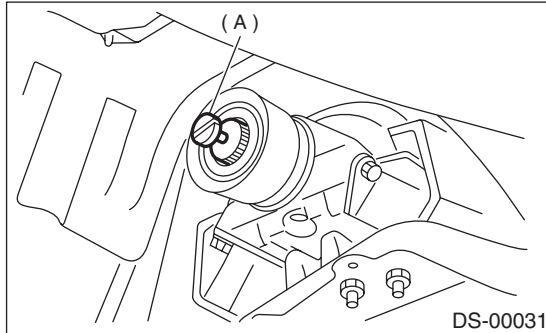
PROPELLER SHAFT

DRIVE SHAFT SYSTEM

12) Install the extension cap to transmission.

NOTE:

If extension cap is not available, cover the opening with a vinyl etc. and hold it with tape or code. Be careful not to spill gear oil or ATF leakage on the floor.



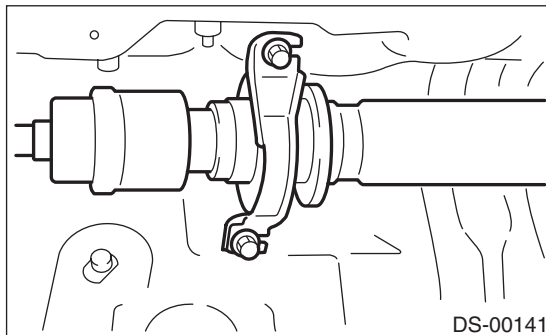
(A) Extension cap

B: INSTALLATION

1) Insert sleeve yoke into transmission and attach center bearing to vehicle body.

Tightening torque:

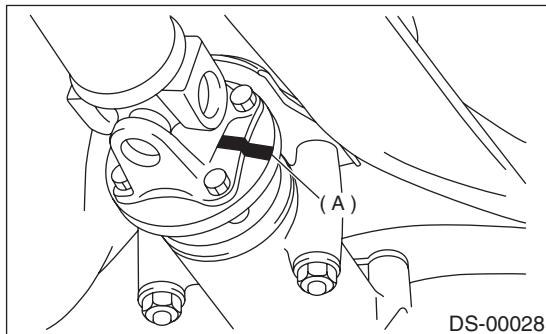
52 N·m (5.3 kgf-m, 38.3 ft-lb)



2) Align matching marks and connect flange yoke and rear differential.

Tightening torque:

31 N·m (3.2 kgf-m, 23.1 ft-lb)



(A) Matching mark

3) Install heat shield cover.

4) Install center exhaust pipes.

5) Install rear exhaust pipe and muffler.

C: INSPECTION

NOTE:

Do not disassemble propeller shaft. Check the following and replace if defective.

- 1) Tube surfaces for dents or cracks
- 2) Splines for deformation or abnormal wear
- 3) Joints for non-smooth operation or abnormal noise
- 4) Center bearing for free play, noise or non-smooth operation
- 5) Oil seals for abnormal wear or damage
- 6) Center bearing for breakage

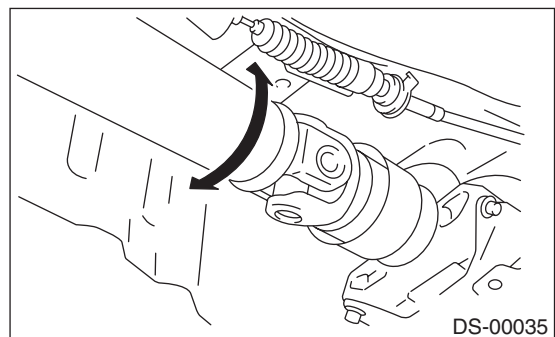
Check the following points with propeller shaft installed in vehicle.

1. JOINTS AND CONNECTIONS

- 1) Remove center exhaust pipes.
- 2) Remove heat shield cover.
- 3) Check for any looseness of yoke flange connecting bolts and center bearing retaining bolts.

2. SPLINES AND BEARING LOCATIONS

- 1) Remove center exhaust pipes.
- 2) Remove rear exhaust pipe and muffler.
- 3) Remove heat shield cover.
- 4) Turn propeller shaft by hand to see if abnormal free play exists at splines. Also move yokes to check if abnormal free play exists at spiders and bearings.



3. RUNOUT OF PROPELLER SHAFT

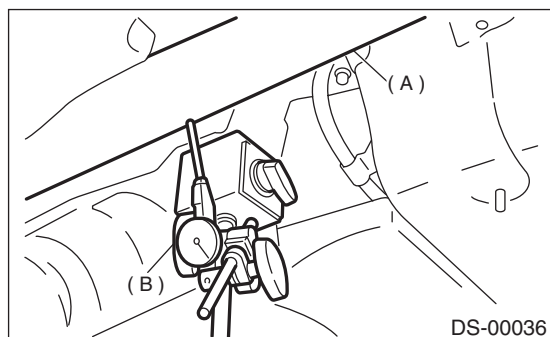
- 1) Remove center exhaust pipes.
- 2) Remove rear exhaust pipe and muffler.
- 3) Remove heat shield cover.
- 4) Turn rear wheels by hand to check for “runout” of propeller shaft.

NOTE:

Measure runout with a dial gauge at the center of front and rear propeller shaft tubes.

Runout:

Limit 0.6 mm (0.024 in)

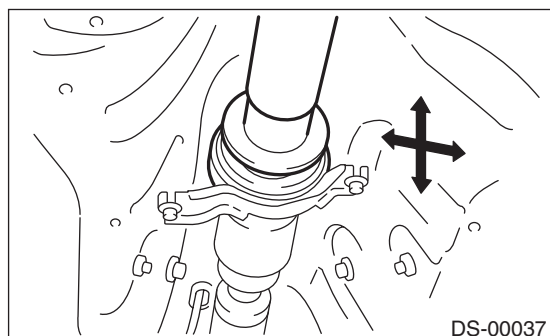


(A) Propeller shaft

(B) Dial gauge

4. CENTER BEARING FREE PLAY

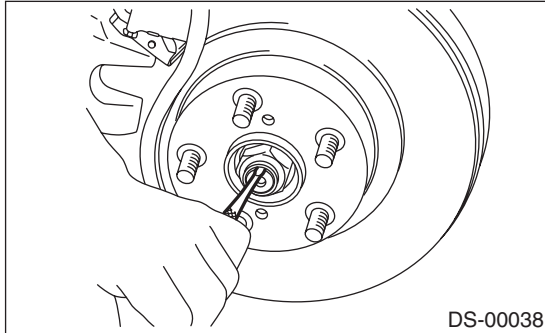
- 1) Remove front and center exhaust pipes.
- 2) Remove rear exhaust pipe and muffler.
- 3) Remove heat shield cover.
- 4) While holding propeller shaft near center bearing with your hand, move it up and down, and left and right to check for any abnormal bearing free play.



3. Front Axle

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Jack-up vehicle, support it with safety stands, and remove front wheels.
- 3) Unlock axle nut.

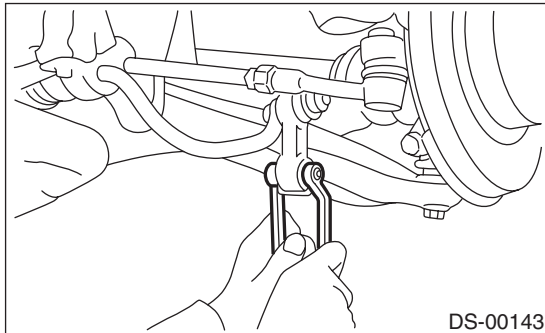


- 4) Remove axle nut while depressing brake pedal to prevent front drive shaft from turning.

CAUTION:

Be sure to loose and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

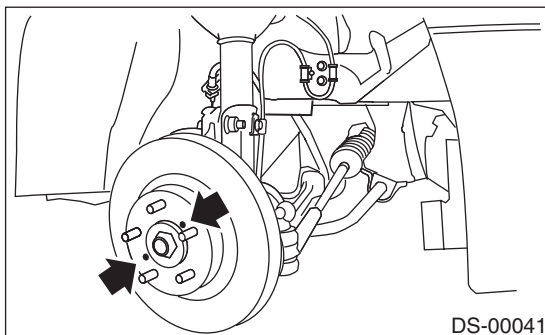
- 5) Remove stabilizer link.



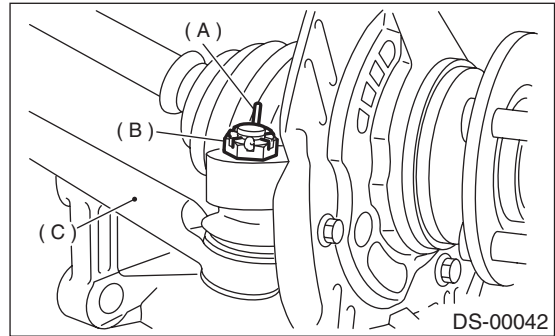
- 6) Remove disc brake caliper from housing, and suspend it from strut using a wire.

- 7) Remove disc rotor from hub.

If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in screw hole on the rotor.

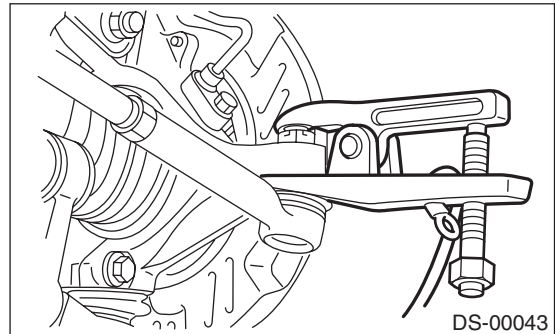


- 8) Remove cotter pin and castle nut which secure tie-rod end to housing knuckle arm.

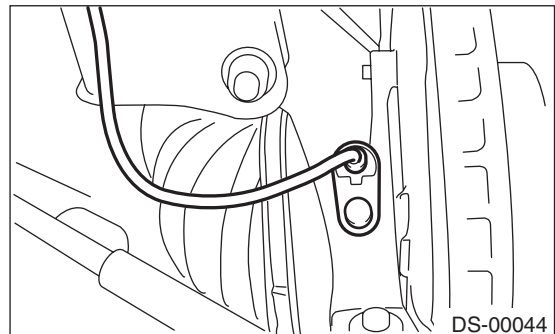


- (A) Cotter pin
- (B) Castle nut
- (C) Tie-rod

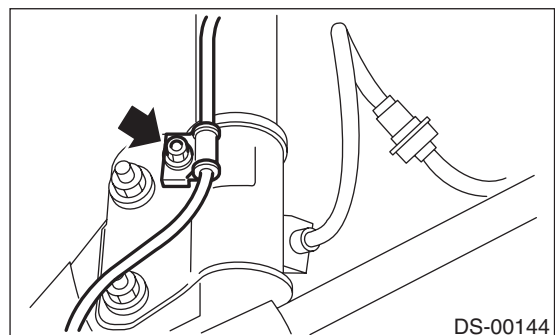
- 9) Using a puller, remove tie-rod ball joint from knuckle arm.



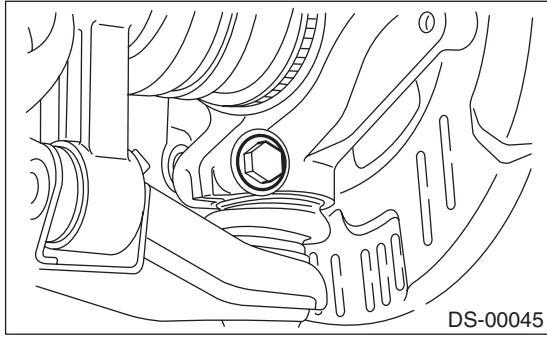
- 10) Remove ABS sensor assembly and harness.



- 11) Remove bolt which secures sensor harness to strut.



12) Remove transverse link ball joint from housing.



13) Remove inner joint from transmission spindle.

CAUTION:

Do not pull inner joint when removing front drive shaft.

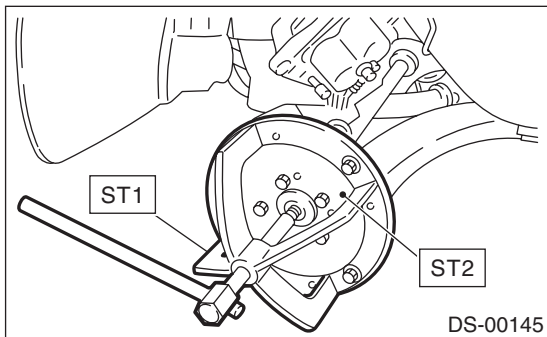
14) Remove front drive shaft assembly from hub. If it is hard to remove, use STs.

ST1 926470000 AXLE SHAFT PULLER

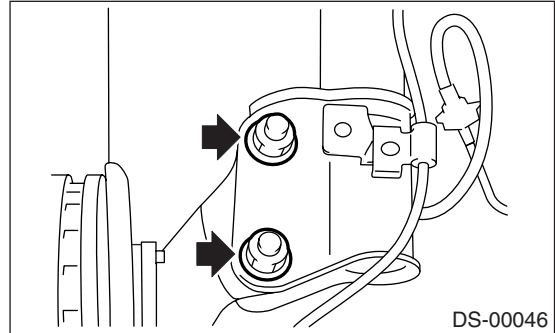
ST2 927140000 PLATE

CAUTION:

- Be careful not to damage oil seal lip and tone wheel when removing front drive shaft.
- If front drive shaft is removed, replace inner oil seal with new one.



15) After scribing an alignment mark on camber adjusting bolt head, remove bolts which connect housing and strut, and disconnect housing from strut.



B: INSTALLATION

1) While aligning alignment mark on camber adjusting bolt head, connect housing and strut.

CAUTION:

When self-locking nut is removed, replace it with new one.

Tightening torque:

177 N·m (18.0 kgf-m, 130 ft-lb)

2) Install front drive shaft. <Ref. to DS-30, INSTALLATION, Front Drive Shaft.>

3) Install transverse link ball joint to housing.

Tightening torque:

49 N·m (5.0 kgf-m, 36 ft-lb)

4) Install ABS sensor harness on strut.

5) Install ABS sensor on housing.

Tightening torque:

32 N·m (3.3 kgf-m, 23.9 ft-lb)

6) Install disc rotor on hub.

7) Install disc brake caliper on housing.

Tightening torque:

78 N·m (8 kgf-m, 57.9 ft-lb)

8) Connect stabilizer link.

9) Install tie-rod end.

Tightening torque:

27.0 N·m (2.75 kgf-m, 19.9 ft-lb)

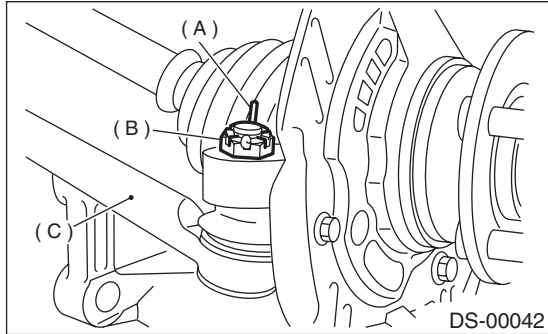
CAUTION:

Do not hammer the bottom of tie-rod end when installing it.

FRONT AXLE

DRIVE SHAFT SYSTEM

10) After tightening castle nut to specified torque, retighten it further within 60° until a slot in castle nut is aligned with the ball joint hole. Insert cotter pin, and then bend the cotter pin around castle nut to secure it.



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

11) While depressing brake pedal to prevent front drive shaft from turning, tighten axle nut to specified torque.

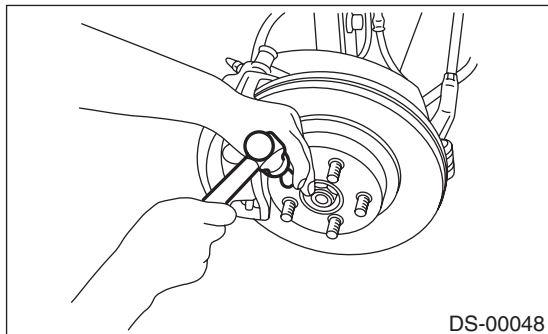
Tightening torque:

220 N·m (22 kgf·m, 162 ft-lb)

CAUTION:

- When axle nut is removed, replace it with new one.
- Always tighten axle nut before installing wheel on vehicle.
- Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

12) After tightening axle nut, lock it securely.



13) Install wheel and tighten wheel nuts to specified torque.

Tightening torque:

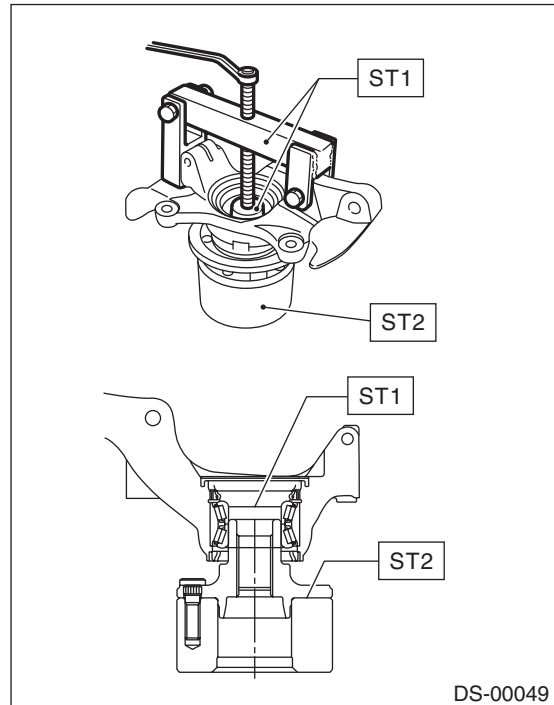
110 N·m (11.2 kgf·m, 81.0 ft-lb)

C: DISASSEMBLY

- 1) Using ST1, support housing and hub securely.
- 2) Attach ST2 to housing and drive hub out.

ST1 927060000 HUB REMOVER

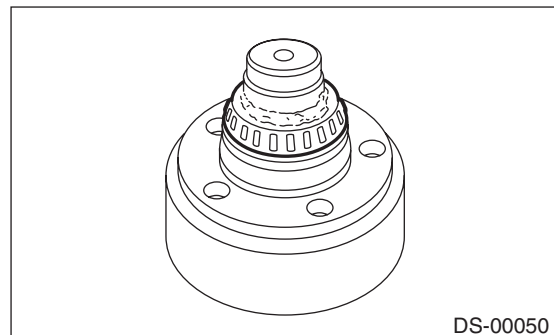
ST2 927080000 HUB STAND



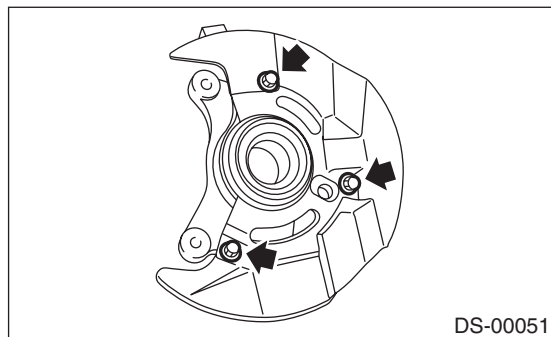
If inner bearing race remains in the hub, remove it with a suitable tool (commercially available).

CAUTION:

- Be careful not to scratch polished area of hub.
- Be sure to install inner race on the side of outer race from which it was removed.
- Replace the removed hub with new one.



3) Remove disc cover from housing.

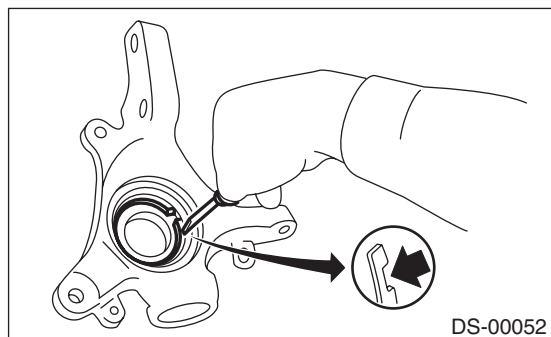


4) Using a screwdriver, remove outer and inner oil seals.

CAUTION:

Replace the removed oil seal with new one.

5) Using flat-bladed screwdriver, remove snap ring.



6) Using ST1, support housing securely.

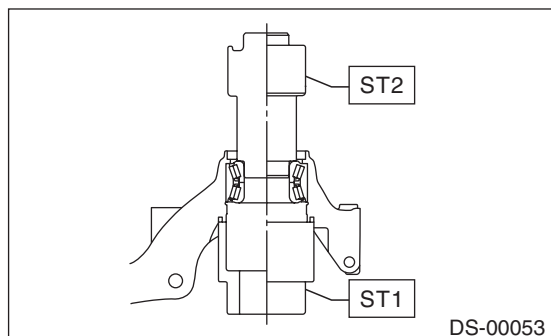
7) Using ST2, press inner race to drive out outer bearing.

ST1 927400000 HOUSING STAND

ST2 927100000 BEARING REMOVER

CAUTION:

- Do not remove outer race unless it is faulty.
- Replace the removed outer race with new one.
- Do not replace inner or outer race separately; always replace as a unit.

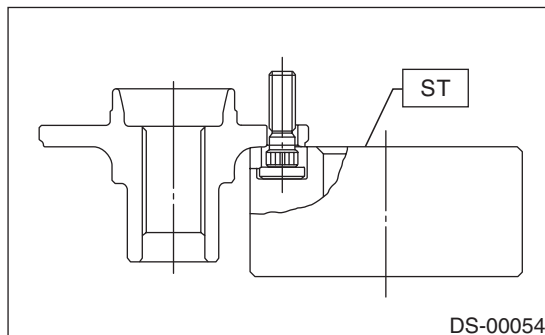


8) Using ST and a hydraulic press, drive hub bolts out.

ST 927080000 HUB STAND

CAUTION:

Be careful not to hammer hub bolts. This may deform hub.



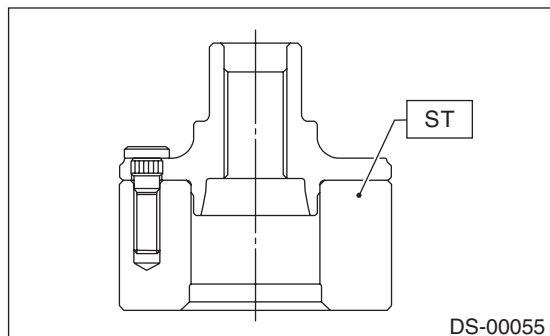
FRONT AXLE

DRIVE SHAFT SYSTEM

D: ASSEMBLY

1) Attach hub to ST securely.

ST 927080000 HUB STAND



2) Using a hydraulic press, press new hub bolts into place.

CAUTION:

Be sure to press hub bolts until their seating surfaces contact the hub.

NOTE:

Use 12 mm (0.47 in) dia. holes in HUB STAND to prevent bolts from tilting.

3) Clean dust or foreign particles from inside the housing.

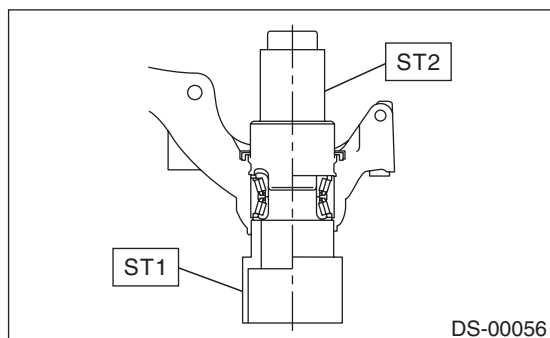
4) Using ST1 and ST2, press a new bearing into place.

ST1 927400000 HOUSING STAND

ST2 927100000 BEARING REMOVER

CAUTION:

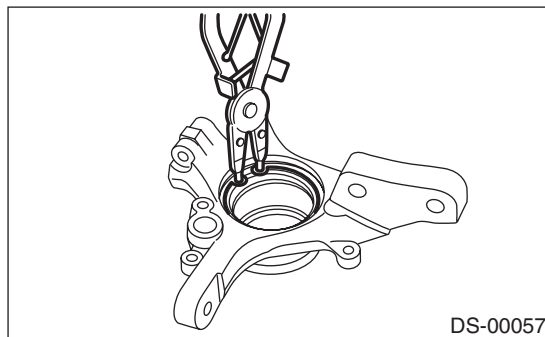
- Always press outer race when installing bearing.
- Be careful not to remove plastic lock from inner race when installing bearing.



5) Using snap ring pliers, install snap ring in its groove.

CAUTION:

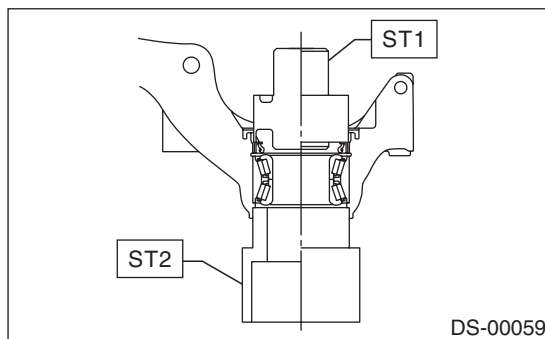
Make sure to install it firmly to groove.



6) Using ST1 and ST2, press inner oil seal until it contacts circlip.

ST1 927410000 OIL SEAL INSTALLER

ST2 927400000 HOUSING STAND



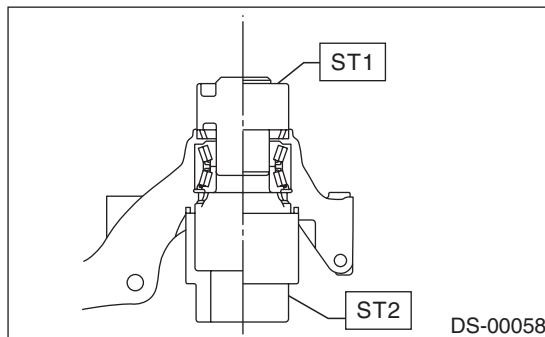
7) Invert ST and housing.

ST 927400000 HOUSING STAND

8) Using ST1 and ST2, press outer oil seal until it contacts the bottom of housing.

ST1 927410000 OIL SEAL INSTALLER

ST2 927400000 HOUSING STAND



9) Apply sufficient grease to oil seal lip portion.

Specified grease
SHELL 6459N

CAUTION:

- If specified grease is not available, remove bearing grease and apply Auto Rex A instead.
- Do not mix different types of grease.

10) Install disc cover to housing the three bolts.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

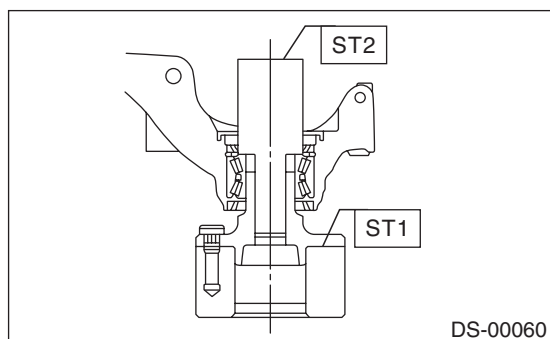
11) Attach hub to ST1 securely.

12) Clean dust or foreign particles from the polished surface of hub.

13) Using ST2, press bearing into hub by driving inner race.

ST1 927080000 HUB STAND

ST2 927120000 HUB INSTALLER



E: INSPECTION

When hub is removed, replace bearing with new one.

CAUTION:

- If bearing is faulty, replace it as a set with new bearing set.
- Replace the removed oil seal with new one.

4. Hub Unit Bearing

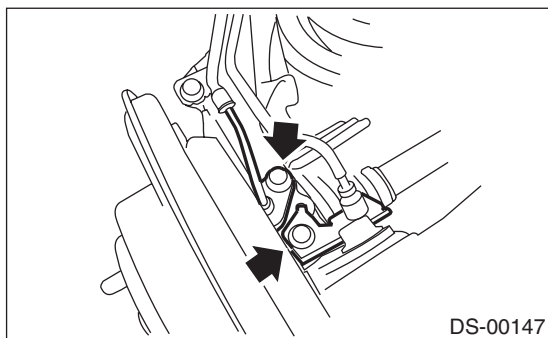
A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Jack-up vehicle, and remove rear wheel while supporting with safety stands.

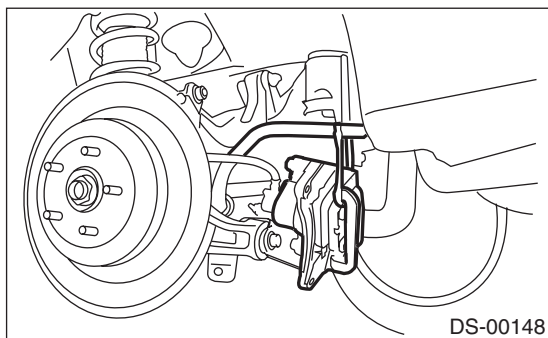
CAUTION:

Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

- 3) Unlock axle nut.
- 4) Remove axle nut while depressing brake pedal to prevent front drive shaft from turning.
- 5) Return parking brake lever.
- 6) Remove ABS sensor.



- 7) Remove brake caliper from back plate and suspend it from stabilizer using a piece of wire.

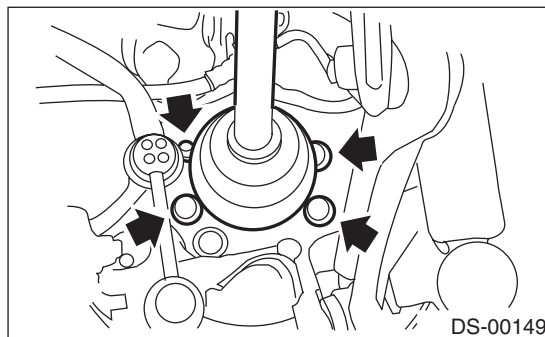


- 8) Remove disc rotor from hub.

NOTE:

- Mark matching marks on hub and disc rotor, before removing.
- If disc rotor seizes up within hub, drive it out by installing an 8 mm bolt into disc rotor bolt hole.

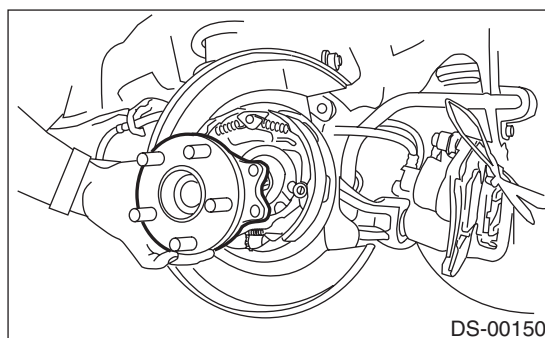
- 9) Remove four bolts from rear arm.



- 10) Remove hub unit bearing.

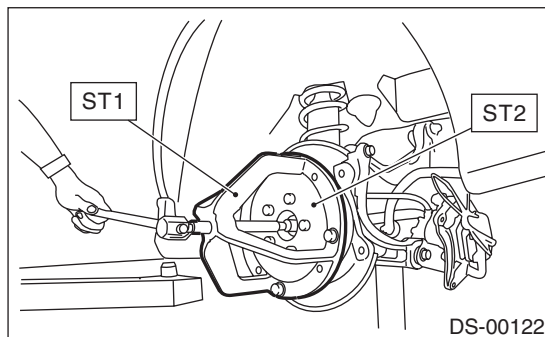
CAUTION:

Be careful not to damage tone wheel.



If it is hard to remove, use STs.

- | | | |
|-----|-----------|-------------------|
| ST1 | 926470000 | AXLE SHAFT PULLER |
| ST2 | 927140000 | PLATE |

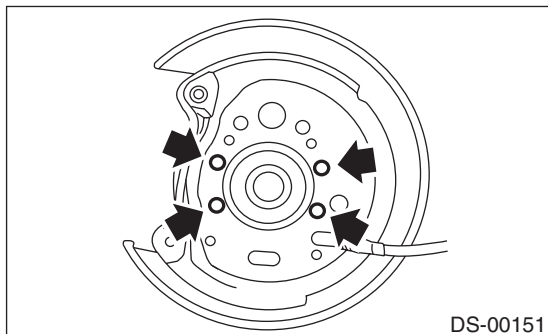


B: INSTALLATION

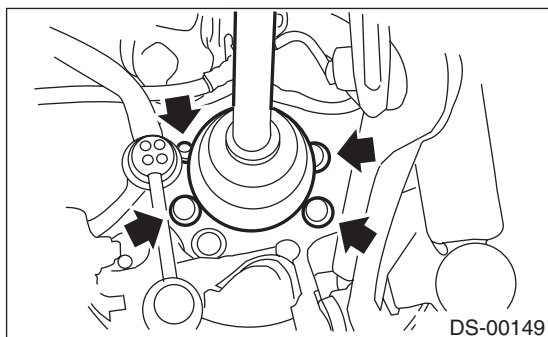
1) Align hub unit bearing with back plate at mounting holes and install hub unit assembly and back plate. Temporarily tighten axle nuts.

CAUTION:

Be careful not to damage tone wheel.



2) Tighten four bolts to back plate.

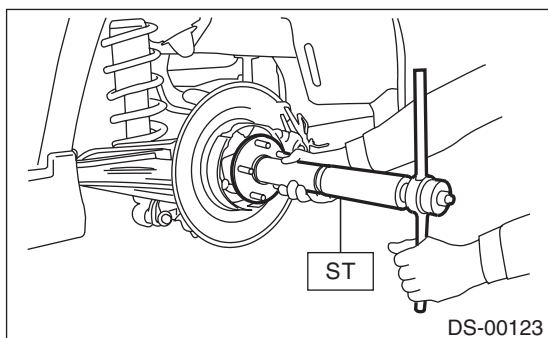


3) Remove axle nut.

4) Using ST1 and ST2, pull axle shaft into place.

ST1 922431000 AXLE SHAFT INSTALLER

ST2 927390000 ADAPTER



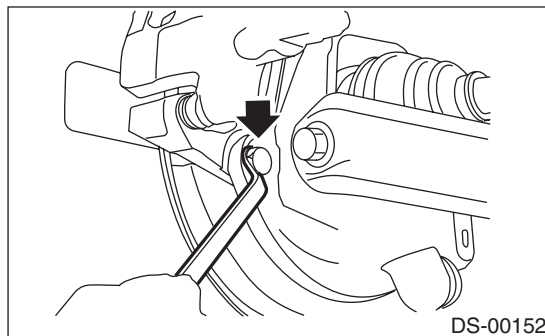
5) Temporarily tighten axle nuts.

6) Install disc rotor on hub.

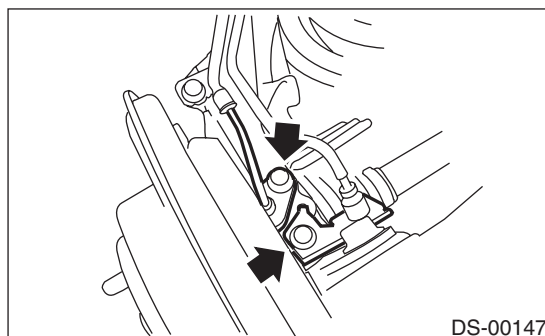
7) Install disc brake caliper on back plate.

Tightening torque:

52 N·m (5.3 kgf-m, 38.3 ft-lb)



8) Install rear ABS sensor and brake cable bracket.



9) Adjust parking brake lever stroke by turning adjuster. <Ref. to PB-5, ADJUSTMENT, Parking Brake Lever.>

HUB UNIT BEARING

DRIVE SHAFT SYSTEM

10) Move brake lever back to apply brakes. While depressing brake pedal to prevent axle shaft from turning, tighten axle nut.

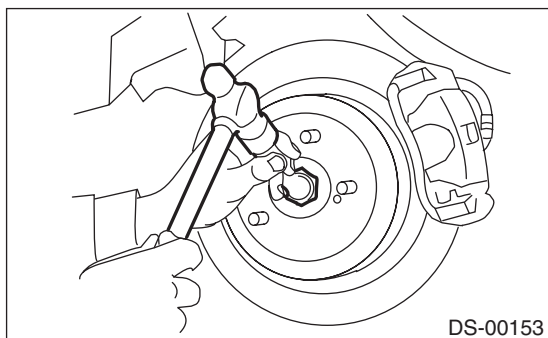
11) Securely lock axle nut after tightening.

Tightening torque:

240 N·m (24.5 kgf-m, 177.2 ft-lb)

CAUTION:

- Replace the removed axle nuts with new one. Use an axle nut for rear use only (Olive color).
- Always tighten axle nut before installing wheel on vehicle.
- Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.



12) Install rear wheel and tighten wheel nuts to specified torque.

Tightening torque:

110 N·m (11.2 kgf-m, 81.0 ft-lb)

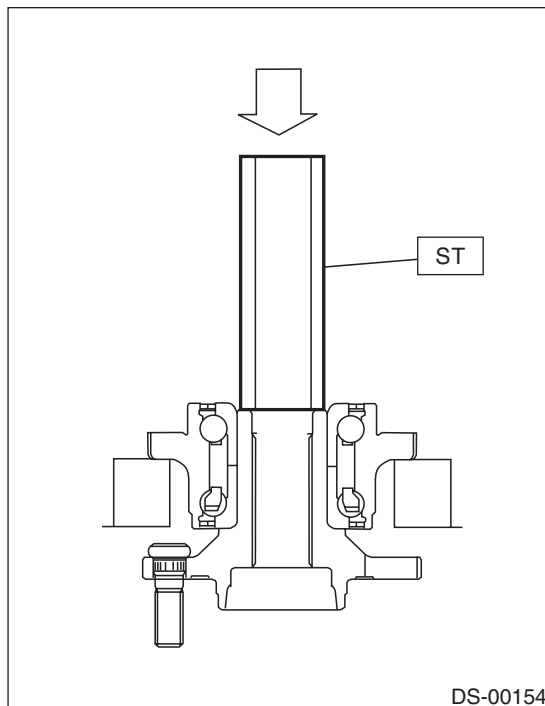
C: DISASSEMBLY

1) Using ST, remove hub unit from hub assembly.

CAUTION:

Securely set hub assembly so that it does not lean.

ST 398507703 DUMMY COLLAR



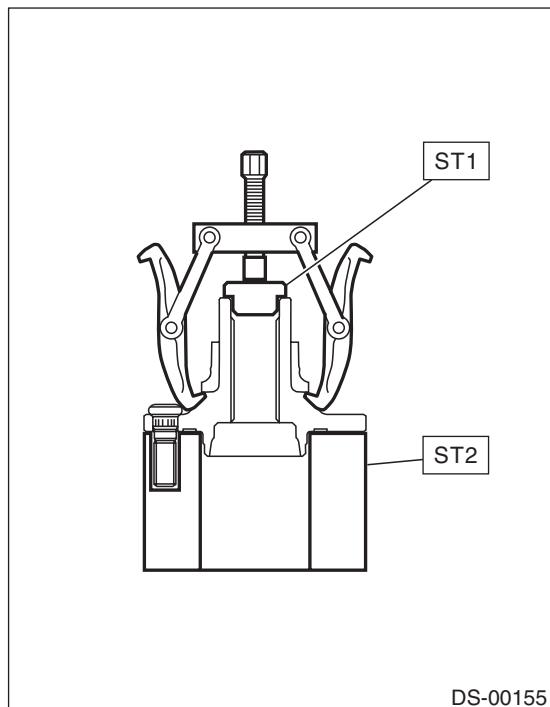
2) Using ST and a puller (common hand tool), remove bearing inner race.

ST1 399520105 SEAT

ST2 927080000 HUB STAND

CAUTION:

- Do not remove hub unit bearing unless damaged.
- Replace the removed hub unit bearing with new one.

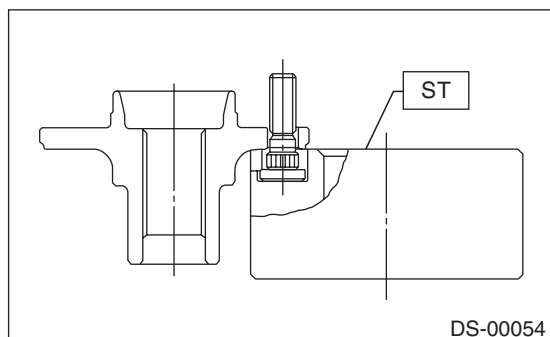


3) Using ST, press hub bolt out.

ST 927080000 HUB STAND

CAUTION:

Be careful not to hammer hub bolts. This may deform hub.



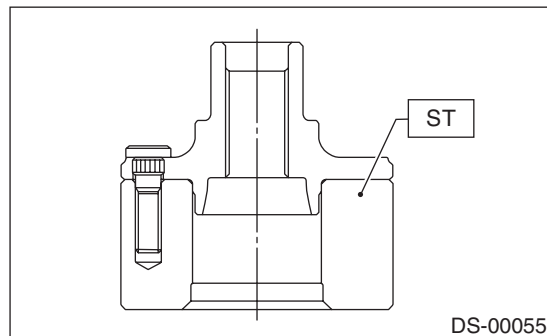
D: ASSEMBLY

1) Using ST, press new hub bolt into place.

CAUTION:

- Be sure to press hub bolt until their seating surfaces contact the hub.
- Using a 12 mm (0.47 in) hole in the ST, be careful not to tilt hub bolt during installation.

ST 927080000 HUB STAND

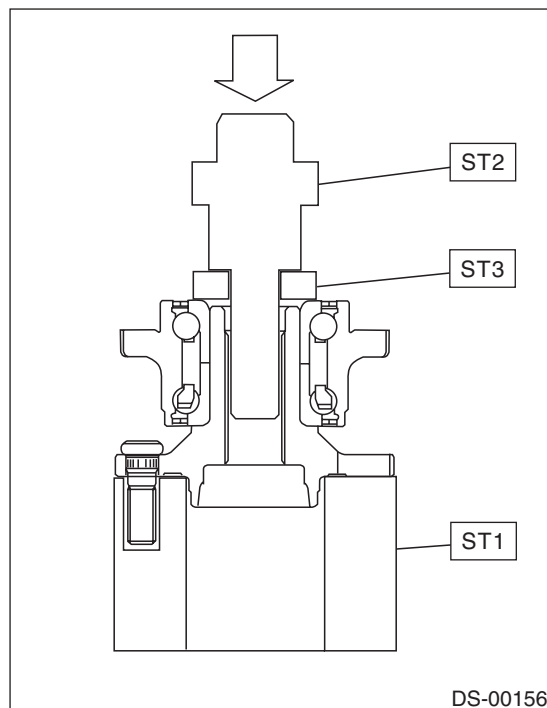


2) Using ST1, ST2 and ST3, press hub unit bearing into hub.

ST1 927080000 HUB STAND

ST2 927450000 HUB INSTALLER

ST3 28499AE000 SPACER



CAUTION:

- Always press inner race when installing hub unit bearing.
- Replace the removed hub unit bearing with new one.

E: INSPECTION

Check the removed parts for wear and damage. If defective, replace with new ones.

CAUTION:

If a bearing is faulty, replace bearing and races as a set with new ones.

5. Front Drive Shaft

A: REMOVAL

1. NON-TURBO MODEL

- 1) Disconnect ground cable from battery.
- 2) Jack-up vehicle, and remove front wheel while supporting with safety stands.
- 3) Unlock axle nut.
- 4) Depress brake pedal to prevent front drive shaft from turning and remove axle nut.

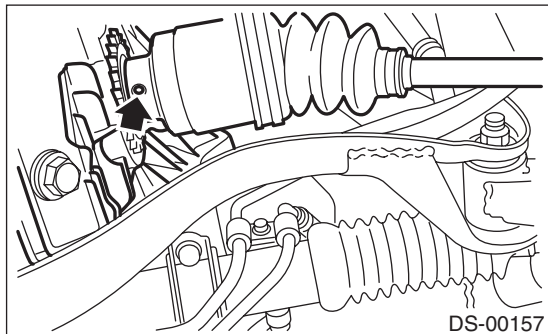
CAUTION:

Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

- 5) Remove stabilizer link from transverse link.
- 6) Disconnect transverse link from housing.
- 7) Remove spring pin which secures transmission spindle to inner joint.

CAUTION:

When drive shaft is removed, replace spring pin with new one.



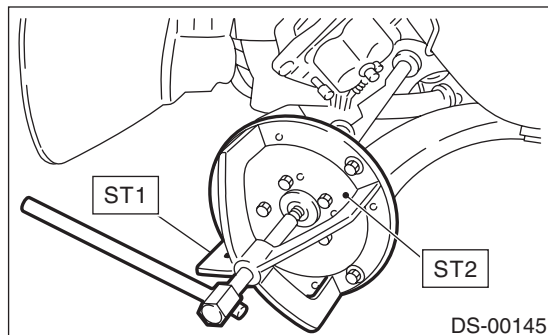
- 8) Remove front drive shaft assembly. If it is hard to remove, use ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER

ST2 927140000 PLATE

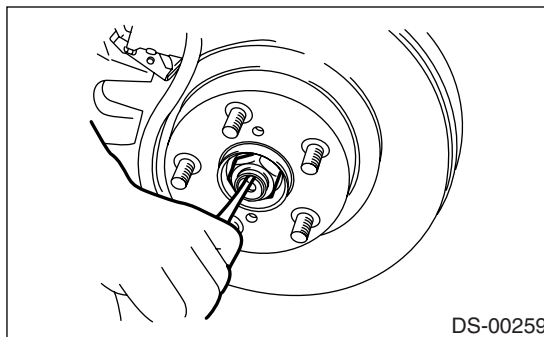
CAUTION:

- Be careful not to damage oil seal lip and tone wheel when removing front drive shaft.
- When front drive shaft is removed, also replace inner oil seal with new one.



2. TURBO-MODEL

- 1) Lift-up the vehicle, and then remove the front wheels while supporting with safety stands.
- 2) Drain the transmission oil.
- 3) Unlock the axle nut.

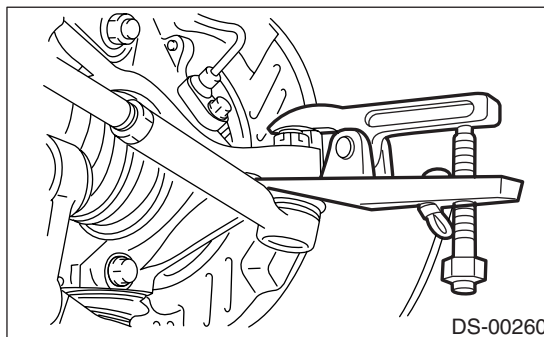


- 4) Remove the axle nut with brake pedal depressed to prevent front drive shaft from turning.

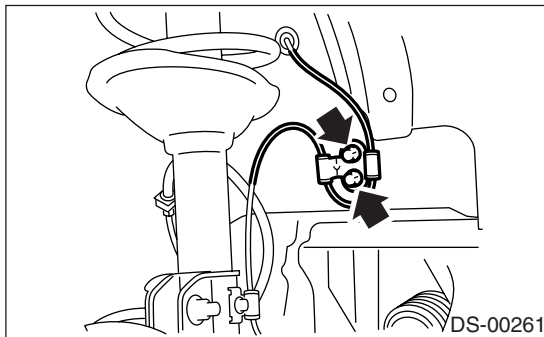
CAUTION:

Remove the axle nut with vehicle weight not applied on axle.

- 5) Remove the cotter pin and castle nut. Remove the tie-rod end using a puller.



- 6) Remove the ABS sensor bracket.

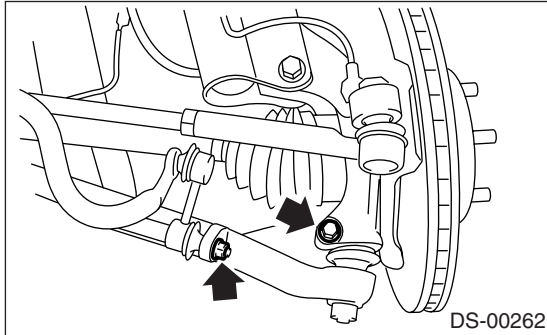


- 7) Remove the front stabilizer link from transverse link.

FRONT DRIVE SHAFT

DRIVE SHAFT SYSTEM

8) Remove the bolt securing ball joint, and then remove the transverse link from front housing.

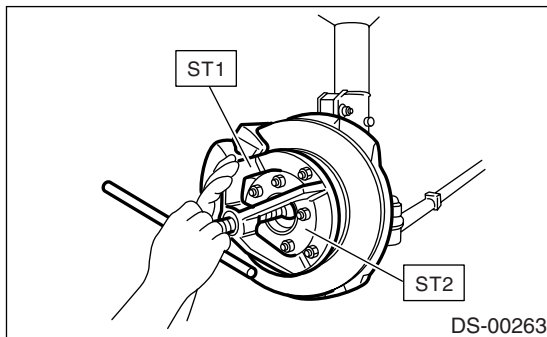


9) Remove the front drive shaft from front axle. If it is hard to remove, remove the brake disk rotor using the ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 AXLE SHAFT PULLER
PLATE

CAUTION:

- Do not pull inner joint when removing front drive shaft.
- Do not hammer the drive shaft when removing.
- Be careful not damage the oil seal and tone wheel.



10) Remove the front drive shaft from transmission using a claw bar.

CAUTION:

Be careful not to damage the holder area with a claw bar.

B: INSTALLATION

1. NON-TURBO MODEL

1) Insert outer joint into hub splines.

CAUTION:

Be careful not to damage inner oil seal lip and tone wheel.

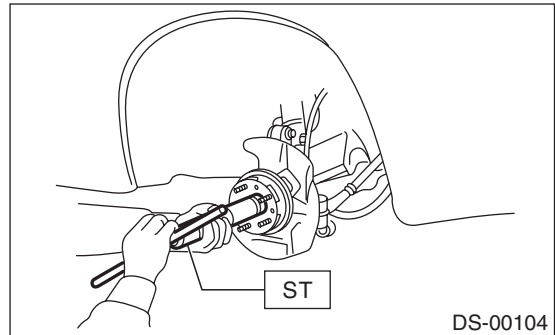
2) Using ST1 and ST2, pull drive shaft into place.

ST1 922431000 AXLE SHAFT INSTALLER

ST2 927390000 ADAPTER

CAUTION:

Do not hammer drive shaft when installing it.

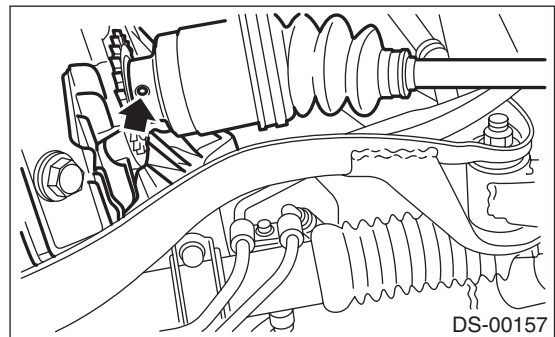


3) Tighten axle nut temporarily.

4) Install inner joint on transmission spindle and drive spring pin into place.

CAUTION:

When front drive shaft is removed, replace spring pin with new one.



5) Connect transverse link to housing.

Tightening torque (self-locking nut):

49 N·m (5.0 kgf-m, 36 ft-lb)

CAUTION:

Replace the removed self-locking nut with new one.

6) Install stabilizer bracket.

7) While depressing brake pedal to prevent front drive shaft from turning, tighten axle nut.

Tightening torque:

220 N·m (22 kgf-m, 162 ft-lb)

CAUTION:

- Replace the removed axle nut with new one.
- Always tighten axle nut before installing wheel on vehicle.
- Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

8) After tightening axle nut, lock it securely.

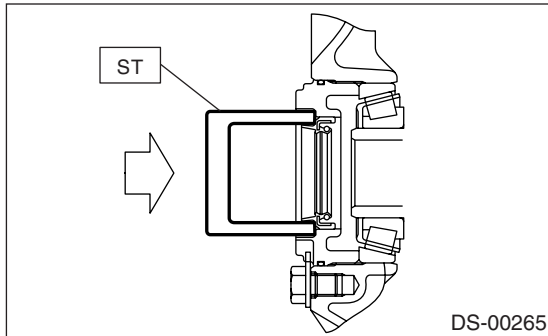
2. TURBO MODEL

1) Using the ST, replace the differential side retainer oil seal with a new one.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

CAUTION:

Be sure to replace the oil seal with a new one when removing drive shaft.

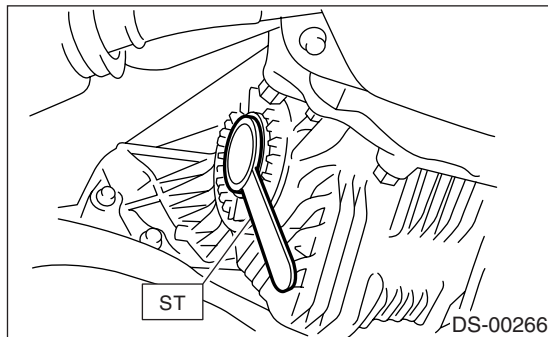


2) Insert the front drive shaft into front axle.

3) Temporarily tighten the axle nut.

4) Install the front drive shaft to transmission using ST.

ST 28399SA010 OIL SEAL PROTECTOR



5) Install the ball joint to front axle.

