

General Description

BRAKE

1. General Description

A: SPECIFICATION

Front disc brake	Type	Disc (Floating type, ventilated)
	Effective disc diameter mm (in)	261 (10.28)
	Disc thickness × Diameter mm (in)	30 × 316 (1.18 × 12.44)
	Effective cylinder diameter	42.8 (1.685) × 2
	Pad dimensions (Length × Width × Thickness) mm (in)	130.0 × 53.5 × 11.0 (5.118 × 2.106 × 0.433)
	Clearance adjustment	Automatic adjustment
Rear disc brake	Type	Disc (Floating type, ventilated)
	Effective disc diameter mm (in)	284.5 (11.2)
	Disc thickness × Diameter mm (in)	18 × 320 (0.71 × 12.59)
	Effective cylinder diameter mm (in)	40.46 (1.592)
	Pad dimensions (Length × Width × Thickness) mm (in)	95.5 × 34.8 × 11.0 (3.759 × 1.370 × 0.433)
	Clearance adjustment	Automatic adjustment
Master cylinder	Type	Tandem
	Effective diameter mm (in)	23.8 (15/16)
	Reservoir type	Sealed type
	Brake fluid reservoir capacity cm ³ (cu in)	285 (17.39)
Brake booster	Type	Vacuum suspended
	Effective diameter mm (in)	238 + 261 (9.37 + 10.28)
Brake line		Dual circuit system
Brake fluid CAUTION: • Avoid mixing brake fluid of different brands to prevent fluid performance from degrading. • When filling with brake fluid, be careful not to allow any dust to enter the reservoir. • Use new SUBARU genuine brake fluid when replacing or refilling the fluid.		FMVSS No. 116, DOT3, or DOT4

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NOTE:

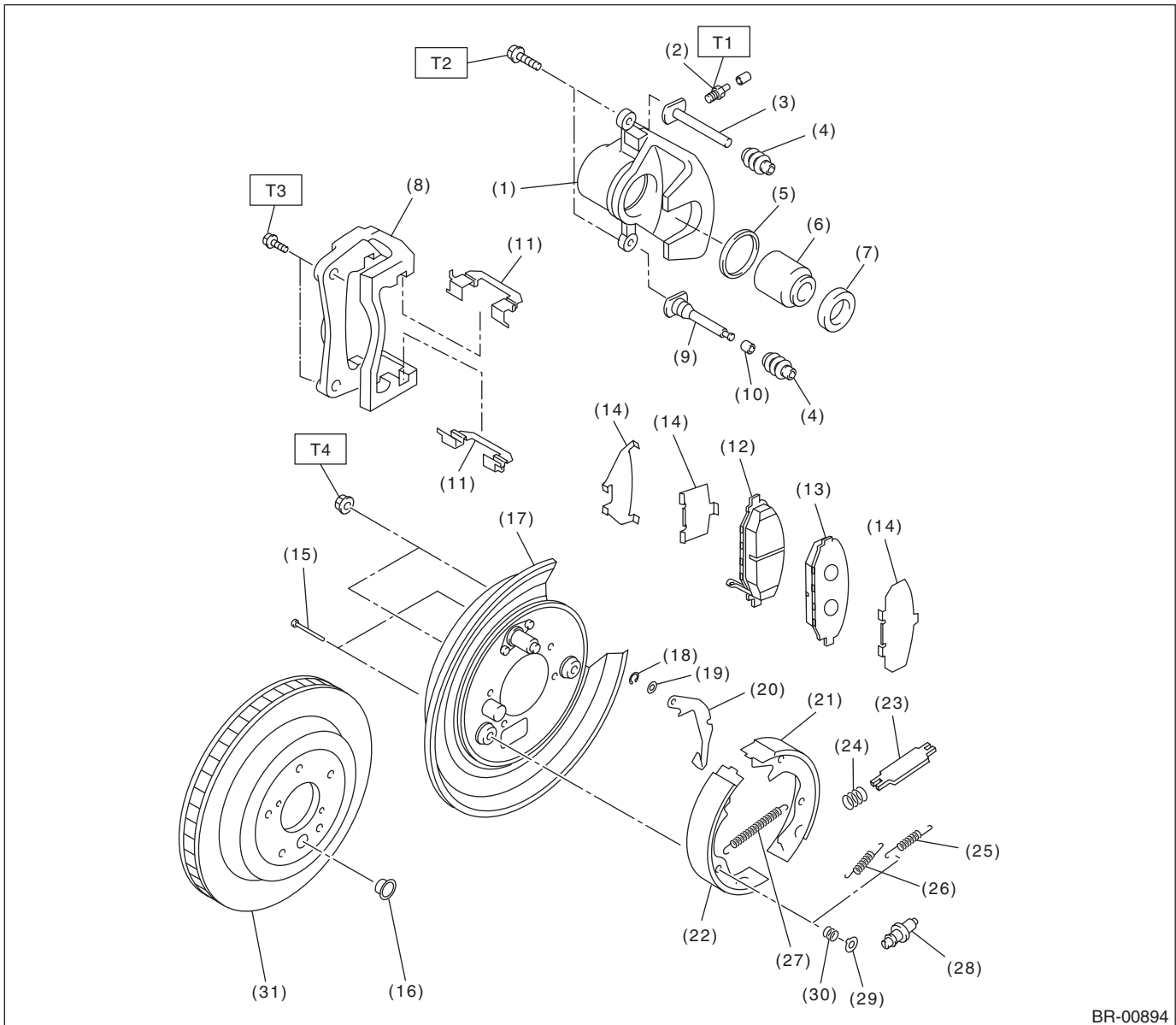
Refer to “PB” section for parking brake specifications. <Ref. to PB-2, SPECIFICATION, General Description.>

Item		Standard	Limit
Front brake	Pad thickness mm (in)	11 (0.43)	1.5 (0.059)
	Disc thickness mm (in)	30 (1.18)	28 (1.10)
	Disc runout mm (in)	—	0.05 (0.0020)
Rear brake (disc type)	Pad thickness mm (in)	11.0 (0.433)	1.5 (0.059)
	Disc thickness mm (in)	18 (0.71)	16 (0.63)
	Disc runout mm (in)	—	0.05 (0.0020)
Parking brake	Inside diameter mm (in)	210 (8.27)	211 (8.31)
	Lining thickness mm (in)	4.0 (0.157)	1.5 (0.059)
	Pedal stroke	5 to 6 notches/300 N (30 kgf, 67.5 lb)	

		Brake pedal force N (kgf, lb)	Fluid pressure kPa (kgf/cm ² , psi)
Brake booster	Brake fluid pressure with engine stopped	147 (15, 33)	590 (6, 86)
		294 (30, 66)	1,654 (17, 240)
	Brake fluid pressure with engine running and vacuum pressure at 66.7 kPa (500 mmHg, 19.69 inHg)	147 (15, 33)	8,539 (87, 1,238)
		294 (30, 66)	15,373 (157, 2,229)

Brake pedal	Free play mm (in)	0.5 — 2 (0.02 — 0.08) [When pulling the brake pedal upward with a force of less than 10 N (1 kgf, 2 lb)]
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2. REAR DISC BRAKE



BR-00894

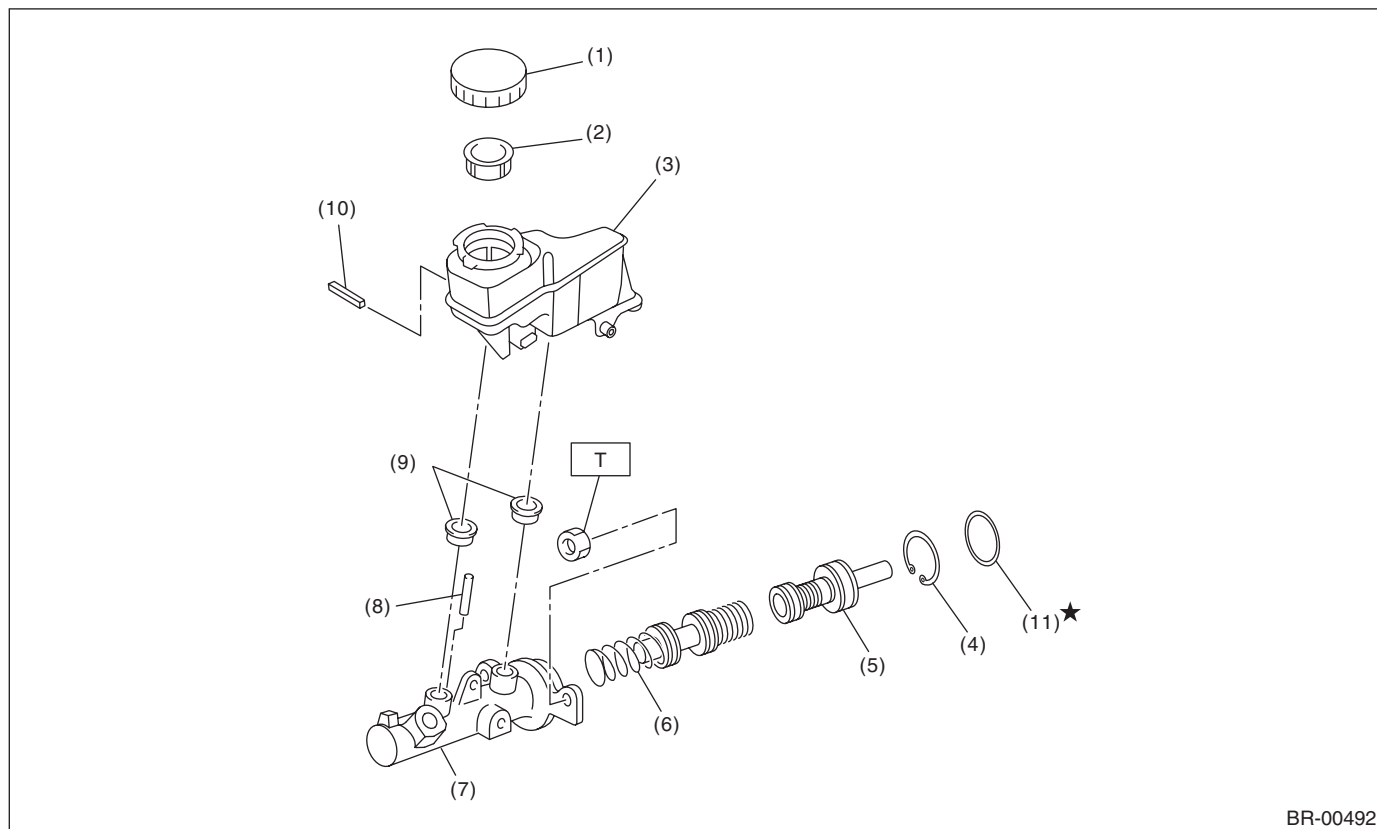
- | | | |
|-----------------------|-------------------------------------|------------------------|
| (1) Caliper body | (14) Shim | (27) Adjusting spring |
| (2) Air bleeder screw | (15) Shoe hold pin | (28) Adjuster |
| (3) Guide pin (gray) | (16) Cover | (29) Brake shoe cup |
| (4) Pin boot | (17)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

Tightening torque: N·m (kgf·m, ft·lb)**T1: 8 (0.8, 5.8)****T2: 27 (2.8, 19.9)****T3: 66 (6.7, 48.7)****T4: 75 (7.6, 55.3)**

General Description

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3. MASTER CYLINDER



- (1) Cap
- (2) Filter
- (3) Reservoir tank
- (4) C-ring
- (5) Primary piston

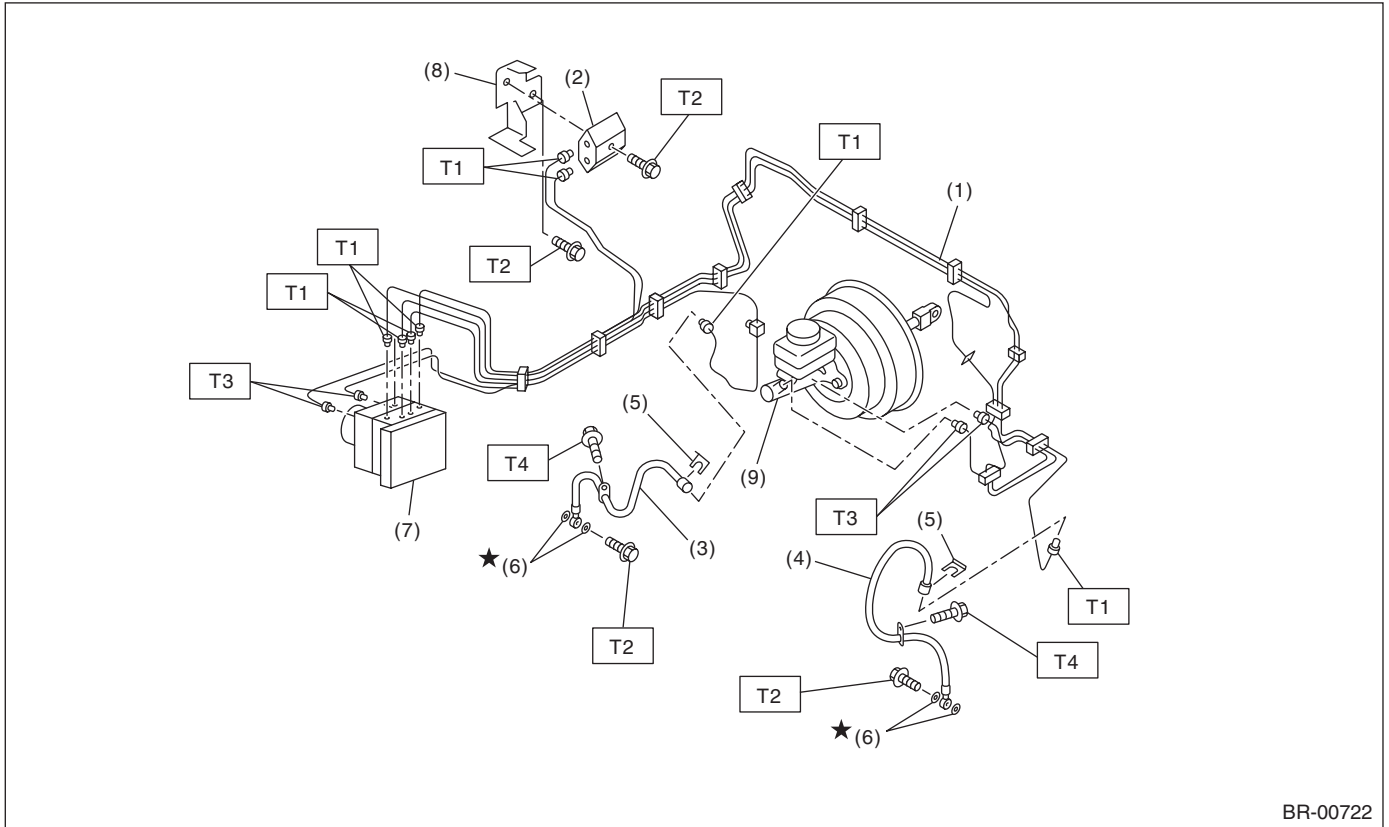
- (6) Secondary piston
- (7) Cylinder body
- (8) Cylinder pin
- (9) Seal
- (10) Pin

- (11) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

T: 25 (2.5, 18.4)

4. FRONT BRAKE PIPES AND HOSES



BR-00722

- | | |
|---------------------------|---|
| (1) Front brake pipe ASSY | (6) Gasket |
| (2) Two-way connector | (7) VDC control module & hydraulic control unit (VDCCM&H/U) |
| (3) Front brake hose RH | (8) Bracket |
| (4) Front brake hose LH | (9) Master cylinder |
| (5) Clamp | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 15 (1.5, 10.8)

T2: 18 (1.8, 13.3)

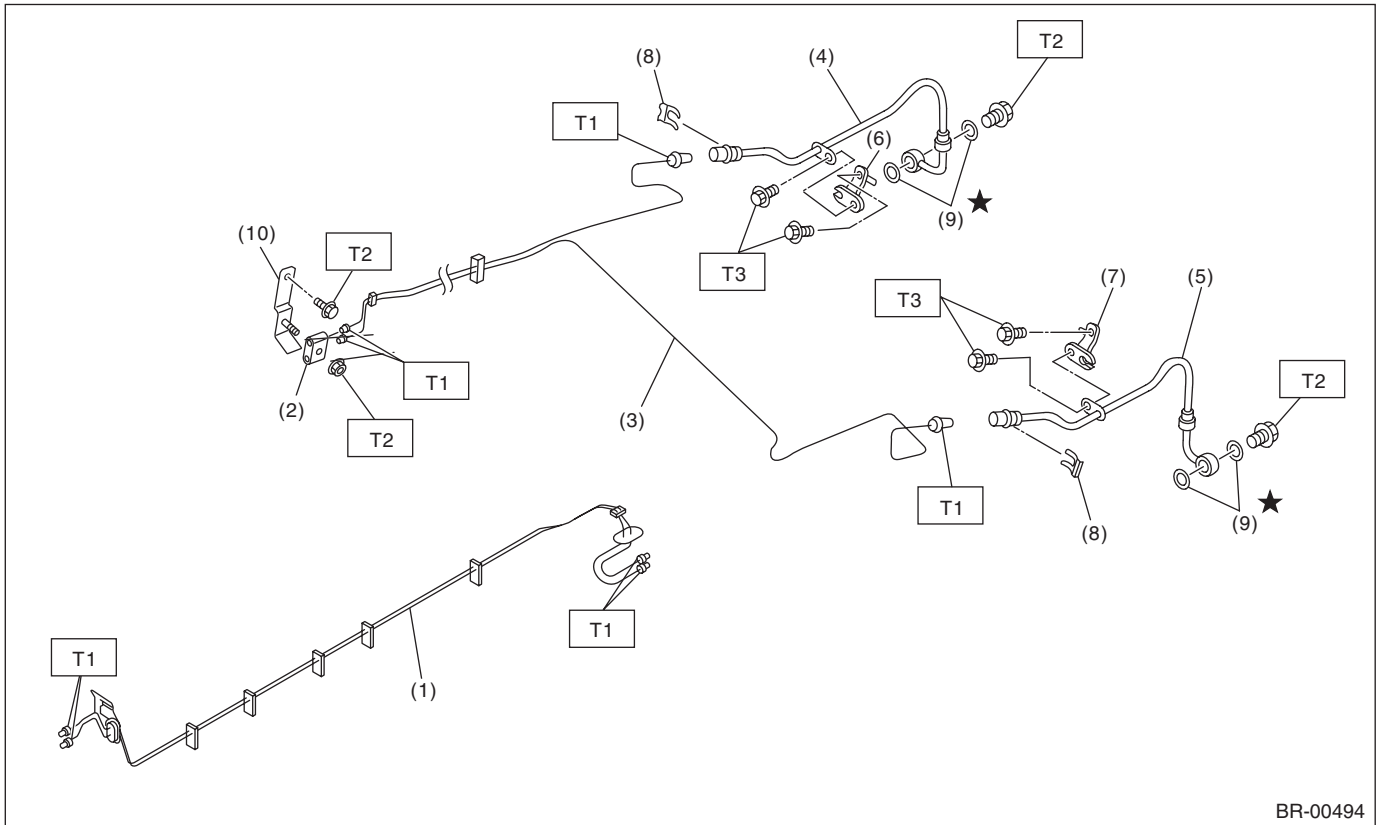
T3: 19 (1.9, 14.0)

T4: 33 (3.4, 24.3)

General Description

BRAKE

5. CENTER AND REAR BRAKE PIPES AND HOSES



- | | |
|----------------------------|--------------------------------|
| (1) Center brake pipe ASSY | (6) Rear brake hose bracket RH |
| (2) Two-way connector | (7) Rear brake hose bracket LH |
| (3) Rear brake pipe ASSY | (8) Clamp |
| (4) Rear brake hose RH | (9) Gasket |
| (5) Rear brake hose LH | (10) Bracket |

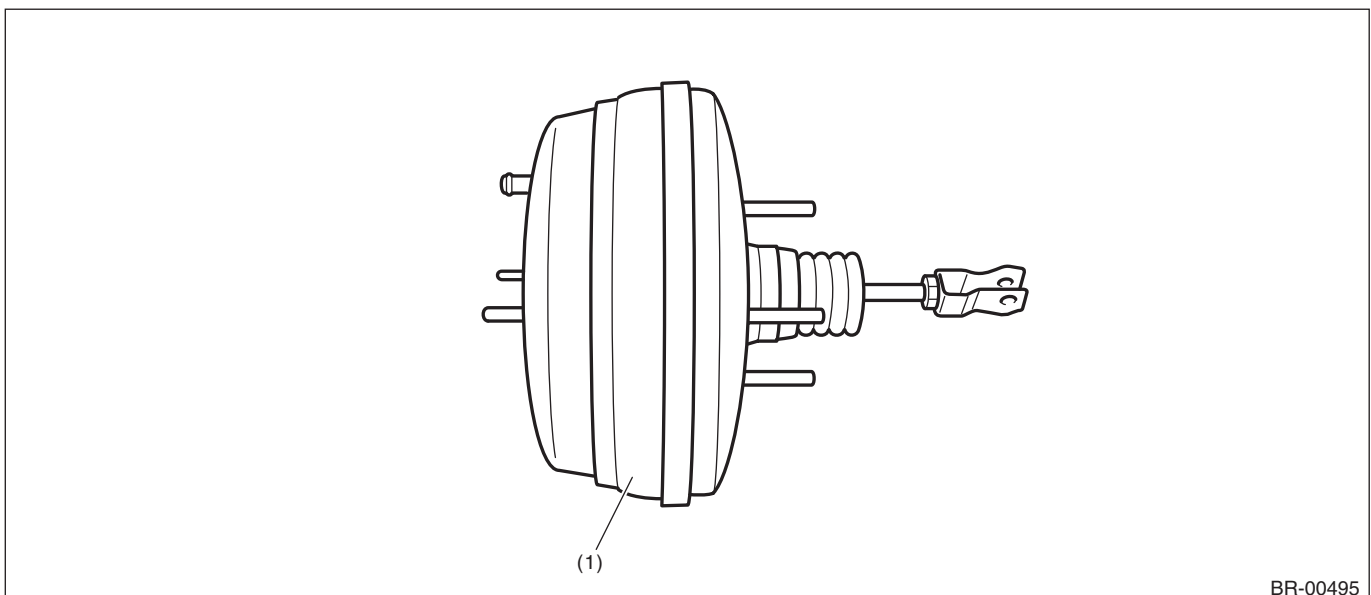
Tightening torque: N·m (kgf-m, ft-lb)

T1: 15 (1.5, 10.8)

T2: 18 (1.8, 13.3)

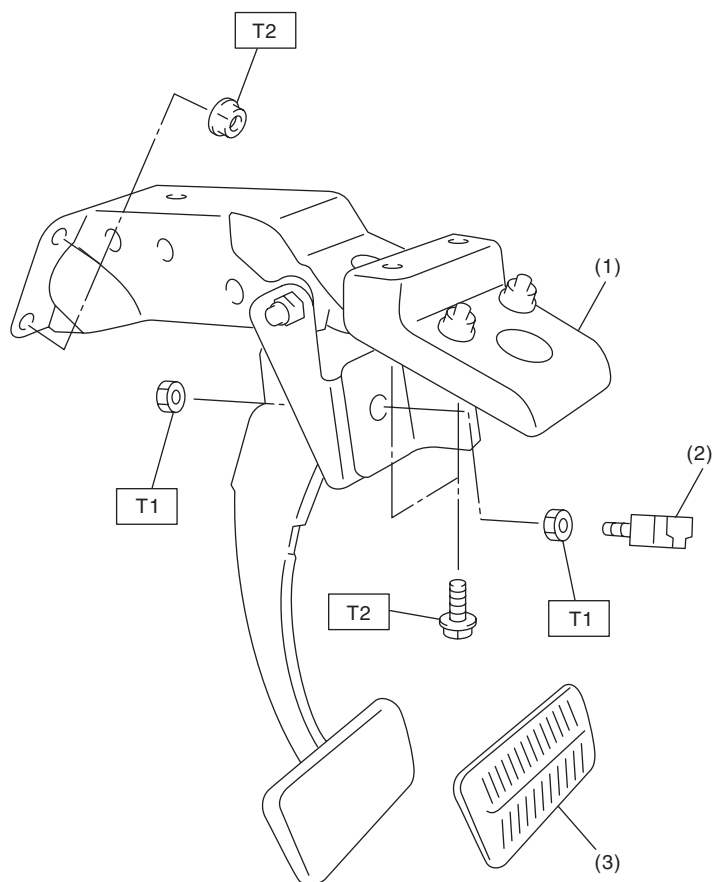
T3: 33 (3.4, 24.3)

6. BRAKE BOOSTER



- (1) Brake booster

7. BRAKE PEDAL



BR-00338

- (1) Brake pedal ASSY
- (2) Stop light switch
- (3) Brake pedal pad

Tightening torque: N·m (kgf-m, ft-lb)

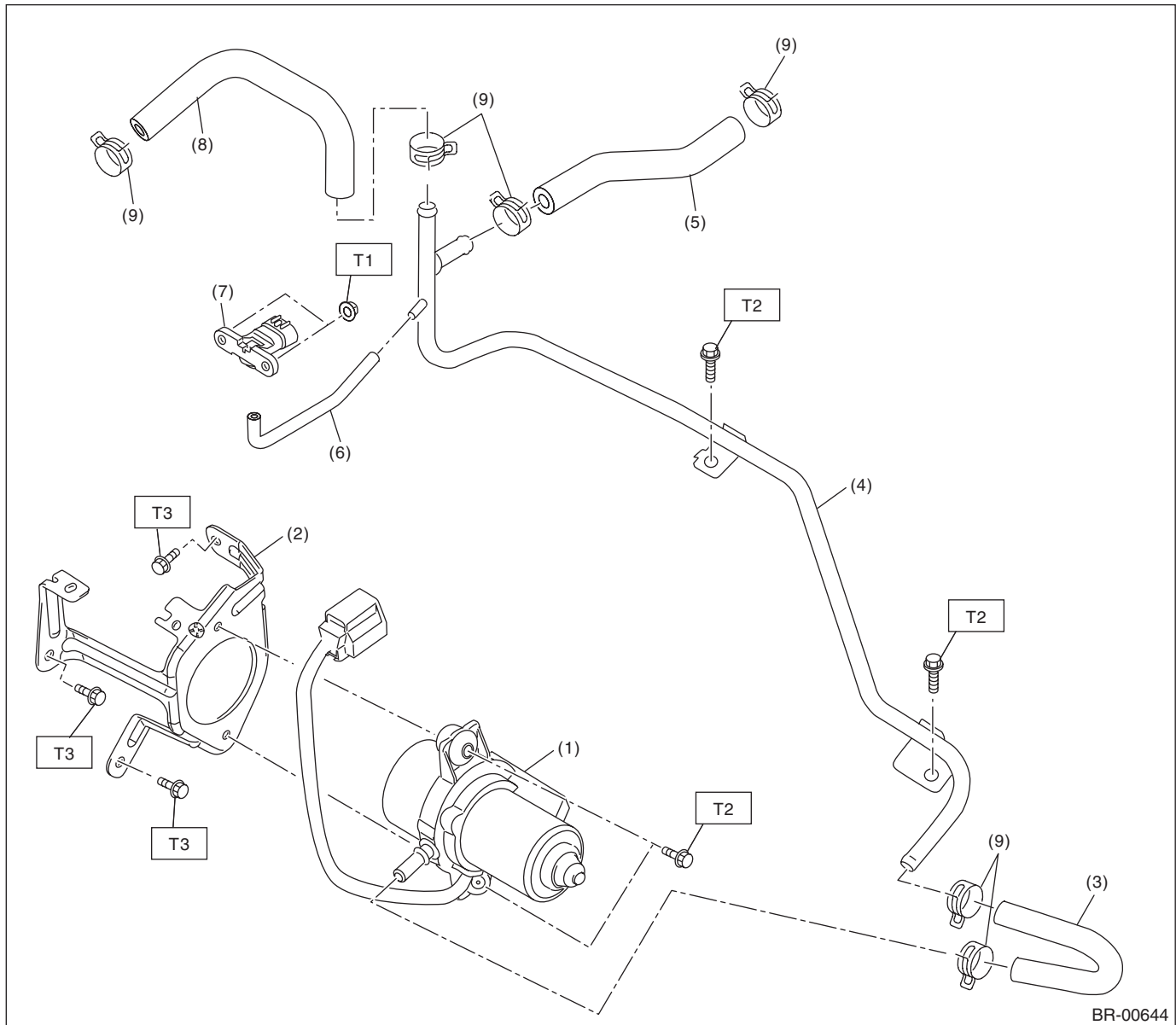
T1: 8 (0.8, 5.8)

T2: 18 (1.8, 13.3)

General Description

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8. BRAKE VACUUM PUMP



BR-00644

- | | |
|-------------------------------|---------------------------------|
| (1) Vacuum pump | (6) Vacuum hose (vacuum sensor) |
| (2) Vacuum pump bracket | (7) Vacuum sensor |
| (3) Vacuum hose (vacuum pump) | (8) Vacuum hose (brake booster) |
| (4) Vacuum pipe | (9) Hose clamp |
| (5) Vacuum hose (engine) | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.7)

T2: 7.5 (0.76, 5.5)

T3: 25 (2.5, 18.4)

C: CAUTION

Please understand and adhere to the following general precautions. They must be strictly followed to avoid any injury to the person performing the work or persons in the area.

1. OPERATION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

2. OIL

When handling oil, follow the rules below to prevent unexpected accidents.

- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

3. BRAKE FLUID

If brake fluid gets in your eyes or on your skin, do the following:

- Wash out your eyes and seek immediate medical attention.
- Wash your skin with soap and then rinse thoroughly with water.

Follow all government and local regulations concerning waste disposal.

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

TOOL NAME	REMARKS
Snap ring pliers	Used for removing and installing snap rings.

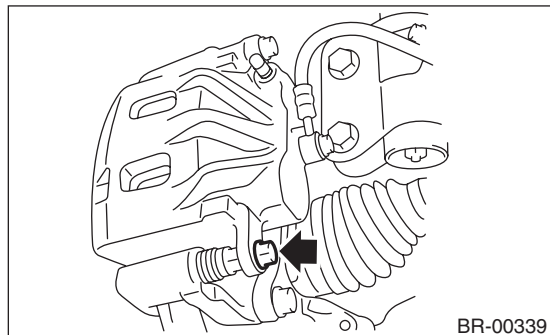
Front Brake Pad

BRAKE

2. Front Brake Pad

A: REMOVAL

- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the caliper bolt.

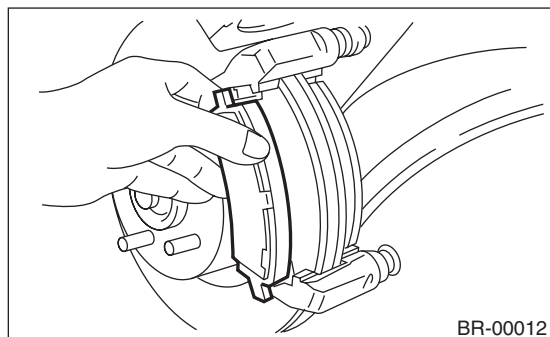


- 3) Raise the caliper body and support it.

NOTE:

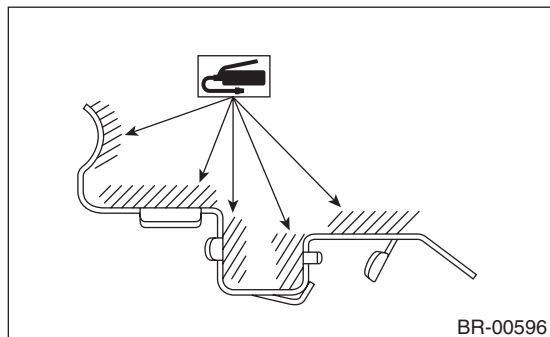
Do not disconnect the brake hose from the caliper body.

- 4) Remove the pad.

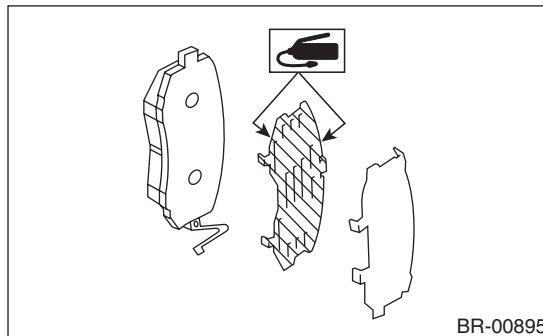


B: INSTALLATION

- 1) Apply a thin coat of grease contained in the pad kit or equivalent to the pad clip.



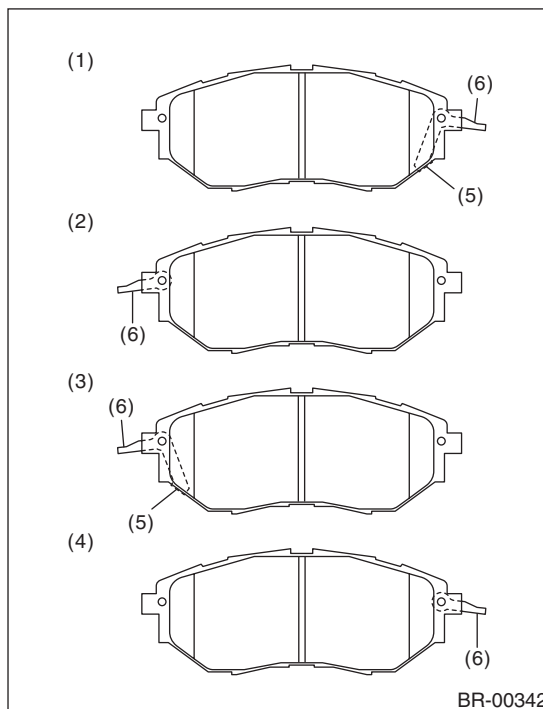
- 2) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) or grease contained in the pad kit to both surfaces of the pad and inner shim.



- 3) Install the pad to support.

NOTE:

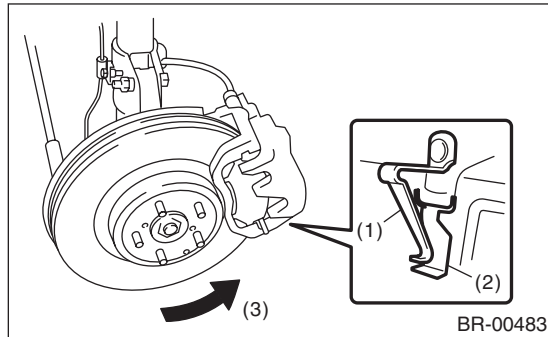
Install the pad indicator in proper direction.



- (1) LH — IN
- (2) LH — OUT
- (3) RH — IN
- (4) RH — OUT
- (5) Pad indicator
- (6) Pad return spring

CAUTION:

- Be sure to install so that the pad return spring faces the input side of the direction of brake rotor rotation, as shown in the figure.
- Correctly install the pad return spring to the supporting surface of the pad clip as shown in the figure.
- If the pad return spring is deformed or damaged, replace the brake pad.



- (1) Pad return spring
- (2) Supporting surface of pad clip
- (3) Direction of brake rotor rotation

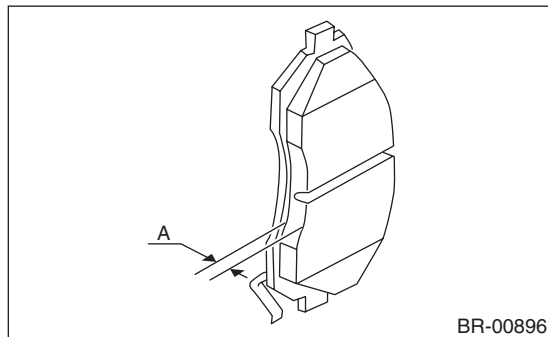
4) Install the caliper body to the support.

Tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

C: INSPECTION

Check the pad thickness A.



Pad thickness mm (in)	Standard	11 (0.433)
	Wear limit	1.5 (0.059)

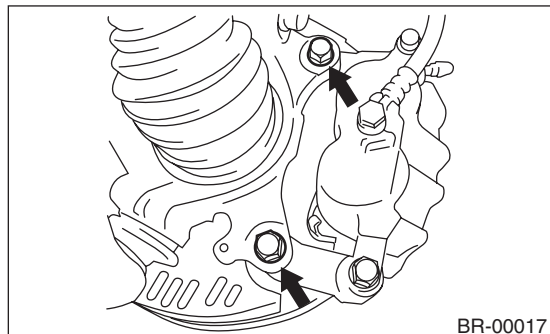
NOTE:

- Always replace the pads of both wheels and both sides as a set.
- Replace pad clips if they are twisted or worn.
- A wear indicator is installed on the inner disc brake pad. If the pad is worn to the limit, the end of wear indicator contacts disc rotor, and a squeaking sound is heard as the wheel rotates. If the sound is heard, replace the pad.
- Replace the pad if there is oil or grease on it.

3. Front Disc Rotor

A: REMOVAL

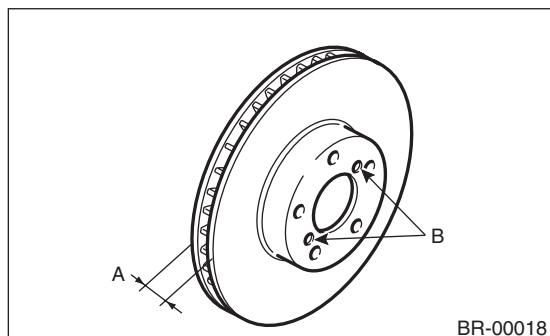
- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the caliper body and the support from housing, and suspend it from the strut using a wire.



- 3) Remove the disc rotor.

NOTE:

If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threaded section (B) of the rotor, then remove the rotor.



- 4) Remove mud and foreign matter from the caliper body assembly and the support.

B: INSTALLATION

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

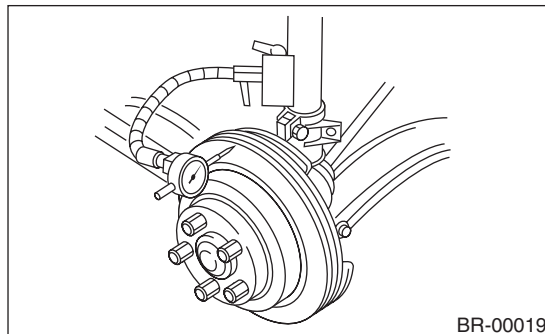
Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

- 3) Install the front wheels.

C: INSPECTION

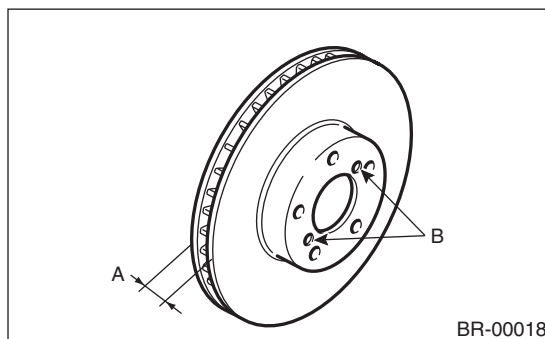
- 1) Check the front wheel bearing play and axle hub runout before the inspection of disc rotor runout limit. <Ref. to DS-16, INSPECTION, Front Axle.>
- 2) Secure the disc rotor by tightening the five wheel nuts.
- 3) Set a dial gauge 10 mm (0.39 in) inward from the disc rotor outer circumference. Rotate the disc rotor to check runout. If the disc rotor runout exceeds the limit, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 4).



Disc rotor runout limit:

0.05 mm (0.0020 in)

- 4) Set a micrometer 10 mm (0.39 in) inward from the disc rotor outer perimeter, and then measure the disc rotor thickness. If the thickness of disc rotor exceeds the service limit, replace with a new disc rotor.



	Standard	Limit	Disc rotor outer diameter
Disc rotor thickness A mm (in)	30 (1.18)	28 (1.10)	316 (12.44)

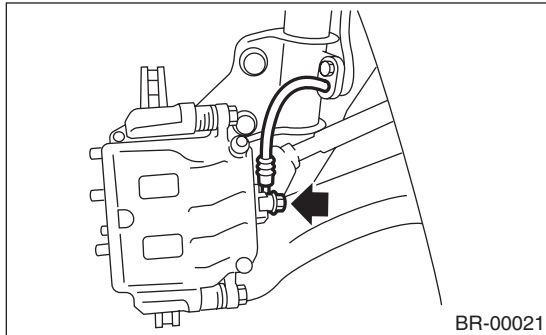
4. Front Disc Brake Assembly

A: REMOVAL

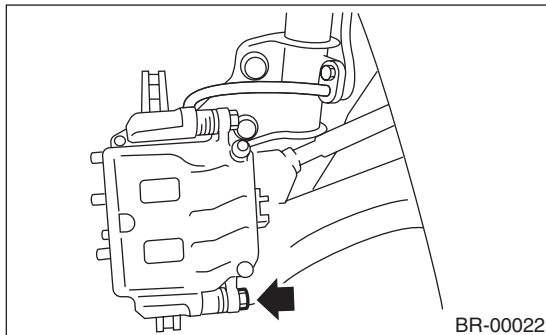
CAUTION:

Do not allow brake fluid to come in contact with vehicle body. If it does, wash off with water and wipe away completely.

- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the union bolt, and disconnect the brake hose from the caliper body assembly.



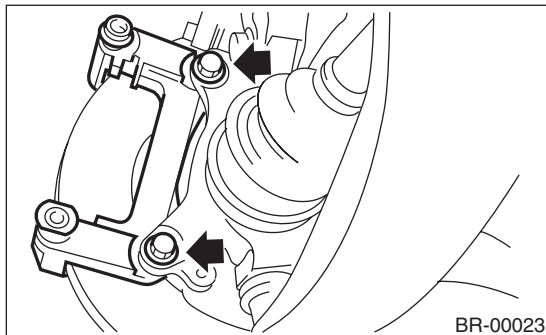
- 3) Remove the bolt securing the lock pin to caliper body.



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

NOTE:

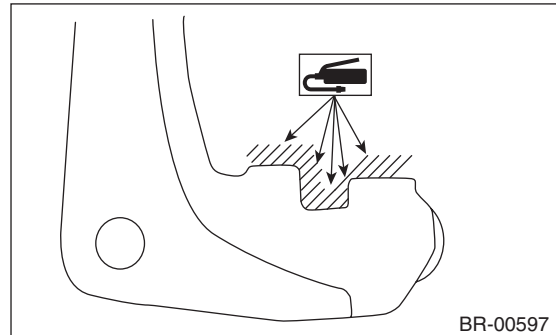
Remove the support only when replacing the rotor or support. It is not necessary to remove it when servicing the caliper body assembly.



- 6) Remove mud and foreign matter from the caliper body assembly and the support.

B: INSTALLATION

- 1) Apply a thin coat of grease contained in the pad kit or equivalent to the support.

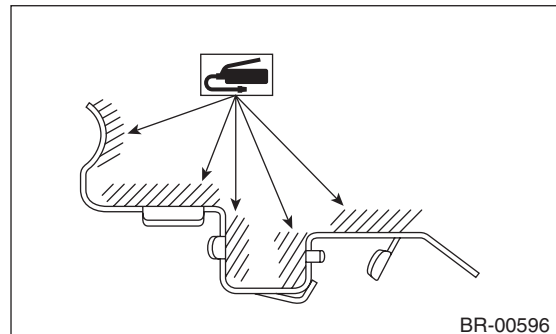


- 2) Install the support to the housing.

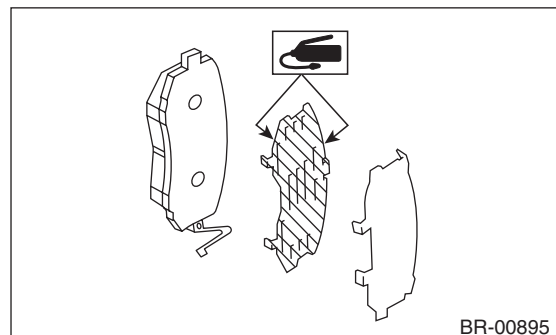
Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

- 3) Apply a thin coat of grease contained in the pad kit or equivalent to the pad clip.



- 4) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) or grease contained in the pad kit to both surfaces of the inner shim.



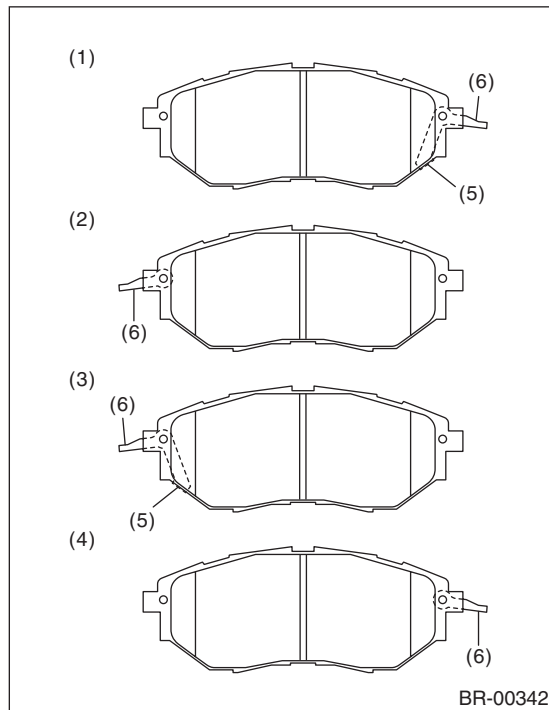
Front Disc Brake Assembly

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5) Install the pad to support.

NOTE:

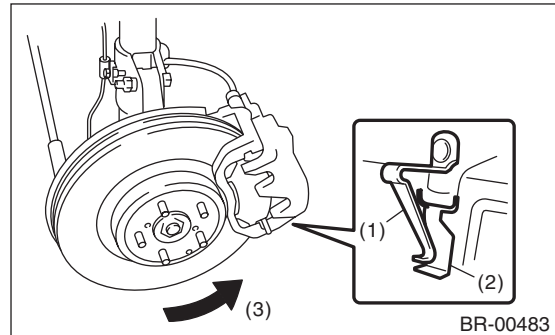
Install the pad indicator in proper direction.



- (1) LH — IN
- (2) LH — OUT
- (3) RH — IN
- (4) RH — OUT
- (5) Pad indicator
- (6) Pad return spring

CAUTION:

- Be sure to install so that the pad return spring faces the input side of the direction of brake rotor rotation, as shown in the figure.
- Correctly install the pad return spring to the supporting surface of the pad clip as shown in the figure.
- If the pad return spring is deformed or damaged, replace the brake pad.



- (1) Pad return spring
- (2) Supporting surface of pad clip
- (3) Direction of brake rotor rotation

6) Install the caliper body to the support.

Tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

7) Connect the brake hose using a new brake hose gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)

8) Bleed air from the brake system.

C: DISASSEMBLY

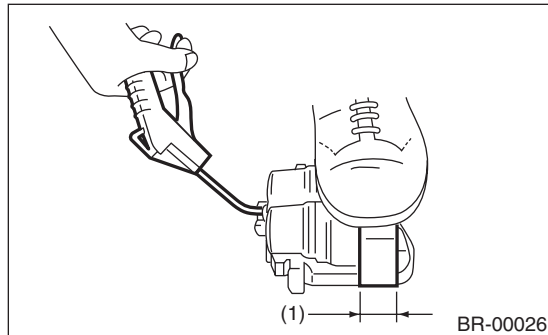
1) Remove mud and foreign matter from the caliper body assembly and the support.

CAUTION:

Be careful not to allow foreign matter to enter the brake hose connector.

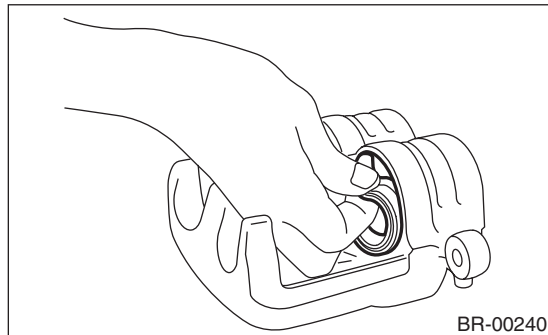
2) Place a wooden block in the caliper body as shown in the figure to prevent the piston from jumping out and being damaged.

3) Gradually apply compressed air via the brake hose installation hole to push the piston out.



(1) Place a wood block of 30 mm (1.18 in) width.

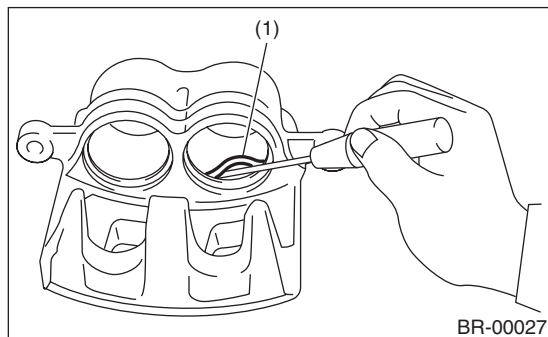
4) Remove the piston boot.



5) Remove the piston seal from caliper body cylinder.

CAUTION:

Do not damage the cylinder and piston seal groove.



(1) Piston seal

6) Remove the guide pin and boot from caliper body.

D: ASSEMBLY

1) Clean the inside of the caliper body using brake fluid.

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

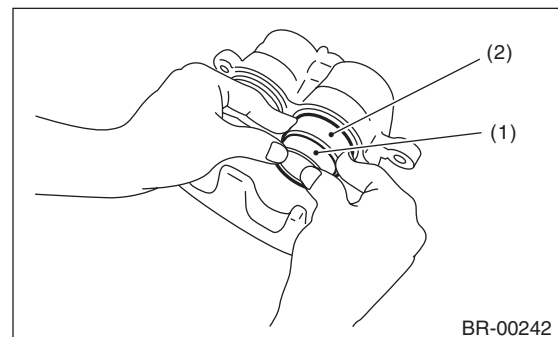
3) Apply a coat of brake fluid to the inner surface of cylinder and the entire outer surface of the piston.

4) Apply grease contained in the piston seal kit to the boot, and install it to the groove at the ends of the cylinder.

5) Insert the piston into cylinder.

CAUTION:

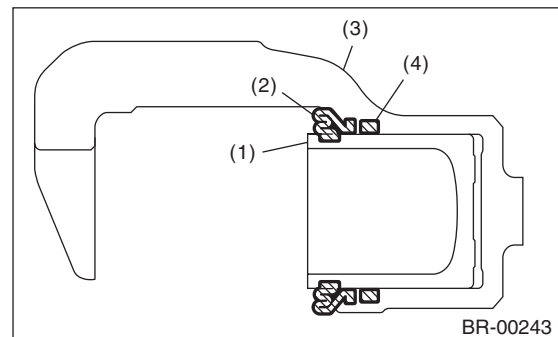
Do not force the piston into cylinder.



(1) Piston

(2) Piston boot

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



(1) Piston

(2) Piston boot

(3) Caliper body

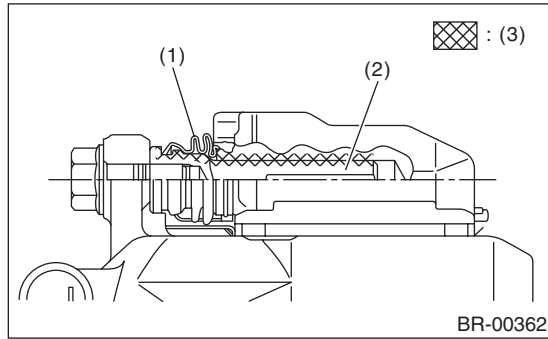
(4) Piston seal

7) Apply grease contained in the piston seal kit to the lock pin and guide pin outer surface, cylinder inner surface, and boot grooves.

Front Disc Brake Assembly

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8) Insert the lock pin and guide pin boot into the support.



- (1) Pin boot
- (2) Lock pin or guide pin
- (3) Grease applied area

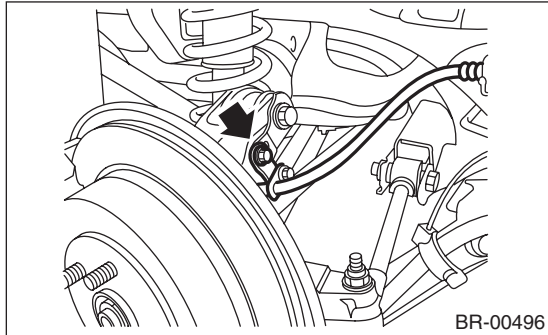
E: INSPECTION

- 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.

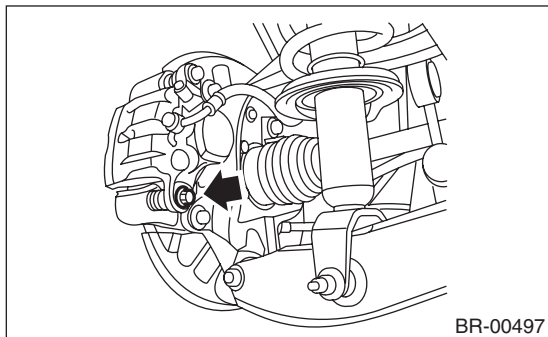
5. Rear Brake Pad

A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the brake hose bracket.



- 3) Remove the caliper bolt.

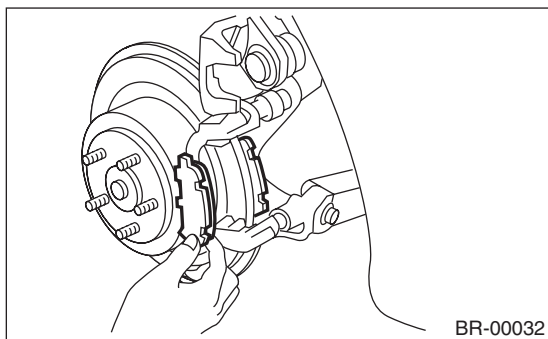


- 4) Raise the caliper body and support it.

NOTE:

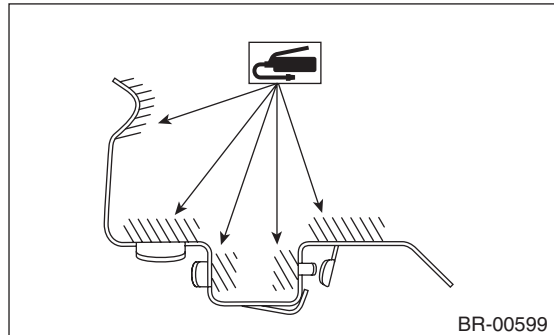
Do not disconnect the brake hose from the caliper body.

- 5) Remove the pad.

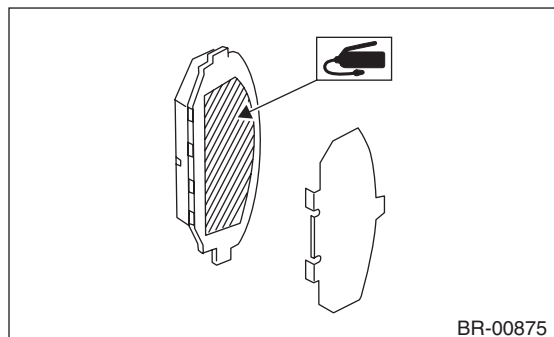


B: INSTALLATION

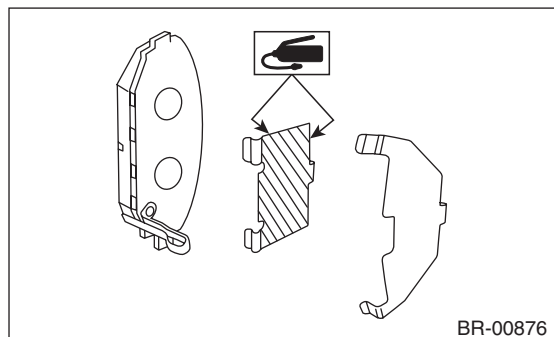
- 1) Apply a thin coat of grease contained in the pad kit or equivalent to the pad clip.



- 2) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) or the grease contained in the pad kit to the contact surface between the outer-side pad and shim.



- 3) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) or grease contained in the pad kit to both surfaces of the inner pad inner shim.



- 4) Install the pad to support.
- 5) Install the caliper body to the support.

Tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

- 6) Install the brake hose bracket.

Tightening torque:

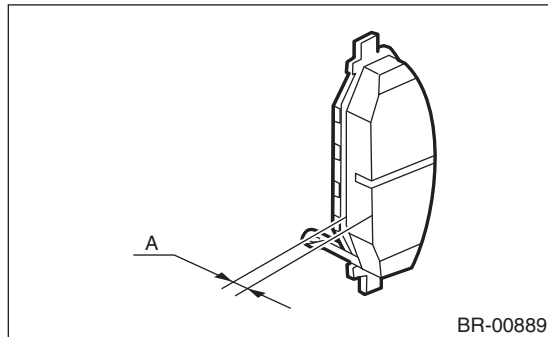
33 N·m (3.4 kgf-m, 24.3 ft-lb)

Rear Brake Pad

BRAKE

C: INSPECTION

Check the pad thickness A.



Pad thickness mm (in)	Standard	11.0 (0.433)
	Wear limit	1.5 (0.059)

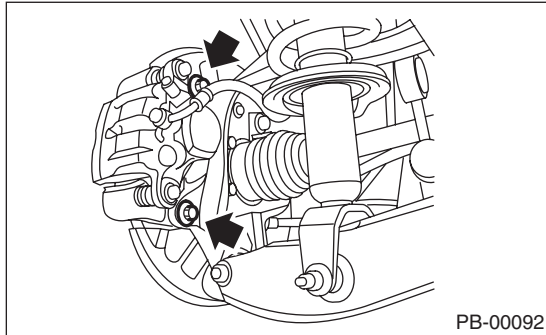
NOTE:

- Always replace the pads of both wheels and both sides as a set.
- Replace pad clips if they are twisted or worn.
- A wear indicator is installed on the inner disc brake pad. If the pad is worn to the limit, the end of wear indicator contacts disc rotor, and a squeaking sound is heard as the wheel rotates. If the sound is heard, replace the pad.
- Replace the pad if there is oil or grease on it.

6. Rear Disc Rotor

A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Release the parking brake.
- 3) Remove the two mounting bolts, and remove the rear disc brake assembly.

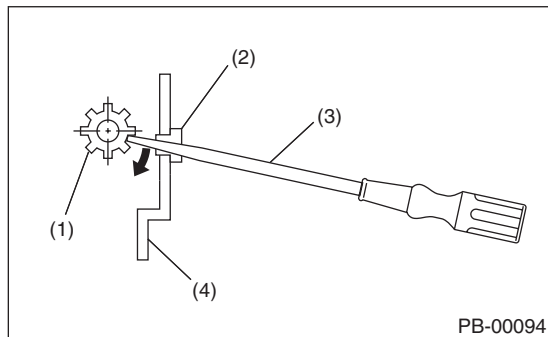


- 4) Suspend the rear disc brake assembly so that the hose is not stretched.
- 5) Remove the rear disc brake rotor.

NOTE:

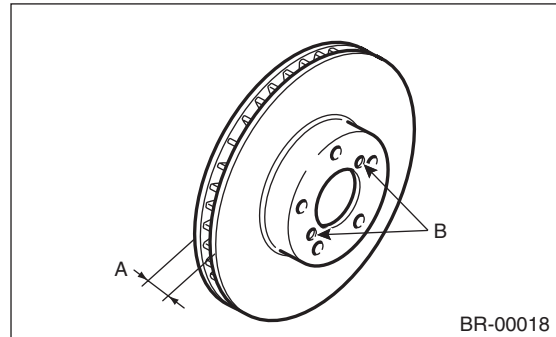
If the disc rotor is difficult to remove, try the following two methods in order.

- (1) Turn the adjusting screw using a flat tip screwdriver until the brake shoe moves adequately away from the disc rotor.



- (1) Adjusting screw
- (2) Cover
- (3) Flat tip screwdriver
- (4) Disc rotor

- (2) If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threads B of the rotor, then remove the rotor.



B: INSTALLATION

- 1) Install in the reverse order of removal.

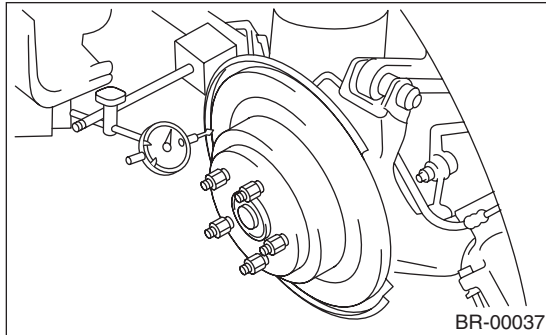
Tightening torque:

66 N·m (6.7 kgf-m, 48.7 ft-lb)

- 2) Adjust the parking brake. <Ref. to PB-9, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

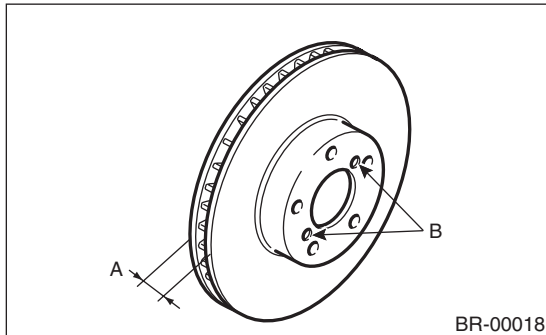
C: INSPECTION

- 1) Check the rear wheel bearing play and axle hub runout before inspecting the disc rotor runout limit.
<Ref. to DS-24, INSPECTION, Rear Hub Unit Bearing.>
- 2) Secure the disc rotor by tightening the five wheel nuts.
- 3) Set a dial gauge 10 mm (0.39 in) inward from the disc rotor outer circumference. Rotate the disc rotor to check runout. If the disc rotor runout exceeds the limit, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 4).



Disc rotor runout limit: **0.05 mm (0.0020 in)**

- 4) Set a micrometer 10 mm (0.39 in) inward from the disc rotor outer perimeter, and then measure the disc rotor thickness. If the thickness of disc rotor exceeds the service limit, replace with a new disc rotor.