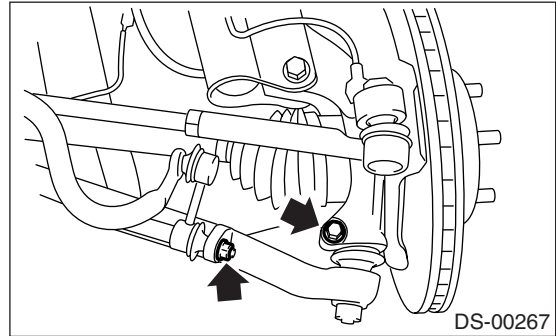
Tightening torque (self-locking nut):

50 N·m (5.1 kgf-m, 37 ft-lb)

6) Install the stabilizer link.

Tightening torque (self-locking nut):

45 N·m (4.6 kgf-m, 33 ft-lb)



7) Install the tie-rod end.

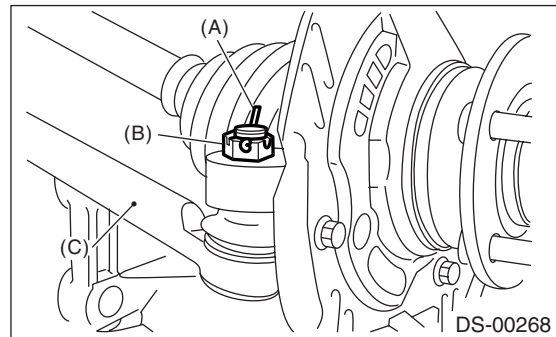
Tightening torque (self-locking nut):

27.0 N·m (2.75 kgf-m, 19.9 ft-lb)

CAUTION:

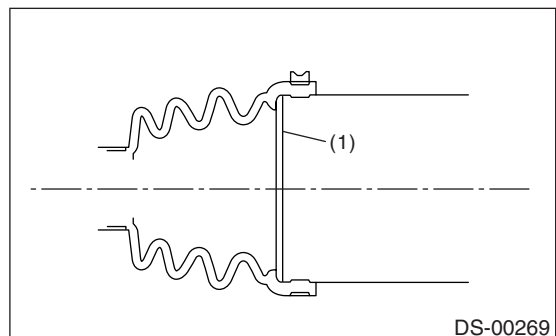
When installing, do not hit the bottom of tie-rod with hammer.

8) Tighten the castle nut to the specified torque and tighten further within 60° until pin hole is aligned with the slot in nut. Bend the cotter pin to lock.



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

9) Make sure the inner joint retainer is in proper position.



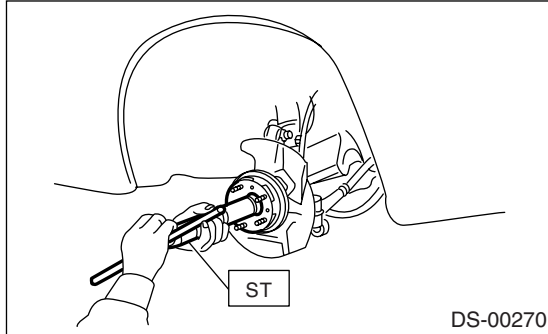
- (1) Retainer

FRONT DRIVE SHAFT

DRIVE SHAFT SYSTEM

10) Using the ST1 and ST2, pull the front drive shaft into place.

ST1 922431000 AXLE SHAFT INSTALLER
ST2 927390000 ADAPTER

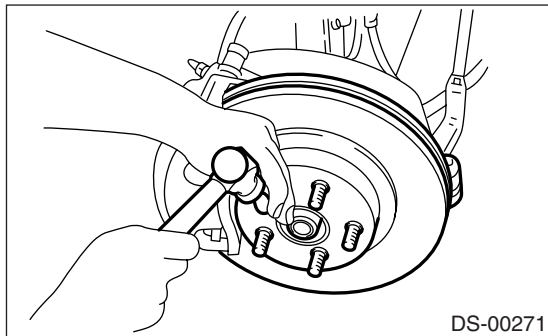


11) Tighten a new axle nut with brake pedal depressed to prevent front drive shaft from turning.

Tightening torque:

220 N·m (22 kgf-m, 162 ft-lb)

12) Tighten the axle nut and lock securely.



13) Install the ABS sensor bracket.

Tightening torque:

32 N·m (3.3 kgf-m, 24 ft-lb)

14) Add the transmission oil.

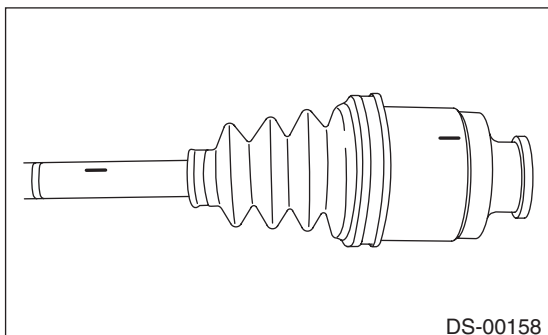
15) Install the front wheel and tighten wheel nut to the specified torque.

Tightening torque:

110 N·m (11.2 kgf-m, 81.0 ft-lb)

C: DISASSEMBLY

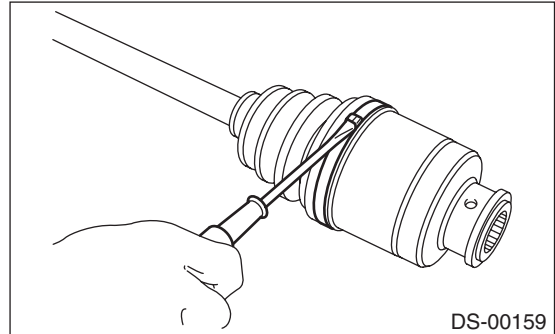
1) Place alignment marks on shaft and outer race.



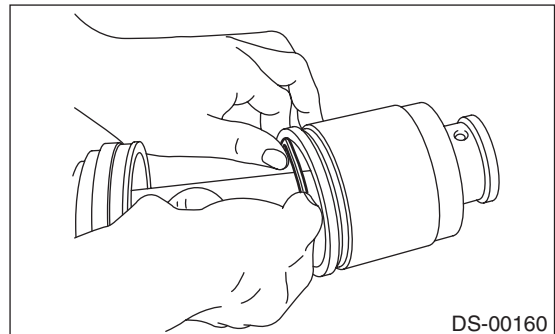
2) Remove inner joint boot band and boot.

CAUTION:

Be careful not to damage boot.



3) Remove circlip from inner joint outer race using screwdriver.



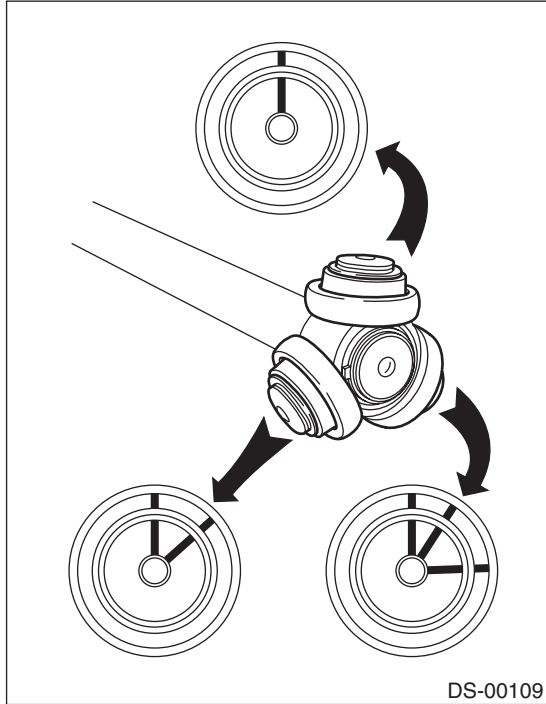
4) Remove inner joint outer race from shaft assembly.

5) Wipe off grease.

CAUTION:

The grease is a special grease. Do not confuse with other greases.

6) Place alignment mark on free ring and trunnion.

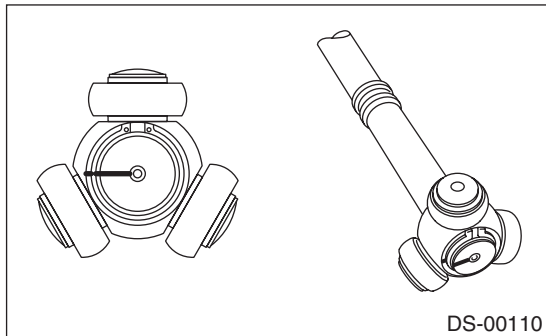


7) Remove free ring from trunnion.

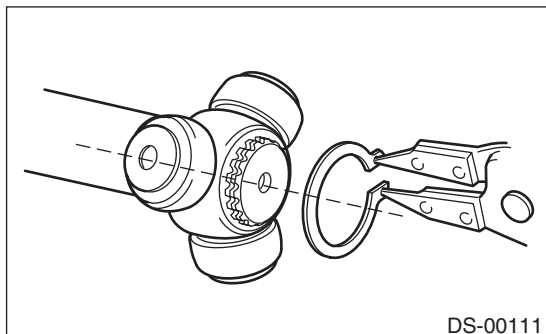
CAUTION:

Be careful with the free ring position.

8) Place alignment mark on trunnion and shaft.



9) Remove snap ring and trunnion.



CAUTION:

Be careful not to damage boot by wrapping shaft splines with vinyl tape.

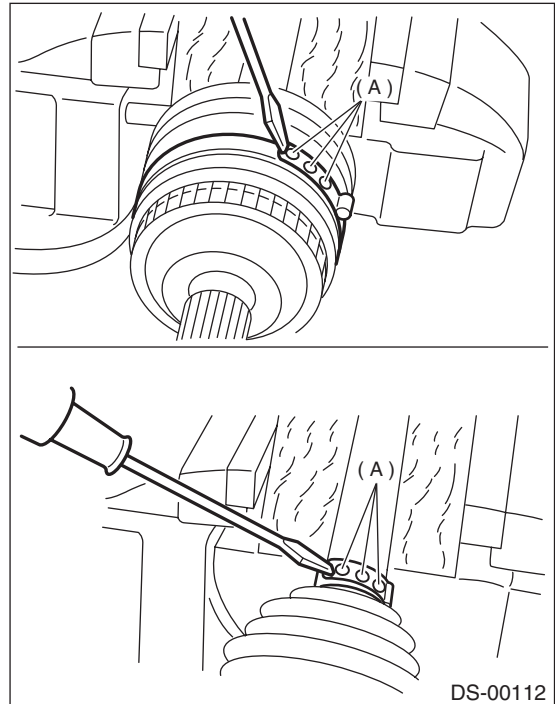
10) Remove inner joint boot.

11) Place drive shaft in a vise between wooden blocks.

CAUTION:

Do not place drive shaft directly in the vise; use wooden block.

12) Raise boot band claws by means of screwdriver and hammer.

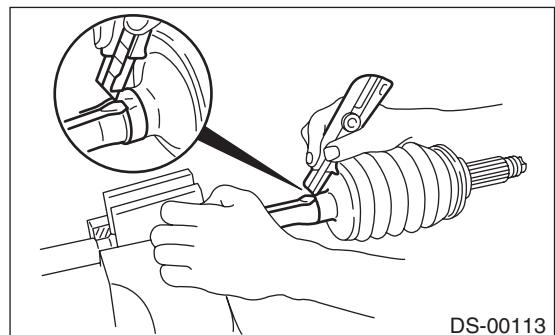


(A) Boot band claws

13) Cut and remove the boot.

CAUTION:

Replace the removed boot with a new one.



14) Thus, disassembly of axle is completed, but outer joint cannot be disassembled.

FRONT DRIVE SHAFT

DRIVE SHAFT SYSTEM

D: ASSEMBLY

CAUTION:

Use specified grease.

BJ side (Non-TURBO MT model, outside):
NTG2218-M (Part No. 28395AG030)

SFJ side (Non-TURBO MT model, inside):
NKG302 (Part No. 28495AE010)

AC side (Non-TURBO AT and TURBO model, outside):
Non-disassemble

AAR side (Non-TURBO AT and TURBO model, inside):
One luber C (Part No. 28395SA000)

1) Place outer joint boot and small boot band on outer joint side of shaft.

CAUTION:

Be careful not to damaged boot by wrapping shaft splines with vinyl tape.

2) Place drive shaft in a vise.

CAUTION:

Do not place drive shaft directly in the vise; use wooden blocks.

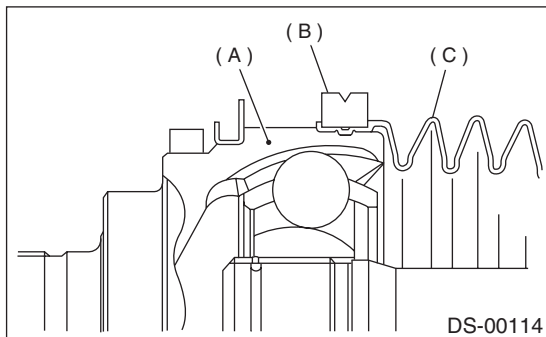
3) Apply a coat of specified grease [60 to 70 g (2.12 to 2.47 oz)] to outer joint.

4) Apply an even coat of specified grease [20 to 30 g (0.71 to 1.06 oz)] to the entire inner surface of boot. Also apply grease to shaft.

NOTE:

The inside of the larger end of outer joint boot and the boot groove shall be cleaned so as to be free from grease and other substances.

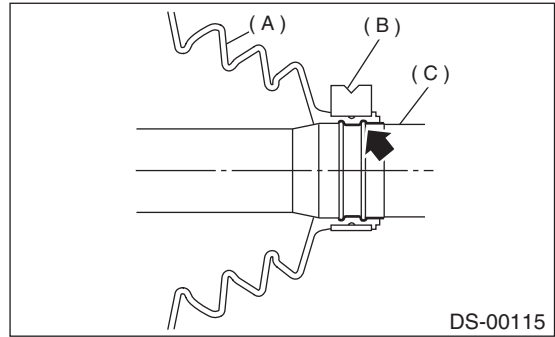
5) Install boot projecting portion to outer joint groove.



- (A) Outer joint
- (B) Large boot band
- (C) Boot

6) Set large boot band in place.

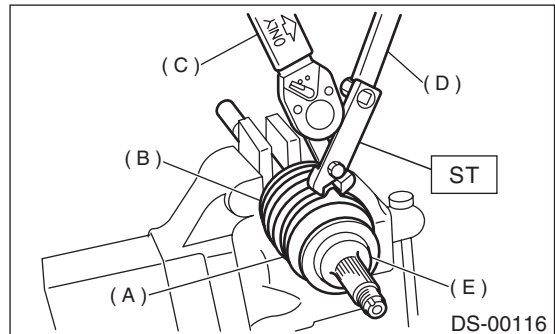
7) Install boot projecting portion to shaft groove.



- (A) Boot
- (B) Small boot band
- (C) Shaft

8) Tighten boot bands using ST, torque wrench and socket flex handle.

ST 28099AC000 BOOT BAND PLIER



- (A) Large boot band
- (B) Boot
- (C) Torque wrench
- (D) Socket flex handle
- (E) Outer joint

Tightening torque:

Large boot band

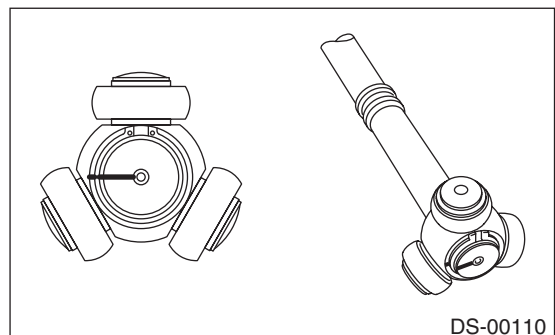
157 N·m (16.0 kgf-m, 116 ft-lb) or more

Small boot band

133 N·m (13.6 kgf-m, 98 ft-lb) or more

9) Place inner joint boot at the center of shaft.

10) Align alignment marks and install trunnion on shaft.



11) Install snap ring to shaft.

CAUTION:

Confirm that the snap ring is completely fitted in the shaft groove.

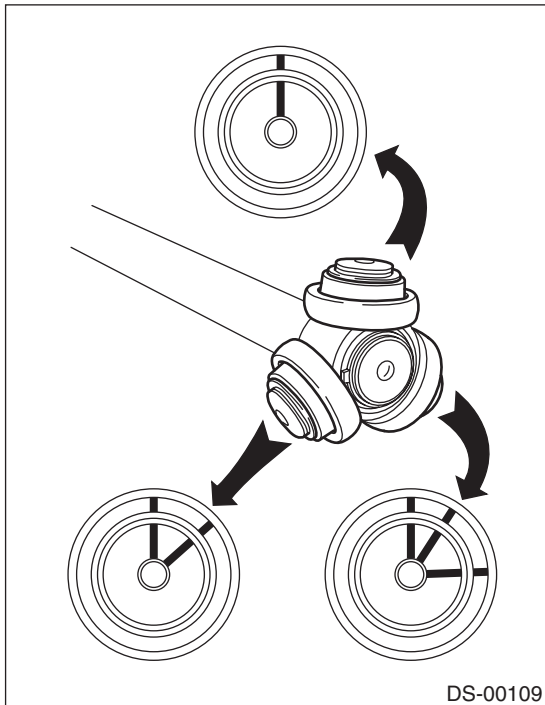
12) Fill 100 to 110 g (3.53 to 3.88 oz) of specified grease into the interior of inner joint outer race.

13) Apply a coat of specified grease to free ring and trunnion.

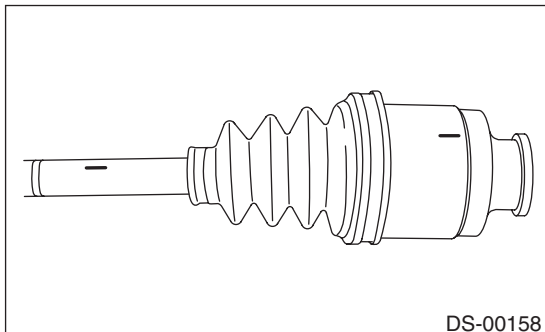
14) Align alignment marks on free ring and trunnion and install free ring.

CAUTION:

Be careful with the free ring position.



15) Align alignment marks on shaft and outer race, and install outer race.



16) Install circlip in the groove on inner joint outer race.

CAUTION:

Pull the shaft lightly and assure that the circlip is completely fitted in the groove.

17) Apply an even coat of the specified grease 30 to 40 g (1.06 to 1.41 oz) to the entire inner surface of boot.

18) Install inner joint boot taking care not to twist it.

CAUTION:

• **The inside of the larger end of inner joint boot and the boot groove shall be cleaned so as to be free from grease and other substances.**

• **When installing inner joint boot, position outer race of inner joint at center of its travel.**

19) Put a band through the clip and wind twice in alignment with band groove of boot.

CAUTION:

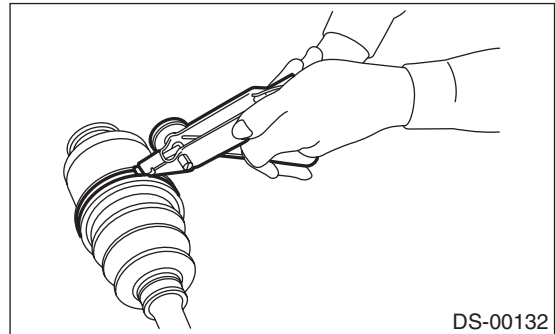
Replace the removed boot band with a new one.

20) Tighten band by using ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tighten band until it cannot be moved by hand.

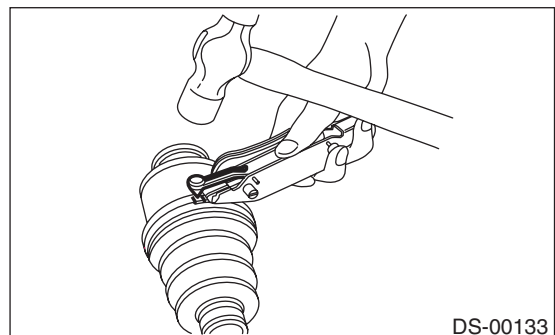


21) Tap on the clip with the punch provided at the end of ST.

ST 925091000 BAND TIGHTENING TOOL

CAUTION:

Tap to an extent that the boot underneath is not damaged.



FRONT DRIVE SHAFT

DRIVE SHAFT SYSTEM

22) Cut off band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

CAUTION:

Bend the band so that its end is in close contact with clip.

23) Fix up boot on outer joint in the same manner.

24) Extend and retract inner joint to provide equal grease coating.

E: INSPECTION

Check the removed parts for damage, wear, corrosion etc. If faulty, repair or replace.

1) Inner joint

Check seizure, corrosion, damage, wear and excessive play.

2) Outer joint

Check seizure, corrosion, damage and excessive play.

3) Shaft

Check excessive bending, twisting, damage and wear.

4) Boot

Check for wear, warping, breakage or scratches.

5) Grease

Check for discoloration or dilution.

6. Rear Drive Shaft

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Jack-up vehicle, support it with safety stands, and remove rear wheels.

CAUTION:

Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

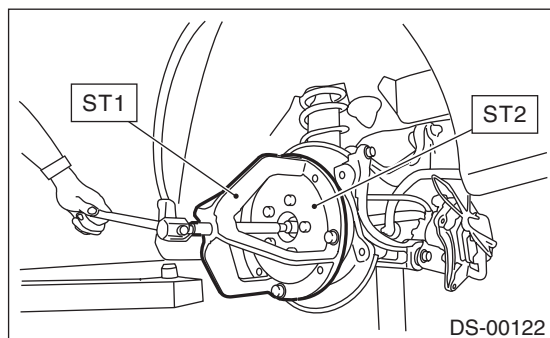
- 3) Unlock axle nut.
- 4) Have another technician depress brake pedal so that rear drive shaft does not rotate, while removing axle nut.
- 5) Remove rear differential assembly.
With T-type
<Ref. to DI-23, REMOVAL, Rear Differential for T-type.>
With VA-type
<Ref. to DI-39, REMOVAL, Rear Differential for VA-type.>

- 6) Remove axle nut and drive shaft. If it is hard to remove, use ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 PLATE

CAUTION:

Be careful not to damage tone wheel when removing rear drive shaft.



B: INSTALLATION

- 1) Insert outer joint into rear hub splines.

CAUTION:

Be careful not to damage tone wheel.

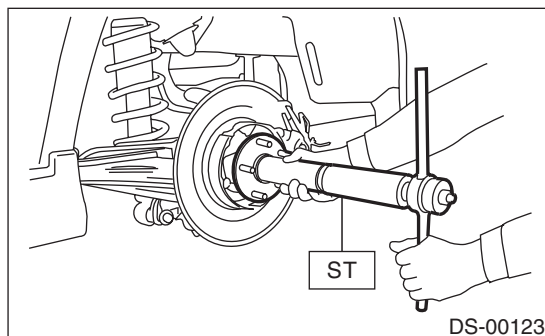
- 2) Using ST1 and ST2, pull drive shaft into place.

ST1 922431000 AXLE SHAFT INSTALLER

ST2 927390000 ADAPTER

CAUTION:

Do not hammer drive shaft when installing it.



- 3) Tighten axle nut temporarily.

- 4) Install rear differential.

With T-type

<Ref. to DI-24, INSTALLATION, Rear Differential for T-type.>

With VA-type

<Ref. to DI-40, INSTALLATION, Rear Differential for VA-type.>

- 5) Have another technician depress brake pedal so that rear drive shaft does not rotate, while tightening axle nut.

Tightening torque:

240 N·m (24 kgf-m, 177 ft-lb)

CAUTION:

- Replace the removed axle nut with a new one. Use an axle nut for rear use only (Olive color).
- Always tighten axle nut before installing wheel on vehicle.
- Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

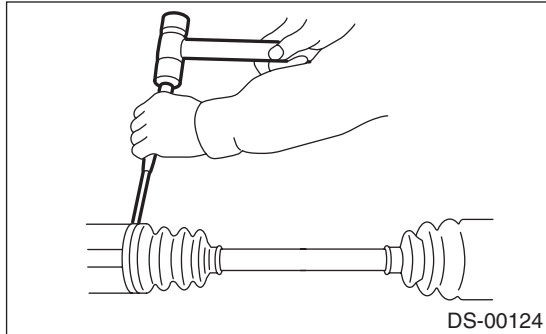
- 6) After tightening axle nut, lock it securely.

REAR DRIVE SHAFT

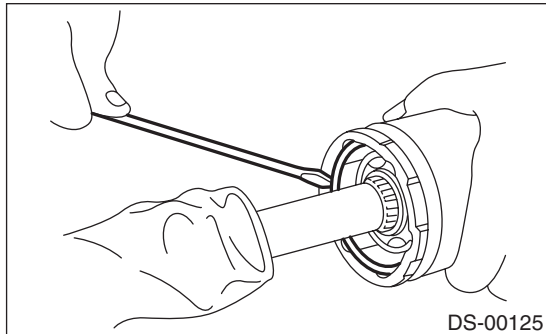
DRIVE SHAFT SYSTEM

C: DISASSEMBLY

- 1) Straighten bent claw of large band which is installed on inner joint boot.
- 2) Loosen band by means of screwdriver or pliers, being careful not to damage the boot.



- 3) Remove small band which is installed on inner joint boot in the same manner.
- 4) Remove larger end of inner joint boot from outer race of inner joint.
- 5) Remove inner snap ring of inner joint outer race.



- 6) Take out inner joint outer race from shaft assembly.

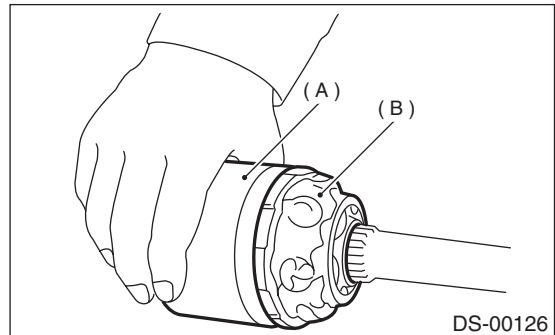
- 7) Wipe off grease and take out balls.

CAUTION:

The grease is a special grease. Do not confuse with other greases.

NOTE:

Disassemble exercising care not to lose balls (6 pcs).



- (A) Outer race
(B) Grease

- 8) To remove the cage from the inner race, turn the cage by a half pitch to the track groove of the inner race and shift the cage.
- 9) Remove snap ring, which fixes inner race to shaft, by using pliers.
- 10) Take out inner joint inner race.
- 11) Take off inner joint cage from shaft and remove inner joint boot.

CAUTION:

Be careful not to damage boot by wrapping shaft splines with vinyl tape.

- 12) Remove outer joint boot in the same procedure as inner joint boot.
- 13) Thus, disassembly of axle is completed, but outer joint is unable to be disassembled.

D: ASSEMBLY

CAUTION:

Use specified grease.

BJ side (outer joint):

NKG708 (Part No. 28495AE000)

DOJ side (inner joint):

NKG205 (Yellow) (Part No. 28495AG000)

1) Install outer joint boot in specified position, and fill it with 60 to 70 g (2.12 to 2.47 oz) of specified grease.

2) Place inner joint boot at the center of shaft.

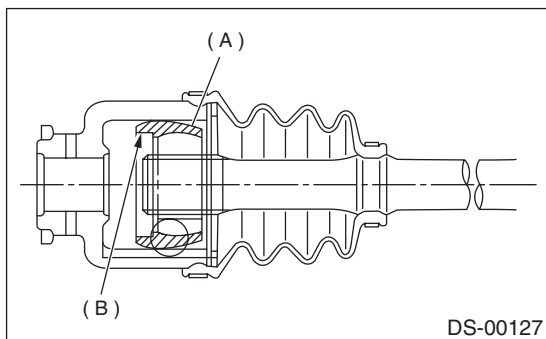
CAUTION:

Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

3) Insert inner joint cage onto shaft.

NOTE:

Insert the cage with the cut-out portion facing the shaft end, since the cage has an orientation.

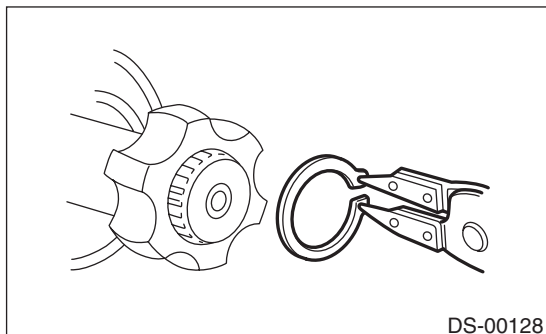


(A) Cage
(B) Cut-out portion

4) Install inner joint inner race on shaft and fit snap ring with snap ring pliers.

NOTE:

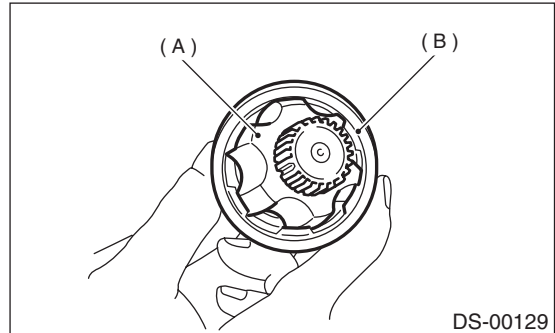
Confirm that the snap ring is completely fitted in the shaft groove.



5) Install cage, which was previously fitted, to inner race fixed upon shaft.

NOTE:

Fit the cage with the protruded part aligned with the track on the inner race and then turn by a half pitch.



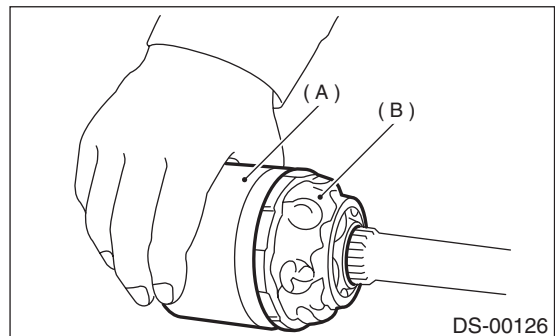
(A) Inner race
(B) Cage

6) Fill 80 to 90 g (2.82 to 3.17 oz) of specified grease into the interior of inner joint outer race.

7) Apply a coat of specified grease to the cage pocket and six balls.

8) Insert six balls into the cage pocket.

9) Align the outer race track and ball positions and place in the part where shaft, inner race, cage and balls are previously installed, and then fit outer race.



(A) Outer race
(B) Grease

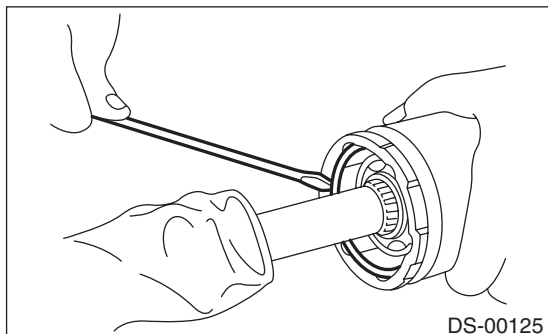
REAR DRIVE SHAFT

DRIVE SHAFT SYSTEM

10) Install circlip in the groove on inner joint outer race.

NOTE:

- Assure that the balls, cage and inner race are completely fitted in the outer race of inner joint.
- Exercise care not to place the matched position of circlip in the ball groove of outer race.
- Pull the shaft lightly and assure that the circlip is completely fitted in the groove.



11) Apply an even coat of the specified grease [20 to 30 g (0.71 to 1.06 oz)] to the entire inner surface of boot. Also apply grease to shaft.

12) Install inner joint boot taking care not to twist it.

CAUTION:

- The inside of the larger end of inner joint boot and the boot groove shall be cleaned so as to be free from grease and other substances.
- When installing inner joint boot, position outer race of inner joint at center of its stroke.

13) Put a band through the clip and wind twice in alignment with band groove of boot.

CAUTION:

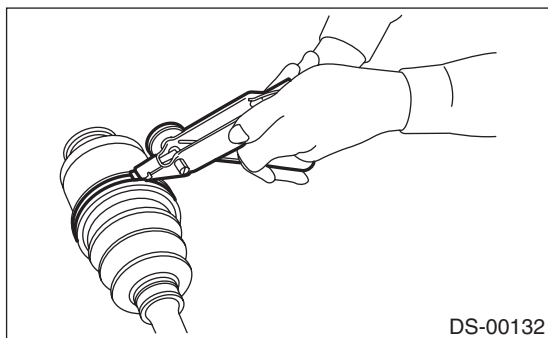
The boot must be replaced with a new one whenever it is removed.

14) Tighten band by using ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tighten band until it cannot be moved by hand.

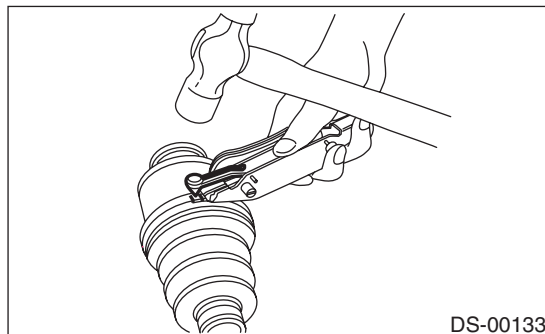


15) Tap on the clip with the punch provided at the end of ST.

ST 925091000 BAND TIGHTENING TOOL

CAUTION:

Tap to an extent that the boot underneath is not damaged.



16) Cut off band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

CAUTION:

Bend the band so that its end is in close contact with clip.

17) Fix up boot on outer joint in the same manner.

18) Extend and retract inner joint so that the grease in inner joint may spread equally.

E: INSPECTION

Check the removed parts for damage, wear, corrosion etc. If faulty, repair or replace.

1) Inner joint

Check seizure, corrosion, damage, wear and excessive play.

2) Outer joint

Check seizure, corrosion, damage and excessive play.

3) Shaft

Check excessive bending, twisting, damage and wear.

4) Boot

Check for wear, warping, breakage or scratches.

5) Grease

Check for discoloration or dilution.

7. General Diagnostic Table

A: INSPECTION

NOTE:

Vibration while cruising may be caused by an unbalanced tire, improper tire inflation pressure, improper wheel alignment, etc.

Symptom	Possible cause	Remedy
1. Vibration of propeller shaft NOTE: Vibration is caused by propeller shaft during operation and is transferred to vehicle body. Generally vibration increases in proportion to vehicle speed.	(1) Worn or damaged universal joint.	Replace.
	(2) Unbalanced propeller shaft due to bend or dent.	Replace.
	(3) Loose installation of propeller shaft.	Retighten.
	(4) Worn or damaged center bearing and damaged center mounting rubber.	Replace.
2. Tapping when starting and noise while cruising, caused by propeller shaft.	(1) Worn or damaged universal joint.	Replace.
	(2) Worn spline of sleeve yoke.	Replace.
	(3) Loose installation of propeller shaft.	Retighten.
	(4) Loose installation of joint.	Replace.
	(5) Worn or damaged center bearing and damaged center mounting rubber.	Replace.

GENERAL DIAGNOSTIC TABLE

DRIVE SHAFT SYSTEM

MEMO:

FRONT SUSPENSION



	Page
1. General Description	2
2. Wheel Alignment	8
3. Front Transverse Link	16
4. Front Ball Joint	19
5. Front Strut	20
6. Front Stabilizer	24
7. Front Crossmember	25
8. General Diagnostic Table.....	26

GENERAL DESCRIPTION

FRONT SUSPENSION

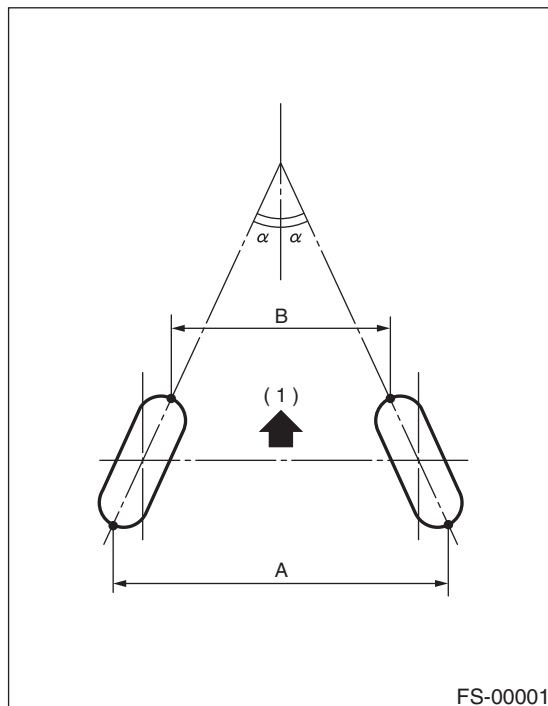
1. General Description

A: SPECIFICATIONS

	Model	PICKUP
Front	Camber (Tolerance: $\pm 0^{\circ}45'$ Adjustment standard: $\pm 0^{\circ}30'$)	$0^{\circ}40'$
	Caster	$2^{\circ}45'$
	Toe-in	Tolerance: 0 ± 3 mm (0 ± 0.12 in), Toe angle (The sum of both wheels): $\pm 0^{\circ}15'$ Tolerance: 0 ± 2 mm (0 ± 0.08 in), Toe angle (The sum of both wheels): $\pm 0^{\circ}10'$
	Kingpin angle	$13^{\circ}00'$
	Wheel arch height [Tolerance: $+12/-24$ mm ($+0.47/-0.94$ in)]	436 mm (17.17 in)
	Diameter of stabilizer	21 mm (0.83 in)
Rear	Camber (Tolerance: $\pm 0^{\circ}45'$ Adjustment standard: $\pm 0^{\circ}30'$)	$0^{\circ}05'$
	Toe-in	Tolerance: 0 ± 3 mm (0 ± 0.12 in), Toe angle (The sum of both wheels): $\pm 0^{\circ}15'$ Tolerance: 0 ± 2 mm (0 ± 0.08 in), Toe angle (The sum of both wheels): $\pm 0^{\circ}10'$
	Wheel arch height [Tolerance: $+12/-24$ mm ($+0.47/-0.94$ in)]	441 mm (17.36 in)
	Thrust angle	Tolerance: $\pm 0^{\circ}30'$, Adjustment standard: $\pm 0^{\circ}20'$
	Diameter of stabilizer	Non-TURBO model: 16 mm (0.63 in) TURBO model: 17 mm (0.67 in)

NOTE:

- Front and rear toe-in and front camber can be adjusted. If toe-in or camber exceeds tolerance, adjust toe-in and camber to the adjustment standard.
- The other items indicated in the specification table cannot be adjusted. If the other items exceed specifications, check suspension parts and connections for deformities; replace with new ones as required.



(1) Front

A – B = Positive: Toe-in, Negative: Toe-out

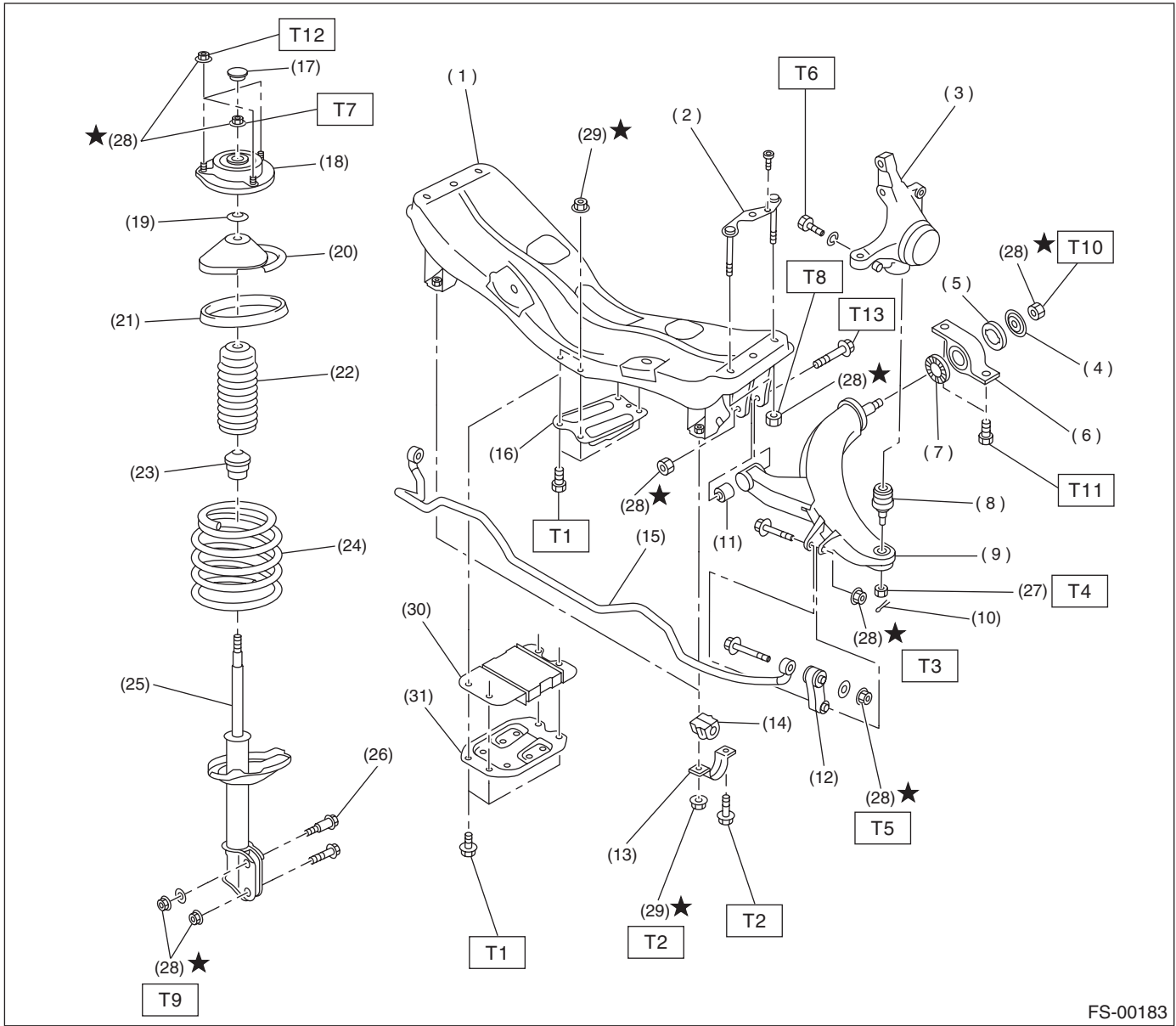
α = Each toe angle

MEMO:

GENERAL DESCRIPTION

FRONT SUSPENSION

B: COMPONENT



FS-00183

GENERAL DESCRIPTION

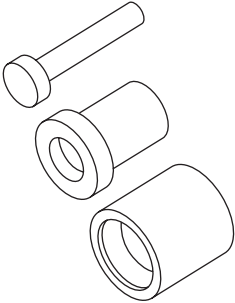
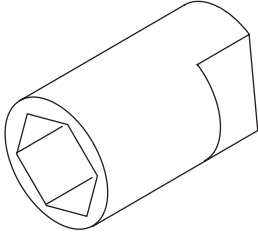
FRONT SUSPENSION

(1) Front crossmember	(17) Dust seal	(31) Dynamic plate (Non-TURBO, MT model)
(2) Bolt ASSY	(18) Strut mount	
(3) Housing	(19) Spacer	
(4) Washer	(20) Upper spring seat	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(5) Stopper rubber (Rear)	(21) Rubber seat	<i>T1: 70 (7.1, 52)</i>
(6) Rear bushing	(22) Dust cover	<i>T2: 25 (2.5, 18.1)</i>
(7) Stopper rubber (Front)	(23) Helper	<i>T3: 30 (3.1, 22)</i>
(8) Ball joint	(24) Coil spring	<i>T4: 39 (4, 29)</i>
(9) Transverse link	(25) Damper strut	<i>T5: 45 (4.6, 33)</i>
(10) Cotter pin	(26) Adjusting bolt	<i>T6: 50 (5.1, 37)</i>
(11) Front bushing	(27) Castle nut	<i>T7: 55 (5.6, 41)</i>
(12) Stabilizer link	(28) Self-locking nut	<i>T8: 100 (10.2, 74)</i>
(13) Clamp	(29) Flange nut	<i>T9: 152 (16, 116)</i>
(14) Bushing	(30) Dynamic damper (Non-TURBO, MT model)	<i>T10: 186 (19.0, 137)</i>
(15) Stabilizer		<i>T11: 245 (25.0, 181)</i>
(16) Jack-up plate		<i>T12: 20 (2.0, 14.5)</i>
		<i>T13: 95 (9.7, 71)</i>

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Use SUBARU genuine grease etc. or the equivalent. Do not mix grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply grease onto sliding or revolution surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of grease to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.

D: PREPARATION TOOL**1. SPECIAL TOOLS**

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927680000	927680000	INSTALLER & REMOVER SET	Used for replacing transverse link bushing.
 ST-927760000	927760000	STRUT MOUNT SOCKET	Used for disassembling and assembling strut and shock mount.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Alignment adapter	Used for wheel alignment measurement.
Alignment gauge	Used for wheel alignment measurement.
Turning radius gauge	Used for wheel alignment measurement.
Toe-in gauge	Used for toe-in measurement.
Dial gauge	Used for damper strut measurement.

2. Wheel Alignment

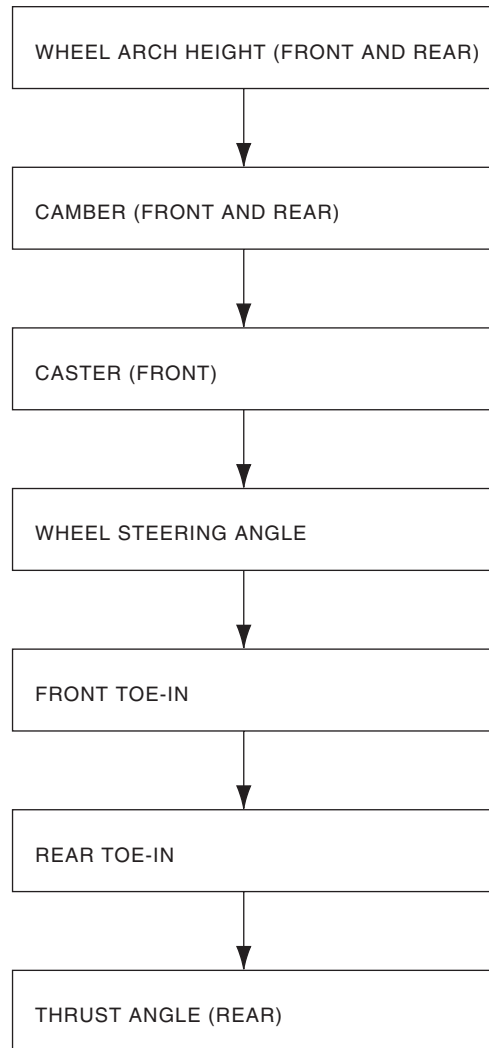
A: INSPECTION

Check the following items before taking wheel alignment measurement.

Check items before taking wheel alignment measurement:

- tire air pressure
- unbalanced right and left tire wear, size difference
- tire run-out
- ball joint excessive play, wear
- tie rod end excessive play, wear
- wheel bearing excessive play
- right and left wheel base imbalance
- steering link part deformed, excessive play
- suspension part deformed, excessive play

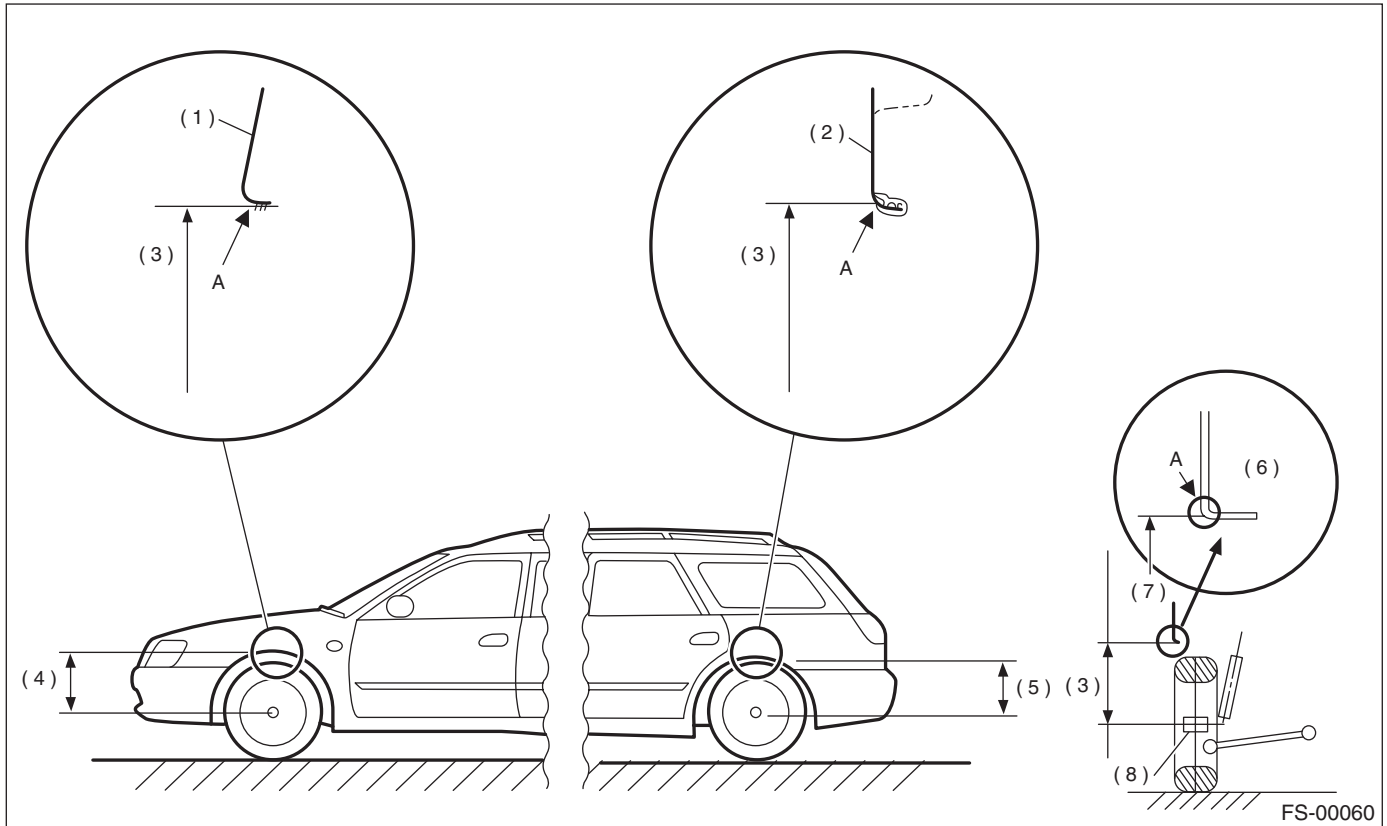
Check, adjust and/or measure wheel alignment in accordance with procedures indicated in figure:



FS-00059

1. WHEEL ARCH HEIGHT

- 1) Set vehicle on a level surface.
- 2) Set vehicle to “curb weight” conditions. (Empty luggage compartment, install spare tire, jack, service tools, and top up fuel tank.)
- 3) Set steering wheel in a straight line, then move the vehicle straight ahead more than 5 m (16 ft) to settle the suspension.
- 4) Suspend thread from wheel arch (point “A” in figure below) to determine a point directly above center of wheel.
- 5) Measure distance between measuring point “A” and center of wheel.



- | | | |
|------------------------|-----------------------------|---------------------|
| (1) Front fender | (4) Front wheel arch height | (7) Measuring point |
| (2) Outer rear quarter | (5) Rear wheel arch height | (8) End of spindle |
| (3) Wheel arch height | (6) Cross-section of arch | |

Model	Specified wheel arch height	
	Front	Rear
PICKUP	436 ⁺¹² / ₋₂₄ mm (17.17 ^{+0.47} / _{-0.94} in)	441 ⁺¹² / ₋₂₄ mm (17.36 ^{+0.47} / _{-0.94} in)

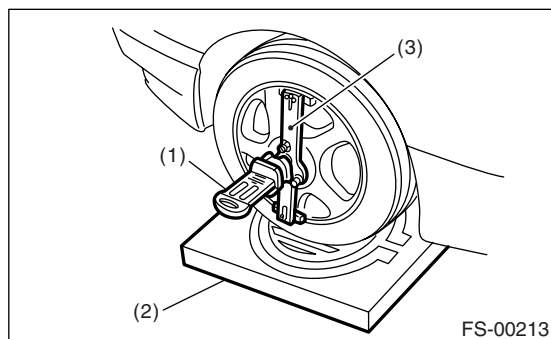
WHEEL ALIGNMENT

FRONT SUSPENSION

2. CAMBER

• Inspection

- 1) Place front wheel on turning radius gauge. Make sure ground contacting surfaces of front and rear wheels are set at the same height.
- 2) Set an adapter into the center of the wheel, and then install the wheel alignment gauge.



- (1) Alignment gauge
- (2) Turning radius gauge
- (3) Alignment adapter

- 3) Follow the wheel alignment gauge operation manual to measure the camber angle.

NOTE:

Refer to the "SPECIFICATIONS" for the camber values.

Front: <Ref. to FS-2, SPECIFICATIONS, General Description.>

Rear: <Ref. to RS-2, SPECIFICATIONS, General Description.>

• Front Camber Adjustment

When exceeding the tolerance, adjust it as follows.

- 1) Loosen two self-locking nuts located at lower front portion of strut.

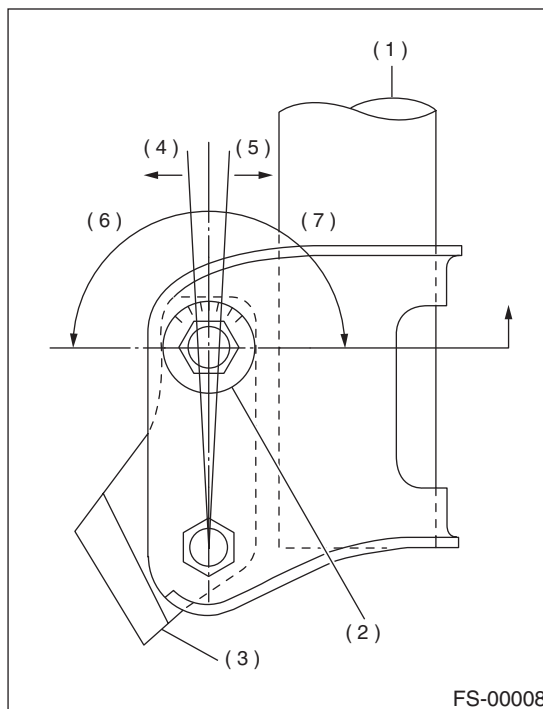
CAUTION:

- When adjusting bolt needs to be loosened or tightened, hold its head with a wrench and turn self-locking nut.
- When self-locking nut is removed, replace with a new one.

- 2) Turn camber adjusting bolt so that camber is set at the specification.

NOTE:

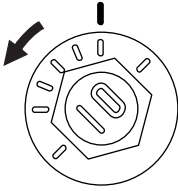
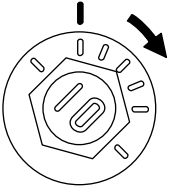
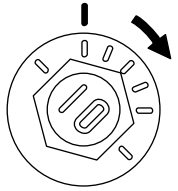
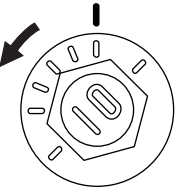
Moving the adjusting bolt by one scale graduation changes camber by approximately $0^{\circ}15'$.



- (1) Strut
- (2) Adjusting bolt
- (3) Housing
- (4) Outer
- (5) Inner
- (6) Camber is increased.
- (7) Camber is decreased.

WHEEL ALIGNMENT

FRONT SUSPENSION

	Left side	Right side
Camber is increased.	 Rotate counter-clockwise. FS-00009	 Rotate clockwise. FS-00010
Camber is decreased.	 Rotate clockwise. FS-00010	 Rotate counter-clockwise. FS-00009

3) Tighten the two self-locking nuts.

Tightening torque:

152 N·m (16 kgf-m, 116 ft-lb)

3. CASTER

• Inspection

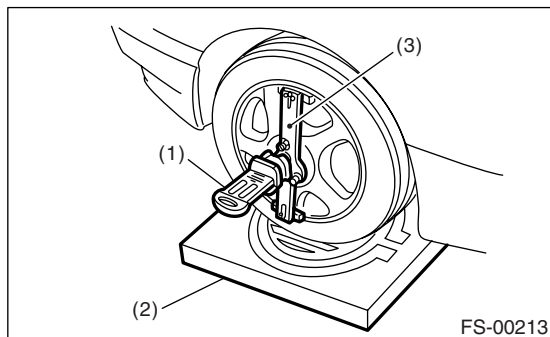
1) Place front wheel on turning radius gauge. Make sure ground contacting surfaces of front and rear wheels are set at the same height.

2) Set an alignment adapter into the center of the wheel, and then install the wheel alignment gauge.

3) Follow the wheel alignment gauge operation manual to measure the caster angle.

NOTE:

Refer to the “SPECIFICATIONS” for the caster values. <Ref. to FS-2, SPECIFICATIONS, General Description.>



- (1) Alignment gauge
- (2) Turning radius gauge
- (3) Alignment adapter

WHEEL ALIGNMENT

FRONT SUSPENSION

4. STEERING ANGLE

• Inspection

- 1) Place vehicle on a turning radius gauge.
- 2) While depressing brake pedal, turn steering wheel fully to the left and right. With steering wheel held at each fully turned position, measure both the inner and outer wheel steering angle.

Steering angle:

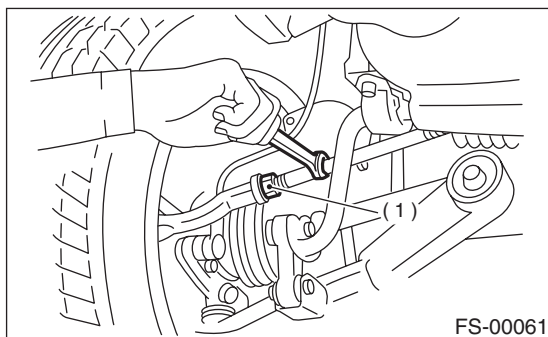
Model	PICKUP
Inner wheel	$34.5^{\circ} \pm 1.5^{\circ}$
Outer wheel	$30.3^{\circ} \pm 1.5^{\circ}$

• Adjustment

Turn tie-rod to adjust steering angle of both inner and outer wheels.

CAUTION:

- Check toe-in.
- Correct boot if it is twisted.



(1) Lock nut

5. FRONT WHEEL TOE-IN

• Inspection

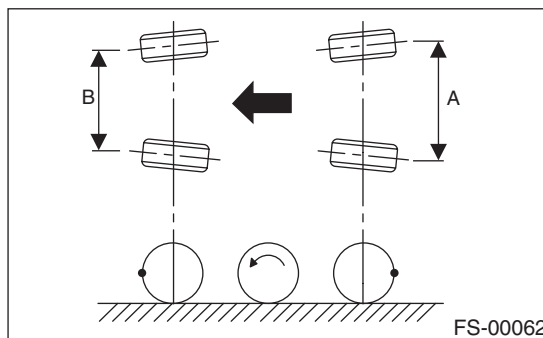
- 1) Using a toe gauge, measure front wheel toe-in.

Toe-in:

$0 \pm 3 \text{ mm } (0 \pm 0.12 \text{ in})$ (tolerance)

- 2) Mark rear sides of left and right tires at height corresponding to center of spindles and measure distance "A" between marks.
- 3) Move vehicle forward so that marks line up with front sides at height corresponding to center of spindles.
- 4) Measure distance "B" between left and right marks. Toe-in can then be obtained by the following equation:

$$A - B = \text{Toe-in}$$



• Adjustment

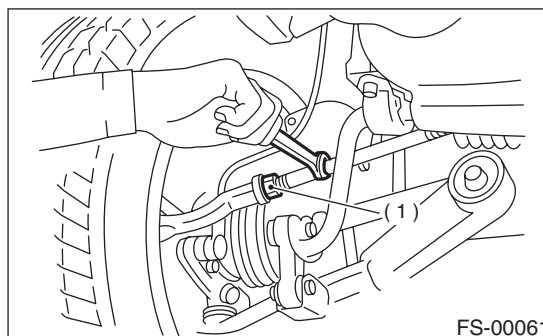
When exceeding the tolerance, adjust it as follows.

- 1) Loosen the left and right side steering tie-rods lock nuts.
- 2) Turn the left and right tie rods equal amounts until the toe-in is at the adjustment standard.

Toe-in:

$0 \pm 2 \text{ mm } (0 \pm 0.08 \text{ in})$ (adjustment standard)

Both the left and right tie-rods are right-hand threaded. To increase toe-in, turn both tie-rods clockwise equal amounts (as viewed from the inside of the vehicle).



(1) Lock nut

3) Tighten tie-rod lock nut.

Tightening torque:

83 N·m (8.5 kgf-m, 61.5 ft-lb)

CAUTION:

Correct tie-rod boot, if it is twisted.

NOTE:

Check the left and right wheel steering angle is within specifications.

6. REAR WHEEL TOE-IN

• Inspection

1) Using a toe-in gauge, measure rear wheel toe-in.

Toe-in:

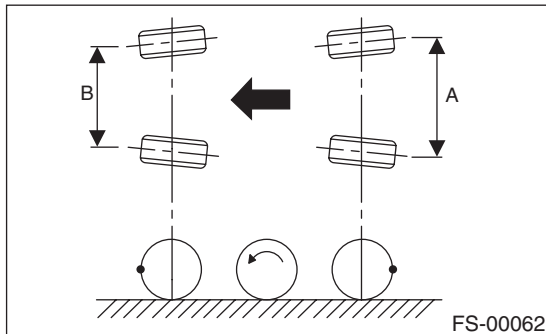
0±3 mm (0±0.12 in) (tolerance)

2) Mark rear sides of left and right tires at height corresponding to center of spindles and measure distance "A" between marks.

3) Move vehicle forward so that marks line up with front sides at height corresponding to center of spindles.

4) Measure distance "B" between left and right marks. Toe-in can then be obtained by the following equation:

$$A - B = \text{Toe-in}$$



• Adjustment

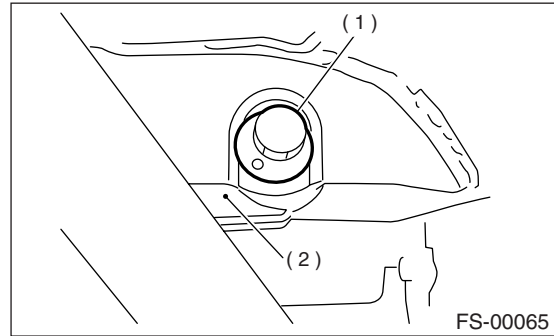
When exceeding the tolerance, adjust it as follows.

1) Loosen self-locking nut on inner side of link rear.

CAUTION:

• When loosening or tightening adjusting bolt, hold bolt head and turn self-locking nut.

• When self-locking nut is removed, replace with a new one.



(1) Adjusting bolt

(2) Link rear

2) Turn adjusting bolt head until toe-in is at the adjustment standard.

Toe-in:

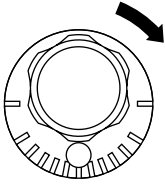
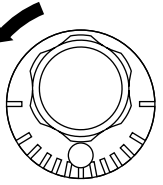
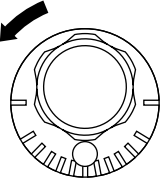
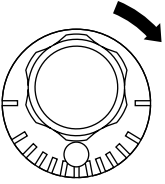
0±2 mm (0±0.08 in) (adjustment standard)

WHEEL ALIGNMENT

FRONT SUSPENSION

NOTE:

When left and right wheels are adjusted for toe-in at the same time, the movement of one scale graduation changes toe-in by approximately 6 mm (0.24 in).

	Left side	Right side
Toe-in is increased.	 Rotate clockwise. FS-00066	 Rotate counter-clockwise. FS-00067
Toe-in is decreased.	 Rotate counter-clockwise. FS-00067	 Rotate clockwise. FS-00066

3) Tighten self-locking nut.

Tightening torque:

120 N·m (12.2 kgf-m, 88 ft-lb)

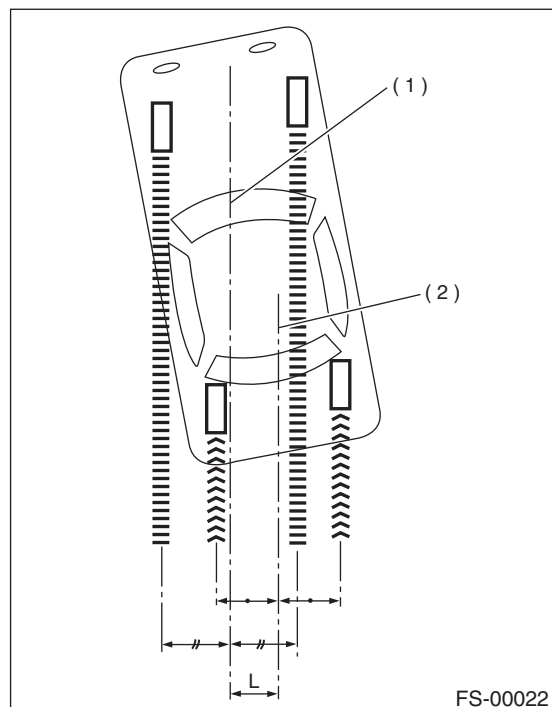
7. THRUST ANGLE

• Inspection

- 1) Position vehicle on a level surface.
- 2) Move vehicle 3 to 4 meters directly forward.
- 3) Determine locus of both front and rear axles.
- 4) Measure distance "L" between center line of loci of the axles.

Thrust angle: $0^\circ \pm 30'$ (tolerance)

[Less than $30'$ when "L" is equal to or less than 23 mm (0.91 in).]



- (1) Center line of loci (front axle)
(2) Center line of loci (rear axle)

• Adjustment

When exceeding the tolerance, adjust it as follows.

- 1) Make thrust angle adjustments by turning toe-in adjusting bolts of rear suspension equally in the same direction.
- 2) When one rear wheel is adjusted in a toe-in direction, adjust the other rear wheel equally in toe-out direction, in order to make thrust angle adjustment.

- 3) When left and right adjusting bolts are turned incrementally by one graduation in the same direction, the thrust angle will change approximately $15'$ ["L" is almost equal to 11 mm (0.46 in)].

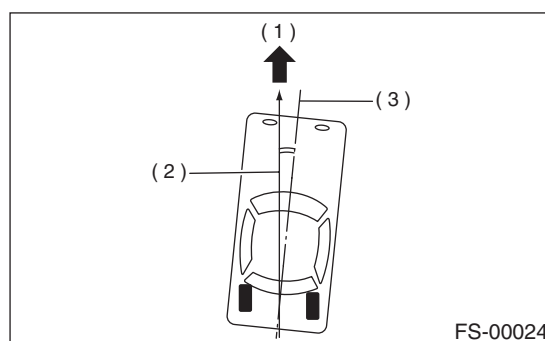
Thrust angle:

$0^\circ \pm 20'$ (adjustment standard)

[Less than $20'$ when "L" is equal to or less than 15 mm (0.59 in).]

NOTE:

Thrust angle refers to a mean value of left and right rear wheel toe angles in relation to vehicle body center line. Vehicle is driven straight in the thrust angle direction while swinging in the oblique direction depending on the degree of the mean thrust angle.



- (1) Front
(2) Thrust angle
(3) Body center line

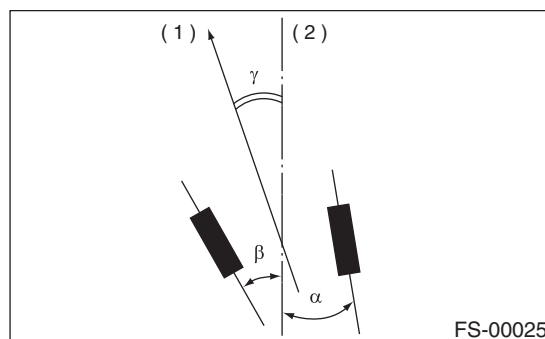
Thrust angle: $r = (\alpha - \beta)/2$

α : Right rear wheel toe-in angle

β : Left rear wheel toe-in angle

NOTE:

Here, use only positive toe-in values from each wheel to substitute for α and β in the equation.

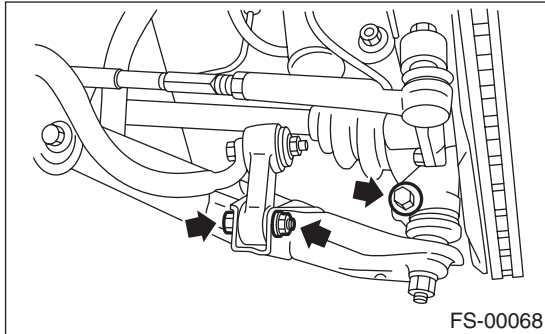


- (1) Front
(2) Body center line

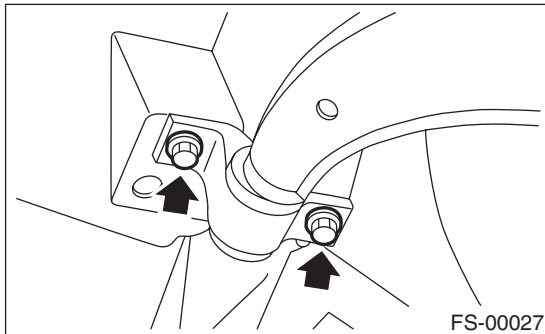
3. Front Transverse Link

A: REMOVAL

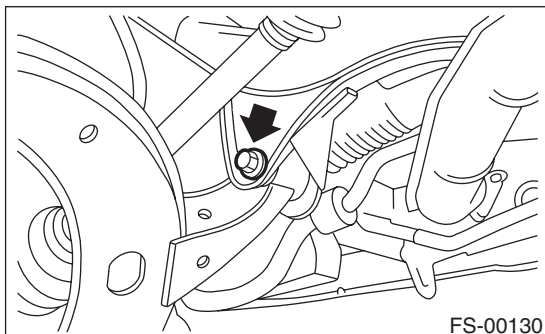
- 1) Set vehicle on a lift.
- 2) Disconnect ground cable from battery.
- 3) Lift-up the vehicle and remove the wheel.
- 4) Disconnect stabilizer link from transverse link.
- 5) Remove bolt securing ball joint of transverse link to housing.



- 6) Remove nut (do not remove bolt.) securing transverse link to crossmember.
- 7) Remove two bolts securing bushing bracket of transverse link to vehicle body at rear bushing location.



- 8) Extract ball joint from housing.
- 9) Remove bolt securing transverse link to crossmember and extract transverse link from crossmember.



B: INSTALLATION

- 1) Temporarily tighten the two bolts used to secure rear bushing of the transverse link to body.

NOTE:

These bolts should be tightened to such an extent that they can still move back and forth in the oblong shaped hole in the bracket (which holds the bushing).

- 2) Install bolts used to connect transverse link to crossmember and temporarily tighten with nut.

CAUTION:

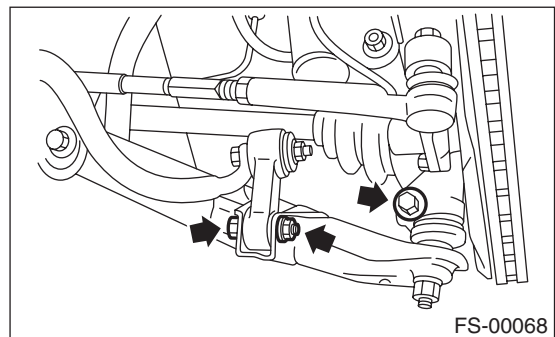
When self-locking nut is removed, replace with a new one.

- 3) Insert ball joint into housing.

- 4) Connect stabilizer link to transverse link, and temporarily tighten bolts.

CAUTION:

When self-locking nut is removed, replace with a new one.



5) Tighten the following points in the order shown below when wheels are in full contact with the ground and vehicle is at curb weight.

- (1) Transverse link and stabilizer

Tightening torque:

30 N·m (3.1 kgf-m, 22 ft-lb)

- (2) Transverse link and crossmember

Tightening torque:

95 N·m (9.7 kgf-m, 71 ft-lb)

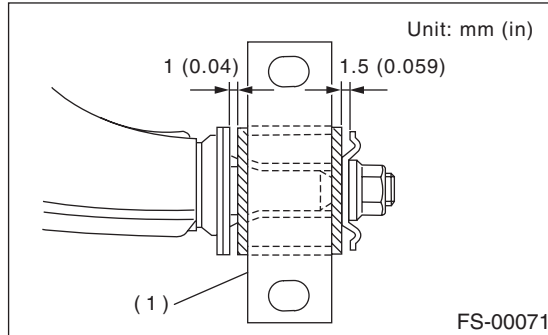
- (3) Transverse link rear bushing and body

Tightening torque:

245 N·m (25 kgf-m, 181 ft-lb)

NOTE:

- Move rear bushing back and forth until transverse link-to-rear bushing clearance is established (as indicated in figure.) before tightening.
- Check wheel alignment and adjust if necessary.



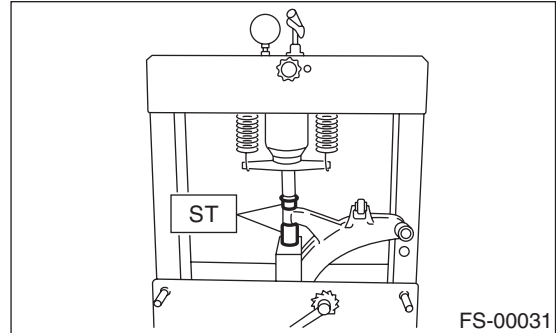
(1) Rear bushing

C: DISASSEMBLY

1. FRONT BUSHING

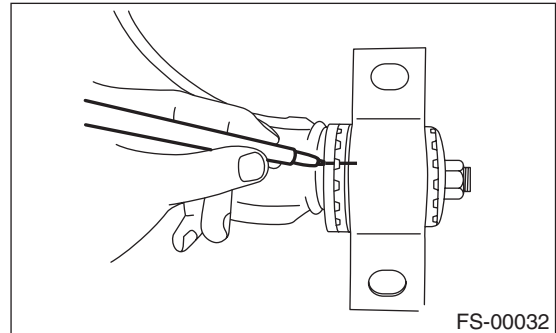
Using ST, press front bushing out of place.

ST 927680000 INSTALLER & REMOVER SET



2. REAR BUSHING

- 1) Scribe an aligning mark on transverse link and rear bushing.
- 2) Loosen nut and remove rear bushing.



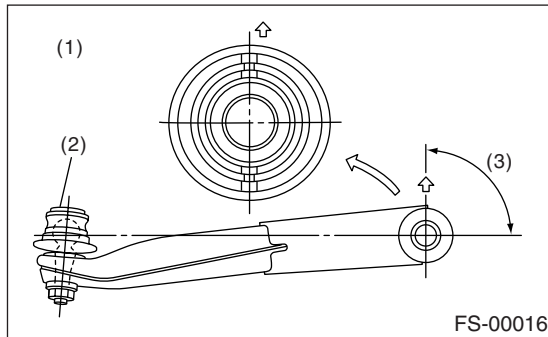
D: ASSEMBLY

1. FRONT BUSHING

To reassemble, reverse disassembly procedures.

CAUTION:

Install front bushing in correct direction, as shown in figure.



- (1) Face bushing toward center of ball joint
- (2) Ball joint

2. REAR BUSHING

- 1) Install rear bushing to transverse link and align aligning marks scribed on the two.
- 2) Tighten self-locking nut.

CAUTION:

- When self-locking nut is removed, replace with a new one.
- While holding rear bushing so as not to change position of aligning marks, tighten self-locking nut.

Tightening torque:

186 N·m (19.0 kgf-m, 137 ft-lb)

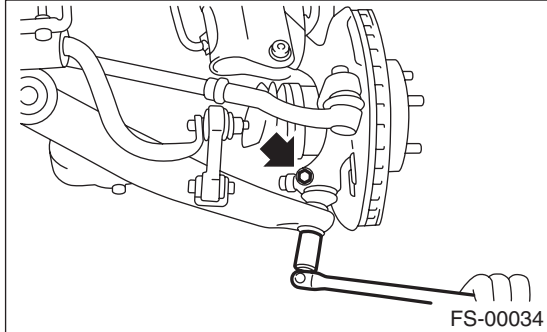
E: INSPECTION

- 1) Check transverse link for wear, damage and cracks, and correct or replace if defective.
- 2) Check bushings for cracks, fatigue or damage.
- 3) Check rear bushing for oil leaks.

4. Front Ball Joint

A: REMOVAL

- 1) Set vehicle on a lift.
- 2) Disconnect ground cable from battery.
- 3) Lift-up the vehicle and remove the wheel.
- 4) Pull out the cotter pin from the ball stud, remove the castle nut, and extract the ball stud from the transverse link.
- 5) Remove the bolt securing the ball joint to the housing.



- 6) Extract the ball joint from the housing.

B: INSTALLATION

- 1) Install ball joint onto housing.

Tightening torque (Bolt):

50 N·m (5.1 kgf-m, 37 ft-lb)

CAUTION:

Do not apply grease to tapered portion of ball stud.

- 2) Connect ball joint to transverse link.

Tightening torque (Castle nut):

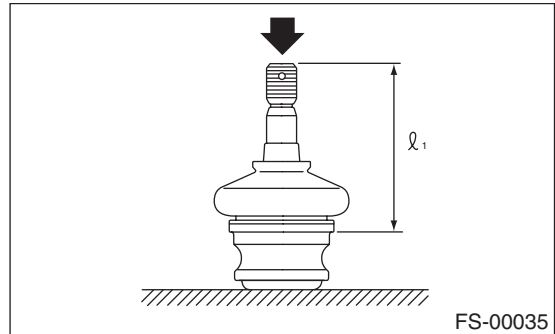
39 N·m (4.0 kgf-m, 29 ft-lb)

- 3) Retighten castle nut further within 60° until a slot in castle nut is aligned with the hole in ball stud end, then insert new cotter pin and bend it around castle nut.
- 4) Install front wheel.

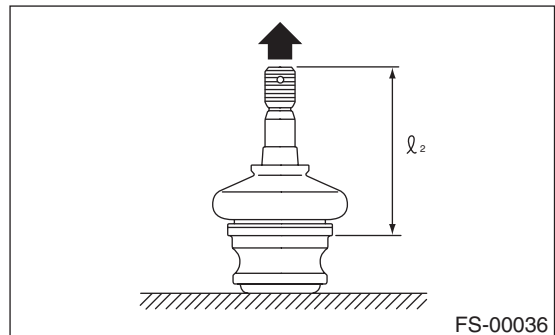
C: INSPECTION

- 1) Measure free play of ball joint by the following procedures. Replace with a new one when the free play exceeds the specified value.

- (1) With 686 N (70 kgf, 154 lb) loaded in the direction shown in the figure, measure dimension $\varnothing_1$.



- (2) With 686 N (70 kgf, 154 lb) loaded in the opposite direction shown in the figure, measure dimension $\varnothing_2$.



- (3) Calculate free play from the following formula. $S = \varnothing_2 - \varnothing_1$

- (4) When free play is larger than the following value, replace with a new one.

FRONT BALL JOINT

Standard for replacement: S

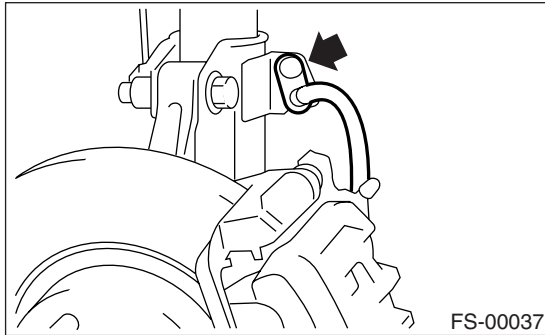
Less than 0.3 mm (0.012 in)

- 2) When free play is smaller than the specified value, visually inspect the dust cover.
- 3) The ball joint and cover that have been removed must be checked for wear, damage or cracks, and any defective part must be replaced.
- 4) If the dust cover is damaged, replace with the new ball joint.

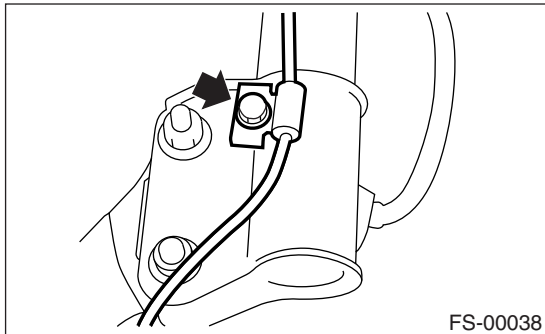
5. Front Strut

A: REMOVAL

- 1) Set vehicle on a lift.
- 2) Disconnect ground cable from battery.
- 3) Lift-up the vehicle and remove the wheel.
- 4) Remove bolt securing brake hose to strut.



- 5) Scribe an alignment mark on the camber adjusting bolt which secures strut to housing.
- 6) Remove bolt securing the ABS sensor harness.

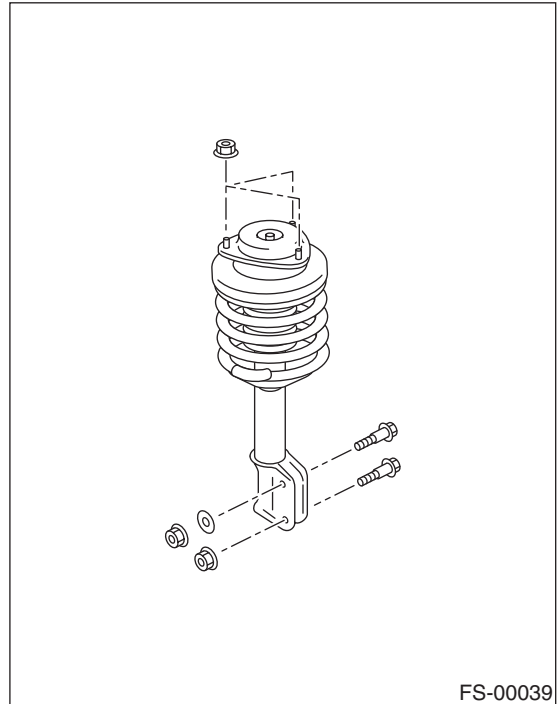


- 7) Remove two bolts securing housing to strut.

CAUTION:

While holding head of adjusting bolt, loosen self-locking nut.

- 8) Remove the three nuts securing strut mount to body.



B: INSTALLATION

- 1) Install strut mount at upper side of strut to body and tighten with nuts.

Tightening torque:

20 N·m (2.0 kgf-m, 14.5 ft-lb)

- 2) Position aligning mark on camber adjustment bolt with aligning mark on lower side of strut.

CAUTION:

- While holding head of adjusting bolt, tighten self-locking nut.
- When self-locking nut is removed, replace with a new one.

Tightening torque:

152 N·m (16 kgf-m, 112 ft-lb)

- 3) Install ABS sensor harness to strut.

Tightening torque:

32 N·m (3.3 kgf-m, 23.9 ft-lb)

- 4) Install bolts which secure brake hose to strut.

Tightening torque:

32 N·m (3.3 kgf-m, 23.9 ft-lb)

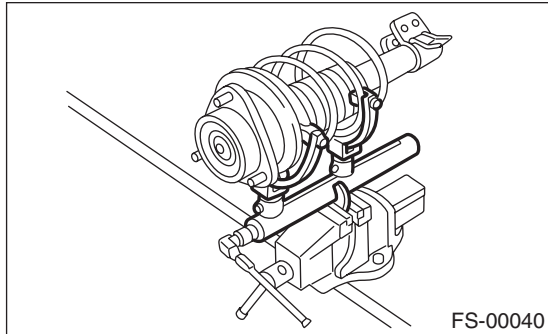
- 5) Install wheels.

NOTE:

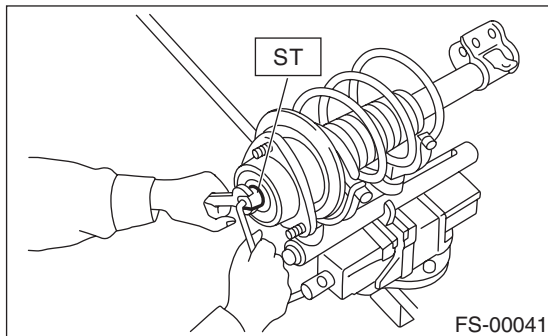
Check wheel alignment and adjust if necessary.

C: DISASSEMBLY

1) Using a coil spring compressor, compress coil spring.



2) Using ST, remove self-locking nut.
ST 927760000 STRUT MOUNT SOCKET



3) Remove strut mount, upper spring seat and rubber seat from strut.
4) Gradually decreasing compression force, and remove coil spring.
5) Remove dust cover and helper spring.

D: ASSEMBLY

1) Before installing coil spring, strut mount, etc., on the strut, check for the presence of air in the dampening force generating mechanism of the strut since air prevents proper dampening force from being produced.

2) Checking for the presence of air

(1) Place the strut vertically with the piston rod facing up.

(2) Move the piston rod to the center of its entire stroke.

(3) While holding the piston rod end with fingertips, move the rod up and down.

(4) If the piston rod moves at least 10 mm (0.39 in) in the former step, purge air from the strut.

3) Air purging procedure

(1) Place the strut vertically with the piston rod facing up.

(2) Fully extend the piston rod.

(3) With the piston rod fully extended, place the piston rod side down. The strut must stand vertically.

(4) Fully contract the piston rod.

(5) Repeat 3 or 4 times from the first step.

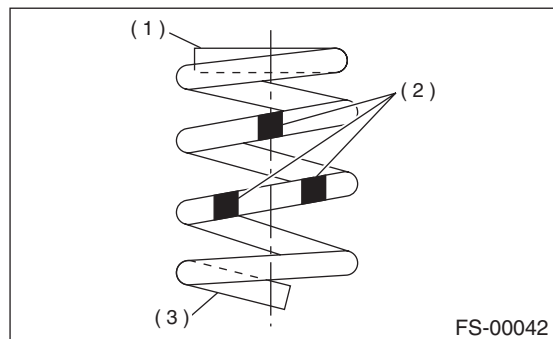
NOTE:

After completely purging air from the strut, be sure to place the strut with the piston rod facing up. If it is laid down, check for entry of air in the strut as outlined under "Checking for the presence of air".

4) Using a coil spring compressor, compress the coil spring.

NOTE:

Make sure that the vertical installing direction of coil spring is as shown in figure.

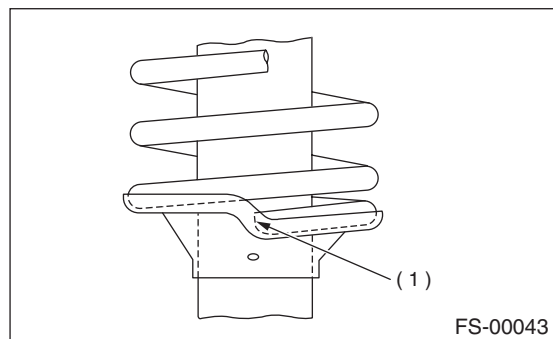


(1) Flat (top side)

(2) Identification paint

(3) Inclined (bottom side)

5) Set the coil spring correctly so that its end face (1) fits well into the spring seat as shown in the figure.



6) Install helper and dust cover to the piston rod.

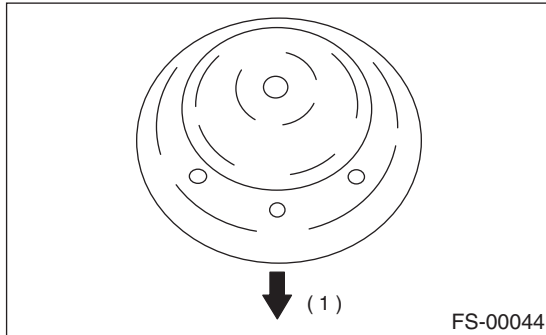
FRONT STRUT

FRONT SUSPENSION

7) Pull the piston rod fully upward, and install rubber seat and upper spring seat.

NOTE:

Ensure that upper spring seat is positioned as shown in figure.



(1) Outside of body

8) Install strut mount to the piston rod, and tighten the self-locking nut temporarily.

CAUTION:

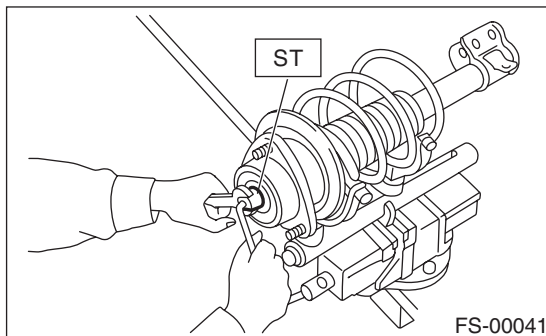
Be sure to use a new self-locking nut.

9) Using hexagon wrench to prevent strut rod from turning, tighten self-locking nut with ST.

ST 927760000 STRUT MOUNT SOCKET

Tightening torque:

55 N·m (5.6 kgf-m, 41 ft-lb)



10) Loosen the coil spring carefully.

E: INSPECTION

Check the disassembled parts for cracks, damage and wear, and replace with new parts if defective.

1. DAMPER STRUT

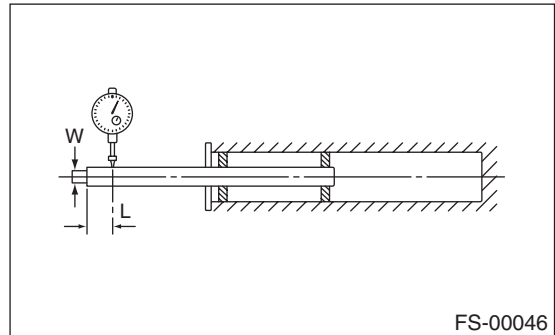
1) Check for oil leakage.

2) Move the piston rod up and down to check it operates smoothly without any binding.

3) Play of piston rod

- Measure the play as follows:

Fix outer shell and fully extend the rod. Set a dial gauge at the end of the rod: L [10 mm (0.39 in)], then apply a force of W [20 N (2 kgf, 4 lb)] to threaded portion. With the force of 20 N (2 kgf, 4 lb) applied, read dial gauge indication: P_1 . Apply a force of 20 N (2 kgf, 4 lb) in the opposite direction of "W", then read dial gauge indication: P_2 .



The free play is determined by the following equation:

$$\text{Play} = P_1, P_2$$

Standard of play:

Less than 0.8 mm (0.031 in)

If the play is greater than the standard, replace the strut.

2. STRUT MOUNT

Check rubber part for creep, cracks and deterioration, and replace it with new one if defective.

3. DUST COVER

If any cracks or damage are found, replace it with a new one.

4. COIL SPRING

One having permanent strain should be replaced with a new one. When vehicle posture is uneven, although there are no considerable reasons like tire puncture, uneven loading, etc., check coil spring for its free length referring to specifications, cracks, etc., and replace it with a new one if defective.

5. HELPER

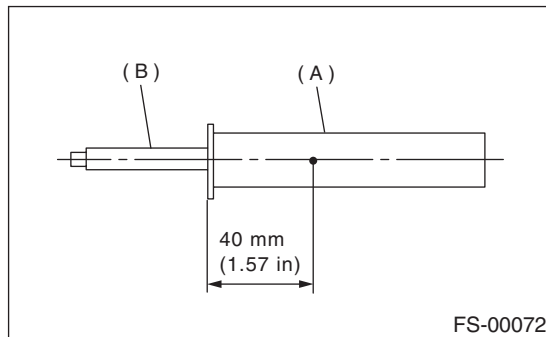
Replace it with new one if cracked or damaged.

F: DISPOSAL**CAUTION:**

- Do not disassemble the strut damper or place it into a fire.
- Drill a hole before disposal of strut.
- Before handling gas filled struts, be sure to wear goggles to protect eyes from gas, oil and/or filings.

1) Place the gas filled strut (A) on a flat and level surface with piston rod (B) fully extended.

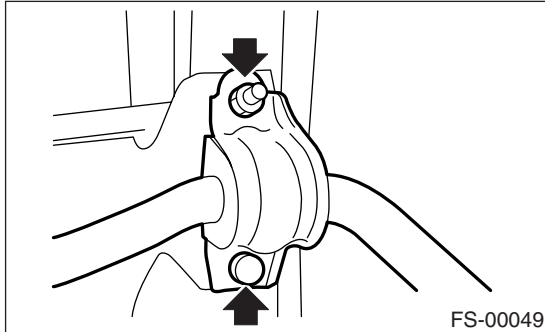
2) Using a 2 to 3 mm (0.08 to 0.12 in) dia. drill, make a hole in area shown in the figure.



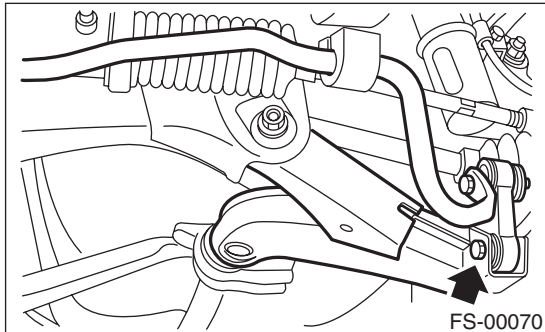
6. Front Stabilizer

A: REMOVAL

- 1) Jack-up the front part of the vehicle and support it with safety stand (rigid racks).
- 2) Remove jack-up plate from lower part of cross-member.
- 3) Remove bolts which secure stabilizer to cross-member.



- 4) Remove bolts which secure stabilizer link to front transverse link.



B: INSTALLATION

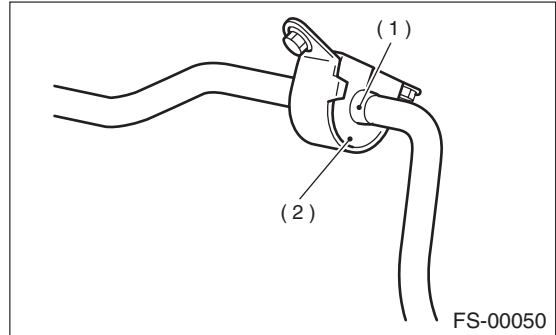
CAUTION:

When self-locking nut is removed, replace with a new one.

- 1) Install in the reverse order of removal.

NOTE:

- Install bushing (on front crossmember side) while aligning it with paint mark on stabilizer.
- Ensure that bushing and stabilizer have the same identification colors when installing.



- (1) Mark stamped on stabilizer
- (2) Bushing identification color

- 2) Always tighten rubber bushing location when wheels are in full contact with the ground and vehicle is at curb weight.

Tightening torque:

Jack-up plate to crossmember:

70 N·m (7.1 kgf-m, 52 ft-lb)

Stabilizer link to front transverse link:

30 N·m (3.1 kgf-m, 22 ft-lb)

Stabilizer to crossmember:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

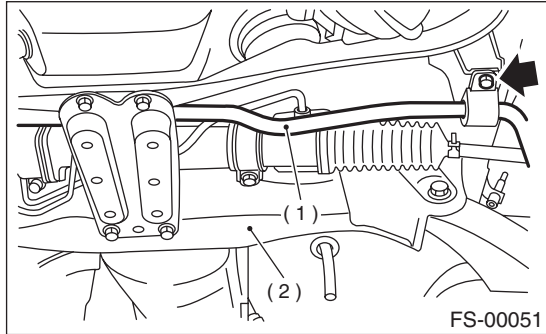
C: INSPECTION

- 1) Check bushing for cracks, fatigue or damage.
- 2) Check stabilizer link for deformities, cracks, or damage, and bushing for protrusions from the hole of stabilizer link.

7. Front Crossmember

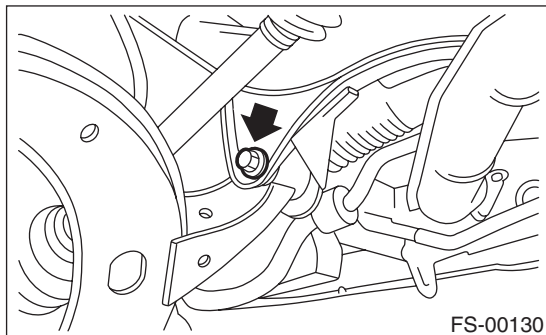
A: REMOVAL

- 1) Set vehicle on a lift.
- 2) Disconnect ground cable from battery.
- 3) Lift-up vehicle and remove front tires and wheels.
- 4) Remove both stabilizer and jack-up plate.

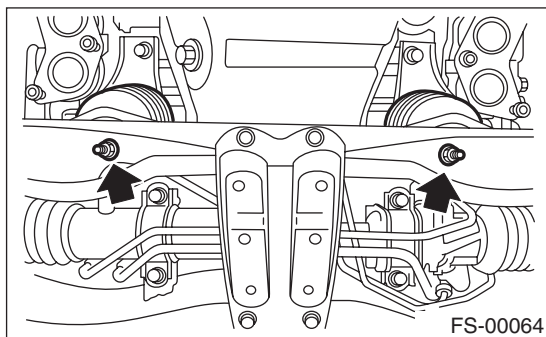


- (1) Front stabilizer
(2) Front crossmember

- 5) Disconnect tie-rod end from housing.
- 6) Remove front exhaust pipe.
- 7) Remove front transverse link from front crossmember and body.



- 8) Remove nuts attaching engine mount cushion rubber to crossmember.



- 9) Remove steering universal joint. <Ref. to PS-18, REMOVAL, Universal Joint.>
- 10) Disconnect power steering hose from steering gear box.

- 11) Lift engine by approx. 10 mm (0.39 in) by using chain block.

- 12) Support crossmember with a jack, remove nuts securing crossmember to body and gradually lower crossmember along with steering gearbox.

CAUTION:

When removing crossmember downward, be careful that tie-rod end does not interfere with SFJ boot.

B: INSTALLATION

- 1) Install in the reverse order of removal.

CAUTION:

Always tighten rubber bushing when wheels are in full contact with the ground and vehicle is at curb weight.

Tightening torque:

Transverse link bushing to crossmember:

95 N·m (9.7 kgf-m, 71 ft-lb)

Stabilizer to bushing:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

Tie-rod end to housing:

27.0 N·m (2.75 kgf-m, 19.9 ft-lb)

Front cushion rubber to crossmember:

75 N·m (7.6 kgf-m, 55 ft-lb)

Universal joint to pinion shaft:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

Crossmember to body:

100 N·m (10.2 kgf-m, 74 ft-lb)

Gearbox to steering hose:

15 N·m (1.5 kgf-m, 10.8 ft-lb)

- 2) Purge air from power steering system.

NOTE:

Check wheel alignment and adjust if necessary.

C: INSPECTION

Check crossmember for wear, damage and cracks, and correct or replace if defective.

GENERAL DIAGNOSTIC TABLE

FRONT SUSPENSION

8. General Diagnostic Table

A: INSPECTION

1. IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible causes	Countermeasures
(1) Permanent distortion or breakage of coil spring	Replace.
(2) Unsmooth operation of damper strut and/or shock absorber	Replace.
(3) Installation of wrong strut and/or shock absorber	Replace with proper parts.
(4) Installation of wrong coil spring	Replace with proper parts.

2. POOR RIDE COMFORT

- 1) Large rebound shock
- 2) Rocking of vehicle continues too long after running over bump and/or hump.
- 3) Large shock in bumping

Possible causes	Countermeasures
(1) Breakage of coil spring	Replace.
(2) Overinflation pressure of tire	Adjust.
(3) Improper wheel arch height	Adjust or replace coil springs with new ones.
(4) Fault in operation of damper strut and/or shock absorber	Replace.
(5) Damage or deformation of strut mount and/or shock absorber mount	Replace.
(6) Unsuitability of maximum and/or minimum length of damper strut and/or shock absorber	Replace with proper parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly and/or shock absorber	Replace.
(9) Oil leakage of damper strut and/or shock absorber	Replace.

3. NOISE

Possible causes	Countermeasures
(1) Wear or damage of damper strut and/or shock absorber component parts	Replace.
(2) Loosening of suspension link installing bolt	Retighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Unsuitability of maximum and/or minimum length of damper strut and/or shock absorber	Replace with proper parts.
(5) Breakage of coil spring	Replace.
(6) Wear or damage of ball joint	Replace.
(7) Deformation of stabilizer clamp	Replace.

PARKING BRAKE

PB

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2. Parking Brake Lever.....	5
3. Parking Brake Cable	6
4. Parking Brake Assembly	8
5. General Diagnostic Table.....	11



GENERAL DESCRIPTION

PARKING BRAKE

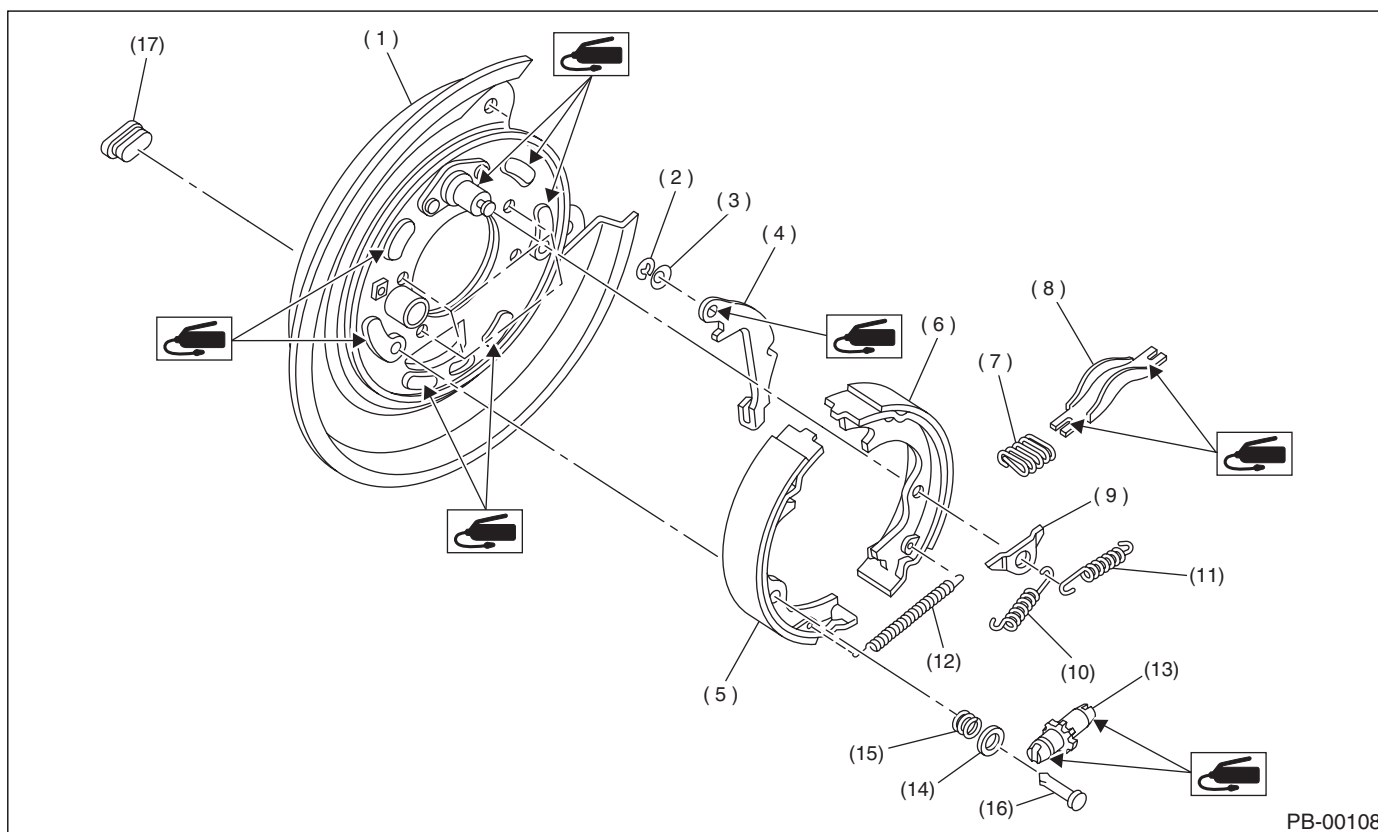
1. General Description

A: SPECIFICATIONS

Type		Mechanical on rear brakes, drum in disc
Effective drum diameter	mm (in)	170 (6.69)
Lining dimensions (length × width × thickness)	mm (in)	162.6 × 30.0 × 3.2 (6.40 × 1.181 × 0.126)
Clearance adjustment		Manual adjustment
Lever stroke	notches/N (kgf, lb)	7 to 8/196 (20, 44)

B: COMPONENT

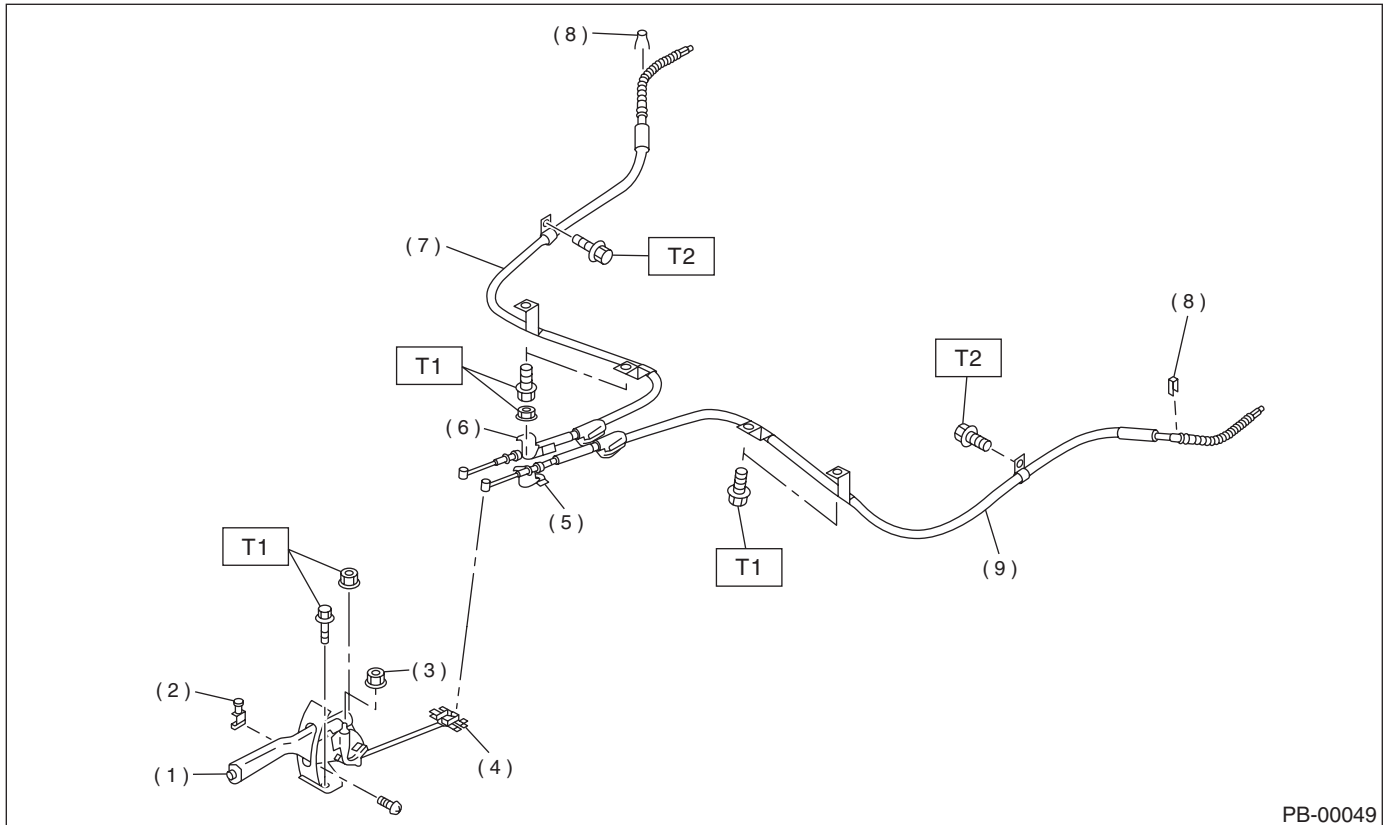
1. PARKING BRAKE



PB-00108

- | | | |
|------------------------------------|------------------------------|----------------------------|
| (1) Back plate | (7) Strut spring | (13) Adjuster |
| (2) Retainer | (8) Strut | (14) Shoe hold-down cup |
| (3) Spring washer | (9) Shoe guide plate | (15) Shoe hold-down spring |
| (4) Lever | (10) Primary return spring | (16) Shoe hold-down pin |
| (5) Parking brake shoe (Primary) | (11) Secondary return spring | (17) Adjusting hole cover |
| (6) Parking brake shoe (Secondary) | (12) Adjusting spring | |

2. PARKING BRAKE CABLE



PB-00049

- | | |
|-----------------------------------|--|
| (1) Parking brake lever | (6) Clamp |
| (2) Parking brake switch | (7) Parking brake cable RH |
| (3) Adjusting nut (Self-lock nut) | (8) Clamp (Rear disc brake model only) |
| (4) Equalizer | (9) Parking brake cable LH |
| (5) Bracket | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 18 (1.8, 13.0)

T2: 32 (3.3, 24)

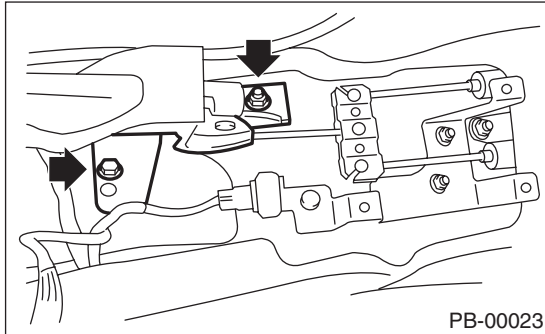
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Use SUBARU genuine grease etc. or the equivalent. Do not mix grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply grease onto sliding or revolution surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of grease to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.
- Keep grease etc. away from parking brake shoes.