	Specifi- cation	Service limit	Disc rotor outer diameter
Disc rotor thickness A mm (in)	18 (0.71)	16 (0.63)	320 (12.59)

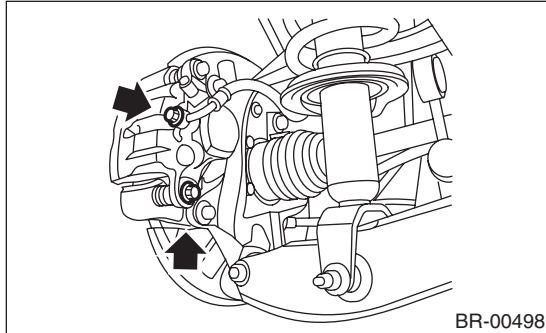
7. Rear Disc Brake Assembly

A: REMOVAL

CAUTION:

Do not allow brake fluid to come in contact with vehicle body. If it does, wash off with water and wipe away completely.

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Disconnect the brake hose from caliper body assembly.
- 3) Remove the caliper lower bolt.



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

NOTE:

Remove the support only when replacing the rotor or support. It is not necessary to remove it when servicing the caliper body assembly.

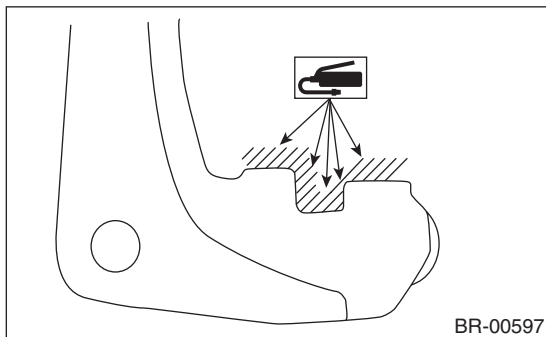
- 6) Remove mud and foreign matter from the caliper body assembly and the support.

CAUTION:

Be careful not to allow foreign matter to enter the brake hose connector.

B: INSTALLATION

- 1) Apply a thin coat of grease contained in the pad kit or equivalent to the support.

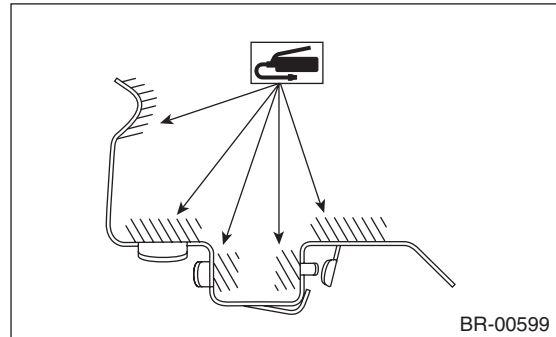


- 2) Install the support to the housing.

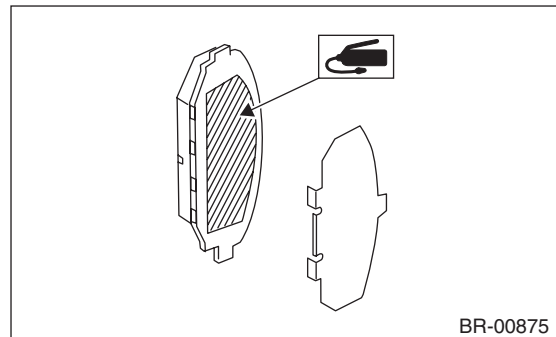
Tightening torque:

66 N·m (6.7 kgf-m, 48.7 ft-lb)

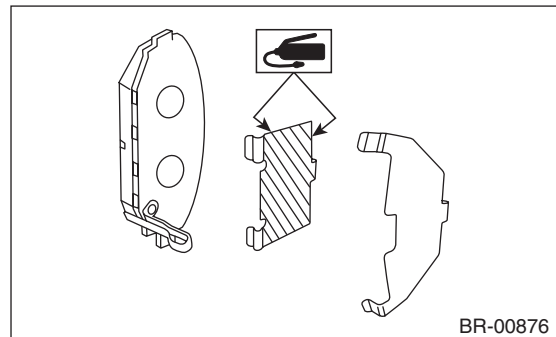
- 3) Apply a thin coat of grease contained in the pad kit or equivalent to the pad clip.



- 4) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) or the grease contained in the pad kit to the contact surface between the outer-side pad and shim.



- 5) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) or grease contained in the pad kit to both surfaces of the inner pad inner shim.



- 6) Install the pad to support.
- 7) Install the caliper body to the support.

Tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

- 8) Connect the brake hose using a new brake hose gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)

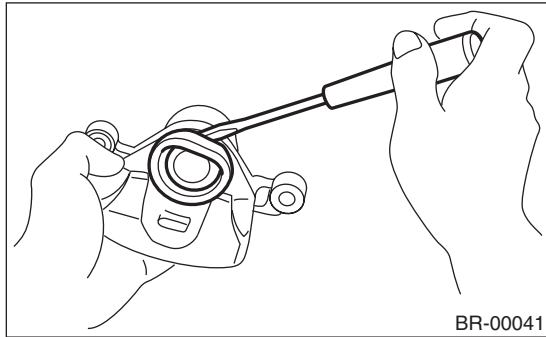
- 9) Bleed air from the brake system.

Rear Disc Brake Assembly

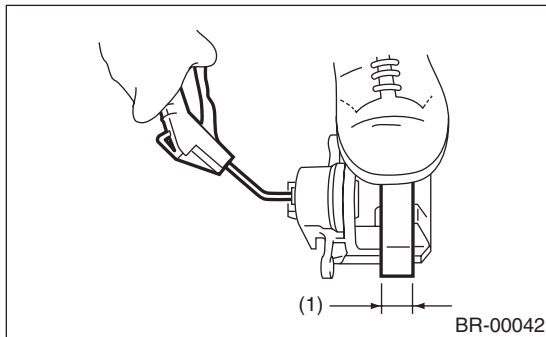
BRAKE

C: DISASSEMBLY

- 1) Remove the piston boot.



- 2) Place a wooden block in the caliper body as shown in the figure to prevent the piston from jumping out and being damaged.
- 3) Gradually apply compressed air via the brake hose installation hole to push the piston out.

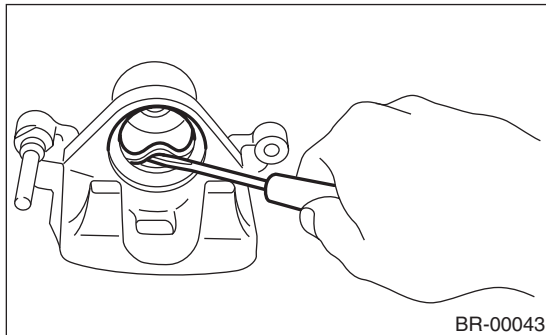


- (1) Place a wood block of 18 mm (0.71 in) width.

- 4) Remove the piston seal from caliper body cylinder.

CAUTION:

Do not damage the cylinder and piston seal groove.



- 5) Remove the lock pin sleeve and boot from caliper body.
- 6) Remove the guide pin boot.

D: ASSEMBLY

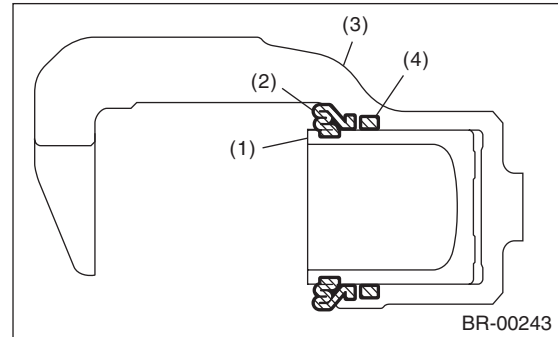
- 1) Clean the inside of the caliper body using brake fluid.
- 2) Apply a coat of brake fluid to piston seal and install the piston seal to the caliper body groove.

- 3) Apply a coat of brake fluid to the inner surface of cylinder and the entire outer surface of the piston.
- 4) Apply grease contained in the piston seal kit to the boot, and install it to the groove at the ends of the cylinder.
- 5) Insert the piston into cylinder.

CAUTION:

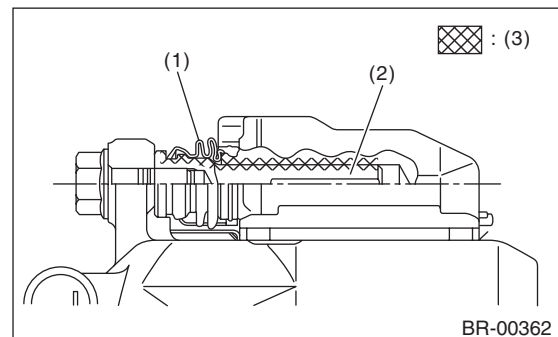
Do not force the piston into cylinder.

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



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

- 7) Apply grease contained in the piston seal kit to the guide pin, outer surface, sleeve outer surface, cylinder inner surface, and boot grooves.



- (1) Pin boot
- (2) Lock pin or guide pin
- (3) Grease applied area

- 8) Insert the guide pin boot to the support.
- 9) Insert the lock pin boot to support, and then insert the lock pin sleeve into the specified position.

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.

8. Master Cylinder

A: REMOVAL

CAUTION:

Do not allow brake fluid to come in contact with vehicle body. If it does, wash off with water and wipe away completely.

- 1) Drain brake fluid from the reservoir tank completely.
- 2) Disconnect the harness connector of the fluid level gauge.
- 3) Remove the brake pipe from the master cylinder.
- 4) Remove the master cylinder mounting nuts, and remove the master cylinder from the brake booster.

B: INSTALLATION

- 1) Install in the reverse order of removal.

Tightening torque:

Master cylinder mounting nut
25 N·m (2.5 kgf-m, 18.4 ft-lb)

Brake pipe
19 N·m (1.9 kgf-m, 14.0 ft-lb)

CAUTION:

Be sure to use recommended brake fluid.

- 2) Bleed air from brake system. <Ref. to BR-33, PROCEDURE, Air Bleeding.>

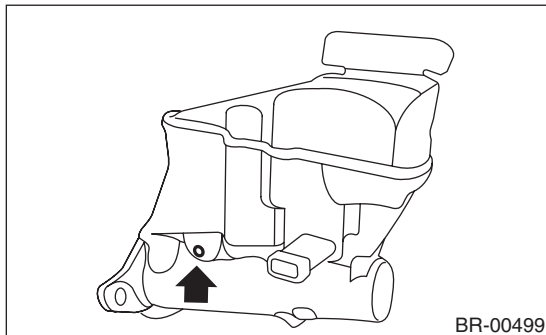
C: REPLACEMENT

- 1) Remove mud and dirt from the surface of brake master cylinder.
- 2) Secure the master cylinder in a vise.

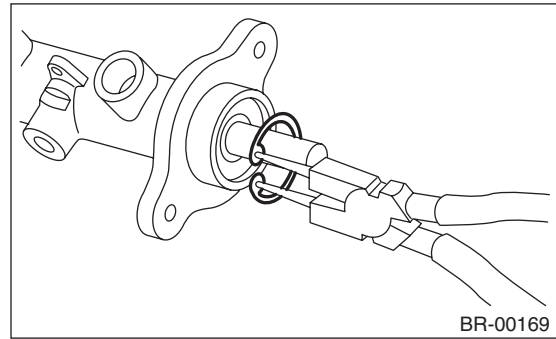
NOTE:

To avoid damaging the master cylinder, place between aluminum plates or other material when holding with a vise.

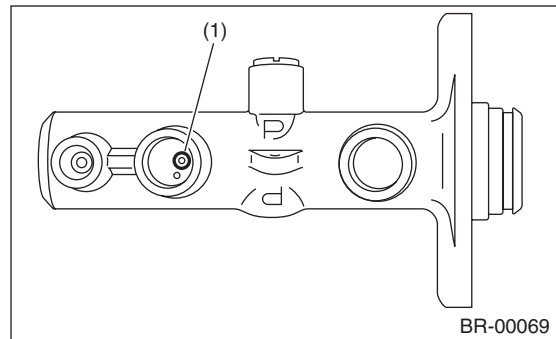
- 3) Remove the pin which secures the master cylinder and reservoir tank, then remove the reservoir tank and seal.



- 4) While pushing in the primary piston, remove the C-ring using pliers.



- 5) While pushing in the primary piston, remove the straight pin from the port on the reservoir tank attachment location using a magnet pick-up tool.



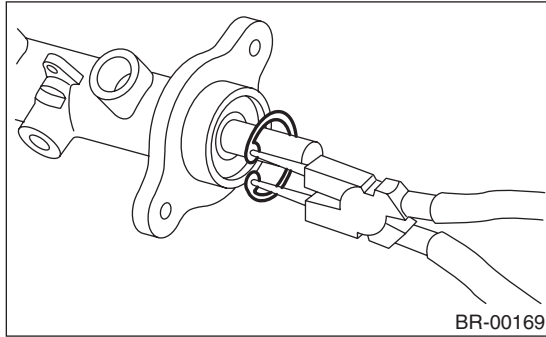
(1) Straight pin

- 6) Extract the primary piston assembly and secondary piston assembly straight out while taking care not to scratch the inner surface of the cylinder.
- 7) Clean the inside of master cylinder with brake fluid. Check the inside of the cylinder for damage, deformation and wear. Replace the master cylinder as assembly if faulty.
- 8) Apply brake fluid to the inner surface of master cylinder and piston assembly.
- 9) Make sure that the inner surface of master cylinder and the piston assembly are free of foreign matter. Install the primary piston assembly and the secondary piston assembly to master cylinder, while taking care not to scratch the master cylinder inner surface.
- 10) While pushing-in the primary piston, install the cylinder pin.

Master Cylinder

BRAKE

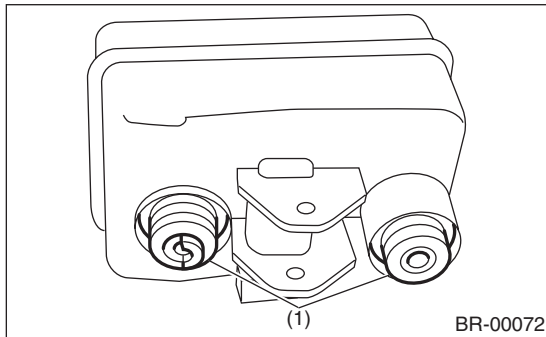
- 11) While pushing-in the primary piston, install the C-ring to the groove using pliers.



CAUTION:

Make sure the C-ring is installed to the groove securely.

- 12) Install the seal to reservoir tank.



(1) Seal

- 13) Install the reservoir tank to the master cylinder, and secure with pin.

D: INSPECTION

Inspect for oil leakage from the master cylinder.

NOTE:

After replacing the piston kit, if an oil leakage is found even though there is no damage or scratches on the inside of the cylinder, the master cylinder inner wall may be worn. In this case, replace the master cylinder as an assembly.

9. Brake Booster

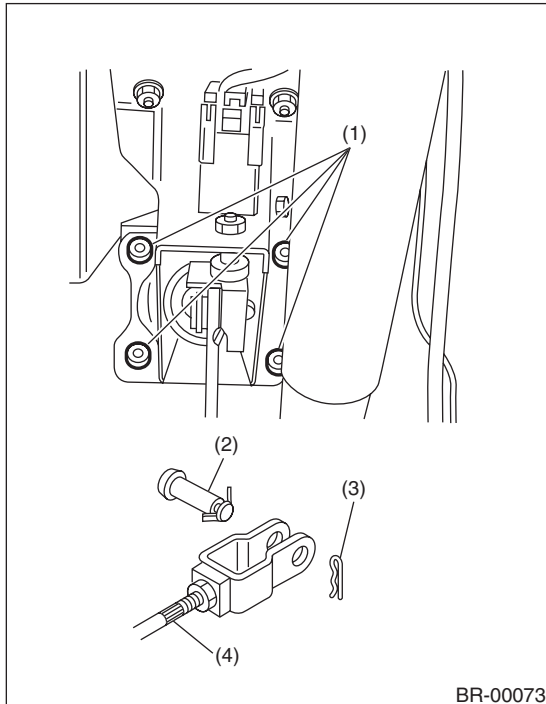
A: REMOVAL

1) Remove or disconnect the following parts in the engine compartment.

- (1) Remove the brake master cylinder.
- (2) Disconnect the vacuum hose from brake booster.

2) Remove the following parts from the pedal bracket.

- (1) Snap pin and clevis pin
- (2) Four brake booster installation nuts



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

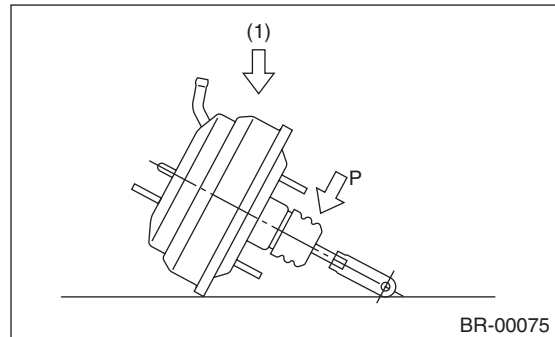
3) Remove the brake booster while avoiding the brake pipe.

NOTE:

- Make sure that the booster shell and vacuum pipe are not subject to strong impacts.
- Be careful not to drop the brake booster. If the booster is dropped, replace it.
- Use special care when handling the operating rod. If excessive force is applied to the operating rod, the angle may change by $\pm 3^\circ$, and it may result in damage to power piston cylinder.
- Be careful when placing the brake booster on floor.
- Do not change the push rod length.

CAUTION:

- **Do not disassemble the brake booster.**
- **If external force is applied from above when brake booster is placed in this position, the resin portion as indicated by "P" may become damaged.**



(1) Force

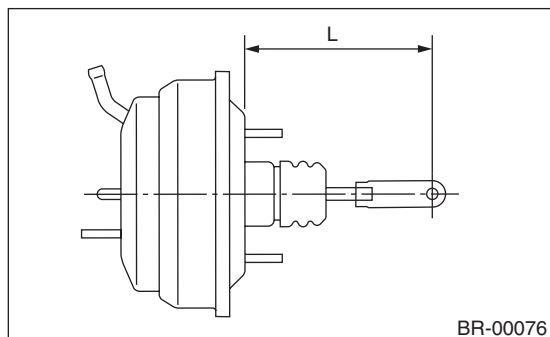
B: INSTALLATION

1) Check and adjust the operating rod of the brake booster.

Specification L:

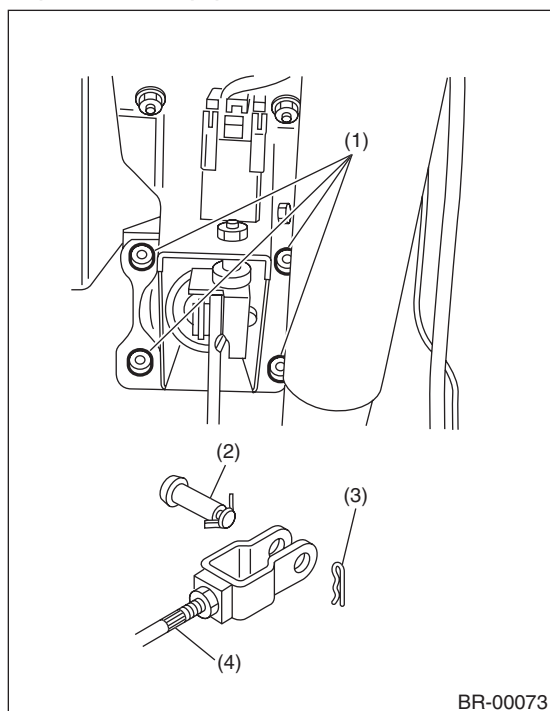
137.6 mm (5.42 in)

If it is out of specification, adjust it with the brake booster operating rod.



2) Mount the brake booster in position.

3) Connect the operating rod to brake pedal with clevis pin and snap pin.



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

NOTE:

- Replace with a new clevis pin.
- Apply NIGTIGHT LYW NO. 2 grease to the clevis pin.
- 4) Connect the vacuum hose to the brake booster.
- 5) Mount the master cylinder onto the brake booster.

6) Connect the brake pipes to the master cylinder.
7) Connect the connector of the brake fluid level gauge.

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

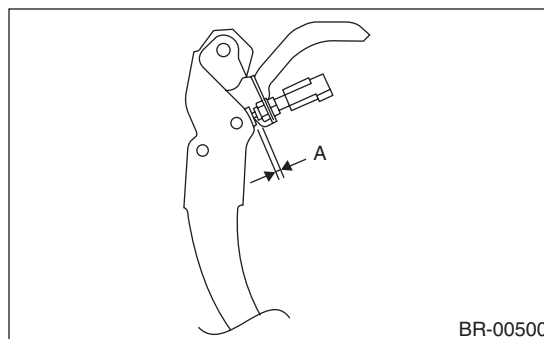
If it is not within the specification, adjust it by adjusting the position of the stop light switch. <Ref. to BR-40, ADJUSTMENT, Stop Light Switch.>

CAUTION:

Be careful not to rotate the stop light switch.

Stop light switch clearance A:

0.8 mm (0.031 in)



9) Apply grease to the operating rod connecting pin to prevent it from wear.

10) Bleed air from brake system.

Tightening torque (air bleeder screw):

8 N·m (0.8 kgf-m, 5.8 ft-lb)

11) Perform a road test to make sure the brakes do not drag.

C: INSPECTION

1. OPERATION CHECK (WITHOUT GAUGE)

CAUTION:

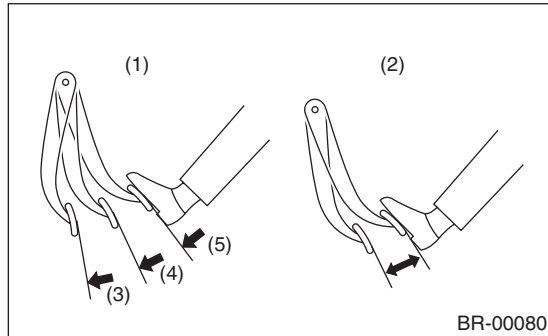
When checking operation, be sure to apply the parking brake securely.

Check without gauge

This method can not determine exactly what part is defective. But it is possible to identify the general type of defect if the following inspection is performed.

Air tightness check

Start the engine, and idle it for 1 to 2 minutes, then turn it OFF. Depress the brake pedal several times applying the normal pedal force. The pedal stroke should be the longest at the 1st depression, and it should become shorter at each successive depression. If no change occurs in the pedal height when pressed, the brake booster is faulty.



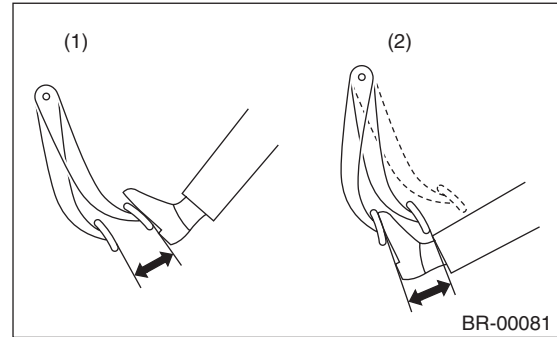
- (1) Normal
- (2) Not OK
- (3) 1st
- (4) 2nd
- (5) 3rd

NOTE:

- In case of defective operation, inspect the condition of the check valve and vacuum hose as well.
- Replace them if faulty, and perform the test again.
- If the defective condition is not improved, check accurately using a gauge.

Operation check

1) While the engine is OFF, depress the brake pedal several times applying the same pedal force, to check for a change in pedal height.



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

2) With the brake pedal depressed, start the engine.

3) As the engine starts, the brake pedal should move slowly toward the floor. If the pedal height does not change, the brake booster is faulty.

NOTE:

If faulty, perform an accurate check with a gauge.

Loaded air tightness check

Depress the brake pedal while the engine is running, and turn the engine OFF while the pedal is depressed. Keep the pedal depressed for 30 seconds. If the pedal height does not change, the function of brake booster is normal. If the pedal height increases, it is faulty.

NOTE:

If faulty, perform an accurate check with a gauge.

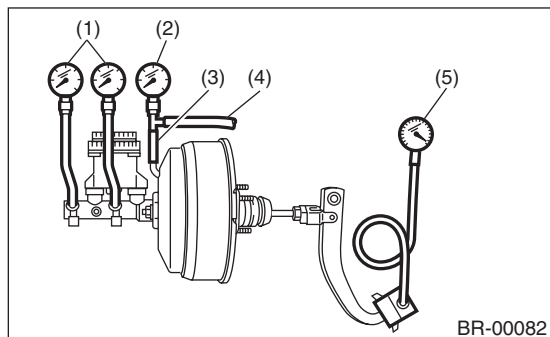
2. OPERATION CHECK (WITH GAUGE)

CAUTION:

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

Check with gauge

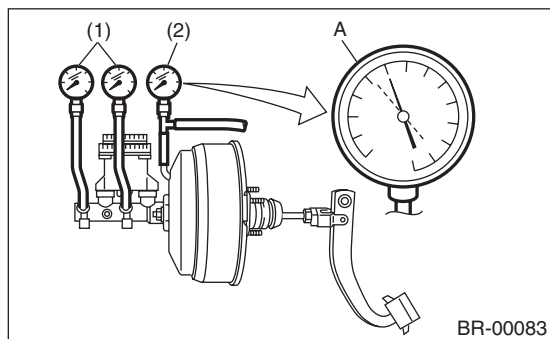
Connect the gauge as shown in the figure. After bleeding air from the pressure gauge, perform the checks.



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

Air tightness check

1) Start the engine and keep it running until vacuum pressure indicates point A of the vacuum gauge = 66.7 kPa (500 mmHg, 19.69 inHg). Do not depress the brake pedal at this time.



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

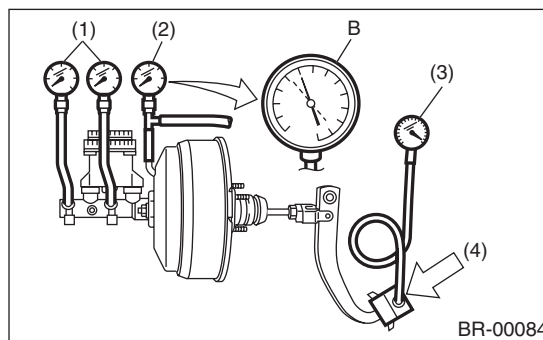
2) Stop the engine and check the gauge. If the vacuum pressure drop within 15 seconds after stopping the engine is 3.3 kPa (25 mmHg, 0.98 inHg) or less, the function of brake booster is normal.

If faulty, the cause may be one of the following.

- Check valve malfunction
- Leak from vacuum hose
- Leak from shell joint section or stud bolt welded section
- Damaged diaphragm
- Leak from valve body seal and bearing section
- Leak from plate and seal assembly section
- Leak from poppet valve assembly section

Loaded air tightness check

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



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

2) Stop the engine and check the vacuum gauge. If the vacuum pressure drop within 15 seconds after stopping the engine is 3.3 kPa (25 mmHg, 0.98 inHg) or less, the function of brake booster is normal.

If defective, refer to "Air tightness check".

<Ref. to BR-29, INSPECTION, Brake Booster.>

3) If the brake booster is faulty, replace it with a new part.

Lack of boost action check

Turn the engine OFF, and set the value of the vacuum gauge to "0". Then, check the fluid pressure when the brake pedal is depressed. The pressure must be greater than the specification listed.

Brake pedal operation force N (kgf, lb)	147 (15, 33)	294 (30, 66)
Fluid pressure kPa (kg/cm ² , psi)	590 (6, 86)	1,654 (17, 240)

Boosting action check

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

Brake pedal operation force N (kgf, lb)	147 (15, 33)	294 (30, 66)
Fluid pressure kPa (kg/cm ² , psi)	8,539 (87, 1,238)	15,373 (157, 2,229)

10.Brake Fluid

A: INSPECTION

1) Check that the brake fluid level is between “MIN” and “MAX”. If out of the specified range, refill or drain fluid. If the fluid level is close to “MIN”, check the brake pad for wear and refill the fluid.

2) Check the fluid for discoloration. If the fluid color has changed excessively, drain the fluid and refill with new fluid.

B: REPLACEMENT

CAUTION:

- Do not let brake fluid come into contact with the painted surface of the vehicle body. Wash away with water immediately and wipe off if it is spilled by accident.
- Avoid mixing brake fluid of different brands to prevent fluid performance from degrading.
- Be careful not to allow dirt or dust to enter the reservoir tank.

NOTE:

- During the operation, keep the reservoir tank filled with brake fluid to prevent entry of air.
- Operate the brake pedal slowly.
- For convenience and safety, perform the work with 2 people.
- The required amount of brake fluid is approximately 600 mL (20 US fl oz, 21 Imp fl oz) for the entire brake system.

1) Lift up the vehicle and set rigid racks at the specified locations, or keep the vehicle lifted.

2) Remove both the front and rear wheels.

3) Drain brake fluid from the reservoir tank.

4) Refill the reservoir tank with recommended brake fluid.

Recommended brake fluid:

Refer to “General Description”. <Ref. to BR-2, SPECIFICATION, General Description.>

Perform the same procedure as for bleeding the brake line, until new brake fluid comes out from vinyl tube. <Ref. to BR-33, PROCEDURE, Air Bleeding.>

11. Air Bleeding

A: PROCEDURE

CAUTION:

- Do not let brake fluid come into contact with the painted surface of the vehicle body. Wash away with water immediately and wipe off if it is spilled by accident.
- Avoid mixing brake fluids of different brands to prevent fluid performance from degrading.
- Be careful not to allow dirt or dust to enter the reservoir tank.

1. MASTER CYLINDER

NOTE:

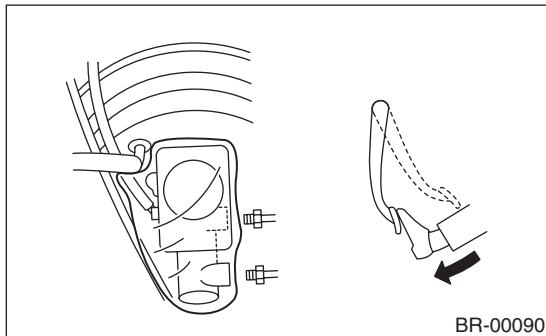
- When the master cylinder is disassembled or the reservoir tank is empty, bleed the master cylinder.
- If bleeding of the master cylinder is not necessary, omit the following procedures, and perform bleeding of the brake line. <Ref. to BR-33, BRAKE LINE, PROCEDURE, Air Bleeding.>

1) Fill the reservoir tank of the master cylinder with brake fluid.

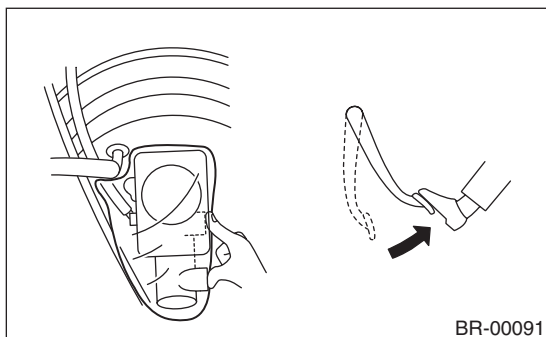
NOTE:

While bleeding air, keep the reservoir tank filled with brake fluid to prevent entry of air.

- 2) Disconnect the brake line at primary and secondary sides.
- 3) Wrap the master cylinder with a plastic bag.
- 4) Depress the brake pedal slowly and hold it.



5) Plug the outlet plug with your finger, and then release the brake pedal.



- 6) Repeat the step 4) and 5) several times.
- 7) Remove the plastic bag.

8) Install the brake pipe to the master cylinder.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

9) Bleed air from the brake line. <Ref. to BR-33, BRAKE LINE, PROCEDURE, Air Bleeding.>

2. BRAKE LINE

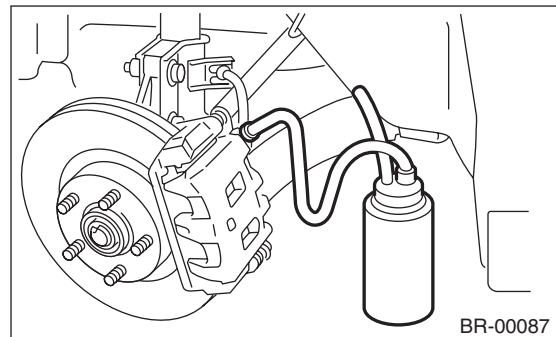
1) When the master cylinder is disassembled or the reservoir tank is empty, bleed the master cylinder before bleeding the brake line. <Ref. to BR-33, MASTER CYLINDER, PROCEDURE, Air Bleeding.>

2) Fill the reservoir tank of the master cylinder with brake fluid.

NOTE:

While bleeding air, keep the reservoir tank filled with brake fluid to prevent entry of air.

3) Attach one end of the vinyl tube to the air bleeder and the other end to the brake fluid container.



- 4) Depress the brake pedal several times, and hold it.
- 5) Loosen the air bleeder screw to drain brake fluid. Tighten the air bleeder quickly, and release the brake pedal.
- 6) Repeat the steps 4) to 5) until there are no more air bubbles in the vinyl tube.
- 7) Repeat the steps from 2) to 6) above to bleed air from each wheel.

NOTE:

Perform air bleed starting in the order from the farthest wheel cylinder from the master cylinder.

8) Securely tighten the air bleeder screws.

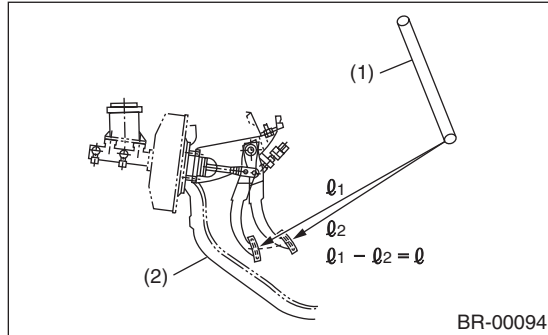
Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)

9) Check that there are no brake fluid leaks in the entire system.

10) Check the pedal stroke.

Run the engine at idle after warming up the engine, and depress the brake pedal with a force of 500 N (51 kgf, 112 lb). Measure the distance between the brake pedal and steering wheel. Release the pedal, and measure the distance between pedal and steering wheel again.



(1) Steering wheel

(2) Toe board

Specification of pedal stroke:

When depressing the pedal with a force of 500 N (51 kgf, 112 lbf).

115 mm (4.53 in) or less

11) If the distance is more than specification, there is a possibility of air being caught in the brake line. Bleed the brake line of all air until the pedal stroke meets the specification.

12) Operate the hydraulic control unit in the sequence control mode. <Ref. to VDC-14, VDC Sequence Control.>

13) Check the pedal stroke again.

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

15) Fill the reservoir tank with brake fluid up to the "MAX" level.

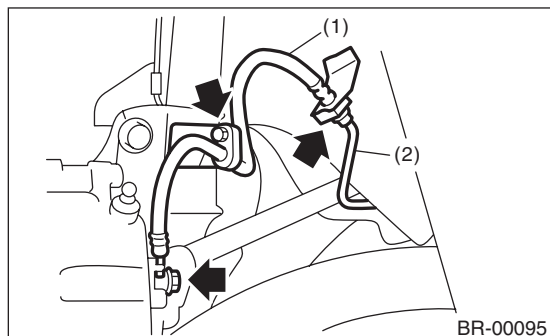
16) Test run the vehicle and ensure that the brakes operate normally.

12.Brake Hose

A: REMOVAL

1. FRONT BRAKE HOSE

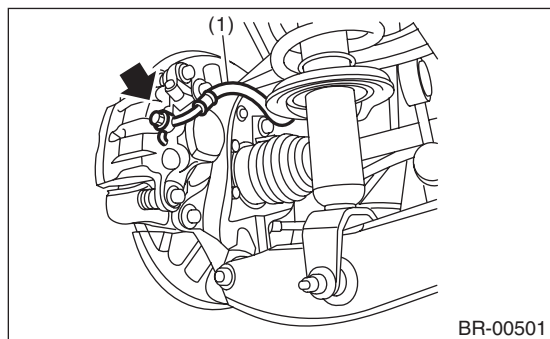
- 1) Separate the brake pipe from brake hose using a flare nut wrench.
- 2) Remove the clamp, the strut mount bolts and union bolt.



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

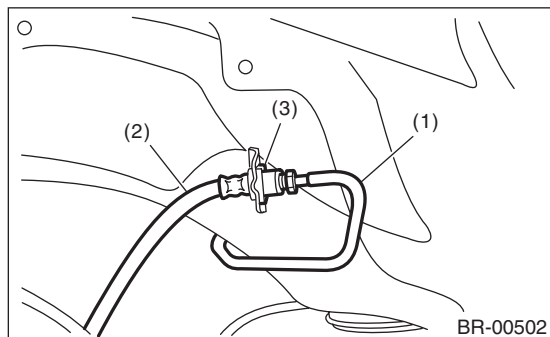
2. REAR BRAKE HOSE

- 1) Remove the union bolt from the rear brake caliper.



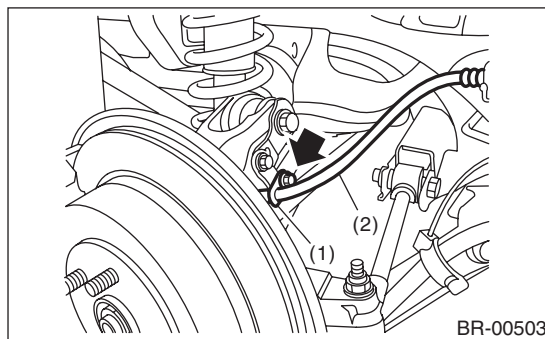
- (1) Brake hose

- 2) Separate the brake pipe from brake hose using a flare nut wrench.



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

- 3) Remove the brake hose bracket, then remove the brake hose.



- (1) Brake hose bracket
- (2) Brake hose

B: INSTALLATION

1. FRONT BRAKE HOSE

- 1) Secure the brake hose to strut mount.

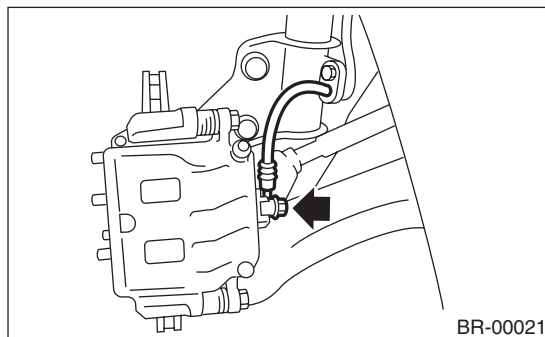
Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

- 2) Install the brake hose to the caliper using a new gasket.

Tightening torque (union bolt):

18 N·m (1.8 kgf-m, 13.3 ft-lb)



- 3) Position the disc in straight position and route the brake hose through the hole in the bracket on the wheel apron side.

CAUTION:

Do not twist the brake hose.

- 4) Temporarily tighten the flare nut which connects brake pipe and hose.
- 5) Secure the brake hose to wheel apron bracket with clamp.
- 6) Tighten the flare nut to the specified torque.

Tightening torque (brake pipe flare nut):

15 N·m (1.5 kgf-m, 10.8 ft-lb)

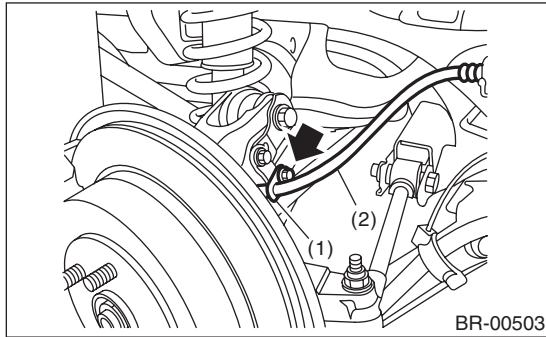
- 7) Bleed air from brake system.

2. REAR BRAKE HOSE

1) Install the brake hose bracket.

Tightening torque:

33 N·m (3.4 kgf·m, 24.3 ft·lb)

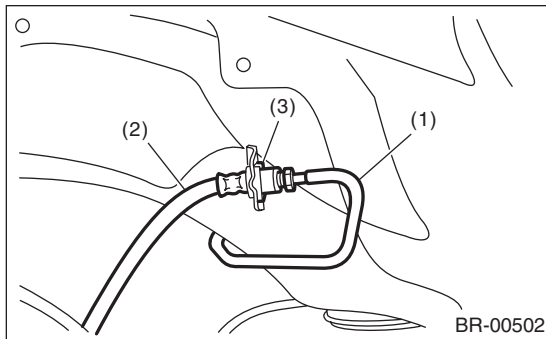


(1) Brake hose bracket

(2) Brake hose

2) Connect the brake hose to the brake pipe.

3) Insert the clamp to secure brake hose.



(1) Brake pipe

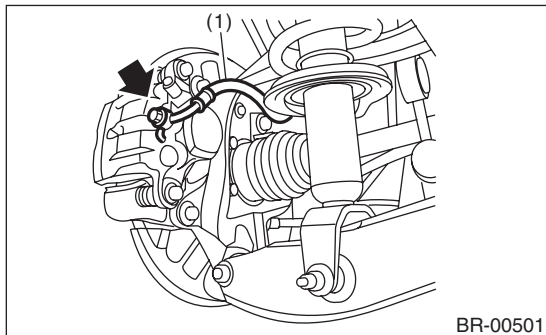
(2) Brake hose

(3) Brake hose clamp

4) Install the brake hose to rear brake caliper using a new gasket.

Tightening torque (union bolt):

18 N·m (1.8 kgf·m, 13.3 ft·lb)



(1) Brake hose

5) Tighten the flare nut to the specified torque.

Tightening torque (brake pipe flare nut):

15 N·m (1.5 kgf·m, 10.8 ft·lb)

6) Bleed air from the brake system.

C: INSPECTION

Make sure there are no cracks, breakage or damage on hoses. Check the joint for fluid leakage. If any cracks, breakage, damage or fluid leakage is found, repair or replace the hose.

13.Brake Pipe

A: REMOVAL

NOTE:

The 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 the electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the center brake pipe.
- When removing the brake pipe, do not bend.

B: INSTALLATION

NOTE:

The 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 the electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the center brake pipe.
- When installing the brake pipe, do not bend.
- After installing the brake pipe and hose, perform air bleed.
- After installing the brake hoses, make sure that they do not contact the tires or suspension assembly, etc.

Brake pipe tightening torque:
15 N·m (1.5 kgf-m, 10.8 ft-lb)

C: INSPECTION

Make sure there are no cracks, breakage or damage on hoses. Check the joint for fluid leakage. If any cracks, breakage, damage or fluid leakage is found, repair or replace the pipes.

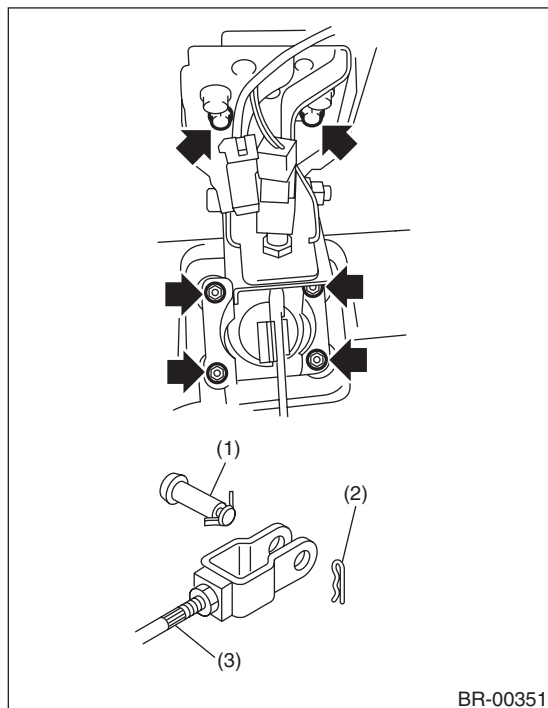
NOTE:

Use a mirror when inspecting back sides and other locations which are hard to see.

14.Brake Pedal

A: REMOVAL

- 1) Remove the steering shaft.
- 2) Disconnect the connector (stop light switch etc.) from the pedal bracket.
- 3) Remove the clevis pin which secures the lever and push rod.
- 4) Remove the bolt and nut which secures the pedal bracket.



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

B: INSTALLATION

- 1) Install in the reverse order of removal.

NOTE:

- Replace with a new clevis pin.
 - Apply NIGTIGHT LYW NO. 2 grease to the clevis pin.
- 2) Check the brake pedal after installation. <Ref. to BR-38, INSPECTION, Brake Pedal.>

C: INSPECTION

- 1) Move the brake pedal pads in a horizontal direction with a force of approx. 10 N (1 kgf, 2 lb), and check that the pedal deflection is in the range of specifications.

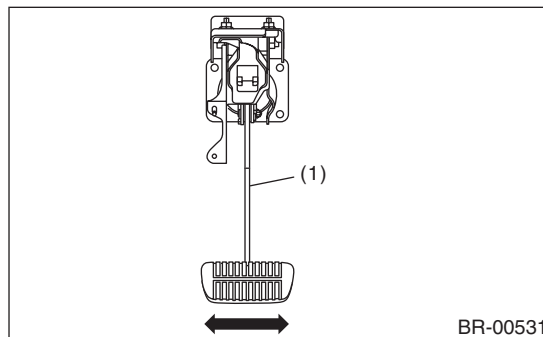
CAUTION:

If excessive deflection is noted, replace with a new bushing.

Deflection of brake pedal:

Limit

4.0 mm (0.157 in) or less



- (1) Brake pedal

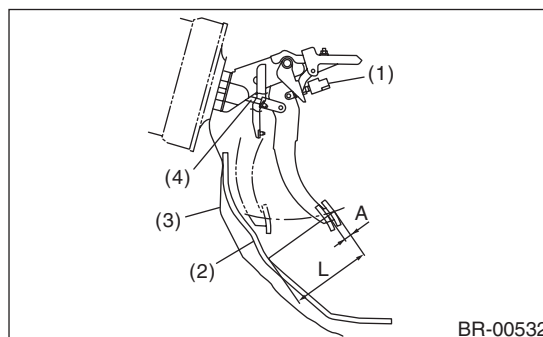
- 2) Check the position of the pedal pad.

Pedal height L:

155 — 175 mm (6.10 — 6.89 in)

Brake pedal free play A:

0.5 — 2 mm (0.02 — 0.08 in) [When pulling the brake pedal upward with a force of less than 10 N (1 kgf, 2 lb).]



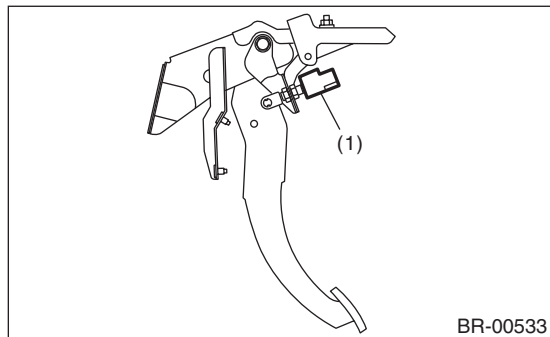
- (1) Stop light switch
- (2) Mat
- (3) Toe board
- (4) Brake booster operating rod

- 3) If it is not within the specification, adjust it by adjusting the brake booster operating rod length.

15. Stop Light Switch

A: REMOVAL

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



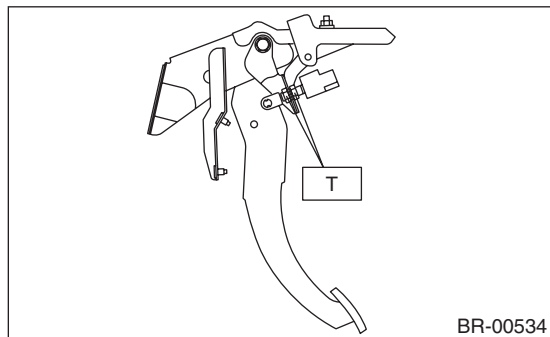
(1) Stop light switch

B: INSTALLATION

- 1) Install the stop light switch onto the bracket with screws and position it with the nut.
 - 2) Adjust the stop light switch position, and then tighten the nut.
- <Ref. to BR-40, ADJUSTMENT, Stop Light Switch.>

Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)



C: INSPECTION

1. CHECK SPECIFIED POSITION

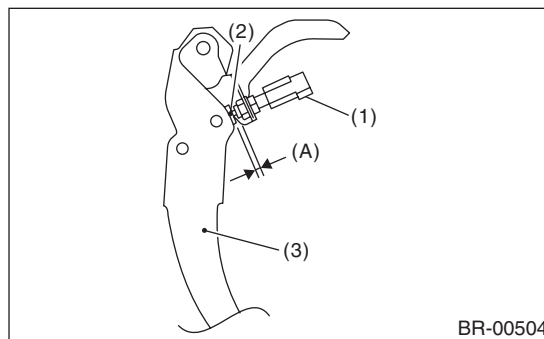
- 1) If the stop light switch does not operate properly (or if it is not secured at the specified position), replace with a new part.
- 2) Measure the clearance between the threaded end of the stop light switch and the stopper.

CAUTION:

Be careful not to rotate the stop light switch.

Stop light switch clearance A:

$0.8 \pm 0.5 \text{ mm (0.031} \pm 0.02 \text{ in)}$



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

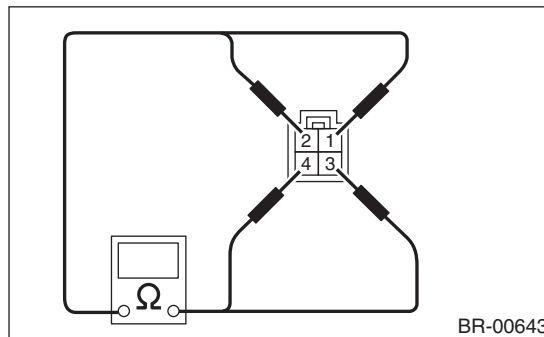
- 3) If it is not within the specification, adjust it by adjusting the position of the stop light switch.

CAUTION:

Be careful not to rotate the stop light switch.

2. CHECK RESISTANCE

- 1) If the stop light switch does not operate properly, replace with a new part.
- 2) Measure the resistance of the stop light switch.



Pedal	Terminal No.	Standard
Released	1 and 4	Less than 1 Ω
	2 and 3	1 MΩ or more
Depressed	1 and 4	1 MΩ or more
	2 and 3	Less than 1 Ω

Stop Light Switch

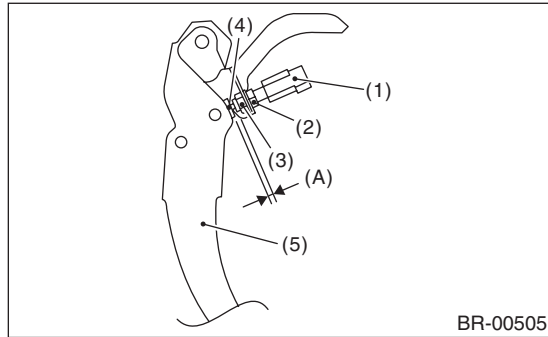
BRAKE

D: ADJUSTMENT

Loosen the lock nut, and adjust the stop light switch position until the clearance (A) between the threaded end of the stop light switch and stopper becomes 0.8 ± 0.5 mm (0.031 ± 0.02 in). Then, tighten the lock nut.

Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)



- (1) Stop light switch
- (2) Lock nut A
- (3) Lock nut B
- (4) Stopper
- (5) Brake pedal

NOTE:

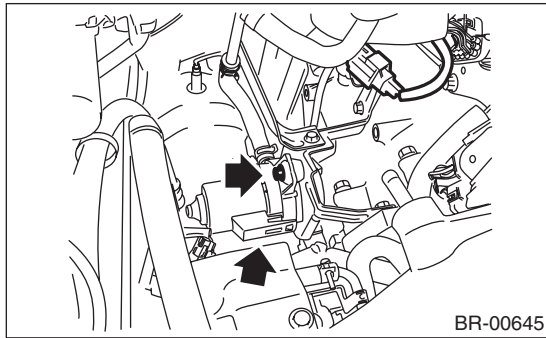
Tighten lock nut B until the threaded end of switch contacts the stopper. Hold the switch so that it does not rotate, and loosen the lock nut B approx. 60°. The clearance (A) will become 0.8 ± 0.5 mm (0.031 ± 0.02 in).

16.Brake Vacuum Pump

A: REMOVAL

1. BRAKE VACUUM PUMP

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the brake vacuum pump connector.
- 3) Remove the vacuum hose.
- 4) Remove the bolt, and remove the brake vacuum pump.



2. VACUUM HOSE

Remove the clip and remove the vacuum hose.

B: INSTALLATION

1. BRAKE VACUUM PUMP

Install in the reverse order of removal.

Tightening torque:

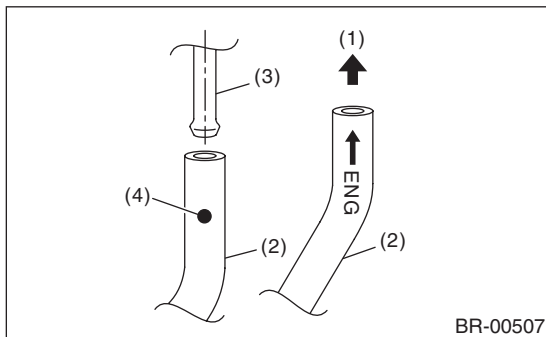
7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

2. VACUUM HOSE

Install in the reverse order of removal.

CAUTION:

**The vacuum hose has an installation direction.
Make sure to install in the proper direction.**



- (1) To engine
- (2) Vacuum hose
- (3) Vacuum pipe
- (4) Marking (Marking to vacuum pipe side)

C: INSPECTION

1. BRAKE VACUUM PUMP

Inspect for whether or not the pump operates when battery voltage is applied to the connector terminal.

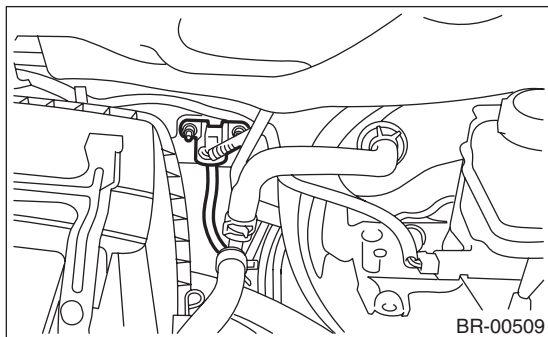
2. VACUUM HOSE

Check to see that air only flows in one direction, when air is blown into or sucked from the hose.

17.Brake Vacuum Sensor

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the brake vacuum sensor connector.
- 3) Remove the vacuum hose from the brake vacuum sensor.
- 4) Remove the bolt, and remove the brake vacuum sensor.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

5 N·m (0.5 kgf-m, 3.7 ft-lb)

18. General Diagnostic Table

A: INSPECTION

	Trouble and possible cause	Corrective action
1. Insufficient braking performance	(1) Fluid leakage from the hydraulic mechanism	Correct or replace. (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose)
	(2) Entry of air into the hydraulic mechanism	Bleed air.
	(3) Wear, deteriorated surface material, water or fluid on lining	Replace, grind or clean.
	(4) Improper operation of master cylinder, disc caliper, brake booster or check valve	Correct or replace.
2. Unstable or uneven braking	(1) Fluid on lining or rotor	Correct the cause of fluid leakage, and clean or replace.
	(2) Rotor defective	Repair or replace the rotor.
	(3) Improper lining contact, deteriorated surface, deteriorated or worn lining material	Repair by grinding, or replace.
	(4) Deformed back plate	Correct or replace.
	(5) Overinflation of tires	Adjust air pressure.
	(6) Defective wheel alignment	Adjust alignment.
	(7) Loose back plate or support installation bolt	Tighten to the specified torque.
	(8) Faulty wheel bearing	Replace.
	(9) Defective hydraulic system	Replace the cylinder, brake pipe or hose.
	(10) Unstable performance of 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 air.
	(2) Excessive play in the master cylinder push rod	Adjust.
	(3) Fluid leakage from the hydraulic mechanism	Correct or replace. (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose)
	(4) 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	Repair or adjust.
	(5) Weakened spring tension or breakage of shoe return spring	Replace the spring.
	(6) Improper disc caliper operation	Correct or replace.
	(7) Faulty wheel bearing	Replace.
5. Brake noise (1) (creaking sound)	(1) Hardened or deteriorated brake pad	Replace the pad.
	(2) Worn brake pad	Replace the pad.
	(3) Loose back plate or support installation bolt	Tighten to the specified torque.
	(4) Loose wheel bearing	Tighten to the specified torque.
	(5) Dirty rotor	Clean the rotor, or clean and replace brake assembly.
6. Brake noise (2) (hissing sound)	(1) Worn brake pad	Replace the pad.
	(2) Improperly installed pad	Correct or replace the pad.
	(3) Loose or bent rotor	Retighten or replace.
7. Brake noise (3) (click sound)	Excessively worn pad or support	Replace the pad or the support.

General Diagnostic Table

BRAKE

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

BVC(diag)

	Page
1. Basic Diagnostic Procedure	2
2. Check List for Interview	3
3. General Description	5
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5. Engine Control Module (ECM) I/O Signal	8
6. Subaru Select Monitor	9
7. Read Diagnostic Trouble Code (DTC)	11
8. Inspection Mode	12
9. Clear Memory Mode	13
10. List of Diagnostic Trouble Code (DTC)	14
11. Diagnostic Procedure with Diagnostic Trouble Code (DTC)	15
12. General Diagnostic Table	31

Basic Diagnostic Procedure

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

CAUTION:

- Subaru Select Monitor is required for reading DTC, reading the current data and clearing the memory.
- Remove foreign matter (dust, water, oil, etc.) from the engine control module (ECM) connector when removing or installing.

NOTE:

- To check the harness for open or short circuits, shake problem spot or connector.
- Refer to "Check List for Interview". <Ref. to BVC(diag)-3, Check List for Interview.>

Step	Check	Yes	No
1 CHECK PRE-INSPECTION. 1) Ask the customer when and how the trouble occurred using the interview check list. <Ref. to BVC(diag)-3, Check List for Interview.> 2) Check the error display. (Odo/trip meter)	Is "Er-bb" displayed on the screen?	Go to step 3.	Go to step 2.
2 BASIC INSPECTION. Check the components which might affect the brake vacuum control. <Ref. to BVC(diag)-5, INSPECTION, General Description.>	Is the component that might affect the brake vacuum control normal?	Go to step 3.	Repair or replace each component.
3 CHECK INDICATION OF DTC. 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON and run the Subaru Select Monitor. 4) Read the DTC. <Ref. to BVC(diag)-11, OPERATION, Read Diagnostic Trouble Code (DTC).> 5) Record all DTC.	Is DTC displayed?	Go to step 5.	Go to step 4.
4 PERFORM GENERAL DIAGNOSTICS. Perform the inspection by referring to "General Diagnostic Table". <Ref. to BVC(diag)-31, INSPECTION, General Diagnostic Table.>	Is result of inspection OK?	Finish the diagnosis.	Go to step 5.
5 PERFORM DIAGNOSIS. 1) Correct the cause of trouble according to the DTC. <Ref. to BVC(diag)-14, LIST, List of Diagnostic Trouble Code (DTC).> 2) Perform the Clear Memory Mode. <Ref. to BVC(diag)-13, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to BVC(diag)-12, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to BVC(diag)-11, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Repeat step 5 until DTC is not shown.	Finish the diagnosis.

Check List for Interview

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

2. Check List for Interview

A: CHECK

Check the following items about the vehicle's state.

1. STATUS OF THE ERROR DISPLAY

An error is displayed in odo/trip meter.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not illuminate • When/How long does it come on?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, while engine is running) ☐ ON (after starting engine, engine is stopped)		
Timing	☐ Immediately after turning the ignition switch to ON ☐ Immediately after turning the ignition switch to START		
	☐ When accelerating	—	km/h
		—	MPH
	☐ While traveling at a constant speed	km/h	MPH
	☐ Decelerating	—	km/h
		—	MPH

Check List for Interview

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

2. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Others:	
	b) Ambient temperature	°C (°F)	
	c) Altitude	m (ft)	
	d) Road	☐ Inner city ☐ Suburbs ☐ Highway ☐ General road ☐ Uphill ☐ Downhill ☐ Paved road ☐ Gravel road ☐ Muddy road ☐ Sandy place ☐ Straight road ☐ Sharp curve ☐ Gentle road ☐ S-curve ☐ Road with a slope on both sides ☐ Others:	
Condition	a) Brakes	Deceleration: _____ G ☐ continuous / ☐ Intermittent	
	b) Accelerator	Acceleration: _____ G ☐ continuous / ☐ Intermittent	
	c) Vehicle speed	km/h	MPH
	☐ Advancing ☐ Accelerating ☐ Decelerating ☐ Low speed ☐ Turning ☐ Others:		☐ Immediately after starting the engine ☐ Idling, etc.

General Description

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

3. General Description

A: CAUTION

1. SRS AIRBAG SYSTEM

The airbag system wiring harness is routed near the main relay and ECM.

CAUTION:

- Do not use electrical test equipment on wiring harness and connector circuits of the airbag system.
- Be careful not to damage the airbag system wiring harness.

B: INSPECTION

Before performing diagnosis, check the following items which might affect the brake vacuum control.

1. BATTERY

Measure the battery voltage and check electrolyte.

Standard voltage: 12 V or more

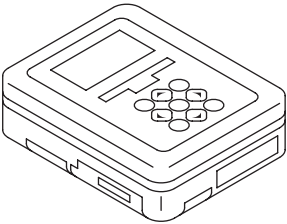
Specific gravity: Above 1.260

2. BRAKE VACUUM HOSE

Make sure that the brake vacuum hose is not cracked or loose.