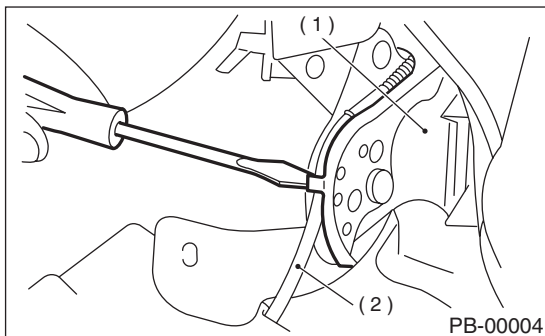
2. Parking Brake Lever

A: REMOVAL

- 1) Lift-up the vehicle.
- 2) Remove rear tire and wheel.
- 3) Remove console box. <Ref. to EI-36, REMOVAL, Console Box.>
- 4) Loosen parking cable adjusting nut and console bracket.
- 5) Remove parking brake lever.



- 6) Unbend parking brake lever pawls and remove cable.



- (1) Parking brake lever
(2) Cable

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Parking brake lever;

18 N·m (1.8 kgf-m, 13.0 ft-lb)

NOTE:

- Be sure to pass cable through guide inside the tunnel.
- Be sure to adjust the lever stroke. <Ref. to PB-5, ADJUSTMENT, Parking Brake Lever.>

C: INSPECTION

While pulling parking brake lever upward, count the notches.

Lever stroke:

7 to 8 notches when pulled with a force of 196 N (20 kgf, 44 lb)

Incorrect, adjust the parking brake. <Ref. to PB-10, ADJUSTMENT, Parking Brake Assembly.>

D: ADJUSTMENT

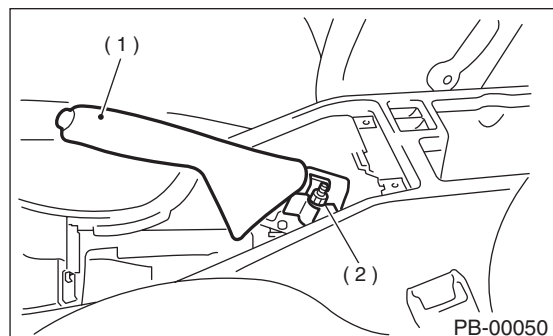
- 1) Remove console cover.
- 2) Forcibly pull parking brake lever 3 to 5 times.
- 3) Adjust parking brake lever by turning adjuster until parking brake lever stroke is set at 7 to 8 notches with operating force of 196 N (20 kgf, 44 lb).

Lever stroke:

7 to 8 notches when pulled with a force of 196 N (20 kgf, 44 lb)

CAUTION:

Replace the removed adjusting nut (self-lock nut) with a new one.



- (1) Parking brake lever
(2) Adjusting nut (Self-lock nut)

- 4) Install console cover.

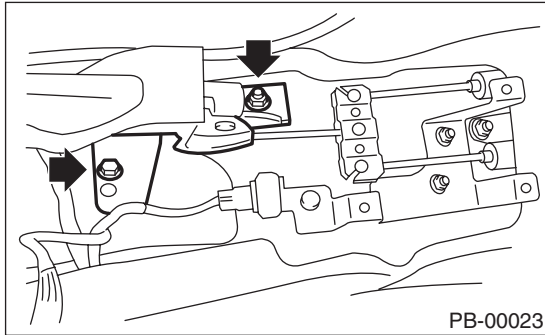
PARKING BRAKE CABLE

PARKING BRAKE

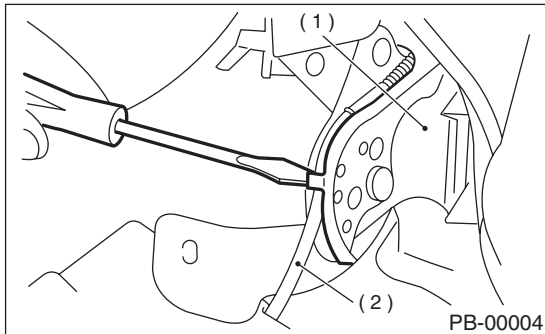
3. Parking Brake Cable

A: REMOVAL

- 1) Lift-up vehicle.
- 2) Remove rear tires and wheels.
- 3) Remove rear seat cushion. <Ref. to SE-14, Rear Seat.>
- 4) Remove console box. <Ref. to EI-36, REMOVAL, Console Box.>
- 5) Loosen parking cable adjusting nut and console bracket.
- 6) Remove parking brake lever.

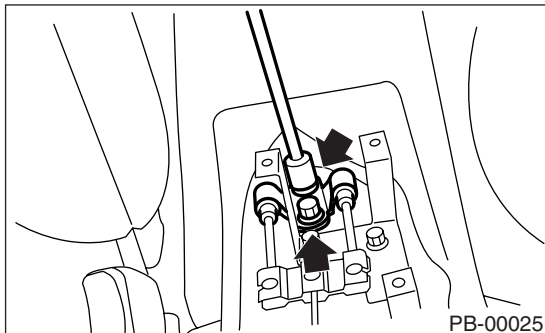


- 7) Unbend parking brake lever pawls and remove cable.

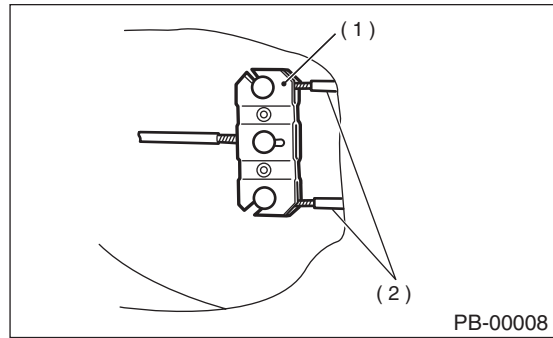


- (1) Parking brake lever
- (2) Cable

- 8) Roll up floor mat and remove clamps.

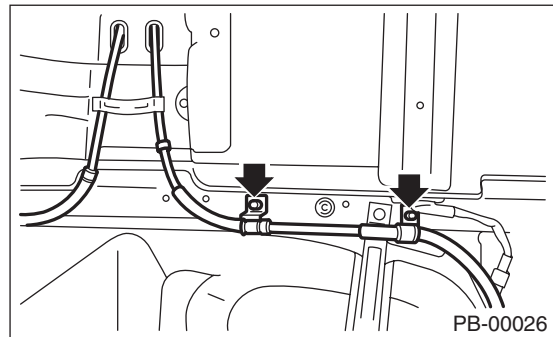


- 9) Remove equalizer cover.
- 10) Remove inner cable end from equalizer.



- (1) Equalizer
- (2) Inner cable end

- 11) Pull out parking brake cable from rear brake. <Ref. to PB-8, REMOVAL, Parking Brake Assembly.>
- 12) Pull out clamp from rear brake.
- 13) Remove bolt and bracket from trailing link bracket.
- 14) Remove bolt and clamp from rear floor.



- 15) Detach grommet from rear floor.
- 16) Remove cable assembly from cabin by forcibly pulling it backward.
- 17) Detach parking brake cable from cable guide at rear trailing link.

B: INSTALLATION

Install (new) parking brake assembly in the reverse order of removal.

NOTE:

- Be sure to pass cable through cable guide inside the tunnel.
- Be sure to adjust the lever stroke. <Ref. to PB-5, ADJUSTMENT, Parking Brake Lever.>

C: INSPECTION

Check the removed cable and replace if damaged, rusty, or malfunctioning.

- 1) Check for smooth operation of the cable.
- 2) Check the inner cable for damage and rust.
- 3) Check the outer cable for damage, bends, and cracks.
- 4) Check the boot for damage, cracks, and deterioration.

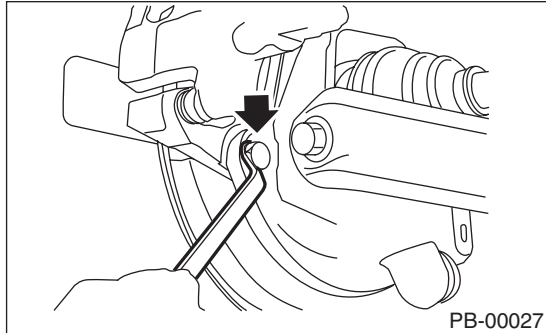
PARKING BRAKE ASSEMBLY

PARKING BRAKE

4. Parking Brake Assembly

A: REMOVAL

1) Remove the two mounting bolts and remove the disc brake assembly.



2) Suspend the disc brake assembly so that the hose is not stretched.

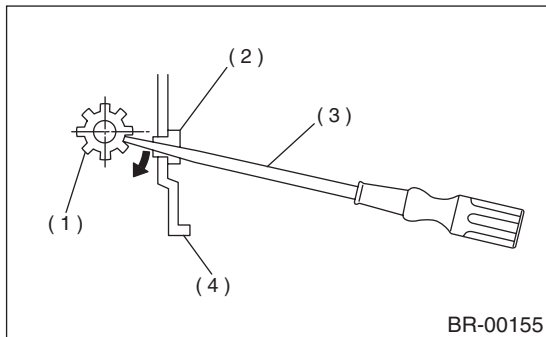
3) Pull down and release parking brake.

4) Remove the disc rotor.

NOTE:

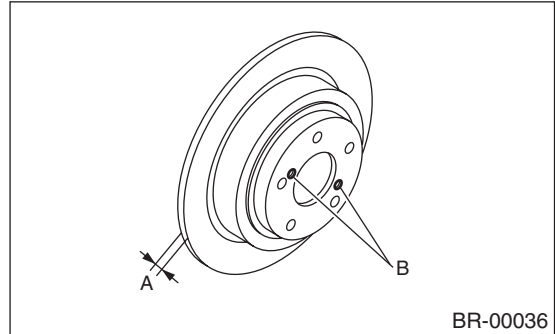
If the disc rotor is difficult to remove, try the following two methods in order.

(1) Turn adjusting screw using a slot-type screwdriver until brake shoe gets away enough from the disc rotor.



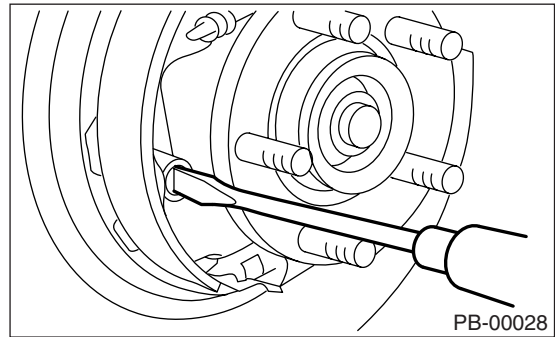
- (1) Adjusting screw
- (2) Cover (rubber)
- (3) Slot-type screwdriver
- (4) Back plate

(2) If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in holes B on the rotor.



5) Remove shoe return spring from parking brake assembly.

6) Using a standard screwdriver, remove front shoe hold-down spring and pin.



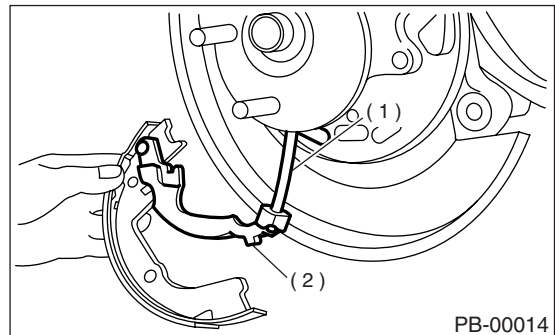
7) Remove strut and strut spring.

8) Remove adjuster assembly from parking brake assembly.

9) Using a standard screwdriver, remove rear shoe hold-down spring and pin.

10) Remove brake shoe.

11) Remove parking cable from parking lever.



- (1) Parking brake cable
- (2) Parking brake lever

12) Using a standard screwdriver, raise retainer. Remove parking lever and washer from brake shoe.

B: INSTALLATION

CAUTION:

Be sure lining surface is free from oil contamination.

Brake grease:

Dow Corning Molykote No. 7439 (Part No. 725191460)

1) Apply brake grease to the following places.

- Six contact surfaces of shoe rim and back plate packing
- Contact surface of shoe wave and anchor pin
- Contact surface of lever and strut
- Contact surface of shoe wave and adjuster assembly
- Contact surface of shoe wave and strut
- Contact surface of lever and shoe wave

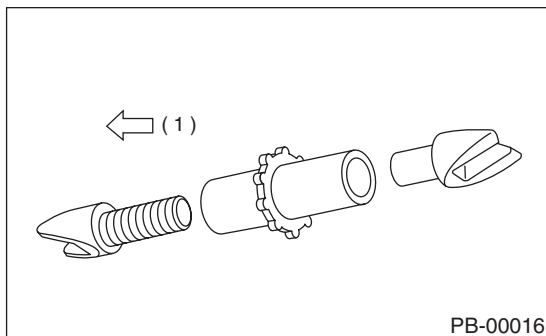
2) Install in reverse order of removal.

CAUTION:

- Use new retainers and clinch them when installing brake shoes to levers.
- Ensure that parking lever moves smoothly.
- Do not confuse left parking lever with right one.
- Do not confuse left strut with right one.

NOTE:

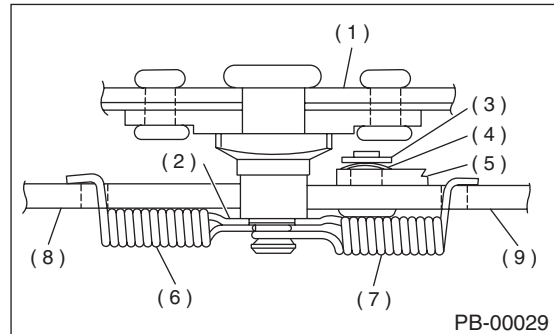
Ensure that adjuster assembly is securely installed with screw in the left side, facing vehicle front.



(1) LEFT

NOTE:

Ensure that shoe return spring is installed as shown in Figure.



- (1) Back plate
- (2) Shoe guide plate
- (3) Retainer
- (4) Spring washer
- (5) Lever
- (6) Primary shoe return spring (Blue)
- (7) Secondary shoe return spring (Yellow)
- (8) Parking brake shoe (Primary)
- (9) Parking brake shoe (Secondary)

3) Adjust parking brakes. <Ref. to PB-10, ADJUSTMENT, Parking Brake Assembly.>

CAUTION:

After replacing parking brake lining, be sure to drive vehicle for "break-in" purposes.

- (1) Drive the vehicle about 35 km/h (22 MPH).
- (2) With the parking brake release button pushed in, pull the parking brake lever gently.
- (3) Drive the vehicle for about 200 meter (0.12 mile) in this condition.
- (4) Wait 5 to 10 minutes for the parking brake to cool down. Repeat this procedure once more.
- (5) After breaking-in, re-adjust parking brakes.

PARKING BRAKE ASSEMBLY

PARKING BRAKE

C: INSPECTION

1) Measure brake disc inside diameter. If the disc is scored or worn, replace the brake disc.

Disc inside diameter:

Standard

170 mm (6.69 in)

Service limit

171 mm (6.73 in)

2) Measure the lining thickness. If it exceeds the limit, replace shoe assembly.

Lining thickness:

Standard

3.2 mm (0.126 in)

Service limit

1.5 mm (0.059 in)

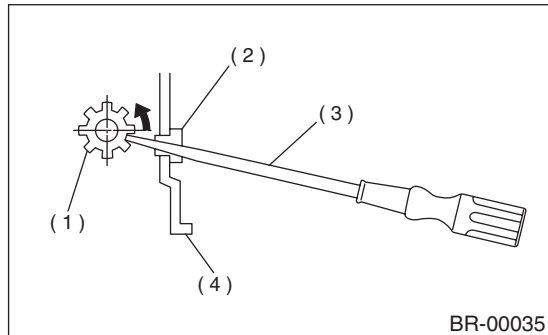
CAUTION:

Replace the brake shoes on the right and left brake assembly at the same time.

D: ADJUSTMENT

1. SHOE CLEARANCE

1) Remove adjusting hole cover from back plate.
2) Turn adjusting screw using a slot-type screwdriver until brake shoe is in close contact with disc rotor.



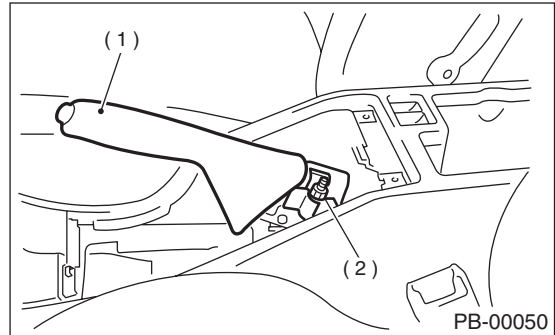
- (1) Adjusting screw
- (2) Cover (rubber)
- (3) Slot-type screwdriver
- (4) Back plate

3) Turn back (downward) adjusting screw 3 or 4 notches.

4) Install adjusting hole cover to back plate.

2. LEVER STROKE

1) Remove console box cover.
2) Forcibly pull parking brake lever 3 to 5 times.
3) Adjust parking brake lever by turning adjuster until parking brake lever stroke is set at 6 notches with operating force of 196 N (20 kgf, 44 lb).



- (1) Parking brake lever
- (2) Adjusting nut (Self-lock nut)

4) Install console box cover.

Lever stroke:

7 to 8 notches when pulled with a force of 196 N (20 kgf, 44 lb)

5. General Diagnostic Table

A: INSPECTION

Symptom	Possible cause	Remedy
Brake drag	• Parking brake lever is maladjusted.	• Adjustment.
	• Parking brake cable does not move.	• Repair or replace.
	• Parking brake shoe clearance is maladjusted.	• Adjustment.
	• Return spring is faulty.	• Replace.
Noise from brake	• Return spring is faulty.	• Replace.
	• Shoe hold-down spring is faulty.	• Replace.

GENERAL DIAGNOSTIC TABLE

PARKING BRAKE

MEMO:

POWER ASSISTED SYSTEM (POWER STEERING)

PS

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GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

1. General Description

A: SPECIFICATIONS

Model			Pick-up	
			TURBO model	NON-TURBO model
Whole system	Minimum turning radius	m (ft)	5.6±0.5 (18.4±1.6)	5.6±0.5 (18.4±1.6)
	Steering angle (Inside — Outside)		34.5°±1.5° — 30.3°±1.5°	34.5°±1.5° — 30.3°±1.5°
	Steering wheel diameter	mm (in)	385 (15.16)	
	Overall gear ratio		19.0	
	Turns lock to lock		3.4	3.4
Gearbox	Type		Rack and pinion, Integral	
	Backlash		0 (Automatically adjustable)	
	Valve (Power steering system)		Rotary valve	
Pump (Power steering system)	Type		Vane pump	
	Oil tank		Installed on body	
	Output	cm ³ (cu in)/rev.	8.5 — 0.6 (0.582 — 0.037)	7.2 (0.439)
	Relief pressure	kPa (kg/cm ² , psi)	7,846 (80, 1,138)	9,807 (100, 1,422)
	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)	1,000 rpm: 7 (7.4, 6.2) 3,000 rpm: 5 (5.3, 4.4)
	Range of revolution		500 — 9,000	
	Revolving direction		Clockwise	
Working fluid (Power steering system)	Name		ATF DEXRON IIE or III	
	Capacity	Oil tank ℓ (US qt, Imp qt)	0.3 (0.3, 0.3)	
		Total ℓ (US qt, Imp qt)	0.7 (0.7, 0.6)	

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

Steering wheel	Free play		mm (in)	17 (0.67)
Turning angle	Inner tire & wheel			34.5°±1.5°
	Outer tire & wheel			30.3°±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 (kgf, lb)	304.0 (31.0, 68.4) or less
	Rack shaft play in radial direction	Right-turn steering	mm (in)	0.15 (0.0059) or less
		Left-turn steering	mm (in)	Horizontal movement: 0.3 (0.012) or less Vertical movement: 0.15 (0.0059) or less
	Input shaft play	In radial direction	mm (in)	0.18 (0.0071) or less
		In axial direction	mm (in)	0.1 (0.004) or less
	Turning resistance		N (kgf, 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	Radial play	mm (in)	0.4 (0.016) or less
		Axial play	mm (in)	0.6 (0.024) or less
	Pulley	Ditch deflection	mm (in)	1.0 (0.039) or less
		Resistance to rotation	N (kgf, lb)	9.22 (0.94, 2.07) or less
	Regular pressure		kPa (kg/cm ² , psi)	981 (10, 142) or less
	Relief pressure		kPa (kg/cm ² , psi)	9,807 (100, 1,422)
Steering wheel effort (Power steering system)	At standstill with engine idling on a concrete road		N (kgf, lb)	29.4 (3.0, 6.6) or less
	At standstill with engine stalled on a concrete road		N (kgf, lb)	294.2 (30, 66.2) or less

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

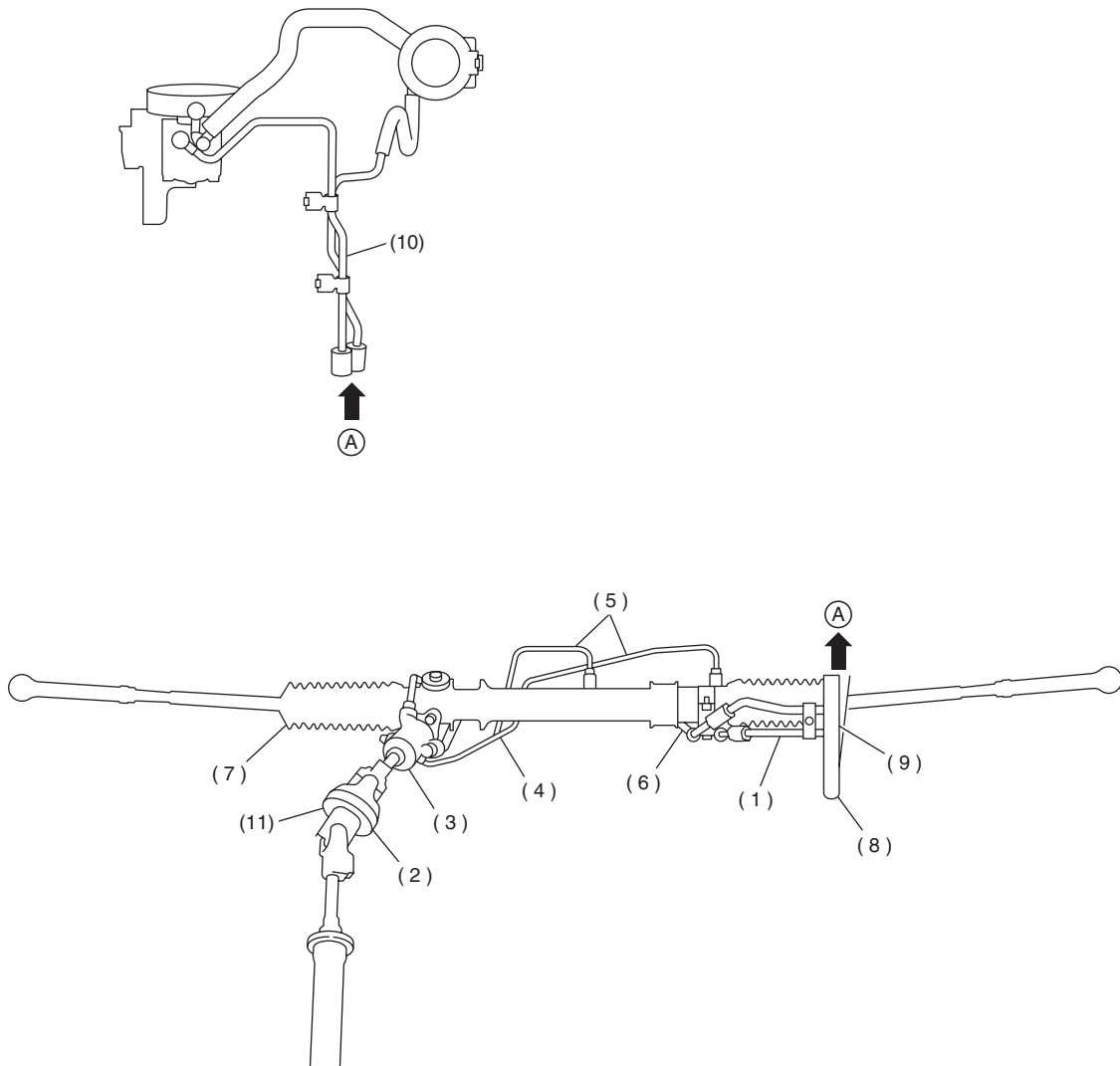
GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

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



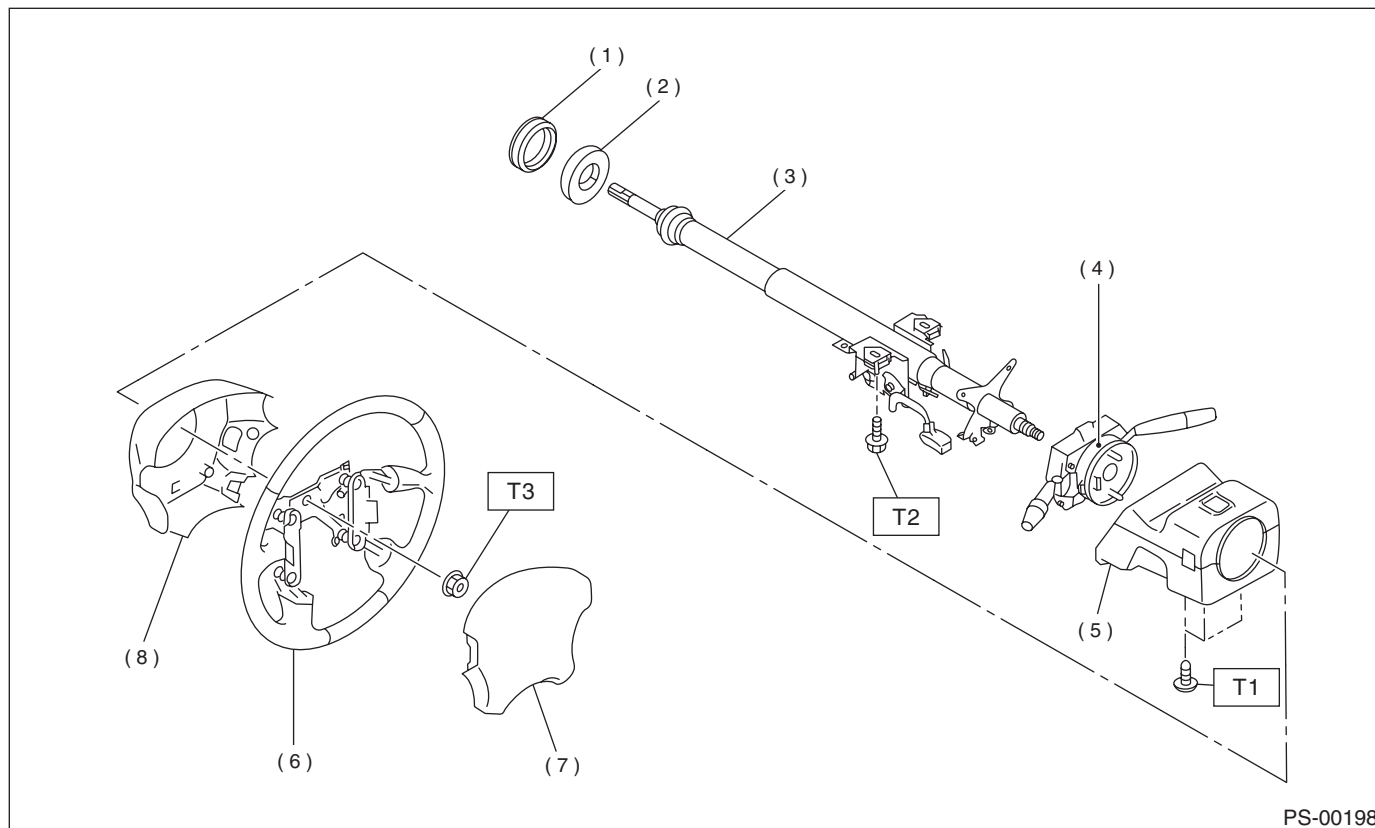
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GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

B: COMPONENT

1. STEERING WHEEL AND COLUMN



- | | |
|-----------------------------|--------------------------------|
| (1) Bushing | (6) Steering wheel |
| (2) Seal | (7) Airbag module |
| (3) Steering shaft | (8) Lower steering wheel cover |
| (4) Steering roll connector | |
| (5) Column cover | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.2 (0.12, 0.9)

T2: 25 (2.5, 18.1)

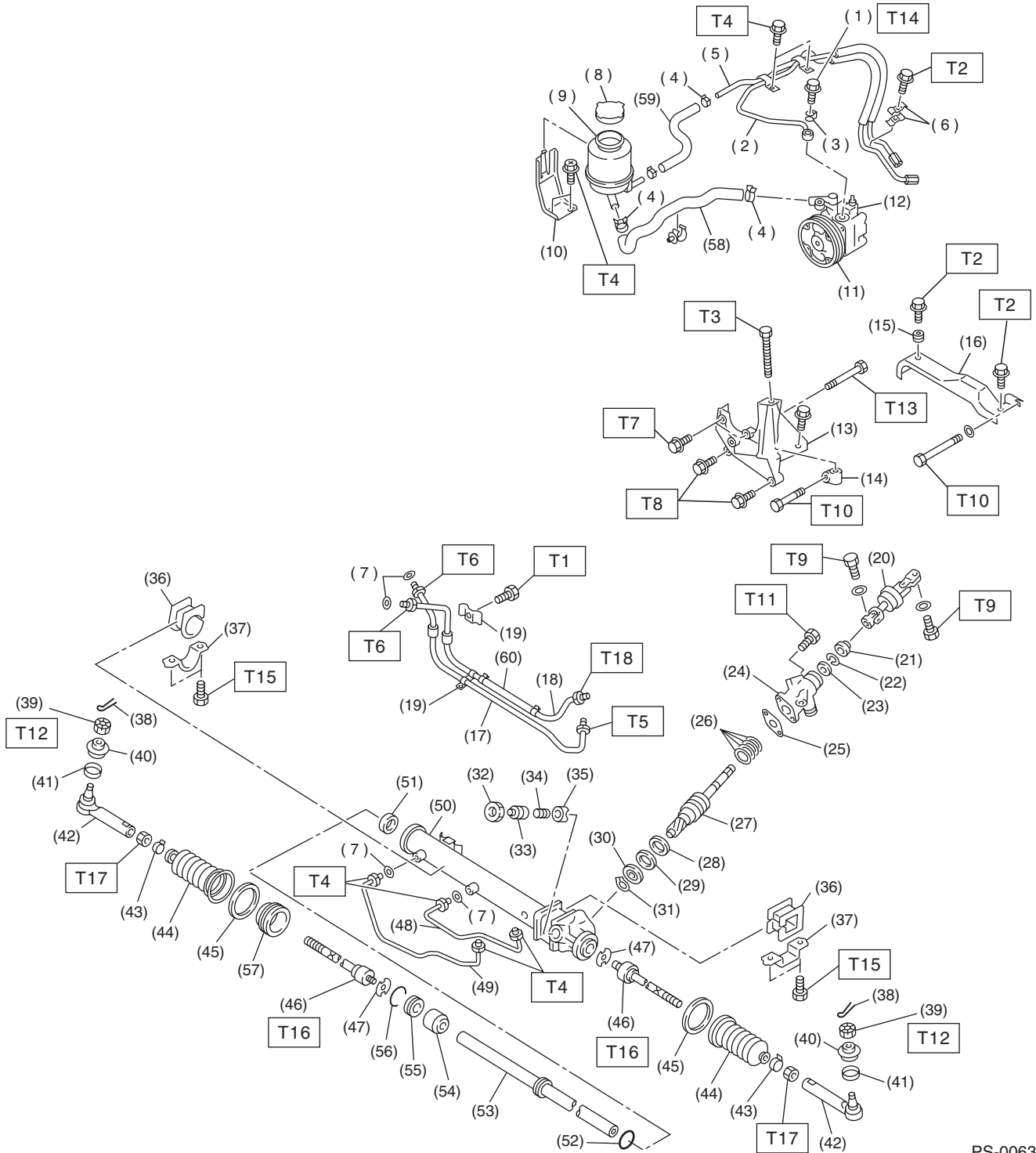
T3: 45 (4.6, 33.2)

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

2. POWER ASSISTED SYSTEM

- Except TURBO model



PS-00630

POWER ASSISTED SYSTEM (POWER STEERING)

[illegible]

PS-7

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

- (1) Eye bolt
- (2) Pipe C
- (3) Gasket
- (4) Clip
- (5) Pipe D
- (6) Clamp E
- (7) O-ring
- (8) Cap
- (9) Reservoir tank
- (10) Reservoir tank bracket
- (11) Pulley
- (12) Oil pump
- (13) Bracket
- (14) Belt tension nut
- (15) Bushing
- (16) Belt cover
- (17) Pipe E
- (18) Pipe F
- (19) Clamp plate
- (20) Universal joint
- (21) Dust seal
- (22) C-ring
- (23) Oil seal
- (24) Valve housing
- (25) Gasket
- (26) Seal ring
- (27) Pinion and valve ASSY
- (28) Oil seal

- (29) Back-up washer
- (30) Ball bearing
- (31) Snap ring
- (32) Lock nut
- (33) Adjusting screw
- (34) Spring
- (35) Sleeve
- (36) Adapter
- (37) Clamp
- (38) Cotter pin
- (39) Castle nut
- (40) Dust cover
- (41) Clip
- (42) Tie-rod end
- (43) Clip
- (44) Boot
- (45) Band
- (46) Tie-rod
- (47) Lock washer
- (48) Pipe B
- (49) Pipe A
- (50) Steering body
- (51) Oil seal
- (52) Piston ring
- (53) Rack
- (54) Rack bushing
- (55) Rack stopper
- (56) Circlip

- (57) Spacer
- (58) Suction hose
- (59) Return hose
- (60) Hose

Tightening torque: N·m (kgf-m, ft-lb)

- T1: 6 (0.6, 4.3)***
 - T2: 7.4 (0.75, 5.4)***
 - T3: 8 (0.8, 5.8)***
 - T4: 13 (1.3, 9.4)***
 - T5: 15 (1.5, 10.8)***
 - T6: 15 (1.5, 10.8)***
 - T7: 15.7 (1.6, 11.6)***
 - T8: 22 (2.2, 15.9)***
 - T9: 24 (2.4, 17.4)***
 - T10: 24.5 (2.5, 18.1)***
 - T11: 25 (2.5, 18.1)***
 - T12: 27 (2.75, 19.9)***
 - T13: 37.3 (3.8, 27.5)***
 - T14: 39 (4.0, 28.9)***
 - T15: 59 (6.0, 43)***
 - T16: 78 (8.0, 58)***
 - T17: 83 (8.5, 61.5)***
 - T18: 25 (2.5, 18.1)***
-

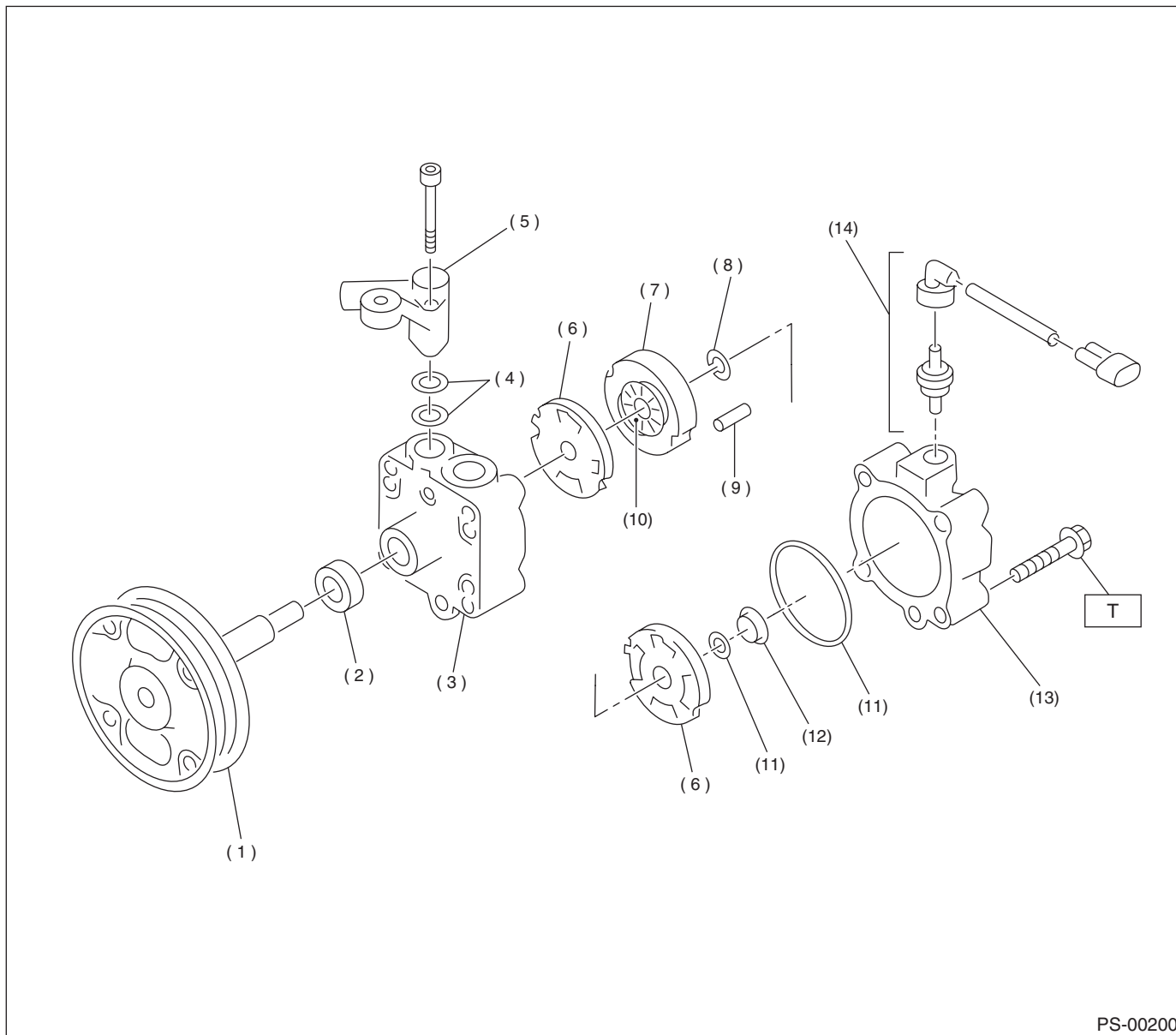
GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

3. OIL PUMP

NOTE:

The illustration for Non-TURBO model is shown below. (Not shown for TURBO model because it cannot be disassembled.)



- (1) Pulley
- (2) Oil seal
- (3) Front casing
- (4) O-ring
- (5) Socket
- (6) Pressure plate

- (7) Cam ring
- (8) Circlip
- (9) Straight pin
- (10) Rotor
- (11) O-ring
- (12) Seal ring

- (13) Rear body
- (14) Connector

Tightening torque: N·m (kgf-m, ft-lb)
T: 27.5 (2.8, 20.3)

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

C: CAUTION

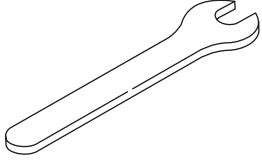
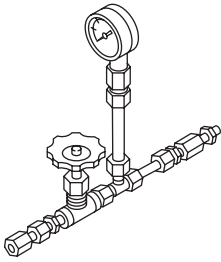
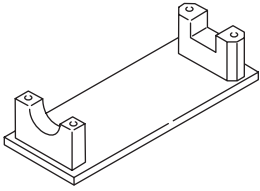
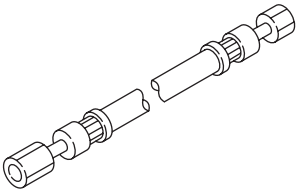
- This section includes Airbag related repair works. For those corresponding to the repair procedures, read carefully CAUTION items in AB section before working and be sure to follow the instructions.
- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Use SUBARU genuine steering fluid, grease etc. or the equivalent. Do not mix steering fluid, grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply steering fluid onto sliding or revolution surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of steering fluid to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

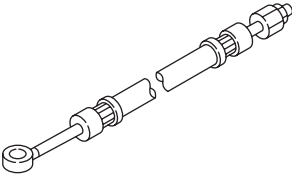
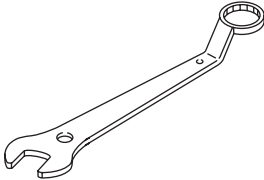
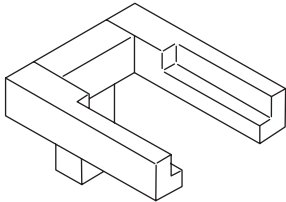
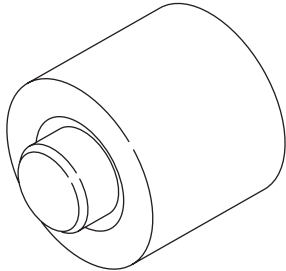
D: PREPARATION TOOL

1. SPECIAL TOOLS

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

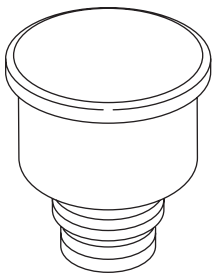
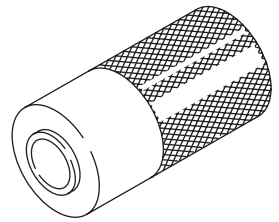
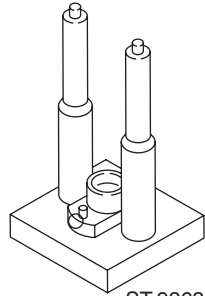
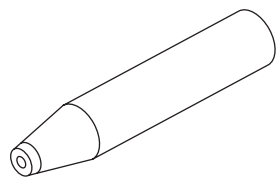
GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099AC020	34099AC020	ADAPTER HOSE B	Used with PRESSURE GAUGE (925711000).
 ST-926230000	926230000	SPANNER	• For the lock nut when adjusting backlash of gearbox. • Measurement of rotating resistance of gear-box assembly.
 ST34199AE020	34199AE020	MOUNT	Used for disassembling oil pump.
 ST34199AE030	34199AE030	INSTALLER	Used for installing oil seal into oil pump.

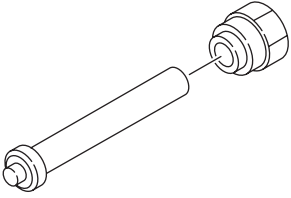
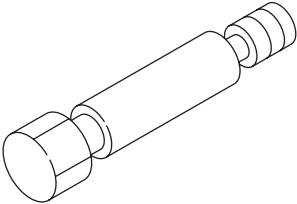
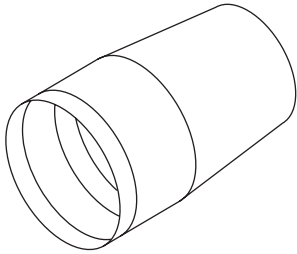
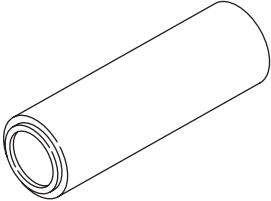
GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AE040	34199AE040	OIL CHARGE GUIDE	Used for charging power steering oil.
 ST-927640000	927640000	INSTALLER B	Used for installing ball bearing into housing.
 ST-926370000	926370000	INSTALLER A	• Used for installing valve assembly into valve housing assembly. • Used with STAND BASE (927630000).
 ST-926390001	926390001	COVER & REMOVER ASSY	Used for assembling rack assembly.

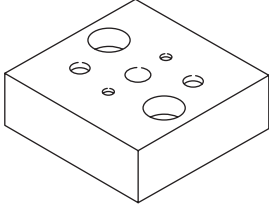
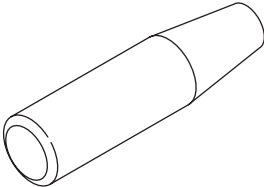
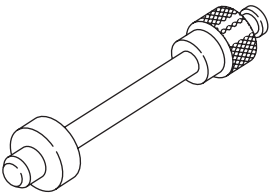
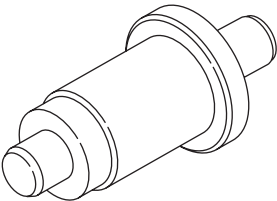
GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-926420000	926420000	PLUG	When oil leaks from pinion side of gearbox assembly, remove pipe B from valve housing, attach this tool and check oil leaking points.
 ST-926400000	926400000	GUIDE	• Right side of rack when installing rack bushing. • Used with GUIDE (927660000).
 ST-927660000	927660000	GUIDE	• Right side of rack when installing rack bushing. • Used with GUIDE (926400000).
 ST-927620000	927620000	INSTALLER B	• Used for installing oil seal of valve housing. • Used with INSTALLER A (926360000).

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927630000	927630000	STAND BASE	Used for assembling power steering gearbox.
 ST-926360000	926360000	INSTALLER A	- Used as a guide to install oil seal. - Used with INSTALLER B (927620000).
 ST34199AE060	34199AE060	INSTALLER	Used for installing oil seal.
 ST-927610000	927610000	INSTALLER & REMOVER SEAL	Used for installing valve housing oil seal.

GENERAL DESCRIPTION

POWER ASSISTED SYSTEM (POWER STEERING)

2. GENERAL PURPOSE TOOLS

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

STEERING WHEEL

POWER ASSISTED SYSTEM (POWER STEERING)

2. Steering Wheel

A: REMOVAL

- 1) Disconnect ground cable from battery.
- 2) Set tires to straight-ahead position.
- 3) Remove airbag module. <Ref. to AB-13, REMOVAL, Driver's Airbag Module.>

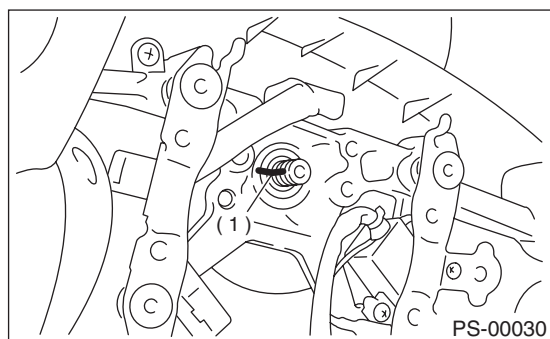
WARNING:

Always refer to "Airbag System" before performing airbag module service (if so equipped). <Ref. to AB-13, INSPECTION, Driver's Airbag Module.>

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

NOTE:

Make matching marks on steering wheel and steering column in advance.



(1) Matching mark

B: INSTALLATION

- 1) Align center of roll connector. <Ref. to AB-18, ADJUSTMENT, Roll Connector.>
- 2) Install in the reverse order of removal.

NOTE:

Align matching marks on steering wheel and steering column.

Tightening torque:

45 N·m (4.6 kgf-m, 33.2 ft-lb)

Column cover-to-steering wheel clearance:

2 — 4 mm (0.08 — 0.16 in)

WARNING:

Always refer to "Airbag System" before performing airbag module service (if so equipped). <Ref. to AB-13, INSPECTION, Driver's Airbag Module.>

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 con-

nectors from guide hole of steering wheel lower end.

C: INSPECTION

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

UNIVERSAL JOINT

POWER ASSISTED SYSTEM (POWER STEERING)

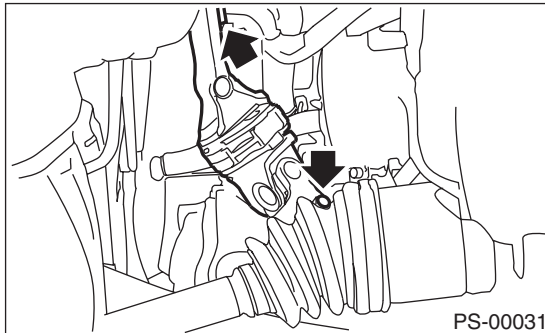
3. Universal Joint

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Remove the steering wheel. <Ref. to PS-17, REMOVAL, Steering Wheel.>
- 3) Lift-up the vehicle.
- 4) 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.



B: INSTALLATION

- 1) Install universal joint.
 - (1) Align bolts 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, then that on the short yoke side.

Tightening torque:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

CAUTION:

- Make sure that universal joint bolt 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)

- 2) Lower the vehicle.
- 3) Align center of roll connector. <Ref. to AB-18, ADJUSTMENT, Roll Connector.>

CAUTION:

Ensure that front wheel are set straight forward direction.

- 4) Install steering wheel and airbag module. <Ref. to PS-17, INSTALLATION, Steering Wheel.>

WARNING:

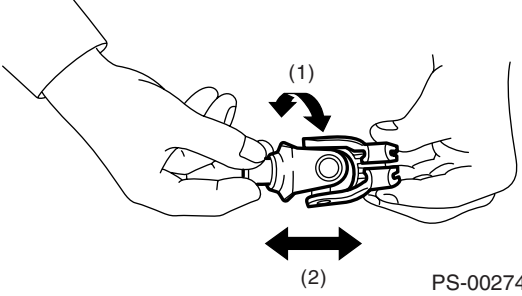
Always refer to “Airbag System” before performing airbag module service (if so equipped). <Ref. to AB-13, INSPECTION, Driver’s Airbag Module.> and <Ref. to AB-13, INSTALLATION, Driver’s Airbag Module.>

UNIVERSAL JOINT

POWER ASSISTED SYSTEM (POWER STEERING)

C: INSPECTION

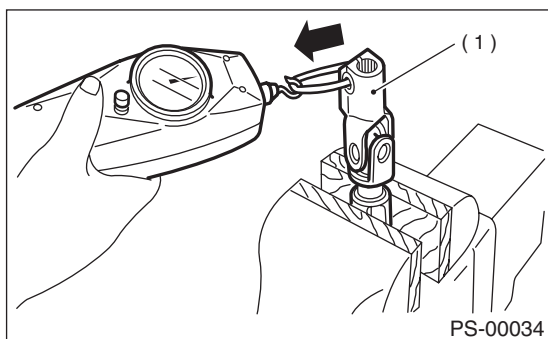
Clean the disassembled parts with a cloth, and check for wear, damage, or any other faults. If necessary, repair or replace faulty parts.

Inspection	Corrective action
(1) Free play (2) Swinging torque Yawing torque Looseness  PS-00274 Standard value of universal joint free play: 0 mm (0 in) Max. value of universal joint swinging torque: 0.3 N·m (0.03 kgf·m, 0.2 ft·lb)	Replace if faulty.

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

Service limit:

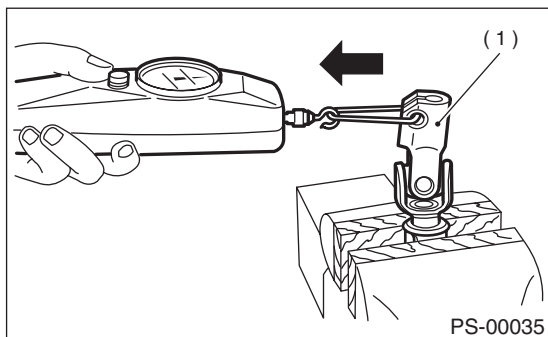
Maximum load; 5.49 N (0.56 kgf, 1.23 lb) or less



(1) Long yoke

Service limit:

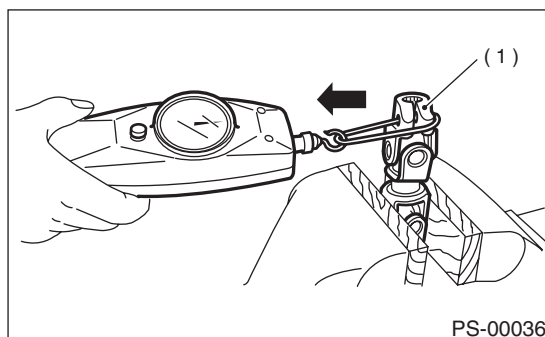
Maximum load; 5.49 N (0.56 kgf, 1.23 lb) or less



(1) Long yoke

Service limit:

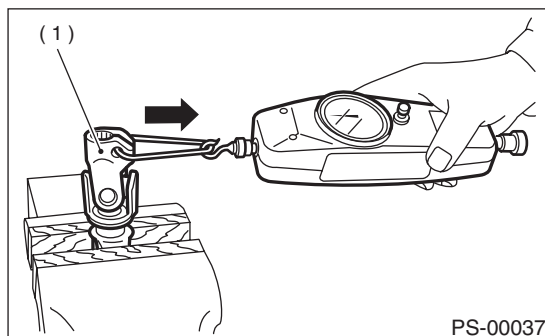
Maximum load; 8.43 N (0.86 kgf, 1.90 lb) or less



(1) Short yoke

Service limit:

Maximum load; 8.43 N (0.86 kgf, 1.90 lb) or less



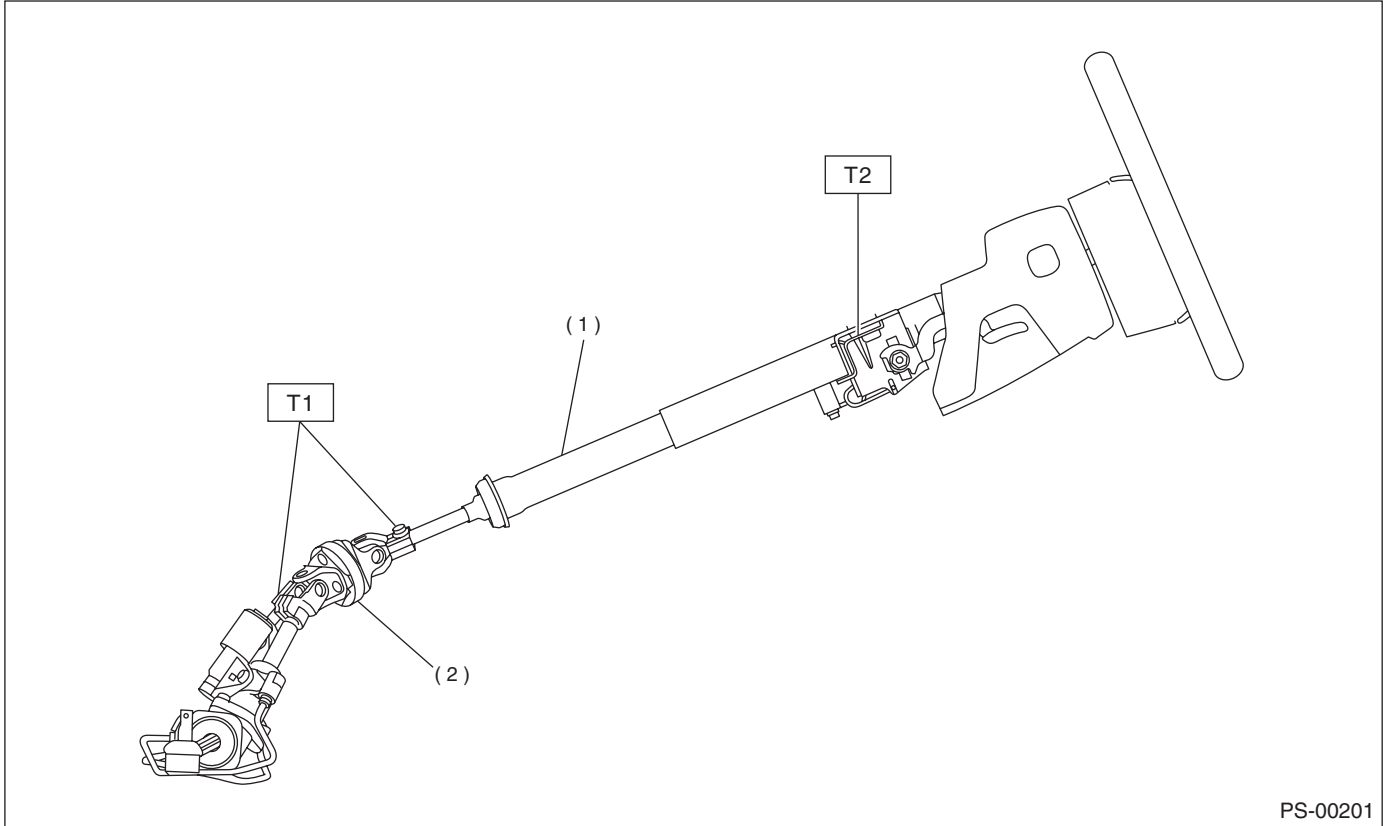
(1) Short yoke

TILT STEERING COLUMN

POWER ASSISTED SYSTEM (POWER STEERING)

4. Tilt Steering Column

A: REMOVAL



PS-00201

- (1) Tilt steering column
- (2) Universal joint

Tightening torque: N·m (kgf-m, ft-lb)

T1: 24 (2.4, 17.4)

T2: 25 (2.5, 18.1)

TILT STEERING COLUMN

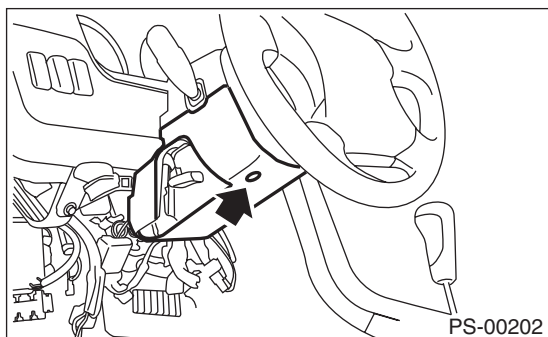
POWER ASSISTED SYSTEM (POWER STEERING)

- 1) Set the vehicle on the lift.
- 2) Disconnect battery minus ground cable.
- 3) Remove airbag module. <Ref. to AB-13, REMOVAL, Driver's Airbag Module.>

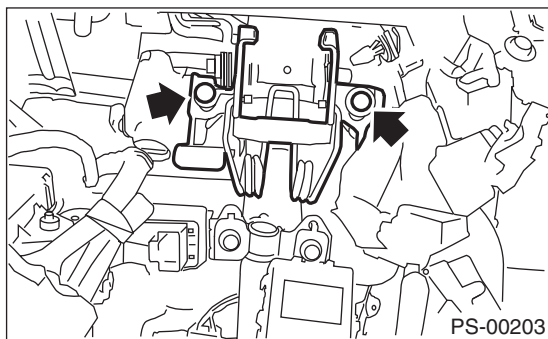
WARNING:

Always refer to "Airbag System" before performing airbag module service (if so equipped). <Ref. to AB-13, INSPECTION, Driver's Airbag Module.>

- 4) Remove steering wheel. <Ref. to PS-17, REMOVAL, Steering Wheel.>
- 5) Lift-up the vehicle.
- 6) Remove universal joint. <Ref. to PS-18, REMOVAL, Universal Joint.>
- 7) Lower the vehicle.
- 8) Remove trim panel under instrument panel.
- 9) Remove the screw securing lower steering column cover.



- 10) Remove all connectors from steering column.
- 11) Remove the two bolts under instrument panel securing steering column.



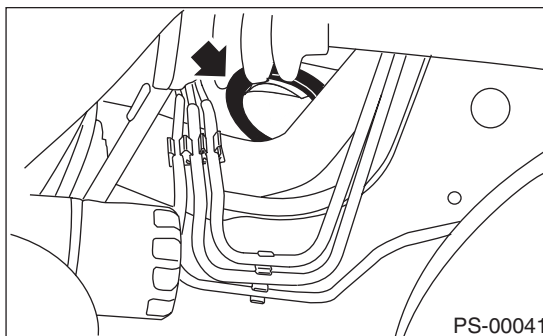
- 12) Pull out steering shaft assembly from hole on toe board.

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: INSTALLATION

- 1) Set grommet to toe board.



- 2) Insert end of steering shaft into toe board grommet.
- 3) Tighten steering shaft mounting bolts under instrument panel.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

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

NOTE:

Make sure to apply double lock.

- 6) Install lower column cover with tilt lever held in the lowered position.
- 7) Install universal joint. <Ref. to PS-18, INSTALLATION, Universal Joint.>
- 8) Align center of roll connector. <Ref. to AB-18, ADJUSTMENT, Roll Connector.>

CAUTION:

Ensure that front wheels are set in straight forward direction.

- 9) Install steering wheel. <Ref. to PS-17, INSTALLATION, Steering Wheel.>
- Set steering wheel to neutral and install it onto steering shaft.

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.

- 10) Install airbag module to steering wheel.

WARNING:

Always refer to "Airbag System" before performing the service operation. <Ref. to AB-13, INSPECTION, Driver's Airbag Module.>

TILT STEERING COLUMN

POWER ASSISTED SYSTEM (POWER STEERING)

C: DISASSEMBLY

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

D: ASSEMBLY

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

Tightening torque:

1.2 N·m (0.12 kgf-m, 0.9 ft-lb)

CAUTION:

Don't overtorque screw.

E: INSPECTION

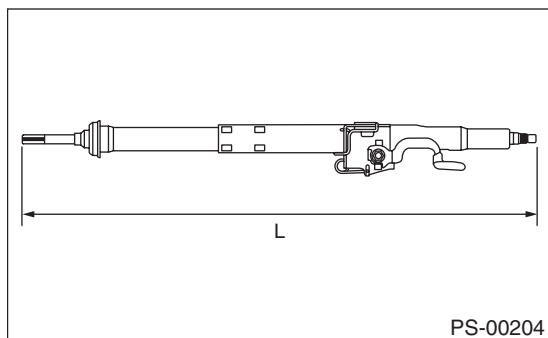
1. BASIC INSPECTION

Measure overall length of steering column and if it is out of standard value, replace it.

Standard value:

Overall length (L)

817 ^{+1.5}/_{-0.5} mm (32.197 ^{+0.059}/_{-0.020} in)



PS-00204

2. AIRBAG MODEL INSPECTION

WARNING:

For airbag model inspection procedures, refer to “Airbag System”. <Ref. to AB-13, INSPECTION, Driver’s Airbag Module.>

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

5. Steering Gearbox

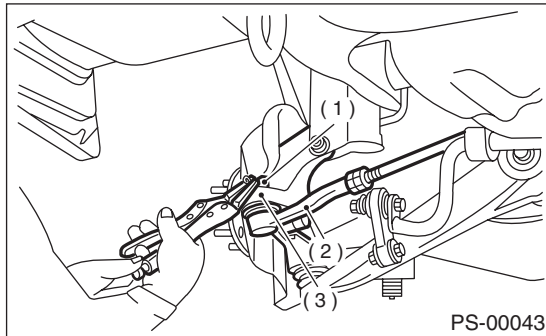
A: REMOVAL

- 1) Disconnect battery ground cable.
- 2) Loosen front wheel nut.
- 3) Lift vehicle and remove front wheels.
- 4) Remove front exhaust pipe assembly.
<Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.>

WARNING:

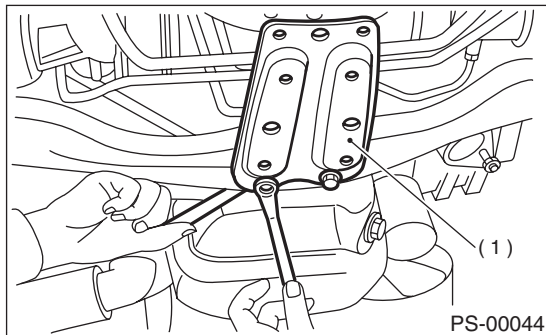
Be careful, exhaust pipe is hot.

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



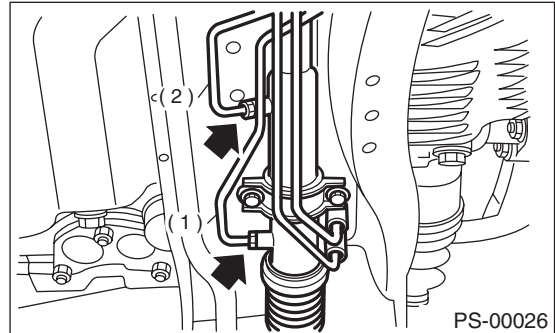
- (1) Castle nut
- (2) Tie-rod end
- (3) Knuckle arm

- 6) Remove jack-up plate and front stabilizer. <Ref. to FS-24, REMOVAL, Front Stabilizer.>



- (1) Jack-up plate

- 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.



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

- 8) Remove universal joint. <Ref. to PS-18, REMOVAL, Universal Joint.>

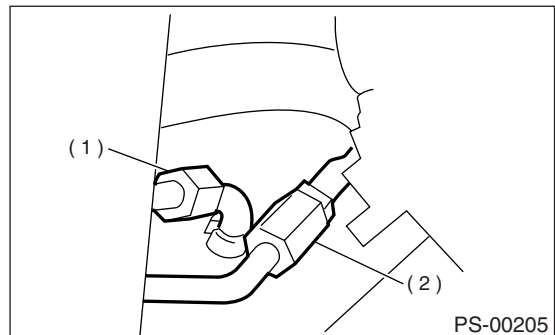
- 9) Disconnect pipes C (Pressure pipe assembly) and D (Return pipe assembly) from pipe of gearbox.

CAUTION:

Be careful not to damage these pipes.

NOTE:

Disconnect upper pipe D (Return hose assembly) first, and lower pipe C (Pressure hose assembly) second.

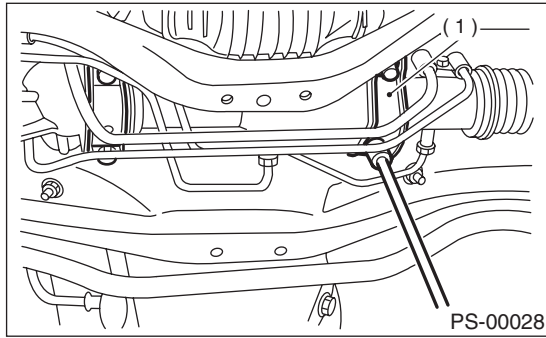


- (1) Pipe C
- (2) Pipe D

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

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



(1) Clamp

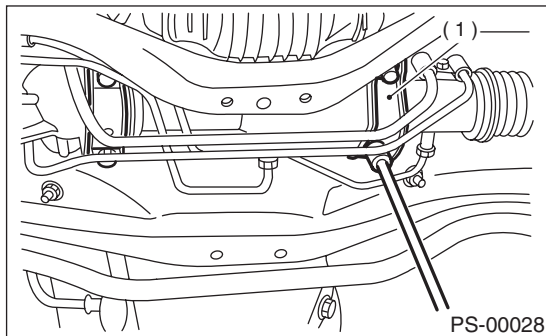
B: INSTALLATION

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 N·m (6.0 kgf-m, 43 ft-lb)



(1) Clamp

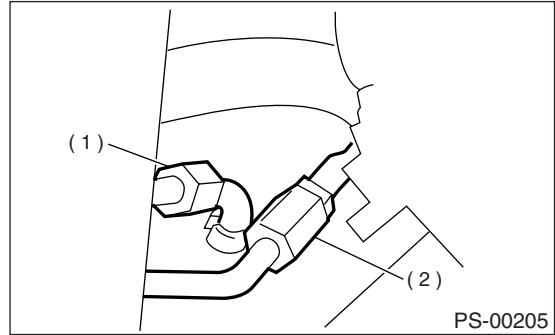
3) Connect pipes C and D to pipe of gearbox.

NOTE:

Connect lower pipe C first, and upper pipe D second.

CAUTION:

Be careful not to damage these pipes.



(1) Pipe C

(2) Pipe D

4) Install universal joint. <Ref. to PS-18, INSTALLATION, Universal Joint.>

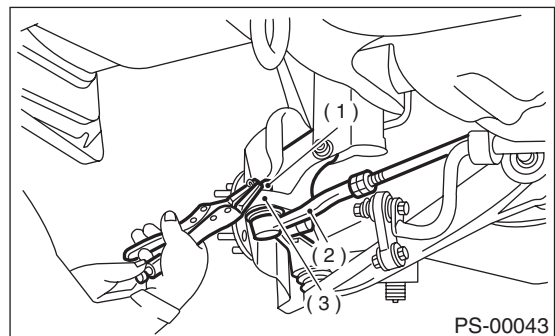
5) Connect tie-rod end and knuckle arm, and tighten with castle nut. Fit cotter pin into the nut and bend the pin to lock.

Castle nut tightening torque:

Tighten to 27.0 N·m (2.75 kgf-m, 19.9 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.



(1) Castle nut

(2) Tie-rod end

(3) Knuckle arm

6) Install front stabilizer to vehicle. <Ref. to FS-24, INSTALLATION, Front Stabilizer.>

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

7) Install front exhaust pipe assembly. <Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.>

8) Install tires.

9) Tighten wheel nuts to the specified torque.

Tightening torque:

88 N·m (9.0 kgf-m, 65 ft-lb)

10) Connect battery ground cable.

11) Pour fluid into oil tank, and bleed air.

<Ref. to PS-59, Power Steering Fluid.>

12) Check for fluid leaks. <Ref. to PS-37, BASIC INSPECTION, INSPECTION, Steering Gearbox.>

13) Install jack-up plate.

WARNING:

Be careful, exhaust manifold is hot.

14) Lower vehicle.

15) Check fluid level in oil tank.

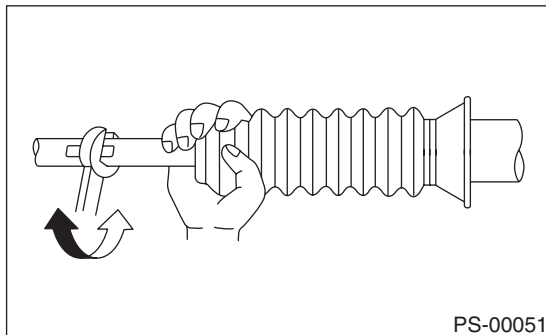
16) After adjusting toe-in and steering angle, tighten lock nut on tie-rod end.

Tightening torque:

83 N·m (8.5 kgf-m, 61.5 ft-lb)

CAUTION:

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



C: DISASSEMBLY

1. RACK HOUSING ASSEMBLY

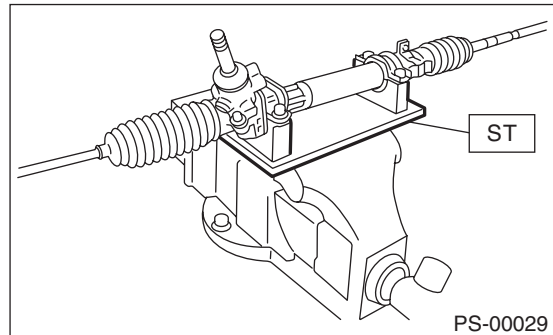
1) Disconnect four pipes from gearbox.

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

ST 926200000 STAND

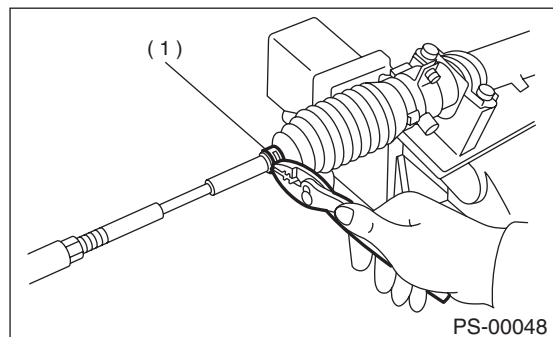
CAUTION:

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



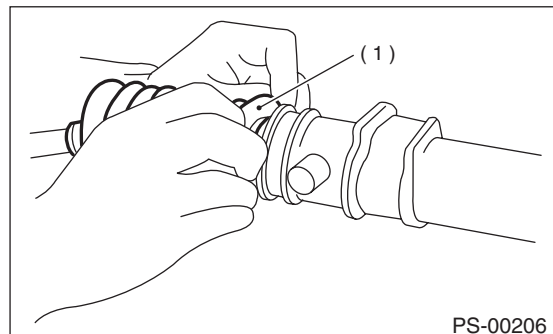
3) Remove tie-rod end and lock nut from gearbox.

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



(1) Clip

5) Remove boot with large clips.



(1) Boot

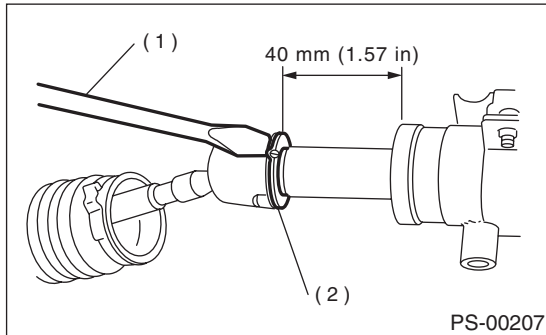
STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

6) Extend rack approximately 40 mm (1.57 in) out. Unlock lock wire at lock washer on each side of tie-rod end using a standard screwdriver.

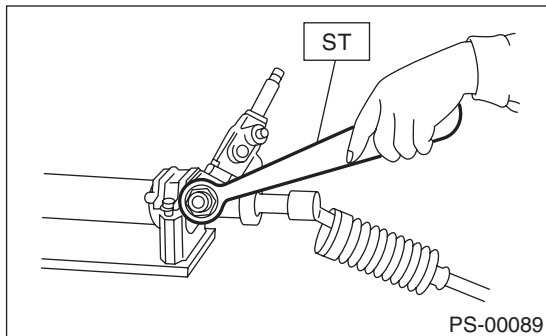
CAUTION:

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

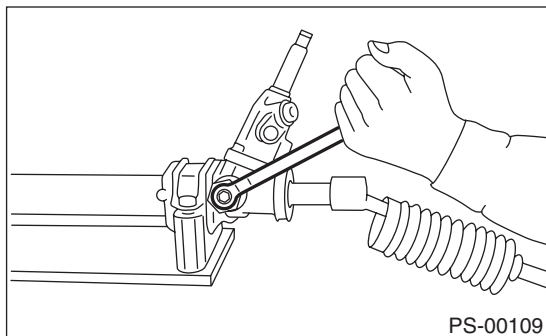


- (1) Standard screwdriver
- (2) Lock washer

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



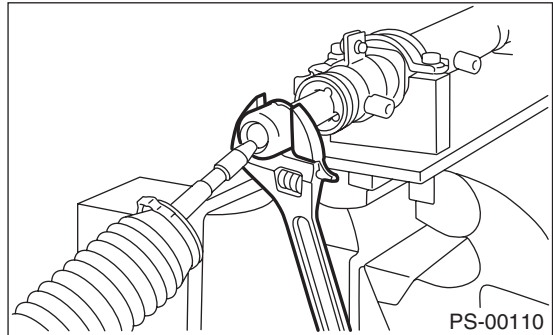
8) Tighten adjusting screw until it no longer tightens.



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

CAUTION:

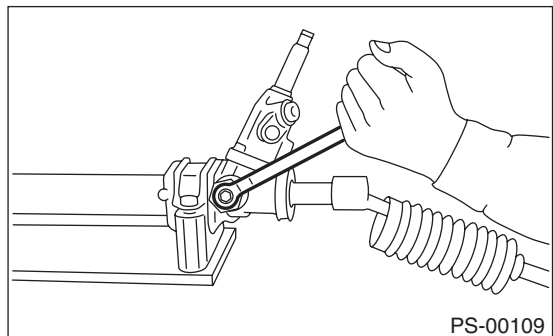
- Check ball joint for free play, and tie-rod for bends. Replace if necessary.
- Check dust seals used with tie-rod end ball joint for damage or deterioration. Replace if necessary.



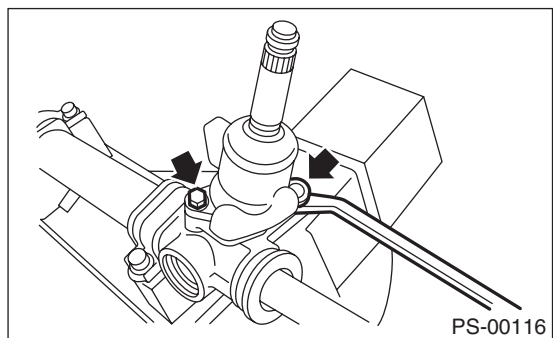
10) Loosen adjusting screw and remove spring and sleeve.

CAUTION:

Replace spring and/or sleeve if damaged.



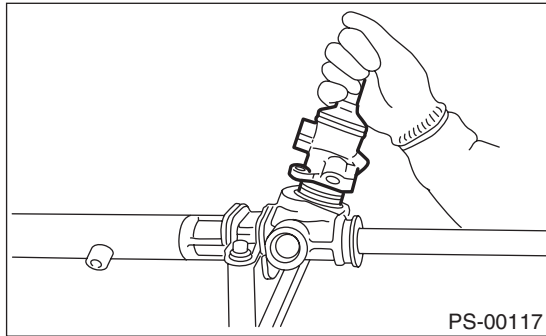
11) Remove two bolts securing valve assembly.



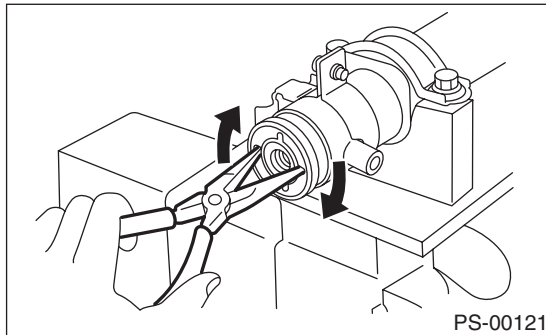
STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

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



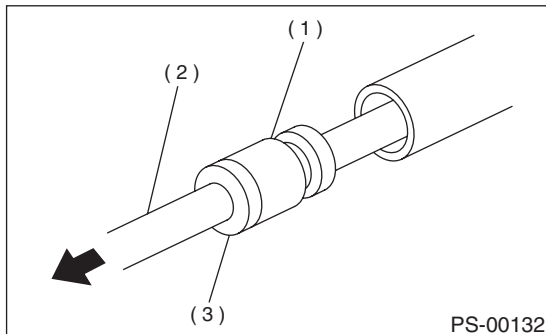
13) Using a sharp pointed pliers, rotate the rack stopper in the direction of the arrow until the end of the circlip comes out of the stopper. Rotate the circlip in the opposite direction and pull it out.



14) 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.



- (1) Rack bushing
- (2) Rack ASSY
- (3) Rack stopper

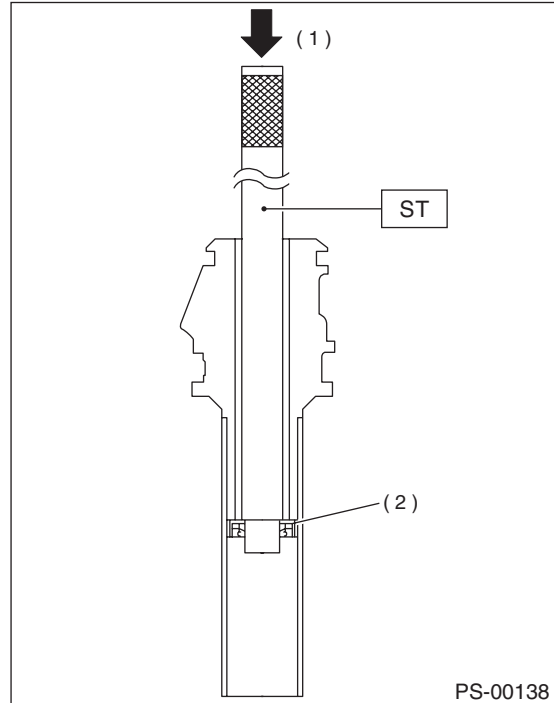
15) Remove rack bushing and rack stopper from rack assembly.

CAUTION:

Do not reuse removed rack bushing and circlip.

16) Insert ST from pinion housing side and remove oil seal using a press.

ST 34199AE050 OIL SEAL REMOVER



- (1) Press
- (2) Oil seal

NOTE:

Discard removed oil seal.

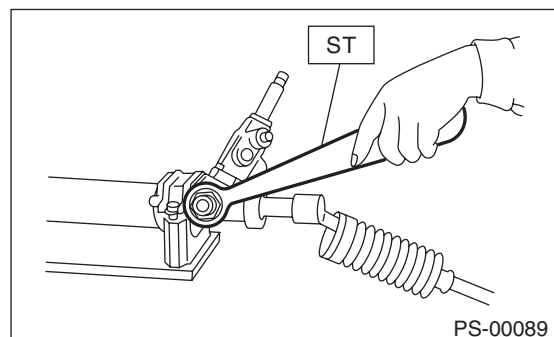
2. CONTROL VALVE ASSEMBLY

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) Using ST, loosen lock nut.

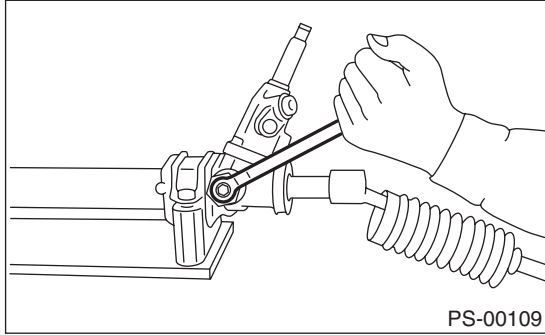
ST 926230000 SPANNER



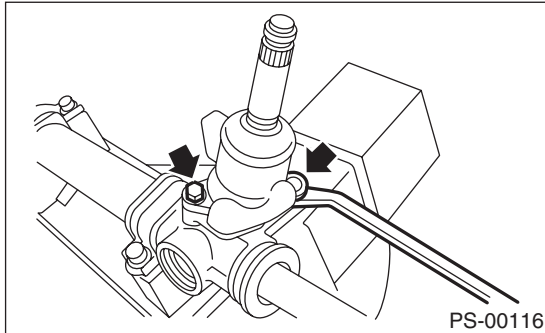
STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

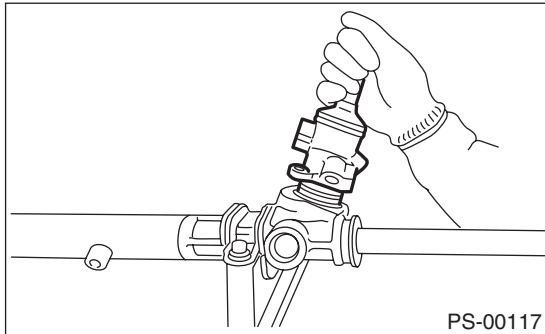
2) Tighten adjusting screw until it no longer tightens.



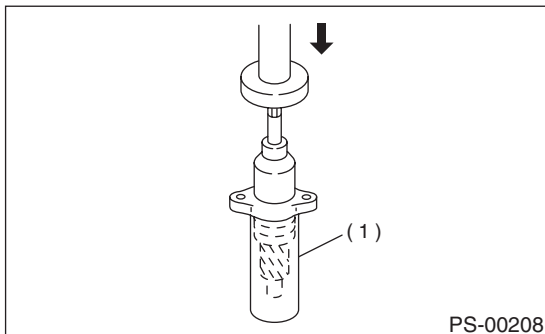
3) Remove two bolts securing valve assembly.



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



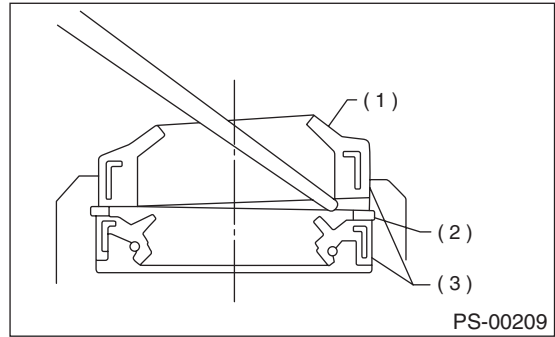
5) Draw out pinion and valve assembly from valve housing, using pipe of I.D. 44 to 46 mm (1.73 to 1.81 in) and a press.



(1) Pipe

6) Pry off dust seal using screwdriver.

7) Remove snap ring using snap ring pliers.

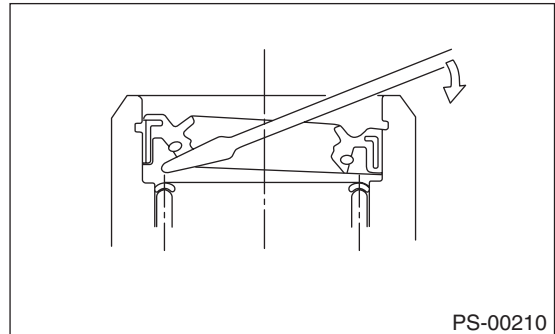


- (1) Dust seal
- (2) Snap ring
- (3) Oil seal

8) Pry off oil seal using screwdriver.

CAUTION:

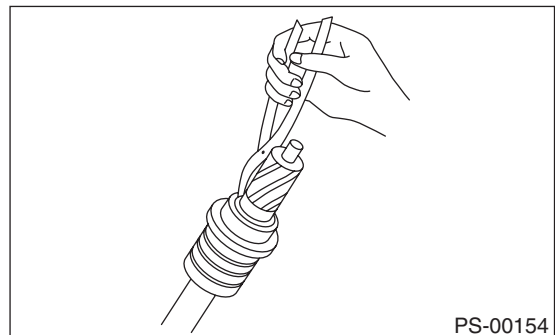
After removing, check inside surface of valve housing for damage. If oil seal contacting surface is damaged, replace valve housing with a new one.



9) Remove snap ring using snap ring pliers.

CAUTION:

- Do not reuse removed snap ring.
- Be careful not to scratch pinion and valve assembly.



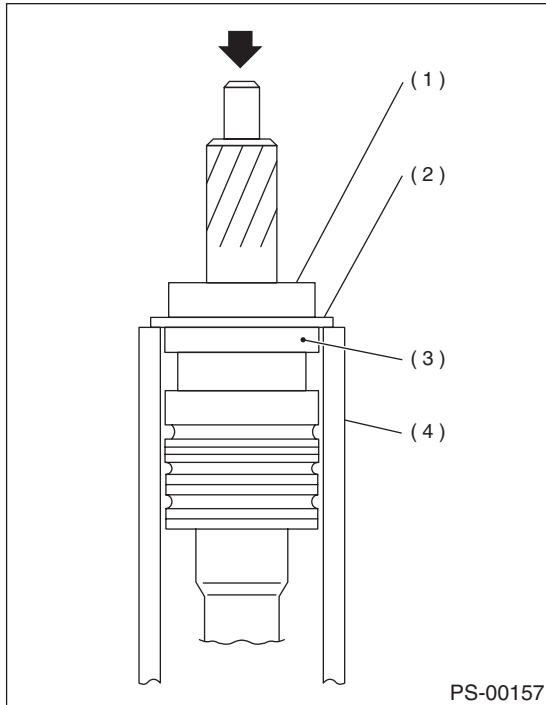
STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

10) 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.



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

11) Remove oil seal.

CAUTION:

Do not reuse removed oil seal.

D: ASSEMBLY

1. RACK HOUSING ASSEMBLY

CAUTION:

Use only SUBARU genuine grease for gearbox.

Grease:

VALIANT GREASE M2

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

- 1) Clean all parts and tools before reassembling.
- 2) 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.

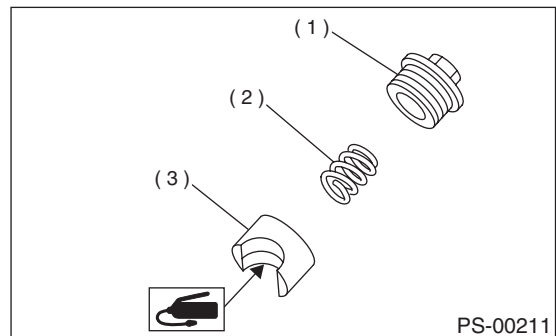
CAUTION:

- 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.
- 3) Apply grease to sleeve insertion hole.
 - 4) 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.

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

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

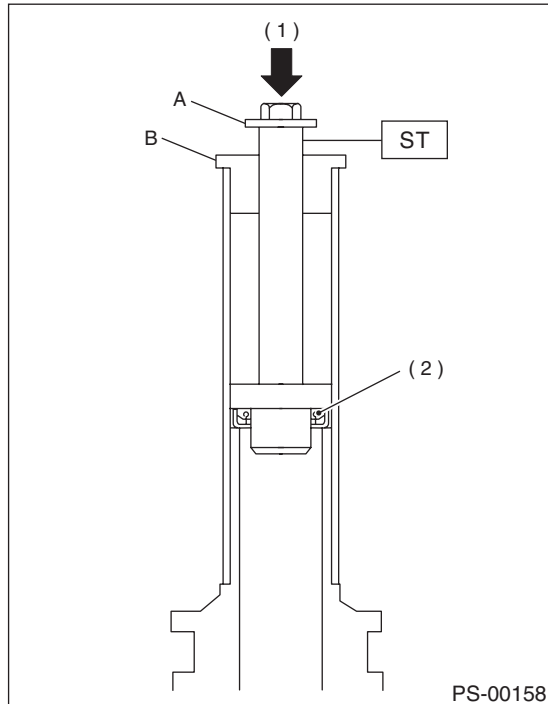
6) Force-fit oil seal using ST.
ST 34199AE060 INSTALLER

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 oil seal in wrong direction.
- Push oil seal until the stepped portion of A contacts end face of B.



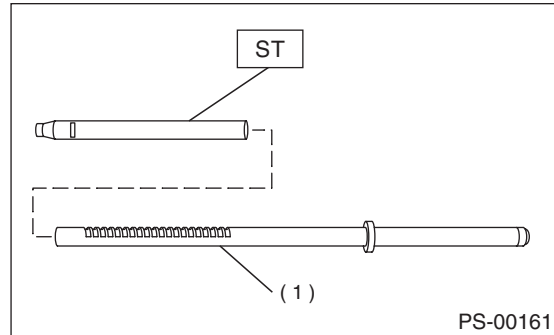
- (1) Press
(2) Oil seal

7) Fixing rack housing
Fix rack housing in vise using ST.
ST 926200000 STAND

CAUTION:

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

8) 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.
ST 926390001 COVER & REMOVER



- (1) Rack ASSY

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

CAUTION:

- Be careful not to block air passage hole 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.

10) 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 & REMOVER

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

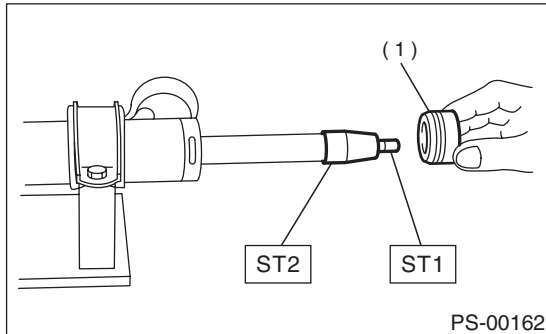
11) Fit ST1 and ST2 over the end of rack, and install rack bushing.

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.



(1) Rack bushing ASSY

12) 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.

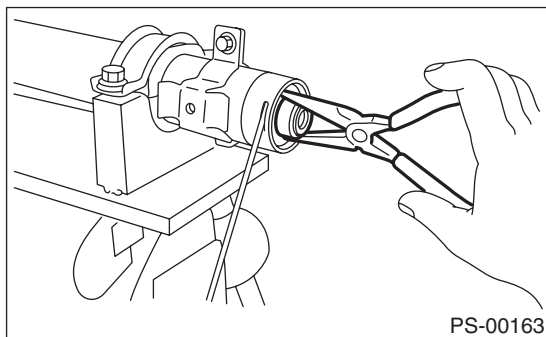
13) Insert rack stopper into rack housing, and wrap circlip using a sharp pointed pliers to secure rack stopper in position.

CAUTION:

Be careful not to scratch rack while winding circlip.

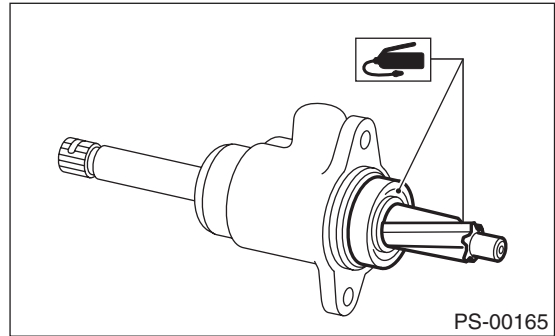
NOTE:

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



14) Fit mounting rubber onto rack housing.

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



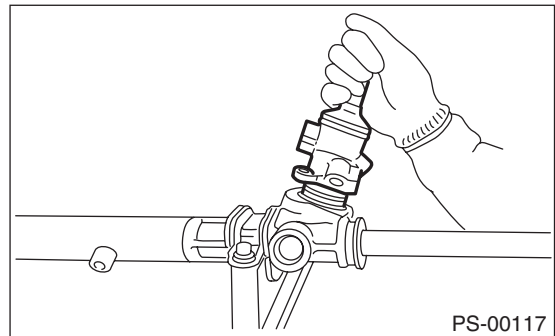
16) Install gasket on valve assembly. Insert valve assembly into place while facing rack teeth toward pinion.

CAUTION:

Be sure to use a new gasket.

NOTE:

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



17) Tighten bolts alternately to secure valve assembly.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

CAUTION:

Be sure to alternately tighten bolts.

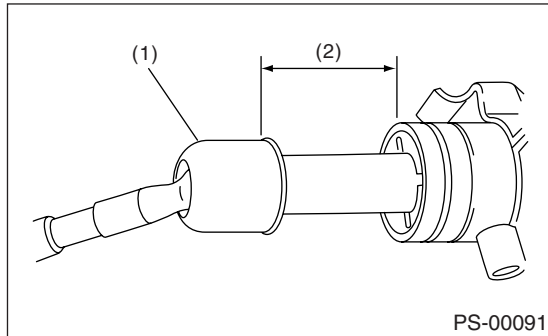
STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

18) Install lock washers and tighten left and right tie-rods into rack ends.

Tightening torque:

78 N·m (8.0 kgf-m, 58 ft-lb)

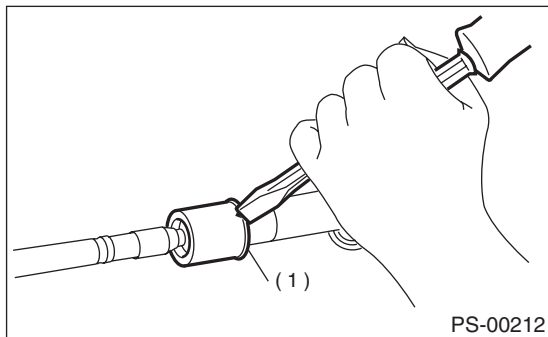


- (1) Tie-rod
- (2) Approx. 40 mm (1.57 in)

19) Bend lock washer, using chisel.

CAUTION:

Be careful not to scratch rack when bending lock washer.

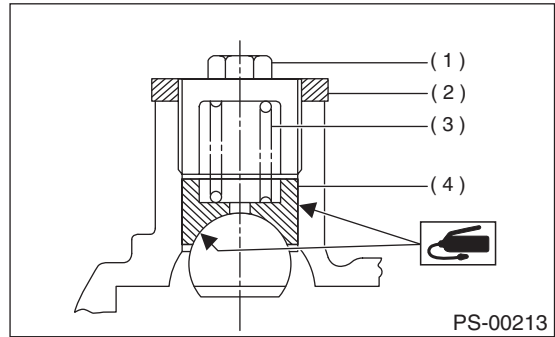


- (1) Lock washer

20) Rack and pinion backlash adjustment

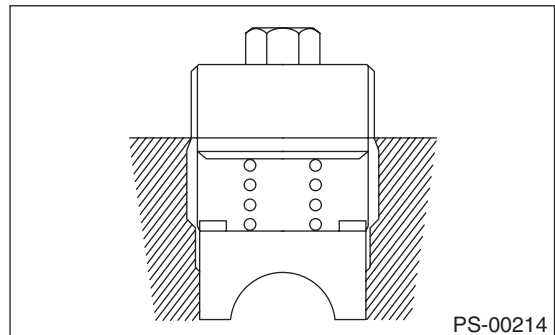
- (1) Loosen adjusting screw.
- (2) Rotate input shaft so that rack is in the straight ahead direction.

(3) Apply grease to sleeve.



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

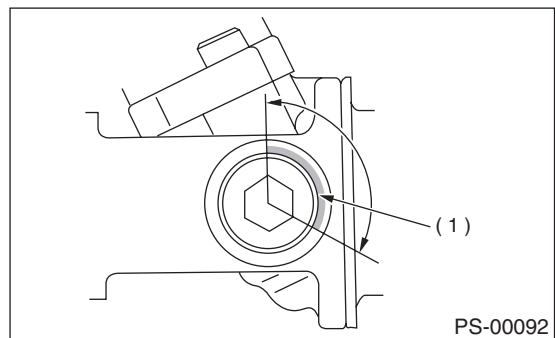
(4) Tighten adjusting screw by two threads.



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

Liquid packing:

THREE BOND 1141



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

(6) Tighten adjusting screw to 7.4 N·m (0.75 kgf-m, 5.4 ft-lb) and back off 25°.

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

ST 926230000 SPANNER

Tightening torque (Lock nut):

39 N·m (4.0 kgf-m, 29 ft-lb)

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

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.

21) Inspect for service limit as per article of "Service limit". <Ref. to PS-38, RACK SHAFT PLAY IN RADIAL DIRECTION, INSPECTION, Steering Gearbox.> Make replacement and adjustment if necessary.

22) Install boot to housing.

NOTE:

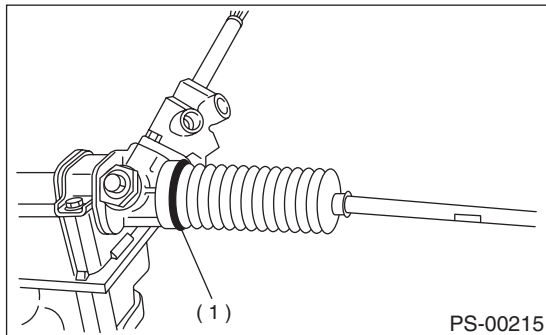
- Before installing boot, be sure to apply grease to the groove of tie-rod.
- Install fitting portions of boots to the following portions in both sides of assembled steering gearbox.

The groove on gearbox

The groove on the rod

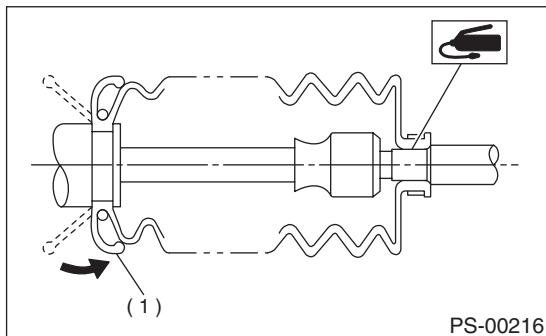
- Make sure that boot is installed without unusual inflation or deflation.

23) 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 cannot be seen.



(1) Clip (large)

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

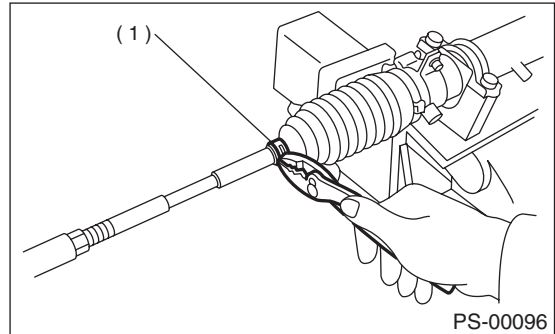


(1) Reverse after installing

25) Fix boot end with clip (small).

CAUTION:

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



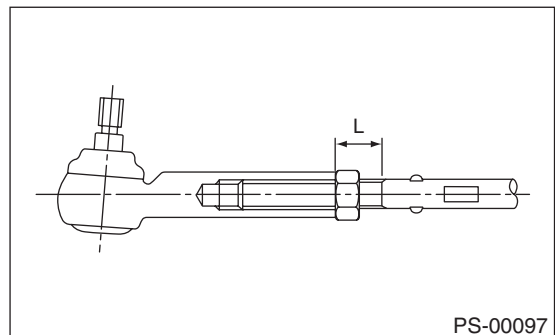
(1) Clip

26) 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.

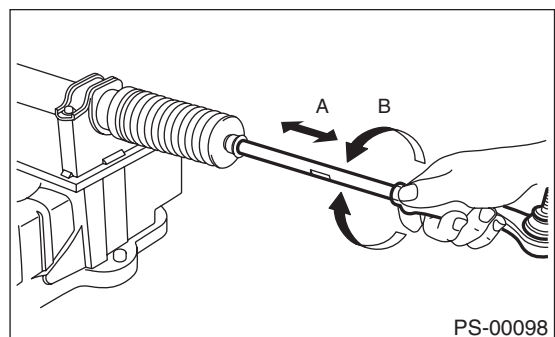


27) Inspect gearbox as follows:

"A" Holding tie-rod end, repeat lock to lock two or three times as quickly as possible.

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

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



STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

28) Remove gearbox from ST.

ST 926200000 STAND

29) 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:

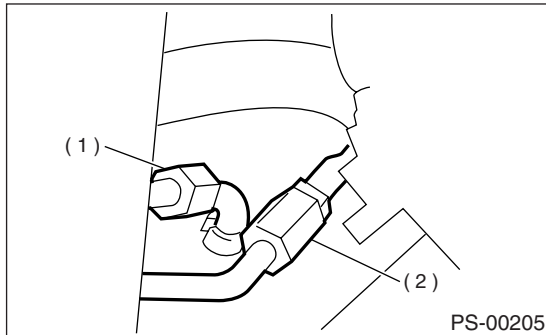
13 N·m (1.3 kgf-m, 9.4 ft-lb)

- (2) Connect pipes C and D to gearbox.

Connect lower pipe C first, and upper pipe D second.

Tightening torque:

15 N·m (1.5 kgf-m, 10.8 ft-lb)



(1) Pipe C

(2) Pipe D

2. CONTROL VALVE ASSEMBLY

Specified steering grease:

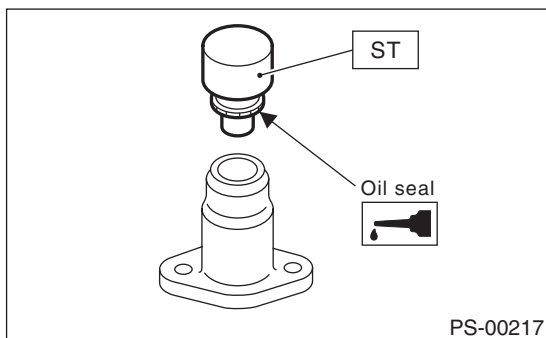
VALIANT GREASE M2 (Part No. 003608001)

- 1) Clean all parts and tools before reassembling.
- 2) Press-fit oil seal into valve housing using ST and press.

ST 927610000 INSTALLER

NOTE:

Before fitting, coat oil seal fully with ATF DEXRON ATF DEXRON III or equivalent.



- 3) 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.

- 4) Put vinyl tape around pinion shaft splines to protect oil seal from damage.

- 5) 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.

- 6) Secure valve assembly to ST1 and ST2.