C: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

2. GENERAL TOOL

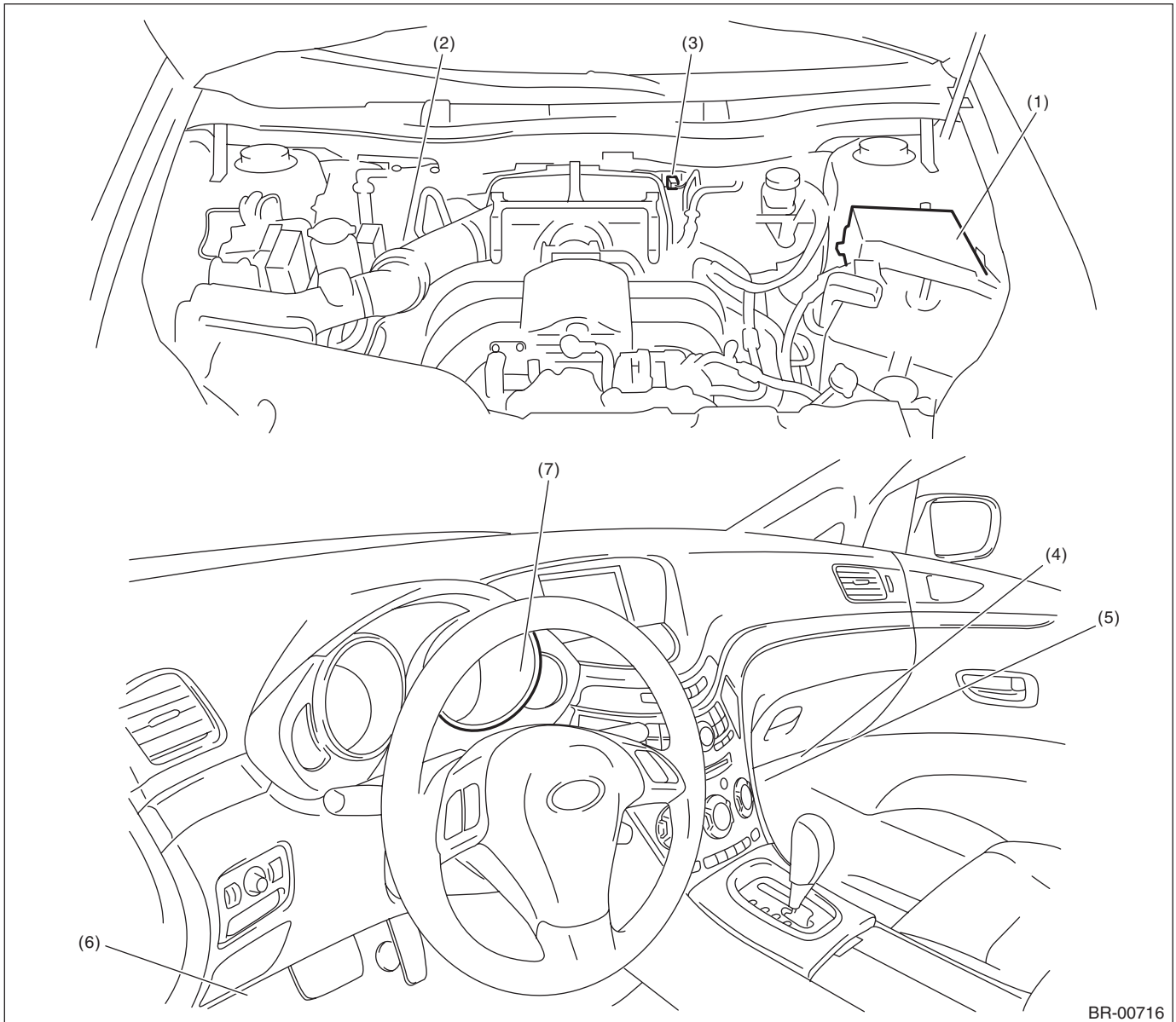
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

Electrical Component Location

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

4. Electrical Component Location

A: LOCATION

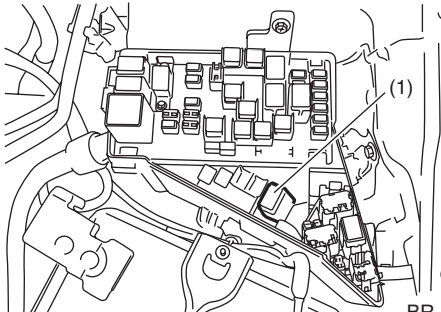
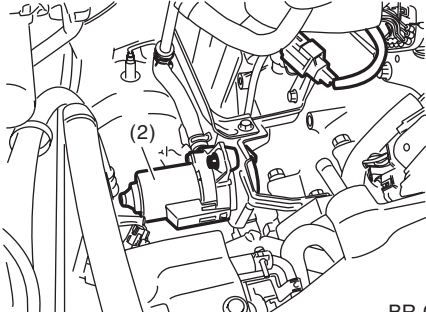
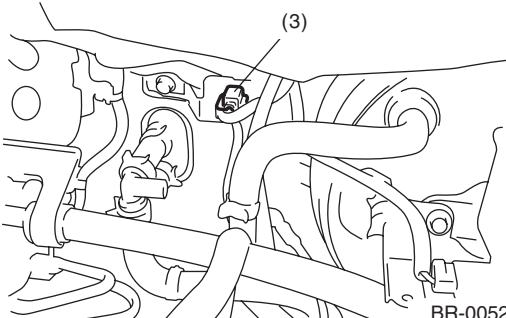
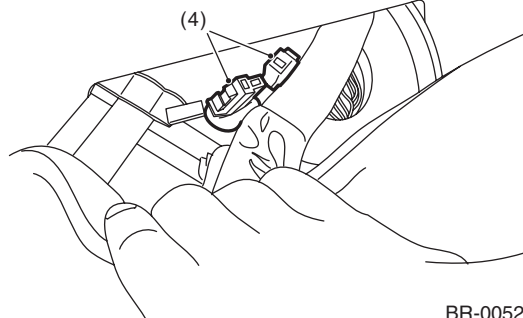
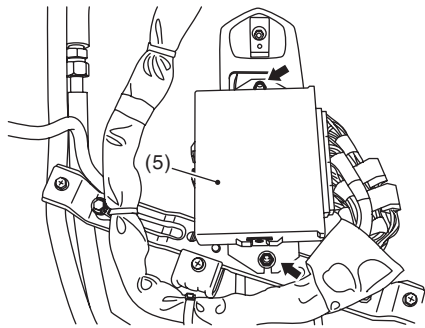
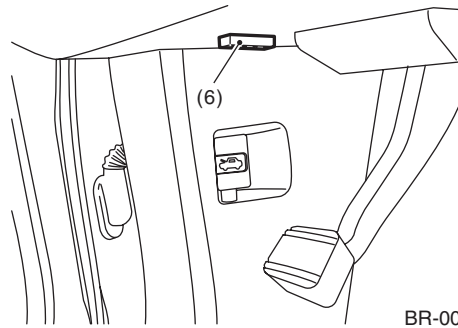
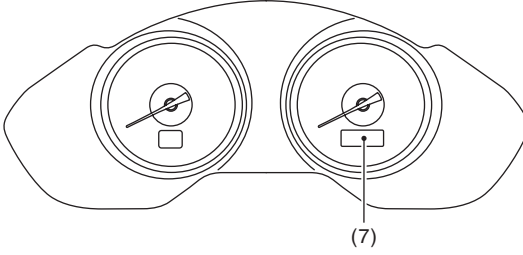


BR-00716

- | | | |
|-----------------------------|------------------------------------|-------------------------|
| (1) Brake vacuum pump relay | (4) Delivery (test) mode connector | (6) Data link connector |
| (2) Brake vacuum pump | (5) Engine control module (ECM) | (7) Odo/trip meter |
| (3) Brake vacuum sensor | | |

Electrical Component Location

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

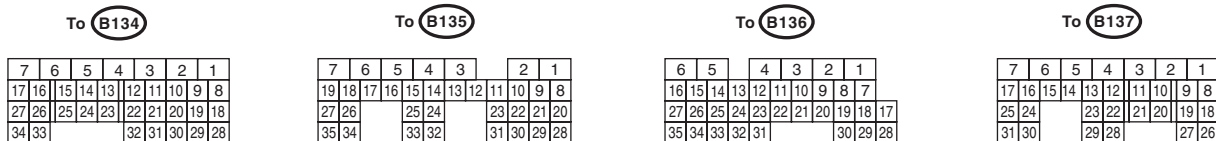
 BR-00797	 BR-00649
 BR-00523	 BR-00524
 BR-00525	 BR-00526
 BR-00527	

Engine Control Module (ECM) I/O Signal

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

5. Engine Control Module (ECM) I/O Signal

A: ELECTRICAL SPECIFICATION



EN-01812

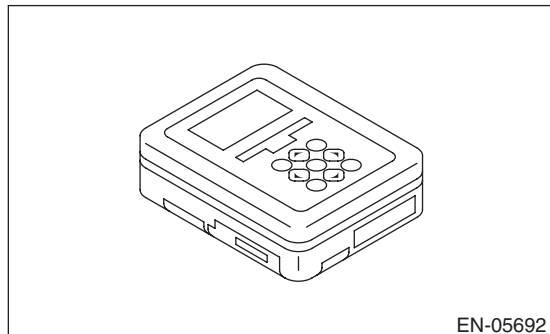
Description		Connector No.	Terminal No.	Signal (V)		Index
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Brake vacuum sensor	Signal	B137	9	1 — 3.8	1 — 3.8	—
	Power supply	B135	22	5	5	—
	Ground	B135	30	0	0	—
Self-shutoff control		B135	13	0	0	—
Brake vacuum pump	Relay drive	B135	27	10 — 13 (When pump is OFF)	12 — 14 (When pump is ON)	—
				0 (When pump is ON)	0 (When pump is ON)	
	Electric load	B136	8	0 (When pump is OFF)	0 (When pump is OFF)	—
				10 — 13 (When pump is ON)	12 — 14 (When pump is ON)	
SSM communication line		B135	14	1 or less ↔ 4 or more	1 or less ↔ 4 or more	—

6. Subaru Select Monitor

A: OPERATION

1. HOW TO USE THE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to BVC(diag)-5, SPECIAL TOOL, PREPARATION TOOL, General Description.>



2) Prepare PC with Subaru Select Monitor installed.

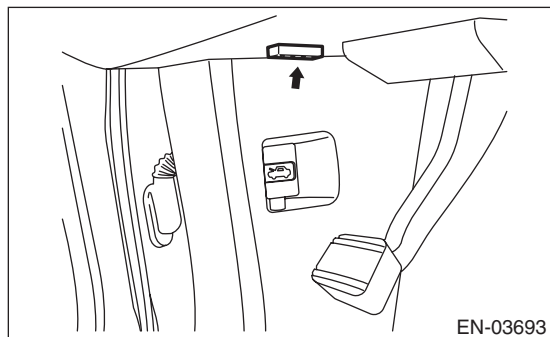
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to SDI.

5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



CAUTION:

Do not connect the scan tools other than the Subaru Select Monitor.

6) Start the PC.

7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".

NOTE:

For details concerning the operation procedure, refer to "PC application help for Subaru Select Monitor".

8) Record the DTC and data.

Subaru Select Monitor

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

2. READ CURRENT DATA

- 1) On «Main Menu» display, select {Each System Check}.
- 2) On «System Selection Menu» display, select {Brake Vacuum Pump System}.
- 3) Click on the [OK] after the {3.6 DOHC} is displayed.
- 4) On the «Brake Vacuum Pump Sys Diagnosis Menu» display screen, select the {Current Data Display & Save}.
- 5) On «Data Display Menu» display, select {Data Display}.
- 6) Using the scroll key, scroll the display screen up or down until necessary data is shown.
 - A list of the support data is shown in the following table.

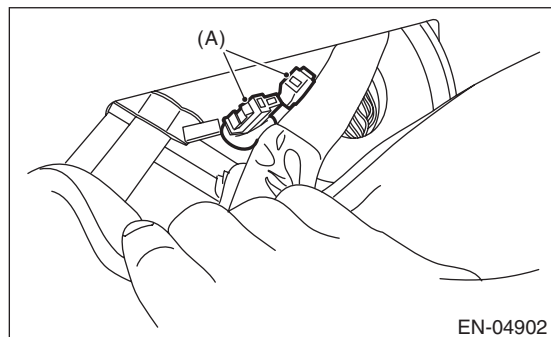
Display	Contents to be displayed	Unit of measure
Atmosphere Pressure	Atmospheric pressure is displayed.	mmHg, kPa or psig
Brake Booster Pressure	Brake booster pressure is displayed.	mmHg, kPa or psig
Test Mode Signal	Connection status of test mode terminal is displayed.	D check or U check
Vacuum Pump Motor	Operation status of vacuum pump motor is displayed.	ON or OFF
Vacuum Pump Motor Relay	Operation status of vacuum pump motor relay is displayed.	ON or OFF

NOTE:

For details concerning the operation procedure, refer to “PC application help for Subaru Select Monitor”.

3. SEQUENCE CONTROL MODE

- 1) Connect the delivery (test) mode connector located under the glove box.



(A) Delivery (test) mode connector

- 2) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.
- 3) On «Main Menu» display, select {Each System Check}.
- 4) On «System Selection Menu» display, select {Brake Vacuum Pump System}.
- 5) Click on the [OK] after the {3.6 DOHC} is displayed.
- 6) On the «Brake Vacuum Pump Sys Diagnosis Menu» display screen, select the {Function Check Mode}.
- 7) When «Sequence Control Mode will be started» is shown on the screen, click the [OK] button.
- 8) When «Depress Brake Pedal Five Times» is shown on the screen, depress the brake pedal 5 times, and click the [OK] button while the brake pedal is not depressed.
- 9) Click the [OK] button after the «OK» is displayed.

7. Read Diagnostic Trouble Code (DTC)

A: OPERATION

- 1) On the «Main Menu» display, select {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Brake Vacuum Pump System}.
- 3) Click the [OK] button after the {3.6 DOHC} is displayed.
- 4) On the «Brake Vacuum Pump Sys Diagnosis Menu» display screen, select the {Diagnostic Code(s) Display}.
- 5) Record the DTC and data.

NOTE:

- For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTCs, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to BVC(diag)-14, List of Diagnostic Trouble Code (DTC).>

8. Inspection Mode

A: PROCEDURE

Reproduce the malfunction occurrence condition as much as possible.

Drive the vehicle at least ten minutes.

9. Clear Memory Mode

A: OPERATION

- 1) On the «Main Menu» display, select {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Brake Vacuum Pump System}.
- 3) Click the [OK] button after the {3.6 DOHC} is displayed.
- 4) On the «Brake Vacuum Pump Sys Diagnosis», select {Clear Memory}.
- 5) When the “Clear Memory?” is shown on the screen, click the [YES] button.
- 6) When “Done” and “Turn ignition switch to OFF” are shown on the display screen, turn the ignition switch to OFF.

NOTE:

For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

List of Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

10.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Content of diagnosis	Reference
11	Sensor Output Out of Range	Brake vacuum sensor output error	<Ref. to BVC(diag)-15, DTC 11 SENSOR OUTPUT OUT OF RANGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
12	Compare Error in Other Sensor	Brake booster relative pressure comparison error	<Ref. to BVC(diag)-17, DTC 12 COMPARE ERROR IN OTHER SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
13	Pressure Sensor Output	Brake vacuum sensor stuck error	<Ref. to BVC(diag)-20, DTC 13 PRESSURE SENSOR OUTPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	Discrepancy in Relays (On)	Unmatched drive of brake vacuum pump relay and brake vacuum pump	<Ref. to BVC(diag)-23, DTC 21 DISCREPANCY IN RELAYS (ON), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	Discrepancy in Relays (Off)	Unmatched drive of brake vacuum pump relay and brake vacuum pump	<Ref. to BVC(diag)-26, DTC 22 DISCREPANCY IN RELAYS (OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	Pump Continuous Work	Continuous drive error of brake vacuum pump	<Ref. to BVC(diag)-29, DTC 23 PUMP CONTINUOUS WORK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

11.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC 11 SENSOR OUTPUT OUT OF RANGE

DTC DETECTING CONDITION:

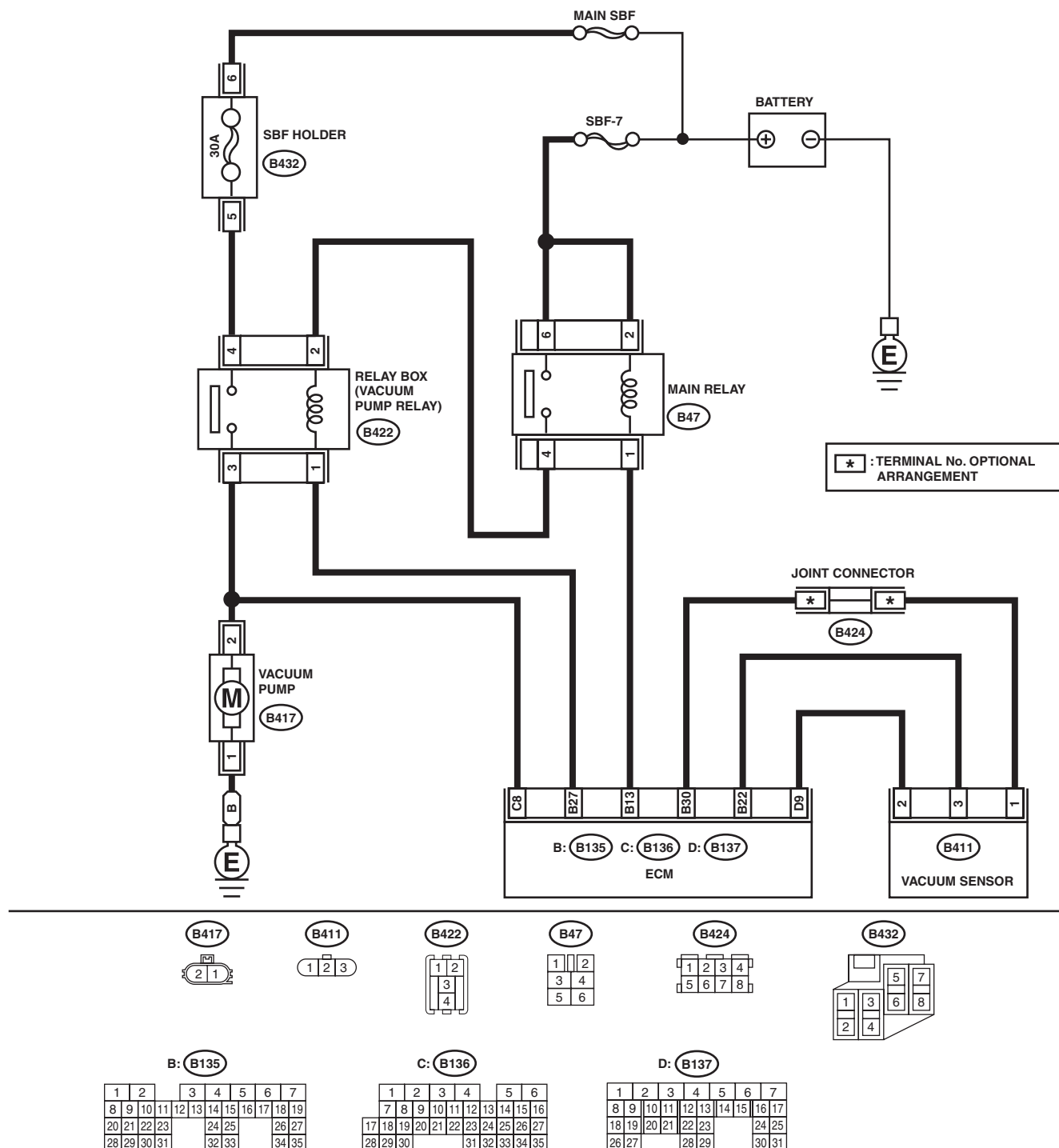
Brake vacuum sensor output error

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:

Vacuum pump control system <Ref. to WI-48, Vacuum Pump Control System.>



BR-00786

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK BRAKE VACUUM SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum sensor connector. 3) Remove the brake vacuum sensor. <Ref. to BR-42, REMOVAL, Brake Vacuum Sensor.> 4) Measure the resistance between brake vacuum sensor connector terminals. Terminals No. 1 — No. 3: No. 2 — No. 3:	Is the resistance 15 kΩ or less?	Go to step 2.	Replace the brake vacuum sensor. <Ref. to BR-42, Brake Vacuum Sensor.>
2	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and brake vacuum sensor connector terminal. Connector & terminal (B135) No. 30 — (B411) No. 1: (B135) No. 22 — (B411) No. 3: (B137) No. 9 — (B411) No. 2:	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between ECM and brake vacuum sensor connector terminal.
3	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 30 — Chassis ground: (B135) No. 22 — Chassis ground: (B137) No. 9 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the ground short circuit of harness between ECM and brake vacuum sensor connector terminal.
4	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 30 (+) — Chassis ground (-): (B135) No. 22 (+) — Chassis ground (-): (B137) No. 9 (+) — Chassis ground (-):	Is the voltage 0.5 V or less?	Go to step 5.	Repair the battery short circuit between ECM and brake vacuum sensor connector.
5	CHECK BRAKE VACUUM SENSOR POWER SUPPLY. 1) Connect the connectors to ECM and brake vacuum sensor. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. Connector & terminal (B135) No. 22 (+) — (B135) No. 30 (-):	Is the voltage 4.75 — 5.25 V?	Go to step 6.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>
6	CHECK CURRENT DATA. 1) Turn the ignition switch to ON. 2) Depress the brake pedal several times, until the pedal becomes firm. 3) Read the current data of the brake vacuum pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the barometric pressure — brake booster pressure -8 — +8 mmHg?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

B: DTC 12 COMPARE ERROR IN OTHER SENSOR

DTC DETECTING CONDITION:

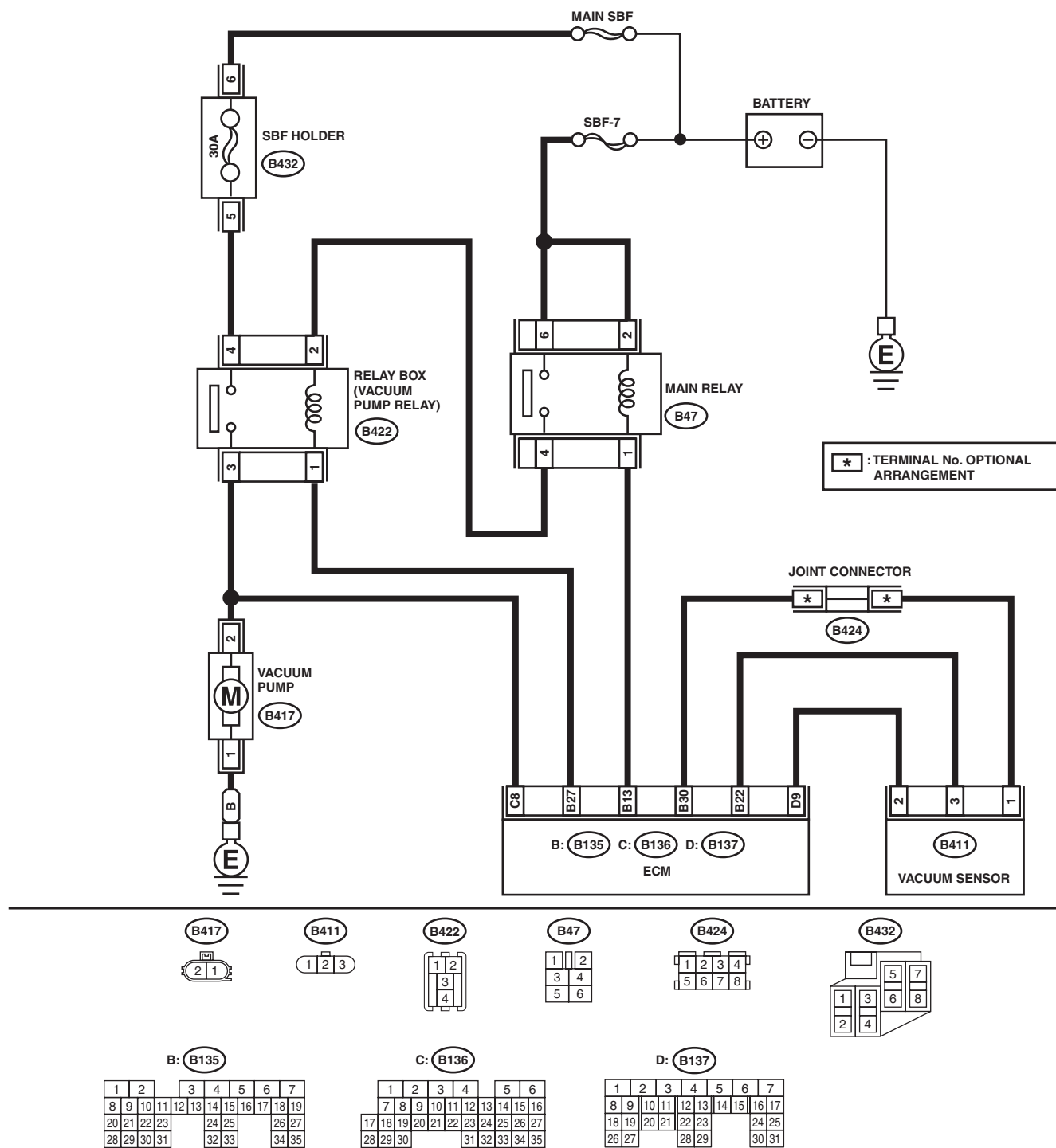
Error in comparison with other brake booster relative pressure

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:

Vacuum pump control system <Ref. to WI-48, Vacuum Pump Control System.>



BR-00786

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK BRAKE VACUUM HOSE. 1) Turn the ignition switch to OFF. 2) Check the status of the brake vacuum hose connection.	Is the brake vacuum hose connected firmly?	Go to step 2.	Connect the brake vacuum hose.
2	CHECK BRAKE VACUUM HOSE. 1) Turn the ignition switch to ON and start engine. 2) Check for leakage from the brake vacuum hose.	Is there a leak from the brake vacuum hose?	Replace the brake vacuum hose.	Go to step 3.
3	CHECK BRAKE VACUUM SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum sensor connector. 3) Remove the brake vacuum sensor. <Ref. to BR-42, REMOVAL, Brake Vacuum Sensor.> 4) Measure the resistance between brake vacuum sensor connector terminals. Terminals No. 1 — No. 3: No. 2 — No. 3:	Is the resistance 15 kΩ or less?	Go to step 4.	Replace the brake vacuum sensor. <Ref. to BR-42, Brake Vacuum Sensor.>
4	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and brake vacuum sensor connector terminal. Connector & terminal (B135) No. 30 — (B411) No. 1: (B135) No. 22 — (B411) No. 3: (B137) No. 9 — (B411) No. 2:	Is the resistance less than 1 Ω?	Go to step 5.	Repair the open circuit of harness between ECM and brake vacuum sensor connector terminal.
5	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 30 — Chassis ground: (B135) No. 22 — Chassis ground: (B137) No. 9 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 6.	Repair the ground short circuit between the ECM and brake vacuum sensor connector terminal.
6	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 30 (+) — Chassis ground (-): (B135) No. 22 (+) — Chassis ground (-): (B137) No. 9 (+) — Chassis ground (-):	Is the voltage 0.5 V or less?	Go to step 7.	Repair the battery short of the harness between ECM and brake vacuum sensor connector.
7	CHECK BRAKE VACUUM SENSOR POWER SUPPLY. 1) Connect the connectors to ECM and brake vacuum sensor. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. Connector & terminal (B135) No. 22 (+) — (B135) No. 30 (-):	Is the voltage 4.75 — 5.25 V?	Go to step 8.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK CURRENT DATA. 1) Turn the ignition switch to ON. 2) Depress the brake pedal several times, until the pedal becomes firm. 3) Read the current data of the brake vacuum pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the barometric pressure — brake booster pressure –8 — +8 mmHg?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

C: DTC 13 PRESSURE SENSOR OUTPUT

DTC DETECTING CONDITION:

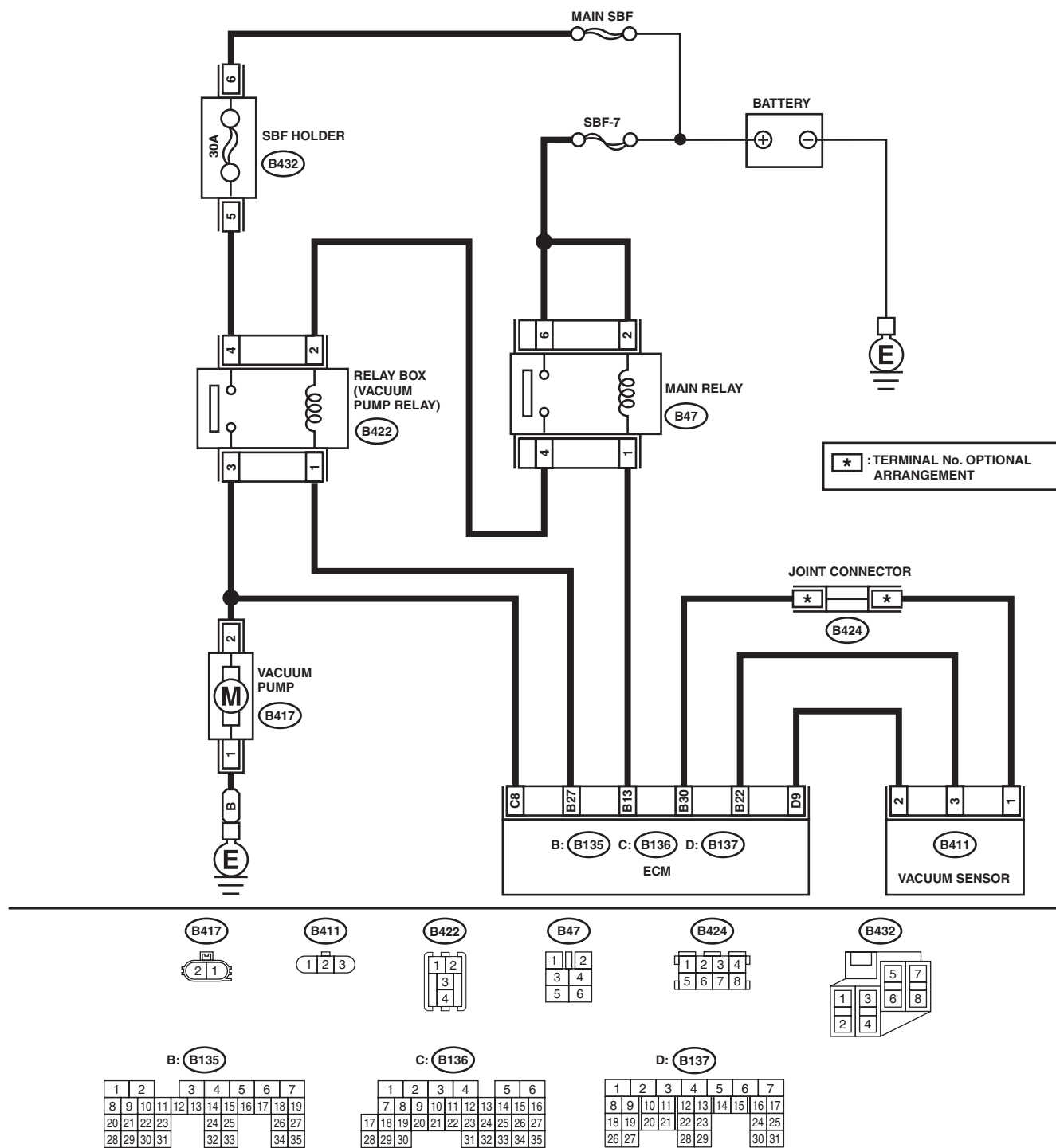
Brake vacuum sensor seizure malfunction

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:

Vacuum pump control system <Ref. to WI-48, Vacuum Pump Control System.>



BR-00786

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK BRAKE VACUUM HOSE. 1) Turn the ignition switch to OFF. 2) Check the status of the brake vacuum hose connection.	Is the brake vacuum hose connected firmly?	Go to step 2.	Connect the brake vacuum hose.
2	CHECK BRAKE VACUUM HOSE. 1) Turn the ignition switch to ON and start engine. 2) Check for leakage from the brake vacuum hose.	Is there a leak from the brake vacuum hose?	Replace the brake vacuum hose.	Go to step 3.
3	CHECK BRAKE VACUUM SENSOR CONNECTOR. Check the status of the brake vacuum sensor connector connection.	Is the brake vacuum sensor connector connected firmly?	Go to step 4.	Connect the brake vacuum sensor connector.
4	CHECK BRAKE VACUUM SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum sensor connector. 3) Remove the brake vacuum sensor. <Ref. to BR-42, REMOVAL, Brake Vacuum Sensor.> 4) Measure the resistance between brake vacuum sensor connector terminals. Connector & terminal No. 1 — No. 3: No. 2 — No. 3:	Is the resistance 15 kΩ or less?	Go to step 5.	Replace the brake vacuum sensor. <Ref. to BR-42, Brake Vacuum Sensor.>
5	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and brake vacuum sensor connector terminal. Connector & terminal (B135) No. 30 — (B411) No. 1: (B135) No. 22 — (B411) No. 3: (B137) No. 9 — (B411) No. 2:	Is the resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between ECM and brake vacuum sensor connector terminal.
6	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 30 — Chassis ground: (B135) No. 22 — Chassis ground: (B137) No. 9 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the ground short circuit of harness between ECM and brake vacuum sensor connector terminal.
7	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 30 (+) — Chassis ground (-): (B135) No. 22 (+) — Chassis ground (-): (B137) No. 9 (+) — Chassis ground (-):	Is the voltage 0.5 V or less?	Go to step 8.	Repair the battery short of the harness between ECM and brake vacuum sensor connector.
8	CHECK BRAKE VACUUM SENSOR POWER SUPPLY. 1) Connect the connectors to ECM and brake vacuum sensor. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. Connector & terminal (B135) No. 22 (+) — (B135) No. 30 (-):	Is the voltage 4.75 — 5.25 V?	Go to step 9.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

Step	Check	Yes	No
9 CHECK CURRENT DATA. 1) Turn the ignition switch to ON. 2) Depress the brake pedal several times, until the pedal becomes firm. 3) Read the current data of the brake vacuum pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the barometric pressure — brake booster pressure –8 — +8 mmHg?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

D: DTC 21 DISCREPANCY IN RELAYS (ON)

DTC DETECTING CONDITION:

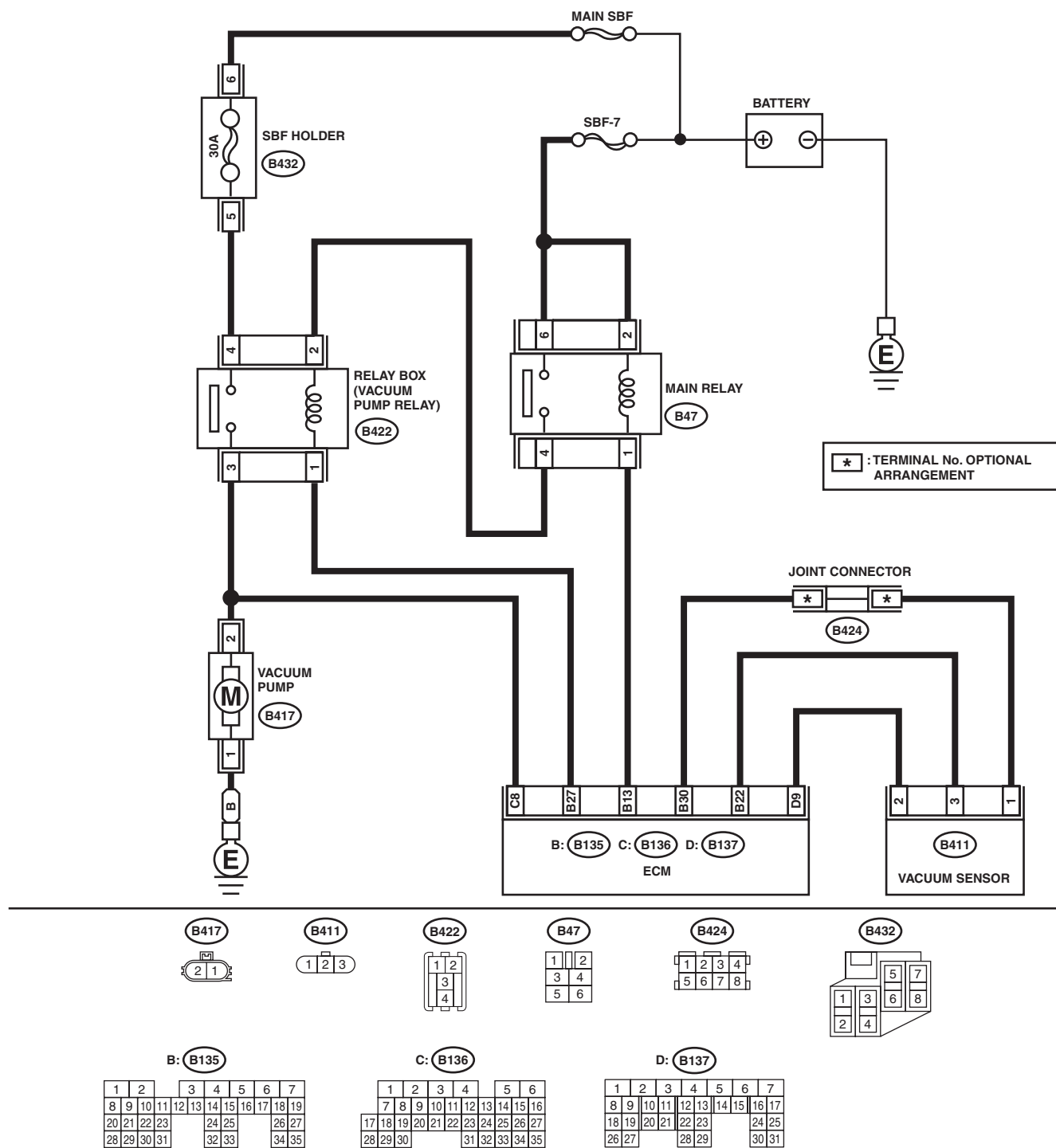
Drive does not match between brake vacuum pump relay and brake vacuum pump.

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:

Vacuum pump control system <Ref. to WI-48, Vacuum Pump Control System.>



BR-00786

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK CONNECTOR. Check the status of the brake vacuum sensor and brake vacuum pump connection.	Are the brake vacuum sensor and brake vacuum pump connected firmly?	Go to step 2.	Connect the connector.
2	CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump fuse. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 3.
3	CHECK BRAKE VACUUM PUMP RELAY. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump relay from relay box. 3) Connect the battery to the brake vacuum pump relay terminals No. 1 and No. 2. 4) Measure the resistance between brake vacuum pump relay terminals. Terminals No. 3 — No. 4:	Is the resistance less than 1 Ω ?	Go to step 4.	Replace the brake vacuum pump relay.
4	CHECK BRAKE VACUUM PUMP RELAY POWER SUPPLY. 1) Turn the ignition switch to ON. 2) Measure the voltage between brake vacuum pump relay connector and chassis ground. Connector & terminal (B422) No. 2 (+) — Chassis ground (-): (B422) No. 4 (+) — Chassis ground (-):	Is the voltage 10 V or more?	Go to step 5.	Repair the open or ground short circuit of power supply circuit.
5	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and brake vacuum pump relay connector terminal. Connector & terminal (B135) No. 27 — (B422) No. 1:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit of harness between ECM and the brake vacuum pump relay connector terminal.
6	CHECK HARNESS BETWEEN THE BRAKE VACUUM PUMP AND BRAKE VACUUM PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum pump connector. 3) Measure the resistance of harness between brake vacuum pump and brake vacuum pump relay connector terminal. Connector & terminal (B422) No. 3 — (B417) No. 2:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair the open circuit of harness between brake vacuum pump and brake vacuum pump relay connector terminal.
7	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP CONNECTOR. Measure the resistance of harness between brake vacuum pump connector and chassis ground. Connector & terminal (B417) No. 2 — Chassis ground:	Is the resistance 1 M Ω or more?	Go to step 8.	Repair the ground short circuit of harness between ECM and brake vacuum pump connector terminal.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP CONNECTOR. Measure the voltage between brake vacuum pump connector and chassis ground. Connector & terminal (B417) No. 2 (+) — Chassis ground (-):	Is the voltage 0.5 V or less?	Go to step 9.	Repair the battery short of the harness between the ECM and the brake vacuum pump connector.
9 CHECK BRAKE VACUUM PUMP. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump. <Ref. to BR-41, REMOVAL, Brake Vacuum Pump.> 3) Connect the battery positive terminal to the brake vacuum pump terminal No. 2, and the negative terminal to terminal No. 1.	Does the brake vacuum pump operate?	Go to step 10.	Replace the brake vacuum pump. <Ref. to BR-41, Brake Vacuum Pump.>
10 CHECK BRAKE VACUUM PUMP. 1) Connect the brake vacuum pump relay. 2) Connect the connectors to the brake vacuum pump and ECM. 3) Turn the ignition switch to ON. 4) Execute the Function Check Mode of the brake negative pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Does the brake vacuum pump operate?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

E: DTC 22 DISCREPANCY IN RELAYS (OFF)

DTC DETECTING CONDITION:

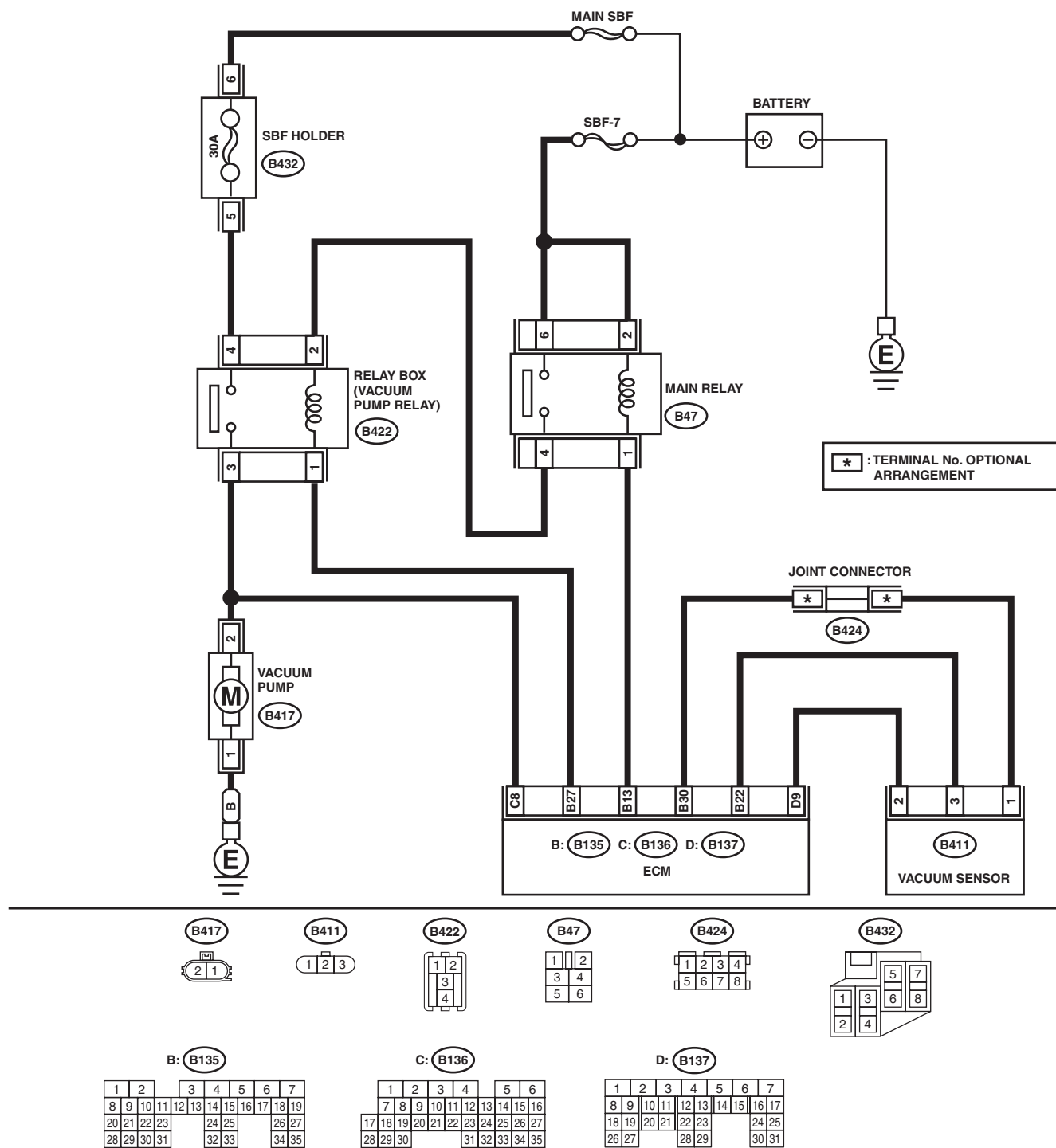
Drive does not match between brake vacuum pump relay and brake vacuum pump.

TROUBLE SYMPTOM:

Vacuum pump does not operate properly.

WIRING DIAGRAM:

Vacuum pump control system <Ref. to WI-48, Vacuum Pump Control System.>



BR-00786

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK BRAKE VACUUM PUMP RELAY. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump relay from relay box. 3) Connect the battery to the brake vacuum pump relay terminals No. 1 and No. 2. 4) Measure the resistance between brake vacuum pump relay terminals. Terminals No. 3 — No. 4:	Is the resistance less than 1 Ω ?	Go to step 2.	Replace the brake vacuum pump relay.
2 CHECK BRAKE VACUUM PUMP RELAY POWER SUPPLY. 1) Turn the ignition switch to ON. 2) Measure the voltage between brake vacuum pump relay connector and chassis ground. Connector & terminal (B422) No. 2 (+) — Chassis ground (-): (B422) No. 4 (+) — Chassis ground (-):	Is the voltage 10 V or more?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
3 CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and brake vacuum pump relay connector terminal. Connector & terminal (B135) No. 27 — (B422) No. 1: (B136) No. 8 — (B422) No. 3:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness between ECM and the brake vacuum pump relay connector terminal.
4 CHECK HARNESS BETWEEN THE BRAKE VACUUM PUMP AND BRAKE VACUUM PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum pump connector. 3) Measure the resistance of harness between brake vacuum pump and brake vacuum pump relay connector terminal. Connector & terminal (B422) No. 3 — (B417) No. 2:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair the open circuit of harness between brake vacuum pump and brake vacuum pump relay connector terminal.
5 CHECK MOTOR GROUND. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum pump connector. 3) Measure the resistance between brake vacuum pump connector and chassis ground. Connector & terminal (B417) No. 1 — Chassis ground:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the ground circuit.
6 CHECK BRAKE VACUUM PUMP. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump. <Ref. to BR-41, REMOVAL, Brake Vacuum Pump.> 3) Connect the battery to the brake vacuum pump terminals No. 2 (+) and No. 1 (-).	Does the brake vacuum pump operate?	Go to step 7.	Replace the brake vacuum pump. <Ref. to BR-41, Brake Vacuum Pump.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

Step		Check	Yes	No
7	CHECK ECM. 1) Connect the brake vacuum pump, brake vacuum pump relay, and connector. 2) Perform the Sequence Control Mode. <Ref. to BVC(diag)-10, SEQUENCE CONTROL MODE, OPERATION, Subaru Select Monitor.>	Does the brake vacuum pump operate?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

F: DTC 23 PUMP CONTINUOUS WORK

DTC DETECTING CONDITION:

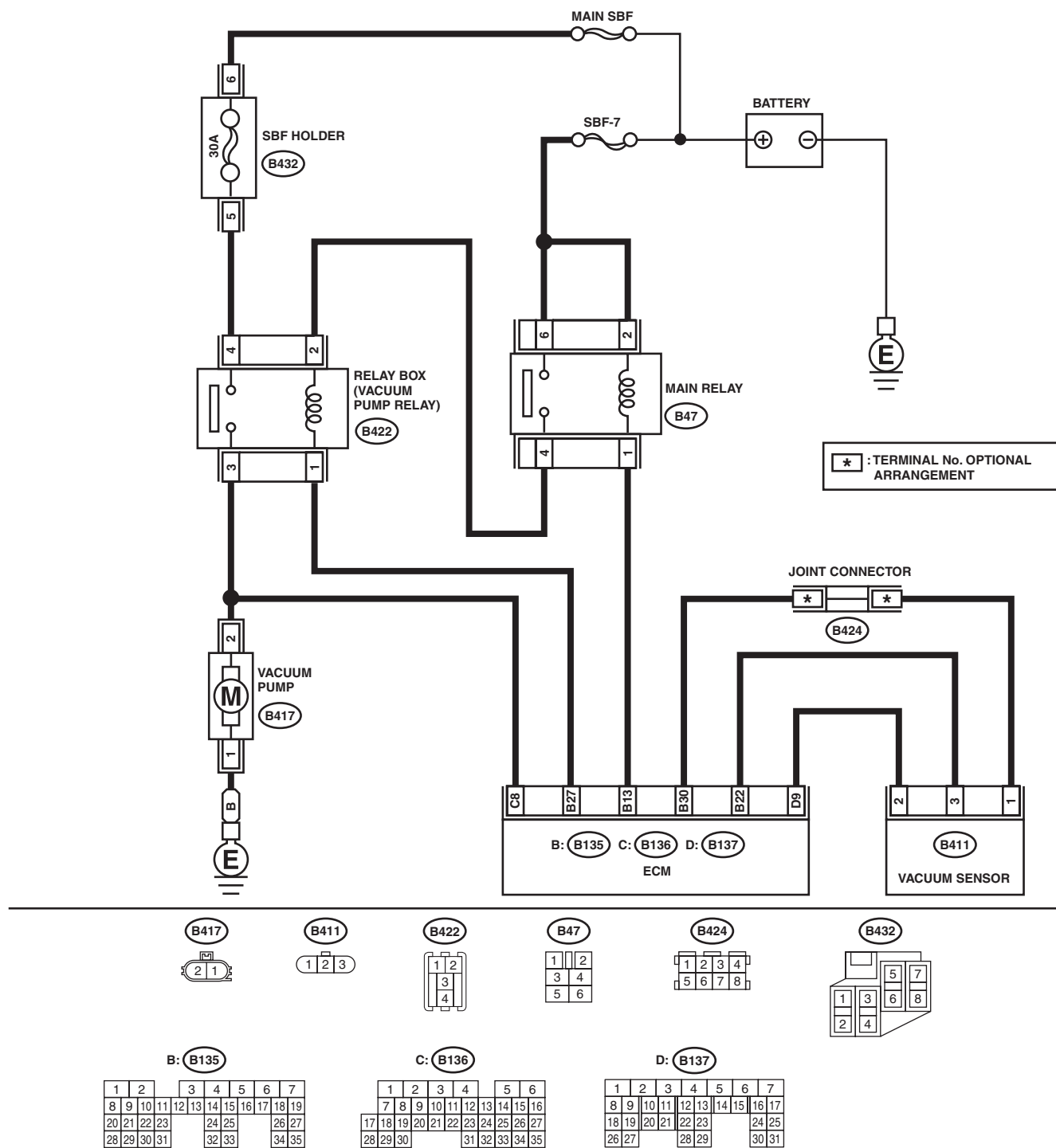
Malfunction in brake vacuum pump continuous drive error

TROUBLE SYMPTOM:

Brake vacuum pump operates continuously.

WIRING DIAGRAM:

Vacuum pump control system <Ref. to WI-48, Vacuum Pump Control System.>



BR-00786

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK BRAKE VACUUM HOSE. 1) Turn the ignition switch to OFF. 2) Check the status of the brake vacuum hose connection.	Is the brake vacuum hose connected firmly?	Go to step 2.	Connect the brake vacuum hose.
2	CHECK BRAKE VACUUM HOSE. 1) Turn the ignition switch to ON and start engine. 2) Check for leakage from the brake vacuum hose.	Is there a leak from the brake vacuum hose?	Replace the brake vacuum hose.	Go to step 3.
3	CHECK BRAKE VACUUM PUMP RELAY. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump relay from relay box. 3) Connect the battery to the brake vacuum pump relay terminals No. 1 and No. 2. 4) Measure the resistance between brake vacuum pump relay terminals. Terminals No. 3 — No. 4:	Is the resistance less than 1 Ω ?	Go to step 4.	Replace the brake vacuum pump relay.
4	CHECK BRAKE VACUUM PUMP RELAY POWER SUPPLY. 1) Turn the ignition switch to ON. 2) Measure the voltage between brake vacuum pump relay connector and chassis ground. Connector & terminal (B422) No. 2 (+) — Chassis ground (–): (B422) No. 4 (+) — Chassis ground (–):	Is the voltage 10 V or more?	Go to step 5.	Repair the open or ground short circuit of power supply circuit.
5	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and brake vacuum pump relay connector terminal. Connector & terminal (B135) No. 27 — (B422) No. 1: (B136) No. 8 — (B422) No. 3:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit of harness between ECM and the brake vacuum pump relay connector terminal.
6	CHECK HARNESS BETWEEN THE BRAKE VACUUM PUMP AND BRAKE VACUUM PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the brake vacuum pump connector. 3) Measure the resistance of harness between brake vacuum pump and brake vacuum pump relay connector terminal. Connector & terminal (B422) No. 3 — (B417) No. 2:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair the open circuit of harness between brake vacuum pump and brake vacuum pump relay connector terminal.
7	CHECK ECM. 1) Connect the brake vacuum pump, brake vacuum pump relay, and connector. 2) Perform the Sequence Control Mode. <Ref. to BVC(diag)-10, SEQUENCE CONTROL MODE, OPERATION, Subaru Select Monitor.>	Does the brake vacuum pump operate?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-55, Engine Control Module (ECM).>

General Diagnostic Table

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

12.General Diagnostic Table

A: INSPECTION

Symptoms		Main probable cause	Other probable cause
Poor brake performance	Long braking/ stopping distance	• Brake pad • Aeration to brake line • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections	• Master cylinder • Brake caliper • Disc rotor • Brake pipe • Brake booster
	Long brake pedal stroke	• Aeration to brake line • Brake pedal play	• Master cylinder • Brake caliper • Brake pad • Brake pipe • Brake booster
	Short brake pedal stroke	• Brake vacuum pump • Brake vacuum sensor • Brake vacuum hose	• Master cylinder • Brake caliper • Brake pad • Brake pipe • Brake booster

General Diagnostic Table

BRAKE VACUUM CONTROL (BVC) (DIAGNOSTICS)

PARKING BRAKE

PB

	Page
1. General Description	2
2. Parking Brake Pedal	4
3. Parking Brake Cable	5
4. Parking Brake Assembly (Rear Disc Brake)	7
5. General Diagnostic Table	10

General Description

DIFFERENTIALS

1. General Description

A: SPECIFICATION

1. REAR DIFFERENTIAL

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

NOTE:

- Using a different rear differential assembly will cause the drive train and tires to drag or emit abnormal noise.
- For option code, refer to “ID” section. <Ref. to ID-2, IDENTIFICATION, Identification.>

Rear differential type	VA2-type
Identification	XB
LSD type	—
Type of gear	Hypoid gear
Gear ratio (Number of gear teeth)	3.583 (43/12)
Oil capacity	0.8 L (0.8 US qt, 0.7 Imp qt)
Rear differential gear oil	GL-5

2. REAR DIFFERENTIAL GEAR OIL

Recommended gear oil:

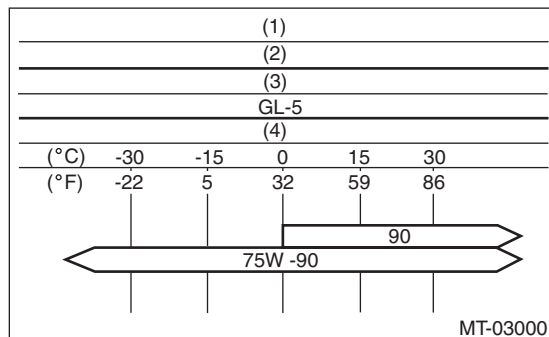
GL-5 (75W-90)

Alternative:

Equivalent product

CAUTION:

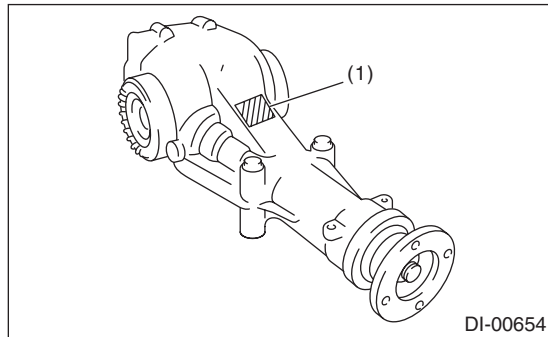
- If an alternative product is used, you may not have the expected functionality and performance.
- Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.



- (1) Item
- (2) Rear differential gear oil
- (3) API classification
- (4) SAE viscosity No. and applicable temperature

3. IDENTIFICATION

Identification positions are shown in the following figures. For details concerning identification, refer to the “ID” section.