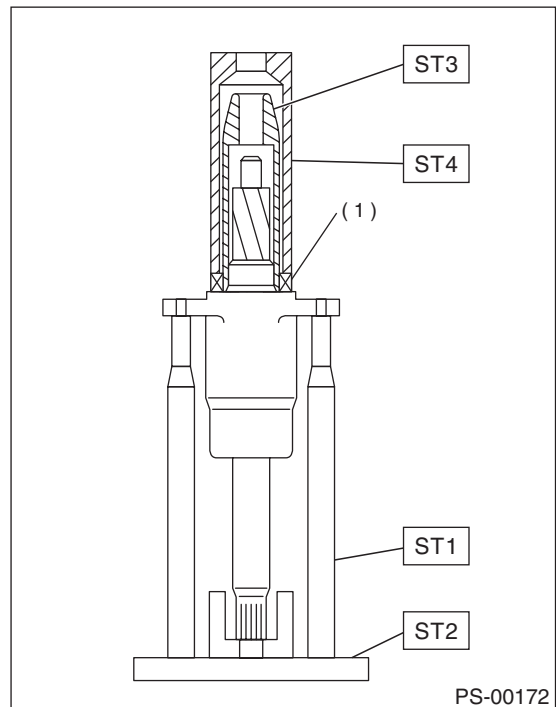
- 7) Put ST3 over pinion, and insert oil seal, then force-fit oil seal into housing using ST4.

ST1 926370000 INSTALLER A

ST2 927630000 STAND BASE

ST3 926360000 INSTALLER A

ST4 927620000 INSTALLER B



(1) Oil seal

NOTE:

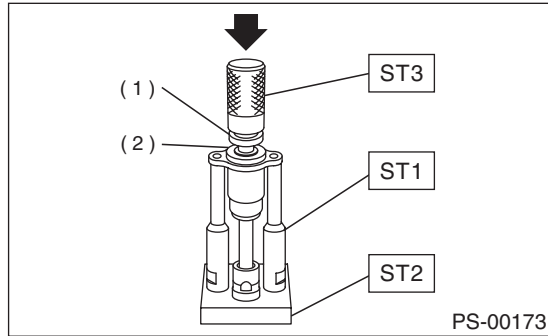
- Apply specified power steering fluid to oil seal and ST3, being careful not to damage oil seal lip.
- Push oil seal until ST3 contacts housing end face.

- 8) Remove ST3, and fit backing washer.

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

- 9) Force-fit ball bearing using ST3.
ST1 926370000 INSTALLER A
ST2 34099FA100 STAND BASE
ST3 927640000 INSTALLER B

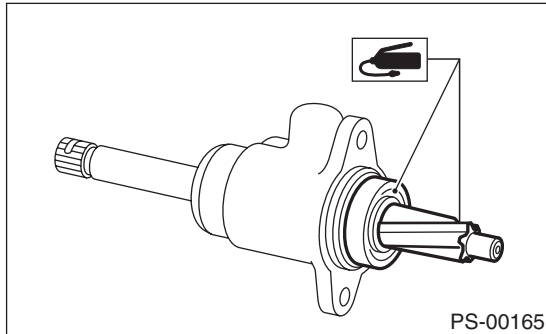


- (1) Ball bearing
(2) Backing washer

NOTE:

Be careful not to tilt ball bearing during installation.

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



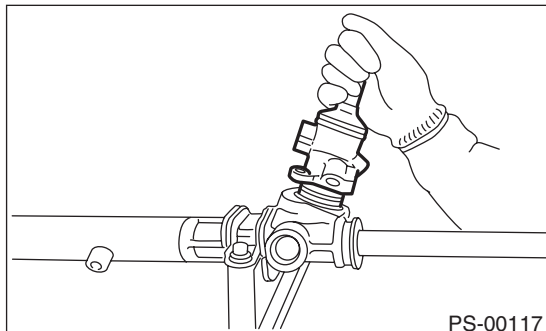
- 11) Install gasket on valve assembly. Insert valve assembly into place while facing rack teeth toward pinion.

CAUTION:

Be sure to use a new gasket.

NOTE:

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



- 12) Tighten bolts alternately to secure valve assembly.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

CAUTION:

Be sure to alternately tighten bolts.

- 13) Apply grease to sleeve insertion hole.

- 14) Apply grease to dust seal insertion hole.

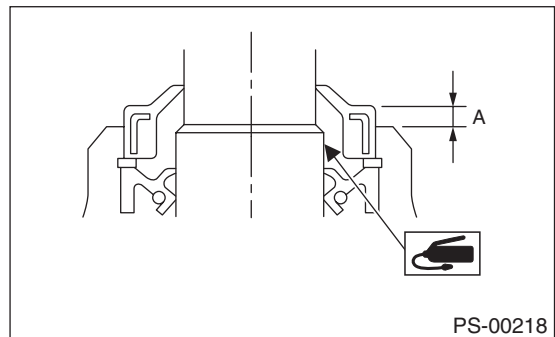
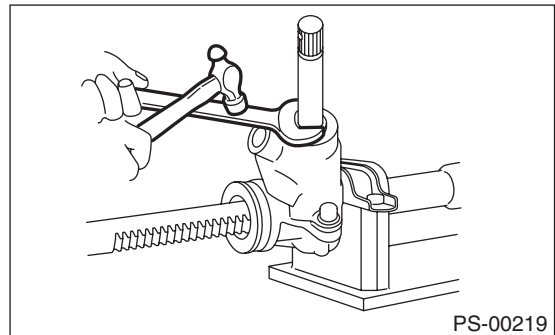
CAUTION:

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.

- 15) 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).

Depth: A

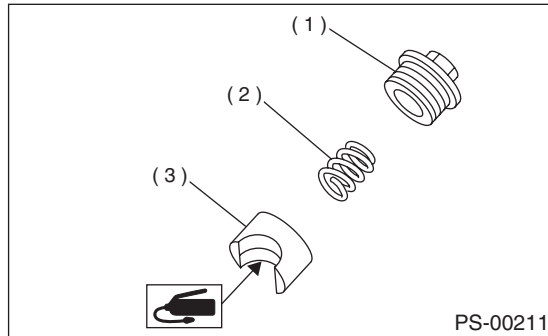
2 mm (0.08 in)



STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

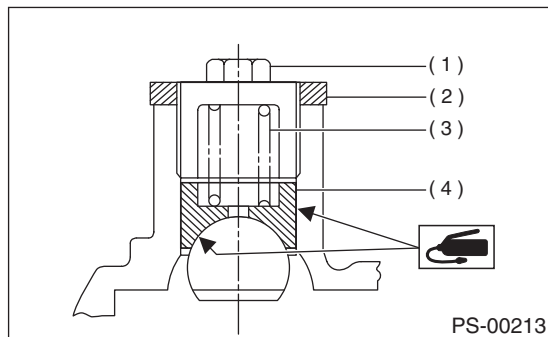
16) Apply grease to sliding surface of sleeve and spring seat, then insert sleeve into pinion housing. Fit spring into sleeve screw, pack grease inside of screw, then install the screw.



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

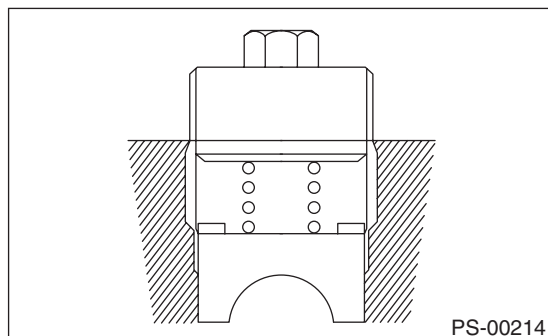
17) Rack and pinion backlash adjustment

- (1) Loosen adjusting screw.
- (2) Rotate input shaft so that rack is in the straight ahead direction.
- (3) Apply grease to sleeve.



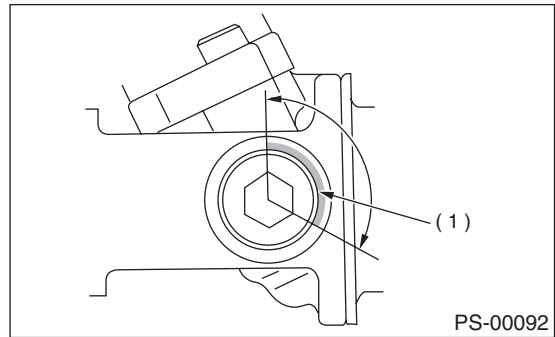
- (1) Adjusting screw
- (2) Lock nut
- (3) Spring
- (4) Sleeve

(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



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

(6) Tighten adjusting screw to 7.4 N·m (0.75 kgf-m, 5.4 ft-lb) and back off 25°.

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

ST 926230000 SPANNER

Tightening torque (Lock nut):
39 N·m (4.0 kgf-m, 29 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.

18) Check for service limit as per article of "Service limit". <Ref. to PS-38, RACK SHAFT PLAY IN RADIAL DIRECTION, INSPECTION, Steering Gear-box.> Make replacement and adjustment if necessary.

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

E: INSPECTION

1. BASIC INSPECTION

1) Clean all disassembled parts, and check for wear, damage, or any other faults, then repair or replace as necessary.

2) When disassembling, check 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.

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

2. SERVICE LIMIT

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

NOTE:

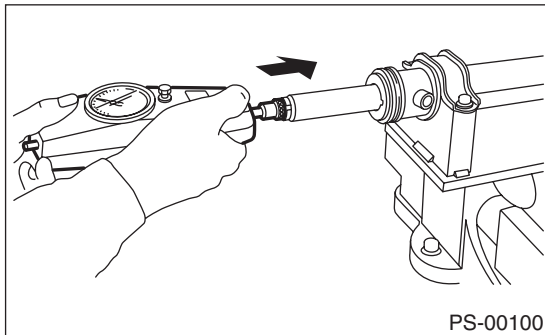
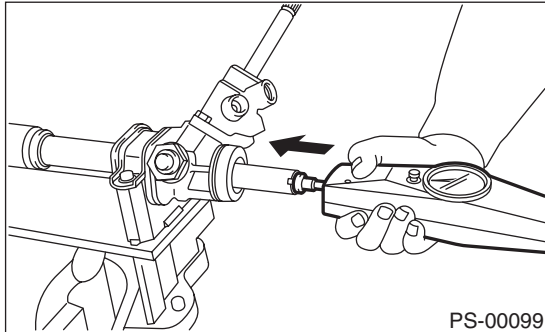
When making a measurement, vise gearbox by using ST. Never vise gearbox by inserting aluminum plates, etc. between vise and gearbox.

ST 926200000 STAND

Sliding resistance of rack shaft:

Service limit

304 N (31 kgf, 68 lb) or less



3. RACK SHAFT PLAY IN RADIAL DIRECTION

Right-turn steering:

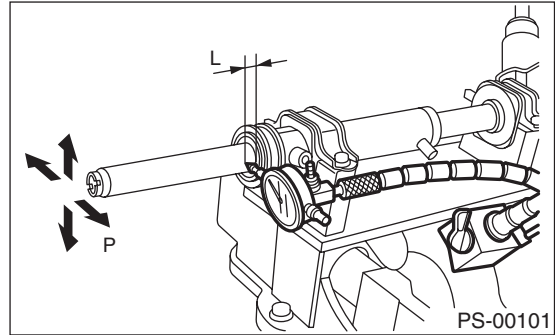
Service limit

0.19 mm (0.0075 in) or less

On condition

L: 5 mm (0.20 in)

P: 122.6 N (12.5 kgf, 27.6 lb)



Left-turn steering:

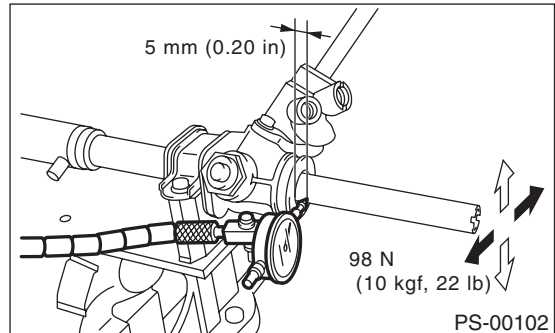
Service limit

Direction

0.3 mm (0.012 in) or less

Direction

0.15 mm (0.0059 in) or less



STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

4. INPUT SHAFT PLAY

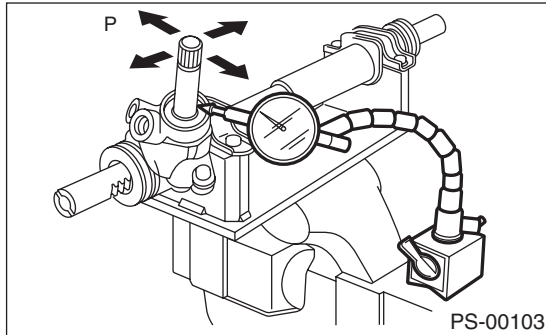
In radial direction:

Service limit

0.18 mm (0.0071 in) or less

On condition

P: 98 N (10 kgf, 22 lb)



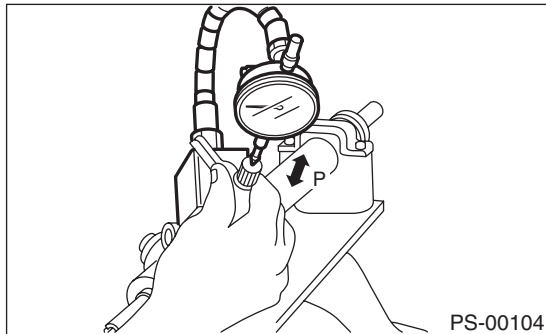
In axial direction:

Service limit

0.5 mm (0.020 in) or less

On condition

P: 20 — 49 N (2 — 5 kgf, 4 — 11 lb)



5. TURNING RESISTANCE OF GEARBOX

Using ST, measure gearbox turning resistance.

ST 926230000 SPANNER

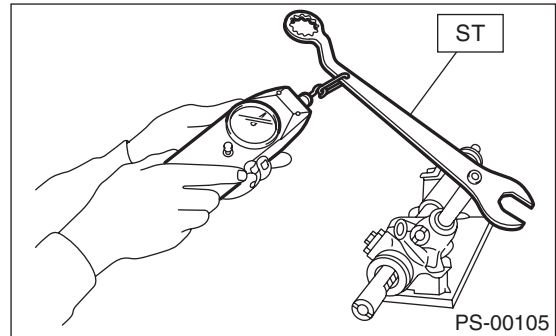
Service limit:

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

Less than 11.18 N (1.14 kgf, 2.51 lb)

Maximum allowable resistance

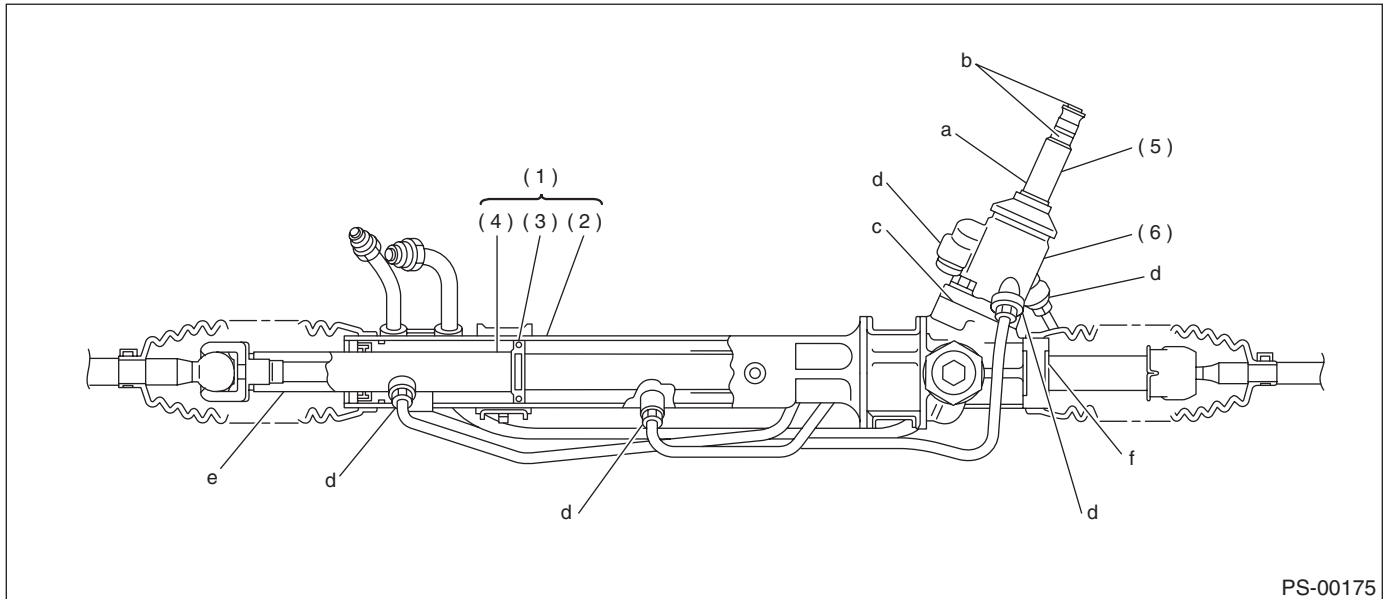
12.7 N (1.3 kgf, 2.9 lb)



STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

6. OIL LEAKING



(1) Power cylinder

(2) Cylinder

(3) Rack piston

(4) Rack axle

(5) Input shaft

(6) Valve housing

• Oil leaking points

1) If leak point is other than a, b, c, or d, perform the 5th step in "Oil leak check procedure and replacement parts" before dismounting gearbox from vehicle. 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.

• 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 or oil seal 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 im-

STEERING GEARBOX

POWER ASSISTED SYSTEM (POWER STEERING)

mediately 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”:

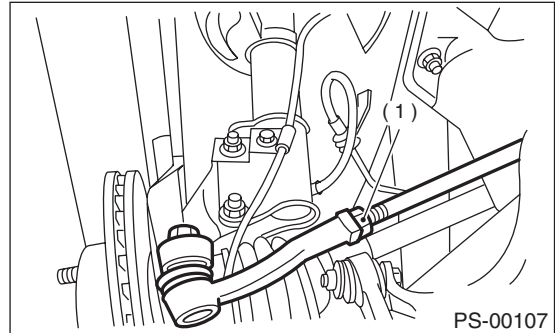
The oil seal of rack housing is damaged. Replace the oil seal and the parts that are damaged during disassembly with new ones.

F: ADJUSTMENT

- 1) Adjust front toe.

Standard of front toe:

IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)



- (1) Lock nut

- 2) Adjust steering angle of wheels.

Standard of steering angle:

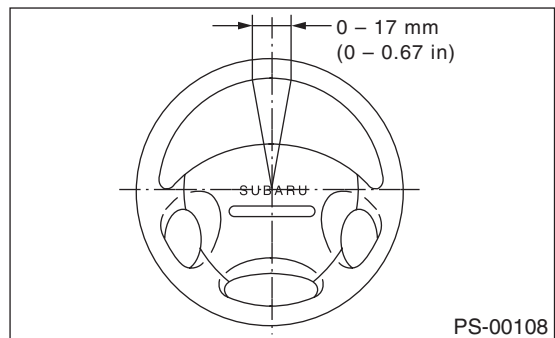
Inner wheel

$34.5^{\circ} \pm 1.5^{\circ}$

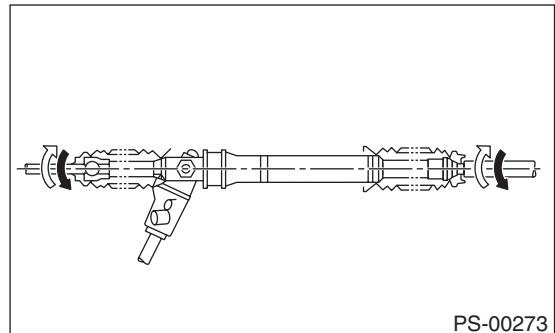
Outer wheel

$30.3^{\circ} \pm 1.5^{\circ}$

- 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.



- 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.



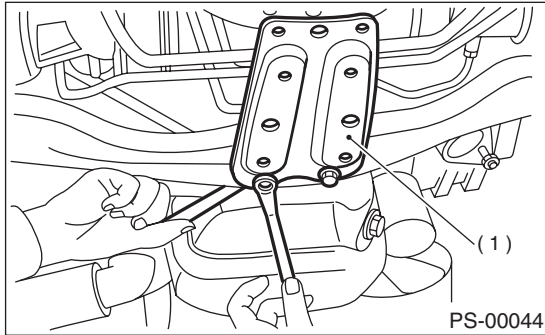
PIPE ASSEMBLY

POWER ASSISTED SYSTEM (POWER STEERING)

6. Pipe Assembly

A: REMOVAL

- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.
- 3) Lift vehicle and remove jack-up plate.

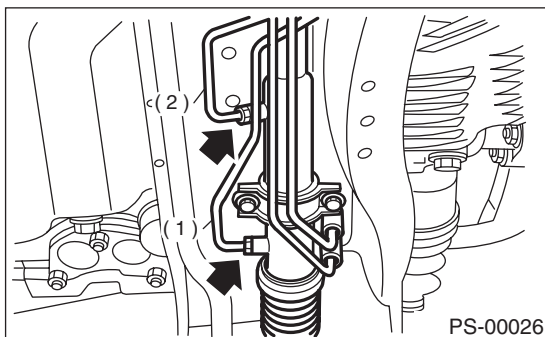


(1) Jack-up plate

- 4) 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.

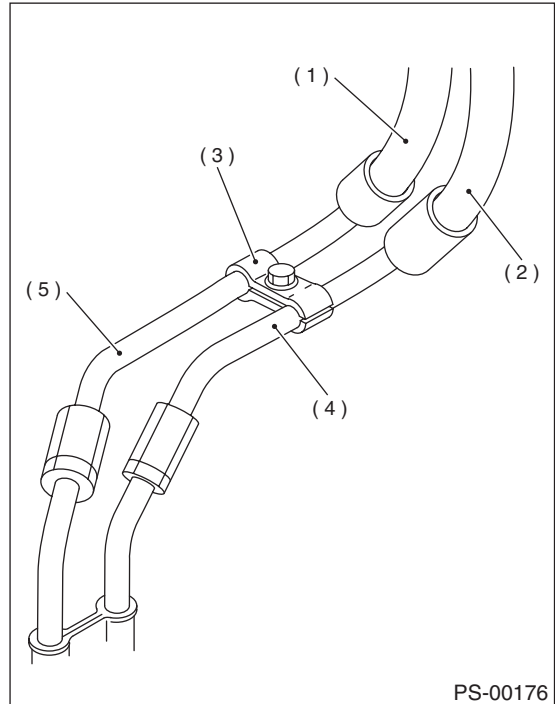
CAUTION:

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.



(1) Pipe A
(2) Pipe B

- 5) Remove clamp E from pipes.

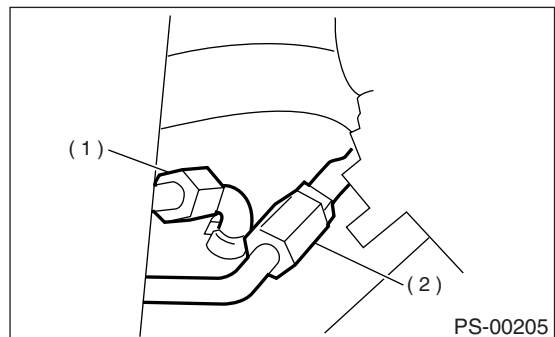


(1) Return hose
(2) Pressure hose
(3) Clamp E
(4) Pipe C
(5) Pipe D

- 6) Disconnect pipe C-D.
Disconnect pipe C-D from pipe (on the gearbox side).

CAUTION:

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



(1) Pipe C
(2) Pipe D

PIPE ASSEMBLY

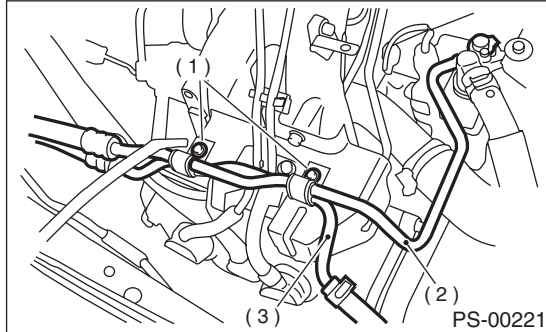
POWER ASSISTED SYSTEM (POWER STEERING)

Disconnect pipe C from oil pump. Disconnect pipe D from return hose.

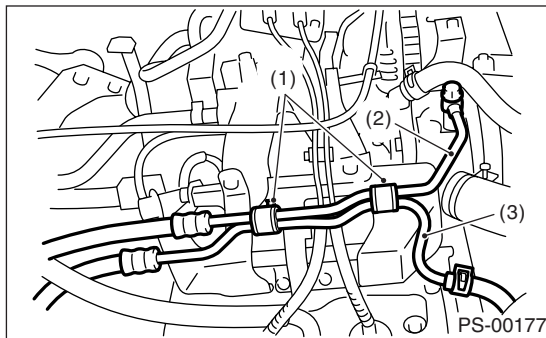
CAUTION:

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

Non-TURBO model



TURBO model



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

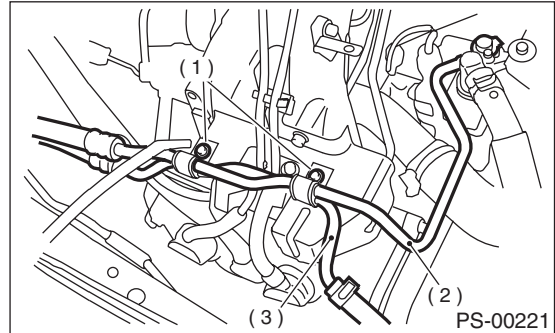
B: INSTALLATION

1) Tighten bolt A.

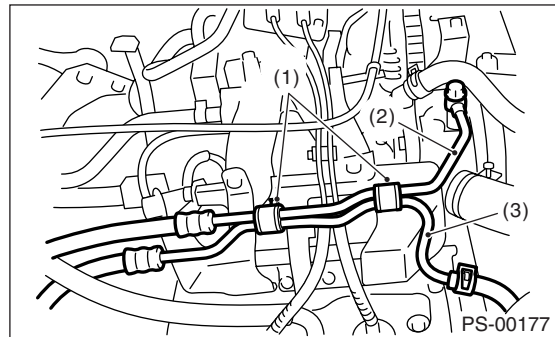
CAUTION:

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

Non-TURBO model



TURBO model



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

- (1) Connect pipe D to oil tank.
- (2) Connect pipe C to oil pump.

CAUTION:

Use anew gasket.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

- (3) Tighten bolt A.

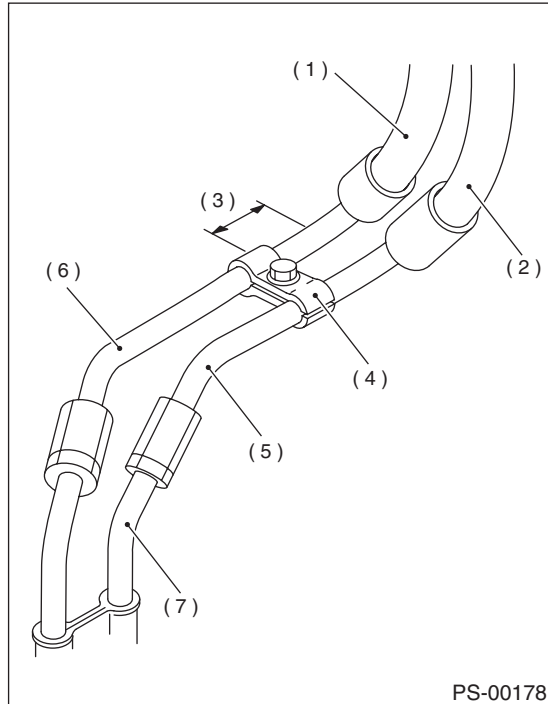
Tightening torque:

13 N·m (1.3 kgf-m, 9.4 ft-lb)

PIPE ASSEMBLY

POWER ASSISTED SYSTEM (POWER STEERING)

2) Temporarily connect pipes C and D.



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

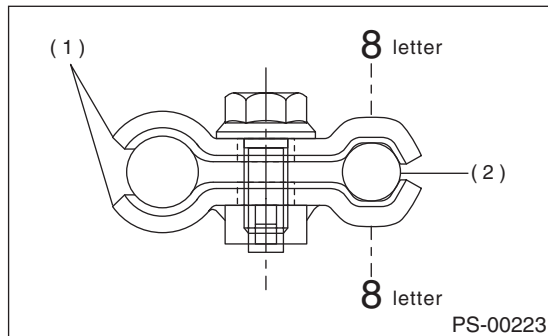
3) Temporarily install clamp E on pipes C and D, and tighten clamp E firmly.

CAUTION:

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

Tightening torque:

7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



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

4) Tighten joint nut.

Tightening torque:

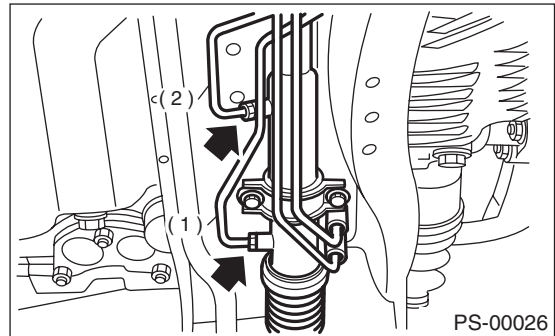
15 N·m (1.5 kgf-m, 10.8 ft-lb)

5) Connect pipe A and B.

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

Tightening torque:

13 N·m (1.3 kgf-m, 9.4 ft-lb)



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

6) Install jack-up plate.

7) Connect battery ground cable.

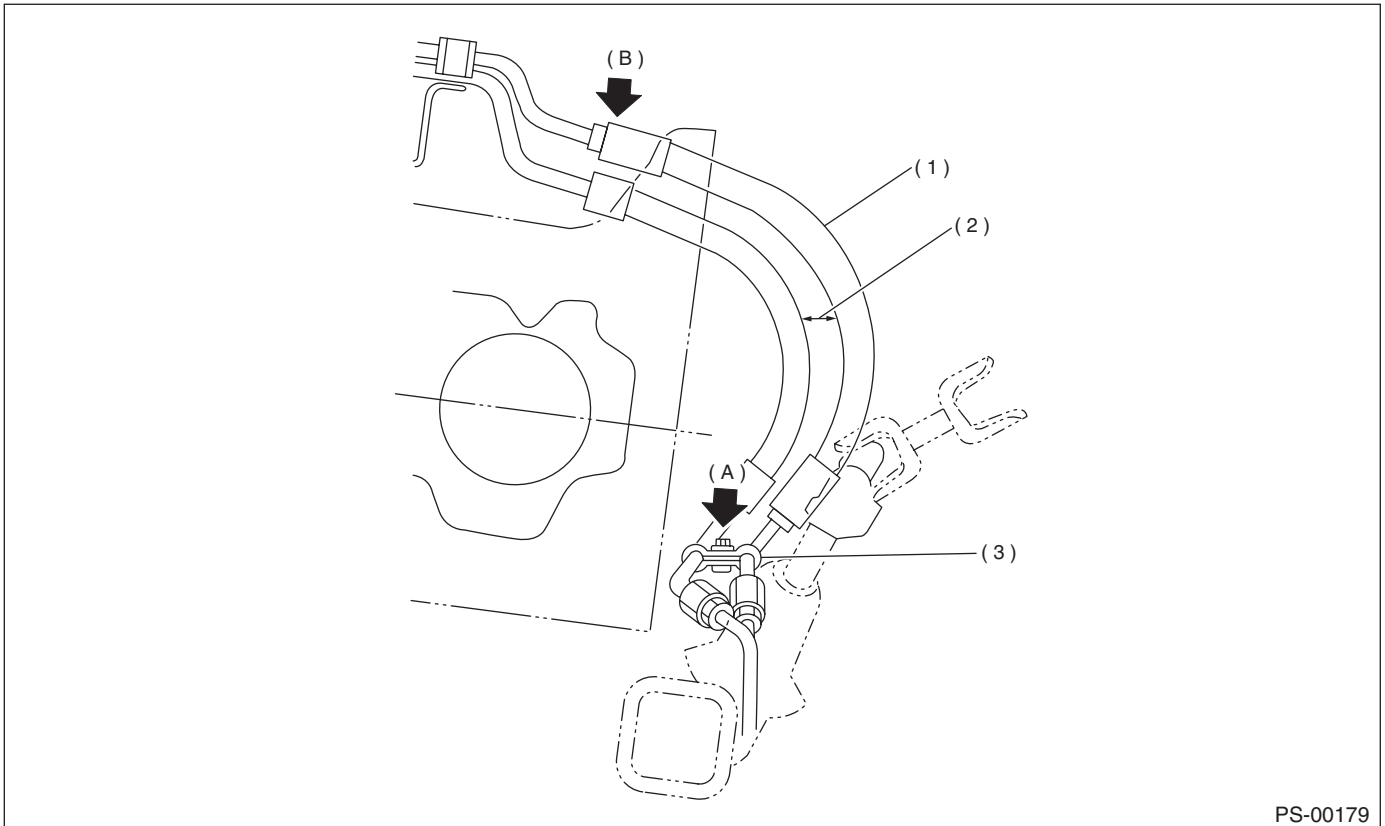
8) Feed the specified fluid.

NOTE:

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

PIPE ASSEMBLY

POWER ASSISTED SYSTEM (POWER STEERING)



(1) High-pressure hose

(2) No interference is allowed between hoses.

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

9) 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 (A) (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 (B) down until a clearance of at least 10 mm (0.39 in) is obtained.

PIPE ASSEMBLY

POWER ASSISTED SYSTEM (POWER STEERING)

C: INSPECTION

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

Part name	Inspection	Remedy
Pipe	• O-ring fitting surface for damage • Nut for damage • Pipe for damage	Replace with new one.
Clamp	• Clamps for weak clamping force	Replace with new one.
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.

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.

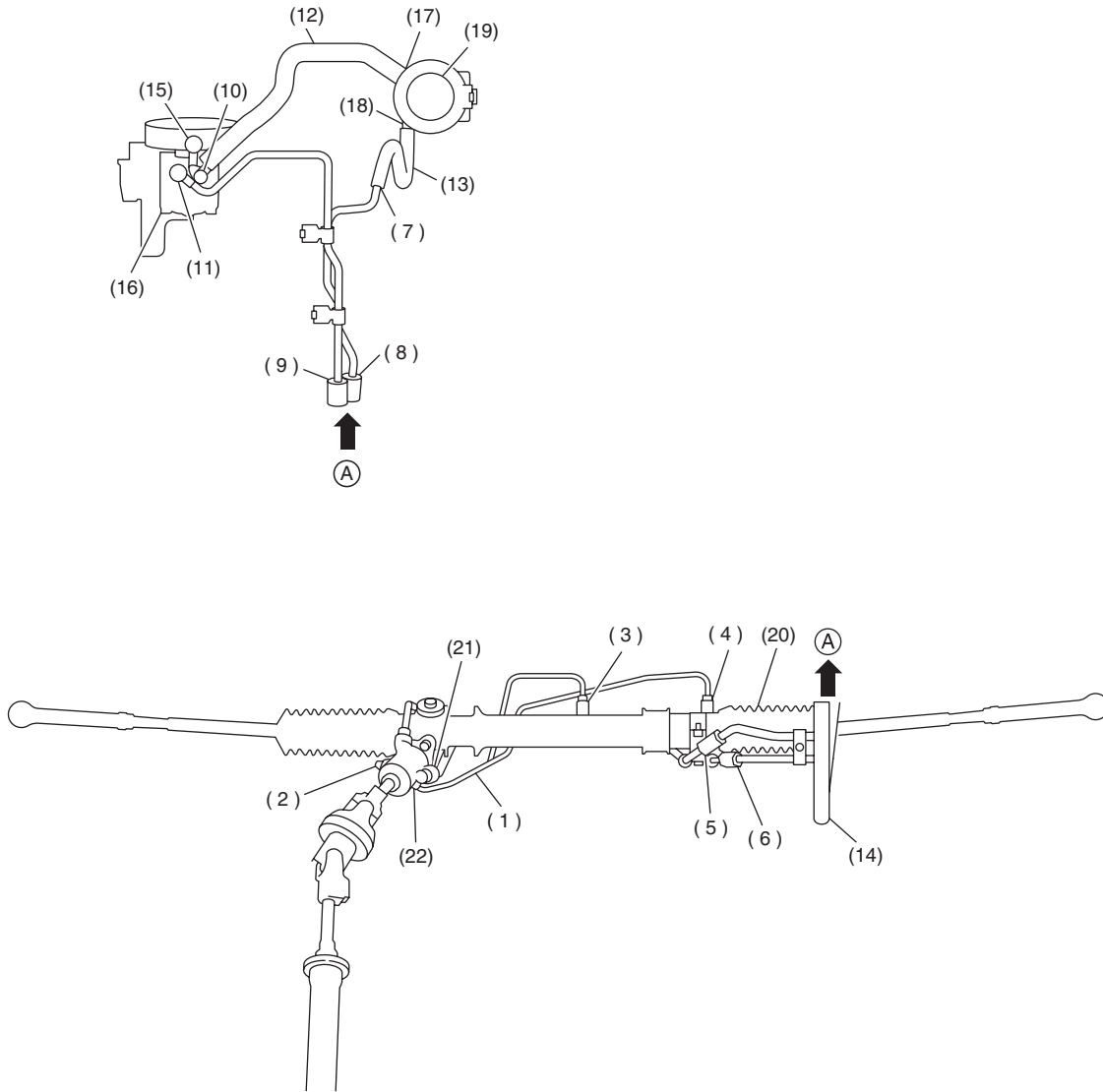
Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct customers.
	Malfunction of relief valve	Replace oil pump.
	Poor cold characteristic of fluid	Replace fluid.
Forced out return hose	Poor connection	Correct.
	Poor holding of clip	Retighten.
	Poor 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.

PIPE ASSEMBLY

POWER ASSISTED SYSTEM (POWER STEERING)

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.



PS-00632

PIPE ASSEMBLY

POWER ASSISTED SYSTEM (POWER STEERING)

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

NOTE:

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.

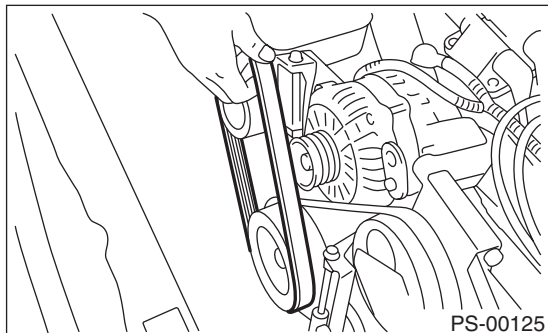
OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

7. Oil Pump

A: REMOVAL

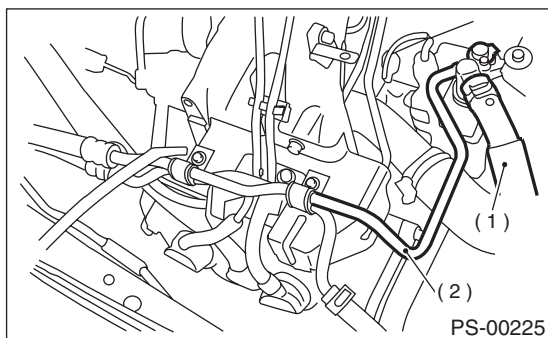
- 1) Remove ground cable from battery.
- 2) Remove pulley belt cover bracket.
- 3) Loosen lock bolt and slider bolt and remove power steering pump drive V-belt.



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

CAUTION:

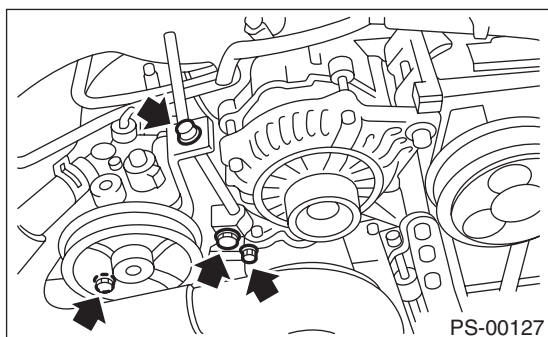
- Do not allow fluid from the hose end to come into contact with pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.



(1) Suction hose

(2) Pipe C

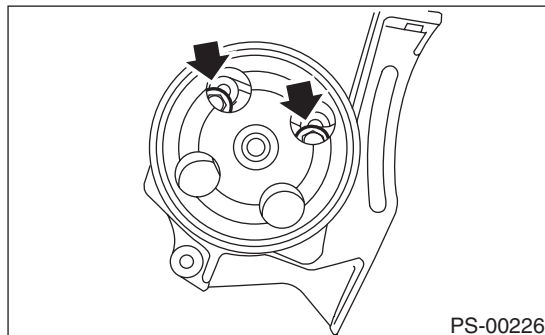
- 6) Remove bolts which install power steering pump bracket.



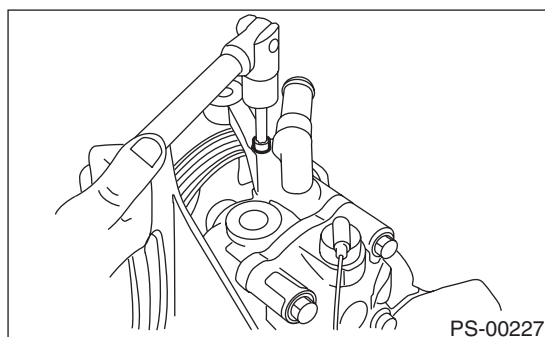
- 7) Place oil pump bracket in a vise, remove two bolts from the front side of oil pump.

CAUTION:

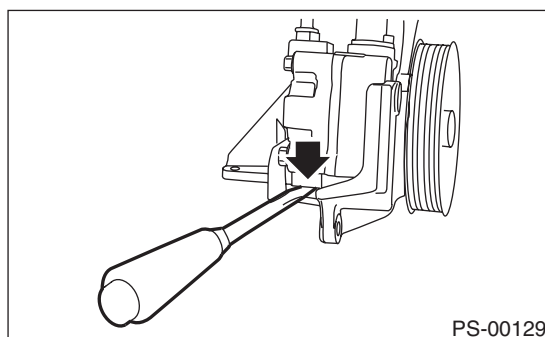
Do not place oil pump bracket directly in the vise; use soft pads and hold oil pump lightly to protect the pump.



- 8) Remove socket from oil pump.



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



OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

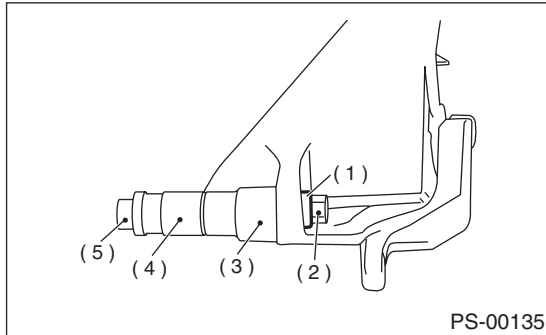
B: INSTALLATION

1) Install oil pump to bracket.

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

CAUTION:

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

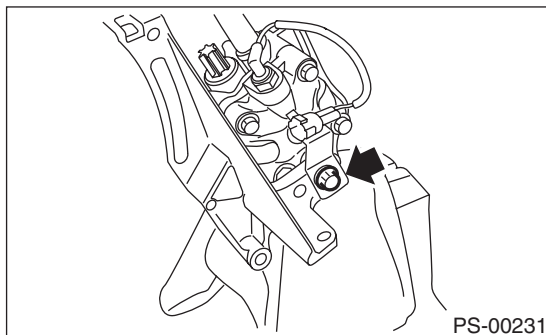


- (1) Bushing
- (2) Nut
- (3) 21 mm
- (4) 14 mm
- (5) Bolt

(2) Tighten bolt which installs oil pump and switch bracket to bracket.

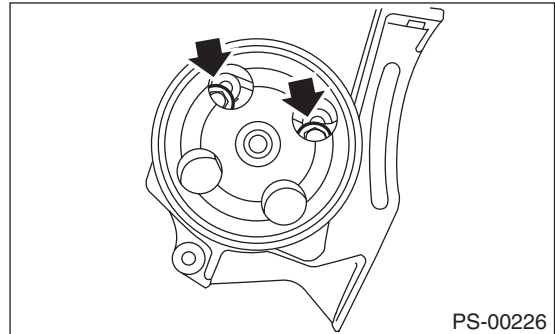
Tightening torque:

37.3 N·m (3.8 kgf-m, 27.5 ft-lb)



Tightening torque:

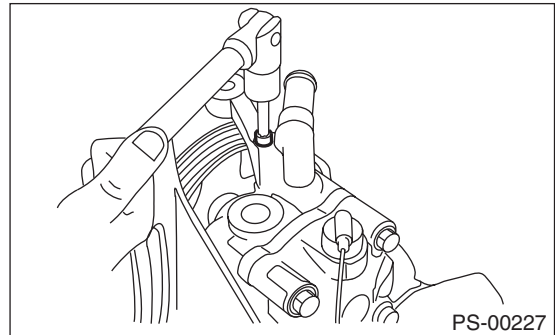
15.7 N·m (1.6 kgf-m, 11.6 ft-lb)



2) Install socket to oil pump.

Tightening torque:

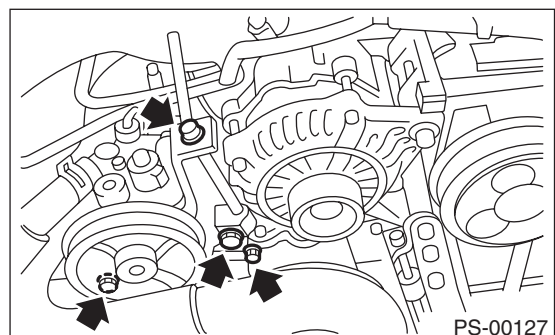
6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



3) Tighten bolts which install power steering pump bracket.

Tightening torque:

22 N·m (2.2 kgf-m, 15.9 ft-lb)



OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

- 4) Interconnect pipes C and suction hose.

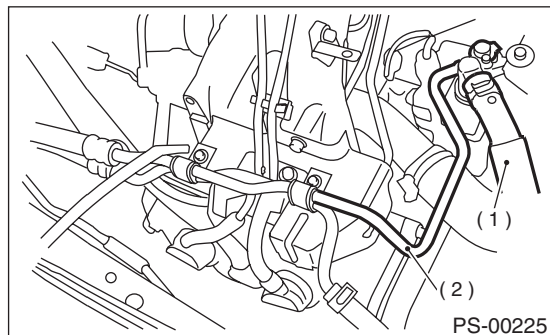
Tightening torque:

Joint nut

39.2 N·m (4 kgf-m, 28.9 ft-lb)

CAUTION:

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



- (1) Suction hose
(2) Pipe C

- 5) Connect connector to power steering oil pressure switch.
6) Install pulley belt to oil pump.
7) Check pulley belt tension. <Ref. to ME(H4SO)-40, V-belt.>
8) Tighten lock bolt.

Tightening torque:

24.5 N·m (2.5 kgf-m, 18.1 ft-lb)

- 9) Tighten bolt belt tension.

Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)

- 10) Install pulley belt cover bracket.
11) Connect ground terminal of battery.
12) Feed the specified power steering fluid <Ref. to PS-59, Power Steering Fluid.>

CAUTION:

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

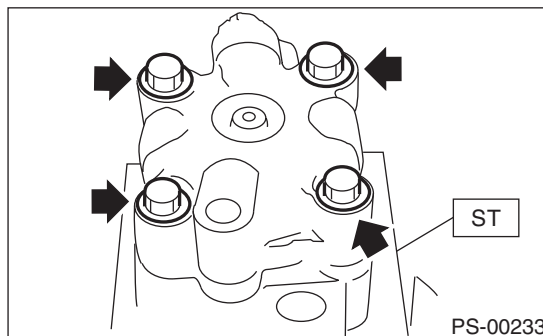
C: DISASSEMBLY

NOTE:

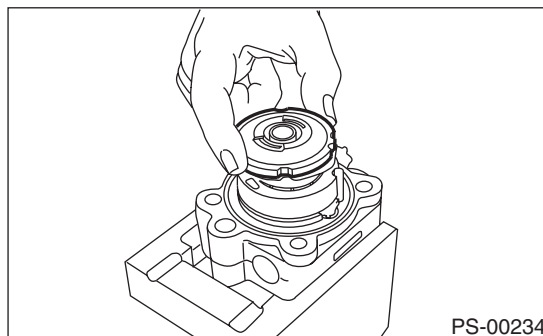
Oil pump for TURBO model and 3.0 L model cannot be disassembled. If the oil pump is malfunctioning, replace the oil pump as an assembly.

- 1) Using ST, place oil pump in a vise and remove four bolts which secure rear cover.

ST 34199AE020 ATTACHMENT



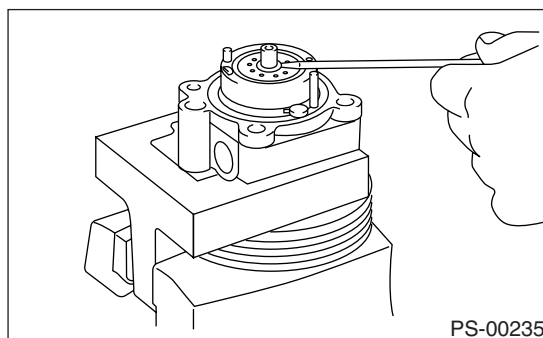
- 2) Remove pressure plate.



- 3) Using a screwdriver, pry retaining ring off.

CAUTION:

Do not remove cam ring, rotor, etc.



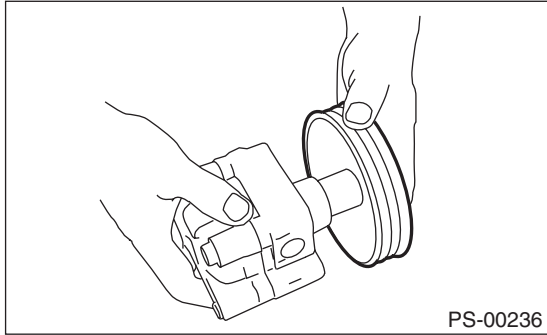
- 4) Install pressure plate.

- 5) Temporarily install rear cover to front casing.

OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

6) Remove oil pump pulley.



7) Place oil pump in a vise.

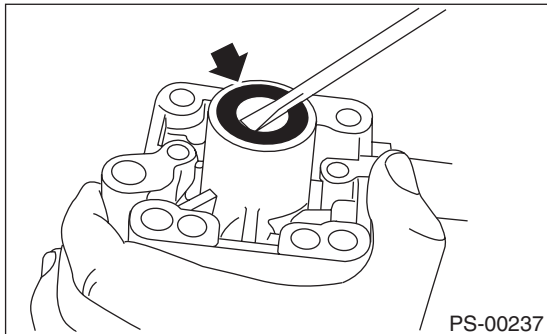
CAUTION:

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

8) Pry oil seal off using a screwdriver.

CAUTION:

Be careful not to scratch inner surface of casing.



D: 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 hydraulic oil for rust prevention after cleaning and drying.)

(6) Reverse the sequence of disassembly procedures.

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

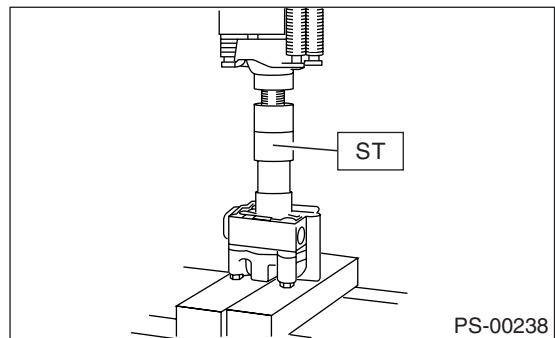
CAUTION:

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

3) Temporarily install rear cover to front body.

4) Attach ST to front body. Using a press, install oil seal.

ST 34199AE030 INSTALLER



5) Install pump pulley to front body.

6) Using ST, place oil pump in a vise.

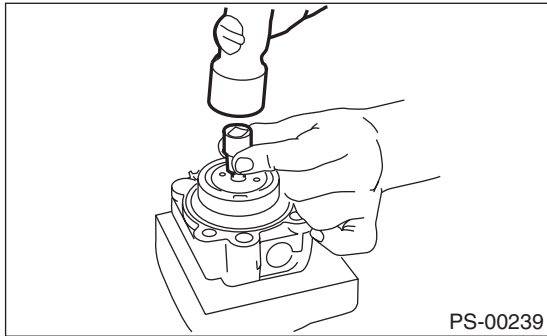
ST 34199AE020 ATTACHMENT

7) Remove rear cover.

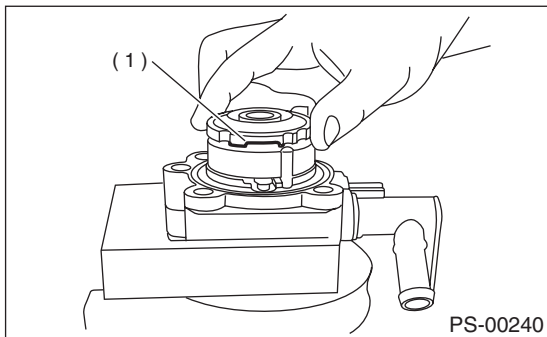
OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

8) Using 10-mm box wrench, tap retaining ring into shaft groove.



9) Install pressure plate as shown in the figure.



(1) Groove

10) Apply specified hydraulic oil to O-rings and fit them into front casing and pressure plate.

11) Install seal ring to pressure plate.

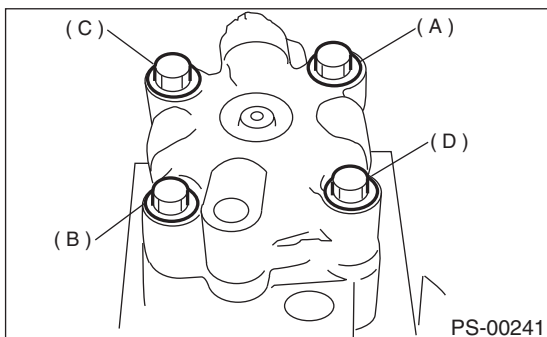
12) With knock pin positions aligned, install rear cover.

Tightening torque:

27.5 N·m (2.8 kgf-m, 20.3 ft-lb)

CAUTION:

Loosely tighten bolts in the sequence (A), (B), (C), and (D) shown in figure. Then, tighten in the same sequence.



13) 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.

14) 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

OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

E: INSPECTION

1. BASIC 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. Pressure 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. Connector	Damage on threads	Replace with a new one.
9. Spring	Damage	Replace with a new one.
10. Bolts and nuts	Damage on threads	Replace with a new one.

- 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.
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.
3	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.
		(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.
4	O-ring	Crack or deterioration	Replace it with a new one.
5	Bracket	Crack	Replace it with a new one.

OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

2. 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.

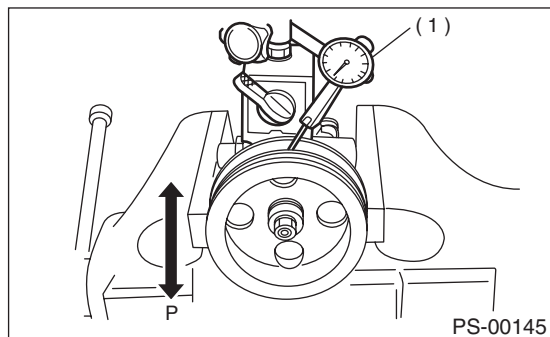
1) Play of pulley shaft

On condition:

P: 9.8 N (1.0 kgf, 2.2 lb)

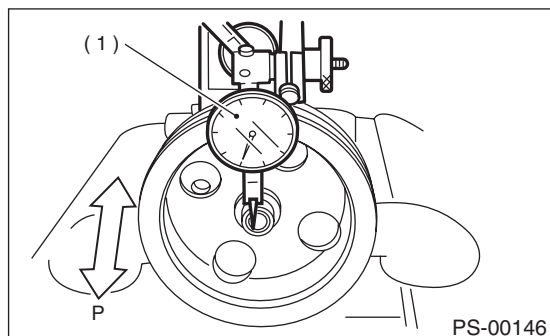
Service limit:

Radial play (Direction $\longleftrightarrow$)
0.4 mm (0.016 in) or less



(1) Dial indicator

Axial play (Direction $\longleftrightarrow$)
0.6 mm (0.024 in) or less



(1) Dial indicator

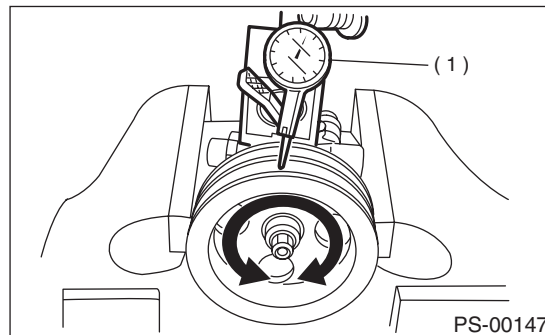
2) Ditch deflection of pulley

Service limit:

1.0 mm (0.039 in) or less

NOTE:

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



(1) Dial indicator

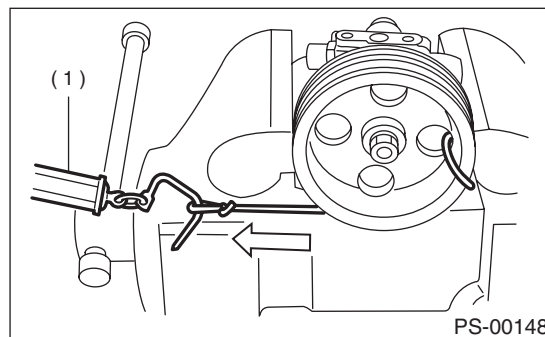
3) Resistance to rotation of pulley

Service limit:

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

NOTE:

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



(1) Spring balance

OIL PUMP

POWER ASSISTED SYSTEM (POWER STEERING)

3. HYDRAULIC PRESSURE

CAUTION:

- Be sure to complete all items aforementioned in "INSPECTION", prior to measuring hydraulic pressure. Otherwise, pressure can not be measured correctly. <Ref. to PS-61, INSPECTION, General Diagnostic Table.>
- Do not leave the valve of pressure gauge closed or hold the steering wheel at stop end for 5 seconds or more in any case, as the oil pump may be damaged due to long keep of these conditions.
- Put 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.

1) REGULAR PRESSURE MEASUREMENT

- (1) Connect ST1, ST2 and ST3.

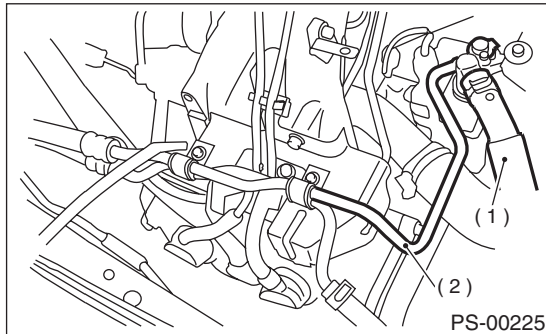
ST1 92511000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A

- (2) Disconnect pressure hose from the pump.

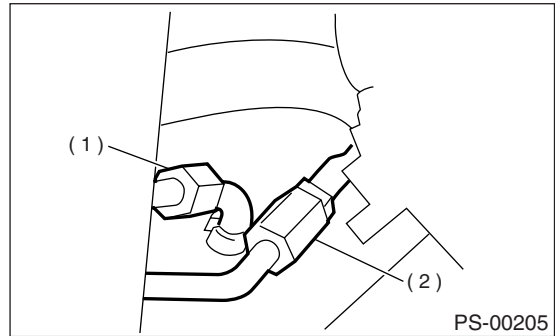
- (3) Using gasket (Part No. 34621AC021) and bolt (Part No. 34620AC010), instal ST2 to the pump instead of pressure hose.



- (1) Suction hose
(2) Pressure hose

- (4) Disconnect pipe C from pipe (on gearbox side).

- (5) Install ST3 to pipe C.



- (1) Pipe C
(2) Pipe D

- (6) Replenish power steering fluid up to specified level.

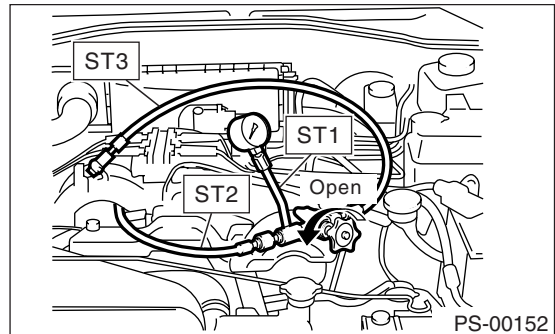
- (7) Open valve, and start the engine.

- (8) Measure regular pressure.

ST1 925711000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A



Service limit:

981 kPa (10 kg/cm², 142 psi) or less

- (9) If it is not within the specified value, replace the troubled part caused by the following symptoms; pipe or hose clogged, leaks from fluid line, and mix of foreign objects in fluid line.

OIL PUMP

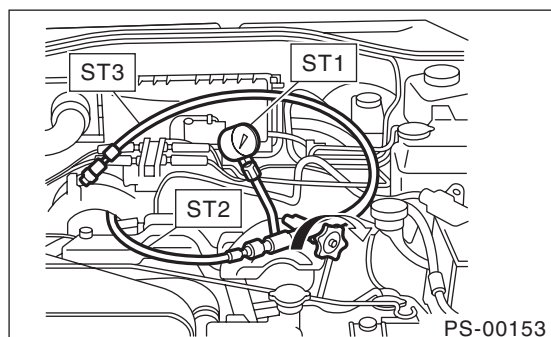
POWER ASSISTED SYSTEM (POWER STEERING)

- 2) Measure relief pressure.
 - (1) Using STs, measure relief pressure.
 - (2) Close valve.
 - (3) Measure relief pressure.

ST1 925711000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A



- (4) If it is within the specified value, measure steering effort. <Ref. to PS-64, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.> If it is not within specified value, replace control valve itself or control valve and pinion as a single unit with new ones.

Service limit:

NON-TURBO model

9,611 — 10,199 kPa (98 — 104 kg/cm²,

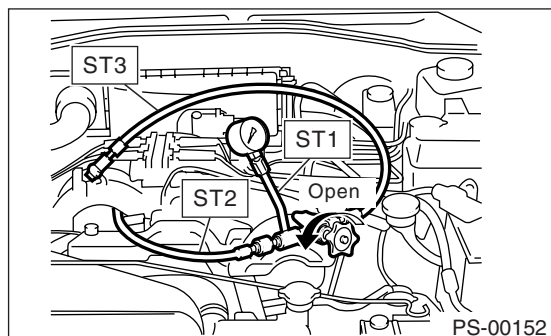
1,394 — 1,479 psi)

TURBO model

7,650 — 8,340 kPa (78.03 — 88.13 kg/cm²,

1,109 — 1,209 psi)

- (4) If it is not within the specified value, replace the oil pump.
 - 3) Measure working pressure.
 - (1) Using STs, measure working pressure.
 - (2) Open valve.
 - (3) Measure working pressure of control valve by turning wheel from stop to stop.
- ST1 925711000 PRESSURE GAUGE
- ST2 34099AC020 ADAPTER HOSE B
- ST3 34099AC010 ADAPTER HOSE A



Service limit:

NON-TURBO model

9,611 — 10,199 kPa (98 — 104 kg/cm²,

1,394 — 1,479 psi)

TURBO model

7,650 — 8,340 kPa (78.03 — 88.13 kg/cm²,

1,109 — 1,209 psi)

RESERVOIR TANK

POWER ASSISTED SYSTEM (POWER STEERING)

8. Reservoir Tank

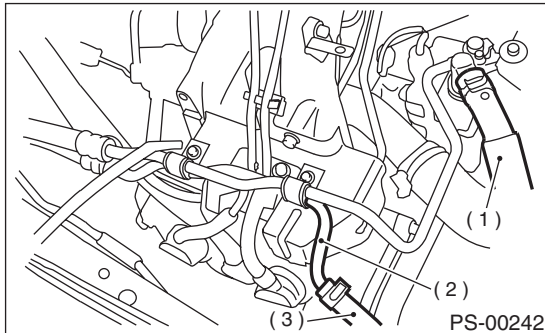
A: REMOVAL

- 1) Drain fluid from the reservoir tank.
- 2) Disconnect pipe D from return hose and suction hose from oil pump.

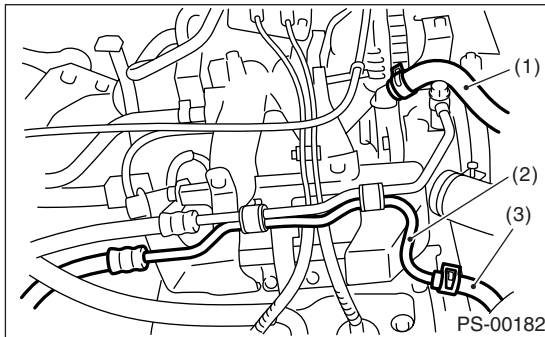
CAUTION:

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

Non-TURBO model



TURBO model



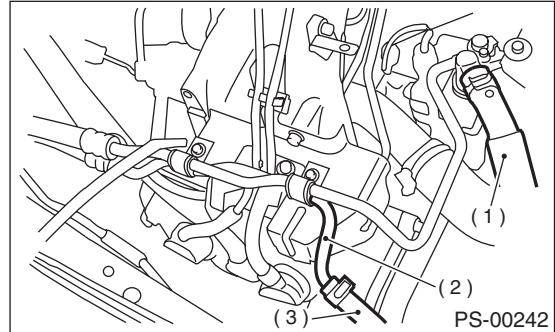
- (1) Suction hose
- (2) Pipe D
- (3) Return hose

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

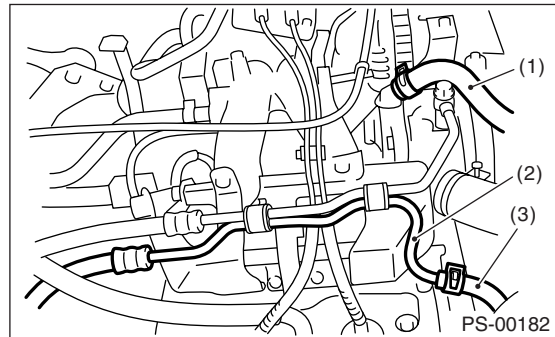
B: INSTALLATION

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

Non-TURBO model



TURBO model



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

- 3) Feed the specified power steering fluid. <Ref. to PS-59, Power Steering Fluid.>

C: INSPECTION

Check reservoir tank for cracks, breakage, or damage. If any cracks, breakage, or damage is found, replace reservoir tank.

POWER STEERING FLUID

POWER ASSISTED SYSTEM (POWER STEERING)

9. Power Steering Fluid

A: SPECIFICATION

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

B: INSPECTION

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

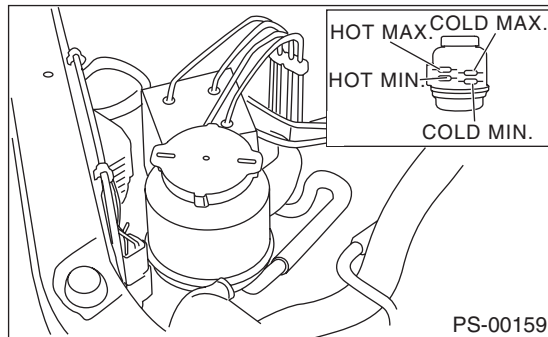
2) Check joints and units for oil leakage. If any oil leaks are found, repair or replace the applicable part.

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

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.

(1) Check at temperature 20°C (68°F) on reservoir surface of oil pump; read the fluid level on the "COLD" side.

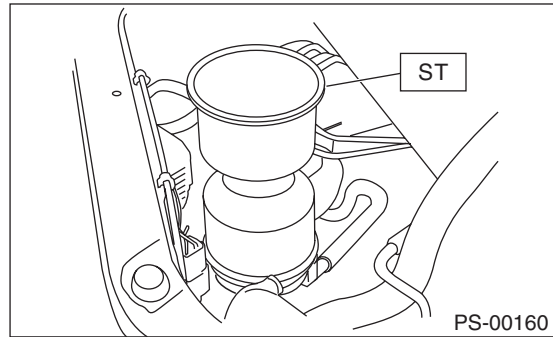
(2) Check at temperature 80°C (176°F) on reservoir surface of oil pump; read the fluid level on the "HOT" side.



C: INSTALLATION

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

ST 34199AE040 OIL CHARGE GUIDE



2) Jack-up vehicle and support it with safety stands, then turn steering wheel with engine stopped.

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

4) 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.

5) Start and idle the engine.

6) 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.

7) 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.

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

Then lower the vehicle, and idle the engine.

9) 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).

10) 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.

11) 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.

POWER STEERING FLUID

POWER ASSISTED SYSTEM (POWER STEERING)

- Remove the flare nut and tighten again it to the specified torque after cleaning flare and tapered seat. If flare or tapered seat is damaged, replace with a new one.

GENERAL DIAGNOSTIC TABLE

POWER ASSISTED SYSTEM (POWER STEERING)

10.General Diagnostic Table

A: INSPECTION

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 PS-54, INSPECTION, Oil Pump.>	Replace problem parts.
	6. Measure steering effort.<Ref. to PS-61, INSPECTION, General Diagnostic Table.>	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 PS-61, INSPECTION, General Diagnostic Table.>	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.

GENERAL DIAGNOSTIC TABLE

POWER ASSISTED SYSTEM (POWER STEERING)

1. NOISE AND VIBRATION

CAUTION:

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

NOTE:

- Grinding noise may be heard immediately after the engine start in extremely cold condition. In this case, if the noise goes off during warm-up there is no abnormal function in the system. This is due to the fluid characteristic in extremely cold condition.
- Oil pump makes whine or growl noise slightly due to its mechanism. Even if the noise can be heard when steering wheel is turned at stand still there is no abnormal function in the system provided that the noise eliminates when the vehicle is running.
- When 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 PS-46, INSPECTION, Pipe Assembly.>
	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 bad parts of 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.

GENERAL DIAGNOSTIC TABLE

POWER ASSISTED SYSTEM (POWER STEERING)

Trouble	Possible cause	Corrective action
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.
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.

GENERAL DIAGNOSTIC TABLE

POWER ASSISTED SYSTEM (POWER STEERING)

2. MEASUREMENT OF STEERING EFFORT

Step	Check	Yes	No
1 CHECK STEERING EFFORT. 1) Stop the vehicle on a concrete road. 2) Start the engine. 3) Idle the engine. 4) Install spring scale on the steering wheel. 5) Pull spring scale at an right angle to the steering wheel, and measure both right and left steering wheel effort. NOTE: 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.	Is the steering effort less than 29.4 N (3.0 kgf, 6.6 lb)?	Go to step 2.	Adjustment backlash.
2 CHECK STEERING EFFORT. 1) Stop the engine. 2) Pull spring scale at an right angle to the steering wheel, and measure both right and left steering wheel effort.	Is the steering effort less than 29.4 N (3.0 kgf, 6.6 lb)?	Go to step 3.	Adjustment.
3 CHECK STEERING WHEEL EFFORT. 1) Remove universal joint. 2) Measure steering wheel effort.	Is the maximum force steering wheel effort less than 2.26 N (0.23 kgf, 0.51 lb)?	Go to step 4.	Check, adjust and replace if necessary.
4 CHECK STEERING WHEEL EFFORT. Measure steering wheel effort.	Is the fluctuation width less than 1.08 N (0.11 kgf, 0.24 lb)?	Go to step 5.	Check, adjust and replace if necessary.
5 CHECK UNIVERSAL JOINT. Measure folding torque of the joint (short yoke). <Ref. to PS-19, INSPECTION, Universal Joint.>	Is the fluctuation width less than 8.43 N (0.86 kgf, 1.90 lb)?	Go to step 6.	Replace with new one.
6 CHECK UNIVERSAL JOINT. Measure folding torque of the joint (long yoke). <Ref. to PS-19, INSPECTION, Universal Joint.>	Is the folding torque less than 5.49 N (0.56 kgf, 1.23 lb)?	Go to step 7.	Replace with new one.
7 CHECK FRONT WHEEL.	Are there unsteady revolution or rattling of front wheels and dragging of brake?	Inspect, readjust and replace if necessary.	Go to step 8.
8 CHECK TIE-ROD ENDS. Remove the tie-rod ends.	Are there unsteady revolution or rattling of tie-rod ends of suspension?	Inspect and replace if necessary.	Go to step 9.
9 CHECK BALL JOINT.	Are there unsteady revolution or rattling of ball joints of suspension?	Inspect and replace if necessary.	Go to step 10.
10 CHECK GEARBOX. Measure rotating of gearbox. <Ref. to PS-40, OIL LEAKING, INSPECTION, Steering Gearbox.>	Is the measured rotating resistance the same as the following values: 11.18 N (1.14 kgf, 2.51 lb) or less at straight position / 15.79 N (1.61 kgf, 3.55 lb) or less at any other positions within 20% difference between clockwise and counterclockwise?	Go to step 11.	Readjust backlash, and if ineffective, replace bad parts.
11 CHECK GEARBOX. Measure sliding of gearbox. <Ref. to PS-38, RACK SHAFT PLAY IN RADIAL DIRECTION, INSPECTION, Steering Gearbox.>	Is the measured sliding resistance within the following value: 304 N (31 kgf, 68 lb) or less within 20% difference between left and right directions?	Steering effort is normal.	Readjust backlash, and if ineffective, replace bad parts.

BODY SECTION

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

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

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

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

**HVAC SYSTEM
(HEATER, VENTILATOR AND A/C)** AC

AIRBAG SYSTEM AB

AIRBAG SYSTEM (DIAGNOSTICS) AB

SEAT BELT SYSTEM SB

LIGHTING SYSTEM LI

WIPER AND WASHER SYSTEMS WW

ENTERTAINMENT ET

COMMUNICATION SYSTEM COM

GLASS/WINDOWS/MIRRORS GW

BODY STRUCTURE BS

INSTRUMENTATION/DRIVER INFO IDI

SEATS SE

SECURITY AND LOCKS SL

**SUNROOF/T-TOP/CONVERTIBLE TOP
(SUNROOF)** SR

EXTERIOR/INTERIOR TRIM EI

EXTERIOR BODY PANELS EB

BODY SECTION**CRUISE CONTROL SYSTEM****CC****CRUISE CONTROL SYSTEM
(DIAGNOSTICS)****CC****CRUISE CONTROL SYSTEM
(DIAGNOSTICS)****CC(ETC)**

REAR SUSPENSION

RS

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2. Wheel Alignment	8
3. Rear Stabilizer	9
4. Rear Arm	10
5. Link Upper	14
6. Rear Shock Absorber	16
7. Link Front	18
8. Link Rear	19
9. Support Sub Frame Front	21
10. Rear Sub Frame	22
11. Helper	23
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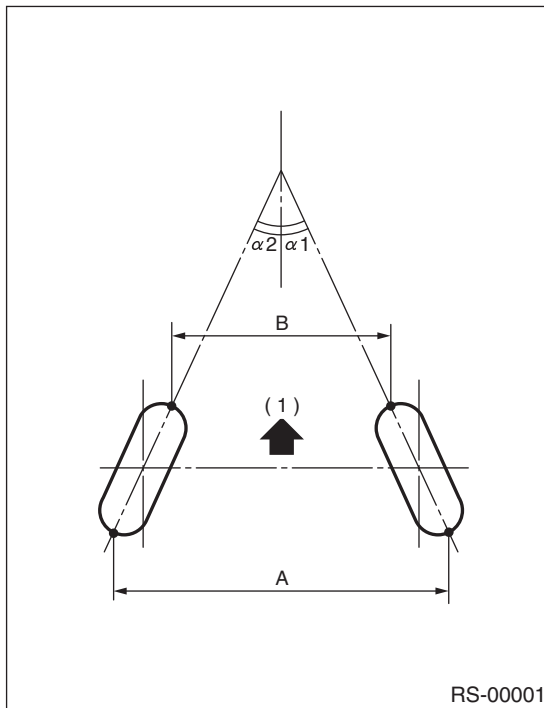
1. General Description

A: SPECIFICATIONS

Refer to “General Description” of FS section about value of wheel alignment. <Ref. to FS-2, General Description.>

NOTE:

- Front and rear toe-in and front camber can be adjusted. If toe-in or camber tolerance exceeds specifications, adjust toe-in and camber to the adjustment standard value.
- The other items indicated in the specification table cannot be adjusted. If the other items exceed specifications, check suspension parts and connections for deformities; replace with new ones as required.



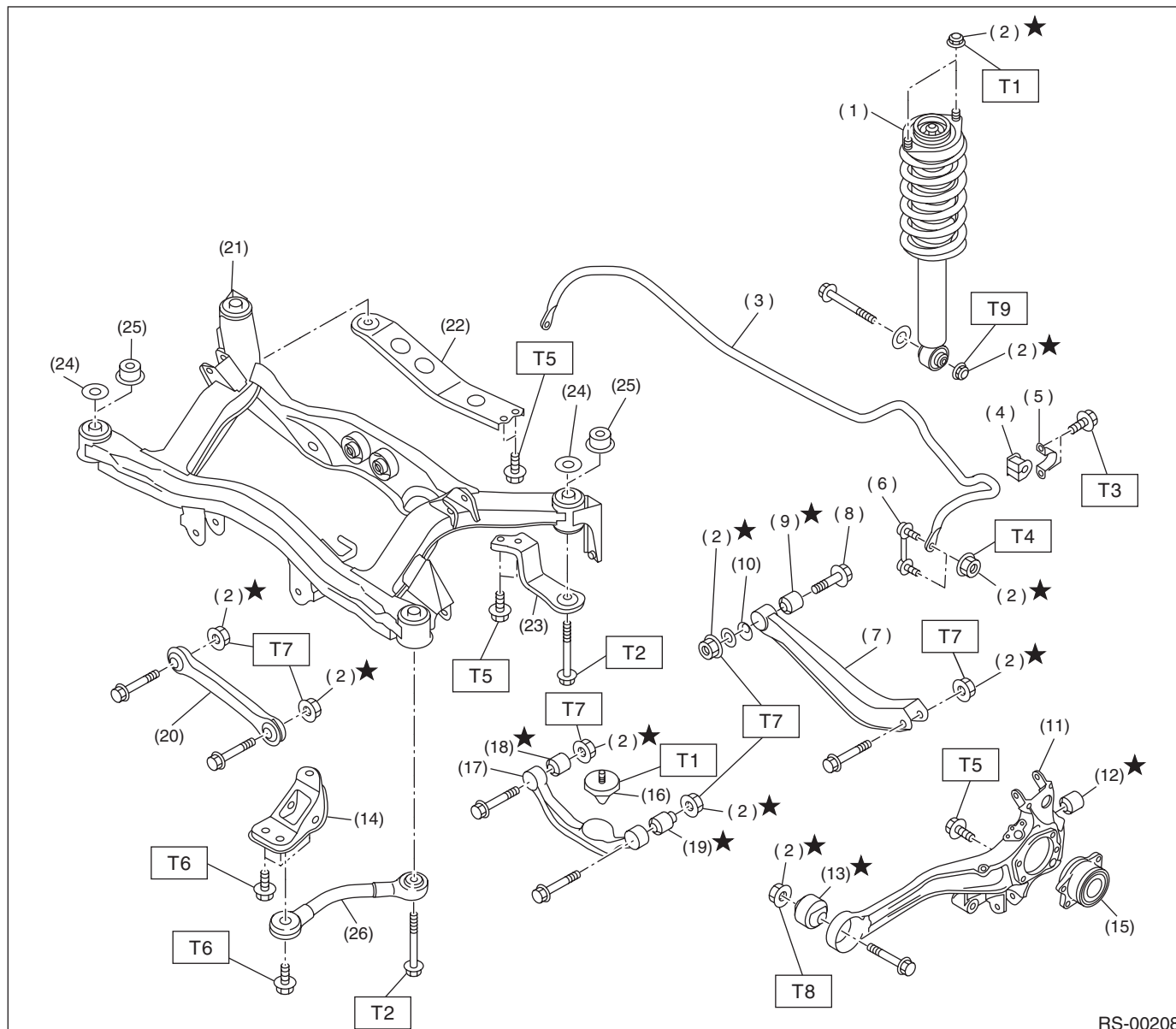
(1) Front

$A - B$ = Positive: Toe-in, Negative: Toe-out

$\alpha 1, \alpha 2$: Each toe-in angle

B: COMPONENT

1. REAR SUSPENSION



RS-00208

- | | |
|-----------------------------|---|
| (1) Shock absorber | (15) Hub bearing unit |
| (2) Self-locking nut | (16) Helper |
| (3) Stabilizer | (17) Link upper |
| (4) Stabilizer bushing | (18) Link upper bushing (Inside) |
| (5) Clamp | (19) Link upper bushing (Outside) |
| (6) Stabilizer link | (20) Link front |
| (7) Link rear | (21) Rear sub frame |
| (8) Adjusting bolt | (22) Support sub frame (RH) |
| (9) Link rear bushing | (23) Support sub frame (LH) |
| (10) Adjusting washer | (24) Stopper upper (Except OUTBACK model) |
| (11) Rear arm | (25) Stopper upper (OUTBACK MODEL) |
| (12) Rear arm rear bushing | (26) Support sub frame front |
| (13) Rear arm front bushing | |
| (14) Rear arm bracket | |

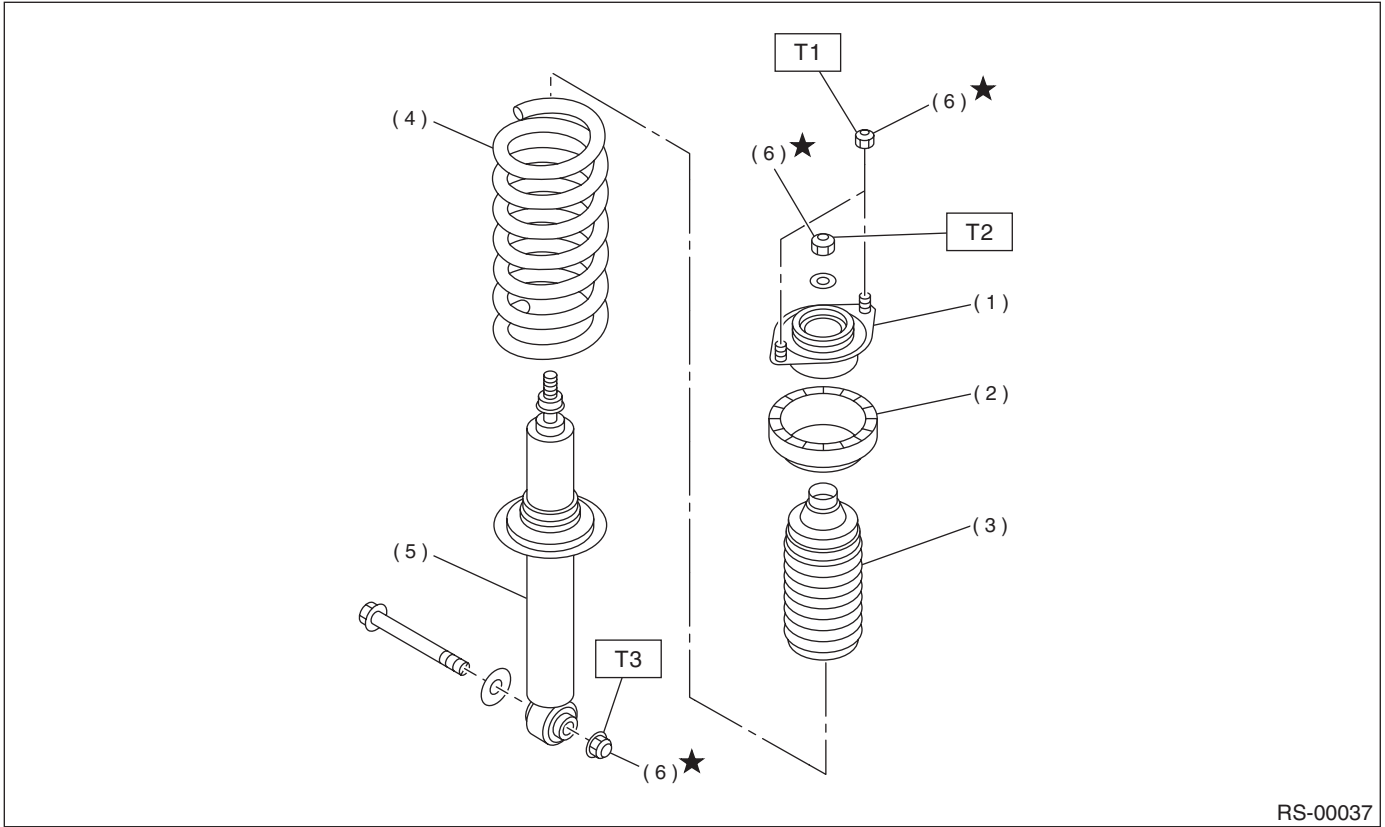
Tightening torque: N·m (kgf-m, ft-lb)

- | | |
|------------|------------------------|
| T1: | 30 (3.1, 22.4) |
| T2: | 175 (17.8, 129) |
| T3: | 40 (4.1, 30) |
| T4: | 44 (4.5, 32.5) |
| T5: | 65 (6.6, 48) |
| T6: | 125 (12.8, 92) |
| T7: | 120 (12.2, 88) |
| T8: | 150 (15.3, 111) |
| T9: | 160 (16.3, 118) |

GENERAL DESCRIPTION

REAR SUSPENSION

2. SHOCK ABSORBER



RS-00037

- | | |
|-----------------------|----------------------|
| (1) Mount | (4) Coil spring |
| (2) Rubber seat upper | (5) Shock absorber |
| (3) Dust cover | (6) Self-locking nut |

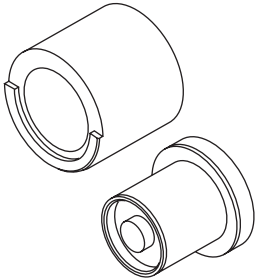
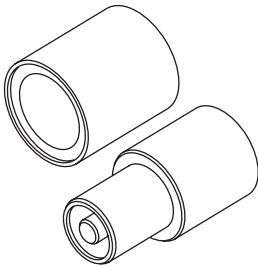
Tightening torque: N·m (kgf-m, ft-lb)
T1: 30 (3.1, 22.4)
T2: 35 (3.6, 26)
T3: 160 (16.3, 118)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Use SUBARU genuine grease etc. or the equivalent. Do not mix grease etc. with that of another grade or from other manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Apply grease onto sliding or revolution surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of grease to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or shop cloth between the part and the vise.
- Before disposing shock absorbers, be sure to bleed gas completely. Also, do not throw away in fire.

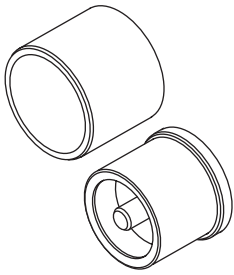
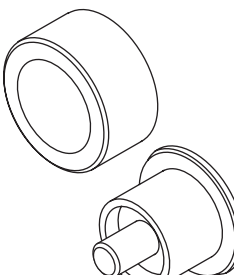
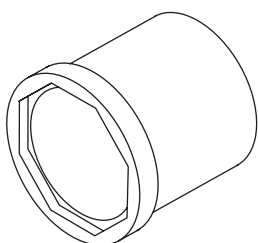
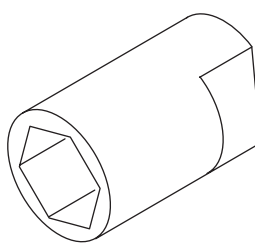
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST20099AE000	20099AE000	INSTALLER & REMOVER	Used for replacing link rear bushing.
 ST20099AE010	20099AE010	INSTALLER & REMOVER	Used for replacing link upper bushing.

GENERAL DESCRIPTION

REAR SUSPENSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST20099AE020	20099AE020	INSTALLER & REMOVER SET	Used for replacing rear arm front bushing.
 ST20099AE040	20099AE040	INSTALLER & REMOVER SET	Used for replacing rear arm rear bushing.
 ST20099AE030	20099AE030	HELPER SOCKET WRENCH	Used for replacing helper.
 ST-927760000	927760000	STRUT MOUNT SOCKET	Used for disassembling and assembling strut and shock mount.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Alignment adapter	Used for wheel alignment measurement.
Alignment gauge	Used for wheel alignment measurement.
Turning radius gauge	Used for wheel alignment measurement.
Toe-in gauge	Used for toe-in measurement.
Transmission jack	Used for suspension assembly/disassembly.
Bearing puller	Used for removing bushings.

2. Wheel Alignment

A: INSPECTION

NOTE:

The front and rear wheel alignment must be measured and/or adjusted at once to obtain accuracy.

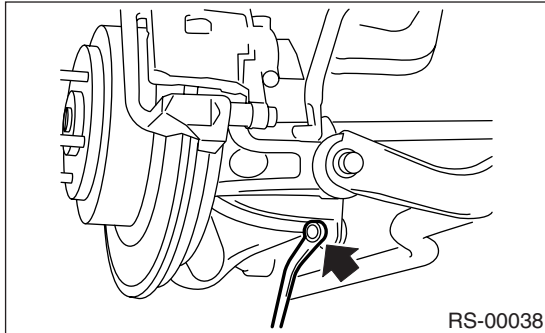
Measure and/or adjust the rear wheel alignment together with the front.

Follow the procedure in “FS” section “Wheel Alignment” for measurement and/or adjustment of wheel alignment. <Ref. to FS-8, Wheel Alignment.>

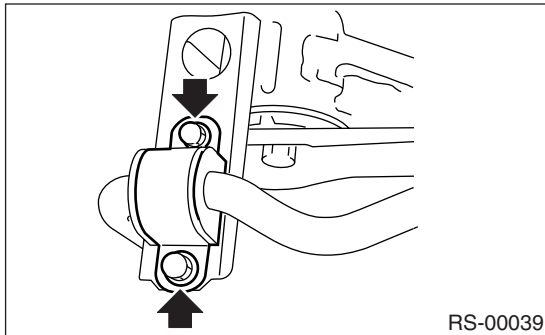
3. Rear Stabilizer

A: REMOVAL

- 1) Jack-up the rear part of the vehicle, support it with safety stands (rigid racks).
- 2) Remove bolts which secure stabilizer link to rear arm.



- 3) Remove bolts which secure stabilizer to sub frame.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Ensure that bushing and stabilizer have the same identification colors when installing.

CAUTION:

Use a new self-locking nut.

Tightening torque:

Stabilizer link to rear arm

44 N·m (4.5 kgf-m, 32.5 ft-lb)

Clamp to sub frame

40 N·m (4.1 kgf-m, 30 ft-lb)

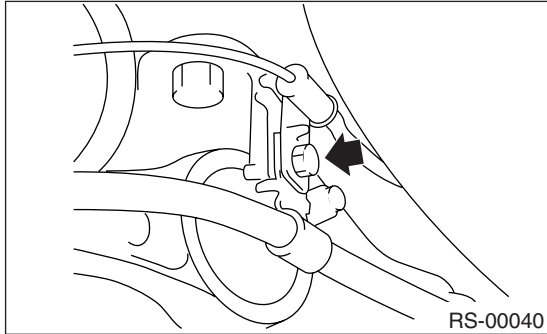
C: INSPECTION

- 1) Check bushing for cracks, fatigue or damage.
- 2) Check stabilizer links for deformities, cracks, or damage, and bushing for protrusions from the hole of stabilizer link.

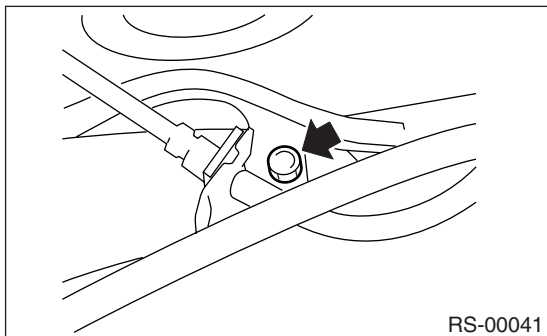
4. Rear Arm

A: REMOVAL

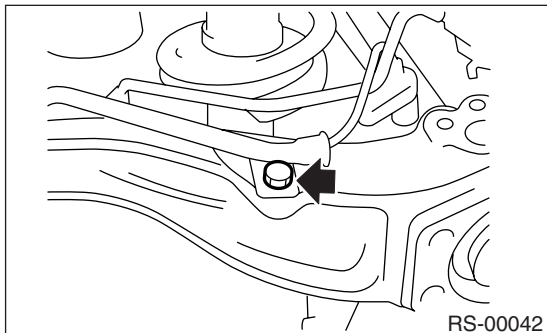
- 1) Lift-up the vehicle and remove rear wheel.
- 2) Remove support sub frame front.
<Ref. to RS-21, REMOVAL, Support Sub Frame Front.>
- 3) Remove bearing unit.
<Ref. to DS-24, REMOVAL, Hub Unit Bearing.>
- 4) Remove bolt securing parking brake cable clamp to rear arm.



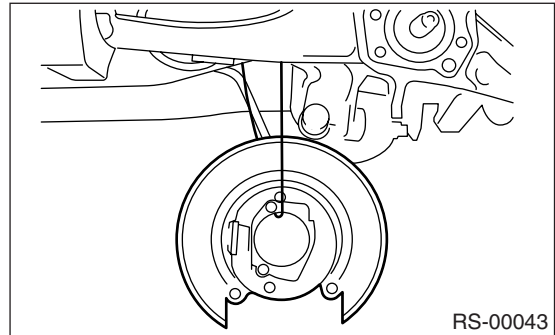
- 5) Remove bolt securing brake hose to rear arm.



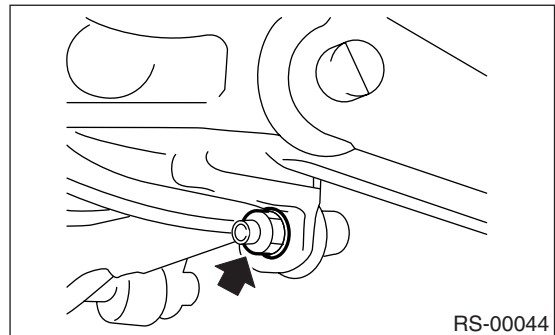
- 6) Remove bolt securing ABS sensor to rear arm.



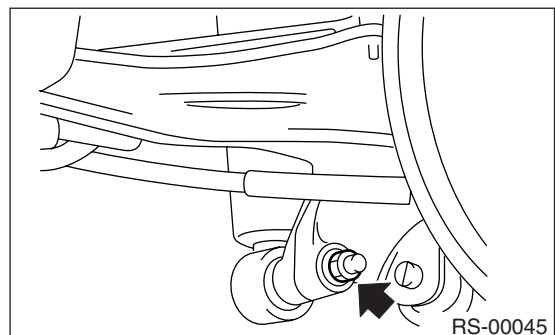
- 7) Suspend the back plate from sub frame.



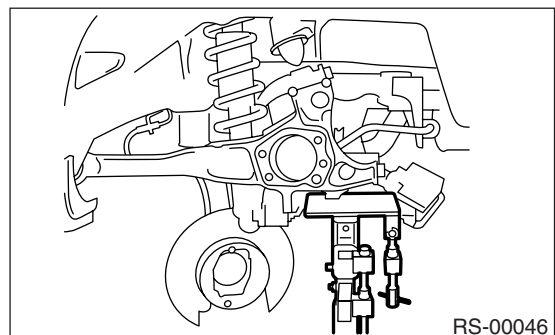
- 8) Remove nut securing stabilizer link to rear arm.



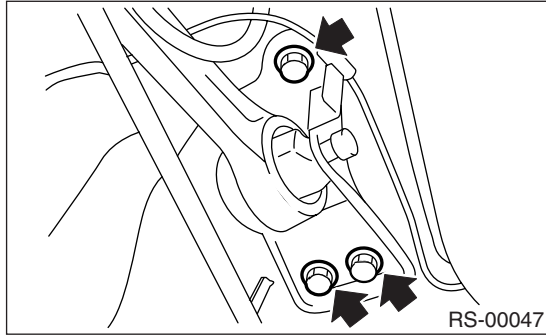
- 9) Remove bolt securing shock absorber to rear arm.



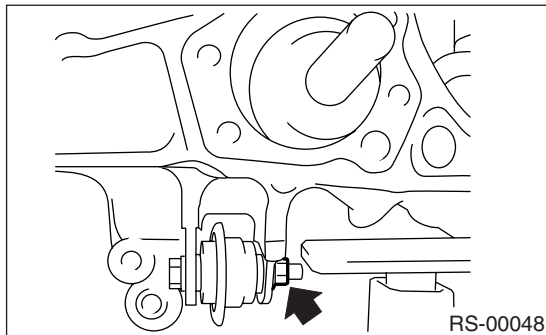
- 10) Use transmission jack to support rear arm horizontally.



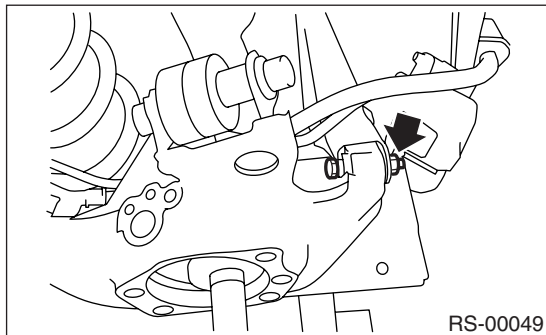
11) Remove bolt securing rear arm to body.



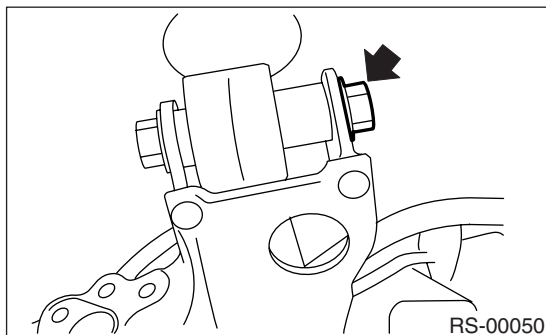
12) Loosen nut securing link front to rear arm.



13) Loosen nut securing link rear to rear arm.



14) Loosen nut securing link upper to rear arm.



15) Remove bolts securing rear arm to links and remove rear arm.

B: INSTALLATION

CAUTION:

Use a new self-locking nut.

1) Use a transmission jack to support the rear arm.
2) Install rear arm and temporarily tighten bolts securing rear arm to links.

3) Install bearing unit.

<Ref. to DS-25, INSTALLATION, Hub Unit Bearing.>

4) Install bolt securing ABS sensor to rear arm.

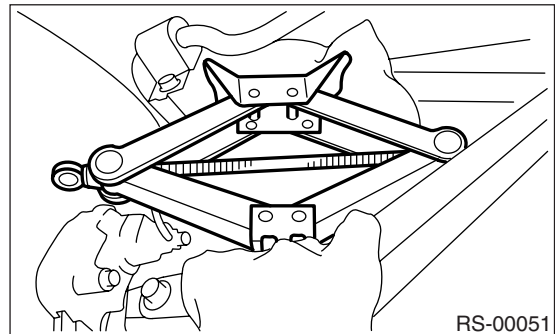
5) Install bolt securing brake hose to rear arm.

6) Install bolt securing parking brake cable clamp to rear arm.

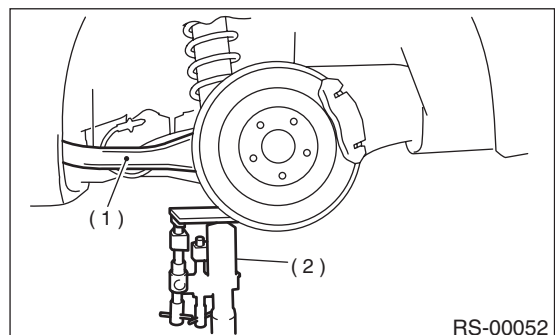
7) Place jack (furnished with vehicle) upside down and position it between link rear and sub frame. Adjust jack position so rear shock absorber is aligned with rear arm at their corresponding holes. Install lower shock absorber bolts.

CAUTION:

Put a cloth between jack and its mating area to protect link rear and sub frame from scratches.



8) Using transmission jack, support rear arm horizontally and tighten nuts and bolts securing rear arm, link front, link rear, link upper and shock absorber.



(1) Rear arm

(2) Transmission jack

REAR ARM

REAR SUSPENSION

9) Install support sub frame front.

NOTE:

Check wheel alignment and adjust if necessary.

Tightening torque:

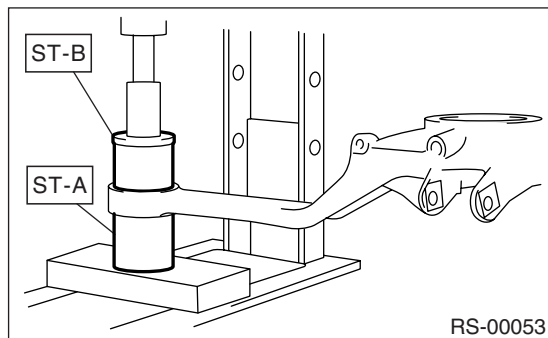
Refer to COMPONENT of General Description for tightening torque. <Ref. to RS-3, REAR SUSPENSION, COMPONENT, General Description.>

C: DISASSEMBLY

1. FRONT BUSHING

1) Using ST-A, B, press front bushing out of place.
ST-A, B 20099AE020INSTALLER & REMOVER SET

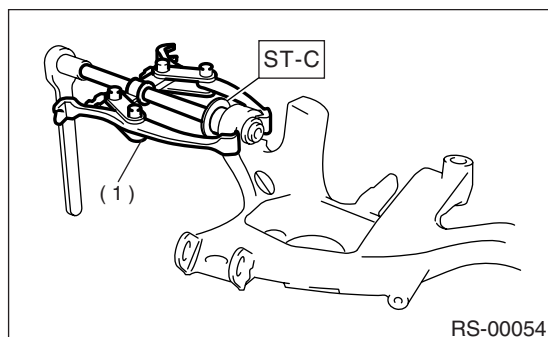
- (1) Set ST-A in position with larger inside diameter side facing up.
- (2) Set rear arm with protruded bushing side facing down.
- (3) Place ST-B on upper side of bushing, then press bushing out of position.



2. REAR BUSHING

Using ST-C and bearing puller, press rear bushing out of place.

ST-C 20099AE040INSTALLER & REMOVER SET



(1) Bearing puller

D: ASSEMBLY

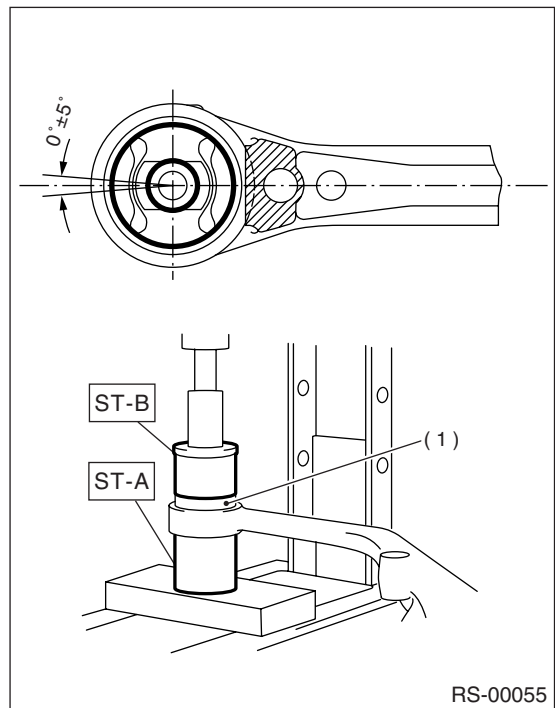
1. FRONT BUSHING

1) Using ST-A, B, press bushing into rear arm.
ST-A, B 20099AE020INSTALLER & REMOVER SET

- (1) Set ST-A in position with smaller inside diameter side facing up.
- (2) Set rear arm in position with outer side of vehicle body facing down.
- (3) Place bushing on upper side of rear arm.
- (4) Place ST-B on upper side of bushing, then press bushing into position.

CAUTION:

- Install bushing with painted side facing up.
- Install front bushing in the proper direction, as shown in figure.



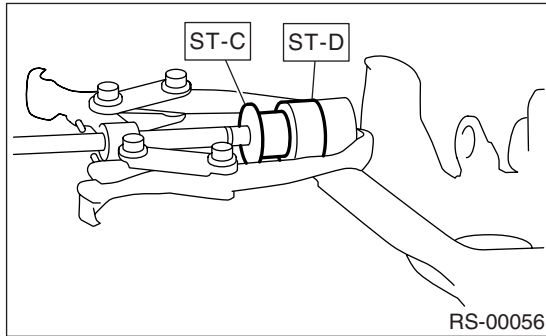
(1) Bushing

2. REAR BUSHING

1) Using ST-C, D and bearing puller, press bushing into rear arm.

ST-C, D 20099AE040INSTALLER & REMOVER SET

- (1) Insert bushing into bore in ST-D.
- (2) Set ST-C, ST-D and bearing puller in position, as shown in the figure, and press bushing into position.



E: INSPECTION

Check rear arm for bends, corrosion or damage.

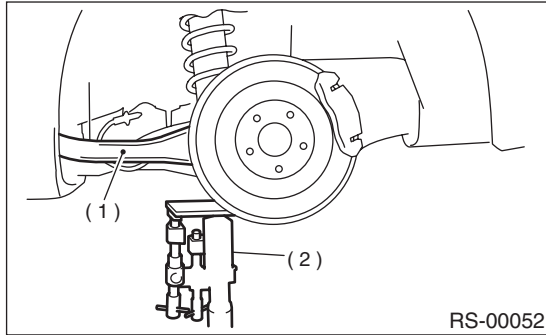
LINK UPPER

REAR SUSPENSION

5. Link Upper

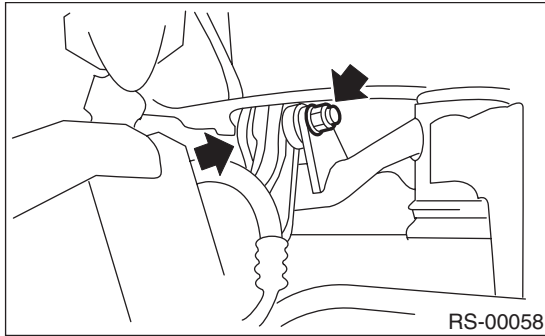
A: REMOVAL

- 1) Loosen wheel nuts. Lift-up vehicle and remove wheel.
- 2) Use transmission jack to support rear arm horizontally.