(1) Identification

4. SERVICE DATA

Drive pinion bearing preload (for new bearing)	Measured with spring measurement (measured from the companion flange bolt) N (kgf, lb)	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
	Measured with torque wrench N·m (kgf-m, ft-lb)	0.48 — 1.22 (0.05 — 0.12, 0.35 — 0.90)
Side gear backlash	mm (in)	0.13 — 0.18 (0.005 — 0.007)
Hypoid driven gear backlash	mm (in)	0.10 — 0.15 (0.004 — 0.006)
Companion flange mating surface runout	mm (in)	0.08 (0.003)
Companion flange runout on its inner side	mm (in)	0.08 (0.003)

General Description

DIFFERENTIALS

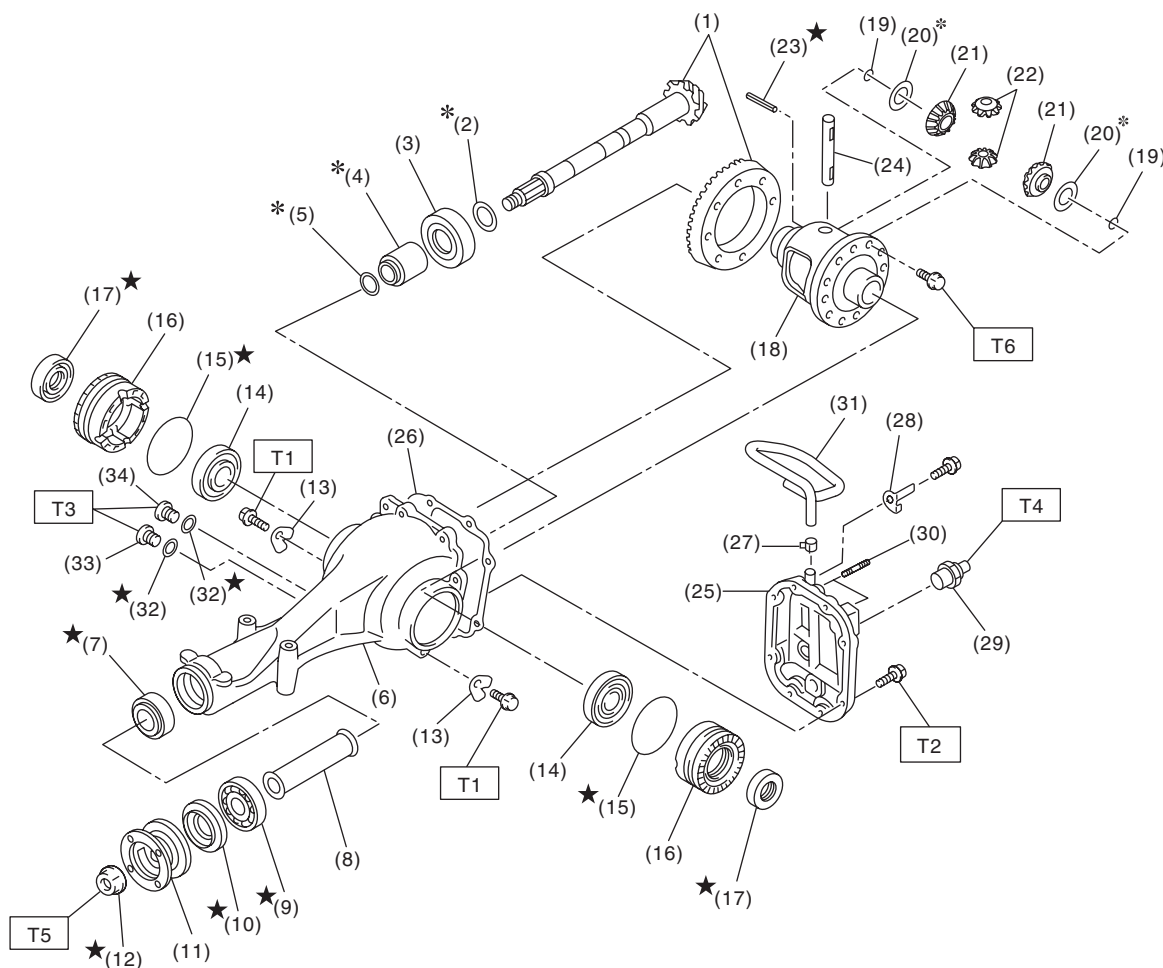
5. ADJUSTING PARTS

Preload adjusting spacer	Part No.	Length mm (in)
	31454AA250	51.05 (2.010)
	31454AA260	51.25 (2.018)
	31454AA270	51.35 (2.022)
	31454AA280	51.45 (2.026)
	31454AA290	51.55 (2.030)
	31454AA300	51.65 (2.033)
	31454AA310	51.75 (2.037)
	31454AA320	51.85 (2.041)
	31454AA330	52.05 (2.049)

Preload adjusting washer	Part No.	Thickness mm (in)
	38336AA430	1.500 (0.0591)
	38336AA440	1.513 (0.0596)
	38336AA450	1.525 (0.0600)
	38336AA460	1.538 (0.0606)
	38336AA470	1.550 (0.0610)
	38336AA480	1.563 (0.0615)
	38336AA490	1.575 (0.0620)
	38336AA500	1.588 (0.0625)
	38336AA510	1.600 (0.0630)
	38336AA520	1.613 (0.0635)
	38336AA530	1.625 (0.0640)
	38336AA540	1.638 (0.0645)
	38336AA550	1.650 (0.0650)
	38336AA560	1.663 (0.0655)
	38336AA570	1.675 (0.0659)
	38336AA580	1.688 (0.0665)
	38336AA590	1.700 (0.0669)
	38336AA600	1.713 (0.0674)
	38336AA610	1.725 (0.0679)
	38336AA620	1.738 (0.0684)
	38336AA630	1.750 (0.0689)
	38336AA640	1.763 (0.0694)
	38336AA650	1.775 (0.0699)
Pinion height adjusting washer	Part No.	Thickness mm (in)
	32295AA350	0.150 (0.0059)
	32295AA360	0.175 (0.0069)
	32295AA370	0.200 (0.0079)
	32295AA380	0.225 (0.0089)
	32295AA390	0.250 (0.0098)
	32295AA400	0.275 (0.0108)
Side gear thrust washer	803138021	0.950 (0.0374)
	803138022	1.000 (0.0394)
	803138023	1.050 (0.0413)

B: COMPONENT

1. REAR DIFFERENTIAL (VA2-TYPE)



DI-00987

General Description

DIFFERENTIALS

(1) Hypoid driven gear and drive pinion set	(16) Side retainer	(31) Air breather hose
(2) Pinion height adjusting washer	(17) Side oil seal	(32) Gasket
(3) Rear bearing	(18) Differential case	(33) Oil filler plug
(4) Bearing preload adjusting spacer	(19) Circlip	(34) Oil drain plug
(5) Bearing preload adjusting washer	(20) Side gear thrust washer	
(6) Differential carrier	(21) Side gear	
(7) Front bearing	(22) Pinion mate gear	
(8) Spacer	(23) Spring pin	
(9) Pilot bearing	(24) Pinion mate shaft	
(10) Front oil seal	(25) Rear cover	
(11) Companion flange	(26) Gasket	
(12) Self-locking nut	(27) Clip	
(13) Lock plate	(28) Stay ground	
(14) Side bearing	(29) Rear differential oil temperature switch	
(15) O-ring	(30) Stud bolt	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 25 (2.5, 18.4)

T2: 34 (3.5, 25.1)

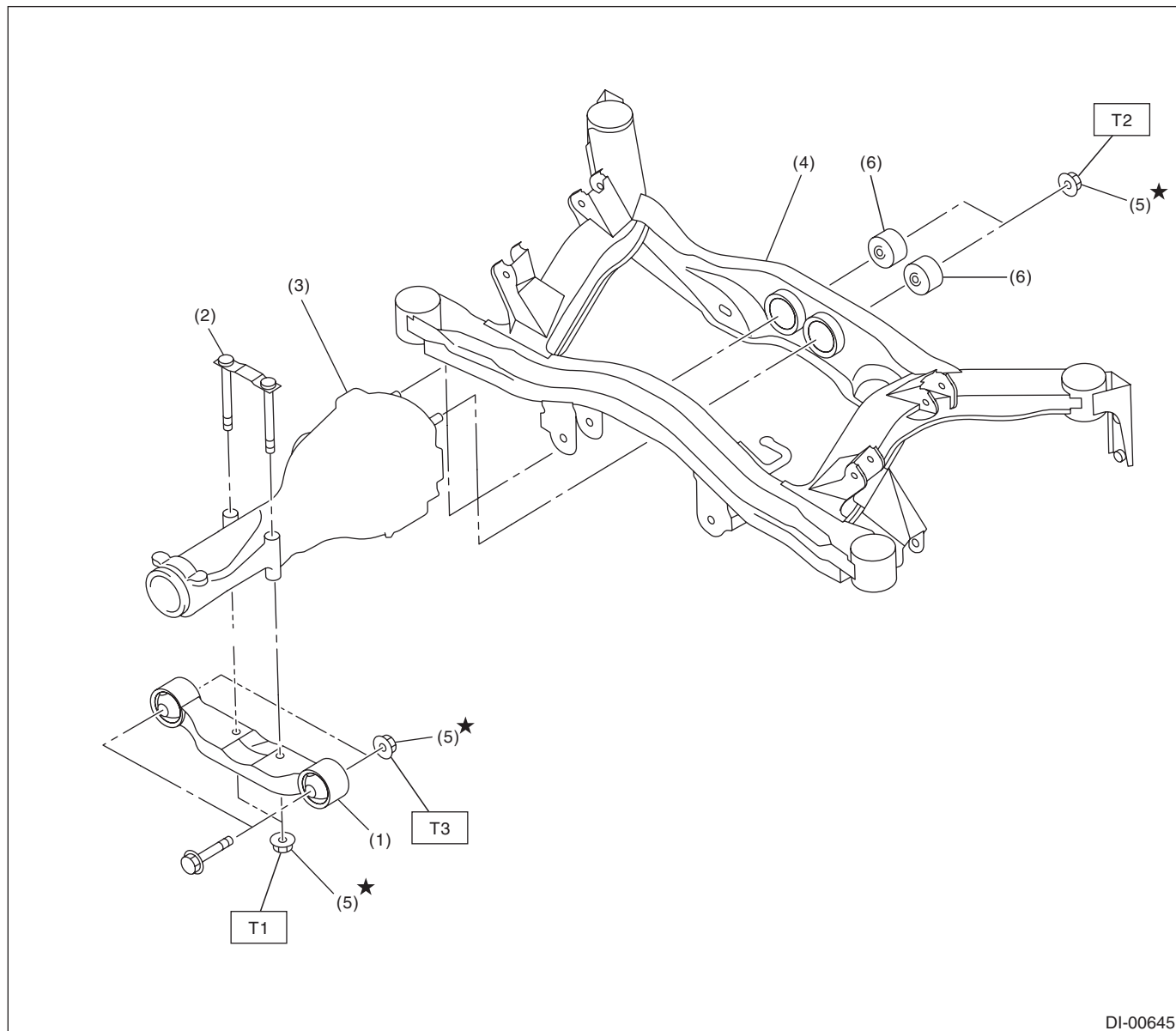
T3: 50 (5.1, 36.9)

T4: 60 (6.1, 44.3)

T5: 191 (19.5, 140.9)

T6: <Ref. to DI-25, ASSEMBLY, Rear Differential (VA-type).>

2. REAR DIFFERENTIAL MOUNTING SYSTEM



- (1) Rear differential front member
- (2) Rear differential member plate
- (3) Rear differential ASSY

- (4) Rear sub frame
- (5) Self-locking nut
- (6) Rear differential mount bushing

Tightening torque: N·m (kgf-m, ft-lb)

T1: 50 (5.1, 36.9)

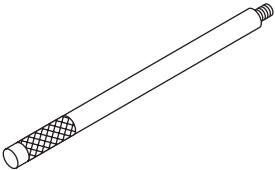
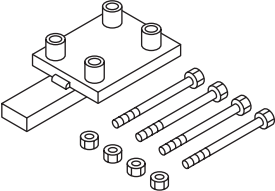
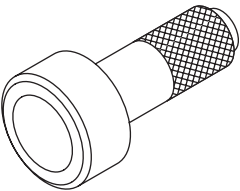
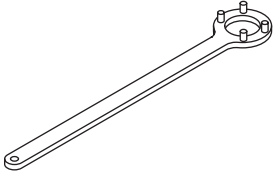
T2: 70 (7.1, 51.6)

T3: 110 (11.2, 81.1)

C: CAUTION

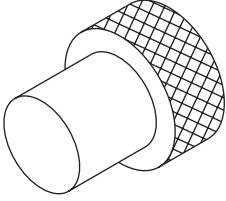
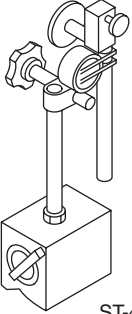
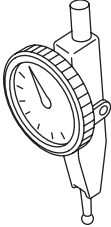
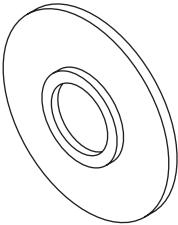
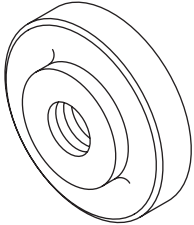
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine gear oil, grease or equivalent. Do not mix gear oil, grease, etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply gear oil onto sliding or revolving surfaces before installation.
- Before installing the O-ring or snap ring, apply a 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 cloth between the part and the vise.
- Avoid damaging the mating surface of the case.

D: PREPARATION TOOL**1. SPECIAL TOOL**

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398477701	398477701	HANDLE	Used for installing the rear bearing race.
 ST-398217700	398217700	ATTACHMENT SET	Stand for rear differential carrier disassembly and assembly.
 ST-498447120	498447120	INSTALLER	Used for installing the front oil seal.
 ST-498427200	498427200	FLANGE WRENCH	Used for stopping rotation of companion flange when removing and tightening self-lock nut.

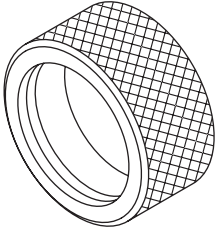
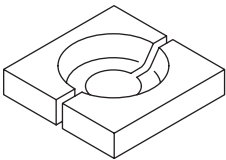
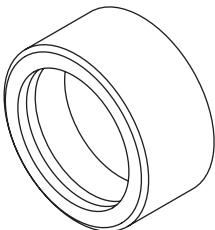
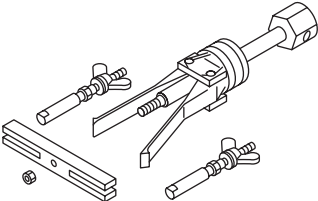
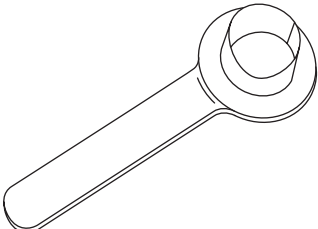
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-399780104	399780104	WEIGHT	Used for installing the front bearing cone and the companion flange.
 ST-498247001	498247001	MAGNET BASE	• Used for measuring backlash between side gear and pinion, and hypoid gear. • Used together with DIAL GAUGE (498247100).
 ST-498247100	498247100	DIAL GAUGE	• Used for measuring backlash between side gear and pinion, and hypoid gear. • Used together with MAGNET BASE (498247001).
 ST-398177700	398177700	INSTALLER	Used for installing the rear bearing cone.
 ST-398477703	398477703	DRIFT 2	Used for press-fitting bearing race (rear) of differential carrier.

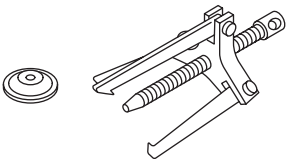
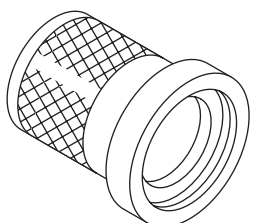
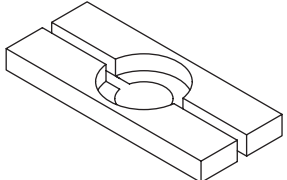
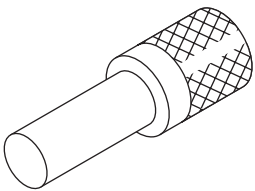
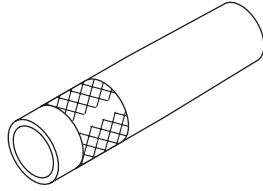
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398437700	398437700	DRIFT	Used for installing the side oil seal.
 ST-398517700	398517700	REPLACER	Used for removing rear bearing cone.
 ST-398487700	398487700	DRIFT	Used for press-fitting side bearing cone.
 ST-398527700	398527700	PULLER ASSY	Used for removing front oil seal.
 ST28099PA090	28099PA090	OIL SEAL PROTECTOR	• Used for installing the rear drive shaft to the rear differential. • Used for oil seal protection.

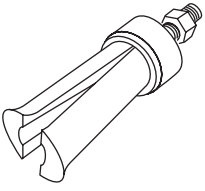
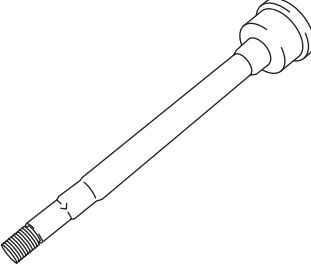
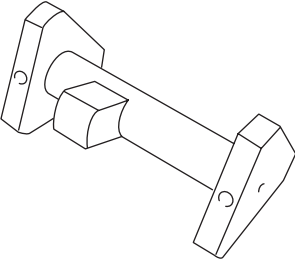
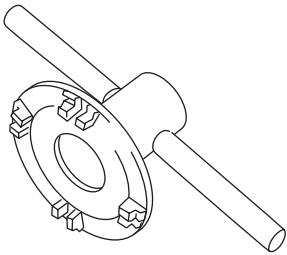
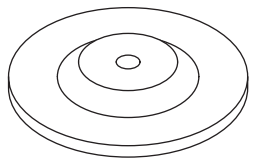
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-399703600	399703600	PULLER ASSY	Used for removing companion flange.
 ST-899874100	899874100	INSTALLER	Used for installing the companion flange.
 ST-498077000	498077000	REMOVER	Used for removing the differential side bearing cone.
 ST-899864100	899864100	REMOVER	Used for removing the side bearing cone.
 ST-499277200	499277200	INSTALLER	Used for installing the front bearing race.

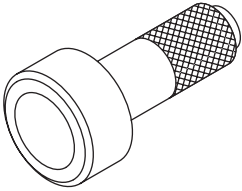
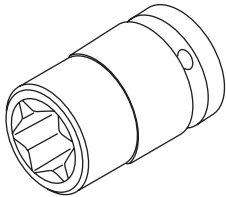
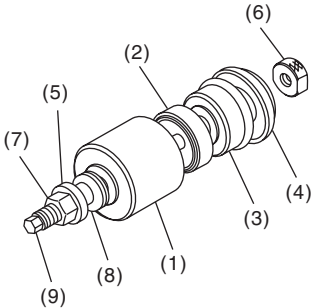
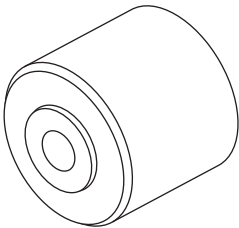
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18758AA000	18758AA000	PULLER	Used for removing the side bearing race.
 ST18678AA000	18678AA000	DUMMY SHAFT	Used for adjusting pinion height.
 ST18831AA010	18831AA010	DIFFERENTIAL CARRIER GAUGE	Used for adjusting pinion height.
 ST18630AA010	18630AA010	WRENCH COMPL RETAINER	Used for removing and installing the side retainer.
 ST-399520105	399520105	SEAT	- Used for removing the side bearing cone. - Used together with REMOVER (899864100).

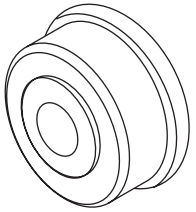
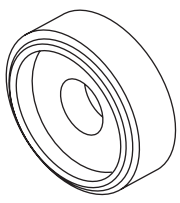
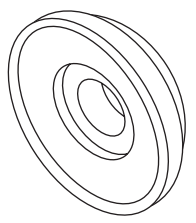
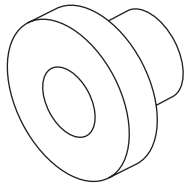
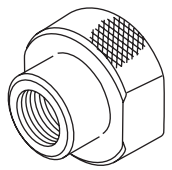
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398417700	398417700	DRIFT	Used for installing side bearing race.
 ST18270KA020	18270KA020	SOCKET (E20)	Used for removing and installing the hypoid driven gear.
 ST41399FG000	41399FG001	SPECIAL TOOL ASSY	• Used for removing and installing the rear differential mount bushing. • Use (1), (3), (5), (6), (7), (8) and (9) for removal. • Use (2), (4), (5), (6), (7), (8) and (9) for installation. (1) SPECIAL TOOL A (41399FG010) (2) SPECIAL TOOL B (41399FG020) (3) SPECIAL TOOL C (41399FG031) (4) SPECIAL TOOL D (41399FG041) (5) SPECIAL TOOL SLEEVE (41399FG050) (6) SPECIAL TOOL RING (41399FG061) (7) SPECIAL TOOL NUT (41399FG070) (8) SPECIAL TOOL BEARING (41399FG080) (9) SPECIAL TOOL SHAFT (41399FG091)
 ST41399FG010	41399FG010	SPECIAL TOOL A	• Used for removing the rear differential mount bushing. • For combination of tools for removal, refer to "SPECIAL TOOL ASSY (41399FG001)".

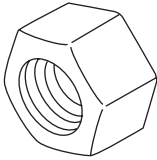
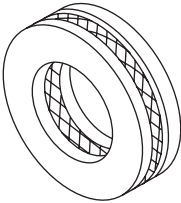
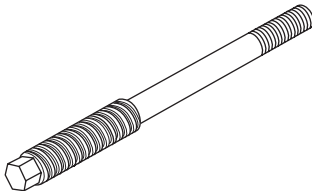
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST41399FG020	41399FG020	SPECIAL TOOL B	- Used for installing the rear differential mount bushing. - For combination of tools for installation, refer to "SPECIAL TOOL ASSY (41399FG001)".
 ST41399FG031	41399FG031	SPECIAL TOOL C	- Used for removing the rear differential mount bushing. - For combination of tools for removal, refer to "SPECIAL TOOL ASSY (41399FG001)".
 ST41399FG041	41399FG041	SPECIAL TOOL D	- Used for installing the rear differential mount bushing. - For combination of tools for installation, refer to "SPECIAL TOOL ASSY (41399FG001)".
 ST41399FG050	41399FG050	SPECIAL TOOL SLEEVE	- Used for removing and installing the rear differential mount bushing. - For combination of tools for removal and installation, refer to "SPECIAL TOOL ASSY (41399FG001)".
 ST41399FG061	41399FG061	SPECIAL TOOL RING	- Used for removing and installing the rear differential mount bushing. - For combination of tools for removal and installation, refer to "SPECIAL TOOL ASSY (41399FG001)".

General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST41399FG070	41399FG070	SPECIAL TOOL NUT	• Used for removing and installing the rear differential mount bushing. • For combination of tools for removal and installation, refer to "SPECIAL TOOL ASSY (41399FG001)".
 ST41399FG080	41399FG080	SPECIAL TOOL BEARING	• Used for removing and installing the rear differential mount bushing. • For combination of tools for removal and installation, refer to "SPECIAL TOOL ASSY (41399FG001)".
 ST41399FG091	41399FG091	SPECIAL TOOL SHAFT	• Used for removing and installing the rear differential mount bushing. • For combination of tools for removal and installation, refer to "SPECIAL TOOL ASSY (41399FG001)".

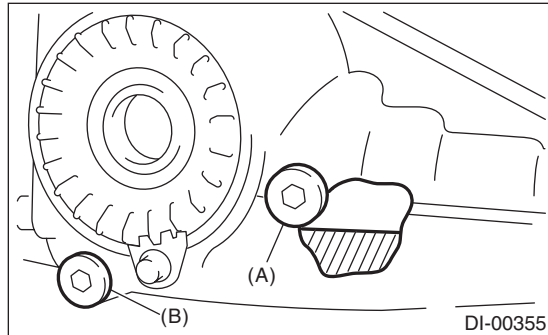
2. GENERAL TOOL

TOOL NAME	REMARKS
Transmission jack	Used for assembly/disassembly of the rear differential.
Puller	Used for removing the side retainer.
Thickness gauge	Used for measuring clearance.
Hexagon wrench	Used for installing and removing the filler and drain plug.
Tire lever	Used for removing the rear drive shaft.
Angle gauge	Used for installing the hypoid driven gear.

2. Differential Gear Oil

A: INSPECTION

- 1) Lift up the vehicle.
- 2) Remove the filler plug, and check the differential gear oil. Replace the gear oil if it is contaminated, deteriorated or cloudy. <Ref. to DI-17, REPLACEMENT, Differential Gear Oil.>
- 3) Check that the gear oil level is within –5 mm (–0.2 in) from the bottom of the filler plug hole. If the level is low, make sure that there is no oil leakage and refill up to the bottom of filler plug hole.



- (A) Filler plug
(B) Oil drain plug

- 4) Install the filler plug.

NOTE:

Use a new gasket.

Tightening torque:

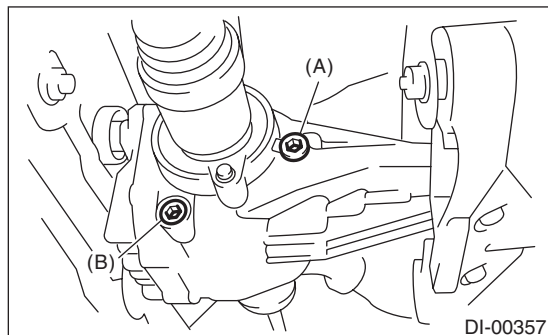
50 N·m (5.1 kgf-m, 36.9 ft-lb)

B: REPLACEMENT

CAUTION:

- Gear oil is extremely hot immediately after driving. Be wary of receiving burns.
- Be careful not to spill the differential gear oil on exhaust pipe. If gear oil is spilled, wipe it off completely.

- 1) Lift up the vehicle.
- 2) Remove the oil drain plug and filler plug, and drain the gear oil.



- (A) Filler plug
(B) Oil drain plug

- 3) Tighten the oil drain plug.

NOTE:

Use a new gasket.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

- 4) Fill the differential carrier with gear oil to the bottom of filler plug.

NOTE:

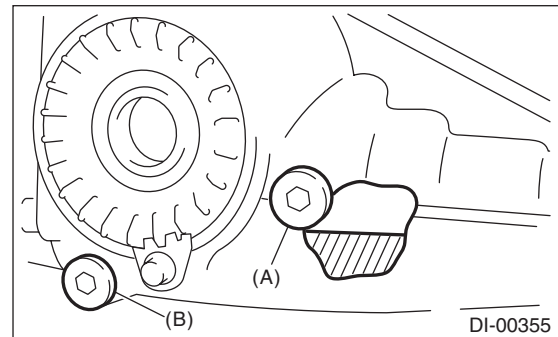
Carefully refill oil while watching the level. Excessive or insufficient oil must be avoided.

Recommended gear oil:

<Ref. to DI-2, SPECIFICATION, General Description.>

Oil capacity:

0.8 L (0.8 US qt, 0.7 Imp qt)



- (A) Filler plug
(B) Oil drain plug

- 5) Install the filler plug.

NOTE:

Use a new gasket.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

3. Front Differential Assembly

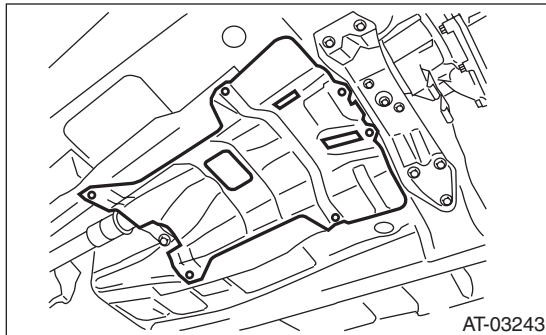
A: NOTE

Regarding the front differential, refer to the “5AT” section. <Ref. to 5AT-87, Front Differential Assembly.>

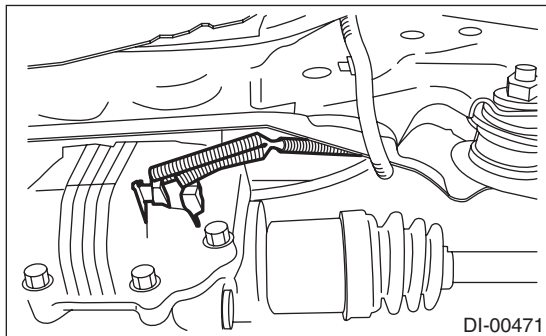
4. Rear Differential (VA-type)

A: REMOVAL

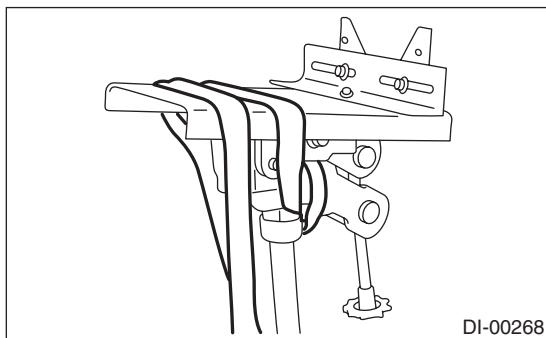
- 1) Disconnect the ground cable from battery.
- 2) Shift the select lever to neutral.
- 3) Release the parking brake.
- 4) Loosen the wheel nuts.
- 5) Lift up the vehicle.
- 6) Remove the wheels.
- 7) Remove the rear exhaust pipe and muffler.
<Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 8) Remove the heat shield cover.



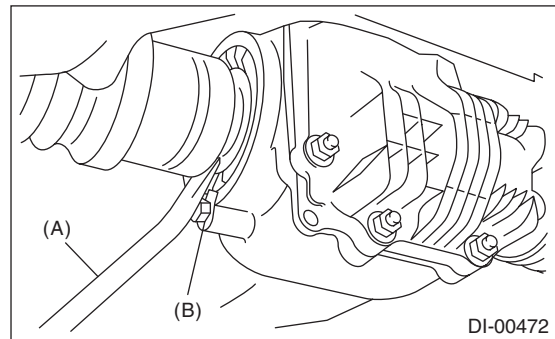
- 9) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 10) Remove the connector from the rear differential oil temperature switch.



- 11) Prepare the transmission jack and band.

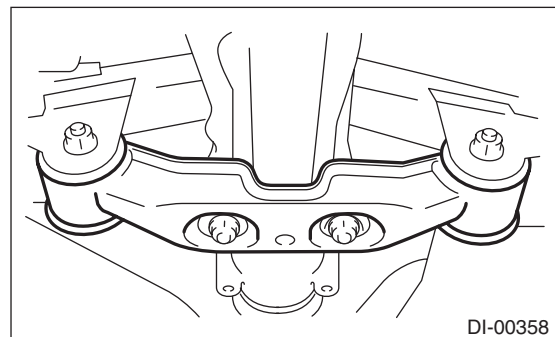


- 12) Remove the DOJ of rear drive shaft from rear differential.

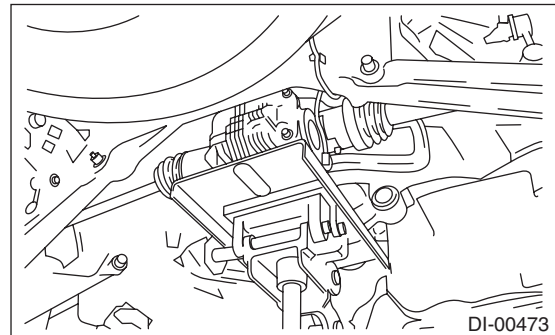


- (A) Tire lever
(B) Bolt

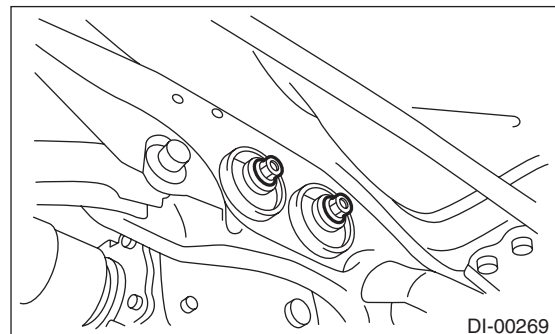
- 13) Remove the nuts which hold the rear differential front member.



- 14) Support the rear differential with the transmission jack.



- 15) Loosen the self-lock nuts which hold the rear differential to the rear sub frame assembly.



- 16) Remove the rear differential front member.
- 17) Secure the rear differential using band.

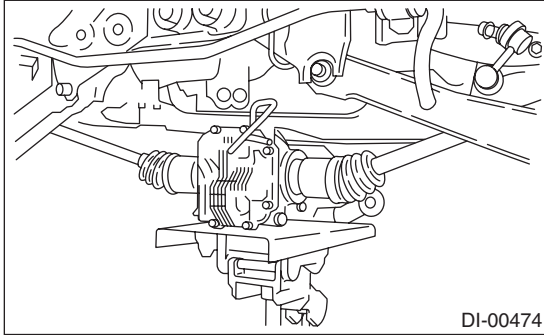
Rear Differential (VA-type)

DIFFERENTIALS

- 18) Remove the self-lock nuts which hold the rear differential to the rear sub frame assembly.
- 19) Remove the air breather hose from the rear sub frame assembly.
- 20) Remove the rear differential stud bolt from rear differential mount bushing.

NOTE:

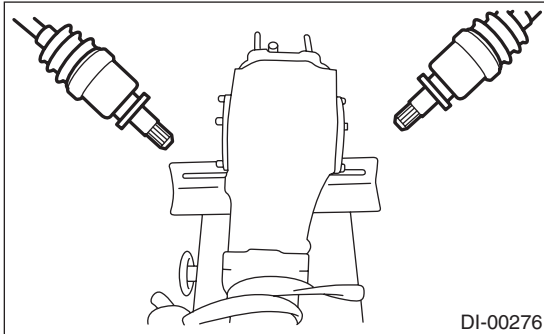
When removing the stud bolt, carefully adjust the angle and location of transmission jack and jack stand, if necessary.



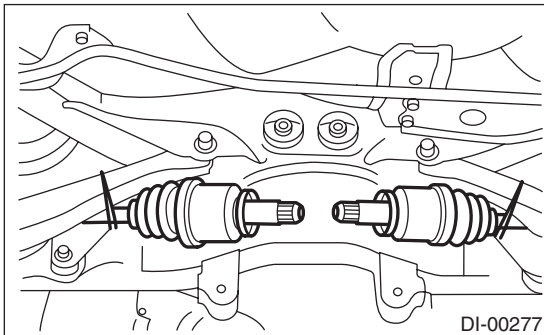
- 21) Pull out the axle shaft from rear differential.

NOTE:

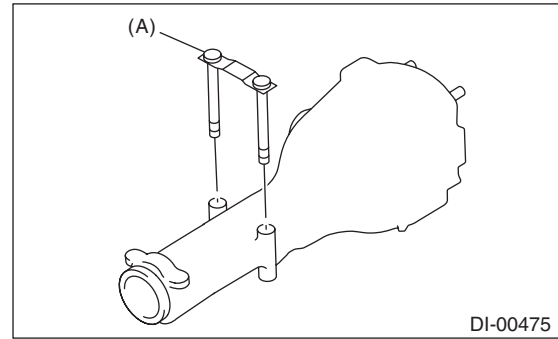
If it is difficult to remove the axle shaft from rear differential, remove it using tire lever.



- 22) Lower the transmission jack.
- 23) Secure the rear drive shaft to lateral link using wire.



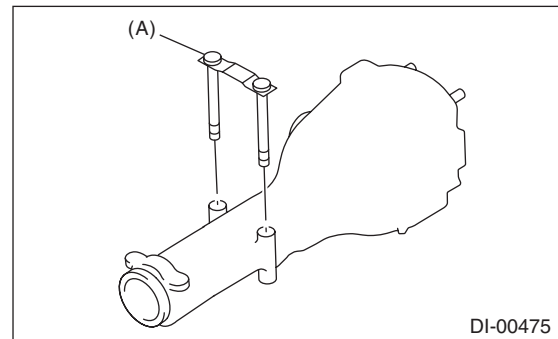
- 24) Remove the rear differential member plate from the rear differential.



(A) Rear differential member plate

B: INSTALLATION

- 1) Insert the rear differential member plate into rear differential.



(A) Rear differential member plate

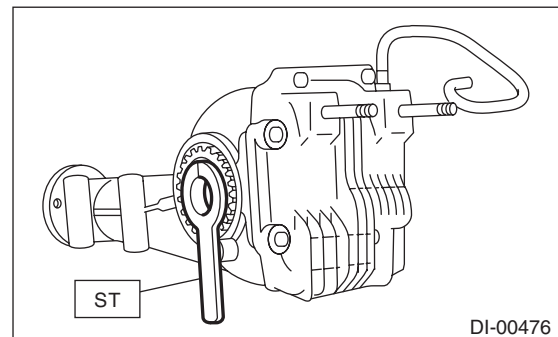
- 2) Set the rear differential to transmission jack.

NOTE:

Secure the rear differential to transmission jack using band.

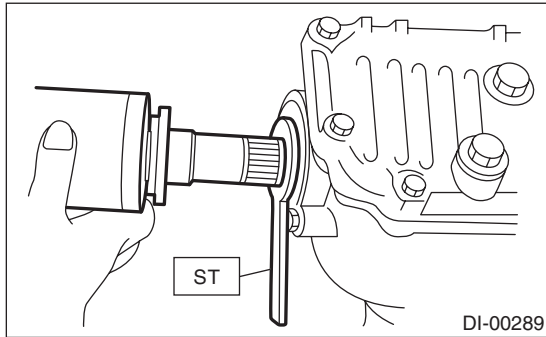
- 3) Attach the ST to rear differential.

ST 28099PA090 OIL SEAL PROTECTOR



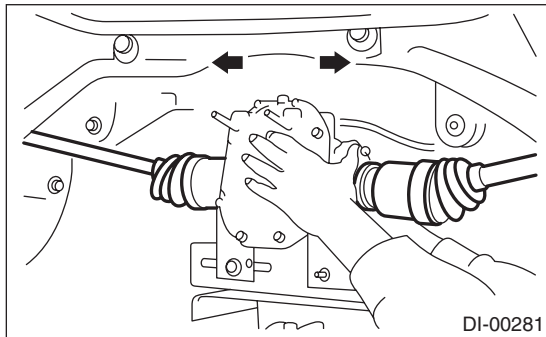
4) Insert the spline shaft until the spline portion comes inside the side oil seal.

ST 28099PA090 OIL SEAL PROTECTOR

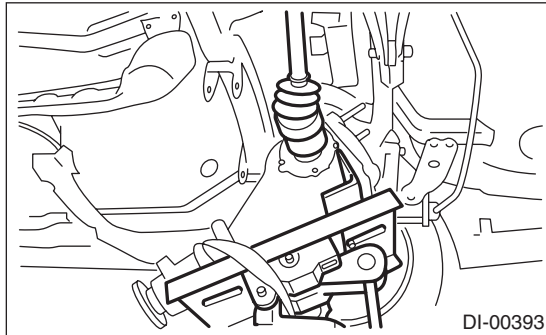


5) Remove ST from rear differential.

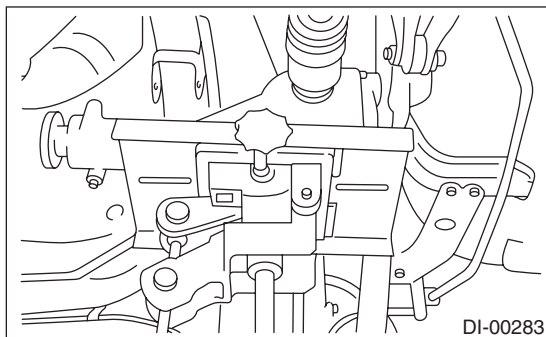
6) Push the rear differential to insert the axle shaft into rear differential.



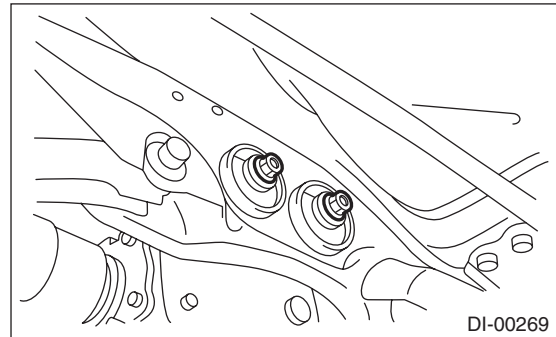
7) Adjust the transmission jack, if necessary, and insert the rear differential stud bolt into the rear differential mount bushing properly.



8) After inserting the rear differential stud bolt into the rear differential mount bushing, lift up the transmission jack and align the rear differential to its attachment position.



9) Tighten a new self-locking nut temporarily to the rear differential stud bolt.



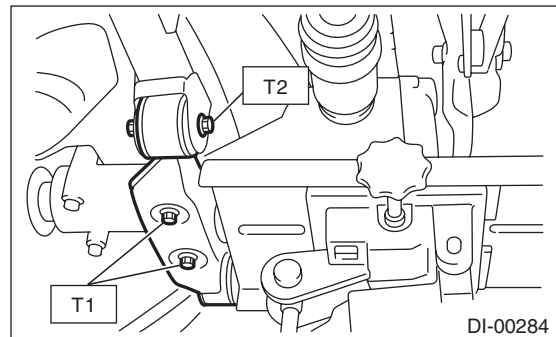
10) Remove the band from rear differential. Lift up the rear differential until the rear differential is separated from the transmission jack.

11) Install the rear differential front member with a new self-locking nut.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

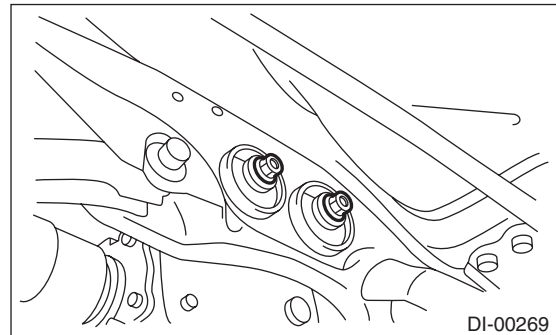
T2: 110 N·m (11.2 kgf-m, 81.1 ft-lb)



12) Tighten the self-locking nut.

Tightening torque:

70 N·m (7.1 kgf-m, 51.6 ft-lb)



13) Lower the transmission jack.

14) Install the air breather hose to the rear sub frame assembly.

15) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

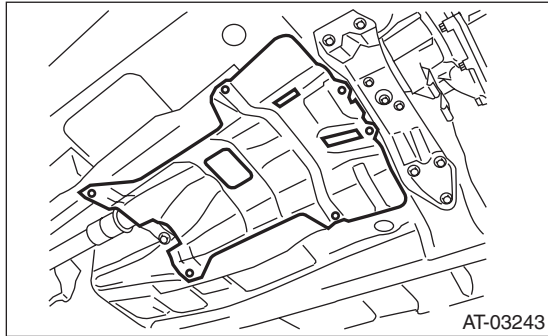
Rear Differential (VA-type)

DIFFERENTIALS

16) Install the heat shield cover.

Tightening torque:

18 N·m (1.8 kgf-m, 33.3 ft-lb)



17) Install the rear exhaust pipe and muffler. <Ref. to EX(H6DO)-7, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, INSTALLATION, Muffler.>

18) Install the wheel. <Ref. to WT-5, INSTALLATION, Tire and Wheel.>

C: DISASSEMBLY

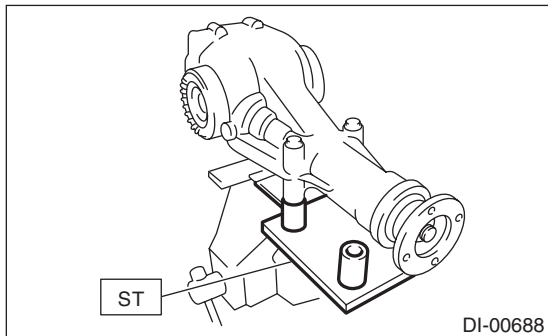
To detect the real cause of trouble, inspect the following items before disassembling.

- Tooth contact and backlash between hypoid driven gear and drive pinion

1) Remove the air breather hose.

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

ST 398217700 ATTACHMENT SET



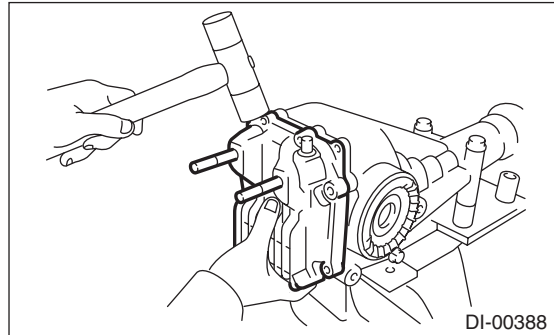
3) Remove the drain plug and filler plug, and drain the gear oil.

4) Remove the rear differential oil temperature switch.

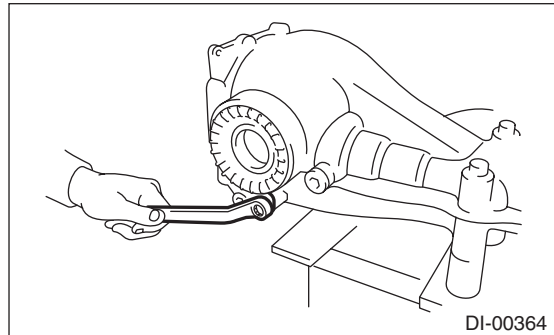
5) Remove the rear cover and ground stay by removing the retaining bolts.

NOTE:

Remove it by tapping with a plastic hammer.



6) Remove the lock plate RH and LH.

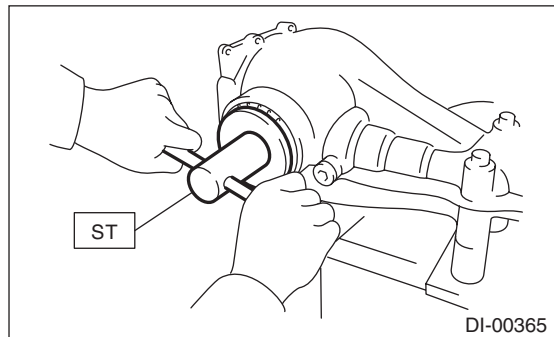


7) Remove the side retainer RH and LH with ST.

NOTE:

When keeping the retainers aside, use labels etc. to avoid confusing the left and right.

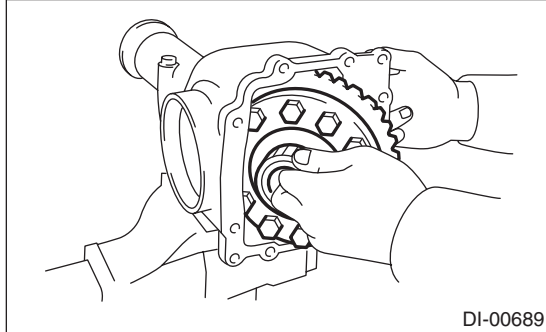
ST 18630AA010 WRENCH COMPL RETAINER



8) Pull out the differential case assembly from differential carrier.

NOTE:

Be careful not to hit the teeth of hypoid driven gear against the differential carrier.

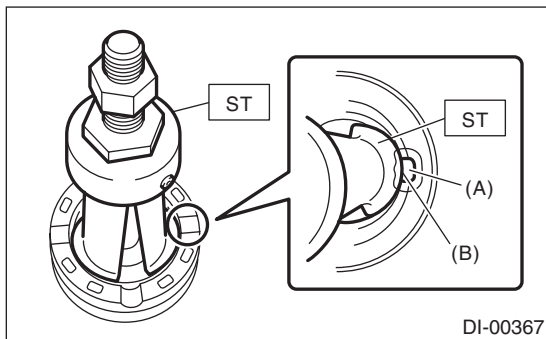


9) Remove the bearing race from side retainer RH and LH with ST and the press.

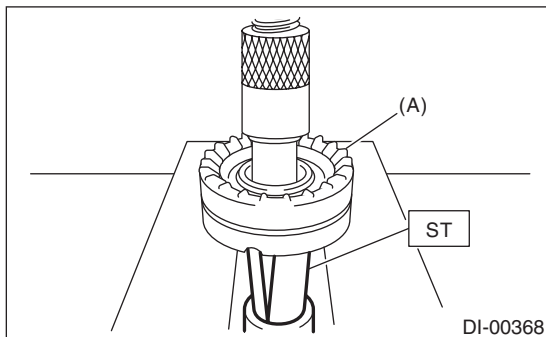
NOTE:

- Be sure to turn the bolt of the ST by hand.
- Set the puller so that its claws catch the groove of side retainer.

ST 18758AA000 PULLER



- (A) Groove
(B) Claw

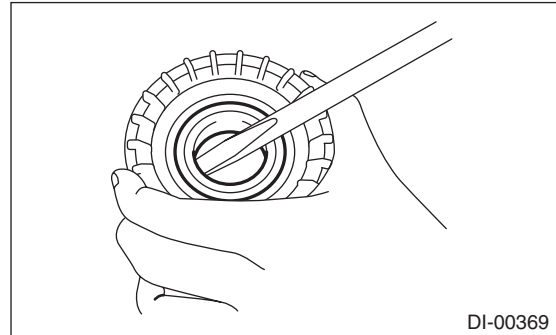


- (A) Side retainer

10) Remove the oil seal from the side retainer RH and LH.

NOTE:

Perform this operation only when changing oil seal.



11) Remove the O-ring.

12) Extract the bearing cone with ST1, ST2 and ST3.

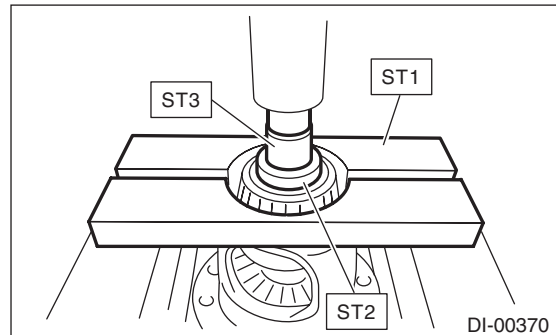
NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Never mix up the RH and LH bearing races and cones.

ST1 498077000 REMOVER

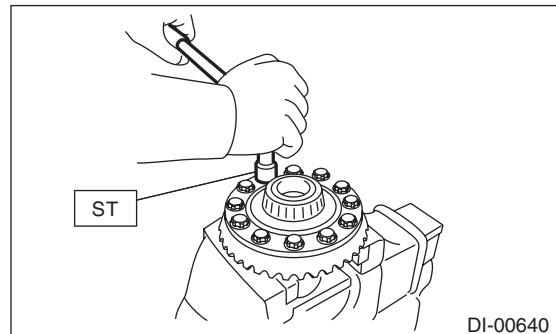
ST2 399520105 SEAT

ST3 899864100 REMOVER



13) Using the ST, loosen the hypoid driven gear bolt and remove the hypoid driven gear.

ST 18270KA020 SOCKET (E20)

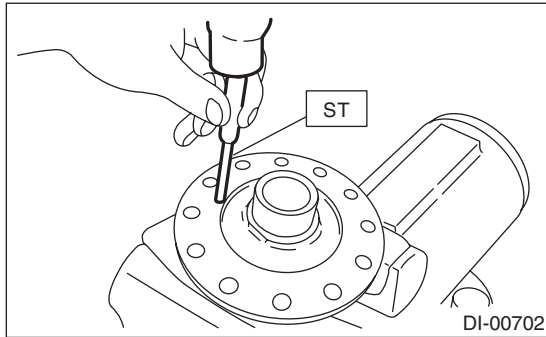


Rear Differential (VA-type)

DIFFERENTIALS

14) Remove the spring pin from hypoid driven gear side using ST.

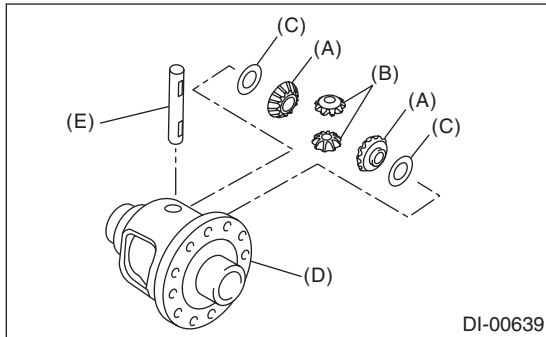
ST 899904100 STRAIGHT PIN REMOVER



15) Draw out the pinion mate shaft and remove pinion mate gears, side gears and side gear thrust washers.

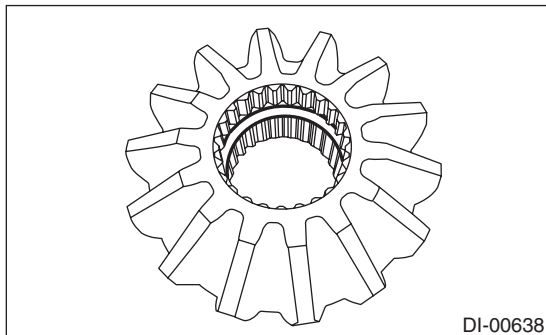
NOTE:

The gears and washers should be marked with RH or LH, front or rear, or kept separately.



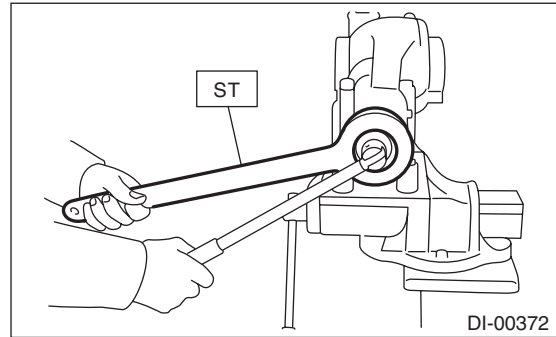
- (A) Side gear
- (B) Pinion mate gear
- (C) Side gear thrust washer
- (D) Differential case
- (E) Pinion mate shaft

16) Remove the circlip from the side gear.

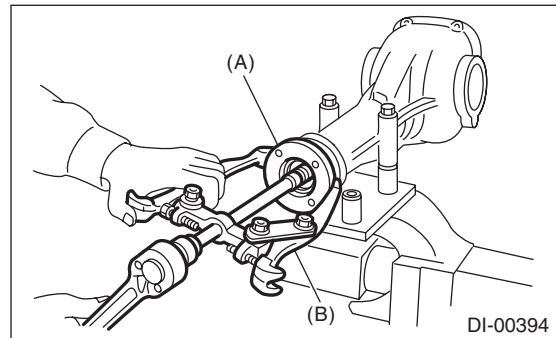


17) Remove the self-locking nut while securing the companion flange with ST.

ST 498427200 FLANGE WRENCH



18) Extract the companion flange using a puller.



- (A) Companion flange
- (B) Puller

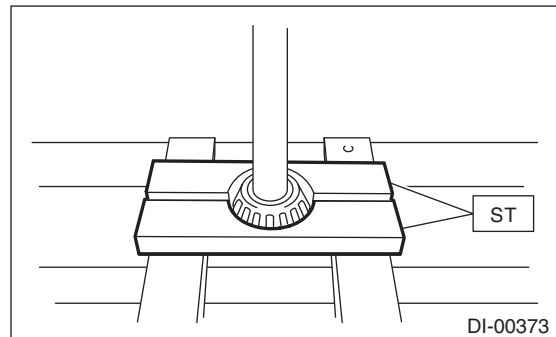
19) Remove the drive pinion shaft.

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

NOTE:

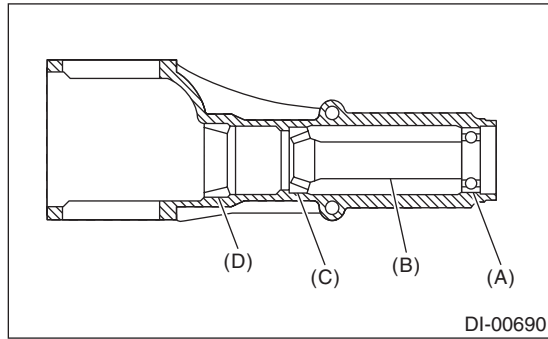
Place the replacer so that its center-recessed side faces the bearing cone.

ST 398517700 REPLACER



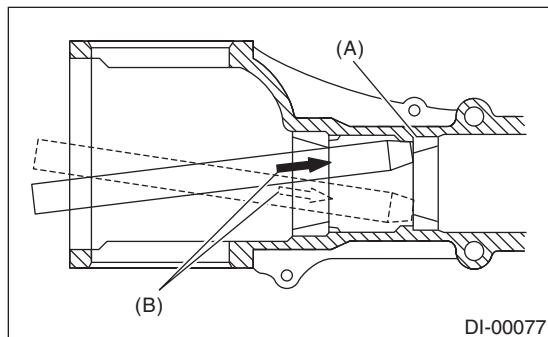
21) Remove the front oil seal from differential carrier using screwdriver.

22) Remove the pilot bearing, front bearing cone and spacer.



- (A) Pilot bearing
- (B) Spacer
- (C) Front bearing
- (D) Rear bearing race

23) When replacing the bearings, tap out the front bearing race and rear bearing race in this order using a brass bar to remove them.

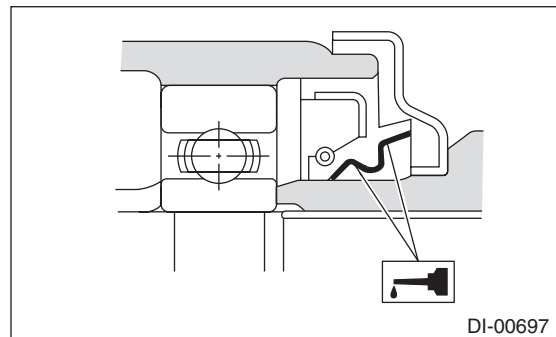


- (A) 2 cutout portions along diagonal lines
- (B) Tap alternately with brass bar.

D: ASSEMBLY

NOTE:

- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use new gaskets and O-rings.
- Keep the shims and washers in order, so that they are not improperly installed.
- 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.
- Attach tags not to mix up the RH and LH bearing races.
- Replace the oil seal and O-ring with a new part at every disassembly.
- Be careful not to mix up the rear differential side oil seal RH and LH.
- Apply differential gear oil to the lips when installing the oil seal.



1) Adjusting preload for front and rear bearings

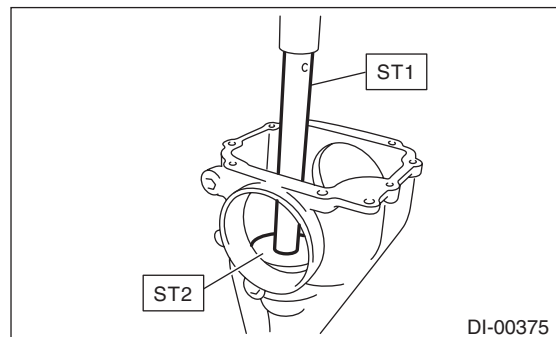
NOTE:

Adjust the bearing preload between front and rear bearings with preload adjusting spacer and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

- (1) Install the rear bearing race into the differential carrier using ST1 and ST2.

ST1 398477701 HANDLE

ST2 398477703 DRIFT 2



Rear Differential (VA-type)

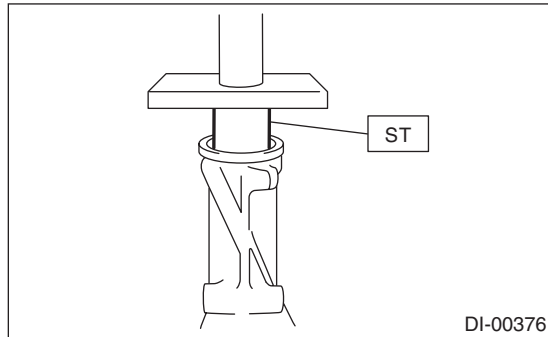
DIFFERENTIALS

(2) Using the ST, press-fit the front bearing race to the differential carrier.

NOTE:

Use a new front bearing race.

ST 499277200 INSTALLER



(3) Insert the front bearing cone.

NOTE:

Use new front bearing cone.

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

NOTE:

If tooth contact (drive pinion and hypoid driven gear) is normal in the inspection before disassembling, verify that the washer is not deformed, and then reuse the used washer.

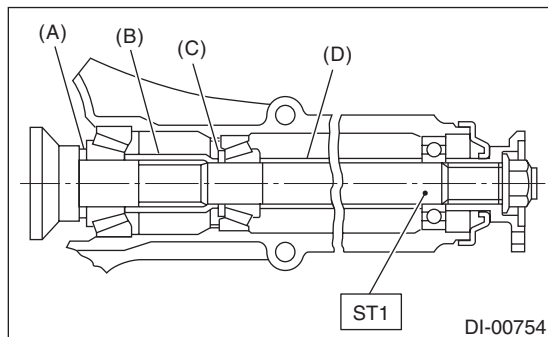
(5) Insert ST1 into the differential carrier with the pinion height adjusting washer and rear bearing cone fitted onto it.

(6) Install the preload adjusting spacer, washer, front bearing cone, spacer, pilot bearing, companion flange, and self-locking nut.

NOTE:

Use a new pilot bearing.

ST1 18678AA000 DUMMY SHAFT



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

(7) Turn the ST1 by hand to smooth the bearing, and tighten the self-locking nut while measuring the initial load or initial torque with a spring scale or torque wrench. Select the preload adjusting washer and spacer so that the specified preload is obtained when nut is tightened to the specified torque.

NOTE:

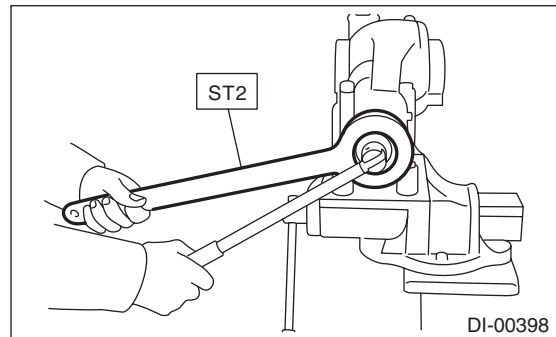
- Use a new self-locking nut.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock companion flange with ST2 as shown in the figure.
- Measure the preload in direction of tangent to the flange.

ST1 18678AA000 DUMMY SHAFT

ST2 498427200 FLANGE WRENCH

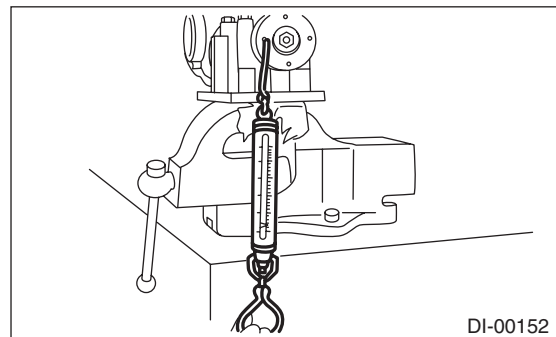
Tightening torque:

191 N·m (19.5 kgf-m, 140.9 ft-lb)



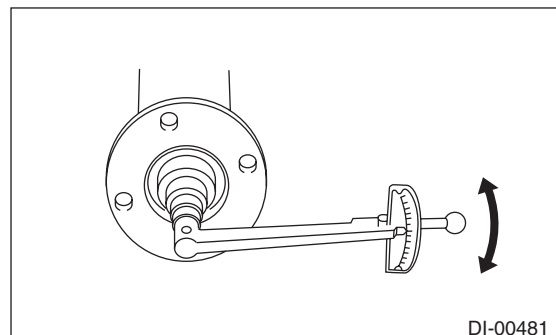
Initial load:

12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lbf)



Initial torque:

0.48 — 1.22 N·m (0.05 — 0.12 kgf-m, 0.35 — 0.90 ft-lb)



Preload adjusting washer	
Part No.	Thickness mm (in)
38336AA430	1.500 (0.0591)
38336AA440	1.513 (0.0596)
38336AA450	1.525 (0.0600)
38336AA460	1.538 (0.0606)
38336AA470	1.550 (0.0610)
38336AA480	1.563 (0.0615)
38336AA490	1.575 (0.0620)
38336AA500	1.588 (0.0625)
38336AA510	1.600 (0.0630)
38336AA520	1.613 (0.0635)
38336AA530	1.625 (0.0640)
38336AA540	1.638 (0.0645)
38336AA550	1.650 (0.0650)
38336AA560	1.663 (0.0655)
38336AA570	1.675 (0.0659)
38336AA580	1.688 (0.0665)
38336AA590	1.700 (0.0669)
38336AA600	1.713 (0.0674)
38336AA610	1.725 (0.0679)
38336AA620	1.738 (0.0684)
38336AA630	1.750 (0.0689)
38336AA640	1.763 (0.0694)
38336AA650	1.775 (0.0699)

Preload adjusting spacer	
Part No.	Length mm (in)
31454AA250	51.05 (2.010)
31454AA260	51.25 (2.018)
31454AA270	51.35 (2.022)
31454AA280	51.45 (2.026)
31454AA290	51.55 (2.030)
31454AA300	51.65 (2.033)
31454AA310	51.75 (2.037)
31454AA320	51.85 (2.041)
31454AA330	52.05 (2.049)

2) Adjusting drive pinion height:
Adjust the drive pinion height with pinion height adjusting washer installed between the rear bearing cone and the back of pinion gear.

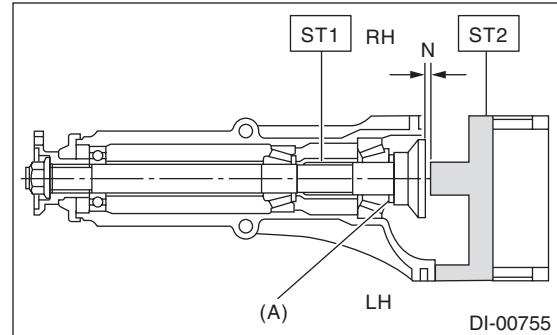
(1) Attach the ST2.

NOTE:

At this time, install a provisionally selected or previously used pinion height adjusting washer.

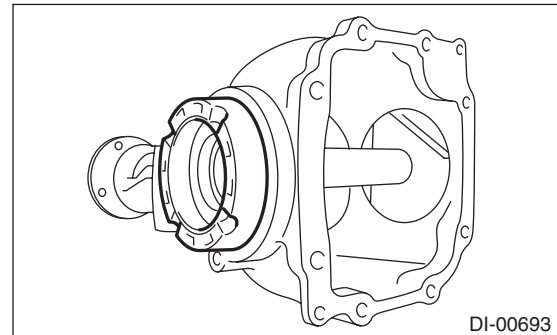
ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(A) Pinion height adjusting washer

(2) Install the side retainer LH to the left side of the differential carrier in reverse direction.



Rear Differential (VA-type)

DIFFERENTIALS

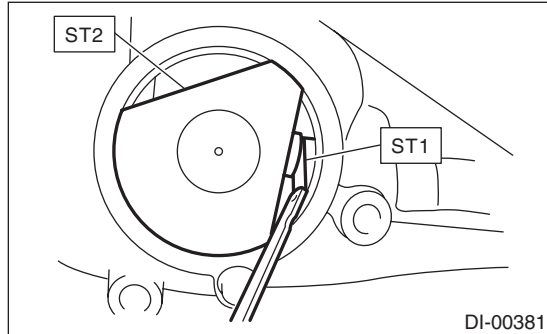
- (3) Measure the clearance “N” between the end of ST2 and the end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the differential carrier and ST2.

ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



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

NOTE:

Adjust it using the 1 — 3 washers.

$$T = T_o + N - 0.05 \text{ mm (0.0020 in)}$$

T	Thickness of pinion height adjusting washer mm (in)	
T _o	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
Memo:		

(Example of calculation)

T_o = 0.15 mm (0.0059 in)

N = 0.1 mm (0.0039 in)

T = 0.15 mm (0.0059 in) + 0.1 mm (0.0039 in) – 0.05 mm (0.0020 in) = 0.2 mm (0.0079 in)

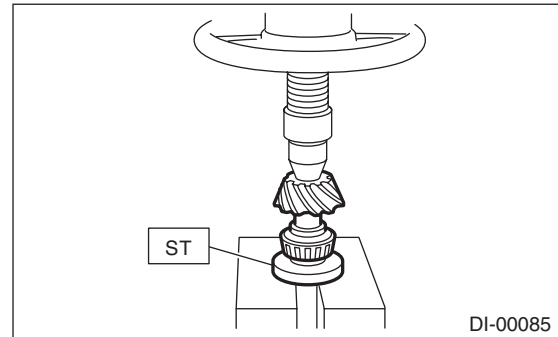
Result: Thickness = 0.2 mm (0.0079 in)

Therefore use part number 32295AA370.

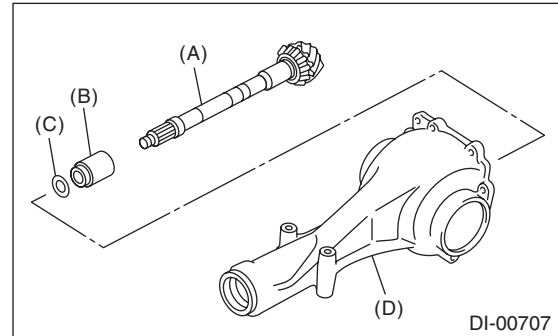
Pinion height adjusting washer	
Part No.	Thickness mm (in)
32295AA350	0.150 (0.0059)
32295AA360	0.175 (0.0069)
32295AA370	0.200 (0.0079)
32295AA380	0.225 (0.0089)
32295AA390	0.250 (0.0098)
32295AA400	0.275 (0.0108)

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

ST 398177700 INSTALLER



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



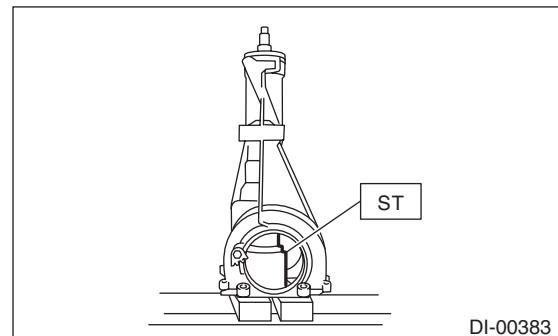
- (A) Drive pinion
(B) Preload adjusting spacer
(C) Preload adjusting washer
(D) Differential carrier

- 5) Set ST and differential carrier to the press and install the front bearing cone.

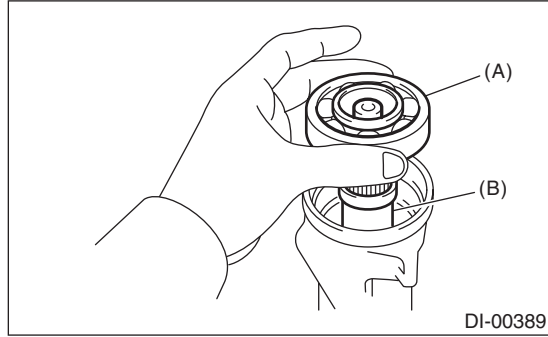
ST 399780104 WEIGHT

NOTE:

Set the carrier to the press until the companion flange is installed.



6) Insert the spacer, then install the pilot bearing.



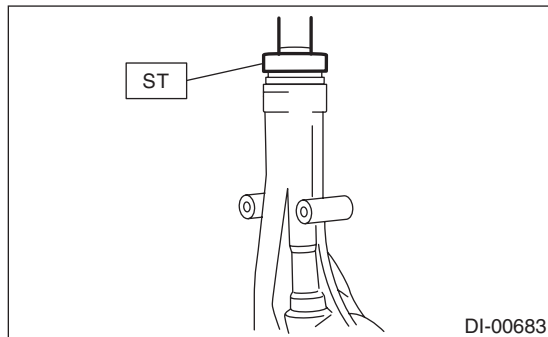
- (A) Pilot bearing
(B) Spacer

7) Using the ST, install the oil seal.

NOTE:

- Use a new oil seal.
- Press-fit until the oil seal end comes 1 mm (0.04 in) inward from end of carrier.
- Apply differential gear oil to the oil seal lips.

ST 499277200 INSTALLER

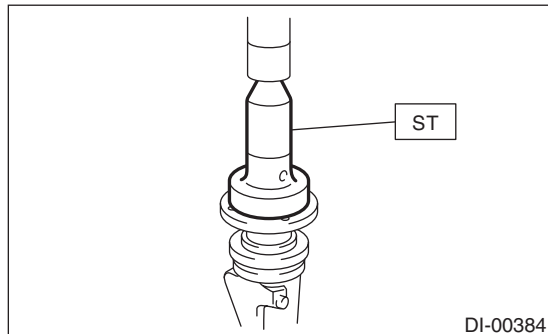


8) Press-fit the companion flange with ST.

NOTE:

Be careful not to damage the bearing.

ST 899874100 INSTALLER



9) Apply seal material on the drive pinion shaft thread and new self-locking nut seat.

Seal material:

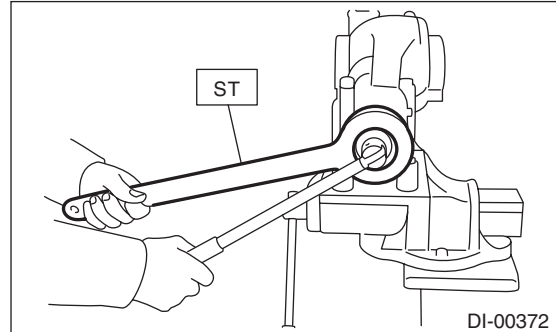
THREE BOND 1324 (Part No. 004403042) or equivalent

10) Install the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH

Tightening torque:

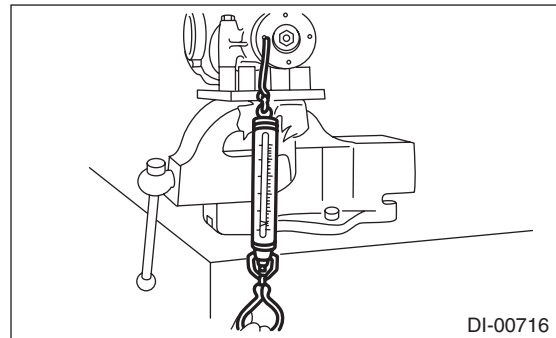
191 N·m (19.5 kgf-m, 140.9 ft-lb)



11) Measure the initial torque and initial load.

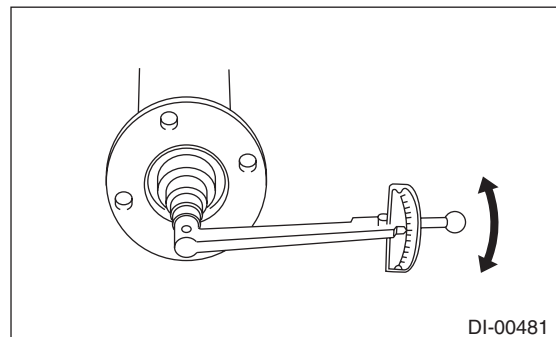
Initial load:

12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lbf)



Initial torque:

0.48 — 1.22 N·m (0.05 — 0.12 kgf-m, 0.35 — 0.90 ft-lb)

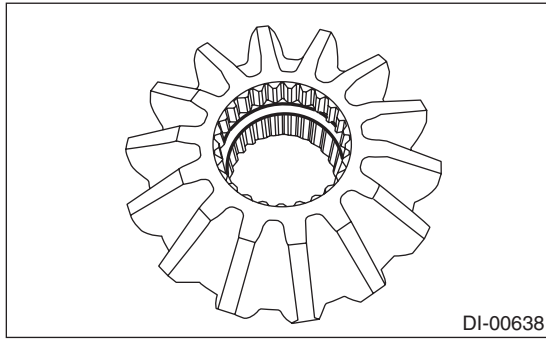


Rear Differential (VA-type)

DIFFERENTIALS

12) Assembling differential case

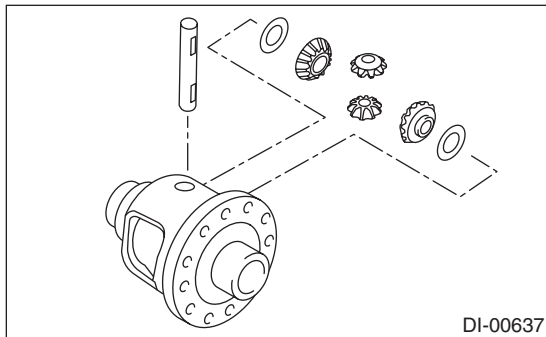
(1) Attach the circlip to the side gear.



(2) Install the side gears and pinion mate gears, with their side gear thrust washers and pinion mate shaft, into the differential case.

NOTE:

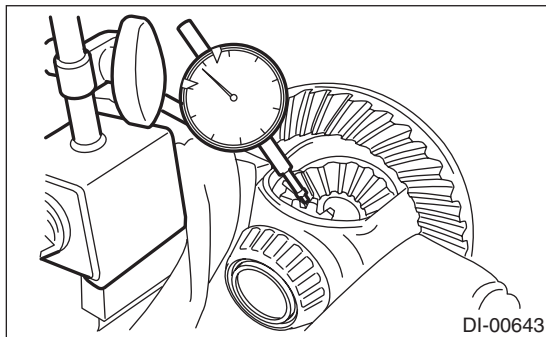
- Apply gear oil on both sides of the washer and on the side gear shaft before installing.
- Insert the pinion mate shaft into the differential case by aligning the pin holes.



(3) Measure the side gear backlash.

Side gear backlash:

0.13 — 0.18 mm (0.005 — 0.007 in)



(4) Adjust the side gear backlash by selecting side gear thrust washer.

Side gear thrust washer	
Part No.	Thickness mm (in)
803138021	0.950 (0.0374)
803138022	1.000 (0.0394)
803135023	1.050 (0.0413)

(5) Check the condition of rotation after applying oil to the gear tooth surfaces and washer surfaces.

(6) Drive the spring pin into the differential case.

NOTE:

Use new spring pin.

13) Install the hypoid driven gear to differential case.

NOTE:

- Set a cushioning such as wooden block, aluminum plate or shop cloth between vise and differential case if the side gear comes into contact with vise.
- Before installing bolts, apply seal material to bolt threads.

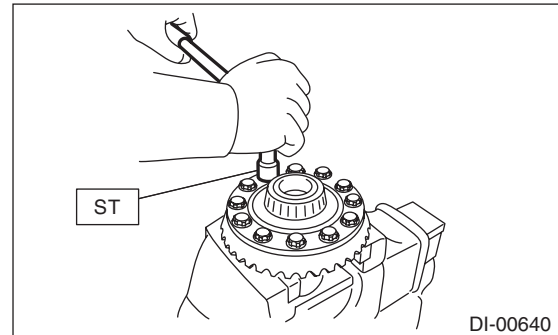
Seal material:

THREE BOND 1324 (Part No. 004403042) or equivalent

- Tighten opposing bolts in order.
(1) Tighten the hypoid driven gear mounting bolts to the specified torque using the ST.
ST 18270KA020 SOCKET (E20)

Tightening torque:

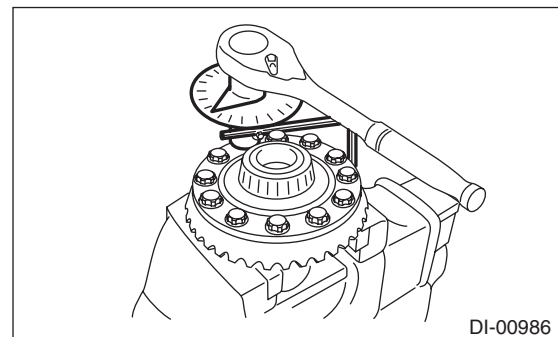
20 N·m (2.0 kgf-m, 14.8 ft-lb)



(2) While checking the tightening angle with the angle gauge, further tighten the hypoid driven gear mounting bolts.

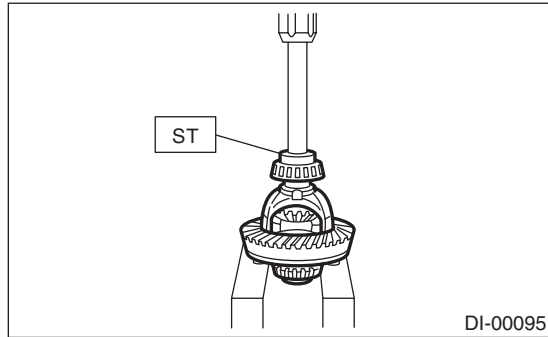
Tightening angle:

33° ± 2°



14) Using the ST, press-fit the side bearing to the differential case.

ST 398487700 DRIFT



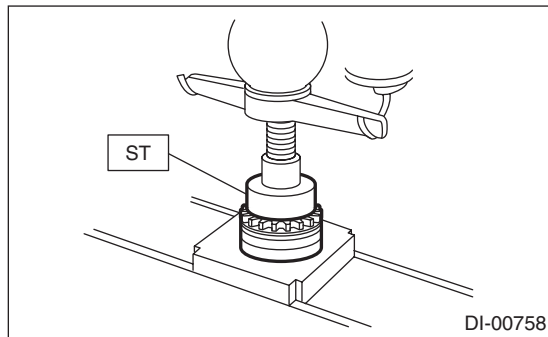
15) Assemble the side retainer.

(1) Install the oil seal into side retainer RH and LH.

NOTE:

- Use a new oil seal.
- Apply differential gear oil to the oil seal lip.

ST 398437700 DRIFT

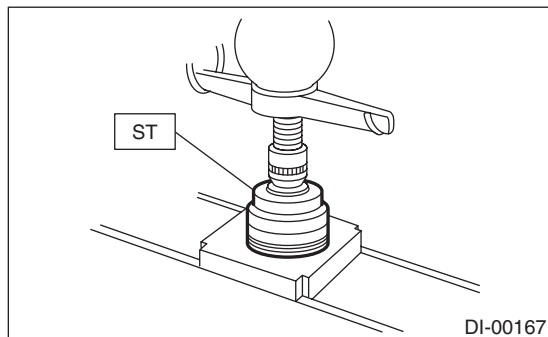


(2) Install the bearing race into side retainer RH and LH.

CAUTION:

Make sure that the bearing outer races and cones are properly assembled.

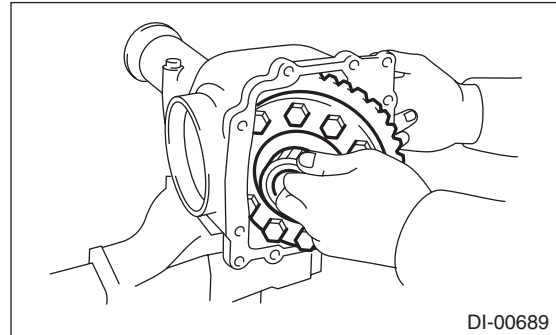
ST 398417700 DRIFT



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

NOTE:

Be careful not to hit the teeth of hypoid driven gear against the differential carrier.

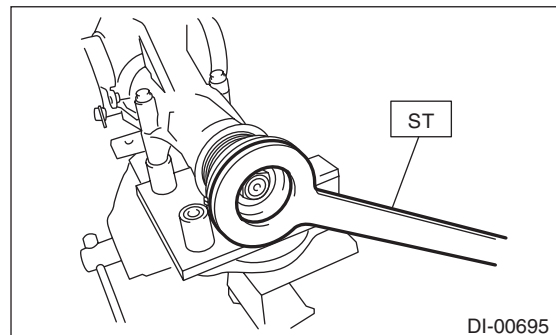


(4) Temporarily tighten the side retainers RH and LH in differential carrier to install.

16) Perform the backlash adjustment between the hypoid driven gear and drive pinion, and side bearing preload adjustment.

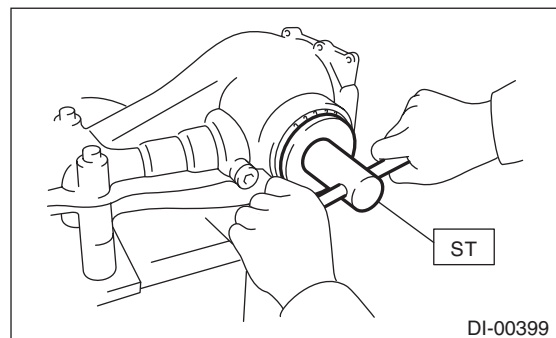
(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Using the ST, tighten side retainer RH, and then tighten side retainer LH until there is no backlash.

ST 18630AA010 WRENCH COMPL RETAINER



Rear Differential (VA-type)

DIFFERENTIALS

- (3) Back off the side retainer LH by approx. 1 and 1/2 teeth, and tighten the side retainer RH by approx. 2 teeth [amount that the side retainer LH is turned back (approx. 1 and 1/2 teeth) + approx. 1/2 teeth].

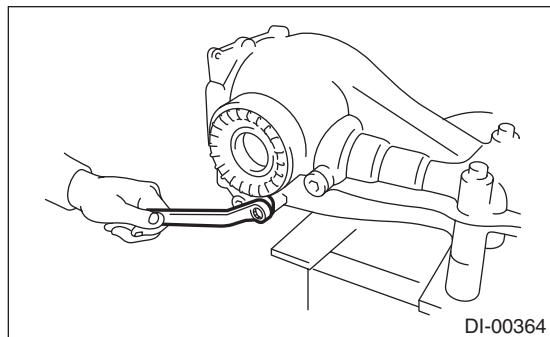
NOTE:

Difference between [amount that the side retainer LH is turned back (approx. 1 and 1/2 teeth)] and [amount that the side retainer RH is tightened (approx. 2 teeth)] gives preload.

- (4) Temporarily attach the lock plate.

NOTE:

Turn over the lock plate to shift the holder by 1/2 teeth.



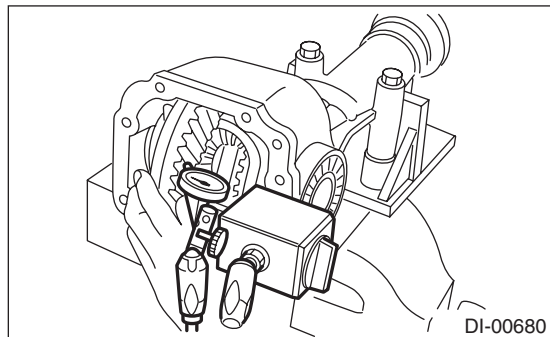
- (5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

NOTE:

If measured value of backlash is not within the specified range, repeat the procedures for the backlash adjustment between hypoid driven gear and drive pinion, and the differential side bearing preload adjustment.

Backlash:

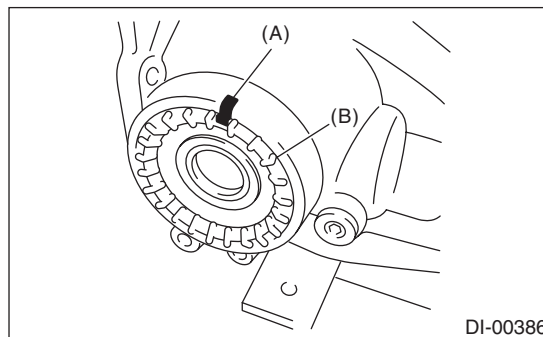
0.10 — 0.15 mm (0.004 — 0.006 in)



- 17) Put alignment marks on both the differential carrier and side retainer. Remove the side retainers one side at a time. After installing an O-ring and applying differential gear oil to the threaded portion, restore them to the original position.

NOTE:

Use new O-rings.



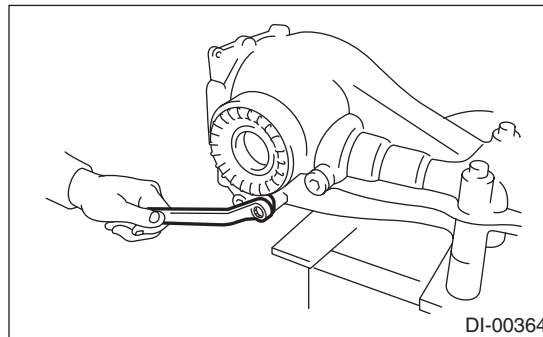
(A) Alignment mark

(B) Side retainer

- 18) Install the lock plate, and tighten the bolts to the specified torque.

Tightening torque:

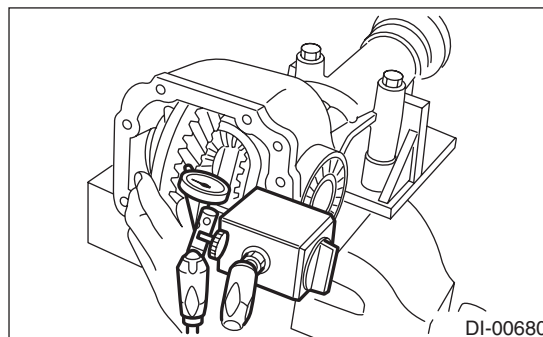
25 N·m (2.5 kgf-m, 18.4 ft-lb)



- 19) Recheck the hypoid driven gear to pinion backlash.

Backlash:

0.10 — 0.15 mm (0.004 — 0.006 in)



20) Checking and adjusting the tooth contact of hypoid driven gear

(1) Apply lead-free red dye evenly on the both sides of three to four teeth of the hypoid driven gear. Check the contact pattern after rotating the hypoid driven gear several revolutions back and forth until a definite contact pattern appears on the hypoid driven gear.

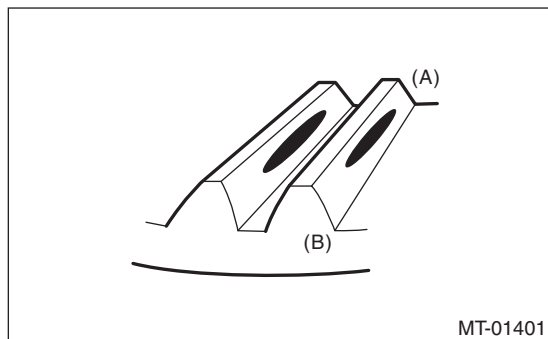
(2) When the contact pattern is not correct, re-adjust.

NOTE:

Be sure to wipe off the lead-free red dye completely after the adjustment is completed.

- Correct tooth contact

Check item: Tooth contact pattern is slightly shifted toward toe side under no-load rotation. (When driving, it moves towards the heel side.)

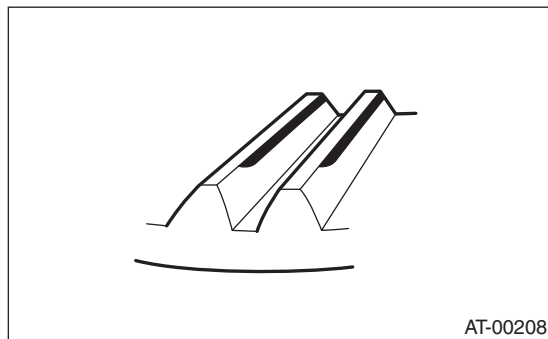


- (A) Toe side
- (B) Heel side

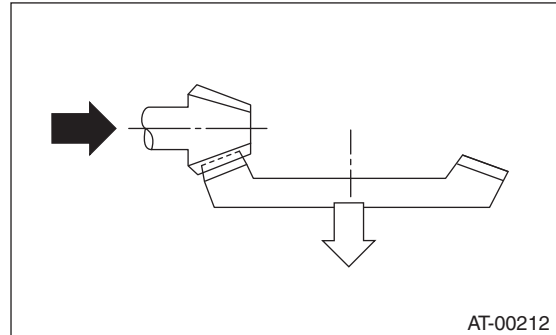
- Face contact

Check item: Backlash is too large.

Contact pattern



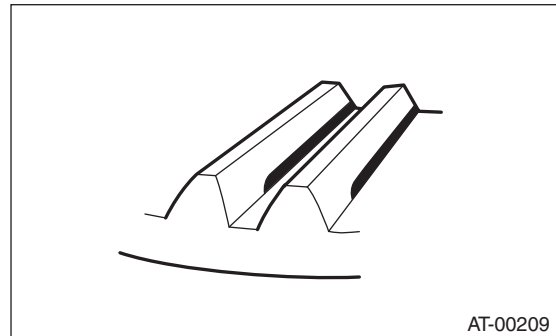
Corrective action: Increase thickness of pinion height adjusting washer according to the procedure for bringing drive pinion close to hypoid driven gear side.



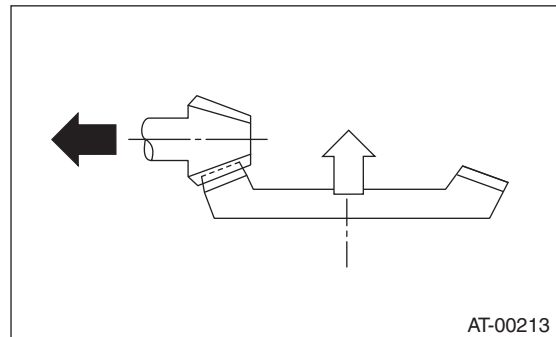
- Flank contact

Check item: Backlash is too small.

Contact pattern



Corrective action: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive pinion away from hypoid driven gear.



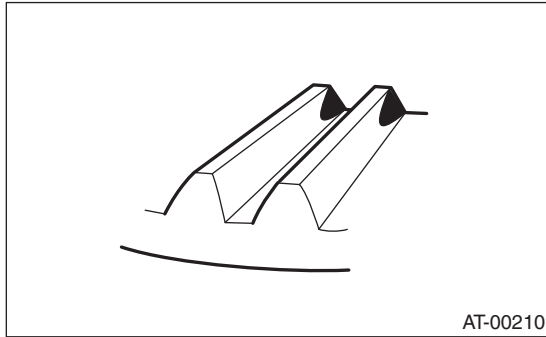
Rear Differential (VA-type)

DIFFERENTIALS

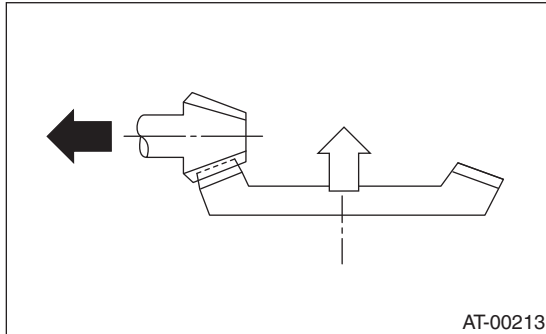
- Toe contact (inside contact)

Check item: Teeth contact area is too small.

Contact pattern



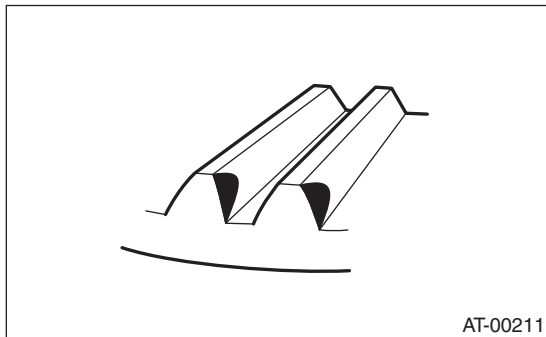
Corrective action: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive pinion away from hypoid driven gear.



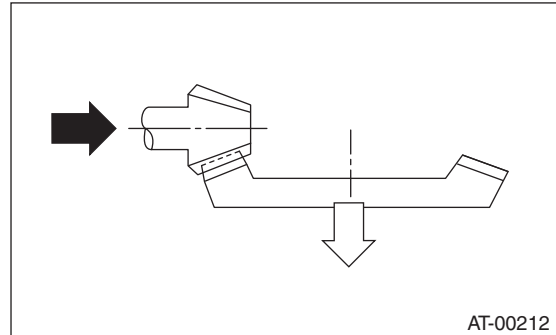
- Heel contact (outside end contact)

Check item: Teeth contact area is too small.

Contact pattern



Corrective action: Increase thickness of pinion height adjusting washer according to the procedure for bringing drive pinion close to hypoid driven gear side.



21) If correct tooth contact is not obtained, readjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

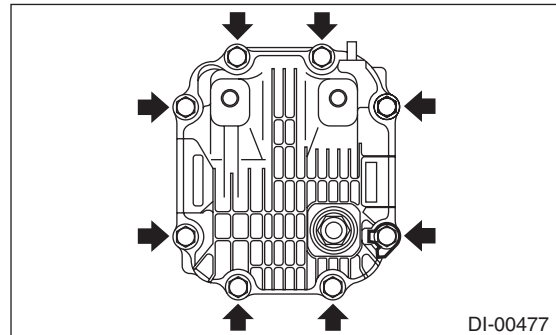
22) Install the gasket, rear cover and ground stay to the differential carrier, and tighten the bolts to specified torque.

NOTE:

Use a new gasket.

Tightening torque:

34 N·m (3.5 kgf-m, 25.1 ft-lb)



23) Install the rear differential oil temperature switch.

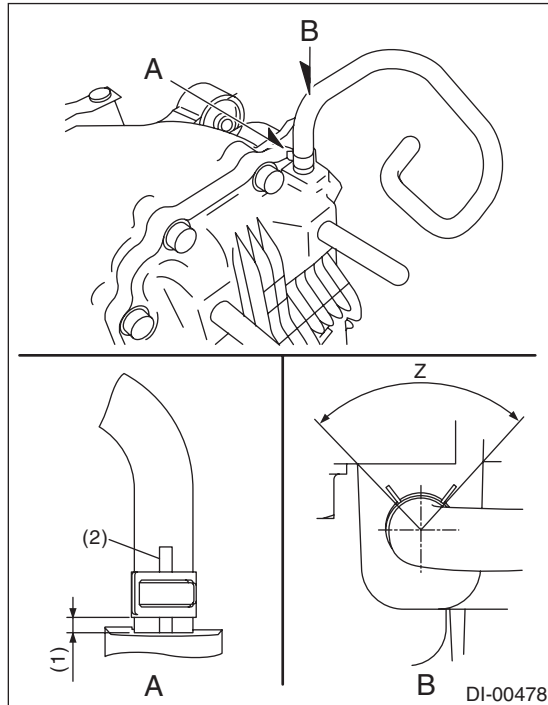
NOTE:

Use a new gasket.

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

24) Affix with the attachment clip so that the white marking of the hose is within the range of Z (87°).



(1) 0 — 1 mm (0 — 0.04 in)

(2) Marking

25) Install the drain plug.

NOTE:

Use a new gasket.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

26) Install the filler plug.

NOTE:

After installing the rear differential assembly to the vehicle, fill the gear oil, then use a new gasket, and tighten to the specified torque. <Ref. to DI-17, REPLACEMENT, Differential Gear Oil.>

E: INSPECTION

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

1) Hypoid driven gear and drive pinion

- If there is evidently an abnormal tooth contact, find out the cause and adjust until the teeth contact correctly. Replace the gear if there is an excessive worn or an incapable adjustment.

- If crack, cutout or seizure is found, replace the parts as a set. Slight damage of some teeth can be corrected by oil stone or the like.

2) Side gear and pinion mate gear

- Replace if cracks, scoring or other defects are evident on the tooth surface.

- Replace if thrust washer contact surface is worn or seized. Slight damages of the surface can be corrected by oil stones or equivalent.

3) Bearing

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

4) Thrust washer of the side gear and pinion mate gear

Replace if seized, flawed, abnormally worn or having other defects.

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 abnormally worn, burned, or cracked.

8) Companion flange

Replace if the oil seal lip contact surface shows cracking.

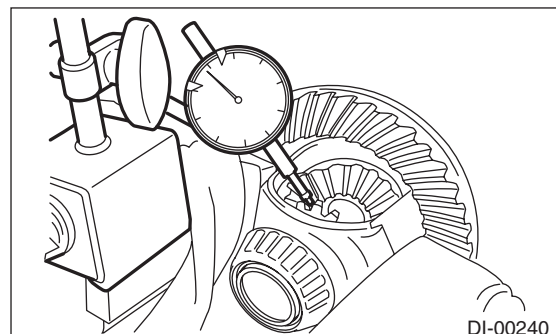
1. SIDE GEAR BACKLASH

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

Side gear backlash:

0.13 — 0.18 mm (0.005 — 0.007 in)

If the side gear backlash is outside the specification range, select the side gear thrust washer and adjust the side gear backlash as specified.



Rear Differential (VA-type)

DIFFERENTIALS

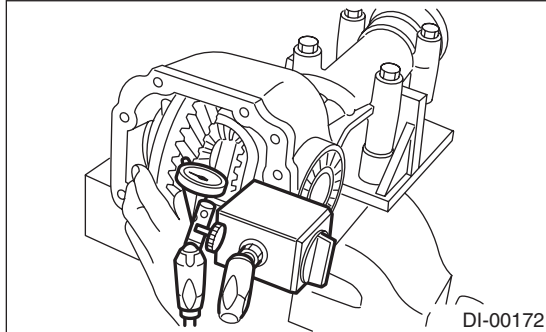
2. HYPOID DRIVEN GEAR BACKLASH

Using a dial gauge, check the backlash of hypoid driven gear.

Hypoid driven gear backlash:

0.10 — 0.15 mm (0.004 — 0.006 in)

If the hypoid driven gear backlash is outside the specification range, adjust the side bearing preload and repair if necessary.

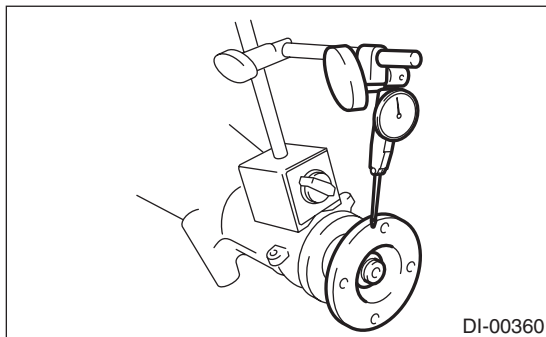


3. COMPANION FLANGE

- 1) If rust or dirt is attached to the companion flange, remove them.
- 2) Set a dial gauge at a companion flange surface (mating surface of propeller shaft and companion flange), and then measure the companion flange runout.

Limit of runout:

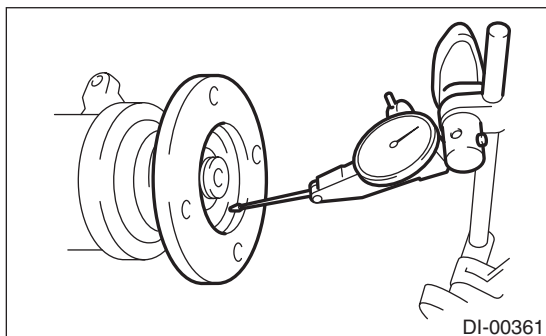
0.08 mm (0.003 in)



- 3) Set the gauge inside of the companion flange, and measure the runout.

Limit of runout:

0.08 mm (0.003 in)



- 4) If either runout exceeds the limit, move the phase of companion flange and drive pinion 90° each, and find the point where the runout will be within the limit.

- 5) If the runout exceeds the limit when changing the phase, replace the companion flange and re-check the runout.

- 6) If the runout exceeds the limit after replacing the companion flange, the drive pinion may be assembled incorrectly or bearing is faulty.

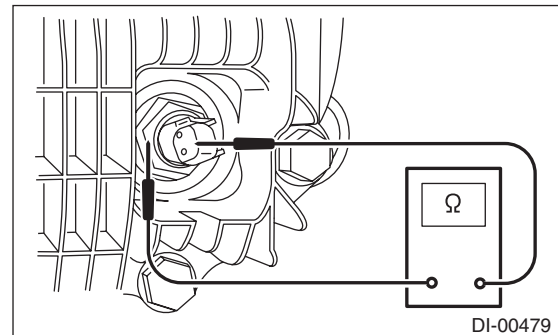
4. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Inspect the tooth contact between the hypoid driven gear and the drive pinion. <Ref. to DI-25, ASSEMBLY, Rear Differential (VA-type).>

5. REAR DIFFERENTIAL OIL TEMPERATURE SWITCH

Check the rear differential oil temperature switch for continuity.

Resistance	Criteria
Less than 1 Ω	Normal
1 M Ω or more	Replacement



F: ADJUSTMENT

1. SIDE GEAR BACKLASH

Adjust the side gear backlash. <Ref. to DI-25, ASSEMBLY, Rear Differential (VA-type).>

2. HYPOID DRIVEN GEAR BACKLASH

Adjust hypoid driven gear backlash. <Ref. to DI-25, ASSEMBLY, Rear Differential (VA-type).>

3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Adjust the tooth contact between hypoid driven gear and drive pinion gear. <Ref. to DI-25, ASSEMBLY, Rear Differential (VA-type).>

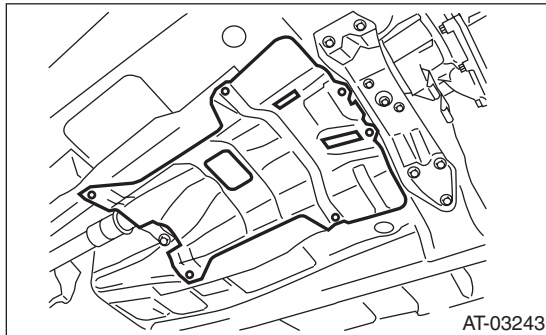
5. Rear Differential Front Oil Seal

A: INSPECTION

Check that there is no leakage from front oil seal portion. If there is any leakage replace the oil seal and inspect the propeller shaft.

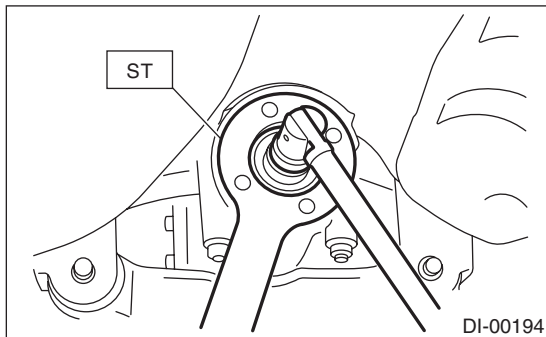
B: REPLACEMENT

- 1) Shift the select lever to neutral.
- 2) Release the parking brake.
- 3) Disconnect the ground cable from battery.
- 4) Lift up the vehicle.
- 5) Drain differential gear oil.
- 6) Remove the rear exhaust pipe and muffler. <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 7) Remove the heat shield cover.



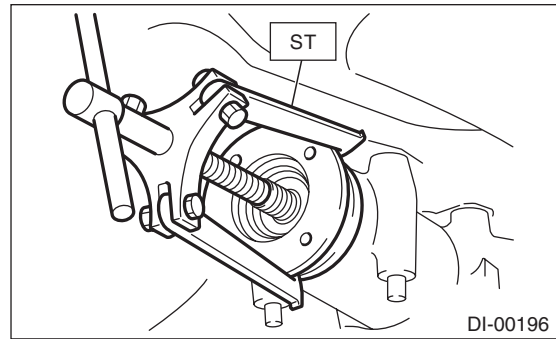
- 8) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 9) Check the initial torque and write it down.
- 10) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



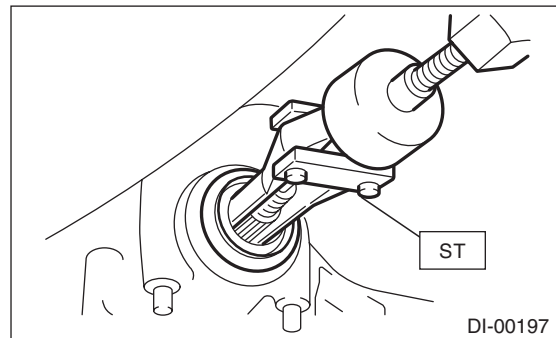
- 11) Extract the companion flange using the ST.

ST 399703600 PULLER ASSY



- 12) Remove the oil seal using ST or screwdriver.

ST 398527700 PULLER ASSY

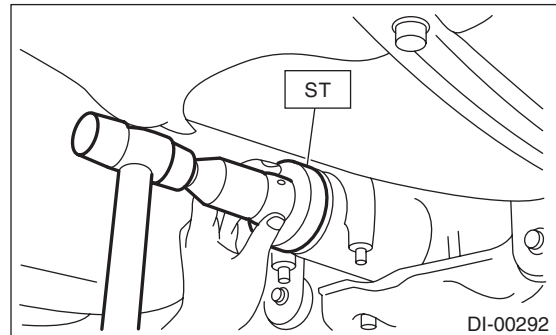


- 13) Using the ST, install the oil seal.

NOTE:

- Use a new oil seal.
- Apply differential gear oil to the oil seal lips.

ST 498447120 INSTALLER



Rear Differential Front Oil Seal

DIFFERENTIALS

14) Use a plastic hammer to install companion flange.

15) Tighten the self-locking nut to the specified torque so that the initial torque of companion flange becomes the same as that of before oil seal replacement.

NOTE:

- Use a new self-locking nut.
- Before installing the self-locking nut, apply the seal material to the threads of the drive pinion shaft and to the seating surface of the self-locking nut.

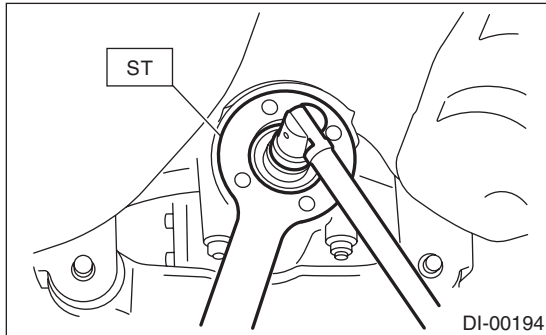
Seal material:

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

162 — 220 N·m (16.5 — 22.5 kgf-m, 119.5 — 162.3 ft-lb)

ST 498427200 FLANGE WRENCH



16) Hereafter, reassemble in the reverse order of disassembly.

17) After installing, fill the differential carrier with gear oil up to the bottom of the filler plug hole. <Ref. to DI-17, Differential Gear Oil.>

6. Rear Differential Side Oil Seal

A: INSPECTION

Make sure that there is no leakage from side oil seal. If there is any leakage, replace the oil seal.

B: REPLACEMENT

1) Remove the rear differential. <Ref. to DI-19, REMOVAL, Rear Differential (VA-type).>

2) Remove the rear differential side oil seal using a ST or screwdriver wrapped with vinyl tape to prevent the side retainer from scratching.

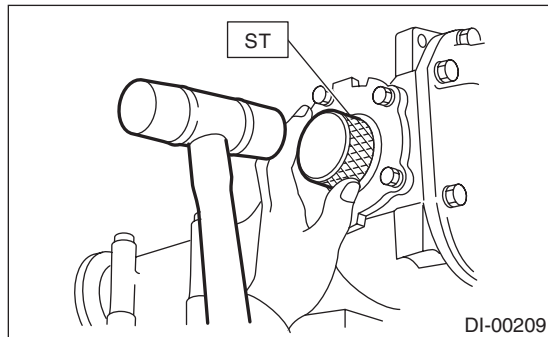
ST 398527700 PULLER ASSY

3) Using the ST, install the oil seal to the side retainer.

NOTE:

- Use a new oil seal.
- Apply differential gear oil to the oil seal lips.

ST 398437700 DRIFT

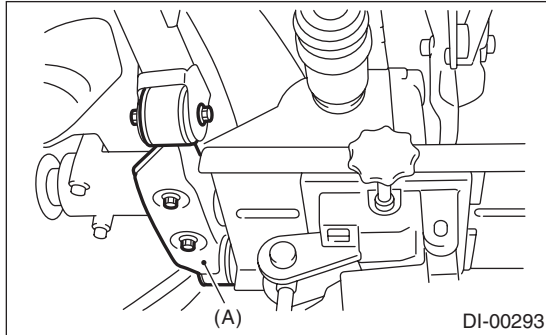


4) Install the rear differential. <Ref. to DI-20, INSTALLATION, Rear Differential (VA-type).>

7. Rear Differential Front Member

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle.
- 3) Support the rear differential using transmission jack, and then remove the rear differential front member.



(A) Rear differential front member

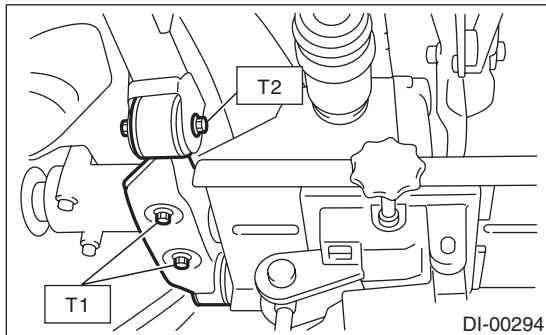
B: INSTALLATION

Install the rear differential front member with a new self-locking nut.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 110 N·m (11.2 kgf-m, 81.1 ft-lb)



C: INSPECTION

- 1) Check the rear differential front member for damage, bend and corrosion. If damage, bend or corrosion is excessive, replace the rear differential front member.
- 2) Check the bushings of rear differential front member for cracking, hardening and damage. If cracking, hardening or damage is excessive, replace rear differential front member.

8. Rear Differential Mount Bushing

A: INSPECTION

Check the rear differential mount bushing for cracks, hardening or damage. If cracking, hardening or damage is excessive, replace rear differential mount bushing.

B: REPLACEMENT

CAUTION:

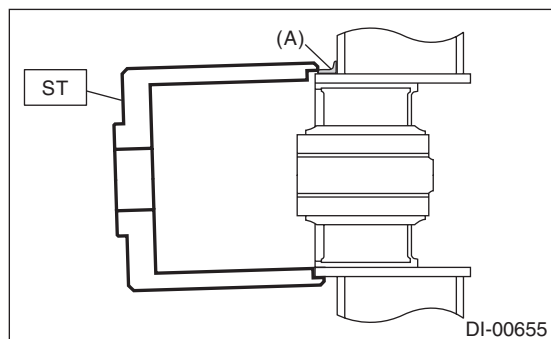
- If there was so much rust in the rear differential mount bushing, remove the rust before starting work.

- Apply the molybdenum grease on the square thread of the ST (shaft and nut) before use.

1) Remove the rear differential. <Ref. to DI-19, REMOVAL, Rear Differential (VA-type).>

2) Fit the ST to the periphery of the sub frame cylinder, and make sure that the ST does not contact with welded spots or spatters.

ST 41399FG010 SPECIAL TOOL A



(A) Welded spot

3) If the ST contacts with welded spots or spatters, remove the excessive welds or spatters with sander or the equivalent so that the ST contacts the cylinder peripheral part.

CAUTION:

Performing the operation with the ST contacting with welded spots or spatters may break the ST. Be sure to remove excessive welds or spatters before the operation.

4) Set ST1, ST2, ST3, ST4 and ST5 as shown in the figure.

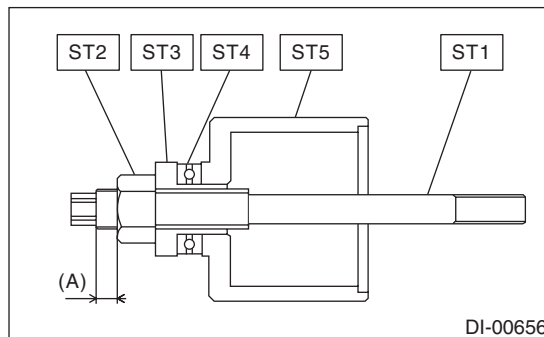
ST1 41399FG091 SPECIAL TOOL SHAFT

ST2 41399FG070 SPECIAL TOOL NUT

ST3 41399FG050 SPECIAL TOOL SLEEVE

ST4 41399FG080 SPECIAL TOOL BEARING

ST5 41399FG010 SPECIAL TOOL A

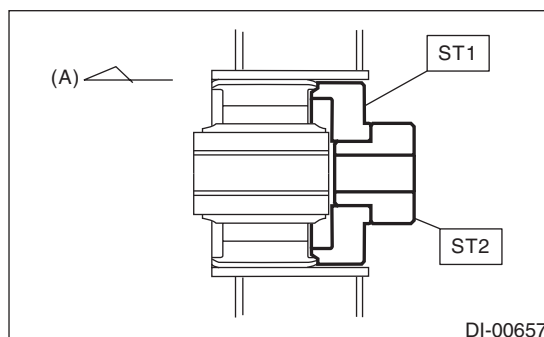


(A) 5 mm (0.2 in) or less

5) Fit and hold the ST1 and ST2 to the rear differential mount bushing from the rear side of vehicle.

ST1 41399FG031 SPECIAL TOOL C

ST2 41399FG061 SPECIAL TOOL RING



(A) Front side of vehicle

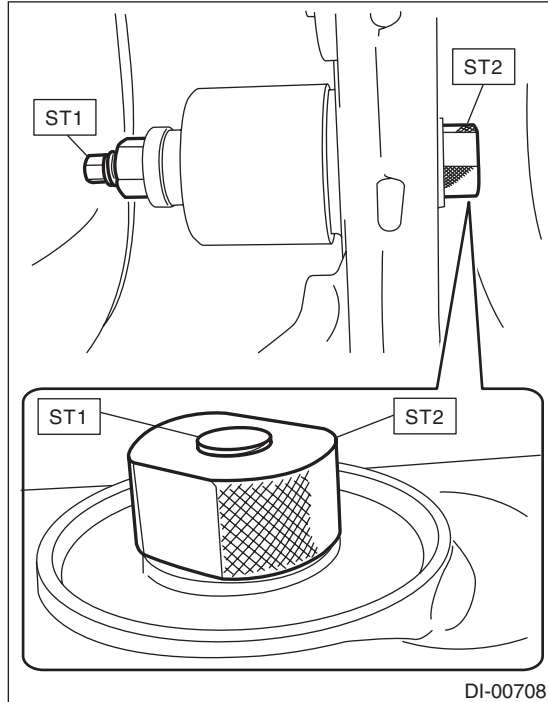
Rear Differential Mount Bushing

DIFFERENTIALS

6) Insert the ST set in the step 4) through the rear differential mount bushing hole from the front side of vehicle, and screw in the ST1 by hand till the front end of ST1 comes out slightly from the rear end of ST2.

ST1 41399FG091 SPECIAL TOOL SHAFT

ST2 41399FG061 SPECIAL TOOL RING



7) Hold the ST1 to prevent it from rotating, and screw in the ST3 by hand till there is no loose fit on the ST2.

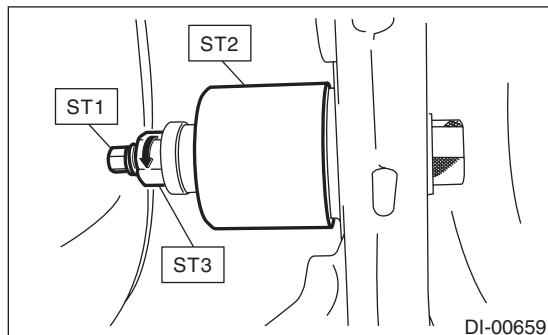
CAUTION:

When setting the ST to the vehicle, always make sure that the ST2 fits the periphery of the sub frame cylinder and is not tilted.

ST1 41399FG091 SPECIAL TOOL SHAFT

ST2 41399FG010 SPECIAL TOOL A

ST3 41399FG070 SPECIAL TOOL NUT



8) Hold the ST1 with a tool to prevent it from rotating, and screw in the ST2 to remove the rear differential mount bushing.

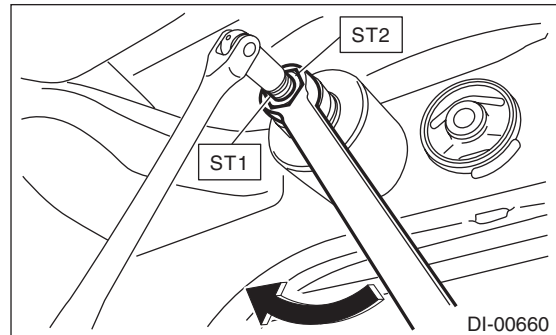
CAUTION:

- **Rotation of ST1 will damage the screw at the rear end of rear differential mount bushing. Never rotate the ST1.**

- **If the ST starts to tilt while removing the rear differential mount bushing, stop the work and set the ST again.**

ST1 41399FG091 SPECIAL TOOL SHAFT

ST2 41399FG070 SPECIAL TOOL NUT

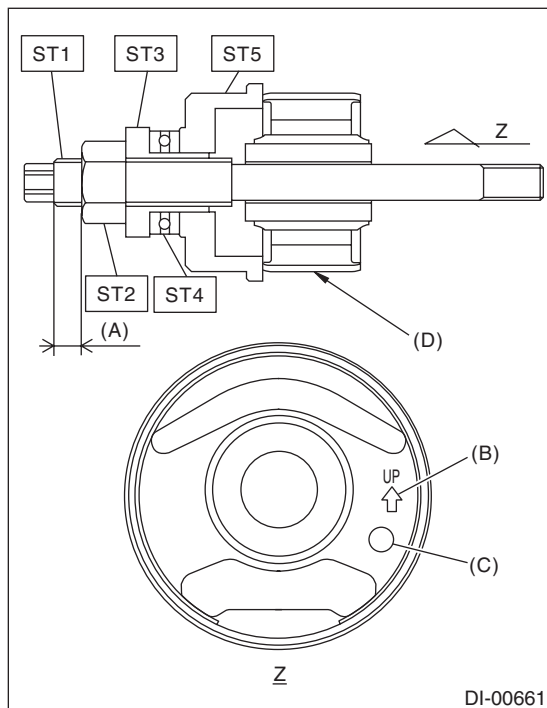


9) Set ST1, ST2, ST3, ST4, ST5 and rear differential mount bushing as shown in the figure.

NOTE:

- Set the ST2 nut near to the end of ST1 screw.
- Hold the rear differential mount bushing with the marked side facing toward the rear of the vehicle, and set the rear differential mount bushing to the ST so that the arrow mark faces upward.
- Mark the bottom end of rear differential mount bushing to identify the installing direction.

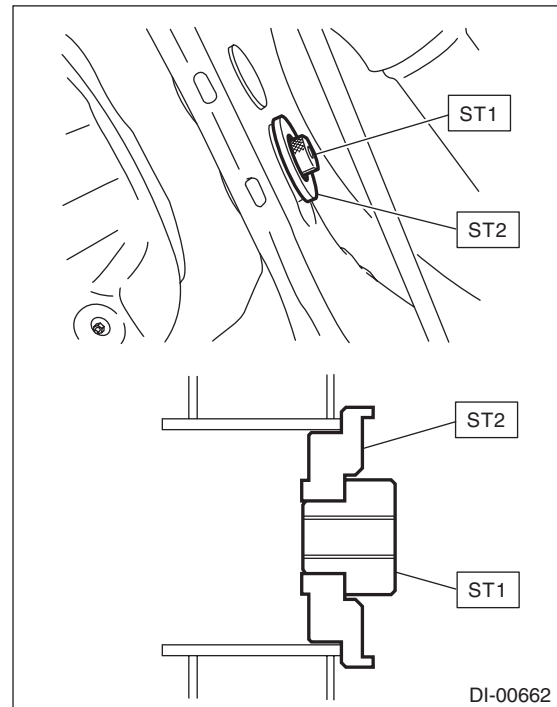
ST1 41399FG091 SPECIAL TOOL SHAFT
 ST2 41399FG070 SPECIAL TOOL NUT
 ST3 41399FG050 SPECIAL TOOL SLEEVE
 ST4 41399FG080 SPECIAL TOOL BEARING
 ST5 41399FG020 SPECIAL TOOL B



- (A) 8 mm (0.31 in) or more
 (B) Arrow mark
 (C) Mark
 (D) Marked position

10) Attach ST1 to the ST2, and fit and hold the STs as a unit to the sub frame from the rear side of vehicle.

ST1 41399FG061 SPECIAL TOOL RING
 ST2 41399FG041 SPECIAL TOOL D



Rear Differential Mount Bushing

DIFFERENTIALS

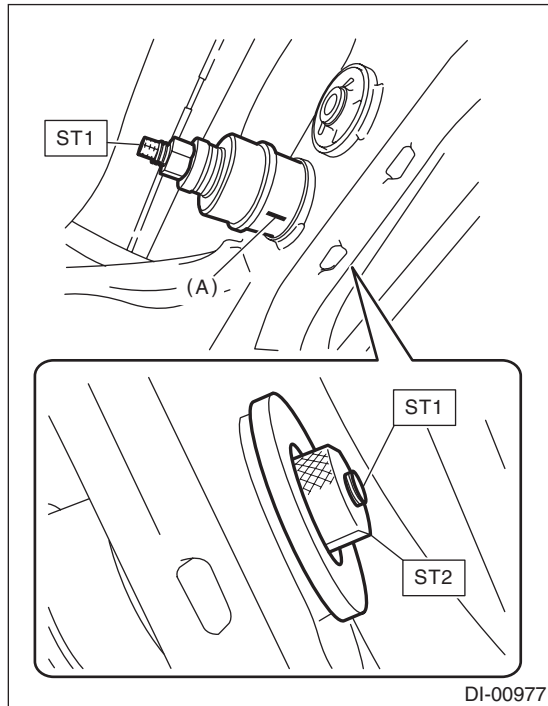
11) Insert the ST and rear differential mount bushing set in the step 9) through the sub frame from the front side of vehicle, and screw in the ST1 by hand till the front end of ST1 comes out slightly from the rear end of ST2.

CAUTION:

Set the rear differential mount bushing with its mark facing the bottom end direction.

ST1 41399FG091 SPECIAL TOOL SHAFT

ST2 41399FG061 SPECIAL TOOL RING



(A) Mark

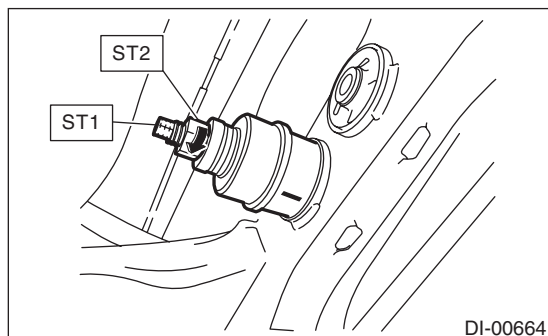
12) Hold the ST1 to prevent it from rotating, and screw in the ST2 by hand till there is no loose fit on the ST and the rear differential mount bushing.

CAUTION:

Make sure that the ST and rear differential mount bushing are not tilted.

ST1 41399FG091 SPECIAL TOOL SHAFT

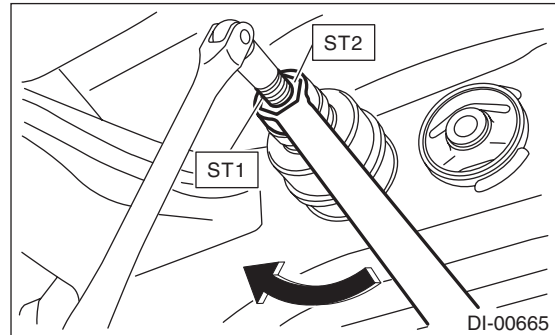
ST2 41399FG070 SPECIAL TOOL NUT



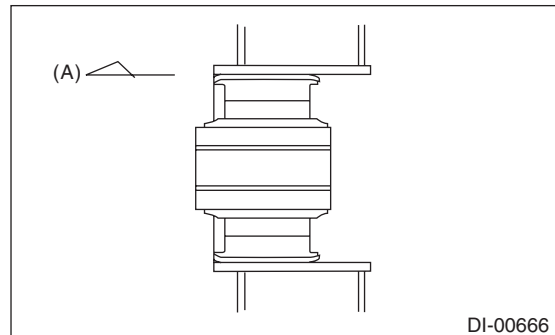
13) Screw in the ST2 while holding the ST1 with a tool to prevent it from rotating, and press-fit the rear differential mount bushing to the front end of sub frame cylinder.

ST1 41399FG091 SPECIAL TOOL SHAFT

ST2 41399FG070 SPECIAL TOOL NUT



14) Make sure that the rear differential mount bushing is inserted to the front end of sub frame cylinder.



(A) Front side of vehicle

15) Install the rear differential. <Ref. to DI-20, INSTALLATION, Rear Differential (VA-type).>

9. General Diagnostic Table

A: INSPECTION

Symptom or trouble	Possible cause	Remedy
1. Oil leakage	(1) Worn, scratched, or incorrectly seated front or side oil seal. Scored, battered or excessively worn sliding surface of companion flange.	Repair or replace.
	(2) Clogged or damaged air breather hose.	Clean, repair or replace.
	(3) Loose bolts on the side retainer, or incorrectly fitted O-ring.	Tighten the bolts to specified torque. Replace the O-ring.
	(4) Loose rear cover attachment bolts or damaged gasket.	Tighten the bolts to specified torque. Replace the gasket.
	(5) Loose filler plug or drain plug.	Replace the gasket, and tighten to the specified torque.
	(6) Wear, damage or incorrect fitting of drive shaft, side retainer or 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.	(1) Insufficient backlash for hypoid driven gear.	Readjust or replace.
	(2) Excessive preload for side, rear or front bearing.	Readjust or replace.
	(3) Insufficient or improper oil used.	Add recommended differential gear oil to the 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.	(1) Improper backlash for hypoid gear.	Readjust or replace.
	(2) Insufficient or excessive preload for side, rear or front bearing.	Readjust or replace.
	(3) Excessive backlash for differential gear.	Replace gear or thrust washer.
	(4) Loose bolts and nuts such as hypoid driven gear bolt.	Retighten.
	(5) 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 disassembling.	(1) Improper tooth contact of hypoid driven gear and drive pinion.	Readjust. (drive pinion adjustment and backlash adjustment)
	(2) Excessive backlash for hypoid driven gear.	Replace the gear or the pinion height adjusting washer.
	(3) Excessive backlash for side gear.	Replace gear or thrust washer.
	(4) Insufficient preload for front or rear bearing.	Readjust.
	(5) Loose drive pinion nut.	Tighten to the specified torque.
	(6) Loose bolts and nuts such as side retainer attachment bolt.	Tighten to the specified torque.
5. Noises when cornering	(1) Damaged differential gear.	Replace.
	(2) Excessive wear or damage of thrust washer.	Replace.
	(3) Broken pinion mate shaft.	Replace.
	(4) Stuck or damaged side bearing.	Replace.

General Diagnostic Table

DIFFERENTIALS

Symptom or trouble	Possible cause	Remedy
6. Gear Noise 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 the condition of trouble. When listening to noises, shift gears into four wheel drive and fourth speed position, trying to pick up only differential noise.	(1) Improper tooth contact of hypoid driven gear and drive pinion.	Readjust or replace the hypoid gear set.
	(2) Improper backlash of the hypoid driven gear.	Readjust.
	(3) Scored or chipped teeth of hypoid gear.	Replace hypoid gear set.
	(4) Scuffed hypoid gear.	Replace hypoid gear set.
	(5) Improper preload for front or rear bearings.	Readjust.
	(6) Stuck, scored or chipped front or rear bearing.	Replace.
	(7) Stuck, scored or chipped side bearing.	Replace.
	(8) Vibrating differential gear.	Replace the differential gear.

TRANSFER CASE

TC

	Page
1. General Description	2
2. Transfer Clutch	3
3. Extension Case	4
4. Oil Seal	5
5. Center Differential Carrier	6
6. Reduction Driven Gear	7
7. Transfer Clutch Pressure Test	8



General Description

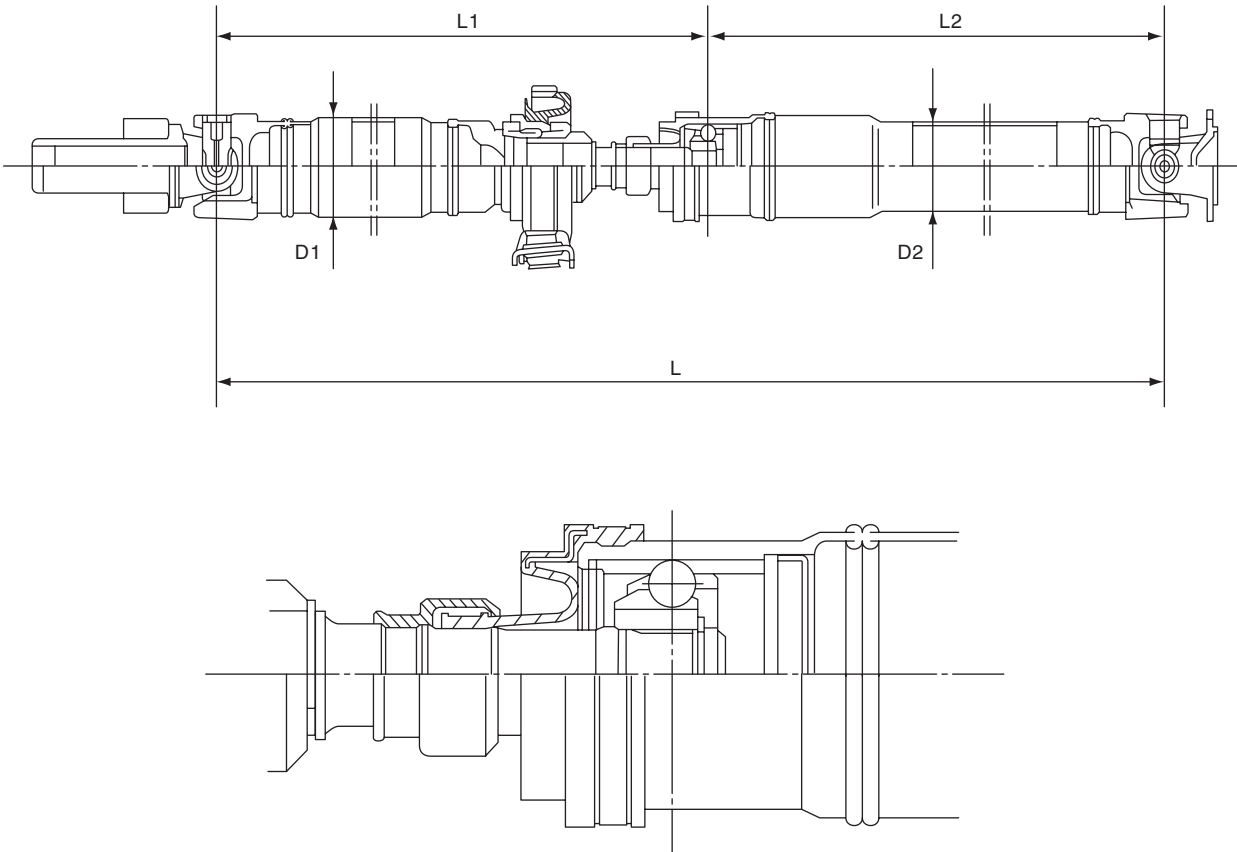
DRIVE SHAFT SYSTEM

1. General Description

A: SPECIFICATION

1. PROPELLER SHAFT

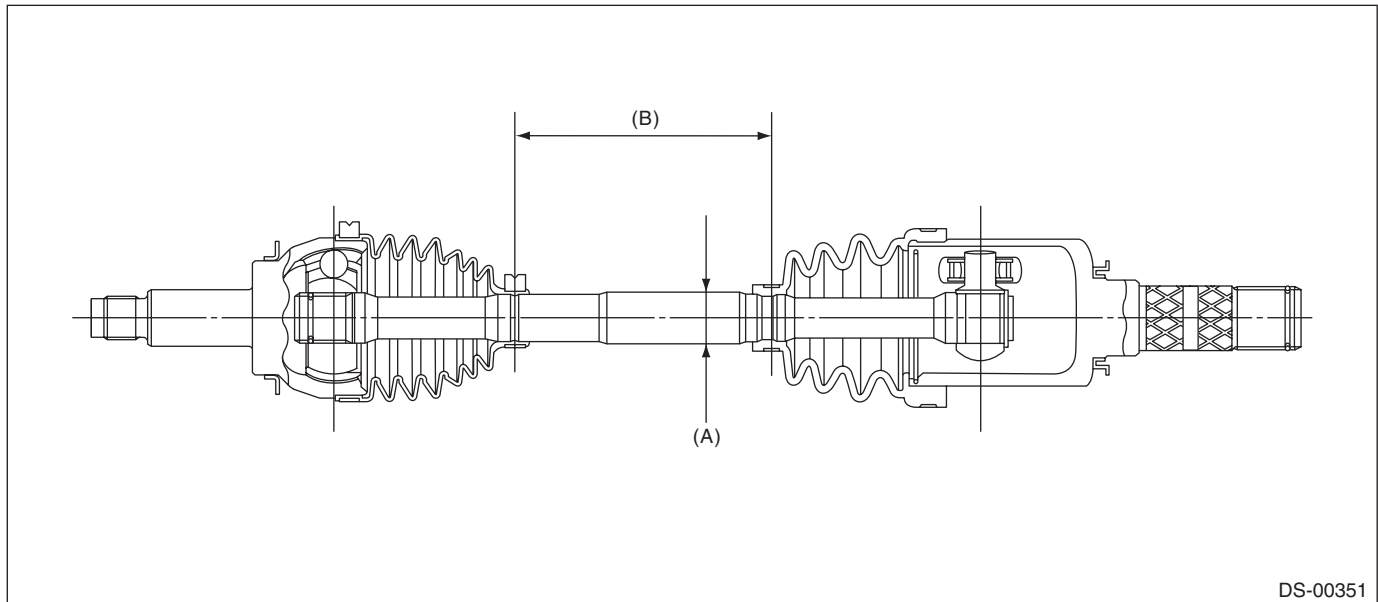
Propeller shaft type		EDJ
Propeller shaft length: L	mm (in)	1,392 (54.8)
Front propeller shaft Joint-to-Joint length: L ₁	mm (in)	645 (25.39)
Rear propeller shaft Joint-to-Joint length: L ₂	mm (in)	747 (29.41)
Outer diameter of tube:	D ₁	63.5 (2.50)
	D ₂	57.5 (2.26)



DS-00350

2. FRONT DRIVE SHAFT ASSEMBLY

Type of drive shaft	Axle diameter ϕ D mm (in)	Axle length L mm (in)
EBJ + PTJ	26 (1.0)	388.5 (15.30)

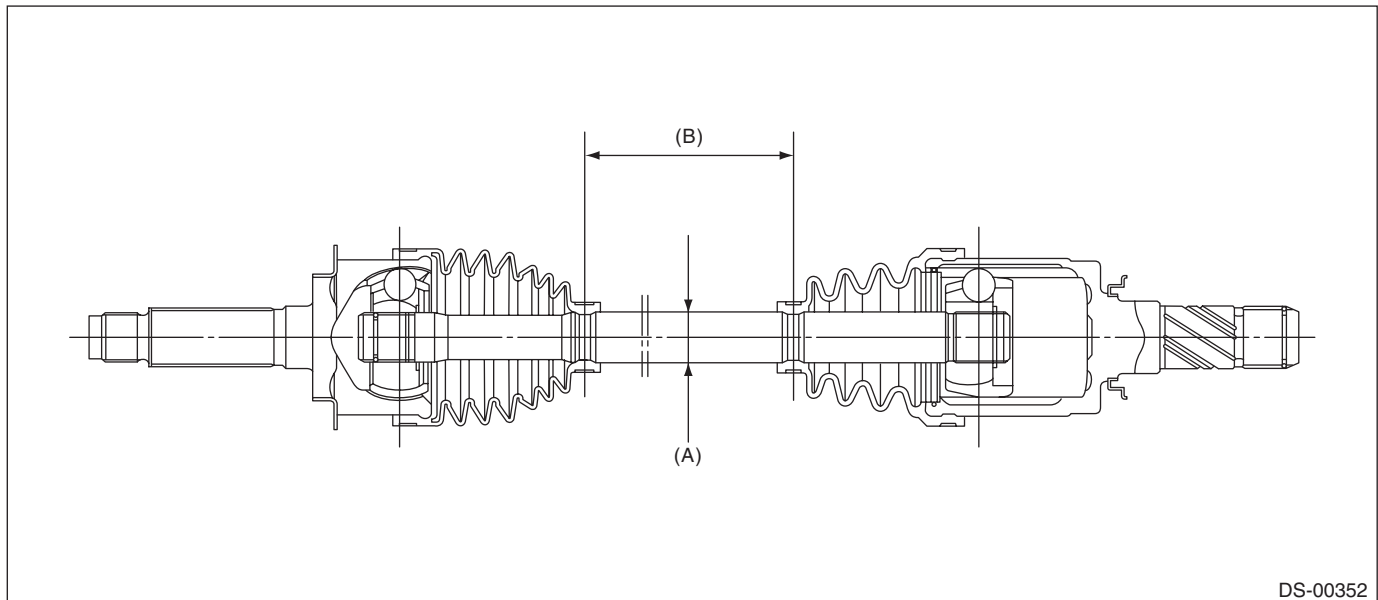


(A) Axle diameter

(B) Axle length

3. REAR DRIVE SHAFT ASSEMBLY

Type of drive shaft	Axle diameter ϕ D mm (in)	Axle length L mm (in)
EBJ + DOJ	24 (0.94)	386.8 (15.23)



(A) Axle diameter

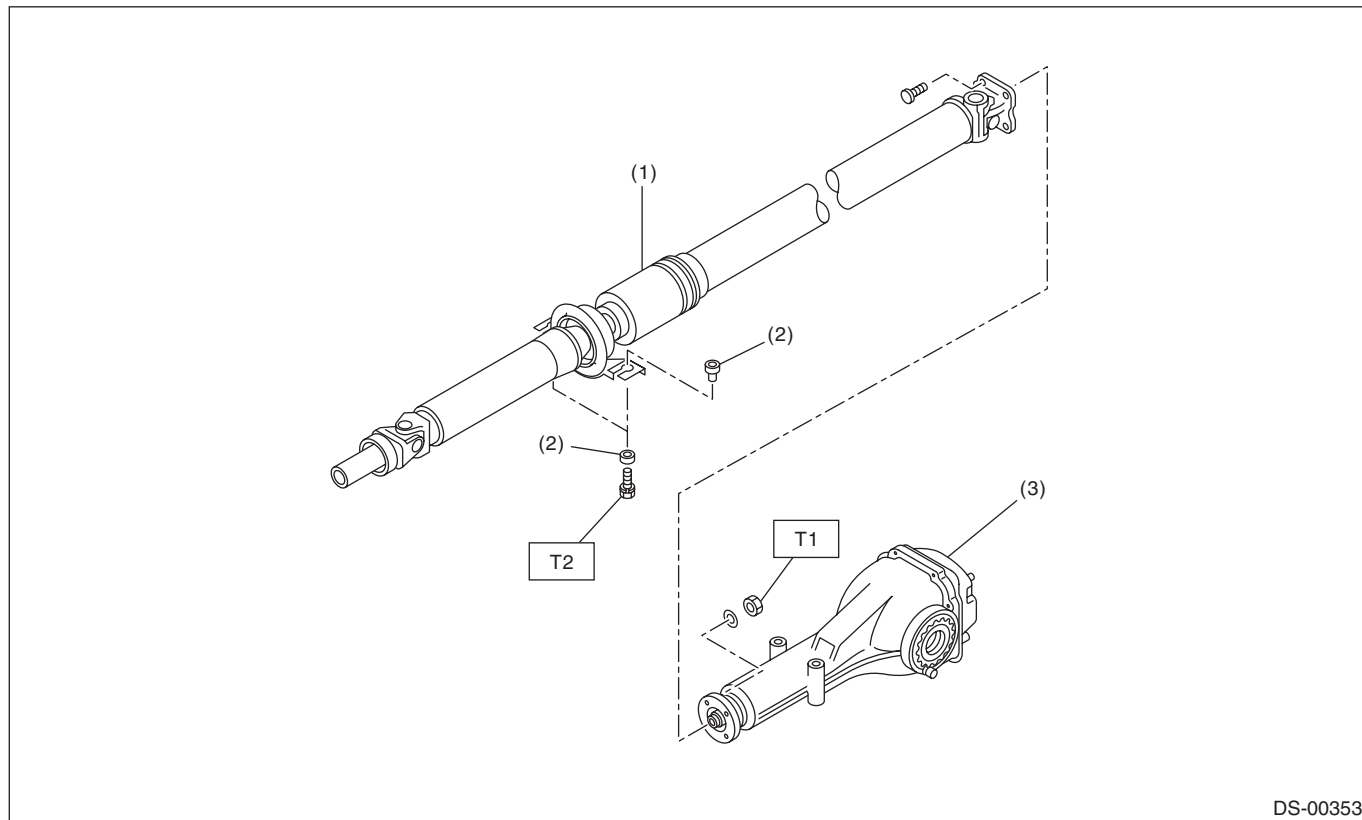
(B) Axle length

General Description

DRIVE SHAFT SYSTEM

B: COMPONENT

1. PROPELLER SHAFT



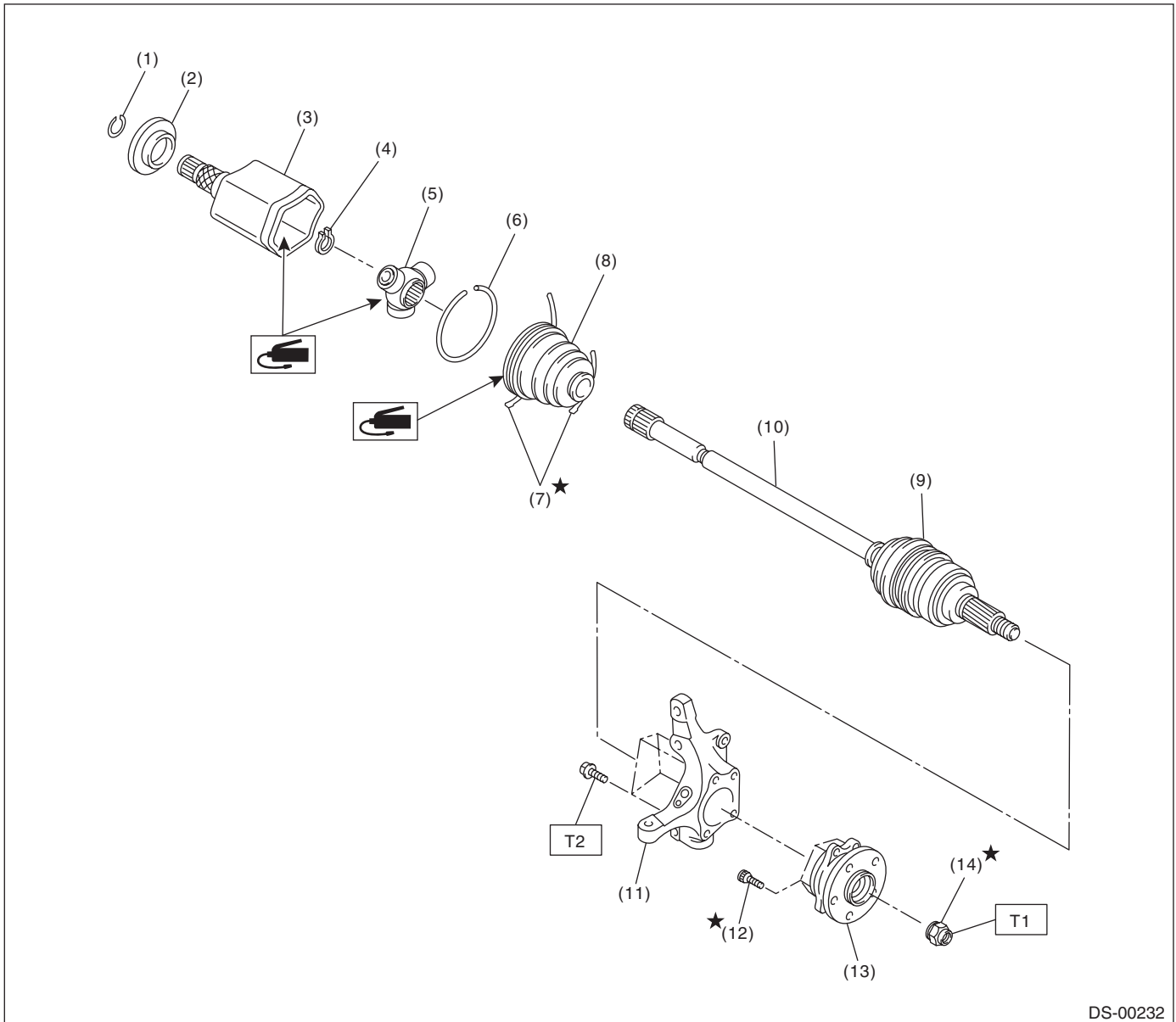
- (1) Propeller shaft
- (2) Bushing
- (3) Rear differential (VA-type)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 31 (3.2, 23.1)

T2: 52 (5.3, 38.3)

2. FRONT AXLE



DS-00232

- (1) Circlip
- (2) Baffle plate
- (3) Outer race (PTJ)
- (4) Snap ring
- (5) Trunnion
- (6) Snap ring

- (7) Boot band
- (8) Boot (PTJ)
- (9) Boot (EBJ)
- (10) EBJ shaft ASSY
- (11) Front housing
- (12) Hub bolt

- (13) Front hub unit bearing
- (14) Axle nut

Tightening torque: N·m (kgf-m, ft-lb)

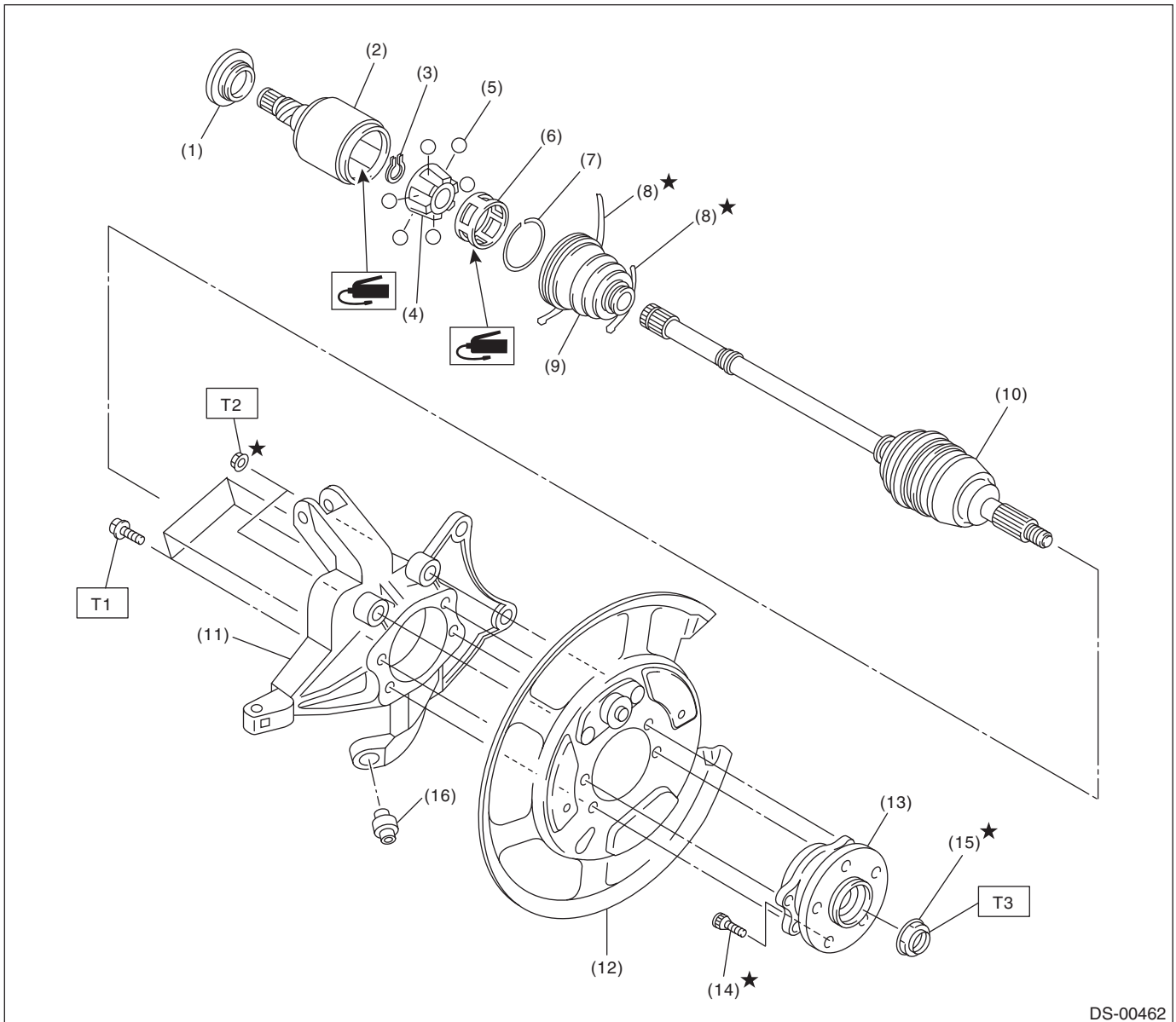
T1: 240 (24.5, 177)

T2: 65 (6.6, 47.9)

General Description

DRIVE SHAFT SYSTEM

3. REAR AXLE



- (1) Baffle plate (DOJ)
- (2) Outer race (DOJ)
- (3) Snap ring
- (4) Inner race
- (5) Ball
- (6) Cage
- (7) Snap ring

- (8) Boot band
- (9) Boot (DOJ)
- (10) EBJ shaft ASSY
- (11) Rear housing
- (12) Back plate
- (13) Rear hub unit bearing
- (14) Hub bolt

- (15) Axle nut
- (16) Bushing

Tightening torque: N·m (kgf-m, ft-lb)

T1: 65 (6.6, 47.9)

T2: 75 (7.6, 55.3)

T3: 240 (24.5, 177)

C: CAUTION

Please clearly understand and adhere to the following general precautions. They must be strictly followed to avoid any injury to the person doing the work or people in the area.

1. OPERATION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply grease onto sliding or revolving surfaces before installation.
- Before installing 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.

2. OIL

When handling oil, follow the rules below to prevent unexpected accidents.

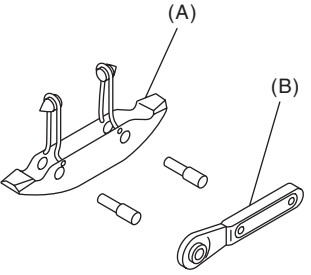
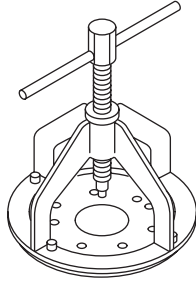
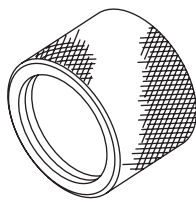
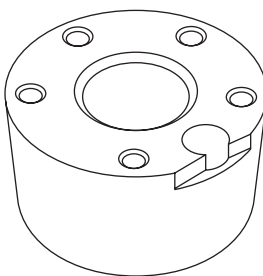
- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

General Description

DRIVE SHAFT SYSTEM

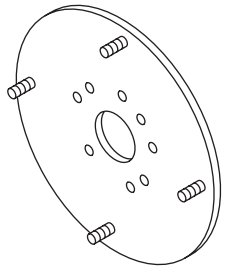
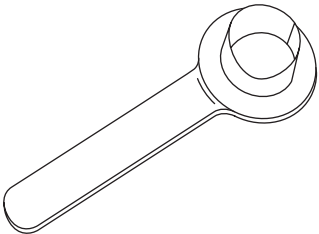
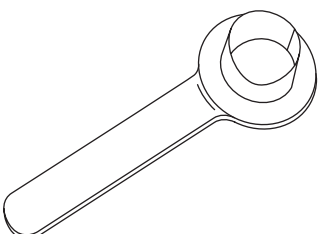
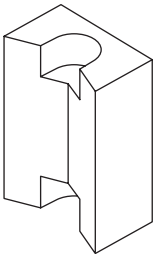
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-925091000	925091000	BAND TIGHTENING TOOL	Used for tightening the boot band. (A) Jig for the band (B) Ratchet wrench
 ST-926470000	926470000	AXLE SHAFT PULLER	Used for removing the axle shaft.
 ST18675AA000	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing the differential side retainer oil seal.
 ST28099PA080	28099PA080	HUB STAND	Used for assembling hub bolt in hub.

General Description

DRIVE SHAFT SYSTEM

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST28099PA110	28099PA110	AXLE SHAFT PULLER PLATE	Same as plate 2 included in AXLE SHAFT PULLER (926470000).
 ST28099PA090	28099PA090	OIL SEAL PROTECTOR	- Used for installing the rear drive shaft to the rear differential. - For protecting the oil seal.
 ST28399SA010	28399SA010	OIL SEAL PROTECTOR	- Used for installing front drive shaft into front differential. - For protecting the oil seal.
 ST28399AG000	28399AG000	HUB STAND	Used for extracting hub bolt.

2. GENERAL TOOL

TOOL NAME	REMARKS
Puller	Used for removing the ball joint from knuckle arm.
Dial gauge	Used for inspecting the propeller shaft run-out.
Extension cap	Used for preventing leakage of gear oil or ATF.
Bar	Used for extracting drive shaft.

Propeller Shaft

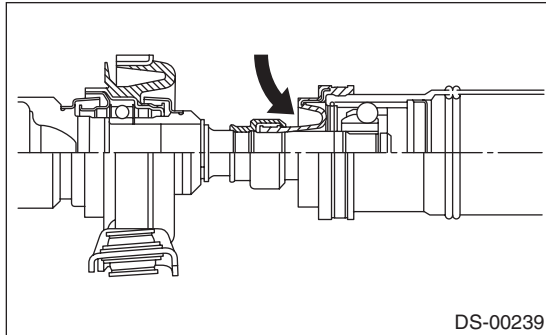
DRIVE SHAFT SYSTEM

2. Propeller Shaft

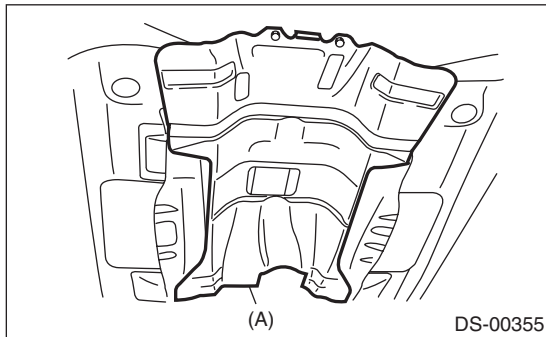
A: REMOVAL

NOTE:

- Before removing propeller shaft, wrap metal parts with a cloth or rubber material.
- In case of EDJ type, wrap the metal parts at the rubber boot at the center EDJ with a cloth or rubber material before removing propeller shaft, as shown in the figure. The rubber boot may be damaged due to interference with adjacent metal parts while bending the EDJ during removal.

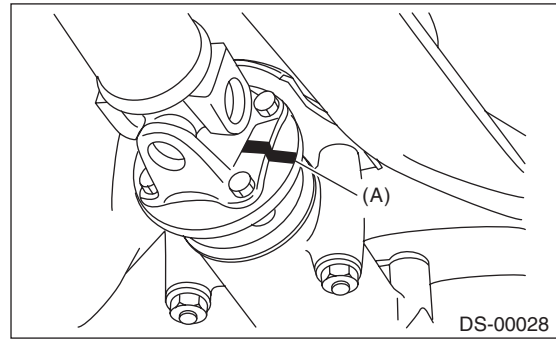


- 1) Disconnect the ground cable from battery.
- 2) Shift the select lever or gear shift lever to neutral.
- 3) Release the parking brake.
- 4) Lift up the vehicle.
- 5) Remove the center exhaust pipe.
- 6) Remove the rear exhaust pipe and muffler.
- 7) Remove the heat shield cover.



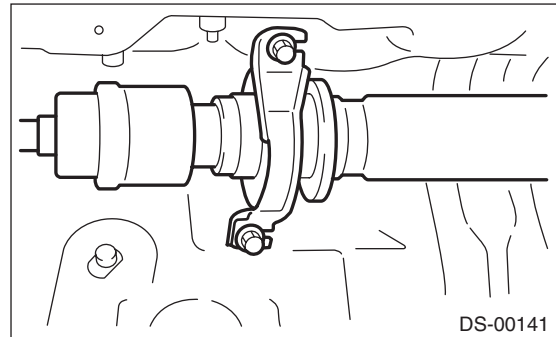
(A) Heat shield cover

- 8) Make alignment marks on the flange yoke and rear differential before removal.



(A) Alignment mark

- 9) Remove the three bolts holding the propeller shaft to the rear differential.
- 10) Remove the remaining bolt.
- 11) Remove the two bolts which hold center bearing to vehicle body.



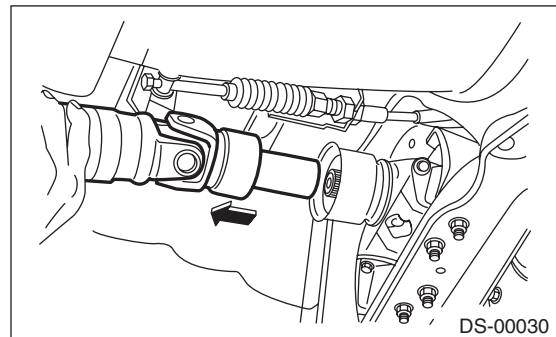
- 12) Remove the propeller shaft from transmission.

CAUTION:

- Be careful not to damage oil seals and frictional surface of the sleeve yoke.
- Cover the center exhaust pipe with a cloth to keep off any ATF or oil spilled from transmission when removing propeller shaft.

NOTE:

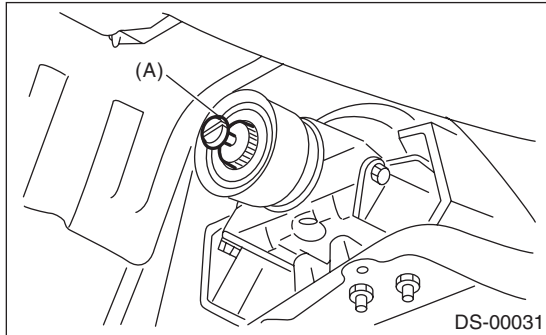
Use a container to catch ATF or oil flowing from propeller shaft.



13) Install an extension cap to the transmission.

NOTE:

If extension cap is not available, place vinyl bag over opening and fasten with string to prevent gear oil or ATF from leaking.



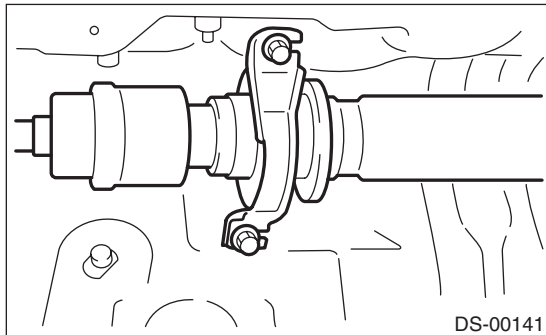
(A) Extension cap

B: INSTALLATION

1) Insert the sleeve yoke into the transmission and attach center bearing to body.

Tightening torque:

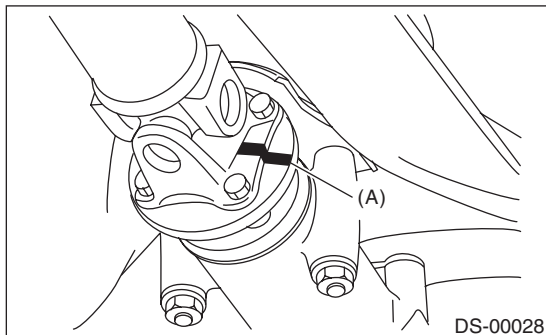
52 N·m (5.3 kgf-m, 38.3 ft-lb)



2) Align the alignment marks and connect the flange yoke and rear differential.

Tightening torque:

31 N·m (3.2 kgf-m, 23.1 ft-lb)



(A) Alignment mark

3) Install the heat shield cover.

4) Install the center exhaust pipe.

5) Install the rear exhaust pipe and muffler.

6) Lower the vehicle.

7) Connect the ground cable to battery.

C: INSPECTION

NOTE:

Do not disassemble propeller shaft. Check the following and replace if necessary.

- Tube surface for dents or cracks
- Splines for deformation or abnormal wear
- Unsmooth joint operation or abnormal noise
- Center bearing for free play, noise or non-smooth operation.
- Oil seals for abnormal wear or damage
- Damaged center bearing

Check the following points with propeller shaft installed in vehicle.

1. JOINTS AND CONNECTIONS

1) Remove the center exhaust pipe.

2) Remove the heat shield cover.

3) Check for any looseness of the yoke flange mounting bolts which connect to the rear differential and center bearing bracket mounting bolts.

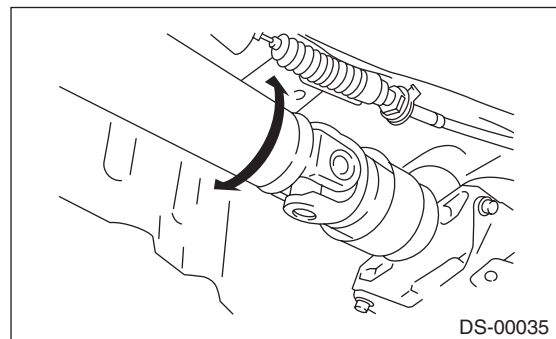
2. SPLINES AND BEARING

1) Remove the center exhaust pipe.

2) Remove the rear exhaust pipe and muffler.

3) Remove the heat shield cover.

4) Turn the propeller shaft by hand to see if abnormal free play exists at splines. Also move yokes to see if abnormal free play exists at spiders and bearings.

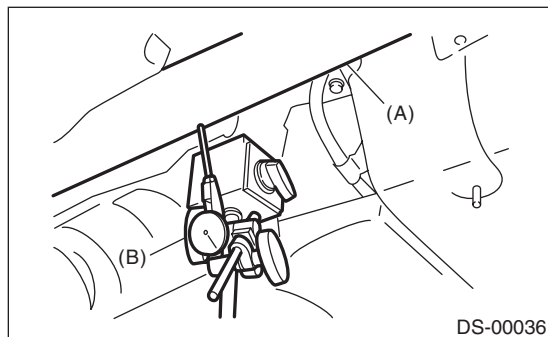


3. RUNOUT OF PROPELLER SHAFT

- 1) Remove the center exhaust pipe.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the heat shield cover.
- 4) Set the dial gauge with its indicator stem at the center of the propeller shaft tube.
- 5) Turn the propeller shaft slowly by hands to check for runout of the propeller shaft.

Runout:

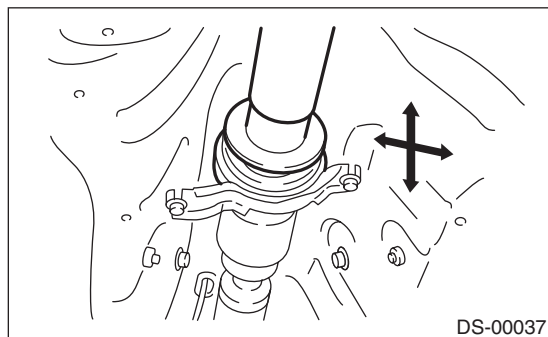
Service limit 0.6 mm (0.024 in)



- (A) Propeller shaft
(B) Dial gauge

4. CENTER BEARING FREE PLAY

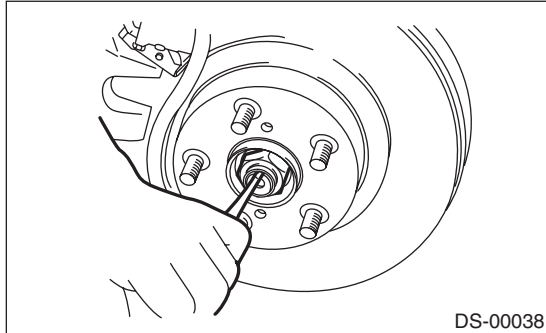
- 1) Remove the front and center exhaust pipes.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the heat shield cover.
- 4) Move the propeller shaft near the center bearing up, down, left, right by hand, to check for any abnormal free play of the bearings.



3. Front Axle

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle, and remove the front wheels.
- 3) Lift the crimped section of axle nut.

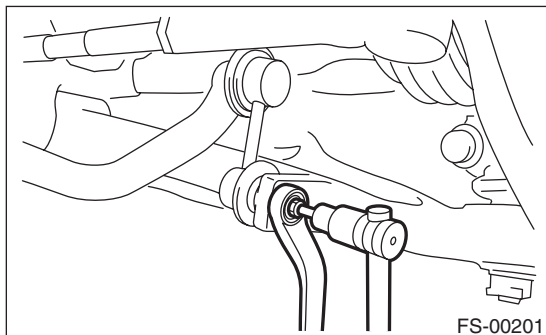


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

CAUTION:

Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

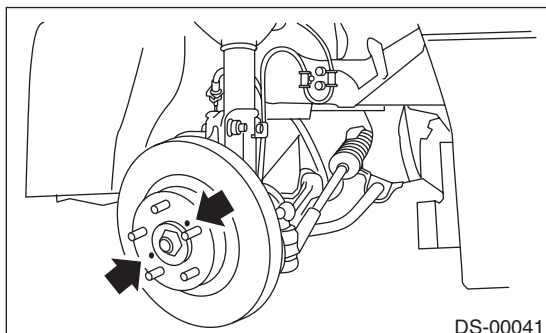
- 5) Remove the stabilizer link.



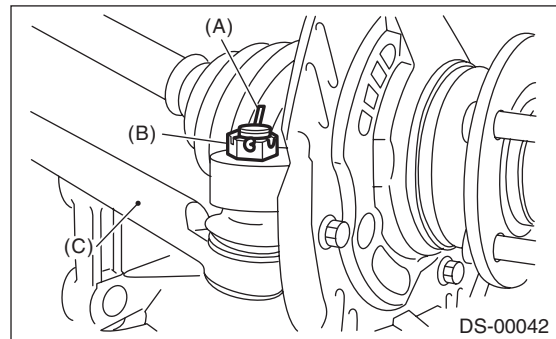
- 6) Remove the disc brake caliper from the front housing, and suspend it from strut using a piece of wire.
- 7) Remove the disc rotor from the hub.

NOTE:

If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threaded end of rotor, and then remove the rotor.

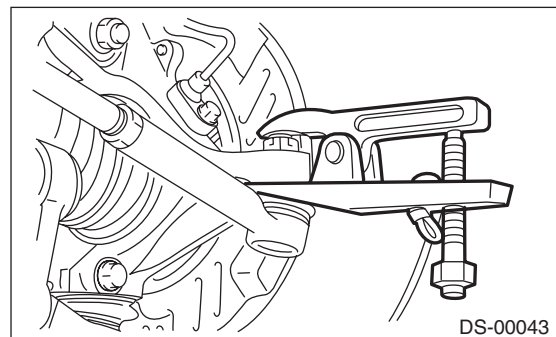


- 8) Remove the cotter pin and castle nut securing the tie-rod end to the front housing knuckle arm.



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

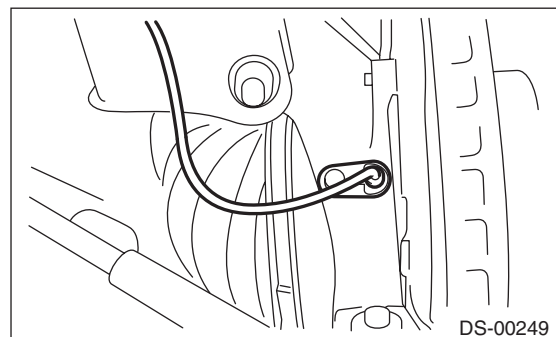
- 9) Using a puller, remove the tie-rod ball joint from knuckle arm.



CAUTION:

When removing tie-rod, do not hit the tie-rod end with hammer.

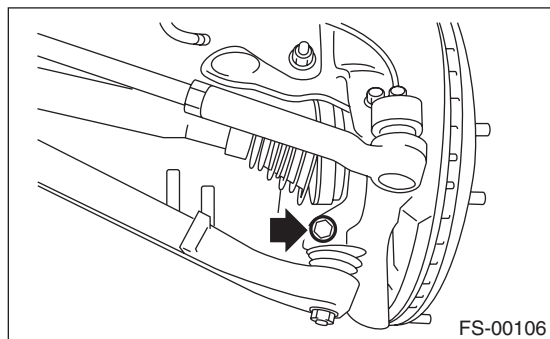
- 10) Remove the ABS wheel speed sensor assembly and harness.



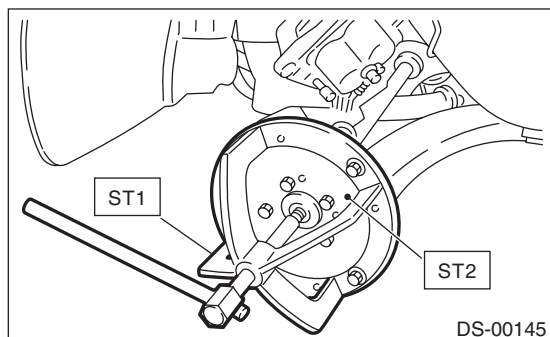
Front Axle

DRIVE SHAFT SYSTEM

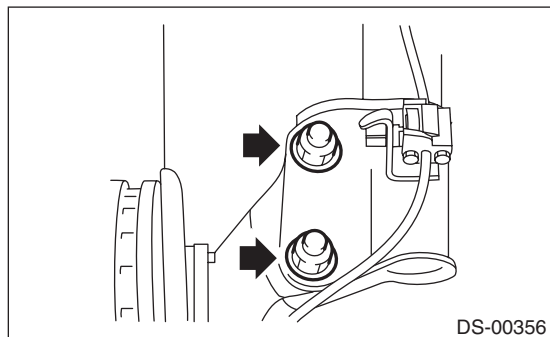
- 11) Remove the front arm ball joint from the front housing.



- 12) Remove the PTJ from transmission.
13) Remove the front drive shaft assembly from the hub. If it is hard to remove, use the ST.
ST1 926470000 AXLE SHAFT PULLER
ST2 28099PA110 AXLE SHAFT PULLER PLATE



- 14) After scribing an alignment mark on the camber adjusting bolt head, remove the bolts which connect the front housing and strut, and disconnect the front housing from the strut.



- 15) Remove the front axle.

B: INSTALLATION

- 1) Align the alignment mark on the camber adjusting bolt head, and affix the front housing and strut together using a new self-locking nut.

Tightening torque:

155 N·m (15.8 kgf-m, 114.3 ft-lb)

- 2) Install the front drive shaft. <Ref. to DS-25, INSTALLATION, Front Drive Shaft.>
3) Install the front arm ball joint to the front housing.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

- 4) Install the ABS wheel speed sensor on the front housing.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

- 5) Install the disc rotor to hub.
6) Install the disc brake caliper to the front housing.

Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

- 7) Install the stabilizer link.
8) Connect the tie-rod end ball joint to the knuckle arm with a castle nut.

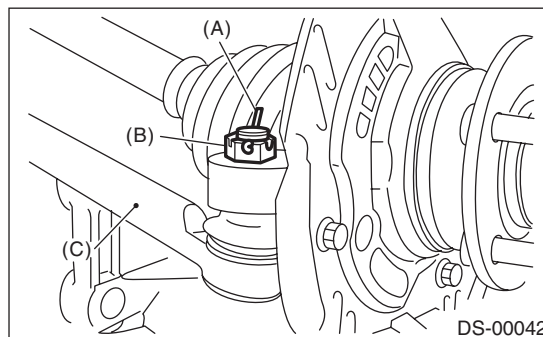
Tightening torque:

27.0 N·m (2.75 kgf-m, 19.9 ft-lb)

CAUTION:

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

- 9) Tighten the castle nut to specified torque and tighten further within 60° until the pin hole is aligned with the slot in nut. Bend the cotter pin to lock.



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

10) While depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

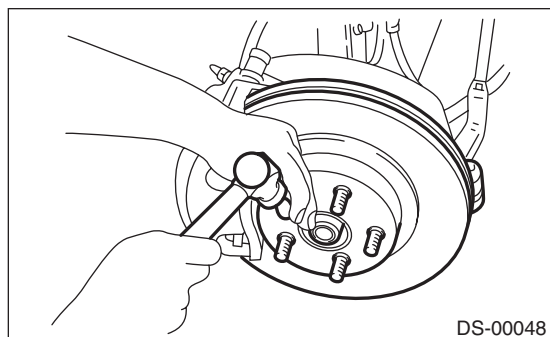
Tightening torque:

240 N·m (24.5 kgf-m, 177 ft-lb)

CAUTION:

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

11) After tightening the axle nut, lock it securely.



12) Install the front wheel and tighten the wheel nuts to specified torque.

Tightening torque:

Chromed wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

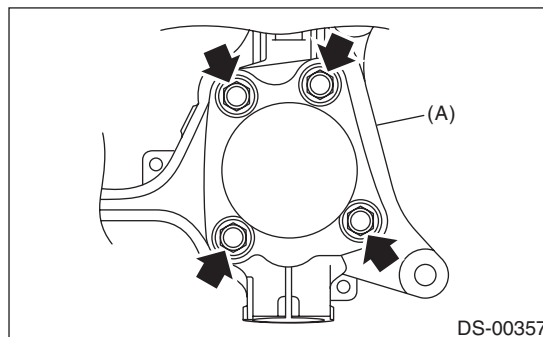
Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

13) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

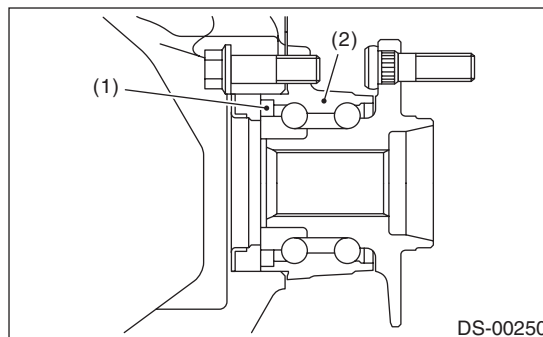
1) Remove the four bolts from the front housing, and remove the front hub unit bearing and disc cover.



(A) Front housing

CAUTION:

- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



(1) Magnetic encoder

(2) Front hub unit bearing

2) Disassemble the front hub unit bearing. <Ref. to DS-21, DISASSEMBLY, Front Hub Unit Bearing.>

Front Axle

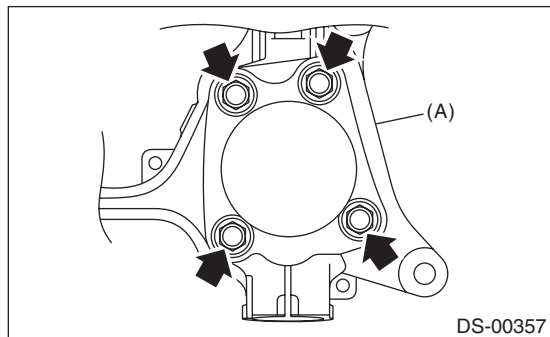
DRIVE SHAFT SYSTEM

D: ASSEMBLY

- 1) Assemble the front hub unit bearing. <Ref. to DS-21, ASSEMBLY, Front Hub Unit Bearing.>
- 2) Place the disc cover between front housing and front hub unit, and tighten the four bolts.

Tightening torque:

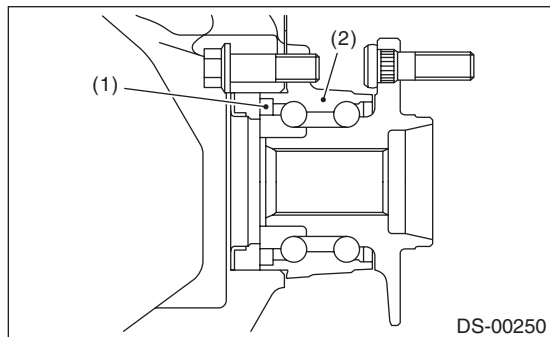
65 N·m (6.6 kgf-m, 47.9 ft-lb)



(A) Front housing

CAUTION:

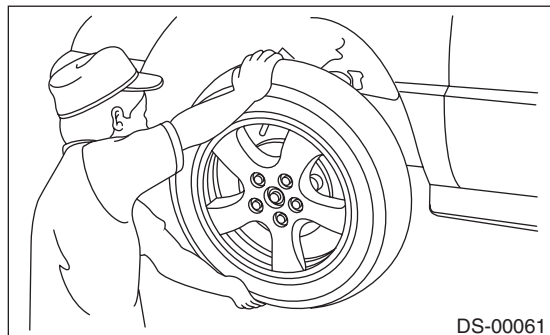
- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



- (1) Magnetic encoder
(2) Front hub unit bearing

E: INSPECTION

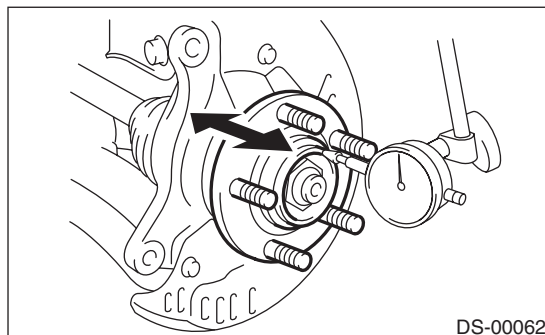
- 1) Moving the front tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



- 2) Inspect the lean of axis direction using a dial gauge. Replace the bearing if the load range exceeds the limitation.

Service limit:

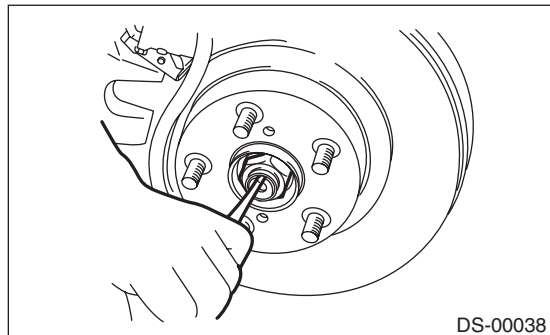
Maximum: 0.05 mm (0.0020 in)



4. Rear Axle

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle, and remove the rear wheels.
- 3) Lift the crimped section of axle nut.

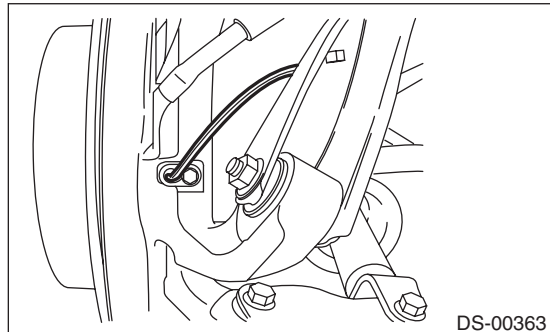


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

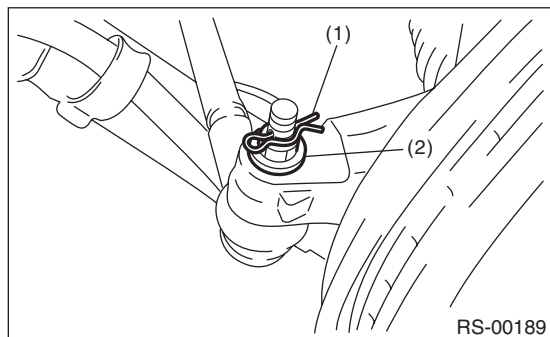
CAUTION:

Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

- 5) Remove the parking brake cable from parking brake assembly. <Ref. to PB-7, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>
- 6) Remove the rear ABS wheel speed sensor.

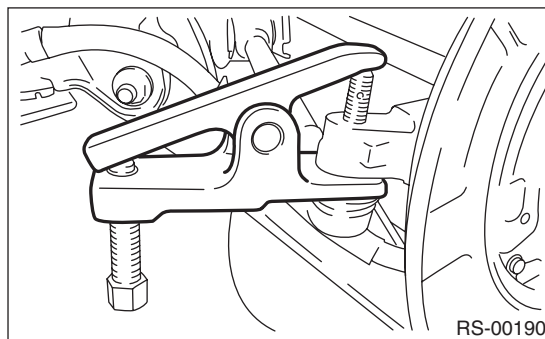


- 7) Remove the snap pin and nut from the front lateral link.

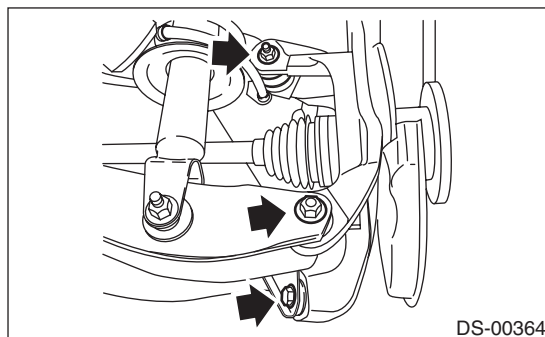


- (1) Snap pin
- (2) Nut

- 8) Separate the rear housing and the ball joint using the puller.



- 9) Separate the upper arm, trailing link and rear lateral link from the rear housing.

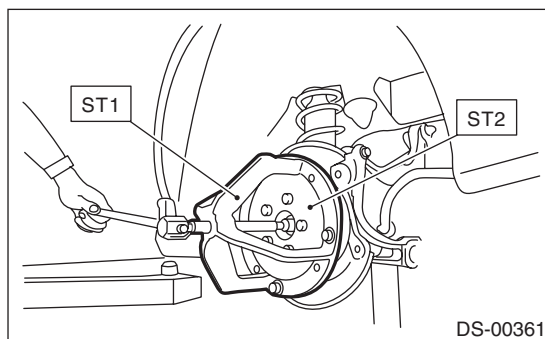


- 10) Remove the rear axle.

NOTE:

If it is hard to remove, use the ST.

- ST1 926470000 AXLE SHAFT PULLER
ST2 28099PA110 AXLE SHAFT PULLER PLATE



B: INSTALLATION

NOTE:

- Be sure to use a new self-locking nut.
 - Always tighten bushings with wheels in full contact with the ground and the vehicle at curb weight.
- 1) Install in the reverse order of removal.

Tightening torque:

Refer to “COMPONENT” of “General Description” for the tightening torque.

<Ref. to DS-4, COMPONENT, General Description.>

<Ref. to BR-4, COMPONENT, General Description.>

<Ref. to PB-2, COMPONENT, General Description.>

<Ref. to RS-3, COMPONENT, General Description.>

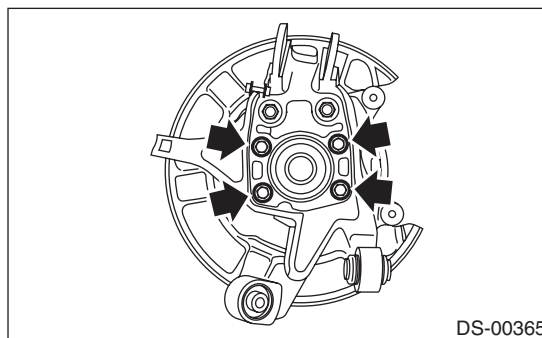
<Ref. to VDC-2, COMPONENT, General Description.>

- 2) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

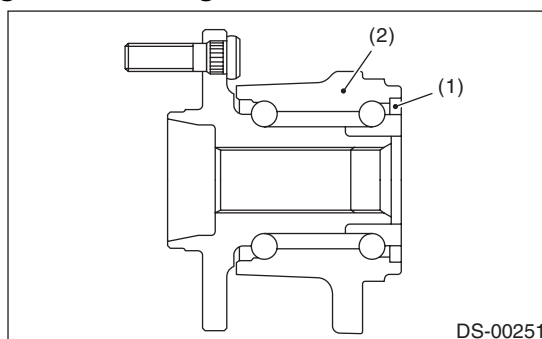
1. REAR HUB UNIT BEARING

- 1) Remove the four bolts from the rear housing, and remove the rear hub unit bearing.



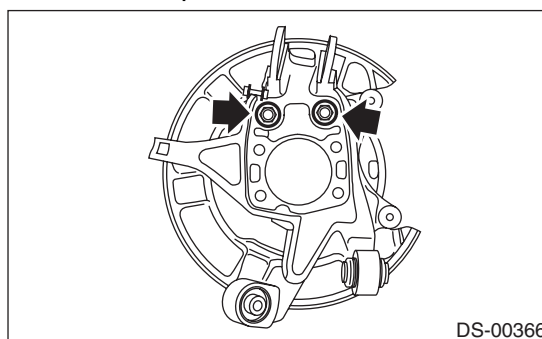
CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.



- (1) Magnetic encoder
(2) Rear hub unit bearing

- 2) Remove the two bolts from the rear housing, and remove the back plate.



2. BUSHING

Refer to “Rear Trailing Link” of “REAR SUSPENSION” for removal procedure.

<Ref. to RS-11, REAR HOUSING BUSHING, DISASSEMBLY, Rear Trailing Link.>

D: ASSEMBLY

1. REAR HUB UNIT BEARING

Assemble in the reverse order of disassembly.

Tightening torque:

Rear hub unit bearing

65 N·m (6.6 kgf-m, 47.9 ft-lb)

Back plate

75 N·m (7.6 kgf-m, 55.3 ft-lb)

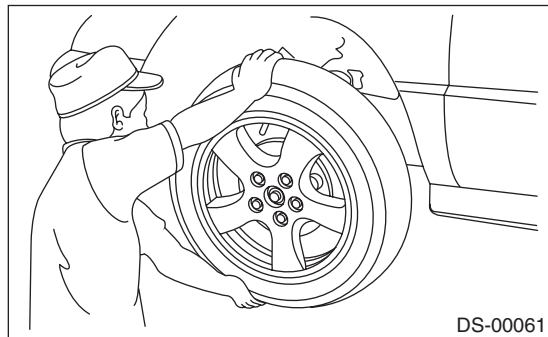
2. BUSHING

Refer to “Rear Trailing Link” of “REAR SUSPENSION” for installation procedure.

<Ref. to RS-12, REAR HOUSING BUSHING, ASSEMBLY, Rear Trailing Link.>

E: INSPECTION

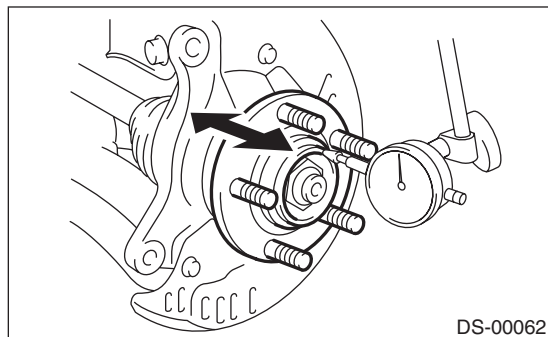
1) Moving the rear tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



2) Inspect the lean of axis direction using a dial gauge. Replace the bearing if the load range exceeds the limitation.

Service limit:

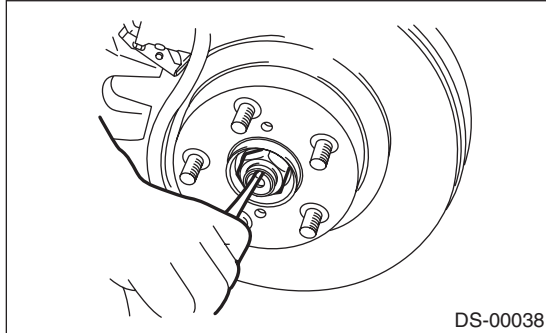
Maximum: 0.05 mm (0.0020 in)



5. Front Hub Unit Bearing

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle, and remove the front wheels.
- 3) Lift the crimped section of axle nut.



- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

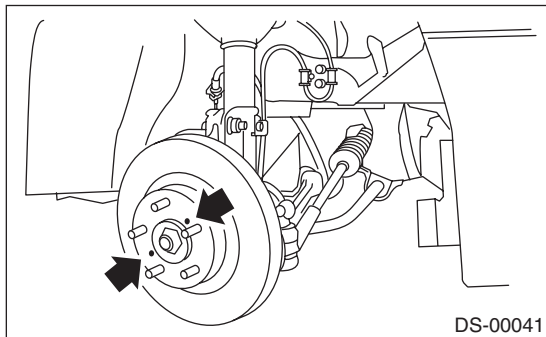
CAUTION:

Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

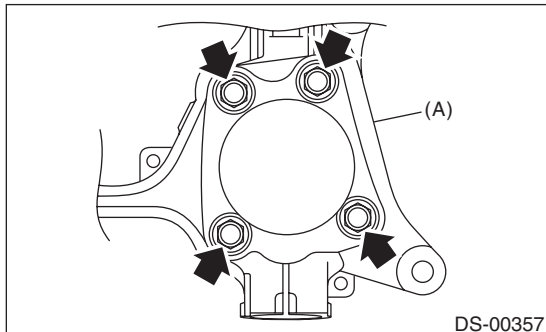
- 5) Remove the disc brake caliper from the front housing, and suspend it from strut using a piece of wire.
- 6) Remove the disc rotor from the hub.

NOTE:

If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threaded end of rotor, and then remove the rotor.



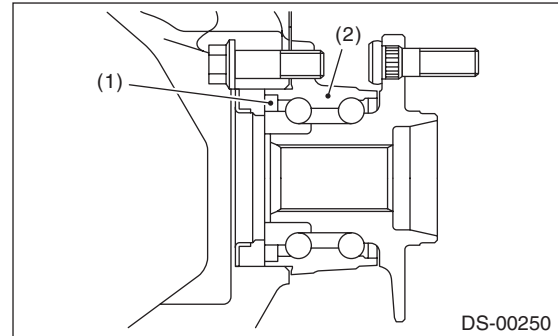
- 7) Remove four bolts from the front housing.



(A) Front housing

CAUTION:

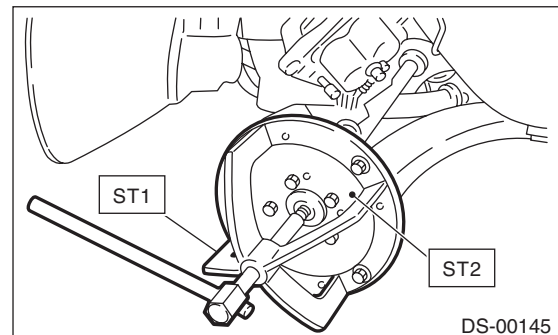
- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



- (1) Magnetic encoder
- (2) Front hub unit bearing

- 8) Remove the front hub unit bearing. If it is hard to remove, use the ST.

ST1 926470000 AXLE SHAFT PULLER
ST2 28099PA110 AXLE SHAFT PULLER PLATE

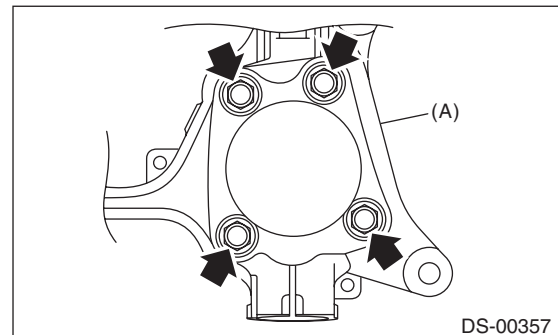


B: INSTALLATION

- 1) Place the disc cover between front housing and front hub unit, and tighten the four bolts.

Tightening torque:

65 N·m (6.6 kgf-m, 47.9 ft-lb)



(A) Front housing

- 2) Install the front drive shaft. <Ref. to DS-25, INSTALLATION, Front Drive Shaft.>

- 3) Tighten the axle nut temporarily.
- 4) Install the disc rotor to hub.
- 5) Install the disc brake caliper to the front housing.

Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

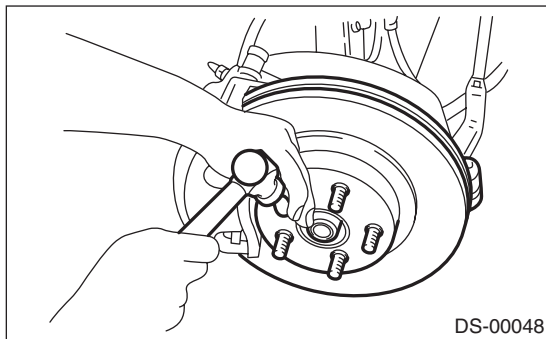
- 6) While depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

Tightening torque:

240 N·m (24.5 kgf-m, 177 ft-lb)

CAUTION:

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
 - Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.
- 7) After tightening the axle nut, lock it securely.



- 8) Install the front wheel and tighten the wheel nuts to specified torque.

Tightening torque:

Chromed wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

C: DISASSEMBLY

Using the ST and a hydraulic press, push out the hub bolts.

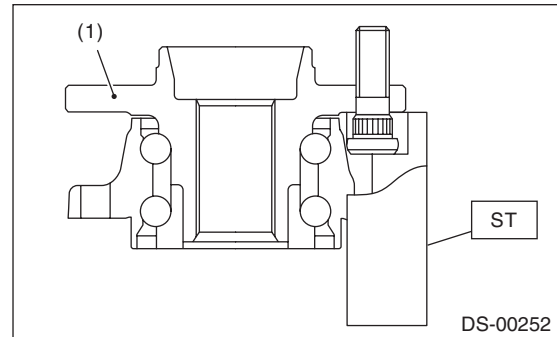
ST 28399AG000 HUB STAND

CAUTION:

- Be careful not to hammer the hub bolts. This may deform the hub.
- Do not reuse the hub bolt.

NOTE:

Since the hub unit bearing can not be disassembled, only hub bolts can be removed.

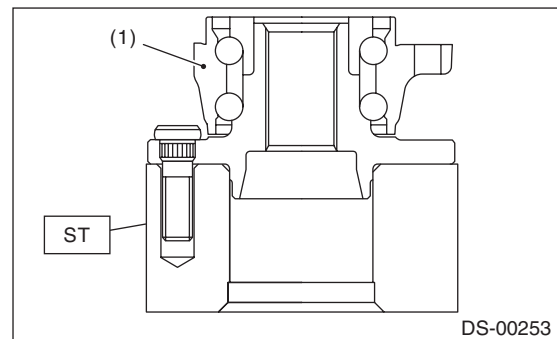


(1) Front hub unit bearing

D: ASSEMBLY

- 1) Attach the hub to the ST securely.

ST 28099PA080 HUB STAND



(1) Front hub unit bearing

- 2) Using a press, press the new hub bolts until their seating surfaces contact the hub.

NOTE:

Use the 12 mm (0.47 in) dia. holes in the HUB STAND to prevent bolts from tilting.

E: INSPECTION

Refer to "Front Axle" for inspection procedures.
<Ref. to DS-16, INSPECTION, Front Axle.>

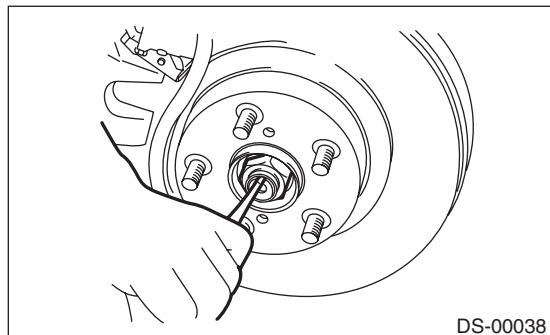
CAUTION:

If there is any fault in the bearing, replace hub unit bearing.

6. Rear Hub Unit Bearing

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle, and then remove the rear wheels.
- 3) Lift the crimped section of axle nut.

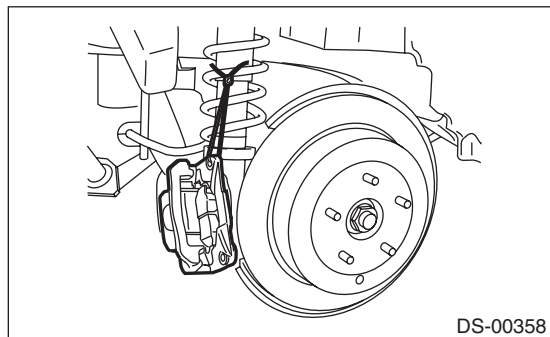


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

CAUTION:

Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

- 5) Release the parking brake.
- 6) Remove the disc brake caliper from the rear housing, and suspend it from the vehicle using a piece of rope.

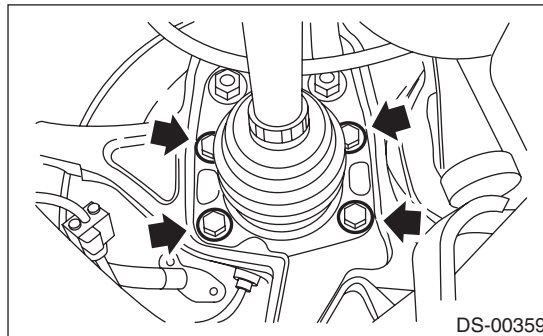


- 7) Remove the disc rotor from the hub.

NOTE:

- Mark the mating surface of hub and disc rotor before removing the disc rotor to avoid confusing when installing.
- If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threaded end of rotor, and then remove the rotor.

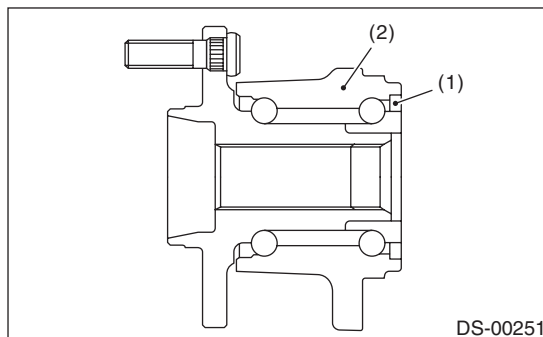
- 8) Remove the four bolts from rear arm.



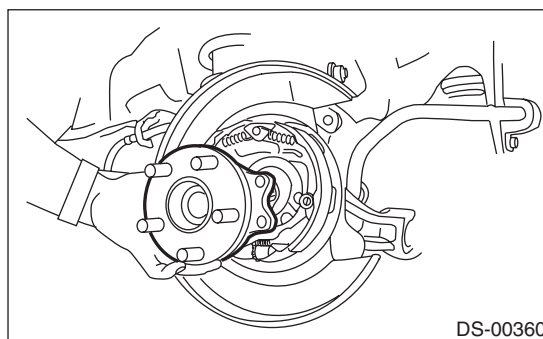
- 9) Remove the hub unit bearing.

CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.



- (1) Magnetic encoder
- (2) Rear hub unit bearing

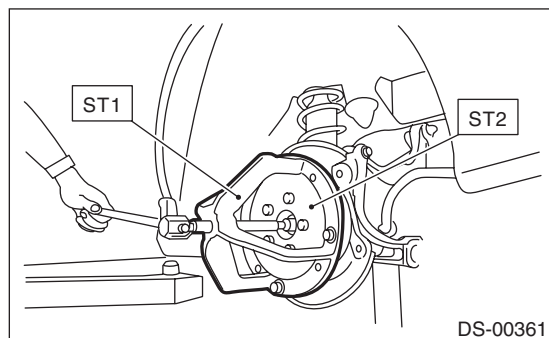


NOTE:

If it is hard to remove, use the ST.

ST1 926470000 AXLE SHAFT PULLER

ST2 28099PA110 AXLE SHAFT PULLER
PLATE

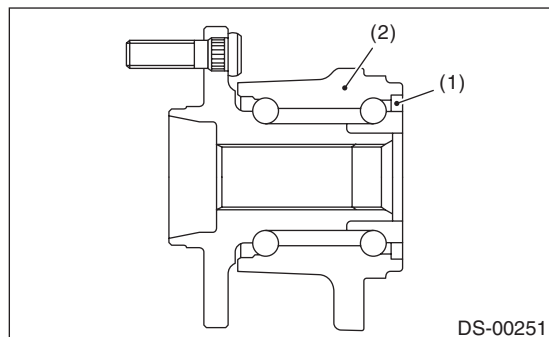


B: INSTALLATION

1) Aligning the hub unit bearing to the mounting hole of the back plate, install the hub unit assembly and back plate. Tighten the axle nut temporarily.

CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.

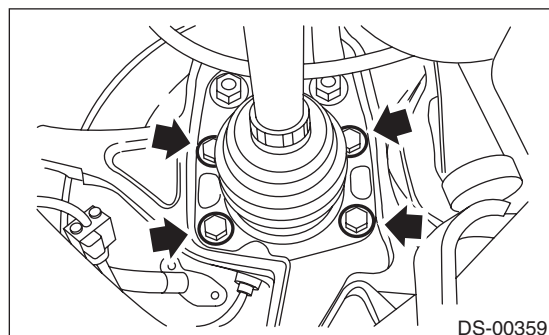


- (1) Magnetic encoder
(2) Rear hub unit bearing

2) Tighten the four bolts to the rear housing.

Tightening torque:

65 N·m (6.6 kgf-m, 47.9 ft-lb)



3) Remove the axle nut.

4) Draw the rear drive shaft into specified position.

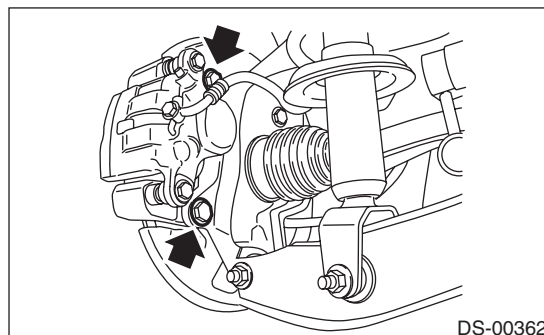
5) Tighten the new axle nut temporarily.

6) Install the disc rotor to hub.

7) Install the disc brake caliper on the rear housing.

Tightening torque:

66 N·m (6.7 kgf-m, 48.7 ft-lb)



8) Adjust the parking brake pedal stroke by turning the adjuster. <Ref. to PB-4, ADJUSTMENT, Parking Brake Pedal.>

9) While applying the parking brake and depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

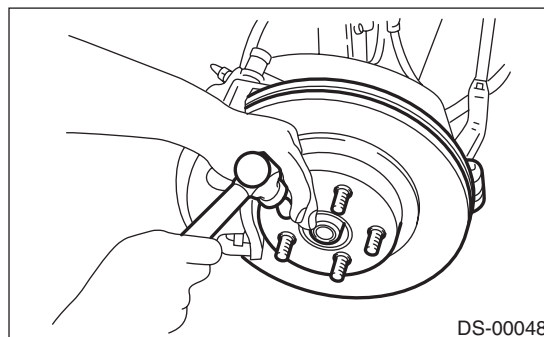
Tightening torque:

240 N·m (24.5 kgf-m, 177 ft-lb)

CAUTION:

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

10) After tightening the axle nut, lock it securely.



11) Install the rear wheel and tighten the wheel nuts to specified torque.

Tightening torque:

Chromed wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

Rear Hub Unit Bearing

DRIVE SHAFT SYSTEM

C: DISASSEMBLY

Using the ST and a hydraulic press, push out the hub bolts.

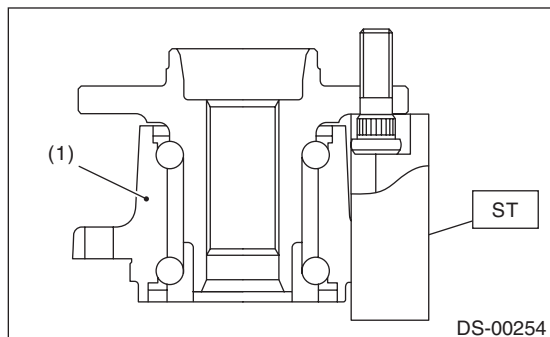
ST 28399AG000 HUB STAND

CAUTION:

- Be careful not to hammer the hub bolts. This may deform the hub.
- Do not reuse the hub bolt.

NOTE:

Since the hub unit bearing can not be disassembled, only hub bolts can be removed.

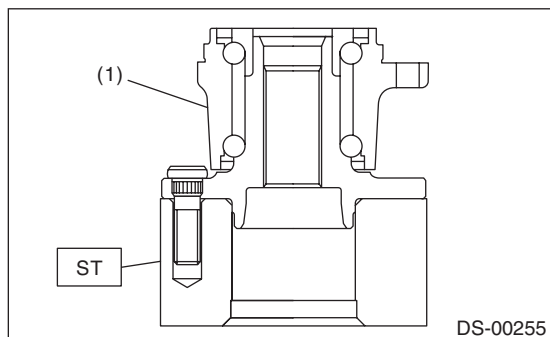


(1) Rear hub unit bearing

D: ASSEMBLY

1) Attach the hub to the ST securely.

ST 28099PA080 HUB STAND



(1) Rear hub unit bearing

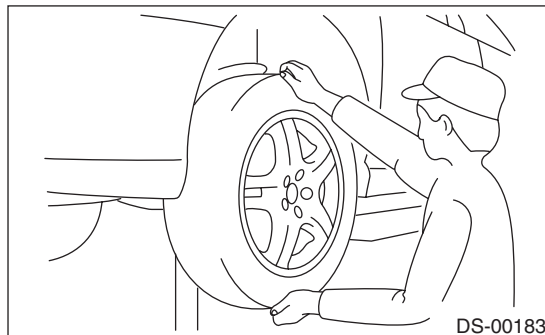
2) Using a press, press the new hub bolts until their seating surfaces contact the hub.

NOTE:

Use the 12 mm (0.47 in) dia. holes in the HUB STAND to prevent bolts from tilting.

E: INSPECTION

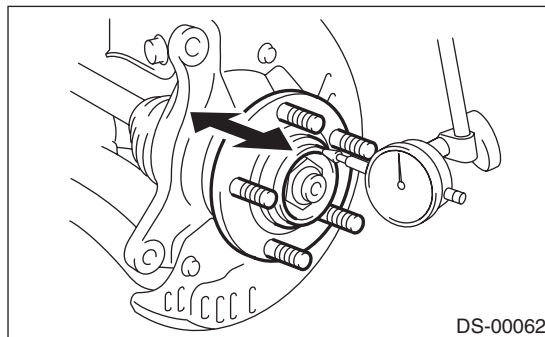
1) Moving the rear tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



2) Inspect the lean of axis direction using a dial gauge. Replace the hub bearing if the play exceeds the limit value.

Service limit:

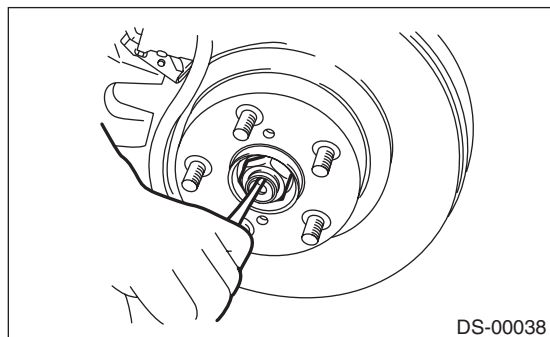
Maximum: 0.05 mm (0.0020 in)



7. Front Drive Shaft

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, and remove the front wheels.
- 3) Drain the differential gear oil.
- 4) Lift the crimped section of axle nut.

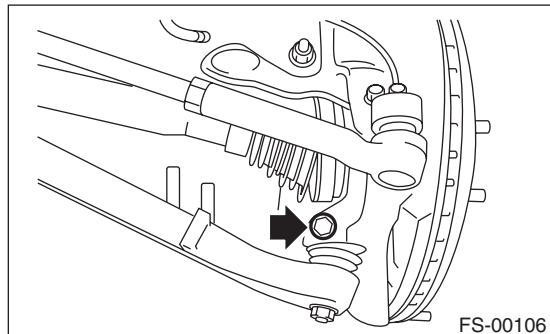


- 5) Remove the axle nut using a socket wrench while depressing the brake pedal.

CAUTION:

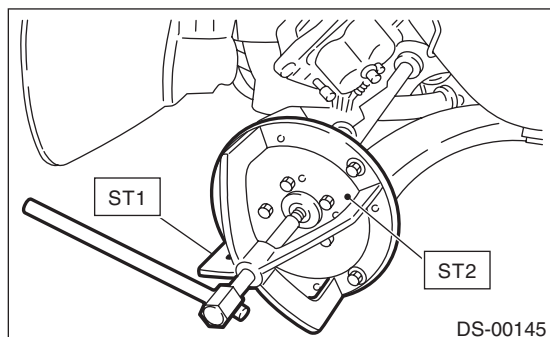
Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

- 6) Remove the stabilizer link from front arm.
- 7) Disconnect the front arm ball joint from the front housing.



- 8) Remove the front drive shaft assembly. If it is hard to remove, use ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER
ST2 28099PA110 AXLE SHAFT PULLER PLATE



- 9) Using a bar, remove the front drive shaft from transmission.

CAUTION:

Be careful not to allow the bar to damage holder area.

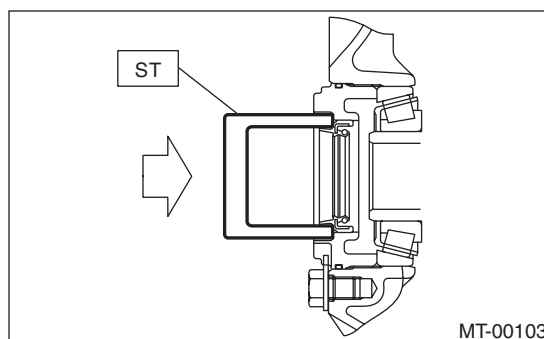
B: INSTALLATION

- 1) Using the ST, replace the differential side retainer oil seal with a new seal.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

NOTE:

After pulling out the drive shaft, be sure to replace with a new oil seal.



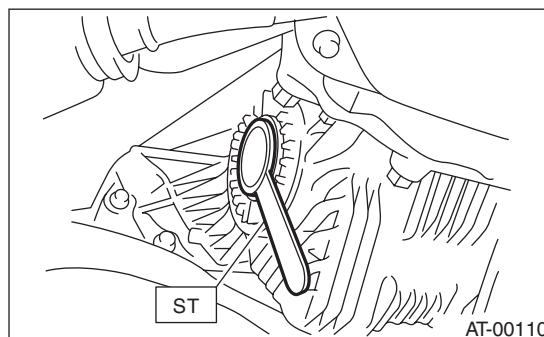
- 2) Insert the EBJ into hub splines.
- 3) Draw the drive shaft into specified position.

CAUTION:

Do not hammer drive shaft when installing it.

- 4) Tighten the axle nut temporarily.
- 5) Using the ST, install the front drive shaft to transmission.

ST 28399SA010 OIL SEAL PROTECTOR



- 6) Connect the front arm ball joint to the front housing.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

- 7) Install the stabilizer link.

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

CAUTION:

Be sure to use a new self-locking nut.

Front Drive Shaft

DRIVE SHAFT SYSTEM

8) While depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

Tightening torque:

240 N·m (24.5 kgf-m, 177 ft-lb)

CAUTION:

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

9) After tightening axle nut, lock it securely.

10) Fill the differential gear oil.

11) Install the front wheel and tighten the wheel nuts to specified torque.

Tightening torque:

Chromed wheel

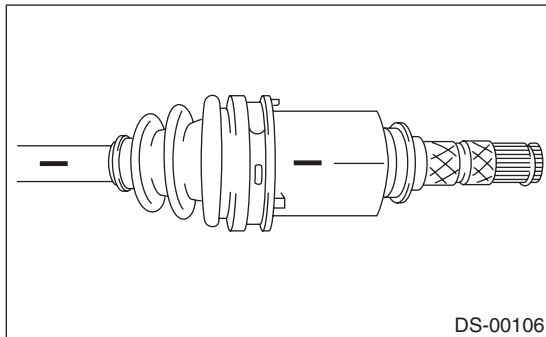
150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

C: DISASSEMBLY

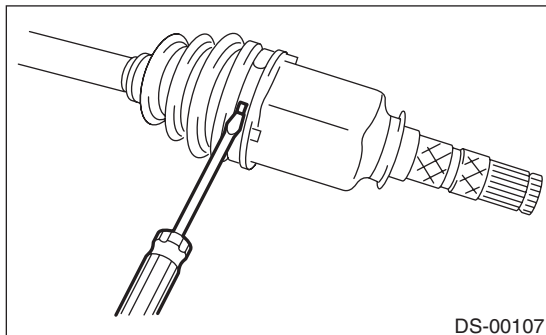
1) Place alignment marks on the shaft and outer race.



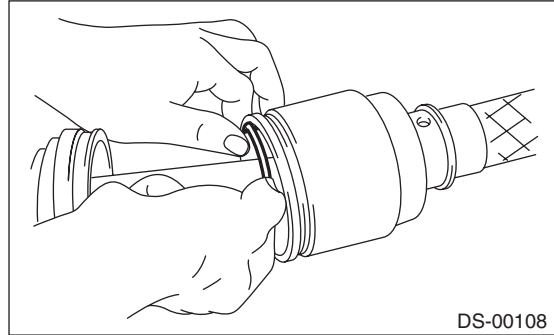
2) Remove the PTJ boot band and boot.

CAUTION:

Be careful not to damage the boot.



3) Remove the snap ring from PTJ outer race.



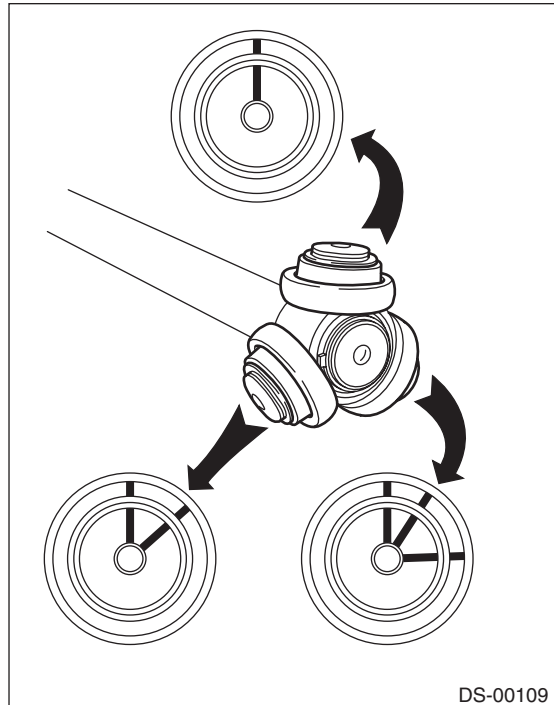
4) Remove the PTJ outer race from shaft assembly.

5) Wipe off grease.

CAUTION:

The grease is a special type of grease. Do not mix with other grease.

6) Place alignment marks on the roller kit and trunnion.

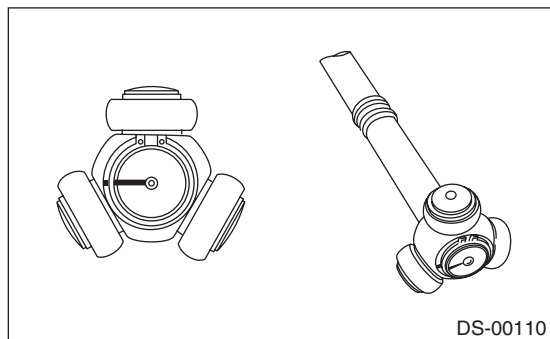


7) Remove the roller kit from trunnion.

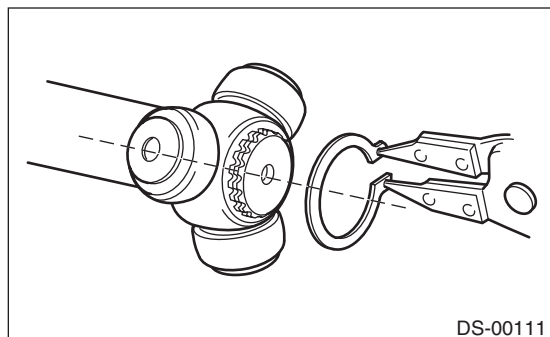
CAUTION:

Be careful with the roller kit position.

- 8) Place alignment marks on the trunnion and shaft.



- 9) Remove the snap ring and trunnion.



CAUTION:
Be sure to wrap shaft splines with vinyl tape to protect the boot from scratches.

- 10) Remove the PTJ boot.

NOTE:

The EBJ is a non-disassembly part, so the drive shaft disassembly stops here.

D: ASSEMBLY

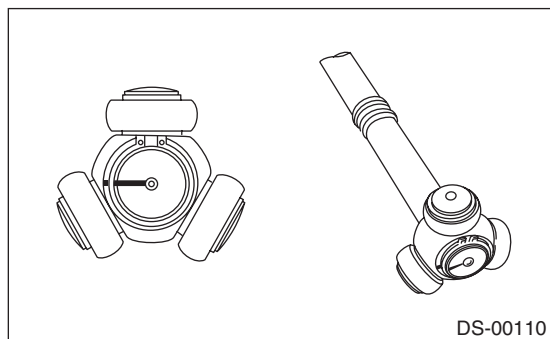
NOTE:

Use specified grease.

PTJ side:

NKG302

- 1) Place the PTJ boot at the center of shaft.
- 2) Align alignment marks and install the trunnion on the shaft.



- 3) Install the snap ring to shaft.

CAUTION:

Confirm that the snap ring is completely fitted in shaft groove.

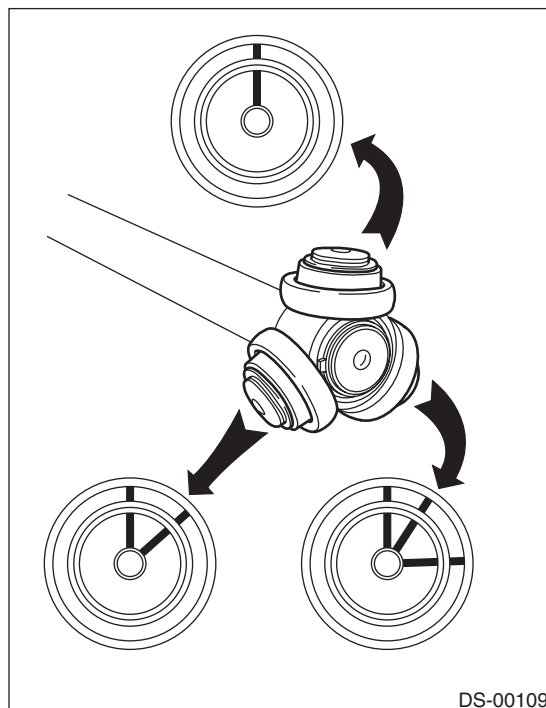
- 4) Fill 100 to 110 g (3.53 to 3.88 oz) of specified grease into the interior of PTJ outer race.

- 5) Apply a thin coat of specified grease to the roller kit and trunnion.

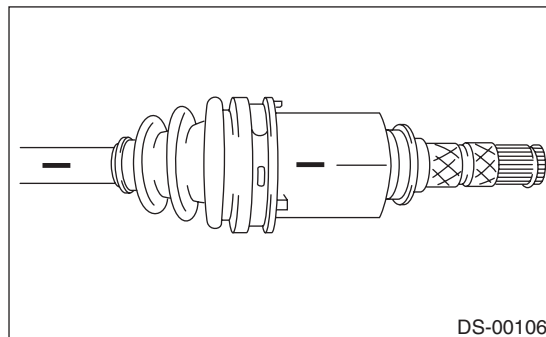
- 6) Align alignment marks on roller kit and trunnion and install the roller kit.

CAUTION:

Be careful with the roller kit position.



- 7) Align the alignment marks of the shaft and outer race, and install the outer race.



- 8) Install the snap ring in the groove on PTJ outer race.

CAUTION:

Pull the shaft lightly and assure that the snap ring is completely fitted in the groove.

- 9) 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.

Front Drive Shaft

DRIVE SHAFT SYSTEM

10) Install the PTJ boot taking care not to twist it.

CAUTION:

- The large end of PTJ boot and the boot groove shall be cleaned completely so as to be free from grease and other substances.
- When installing PTJ boot, position outer race of PTJ at center of its travel.

11) Put a new band through the clip and wind twice in the band groove of the boot.

12) Pinch the end of band with pliers. Hold the clip and tighten securely.

NOTE:

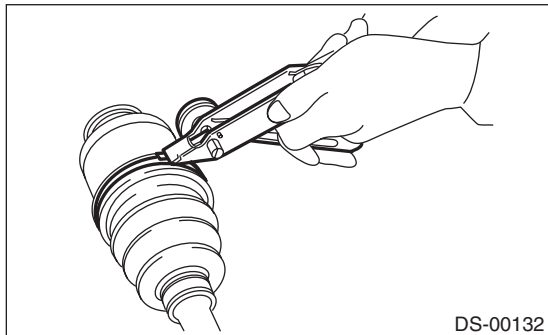
When tightening boot, use care so that the air within the boot is appropriate.

13) Tighten the band using the ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tighten the band until it cannot be moved by hand.

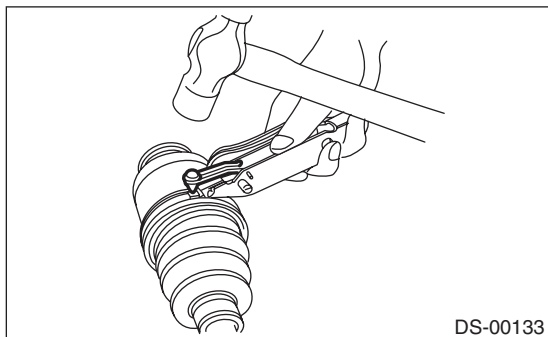


14) Tap the clip with the punch provided at the end of the ST.

ST 925091000 BAND TIGHTENING TOOL

CAUTION:

Tap to an extent that the boot underneath is not damaged.



15) Cut off the band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

CAUTION:

Make sure that the end of the band is in close contact with clip.

16) Extend and retract the PTJ to provide equal grease coating.

E: INSPECTION

Check the removed parts for damage, wear, corrosion etc. If faulty, repair or replace.

- PTJ (pillow tripod joint)

Check for seizure, corrosion, damage, wear and excessive play.

- EBJ (high-efficiency compact ball fixed joint)

Check for seizure, corrosion, damage and excessive play.

- Shaft

Check for excessive bending, twisting, damage and wear.

- Boot

Check for wear, warping, breakage and scratches.

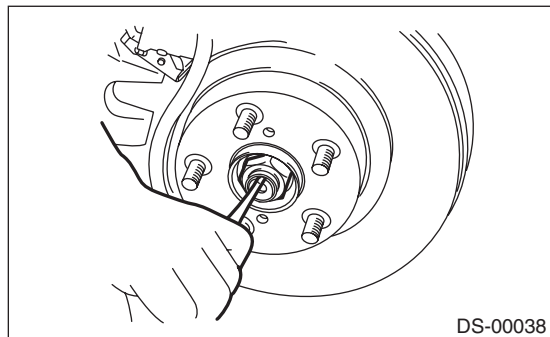
- Grease

Check for discoloration and fluidity.

8. Rear Drive Shaft

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle, and then remove the rear wheels.
- 3) Lift the crimped section of axle nut.



- 4) While applying the parking brake, remove the axle nut using a socket wrench.

CAUTION:

Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

- 5) Remove the rear differential assembly.

VA-type

<Ref. to DI-19, REMOVAL, Rear Differential (VA-type).>

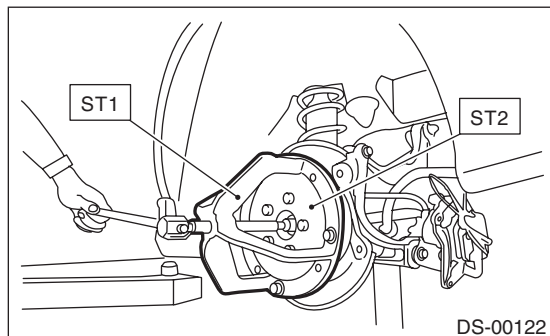
- 6) Remove the axle nut and rear drive shaft. If it is hard to remove, use ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER

ST2 28099PA110 AXLE SHAFT PULLER
PLATE

CAUTION:

- Do not hammer drive shaft when removing it.
- Do not damage the oil seal and magnetic encoder.

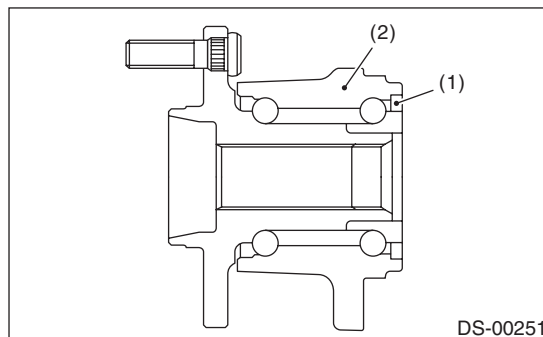


B: INSTALLATION

- 1) Insert the EBJ into rear hub splines.

CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.



- (1) Magnetic encoder
- (2) Rear hub unit bearing

- 2) Draw the rear drive shaft into specified position.

CAUTION:

Do not hammer drive shaft when installing it.

- 3) Tighten the axle nut temporarily.

- 4) Install the rear differential assembly.

VA-type

<Ref. to DI-20, INSTALLATION, Rear Differential (VA-type).>

- 5) While applying the parking brake and depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

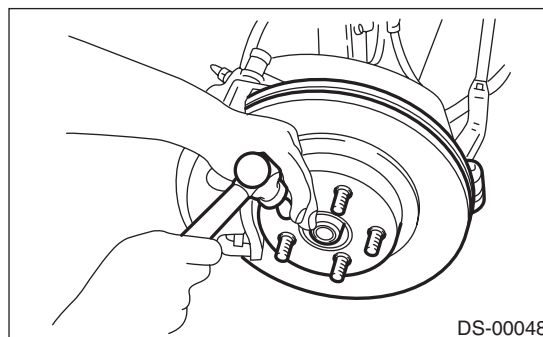
Tightening torque:

240 N·m (24.5 kgf-m, 177 ft-lb)

CAUTION:

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

- 6) Lock the axle nut securely.



Rear Drive Shaft

DRIVE SHAFT SYSTEM

7) Install the rear wheel and tighten to specified torque.

Tightening torque:

Chromed wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

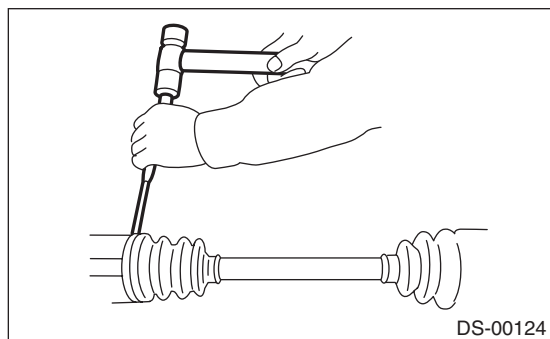
C: DISASSEMBLY

1) Straighten the bent claw at the larger end of the DOJ boot.

2) Loosen the band by means of screwdriver or pliers.

CAUTION:

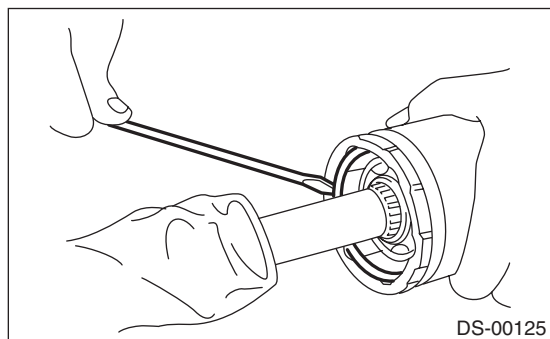
Be careful not to damage the boot.



3) Remove the boot band on the small end of DOJ boot in the same manner.

4) Remove the larger end of DOJ boot from DOJ outer race.

5) Pry and remove the circlip at the neck of DOJ outer race with a screwdriver.



6) Take out the DOJ outer race from the shaft assembly.

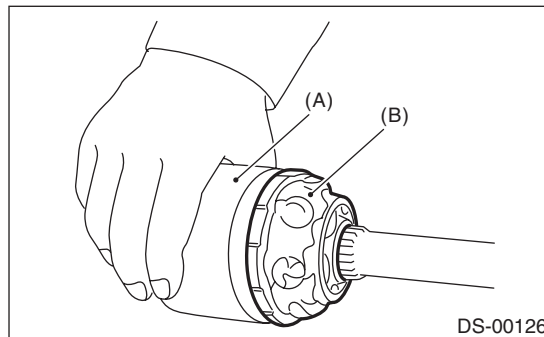
7) Wipe off the grease and take out the ball bearings.

CAUTION:

The grease is a special grease (grease for constant velocity joints). Do not mix with other greases.

NOTE:

Disassemble exercising care not to lose balls (6 pcs).



(A) Outer race

(B) Grease

8) To remove the cage from inner race, turn the cage by a half pitch to the track groove of inner race and shift the cage.

9) Using pliers, remove the snap ring fixing the inner race to the shaft.

10) Take out the DOJ inner race.

11) Take off the DOJ cage from shaft and remove the DOJ boot.

CAUTION:

Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

NOTE:

The EBJ is a non-disassembly part, so the drive shaft disassembly stops here.

D: ASSEMBLY

NOTE:

Use specified grease.

DOJ side:

NKG205

1) Place the DOJ boot at the center of shaft.

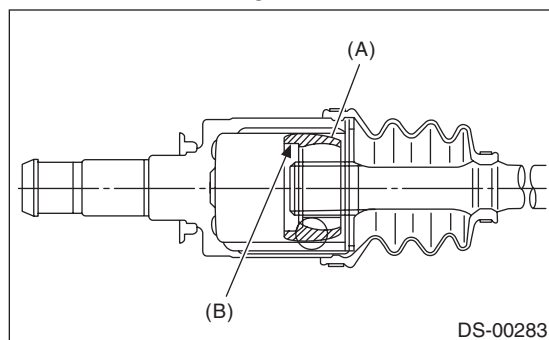
CAUTION:

Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

2) Insert the DOJ cage onto shaft.

NOTE:

Insert the cage with the cutout portion facing the shaft end, since the cage has an orientation.

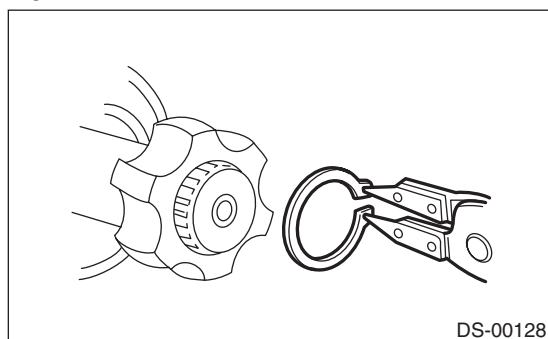


(A) Cage
(B) Cutout portion

3) Install the DOJ inner race on shaft and fix the snap ring in place with pliers.

NOTE:

Confirm that the snap ring is completely fitted in the shaft groove.

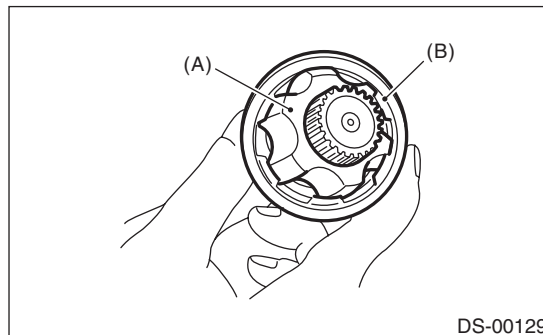


DS-00128

4) Install the cage to inner race fixed upon shaft.

NOTE:

Fit the cage with the protruding section aligned with the track on the inner race, and turn by a half pitch.



DS-00129

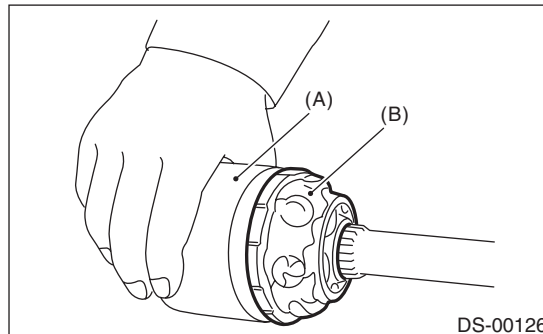
(A) Inner race
(B) Cage

5) Fill 80 to 90 g (2.82 to 3.17 oz) of specified grease into the inner side of the DOJ outer race.

6) Apply a thin coat of specified grease to the cage pocket and six ball bearings.

7) Insert the six ball bearings into the cage pocket.

8) Align the outer race track and ball positions, and place the shaft, inner race, cage and ball bearings in the original positions, and then fix outer race in place.



DS-00126

(A) Outer race
(B) Grease

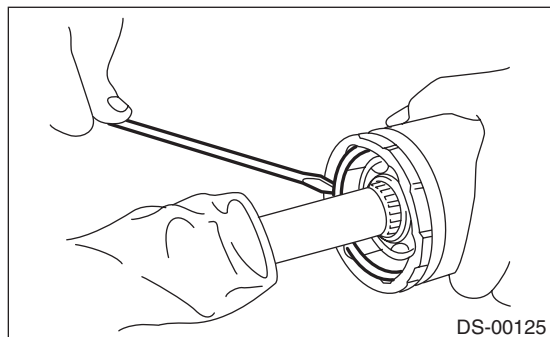
Rear Drive Shaft

DRIVE SHAFT SYSTEM

9) Install the snap ring in the groove on the DOJ outer race.

NOTE:

- Assure that the balls, cage and inner race are completely fitted in the outer race of DOJ.
- Use care not to place the matched position of snap ring in the ball groove of outer race.
- Pull the shaft lightly and assure that the circlip is completely fitted in the groove.



10) 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 the shaft.

11) Install the DOJ boot taking care not to twist it.

NOTE:

- The inside of the large end of DOJ boot and the boot groove shall be cleaned so as to be free from grease and other substances.
- When installing the DOJ boot, position the outer race of DOJ at center of the stroke.

12) Put a new band through the clip and wind twice in the band groove of the boot.

13) Pinch the end of band with pliers. Hold the clip and tighten securely.

NOTE:

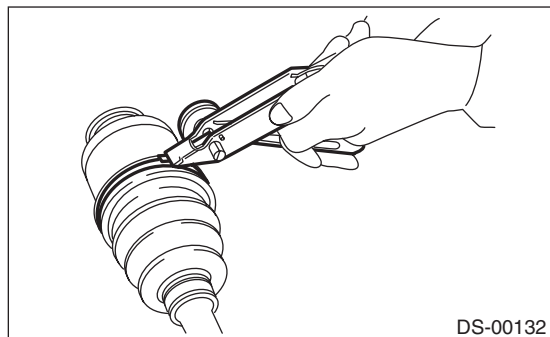
When tightening boot, use care so that the air within the boot is appropriate.

14) Tighten the band using the ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tighten the band until it cannot be moved by hand.

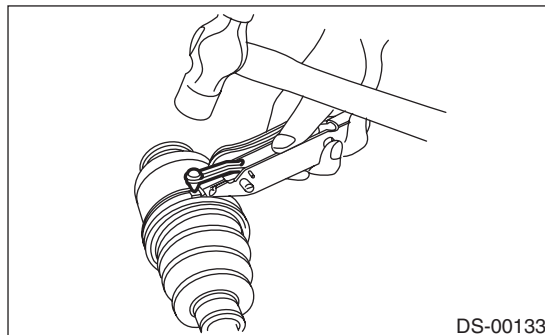


15) Tap the clip with the punch provided at the end of the ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tap to an extent that the boot underneath is not damaged.



16) Cut off the band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

NOTE:

Be careful so that the end of the band is in close contact with clip.

17) Install the EBJ boot using the same procedures as for the DOJ boot.

18) Extend and retract the DOJ repeatedly to provide an equal coating of grease.

E: INSPECTION

Check the removed parts for damage, wear, corrosion etc. Repair or replace if defective.

- DOJ (Double Offset Joint)

Check for seizure, corrosion, damage, wear and excessive play.

- EBJ (high-efficiency compact ball fixed joint)

Check for seizure, corrosion, damage, wear and excessive play.

- Shaft

Check for excessive bending, twisting, damage and wear.

- Boot

Check for wear, warping, breakage and scratches.

- Grease

Check for discoloration and fluidity.

9. General Diagnostic Table

A: INSPECTION

NOTE:

Vibration while cruising may be caused by an unbalanced tire, improper tire inflation pressure, improper wheel alignment, etc.

Symptoms	Possible cause	Corrective action
Noise or vibration from propeller shaft	Center bearing	Check the center bearing. <Ref. to DS-12, CENTER BEARING FREE PLAY, INSPECTION, Propeller Shaft.>
	Runout of propeller shaft	Check for deflection of the propeller shaft. <Ref. to DS-12, RUNOUT OF PROPELLER SHAFT, INSPECTION, Propeller Shaft.>
	Loose or gap at connections	Check the joints and connectors. <Ref. to DS-11, JOINTS AND CONNECTIONS, INSPECTION, Propeller Shaft.>
		Check the spline and bearing. <Ref. to DS-11, SPLINES AND BEARING, INSPECTION, Propeller Shaft.>
Abnormal wheel vibration	Wheel is out of balance.	Check the wheel balance. <Ref. to WT-6, WHEEL BALANCING, INSPECTION, Tire and Wheel.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-6, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-8, INSPECTION, Wheel Alignment.>
	Front strut	Check the front strut. <Ref. to FS-21, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-15, INSPECTION, Rear Shock Absorber.>
	Front drive shaft	Check the front drive shaft. <Ref. to DS-28, INSPECTION, Front Drive Shaft.>
	Rear drive shaft	Check the rear drive shaft. <Ref. to DS-32, INSPECTION, Rear Drive Shaft.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-21, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-24, INSPECTION, Rear Hub Unit Bearing.>
Noise from the underbody	Wheel is out of balance.	Check the wheel balance. <Ref. to WT-6, WHEEL BALANCING, INSPECTION, Tire and Wheel.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-6, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-8, INSPECTION, Wheel Alignment.>
	Front strut	Check the front strut. <Ref. to FS-21, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-15, INSPECTION, Rear Shock Absorber.>

General Diagnostic Table

DRIVE SHAFT SYSTEM

VEHICLE DYNAMICS CONTROL (VDC)

VDC

	Page
1. General Description	2
2. VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)	6
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5. Yaw Rate and G Sensor	17
6. Steering Angle Sensor	18
7. Front ABS Wheel Speed Sensor	20
8. Rear ABS Wheel Speed Sensor	22
9. Front Magnetic Encoder	23
10. Rear Magnetic Encoder	24
11. TCS OFF Switch	25

General Description

FRONT SUSPENSION

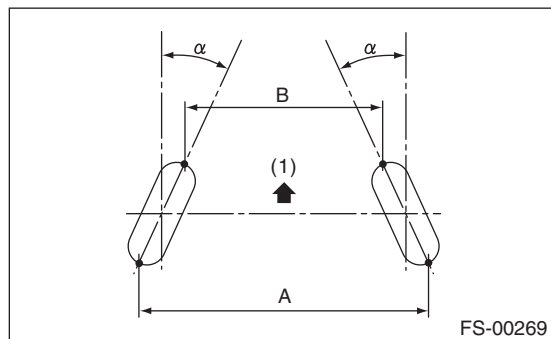
1. General Description

A: SPECIFICATION

Front	Wheel arch height (Tolerance: $+12\text{ mm}$ -24 mm ($+0.47\text{ in}$ -0.94 in)) mm (in)		452 (17.8)
	Camber (tolerance: $\pm 0^\circ 45'$ Differences between RH and LH: 45' or less)		$0^\circ 10'$
	Caster (referential value)		$4^\circ 00'$
	Steering angle (tolerance: $\pm 1.5^\circ$)	Inner wheel	37.0°
		Outer wheel	32.0°
	Toe-in mm (in)	0 $\pm$ 3 (0 $\pm$ 0.12) Toe angle (sum of both wheels): $0^\circ \pm 0^\circ 14'$	
Rear	Kingpin angle (referential value)		$12^\circ 00'$
	Wheel arch height (Tolerance: $+12\text{ mm}$ -24 mm ($+0.47\text{ in}$ -0.94 in)) mm (in)		449 (17.7)
	Camber (tolerance: $\pm 0^\circ 45'$ Differences between RH and LH: 45' or less)		$-0^\circ 15'$
	Toe-in mm (in)	2 $\pm$ 2 (0.08 $\pm$ 0.08) Toe angle (sum of both wheels): $0^\circ 10' \pm 0^\circ 10'$	
	Thrust angle (tolerance: $\pm 0^\circ 30'$)		0°

NOTE:

- Front and rear toe-in and front camber can be adjusted. Adjust if the toe-in or camber tolerance exceeds specifications.
- Other items indicated in the specifications table cannot be adjusted. If other items exceed specifications, check the suspension parts and connections for deformation, and replace with new parts as required.

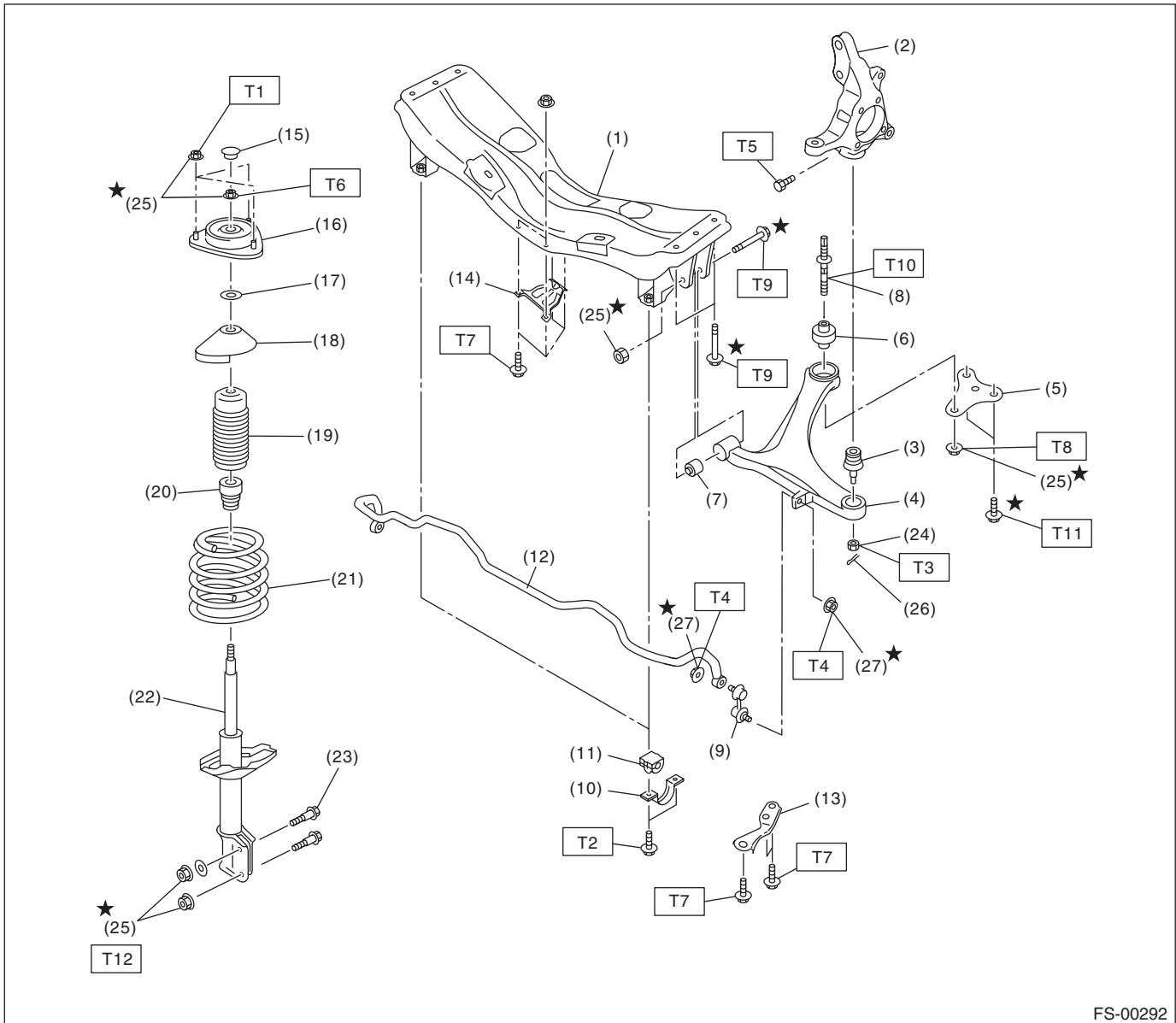


(1) Front

A – B = Positive: Toe-in, Negative: Toe-out

α = Individual toe angles

B: COMPONENT



- | | |
|--------------------------------|------------------------|
| (1) Front crossmember | (15) Dust seal |
| (2) Housing | (16) Strut mount |
| (3) Ball joint | (17) Spacer |
| (4) Front arm | (18) Upper spring seat |
| (5) Arm support plate | (19) Dust cover |
| (6) Rear bushing | (20) Front helper |
| (7) Front bushing | (21) Front coil spring |
| (8) Stud bolt | (22) Front strut |
| (9) Stabilizer link | (23) Adjusting bolt |
| (10) Stabilizer clamp | (24) Castle nut |
| (11) Stabilizer bushing | (25) Self-locking nut |
| (12) Front stabilizer | (26) Cotter pin |
| (13) Crossmember support plate | (27) Flange nut |
| (14) Jack-up plate | |

- (15) Dust seal
- (16) Strut mount
- (17) Spacer
- (18) Upper spring se
- (19) Dust cover
- (20) Front helper
- (21) Front coil spring
- (22) Front strut
- (23) Adjusting bolt
- (24) Castle nut
- (25) Self-locking nut
- (26) Cotter pin
- (27) Flange nut

Tightening torque: N·m (kgf-m, ft-lb)

T1: 20 (2.0, 14.5)

T2: 25 (2.5, 18.1)

T3: 45 (4.6, 33.2)

T4: 60 (6.1, 44.3)

T5: 50 (5.1, 36.9)

T6: 55 (5.6, 40.6)

T7: 60 (6.1, 44.3)

T8: 88 (9.0, 64.9)

T9: 95 (9.7, 70.1)

T10: 110 (11.2, 81.1)

T11: 150 (15.3, 110.6)

T12: 155 (15.8, 114.3)

General Description

FRONT SUSPENSION

C: CAUTION

Please clearly understand and adhere to the following general precautions. They must be strictly followed to avoid any injury to the person doing the work or people in the area.

1. OPERATION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

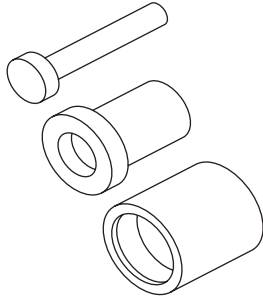
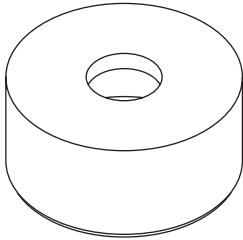
2. OIL

When handling oil, follow the rules below to prevent unexpected accidents.

- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

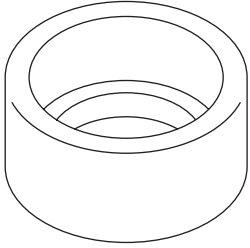
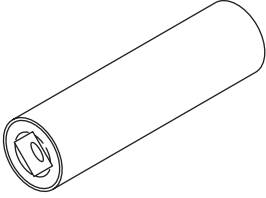
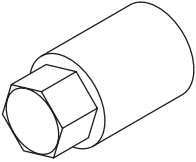
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-927680000	927680000	INSTALLER & REMOVER SET	Used for replacing front arm front bushing.
 ST20299AG000	20299AG000	REMOVER	Used for replacing front arm rear bushing. Used together with BASE (20299AG010).

General Description

FRONT SUSPENSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST20299AG010	20299AG010	BASE	Used for replacing front arm rear bushing. Used together with REMOVER (20299AG000).
 ST20299AG020	20299AG020	STUD BOLT SOCKET	Used for removing and installing the stud bolt for front arm installing portion.
 ST20399AG000	20399AG000	STRUT MOUNT SOCKET	Used for disassembling and assembling strut mount.

2. GENERAL TOOL

TOOL NAME	REMARKS
Alignment gauge	Used for measuring wheel alignment.
Alignment gauge adapter	Used for measuring wheel alignment.
Turning radius gauge	Used for measuring wheel alignment.
Toe-in gauge	Used for toe-in measurement.
Dial gauge	Used for damper strut measurement.
Coil spring compressor	Used for strut assembly/disassembly.

Wheel Alignment

FRONT SUSPENSION

2. Wheel Alignment

A: INSPECTION

Check the following items before performing the wheel alignment measurement.

Check items before measuring wheel alignment:

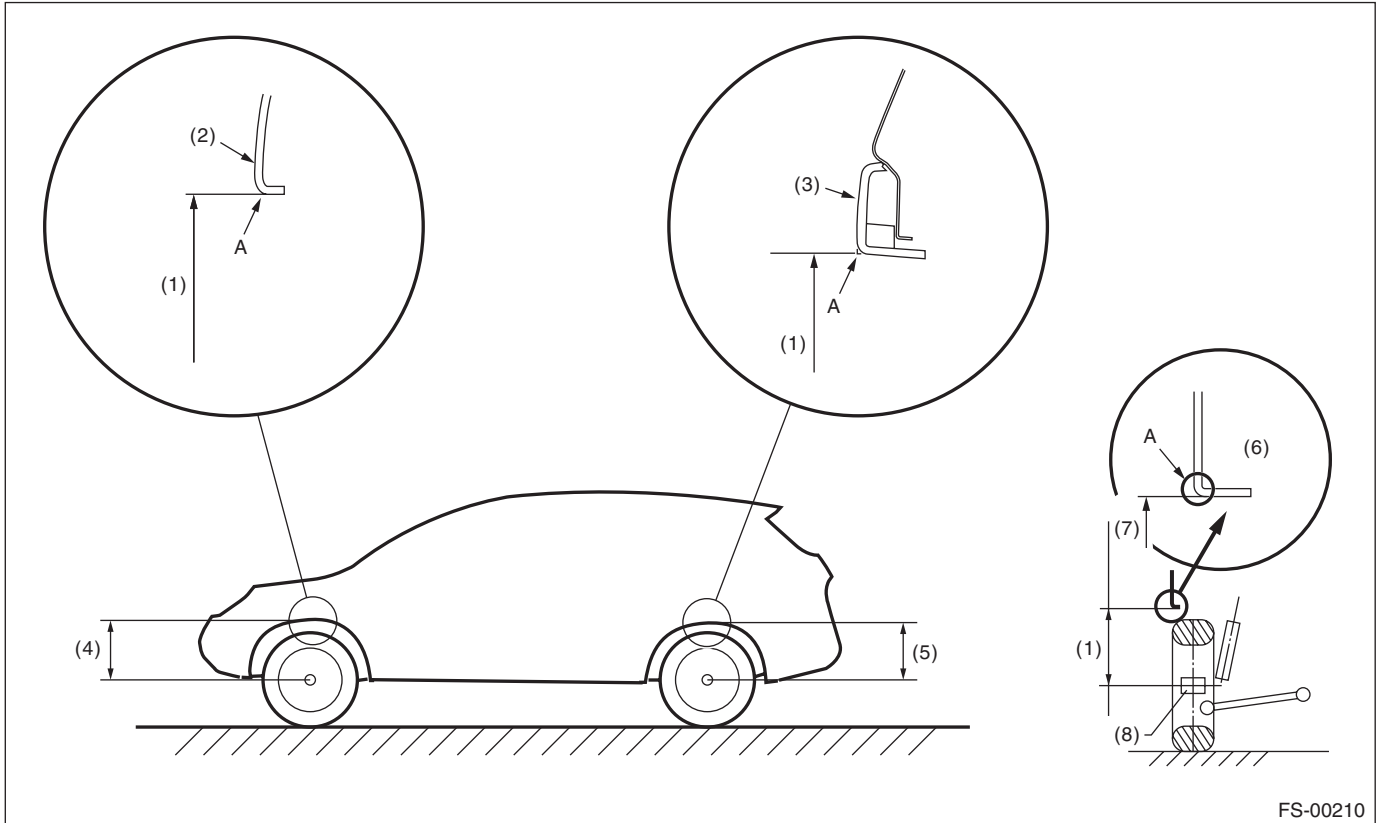
- Tire inflation pressure
- Uneven wear of RH and LH tires, or difference of sizes
- Tire runout
- Excessive play and wear of ball joint
- Excessive play and wear of tie-rod end
- Excessive play of wheel bearing
- Right and left wheel base imbalance
- Deformation and excessive play of steering link
- Deformation and excessive play of suspension parts

Check, adjust and measure the wheel alignment in accordance with the procedures indicated in the figure.

Wheel arch height (front and rear wheels) <Ref. to FS-7, WHEEL ARCH HEIGHT, INSPECTION, Wheel Alignment.>
↓
Camber (front and rear wheels) <Ref. to FS-8, CAMBER, INSPECTION, Wheel Alignment.>
↓
Caster (front wheel) <Ref. to FS-9, CASTER, INSPECTION, Wheel Alignment.>
↓
Steering angle <Ref. to FS-10, STEERING ANGLE, INSPECTION, Wheel Alignment.>
↓
Front wheel toe-in <Ref. to FS-10, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>
↓
Rear wheel toe-in <Ref. to FS-10, REAR WHEEL TOE-IN, INSPECTION, Wheel Alignment.>
↓
Thrust angle <Ref. to FS-12, THRUST ANGLE, INSPECTION, Wheel Alignment.>

1. WHEEL ARCH HEIGHT

- 1) Park the vehicle on a level surface.
- 2) Empty the vehicle so that it is at “curb weight”. (Empty the luggage compartment, load the spare tire, jack and service tools, and fill up the fuel tank.)
- 3) Set the steering wheel in a straight-ahead position, and stabilize the suspension by moving the vehicle in a straight line for 5 m (16 ft) or more.
- 4) Suspend a thread from the wheel arch (point “A” in the figure below) and affix at a position directly above the center of wheel.
- 5) Measure the distance between the point “A” and the center of wheel.



FS-00210

- | | | |
|-----------------------|-----------------------------|--------------------------|
| (1) Wheel arch height | (4) Front wheel arch height | (7) Point of measurement |
| (2) Front fender | (5) Rear wheel arch height | (8) End of spindle |
| (3) Rear quarter | (6) Flange bend line | |

Wheel arch height specification mm (in) (Tolerance: +12 mm -24 mm (+0.47 in -0.94 in))	
Front	452 (17.8)
Rear	449 (17.7)

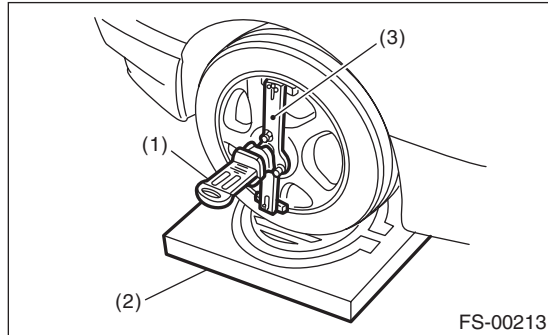
Wheel Alignment

FRONT SUSPENSION

2. CAMBER

• Inspection

- 1) Place the front wheel on the turning radius gauge. Make sure the ground contact surfaces of the front and rear wheels are at the same height.
- 2) Set the adapter into the center of wheel, and then set the wheel alignment gauge.



- (1) Alignment gauge
- (2) Turning radius gauge
- (3) Adapter

- 3) Measure the camber angle in accordance with the operation manual for wheel alignment gauge.

Camber (Difference between RH and LH 45' or less)
$0^{\circ}10' \pm 0^{\circ}45'$

• Front camber adjustment

- 1) When adjusting the camber, adjust it to the following value.

Camber (Difference between RH and LH 45' or less)
$0^{\circ}10' \pm 0^{\circ}30'$

- 2) Loosen the two self-locking nuts located at the front lower section of the strut.

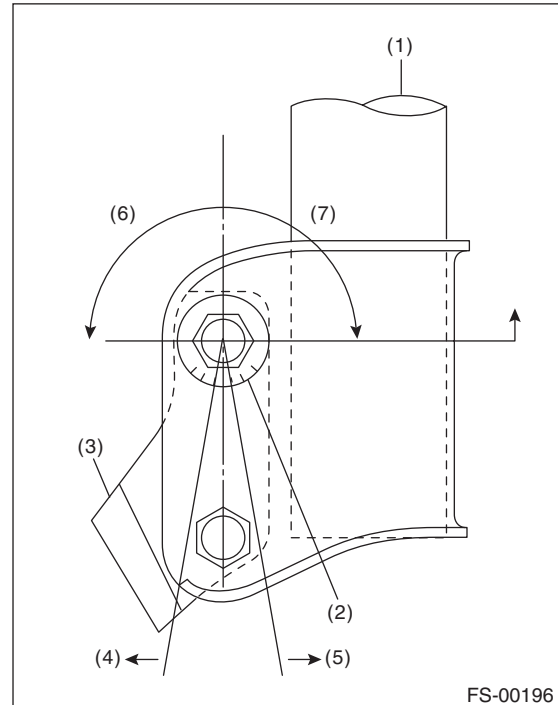
NOTE:

When the adjusting bolt needs to be loosened or tightened, hold its head with a wrench and turn the self-locking nut.

- 3) Turn the camber adjusting bolt so that the camber is set at specification.

NOTE:

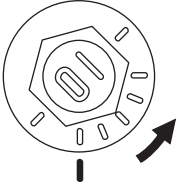
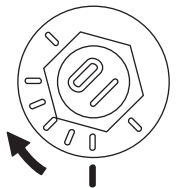
Moving the adjusting bolt by one scale changes the camber by approximately $0^{\circ}10'$.

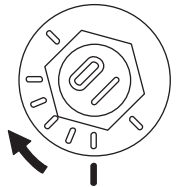
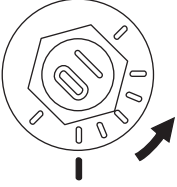


- (1) Strut
- (2) Adjusting bolt
- (3) Housing
- (4) Outer
- (5) Inner
- (6) Camber is increased.
- (7) Camber is decreased.

Wheel Alignment

FRONT SUSPENSION

To increase camber.	
Rotate the left side counterclockwise.	Rotate the right side clockwise.
	
FS-00197	FS-00198

To decrease camber.	
Rotate the left side clockwise.	Rotate the right side counterclockwise.
	
FS-00198	FS-00197

4) Tighten two new self-locking nuts.

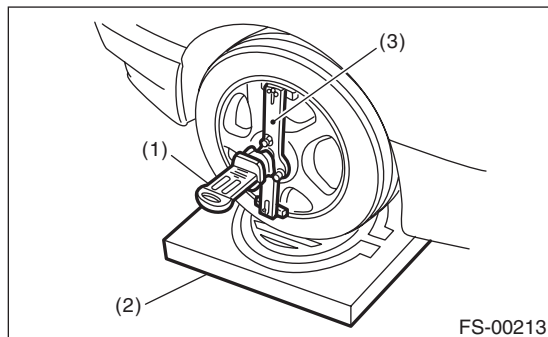
Tightening torque:

155 N·m (15.8 kgf-m, 114.3 ft-lb)

3. CASTER

• Inspection

- 1) Place the front wheel on the turning radius gauge. Make sure the ground contact surfaces of the front and rear wheels are at the same height.
- 2) Set the adapter into the center of wheel, and then set the wheel alignment gauge.



- (1) Alignment gauge
- (2) Turning radius gauge
- (3) Adapter

3) Measure the caster angle in accordance with the operation manual for wheel alignment gauge.

Caster (Reference)
4°00'

Wheel Alignment

FRONT SUSPENSION

4. STEERING ANGLE

• Inspection

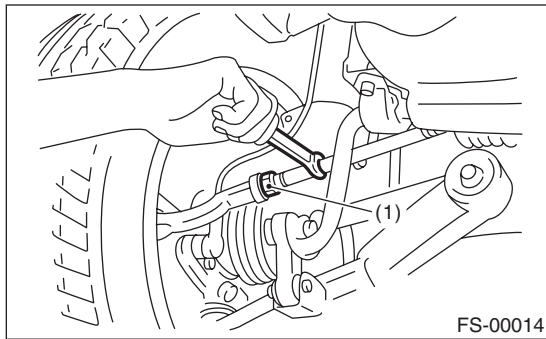
Inner wheel	Outer wheel
$37.0^{\circ} \pm 1.5^{\circ}$	$32.0^{\circ} \pm 1.5^{\circ}$

• Adjustment

- 1) Turn the tie-rod to adjust the steering angle of both inner and outer wheels.
- 2) Check the toe-in.

NOTE:

Correct the boot if it is twisted.



(1) Lock nut

5. FRONT WHEEL TOE-IN

• Inspection

Toe-in

$0 \pm 3 \text{ mm } (0 \pm 0.12 \text{ in})$

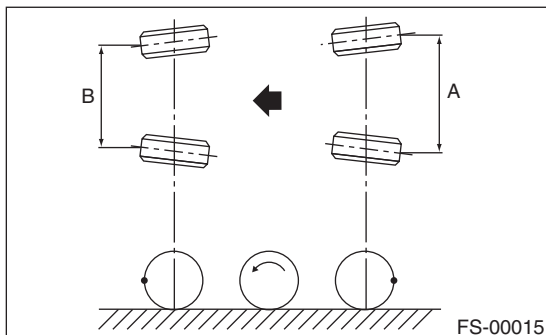
- 1) Set the toe-in gauge in the position at wheel axis center height behind the right and left front tires.
- 2) Place a mark at the center of both left and right tires, and measure distance "A" between the marks.
- 3) Move the vehicle forward to rotate the tires 180° .

NOTE:

Be sure to rotate the tires in the forward direction.

- 4) Measure distance "B" between the left and right marks. Find toe-in using the following equation:

$$A - B = \text{Toe-in}$$



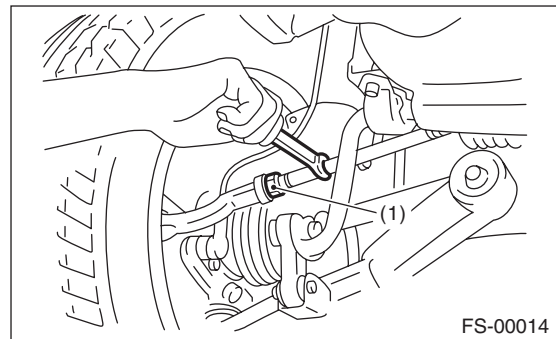
• Adjustment

When adjusting the toe-in, adjust it to the following value.

Toe-in

$0 \pm 2 \text{ mm } (0 \pm 0.08 \text{ in})$

- 1) Check that the left and right wheel steering angles are within specification.
 - 2) Loosen the left and right side steering tie-rod lock nuts.
 - 3) Turn the left and right tie-rods by equal amounts until the toe-in is at the specification.
- Both the left and right tie-rods are right-hand threaded. To increase toe-in, turn both tie-rods clockwise by equal amount (viewing from the inside of vehicle).



(1) Lock nut

- 4) Tighten the tie-rod lock nut.

Tightening torque:

$85 \text{ N}\cdot\text{m } (8.7 \text{ kgf}\cdot\text{m}, 62.7 \text{ ft}\cdot\text{lb})$

NOTE:

Check and correct the tie-rod boot if twisted.

6. REAR WHEEL TOE-IN

Inspection

Toe-in:

$2 \pm 2 \text{ mm } (0.08 \pm 0.08 \text{ in})$

Refer to FRONT WHEEL TOE-IN for rear toe-in inspection procedures.

<Ref. to FS-10, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

• Adjustment

When adjusting, adjust it to the following value.

Toe-in:

$2 \pm 1.5 \text{ mm } (0.08 \pm 0.06 \text{ in})$

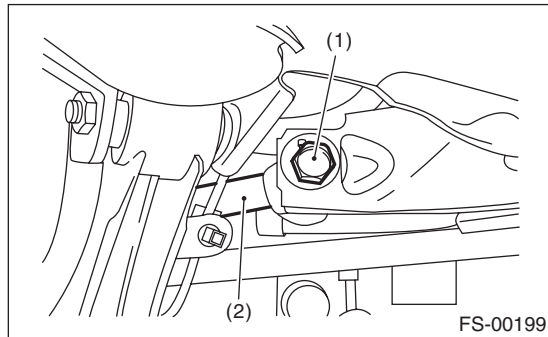
Wheel Alignment

FRONT SUSPENSION

1) Loosen the self-locking nut on the inner side of the front lateral link.

NOTE:

When loosening or tightening the adjusting bolt, hold the bolt head and turn the self-locking nut.



(1) Adjusting bolt

(2) Front lateral link

2) Turn the adjusting bolt until toe-in is within the specification.

NOTE:

When the left and right wheels are adjusted for toe-in at the same time, moving one mark on the scale changes toe-in by approx. 3 mm (0.12 in).

To increase toe-in.	
Rotate the left side clockwise.	Rotate the right side counterclockwise.
Diagram showing the left side adjusting bolt with a clockwise rotation arrow. The diagram is labeled FS-00018.	Diagram showing the right side adjusting bolt with a counterclockwise rotation arrow. The diagram is labeled FS-00019.

To decrease toe-in.	
Rotate the left side counterclockwise.	Rotate the right side clockwise.
Diagram showing the left side adjusting bolt with a counterclockwise rotation arrow. The diagram is labeled FS-00019.	Diagram showing the right side adjusting bolt with a clockwise rotation arrow. The diagram is labeled FS-00018.

3) Attach and tighten a new self-locking nut.

Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

Wheel Alignment

FRONT SUSPENSION

7. THRUST ANGLE

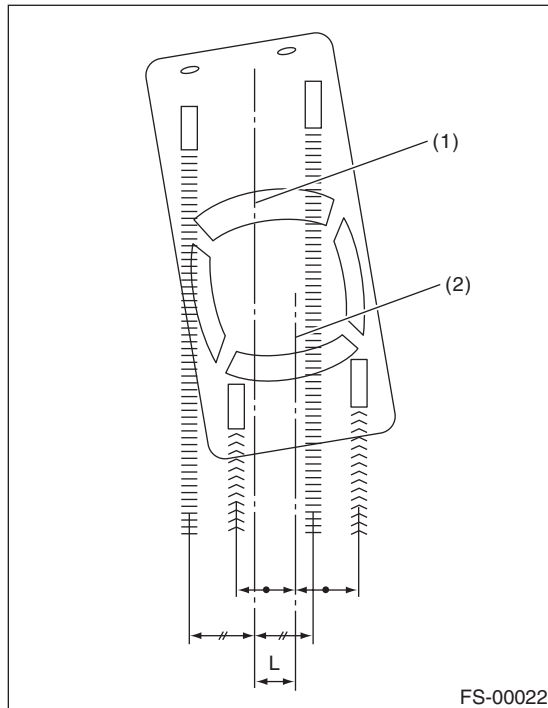
• Inspection

- 1) Park the vehicle on a level surface.
- 2) Move the vehicle 3 to 4 meters (10 to 13 feet) straight forward.
- 3) Draw the center of loci for both the front and rear axles.
- 4) Measure distance "L" between the center lines of the axle loci.

Thrust angle:

$0^{\circ} \pm 30'$

Less than 30' when "L" is 24 mm (0.9 in) or less



- (1) Center line of loci (front axle)
(2) Center line of loci (rear axle)

• Adjustment

When adjusting, adjust it to the following value.

Thrust angle:

$0^{\circ} \pm 20'$

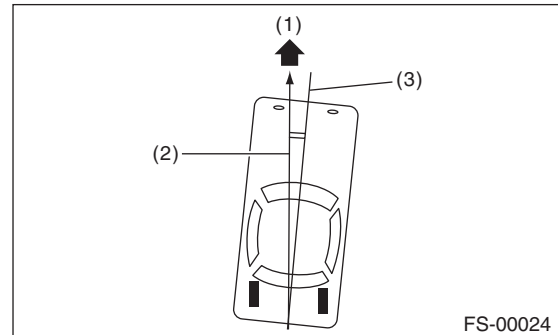
Less than 20' when "L" is 16 mm (0.6 in) or less

- 1) Make thrust angle adjustments by turning the toe-in adjusting bolts of the 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 the thrust angle adjustment.

- 3) When the left and right adjusting bolts are turned by one graduation, the thrust angle will change approx. 19'. ("L" is approx. 16 mm (0.63 in)).

NOTE:

Thrust angle is a mean value of left and right wheel toe angles in relation to the vehicle body center line. Vehicle is driven straight in the thrust angle direction while slanting in the oblique direction depending on the degree of the mean thrust angle.



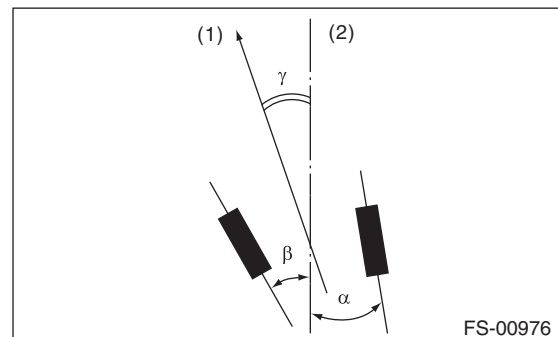
- (1) Front
(2) Thrust angle
(3) Body center line

Thrust angle: $\gamma = (\alpha - \beta)/2$

α : Rear RH wheel toe-in angle

β : Rear LH wheel toe-in angle

Substitute only the positive toe-in values from each wheel into α and β in the calculation.

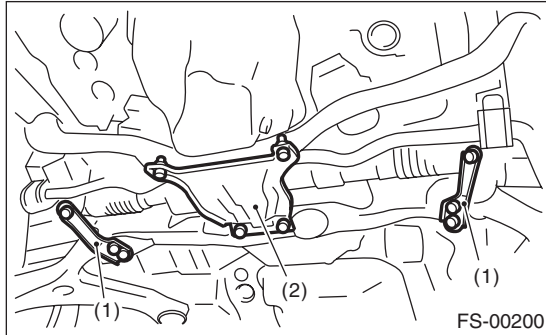


- (1) Front
(2) Body center line

3. Front Crossmember Support Plate

A: REMOVAL

- 1) Lift up the vehicle.
- 2) Remove the front under cover. <Ref. to EI-18, REMOVAL, Front Under Cover.>
- 3) Remove the bolt and remove front crossmember support plate.



- (1) Crossmember support plate
(2) Jack-up plate

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

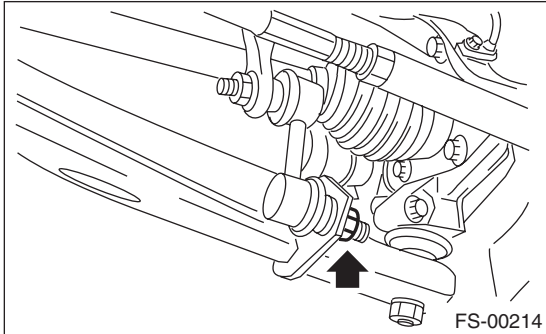
Crossmember support plate
60 N·m (6.1 kgf-m, 44.3 ft-lb)

Jack-up plate
60 N·m (6.1 kgf-m, 44.3 ft-lb)

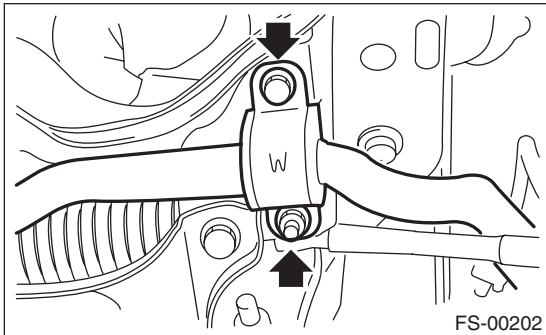
4. Front Stabilizer

A: REMOVAL

- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Remove the front under cover. <Ref. to EI-18, REMOVAL, Front Under Cover.>
- 3) Remove the front crossmember support plate. <Ref. to FS-13, REMOVAL, Front Crossmember Support Plate.>
- 4) Remove the stabilizer link.



- 5) Remove the stabilizer clamp.



B: INSTALLATION

Install in the reverse order of removal.

CAUTION:

- Be sure to use a new flange nut.
- Install so that the paint mark on the stabilizer is on the left side of the vehicle.
- Install the stabilizer bushing (front crossmember side) while aligning it with the paint mark on stabilizer.

Tightening torque:

Stabilizer link:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

Stabilizer clamp:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

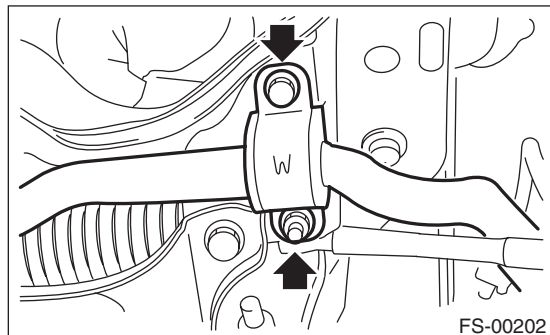
C: INSPECTION

- 1) Check the bushing for cracks, fatigue or damage.
- 2) Check the stabilizer link for damage.

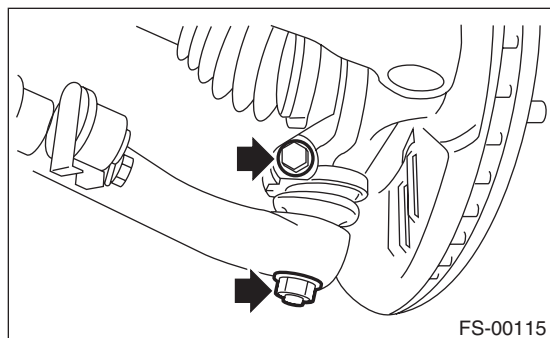
5. Front Ball Joint

A: REMOVAL

- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the both sides of stabilizer bracket.



- 3) Pull out the pin from ball stud, remove the castle nut, and extract the ball stud from the front arm.
- 4) Remove the bolt attaching the ball joint to the housing.



- 5) Extract the ball joint from housing.

B: INSTALLATION

- 1) Insert the ball joint into housing.

Tightening torque (Bolt):
50 N·m (5.1 kgf-m, 36.9 ft-lb)

CAUTION:

Do not apply grease to the tapered portion of ball stud.

- 2) Install the ball joint into front arm.

Tightening torque (castle nut):
Front arm:

45 N·m (4.6 kgf-m, 33.2 ft-lb)

- 3) Retighten the castle nut further up to 60° until the hole in the ball stud is aligned with a slot in castle nut. Then, insert a new cotter pin and bend it around the castle nut.
- 4) Install the stabilizer bracket.

Tightening torque:

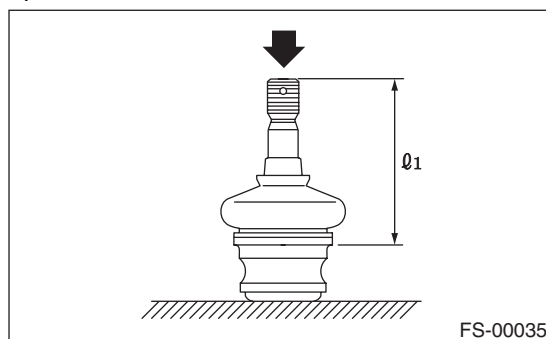
25 N·m (2.5 kgf-m, 18.1 ft-lb)

- 5) Install the front wheels.

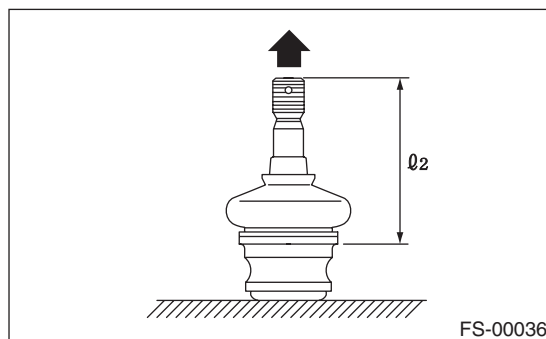
C: INSPECTION

- 1) Measure the play of the ball joint using the following procedures. Replace with a new part if the play exceeds specification.

- (1) With 980 N (100 kgf, 220 lb) loaded in direction shown in the figure, measure the distance L_1 .



- (2) With 980 N (100 kgf, 220 lb) loaded in direction shown in the figure, measure the distance L_2 .



- (3) Determine free play using the following formula.

$$S = L_2 - L_1$$

- (4) Replace with a new part if the play exceeds specification.

Front ball joint

Specification for replacement S:

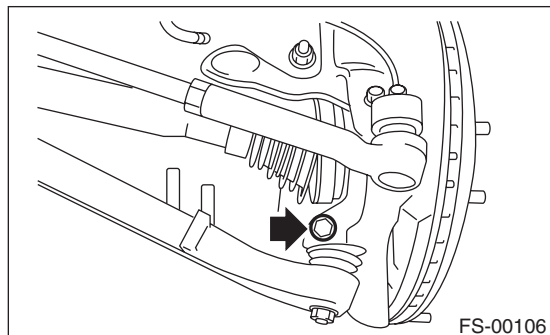
Less than 0.3 mm (0.012 in)

- 2) If the play is within specification, visually check the dust cover.
- 3) Remove the ball joint and cover, and check for wear, damage or cracks. If any damage is found, replace the corresponding part.
- 4) If the dust cover is damaged, replace with a new ball joint.

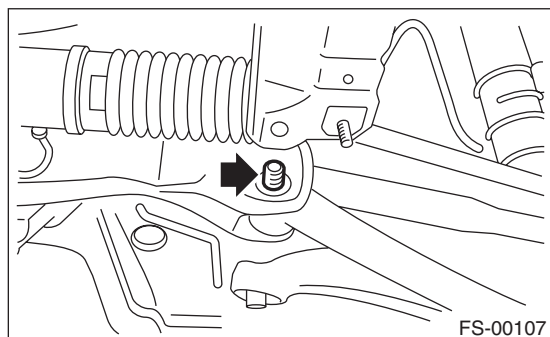
6. Front Arm

A: REMOVAL

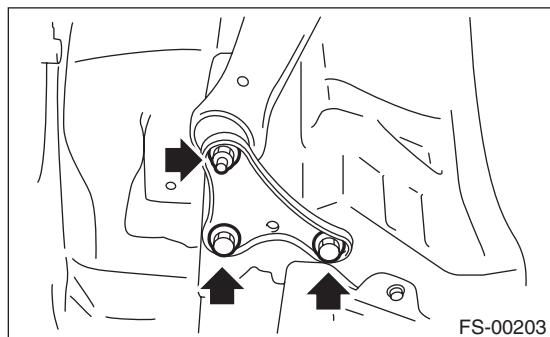
- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Remove the front crossmember support plate. <Ref. to FS-13, REMOVAL, Front Crossmember Support Plate.>
- 3) Remove the front stabilizer. <Ref. to FS-14, REMOVAL, Front Stabilizer.>
- 4) Remove the ball joint of front arm.



- 5) Remove the nut securing the front arm to crossmember. (Do not remove the bolt.)



- 6) Remove the front arm support plate.

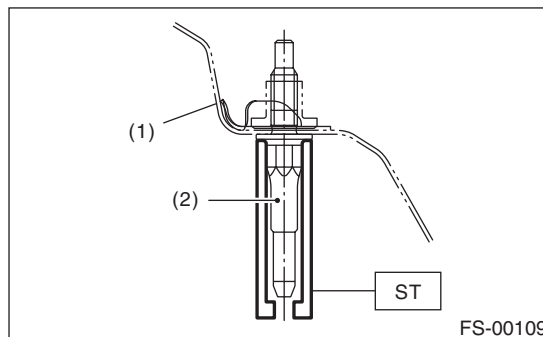


- 7) Remove the bolt securing front arm to crossmember and pull the front arm out of the crossmember.

- 8) To remove the stud bolt, use the ST.
ST 20299AG020 STUD BOLT SOCKET

CAUTION:

Do not remove the stud bolt without necessity. Always replace the parts with new parts when removed.



- (1) Vehicle body
- (2) Stud bolt

B: INSTALLATION

- 1) Using the ST, install the stud bolt.
ST 20299AG020 STUD BOLT SOCKET

Tightening torque:

110 N·m (11.2 kgf-m, 81.1 ft-lb)

- 2) Using new bolts and self-locking nuts, temporarily tighten the front arm to crossmember.
- 3) Secure the front arm to body, and then install the support plate with new bolts and self-locking nuts.

Tightening torque:

Support plate to Front arm:

88 N·m (9.0 kgf-m, 64.9 ft-lb)

Support plate to Body:

150 N·m (15.3 kgf-m, 110.6 ft-lb)

- 4) Install the ball joint into housing.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

- 5) Install the stabilizer. <Ref. to FS-14, INSTALLATION, Front Stabilizer.>

- 6) Lower the vehicle from lift, and tighten the bolt which secures the front arm to crossmember with wheels in full contact with the ground and the vehicle at curb weight.

Tightening torque:

95 N·m (9.7 kgf-m, 70.1 ft-lb)

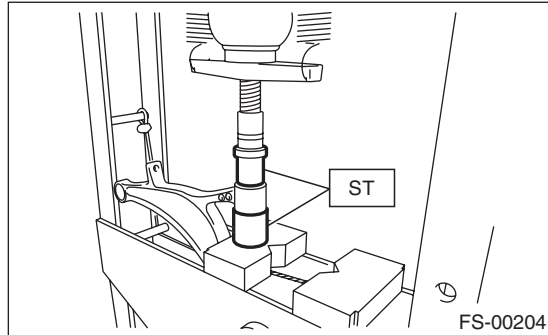
- 7) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

1. FRONT BUSHING

Using the ST and a press, remove the front bushing.

ST 927680000 INSTALLER & REMOVER SET

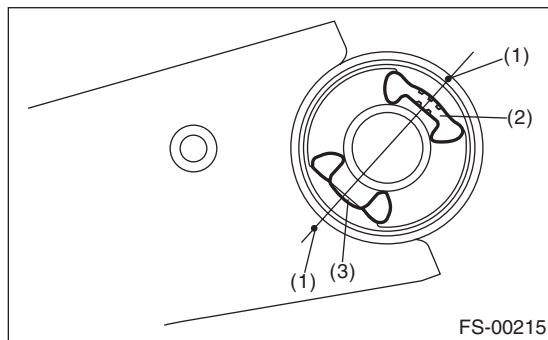


2. REAR BUSHING

1) Put an alignment mark on the front arm based on the center of rear bushing recess portion.

CAUTION:

Always put an alignment mark for aligning the position on bushing installation.

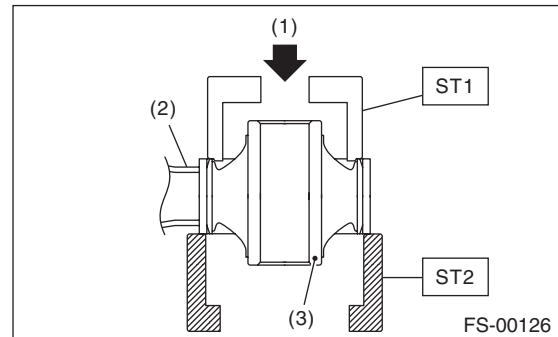


- (1) Put an alignment mark.
- (2) Recess portion (wide spacing)
- (3) Recess portion (narrow spacing)

2) Using the ST and a press, remove the rear bushing.

ST1 20299AG000 REMOVER

ST2 20299AG010 BASE



- (1) Press
- (2) Front arm
- (3) Rear bushing

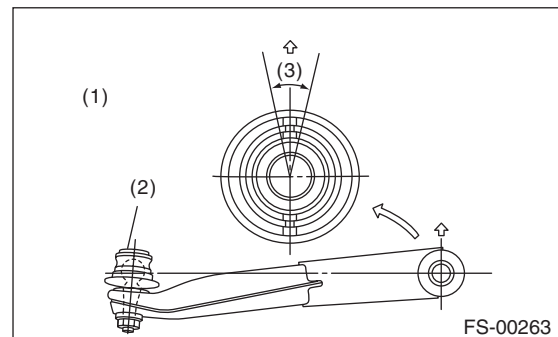
D: ASSEMBLY

1. FRONT BUSHING

Assemble in the reverse order of disassembly.

CAUTION:

Install the front bushing in proper direction as shown in the figure.



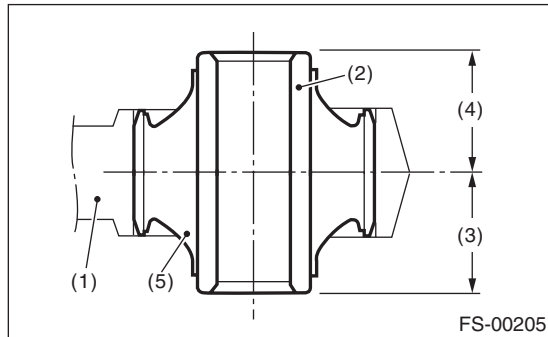
- (1) Face the bushing toward the center of ball joint.
- (2) Ball joint
- (3) $\pm 3^\circ$

Front Arm

FRONT SUSPENSION

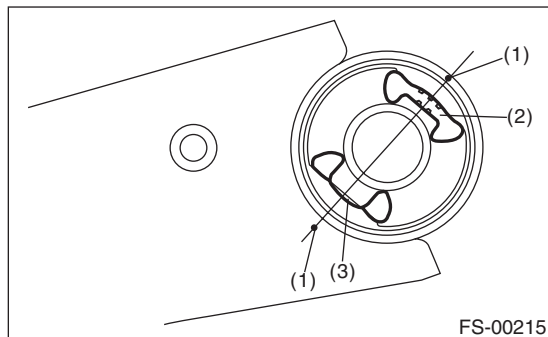
2. REAR BUSHING

1) As shown in the figure below, install the rear bushing with its longer inner cylinder facing downward and the shorter facing upward, with the identification paint marking pointed down.



- (1) Front arm
- (2) Bushing inner cylinder
- (3) Longer
- (4) Shorter
- (5) Identification paint

2) Align the center of rear bushing recess portion with the aligning mark on the front arm.

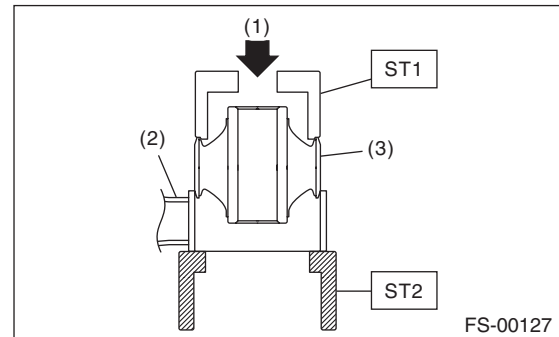


- (1) Alignment mark
- (2) Recess portion (wide spacing)
- (3) Recess portion (narrow spacing)

3) Using the ST and a press, install the rear bushing.

ST1 20299AG000 REMOVER

ST2 20299AG010 BASE



- (1) Press
- (2) Front arm
- (3) Rear bushing

E: INSPECTION

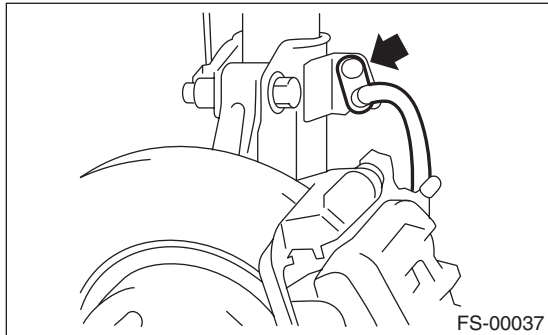
1) Check the front arm for wear, damage or cracks, and correct or replace if defective.

2) Check the bushing for abnormal fatigue or damage.

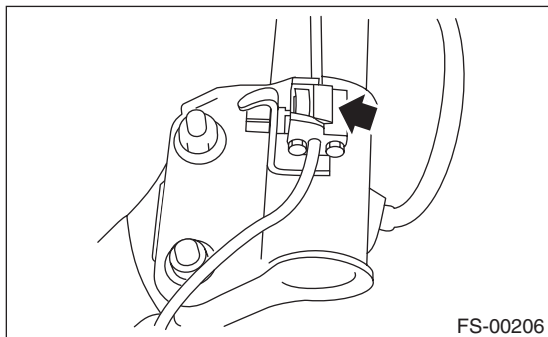
7. Front Strut

A: REMOVAL

- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Place an alignment mark on the camber adjusting bolt and strut.
- 3) Remove the bolt securing the brake hose from the strut.



- 4) Remove the clip securing the ABS wheel speed sensor harness.

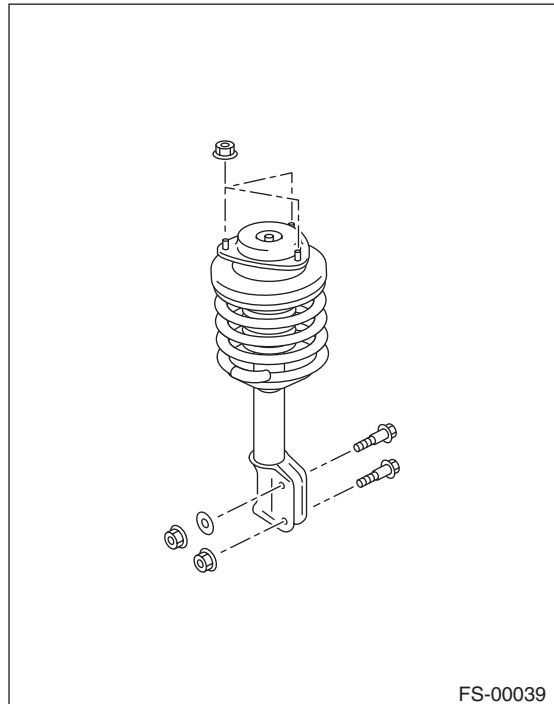


- 5) Remove the two bolts securing the housing to the strut.

NOTE:

While holding the head of the adjusting bolt, loosen the self-locking nut.

- 6) Remove the three nuts securing strut mount to body.



B: INSTALLATION

- 1) Install the strut mount at the upper side of strut to body, and tighten it with new self-locking nuts.

Tightening torque:

20 N·m (2.0 kgf-m, 14.5 ft-lb)

- 2) Align alignment marks on the camber adjusting bolt and strut.

Using new self-locking nuts, install the strut to the housing.

NOTE:

While holding the head of adjusting bolt, tighten the self-locking nut.

Tightening torque:

155 N·m (15.8 kgf-m, 114.3 ft-lb)

- 3) Secure the ABS wheel speed sensor harness to the strut.
- 4) Install the bolts which secure the brake hose to the strut.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

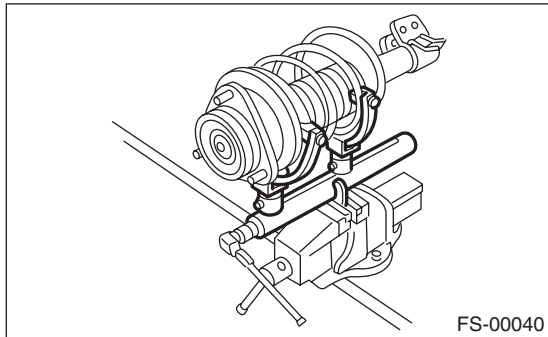
- 5) Install the front wheels.
- 6) Inspect the wheel alignment and adjust if necessary.

Front Strut

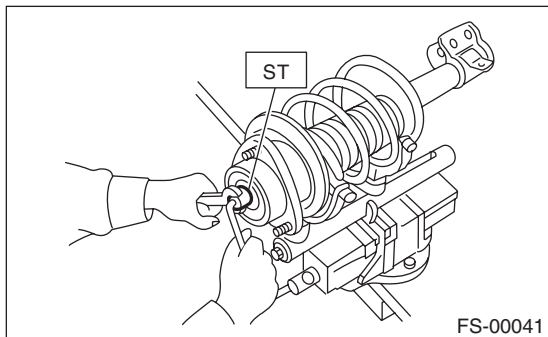
FRONT SUSPENSION

C: DISASSEMBLY

- 1) Using a coil spring compressor, compress the coil spring.



- 2) Using the ST, remove the self-locking nut.
ST 20399AG000 STRUT MOUNT SOCKET



- 3) Remove the strut mount, spacer and upper spring seat from strut.
- 4) Gradually decrease the compression force of compressor, and remove the coil spring.
- 5) Remove the dust cover and helper spring.

D: ASSEMBLY

- 1) Before installing the coil spring, strut mount, etc. on strut, check for the presence of air in the dampening force generating mechanism of the strut since air prevents proper dampening force production.
- 2) Checking for 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 fingers, move the rod up and down.
 - (4) If the piston rod moves 10 mm (0.39 in) or more 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 retract the piston rod.
- (5) Repeat 3 or 4 times from the step (1).

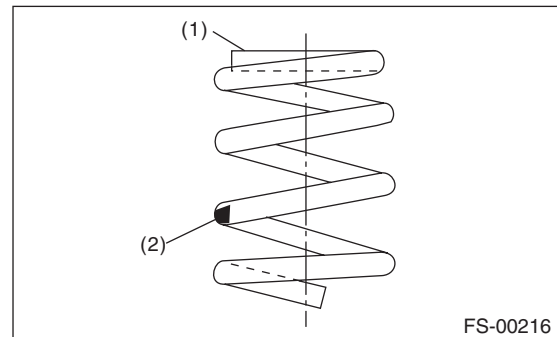
NOTE:

After purging air from the strut, be sure to place the strut with the piston rod facing up. If the strut is laid down for any reason, check for the entry of air in accordance with "Checking for presence of air"

- 4) Using a coil spring compressor, compress the coil spring.

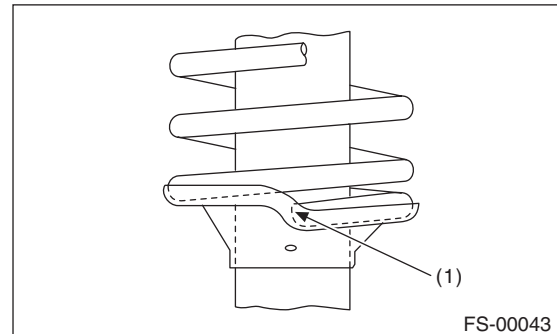
NOTE:

Make sure that the vertical install direction of the coil spring is as shown in the figure.



- (1) Place the flat end on the top side.
- (2) Identification paint

- 5) Set the coil spring correctly so that its end face seats well in the spring seat as shown in the figure.



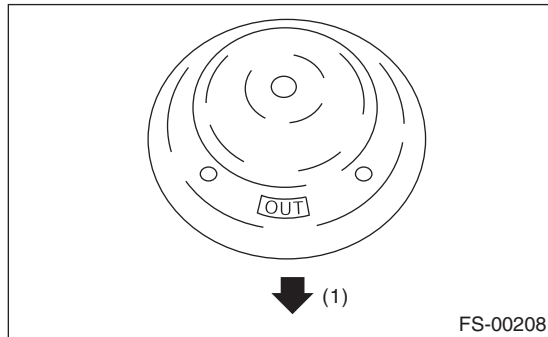
- (1) Coil spring end face

- 6) Install the helper and dust cover to the piston rod.

7) Pull the piston rod fully upward, and install the spring seat.

NOTE:

Position the upper spring seat as shown in the figure.



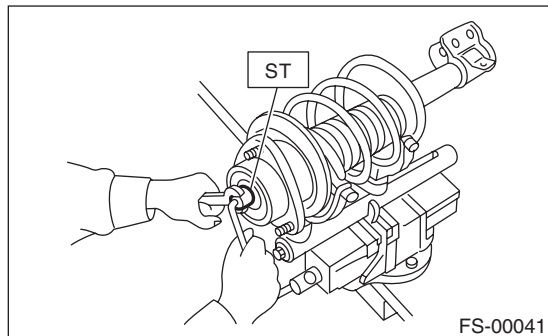
(1) Outside of body

8) Install spacer and the strut mount to piston rod, and tighten a new self-locking nut temporarily.
9) Using a hexagon wrench to prevent strut rod from turning, tighten the new self-locking nut with ST.

ST 20399AG000 STRUT MOUNT SOCKET

Tightening torque:

55 N·m (5.6 kgf-m, 40.6 ft-lb)



10) Loosen the coil spring compressor carefully.

E: INSPECTION

Check the removed part for wear, damage and cracks, and then repair or replace it if defective.

1. STRUT

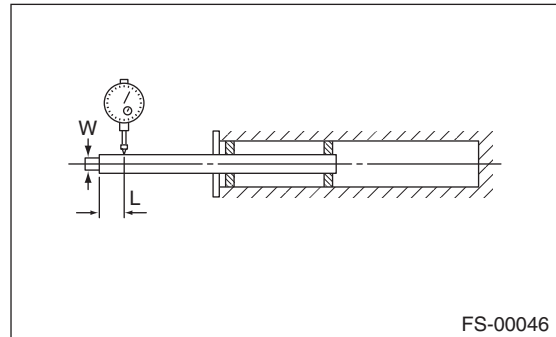
1) Check for oil leaks.

2) Move the piston rod up and down to check that it operates smoothly without any hitch.

3) Piston rod play

- Measure the play as follows:

Fix the outer shell in place and fully extend the rod. Set a dial gauge at the end of rod L [10 mm (0.39 in)], and then read the dial gauge indication P_1 while applying a force of W [20 N (2 kgf, 4 lb)] to the threaded portion. Apply a force of 20 N (2 kgf, 4 lb) from the opposite direction of "W", and then read the dial gauge indication P_2 .



Play limit ($P_1 + P_2$):

0.8 mm (0.031 in)

If the play exceeds limit, replace the strut.

2. STRUT MOUNT

Check the rubber part for deformation, cracks or deterioration, and then replace it with a new part if defective.

3. DUST COVER

If any cracks or damage are found, replace it with a new part.

4. COIL SPRING

If a permanent strain is found, replaced it with a new part.

5. HELPER

Replace it with a new part if cracked or damaged.

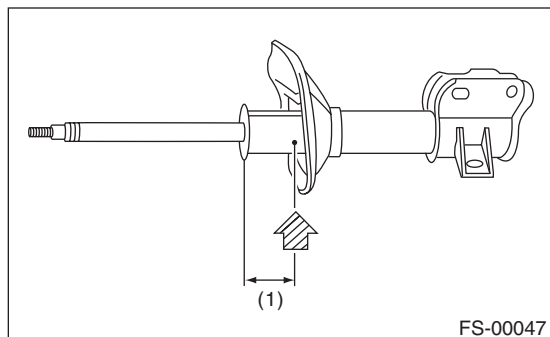
F: DISPOSAL

CAUTION:

- Before handling struts, be sure to wear goggles to protect eyes from gas, oil and cutting powder.
- Do not disassemble the strut damper or throw into flames.
- When discarding gas filled struts, drill holes in them to purge the gas.

1) Place the strut on a level surface with the piston rod fully expanded.

2) Using a 2 — 3 mm (0.08 — 0.12 in) dia. drill, make holes in areas shown in the figure.

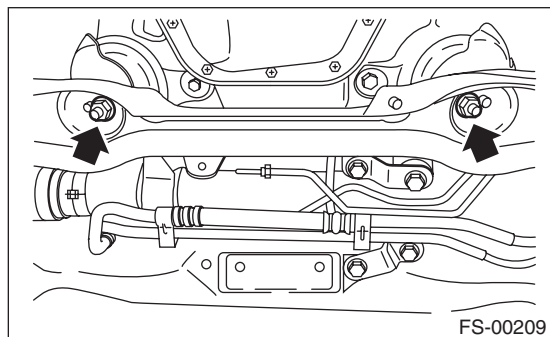


(1) 40 mm (1.57 in)

8. Front Crossmember

A: REMOVAL

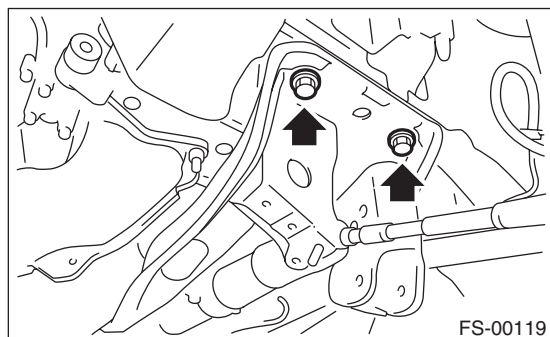
- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Remove the front exhaust pipe.
- 3) Remove the front crossmember support plate. <Ref. to FS-13, REMOVAL, Front Crossmember Support Plate.>
- 4) Remove the front stabilizer. <Ref. to FS-14, REMOVAL, Front Stabilizer.>
- 5) Disconnect the tie-rod end from housing.
- 6) Remove the front arm. <Ref. to FS-16, REMOVAL, Front Arm.>
- 7) Remove the nuts attaching the engine mount cushion rubber to crossmember.



- 8) Remove the steering universal joint.
- 9) Disconnect the power steering hose from steering gearbox.
- 10) Lift the engine approx. 10 mm (0.39 in) using a chain block.
- 11) Support the crossmember with a jack, remove the bolts securing crossmember to body, and then gradually lower the crossmember with steering gearbox as a unit.

CAUTION:

When removing the crossmember downward, be careful that the tie-rod end does not interfere with drive shaft boot.



B: INSTALLATION

- 1) Install in the reverse order of removal.

CAUTION:

- Use a new bolt and self-locking nut. For parts which are not reusable, refer to COMPONENT. <Ref. to FS-3, COMPONENT, General Description.>
- Always tighten the bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

Tightening torque:

Crossmember to Body:

95 N·m (9.7 kgf-m, 70.1 ft-lb)

Engine mounting to Crossmember:

75 N·m (7.6 kgf-m, 55.3 ft-lb)

Front arm to Crossmember:

95 N·m (9.7 kgf-m, 70.1 ft-lb)

Front arm to Support plate:

88 N·m (9.0 kgf-m, 64.9 ft-lb)

Support plate to Body:

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Tie-rod end to Housing:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

After tightening to the specified torque, tighten the castle nut further but within 60° until the hole in the ball stud is aligned with a slot in castle nut.

Universal joint:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

Stabilizer clamp:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

Stabilizer link:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

Power steering hose to Steering gearbox:

15 N·m (1.5 kgf-m, 11 ft-lb)

- 2) Purge air from the power steering system.
- 3) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

Check the crossmember for wear, damage or cracks, and then repair or replace if faulty.

General Diagnostic Table

FRONT SUSPENSION

9. General Diagnostic Table

A: INSPECTION

1. IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible cause	Corrective action
(1) Permanent distortion or damage of the coil spring	Replace.
(2) Rough operation of strut or shock absorber	Replace.
(3) Improper installation of strut or shock absorber	Replace with appropriate parts.
(4) Installation of the wrong coil spring	Replace with appropriate parts.

2. POOR RIDE COMFORT

- 1) Large rebound shock
- 2) Rocking of the vehicle continues too long after running over bump and hump.
- 3) Excessive shock in bumping

Possible cause	Corrective action
(1) Damaged coil spring	Replace.
(2) Overinflation of tires	Adjust.
(3) Improper wheel arch height	Replace the coil springs with new parts.
(4) Fault in operation of strut or shock absorber	Replace.
(5) Damage or deformation of strut mount or shock absorber mount	Replace.
(6) Unsuitable length (maximum or minimum) of strut or shock absorber	Replace with appropriate parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly or shock absorber	Replace.
(9) Oil leakage from the strut or shock absorber	Replace.

3. NOISE

Possible cause	Corrective action
(1) Wear or damage of strut or shock absorber component parts	Replace.
(2) Loosening of the suspension link installing bolt	Tighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Improper length (maximum or minimum) of strut or shock absorber	Replace with appropriate parts.
(5) Damaged coil spring	Replace.
(6) Wear or damage of the ball joint	Replace.
(7) Deformation of the stabilizer clamp	Replace.

REAR SUSPENSION

RS

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General Description

PARKING BRAKE

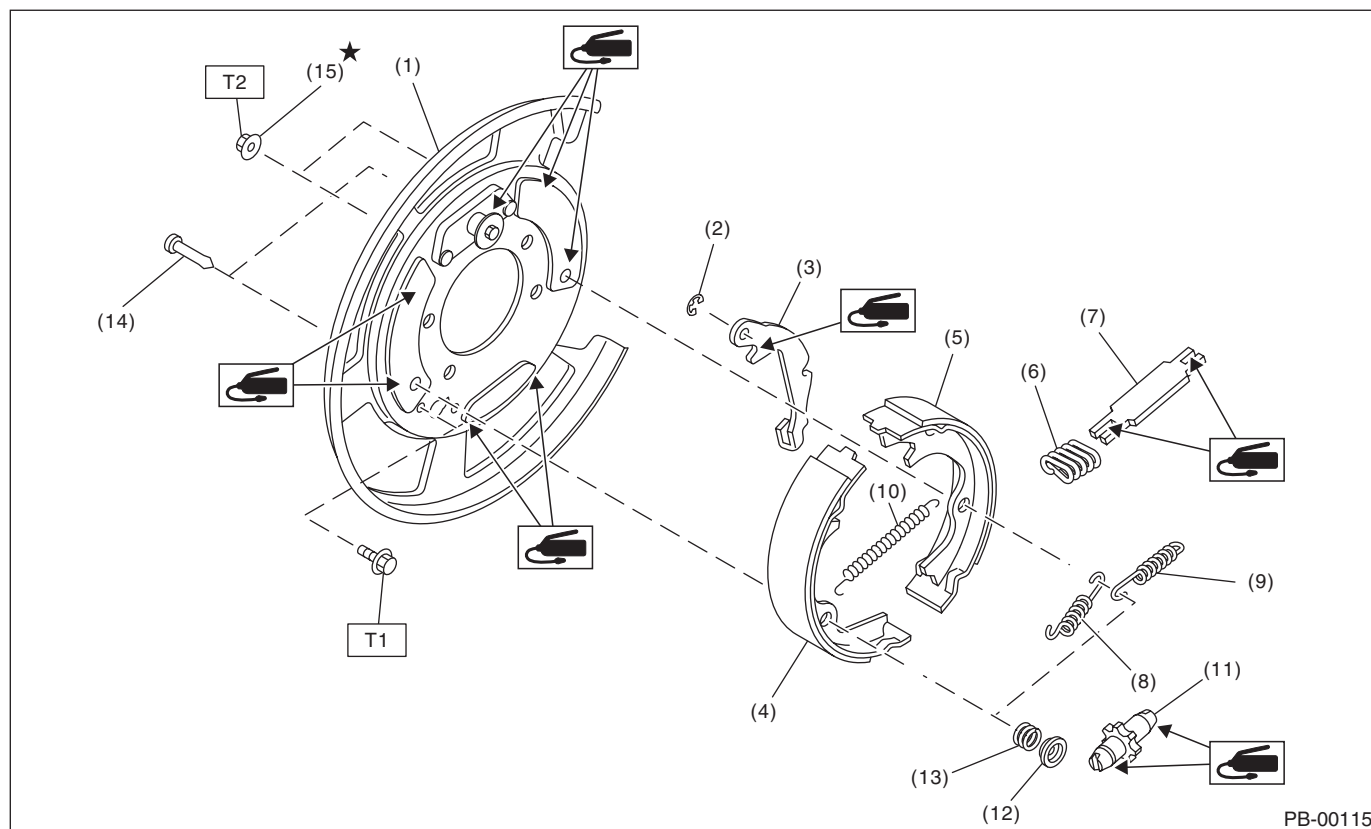
1. General Description

A: SPECIFICATION

Type		Mechanical, drum in disc rear brakes
Effective drum diameter	mm (in)	210 (8.27)
Lining dimensions (Length × Width × Thickness)	mm (in)	238.2 × 30.0 × 4.0 (9.378 × 1.181 × 0.157)
Clearance adjustment		Manual adjustment
Pedal stroke	notches/N (kgf, lb)	5 — 6/300 (30.6, 67)

B: COMPONENT

1. PARKING BRAKE (REAR DISC BRAKE)



PB-00115

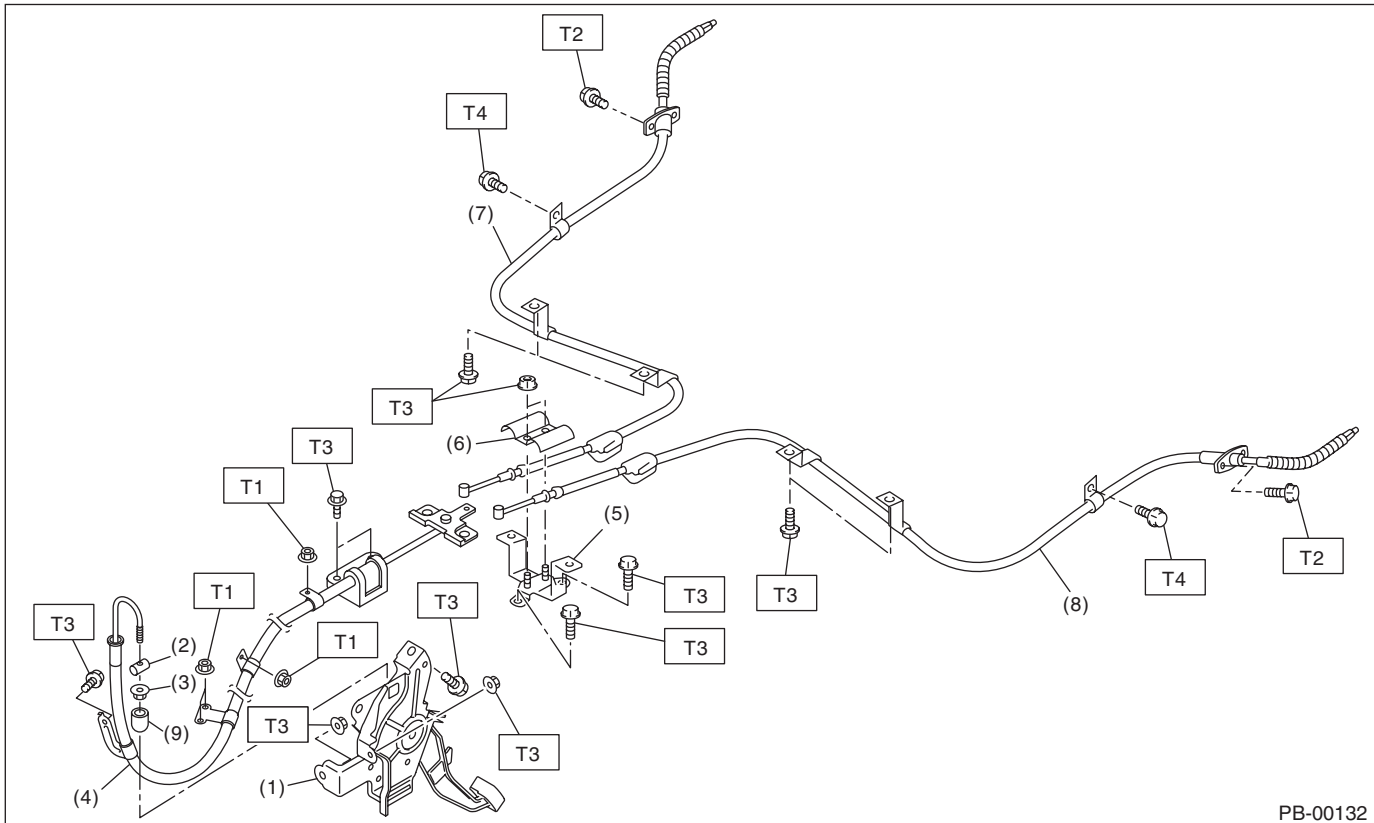
- | | | |
|------------------------------------|-----------------------------|----------------------------------|
| (1) Back plate | (8) Primary return spring | (14) Shoe hold pin |
| (2) Retainer | (9) Secondary return spring | (15) Self locking nut (with WAX) |
| (3) Lever | (10) Adjusting spring | |
| (4) Parking brake shoe (primary) | (11) Adjuster | |
| (5) Parking brake shoe (secondary) | (12) Brake shoe cup | |
| (6) Strut spring | (13) Brake shoe spring | |
| (7) Strut | | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 8 (0.8, 5.9)

T2: 75 (7.6, 55.3)

2. PARKING BRAKE CABLE



- | | |
|--------------------------------------|---------------------------------|
| (1) Parking brake pedal | (6) Clamp |
| (2) Spacer | (7) Rear parking brake cable RH |
| (3) Adjusting nut (Self-locking nut) | (8) Rear parking brake cable LH |
| (4) Front parking brake cable | (9) Adjuster cap |
| (5) Bracket | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 7.5 (0.76, 5.5)