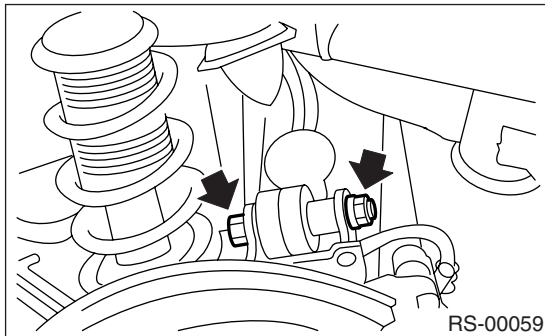


- (1) Rear arm
(2) Transmission jack

- 3) Remove bolt securing link upper to sub frame.



- 4) Remove bolts which secure link upper to rear arm and detach link upper.

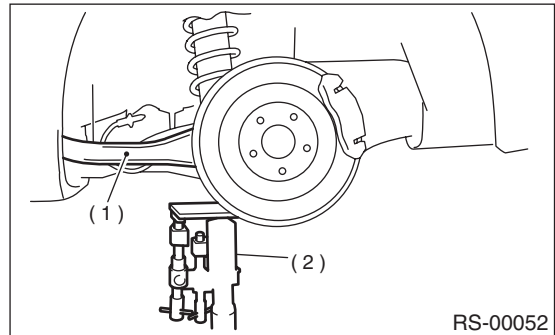


B: INSTALLATION

Install in the reverse order of removal, observing the following instructions.

CAUTION:

Using transmission jack, support rear arm horizontally, install link upper and tighten nuts to specified torque.



- (1) Rear arm
(2) Transmission jack

CAUTION:

- Tighten nut when installing adjusting bolt.
- Use a new self-locking nut.

NOTE:

Check wheel alignment and adjust if necessary.

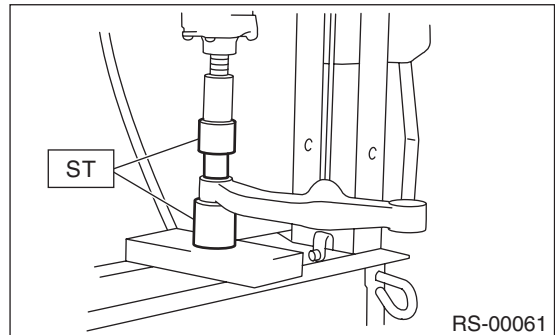
Tightening torque:

120 N·m (12.2 kgf-m, 88 ft-lb)

C: DISASSEMBLY

Using ST, press bushing out of place.

ST 20099AE010 INSTALLER & REMOVER



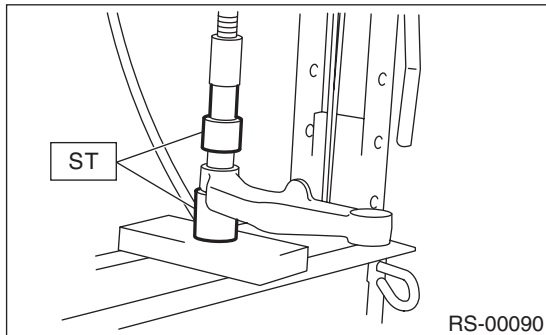
D: ASSEMBLY

1) Using ST, press bushing into place.

ST 20099AE010 INSTALLER & REMOVER

CAUTION:

Outer bushing has a “directional” design. Be sure to install bushing with longer inner housing side facing vehicle rear.



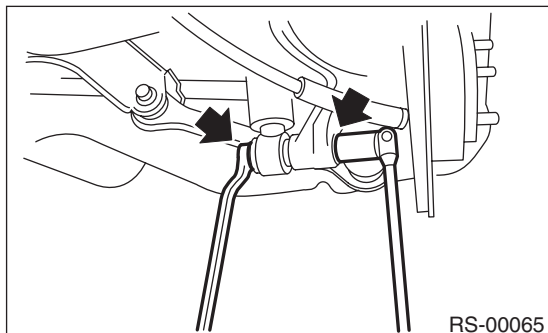
E: INSPECTION

Visually check link upper for damage or bends.

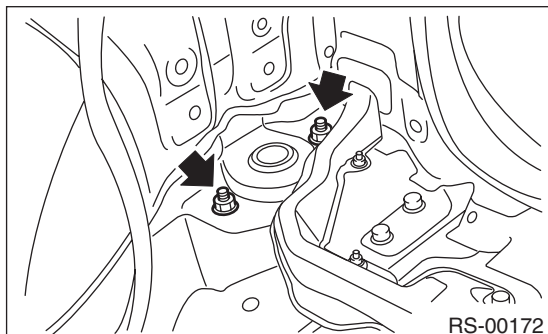
6. Rear Shock Absorber

A: REMOVAL

- 1) Lift-up vehicle and remove rear wheels.
- 2) Remove rear pillar lower trim. <Ref. to EI-52, REMOVAL, Rear Pillar Trim.>
- 3) Remove bolt securing shock absorber to rear arm.



- 4) Use a jack to support the shock absorber.
- 5) Remove nuts securing shock absorber mount to body.



- 6) Remove shock absorber.

B: INSTALLATION

- 1) Use a jack to support the shock absorber.
- 2) Tighten self-locking nut used to secure shock absorber to vehicle body.

CAUTION:

Use a new self-locking nut.

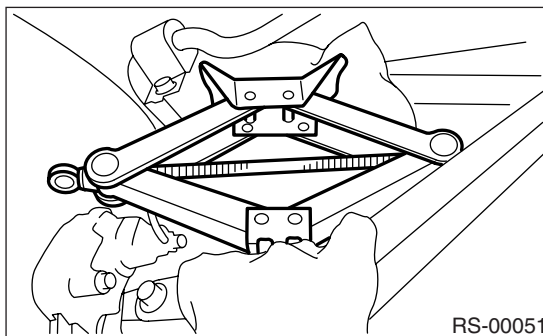
Tightening torque:

30 N·m (3.1 kgf-m, 22 ft-lb)

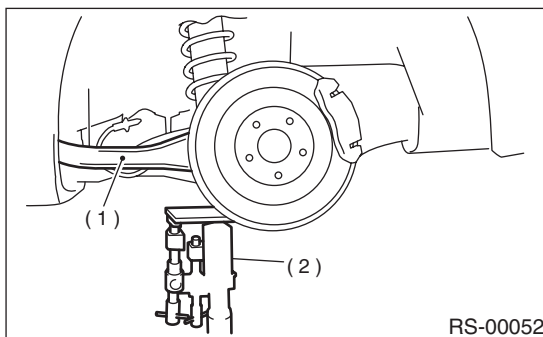
- 3) Place jack (furnished with vehicle) upside down and position it between link rear and sub frame. Adjust jack position so rear shock absorber is aligned with rear arm at their corresponding holes. Install lower shock absorber bolts.

CAUTION:

Put a cloth between jack and its mating area to protect link rear and sub frame from scratches.



- 4) Using transmission jack, support rear arm horizontally and tighten shock absorber nuts and bolts to specified torque.



- (1) Rear arm
- (2) Transmission jack

Tightening torque:

160 N·m (16.3 kgf-m, 118 ft-lb)

CAUTION:

Use a new self-locking nut.

- 5) Install all removed trims.

NOTE:

Check wheel alignment and adjust if necessary.

C: DISASSEMBLY

For disassembly of shock absorber, refer to procedures outlined under front strut as a guide.

<Ref. to FS-21, DISASSEMBLY, Front Strut.>

D: ASSEMBLY

Refer to Front Strut as a guide for assembly procedures.

<Ref. to FS-21, ASSEMBLY, Front Strut.>

E: INSPECTION

Refer to Front Strut as a guide for inspection procedures.

<Ref. to FS-22, INSPECTION, Front Strut.>

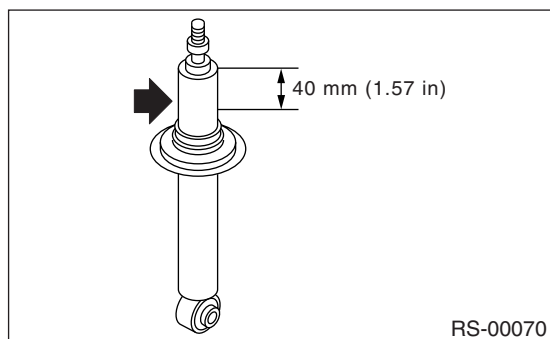
F: DISPOSAL

CAUTION:

- Before handling shock absorber, be sure to wear goggles to protect eyes from gas, oil and/or filings.
- Completely discharge the gas from the shock absorber before disposal. Follow the disposal procedure outlined below.
- Do not disassemble shock absorber or place into a fire.
- Drill holes before disposing of shock absorber.

1) Place shock absorber on a flat and level surface with piston rod fully extended.

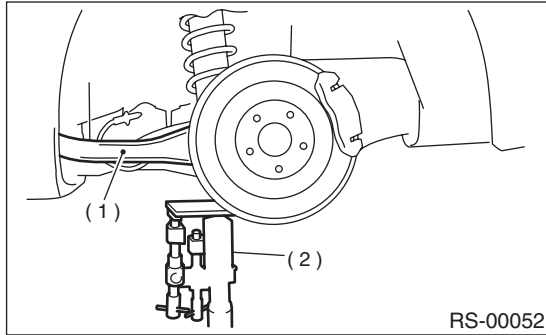
2) Using a 2 to 3 mm (0.08 to 0.12 in) dia. drill, drill 30 mm (1.18 in) deep holes in areas shown in the figure.



7. Link Front

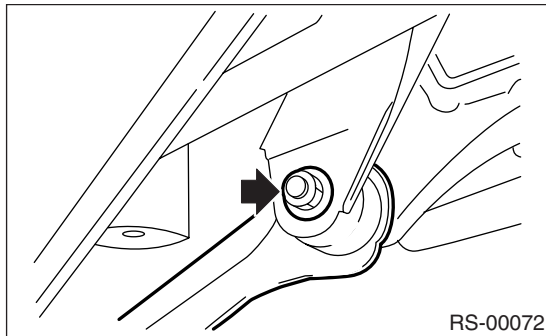
A: REMOVAL

- 1) Loosen wheel nuts. Lift-up vehicle and remove wheel.
- 2) Use transmission jack to support rear arm horizontally.

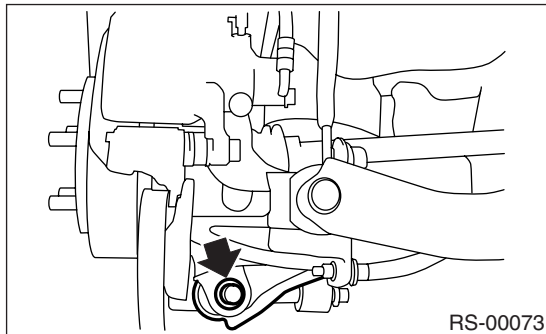


- (1) Rear arm
- (2) Transmission jack

- 3) Remove bolt securing link front to sub frame.



- 4) Remove bolts which secure link front to rear arm and detach link front.



NOTE:

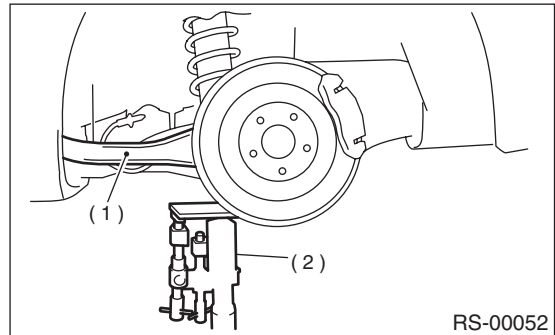
Link front bushing cannot be replaced alone. Always replace link front and bushing as a single unit.

B: INSTALLATION

Install in the reverse order of removal, observing the following instructions.

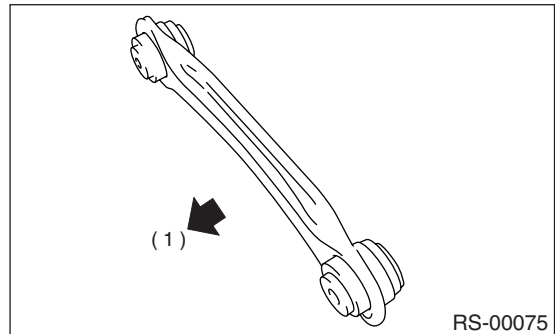
CAUTION:

- Using transmission jack, support rear arm horizontally, install link front and tighten nuts to specified torque.



- (1) Rear arm
- (2) Transmission jack

- Install link front with protruded side facing front.



- (1) Front

CAUTION:

Use a new self-locking nut.

NOTE:

Check wheel alignment and adjust if necessary.

Tightening torque:

120 N·m (12.2 kgf-m, 88 ft-lb)

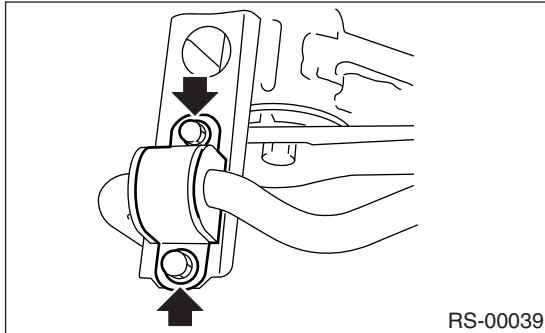
C: INSPECTION

Visually check link front for damage or bends.

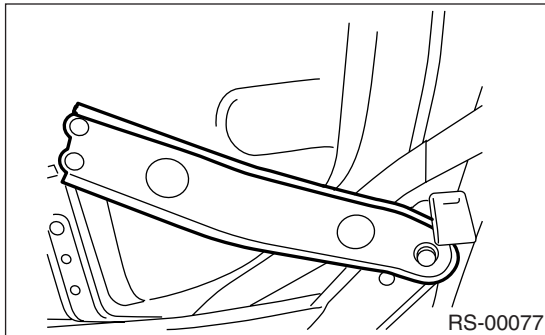
8. Link Rear

A: REMOVAL

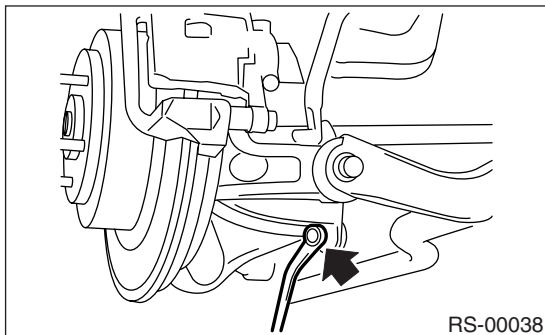
- 1) Loosen wheel nuts. Lift-up vehicle and remove wheel.
- 2) Remove bolt securing stabilizer clamps to sub frame.



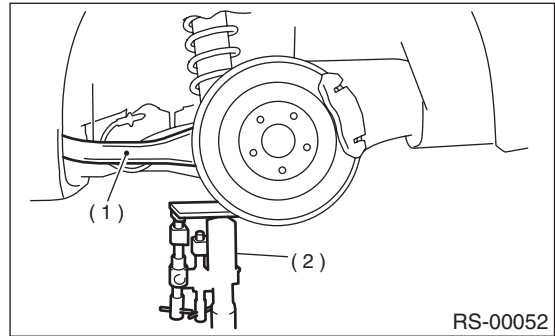
- 3) Remove support sub frame RH. (When removing RH side link rear.)



- 4) Remove stabilizer link.

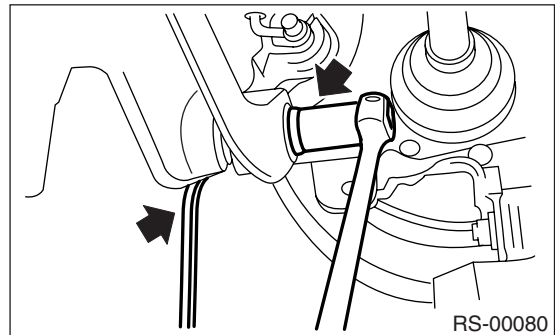


- 5) Use transmission jack to support rear arm horizontally.



- (1) Rear arm
- (2) Transmission jack

- 6) Remove bolt securing link rear to rear arm.

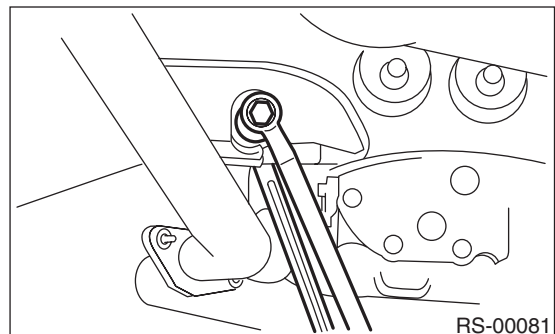


- 7) Scribe an alignment mark on link rear adjusting bolt and sub frame.

- 8) Remove bolts securing link rear to sub frame, detach link rear.

CAUTION:

To loosen adjusting bolt, always loosen nut while holding the head of adjusting bolt.



LINK REAR

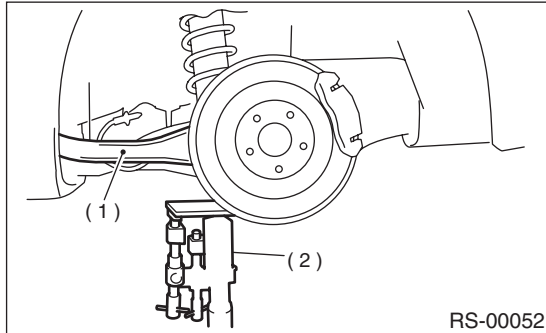
REAR SUSPENSION

B: INSTALLATION

Install in the reverse order of removal, observing the following instructions.

CAUTION:

Using transmission jack, support rear arm horizontally, install link rear and tighten nuts to specified torque.



- (1) Rear arm
- (2) Transmission jack

CAUTION:

- Tighten nut when installing adjusting bolt.
- Use a new self-locking nut.

NOTE:

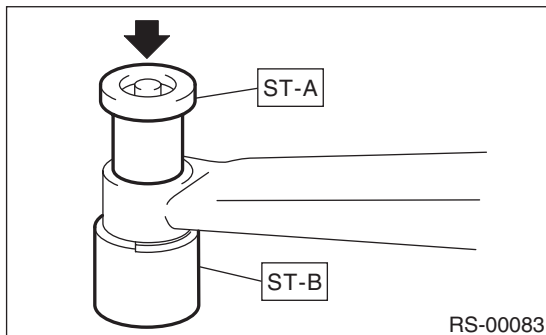
Check wheel alignment and adjust if necessary.

C: DISASSEMBLY

Using ST-A, B, press bushing out of place.

ST-A 20099AE000 INSTALLER & REMOVER

ST-B 20099AE000 INSTALLER & REMOVER

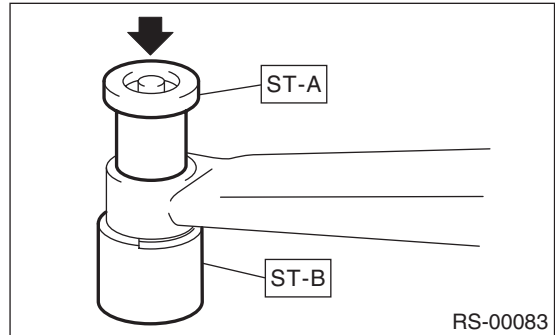


D: ASSEMBLY

Using ST-A and ST-B, press bushing into place.

ST-A 20099AE000 INSTALLER & REMOVER

ST-B 20099AE000 INSTALLER & REMOVER



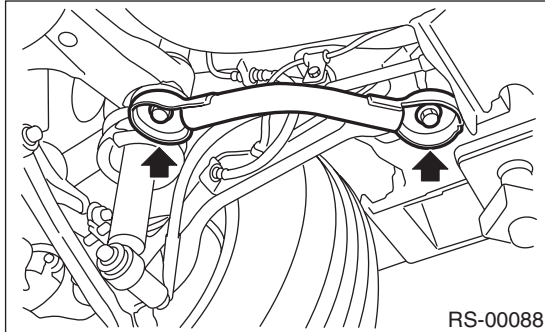
E: INSPECTION

Visually check link rear for damage or bends.

9. Support Sub Frame Front

A: REMOVAL

- 1) Lift-up the vehicle, using support stand to support rear sub frame.
- 2) Remove support sub frame front.



B: INSTALLATION

- 1) Install in reverse order of removal.

Tightening torque:

Support sub frame front to rear arm bracket

125 N·m (12.8 kgf-m, 92 ft-lb)

Support sub frame front to rear sub frame

175 N·m (17.8 kgf-m, 129 ft-lb)

C: INSPECTION

Visually check support sub frame front for damage or bends.

10.Rear Sub Frame

A: REMOVAL

1) Separate front exhaust pipe and rear exhaust pipe.

2) Remove rear exhaust pipe and muffler.

3) Remove rear differential.

With T-type

<Ref. to DI-23, REMOVAL, Rear Differential for T-type.>

With VA-type

<Ref. to DI-39, REMOVAL, Rear Differential for VA-type.>

4) Disconnect link front from sub frame.

<Ref. to RS-18, REMOVAL, Link Front.>

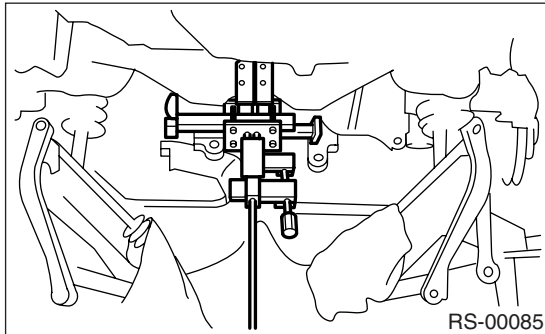
5) Disconnect link rear from sub frame.

<Ref. to RS-19, REMOVAL, Link Rear.>

6) Disconnect link upper from sub frame.

<Ref. to RS-14, REMOVAL, Link Upper.>

7) Place transmission jack under sub frame.



8) Remove support sub frame front.

9) After removing bolts, remove sub frame and support sub frame from vehicle body.

B: INSTALLATION

1) Install in reverse order of removal.

2) For installation and tightening torque of rear differential.

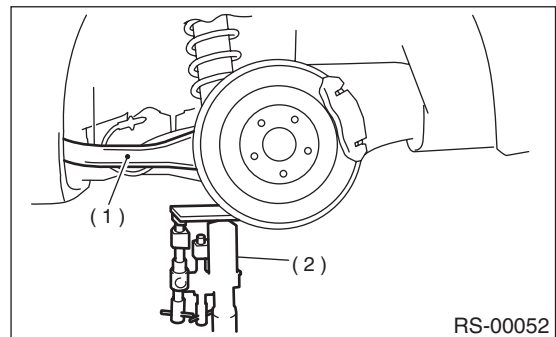
With T-type

<Ref. to DI-24, INSTALLATION, Rear Differential for T-type.>

With VA-type

<Ref. to DI-40, INSTALLATION, Rear Differential for VA-type.>

3) Using transmission jack, support rear arm horizontally and tighten nuts and bolts securing rear arm, link front, link rear, link upper and shock absorber.



(1) Rear arm

(2) Transmission jack

4) Install support sub frame front.

NOTE:

Check wheel alignment and adjust if necessary.

C: INSPECTION

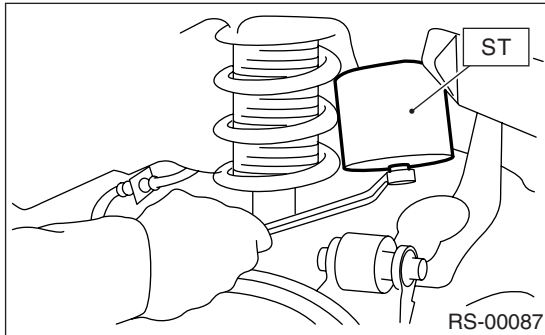
Check removed parts for wear, damage and cracks, and correct or replace if defective.

11.Helper

A: REMOVAL

- 1) Jack-up the rear part of the vehicle, support it with safety stands (rigid racks).
- 2) Using ST, remove helper.

ST 20099AE030 HELPER SOCKET WRENCH



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)

C: INSPECTION

Check helper for cracks, fatigue or damage.

GENERAL DIAGNOSTIC TABLE

REAR SUSPENSION

12.General Diagnostic Table

A: INSPECTION

1. IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible causes	Countermeasures
(1) Permanent distortion or breakage of coil spring	Replace.
(2) Unsmooth operation of damper strut and/or shock absorber	Replace.
(3) Installation of wrong strut and/or shock absorber	Replace with proper parts.
(4) Installation of wrong coil spring	Replace with proper parts.

2. POOR RIDE COMFORT

- 1) Large rebound shock
- 2) Rocking of vehicle continues too long after running over bump and/or hump.
- 3) Large shock in bumping

Possible causes	Countermeasures
(1) Breakage of coil spring	Replace.
(2) Overinflation pressure of tire	Adjust.
(3) Improper wheel arch height	Adjust or replace coil springs with new ones.
(4) Fault in operation of damper strut and/or shock absorber	Replace.
(5) Damage or deformation of strut mount and/or shock absorber mount	Replace.
(6) Unsuitability of maximum and/or minimum length of damper strut and/or shock absorber	Replace with proper parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly and/or shock absorber	Replace.
(9) Oil leakage of damper strut and/or shock absorber	Replace.

3. NOISE

Possible causes	Countermeasures
(1) Wear or damage of damper strut and/or shock absorber component parts	Replace.
(2) Loosening of suspension link installing bolt	Retighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Unsuitability of maximum and/or minimum length of damper strut and/or shock absorber	Replace with proper parts.
(5) Breakage of coil spring	Replace.
(6) Wear or damage of ball joint	Replace.
(7) Deformation of stabilizer clamp	Replace.

TRANSFER CASE

TC

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3. Transfer Clutch and Extension (4AT)	4
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6. Transfer Driven Gear (5MT)	7
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8. Reduction Drive Gear (4AT with VTD)	9
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11. Center Differential	12
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1. General Description

A: NOTE

For general description, refer to “4AT” or “5MT” section.

4AT model: <Ref. to 4AT-2, General Description.>

5MT model: <Ref. to 5MT-2, General Description.>

2. Transfer Case and Extension (5MT)

A: NOTE

For removal, installation and inspection work, refer to "5MT" section.

5MT model: <Ref. to 5MT-40, Transfer Case and Extension Case Assembly.>

3. Transfer Clutch and Extension (4AT)

A: NOTE

For removal, installation and inspection work, refer to “4AT” section. <Ref. to 4AT-90, Transfer Clutch.>, <Ref. to 4AT-86, Extension Case.>

4. Oil Seal

A: NOTE

For removal, installation and inspection work, refer to "4AT" or "5MT" section.

4AT model: <Ref. to 4AT-49, Extension Case Oil Seal.>

5MT model: <Ref. to 5MT-34, Oil Seal.>

5. Transfer Drive Gear (5MT)

A: NOTE

For removal, installation and inspection work, refer to "5MT" section.

5MT model: <Ref. to 5MT-44, Transfer Drive Gear.>

6. Transfer Driven Gear (5MT)

A: NOTE

For removal, installation and inspection work, refer to "5MT" section.

5MT model: <Ref. to 5MT-46, Transfer Driven Gear.>

7. Reduction Drive Gear (4AT without VTD)

A: NOTE

For removal, installation and inspection work, refer to “4AT” section. <Ref. to 4AT-100, Reduction Drive Gear.>

8. Reduction Drive Gear (4AT with VTD)

A: NOTE

For removal, installation and inspection work, refer to "4AT" section. <Ref. to 4AT-100, Reduction Drive Gear.>

9. Reduction Driven Gear (4AT without VTD)

A: NOTE

For removal, installation and inspection work, refer to "4AT" section. <Ref. to 4AT-98, Reduction Driven Gear.>

10.Reduction Driven Gear (4AT with VTD)

A: NOTE

For removal, installation and inspection work, refer to "4AT" section. <Ref. to 4AT-98, Reduction Driven Gear.>

11.Center Differential

A: NOTE

For removal, installation and inspection work, refer to "4AT" or "5MT" section.

4AT model: <Ref. to 4AT-102, Center Differential Carrier.>

5MT model: <Ref. to 5MT-48, Center Differential.>

12. Transfer Clutch Pressure Test

A: NOTE

For inspection work, refer to “4AT” section. <Ref. to 4AT-38, Transfer Clutch Pressure Test.>

13. Transfer Duty Solenoid and Valve Body

A: NOTE

For removal, installation and inspection work, refer to "4AT" section. <Ref. to 4AT-72, Shift Solenoids, Duty Solenoids and ATF Temperature Sensor.>

WHEEL AND TIRE SYSTEM

WT

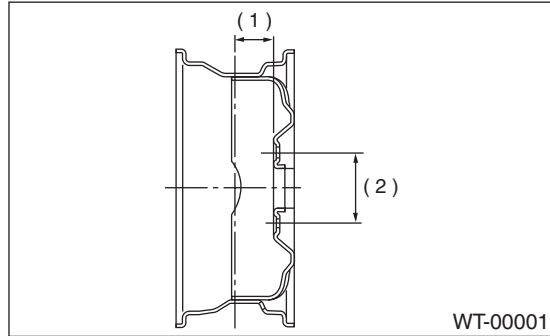
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1. General Description	2
2. Tire	6
3. Steel Wheel	7
4. Aluminum Wheel	8
5. Wheel Balancing	9
6. "T-type" Tire	11
7. Spare Tire Hoist	12
8. General Diagnostic Table.....	13

GENERAL DESCRIPTION

WHEEL AND TIRE SYSTEM

1. General Description

A: SPECIFICATIONS



(1) Offset

(2) P.C.D.

		Tire size	Rim size	Rim offset mm (in)	P.C.D. mm (in)
PICKUP	Front and Rear	P225/60R16 97H	16 × 6 1/2JJ	48 (1.89)	100 (3.94) dia.
	T-type tire	T145/80R16	16 × 4T	50 (1.97)	

		Tire size	Tire inflation pressure kPa (kg/cm ² , psi)	
			Light load	Trailer towing
PICKUP	Front and Rear	P225/60R16 97H	Ft: 230 (2.3, 33) Rr: 230 (2.3, 33)	Ft: 230 (2.3, 33) Rr: 230 (2.3, 33)
	T-type tire	T145/80R16	420 (4.2, 60)	—

NOTE:

"T-type" tire for temporary use is supplied as a spare tire.

GENERAL DESCRIPTION

WHEEL AND TIRE SYSTEM

1. SERVICE DATA

Item	Axial runout	Radial runout
Steel wheel	1.5 mm (0.059 in)	
Aluminum wheel	1.0 mm (0.039 in)	

2. ADJUSTING PARTS

Wheel balancing	Standard	Service limit
Dynamic unbalance	Less than 5 g (0.18 oz)	

Balance weight part number (For steel wheel)	Weight
28101AA001	5 g (0.18 oz)
28101AA011	10 g (0.35 oz)
28101AA021	15 g (0.53 oz)
28101AA031	20 g (0.71 oz)
28101AA041	25 g (0.88 oz)
28101AA051	30 g (1.06 oz)
28101AA061	35 g (1.23 oz)
28101AA071	40 g (1.41 oz)
28101AA081	45 g (1.59 oz)
28101AA091	50 g (1.76 oz)
—	55 g (1.94 oz)
28101AA111	60 g (2.12 oz)

Balance weight part number (Stick-on type for aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
—	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

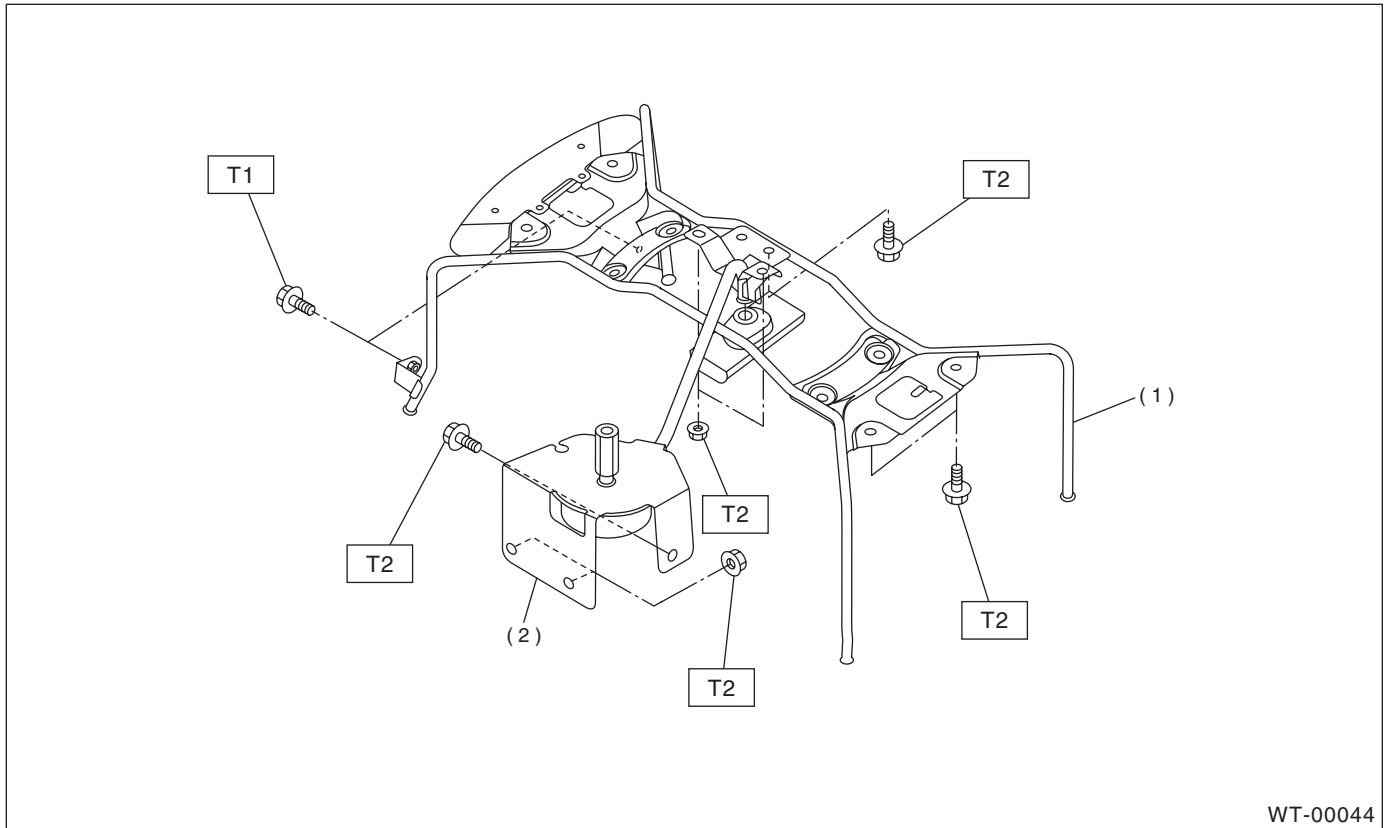
Balance weight part number (Paste-on type for aluminum wheel)	Weight
28101AE00B	5 g (0.18 oz)
28101AE01B	7.5 g (0.26 oz)
28101AE02B	10 g (0.35 oz)
28101AE03B	12.5 g (0.44 oz)
28101AE04B	15 g (0.53 oz)
28101AE05B	17.5 g (0.62 oz)
28101AE06B	20 g (0.71 oz)
28101AE07B	22.5 g (0.79 oz)
28101AE08B	25 g (0.88 oz)
28101AE09B	27.5 g (0.97 oz)
28101AE10B	30 g (1.06 oz)
28101AE11B	32.5 g (1.15 oz)
28101AE12B	35 g (1.23 oz)
28101AE13B	37.5 g (1.32 oz)
28101AE14B	40 g (1.41 oz)
28101AE15B	42.5 g (1.50 oz)
28101AE16B	45 g (1.59 oz)
28101AE17B	47.5 g (1.68 oz)
28101AE18B	50 g (1.76 oz)
28101AE19B	52.5 g (1.85 oz)
28101AE20B	55 g (1.94 oz)
28101AE21B	57.5 g (2.03 oz)
28101AE22B	60 g (2.12 oz)
28101AE23B	62.5 g (2.20 oz)
28101AE24B	65 g (2.29 oz)
28101AE25B	67.5 g (2.38 oz)
28101AE26B	70 g (2.47 oz)
28101AE27B	72.5 g (2.56 oz)
28101AE28B	75 g (2.65 oz)
28101AE29B	77.5 g (2.73 oz)
28101AE30B	80 g (2.82 oz)
28101AE31B	82.5 g (2.91 oz)
28101AE32B	85 g (3.00 oz)
28101AE33B	87.5 g (3.09 oz)
28101AE34B	90 g (3.17 oz)
28101AE35B	92.5 g (3.26 oz)
28101AE36B	95 g (3.35 oz)
28101AE37B	97.5 g (3.44 oz)
28101AE38B	100 g (3.53 oz)

GENERAL DESCRIPTION

WHEEL AND TIRE SYSTEM

B: COMPONENT

1. SPARE TIRE HOIST



- (1) Spare tire guide
- (2) Spare tire hoist

Tightening torque: N·m (kgf-m, ft-lb)

T1: 13 (1.3, 9.4)

T2: 18 (1.8, 13.0)

C: PREPARATION TOOL

1. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Air Pressure Gauge	Used for measuring tire air pressure.
Dial Gauge	Used for measuring wheel runout.

2. Tire

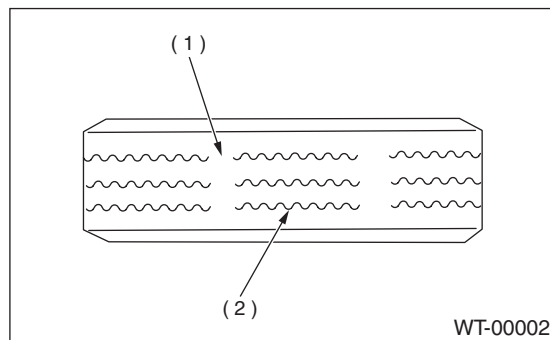
A: INSPECTION

- 1) Take stone, glass, nail etc. off the tread groove.
- 2) Replace tire:

CAUTION:

- When replacing a tire, make sure to use only the same size, construction and load range as originally installed.
- Avoid mixing radial, belted bias or bias tires on the vehicle.

- (1) When large crack on side wall, damage or crack on tread is found.
- (2) When the "tread wear indicator" appears as a solid band across the tread.



- (1) Tread wear indicator
- (2) Tire tread

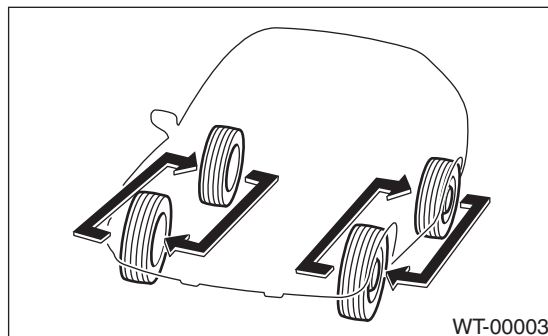
- 3) When extremely biased wear on tire tread can be seen, after replacing tire, check wheel alignment. <Ref. to FS-8, Wheel Alignment.>

1. TIRE ROTATION

If tires are maintained at the same positions for a long period of time, uneven wear results. Therefore, they should be periodically rotated. This lengthens service life of tires.

CAUTION:

When rotating tires, replace unevenly worn or damaged tires with new ones.



3. Steel Wheel

A: REMOVAL

- 1) Apply parking brake, and position select lever to "P" or "LOW".
- 2) Set shop jacks or a lift to the specified point, and support the vehicle with its wheels slightly contacting the floor.
- 3) Loosen wheel nuts.
- 4) Raise the vehicle until its wheels take off the ground using a jack or a lift.
- 5) Remove wheel nuts and wheels.

NOTE:

- While removing wheels, prevent hub bolts from damage.

NOTE:

- Place wheels with their outer sides facing upward to prevent wheels from damage.

B: INSTALLATION

- 1) Attach the wheel to the hub by aligning the wheel bolt hole with the hub bolt.
- 2) Temporarily attach the wheel nuts to the hub bolts. (In the case of aluminum wheel, use SUBARU genuine wheel nut for aluminum wheel.)
- 3) Manually tighten the nuts making sure the wheel hub hole is aligned correctly to the guide portion of hub.
- 4) Tighten the wheel nuts in a diagonal selection to the specified torque. Use a wheel nut wrench.

Wheel nut tightening torque:

110 N·m (11.2 kgf-m, 81.0 ft-lb)

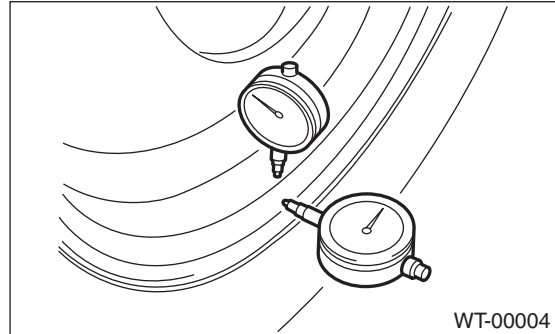
CAUTION:

- Tighten the wheel nuts in two or three steps by gradually increasing the torque and working diagonally, until the specified torque is reached. For drum brake models, excess tightening of wheel nuts may cause wheels to "judder".
- Do not depress the wrench with a foot; Always use both hands when tightening.
- Make sure the bolt, nut and the nut seating surface of the wheel are free from oils.

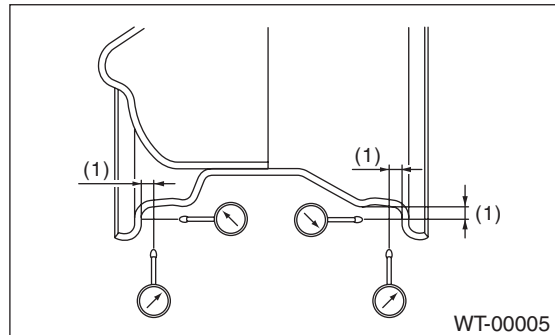
- 5) If a wheel is removed for replacement or for repair of a puncture, retighten the wheel nuts to the specified torque after running 1,000 km (600 miles).

C: INSPECTION

- 1) Deformation or damage on the rim can cause air leakage. Check the rim flange for deformation, crack, or damage, and repair or replace as necessary.
- 2) Jack-up vehicle until wheels clear the floor.
- 3) Slowly rotate wheel to check rim "runout" using a dial gauge.



Axial runout limit	Radial runout limit
1.5 mm (0.059 in)	



(1) Approx. 7 mm (0.28 in)

- 4) If rim runout exceeds the limit, remove tire from rim and check runout while attaching dial gauge to positions shown in figure.
- 5) If measured runout still exceeds the limit, replace the wheel.

4. Aluminum Wheel

A: REMOVAL

Refer to Steel Wheel for removal procedure of aluminum wheels.

<Ref. to WT-7, REMOVAL, Steel Wheel.>

B: INSTALLATION

Refer to Steel Wheel for installation procedure of aluminum wheels.

<Ref. to WT-7, INSTALLATION, Steel Wheel.>

C: INSPECTION

Refer to Steel Wheel for inspection procedure of aluminum wheels.

<Ref. to WT-7, INSPECTION, Steel Wheel.>

Rim runout:

Axial runout limit	Radial runout limit
1.0 mm (0.039 in)	

D: CAUTION

Aluminum wheels are easily scratched. To maintain their appearance and safety, do the following:

1) Do not damage aluminum wheels during removal, disassembly, installation, wheel balancing, etc. After removing aluminum wheels, place them on a rubber mat, etc.

2) While vehicle is being driven, be careful not to ride over sharp obstacles or allow aluminum wheels to contact the shoulder of the road.

3) When washing aluminum wheel, use neutral synthetic detergent and water. Avoid using the cleanser including abrasive, hard brushes or an automatic car washer.

5. Wheel Balancing

A: REPLACEMENT

1. STICK-ON TYPE BALANCE WEIGHT

- 1) Remove balance weights.
- 2) Using dynamic balancing, measure wheel balance.
- 3) Select a weight close to the value measured by dynamic balancing.

Balance weight part number (For steel wheel)	Weight
28101AA001	5 g (0.18 oz)
28101AA011	10 g (0.35 oz)
28101AA021	15 g (0.53 oz)
28101AA031	20 g (0.71 oz)
28101AA041	25 g (0.88 oz)
28101AA051	30 g (1.06 oz)
28101AA061	35 g (1.23 oz)
28101AA071	40 g (1.41 oz)
28101AA081	45 g (1.59 oz)
28101AA091	50 g (1.76 oz)
—	55 g (1.94 oz)
28101AA111	60 g (2.12 oz)

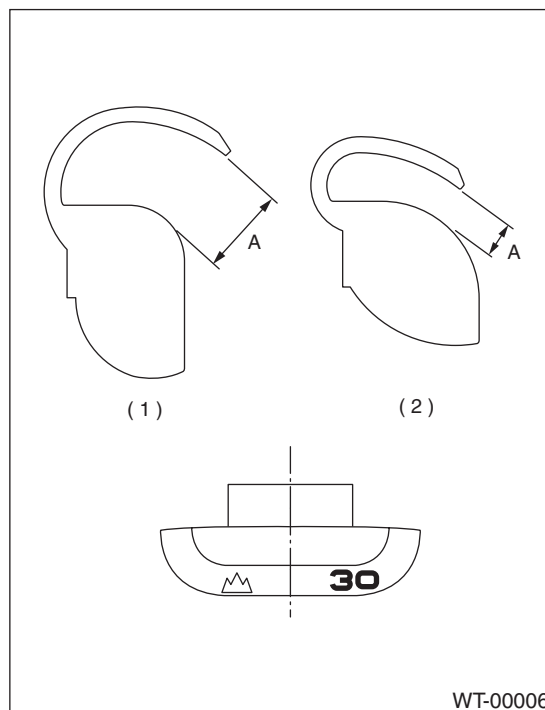
Balance weight part number (For aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
—	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

- 4) Install the selected weight to the point designated by dynamic balancing.
- 5) Using dynamic balancing, measure wheel balance again. Check that wheel balance is correctly adjusted.

Service limit: A

**Balance weight for steel wheel;
2.16 mm (0.085 in)**

**Balance weight for aluminum wheel;
4.5 mm (0.177 in)**



- (1) Balance weight for aluminum wheel
- (2) Balance weight for steel wheel

CAUTION:

- Use genuine balance weights.
- Balance weights are available for use with any of 14- to 16-inch wheels.

2. PASTE-ON TYPE BALANCE WEIGHT

- 1) Remove balance weights.
- 2) Remove traces of two-sided tape on wheel and clean adhesive layer.
- 3) Set balancing (dynamic balancing for stick-on balance weight is available) and measure wheel balance.
- 4) Multiply the measured weight by 1.6 to select a weight.
- 5) Select a weight close to the calculated value, clean the point designated by balancing and paste on the weight there.

WHEEL BALANCING

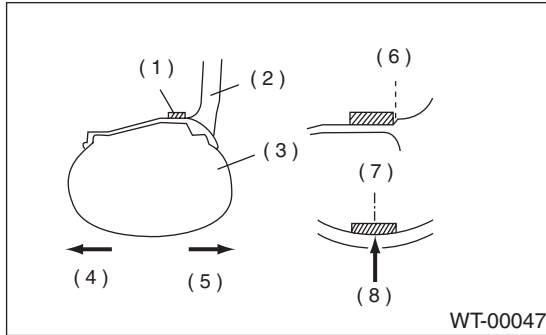
WHEEL AND TIRE SYSTEM

Example of selecting balance weight:

Measured wheel balance: 34 g

$$34 \text{ g} \times 1.6 = 54.4$$

Weight to be selected: 55g



- (1) Paste-on type balance weight
- (2) Wheel
- (3) Tire
- (4) Inside
- (5) Outside
- (6) Clamp the balance on the step
- (7) Center of balance weight
- (8) Point designated by balancing

CAUTION:

- Press on the weight for more than 2 seconds with a force of 25 N·m (2.6 kgf-m, 18 ft-lb) or more per 5 g to paste on.
- Adjust weight balance from outside first and then inside.
- The weight to be pasted on must be under 100 g.

B: INSPECTION

- 1) Proper wheel balance may be lost if the tire is repaired or if it wears. Check the tire for dynamic balance, and repair as necessary.
- 2) To check for dynamic balance, use a dynamic balancer. Drive in the balance weight on both the top and rear sides of the rim.
- 3) Some types of balancer can cause damage to the wheel. Use an appropriate balancer when adjusting the wheel balance.

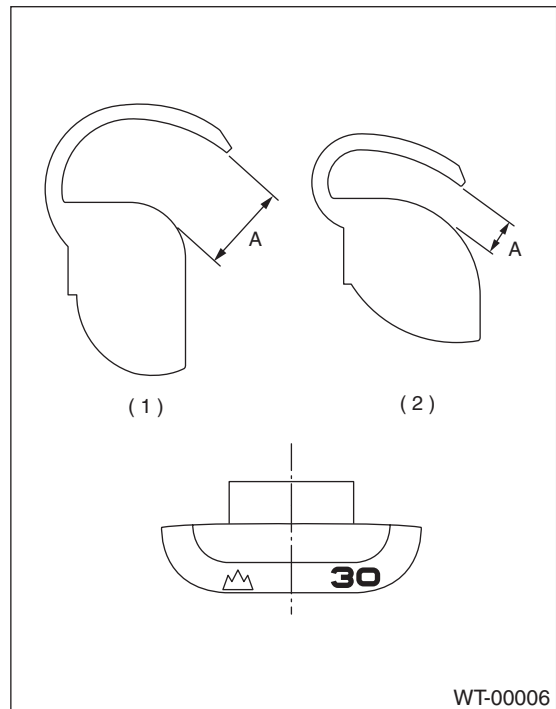
Service limit: A

Balance weight for steel wheel;

2.16 mm (0.085 in)

Balance weight for aluminum wheel;

4.5 mm (0.177 in)



- (1) Balance weight for aluminum wheel
- (2) Balance weight for steel wheel

CAUTION:

- Use genuine balance weights.
- Balance weights are available for use with any of 14- to 16-inch wheels.

6. “T-type” Tire

A: NOTE

“T-type” tire for temporary use is prepared as a spare tire.

CAUTION:

- Do not use a tire chain with the “T-type” tire. Because of the smaller tire size, a tire chain will not fit properly and will result in damage to the vehicle and the tire.
- Do not drive at a speed greater than 80 km/h (50 MPH).
- Drive as slowly as possible and avoid passing over bumps.

B: REPLACEMENT

Refer to Removal and Installation of Steel Wheel for removal/installation of “T-type” tires. <Ref. to WT-7, Steel Wheel.>

CAUTION:

Replace with a conventional tire as soon as possible since the “T-type” tire is only for temporary use.

C: INSPECTION

- 1) Check tire inflation pressure.

Specification:

420 kPa (4.2 kg/cm², 60 psi)

- 2) Take stones, glass, nails, etc. out of the tread groove.
- 3) Check tires for deformation, cracks, partial wear, or wear.

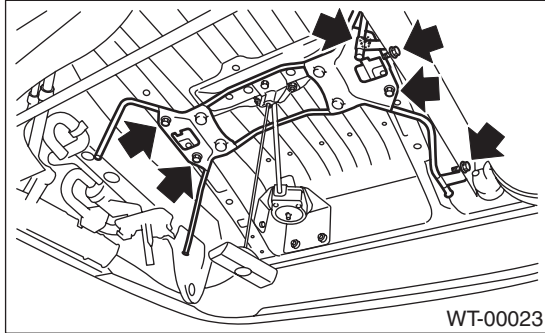
CAUTION:

Replace the tire with a new one.

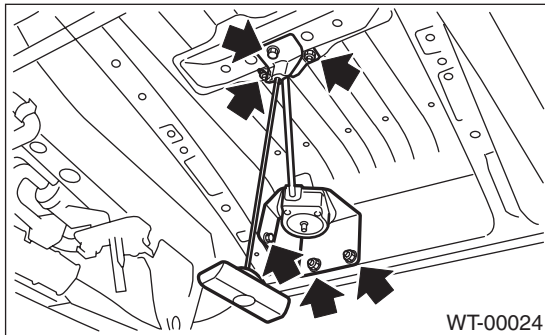
7. Spare Tire Hoist

A: REMOVAL

- 1) Remove spare tire from the vehicle.
- 2) Lift up the vehicle.
- 3) Remove spare tire guide.



- 4) Remove spare tire hoist.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Spare guide to body;

18 N·m (1.8 kgf-m, 13.0 ft-lb)

Spare guide to heat shield plate;

13 N·m (1.3 kgf-m, 9.4 ft-lb)

8. General Diagnostic Table

A: INSPECTION

Symptom	Possible cause	Remedy
Front wheel shimmy	• Worn or improperly inflated of tire.	Replace
	• Wheel is out of balance.	Adjustment
Abnormal tire wear	• Improperly inflated of tire.	Replace
Sways/pitches	• Worn or improperly inflated of tire.	Replace
Wander/pulls	• Worn or improperly inflated of tire.	Replace

GENERAL DIAGNOSTIC TABLE

WHEEL AND TIRE SYSTEM

MEMO: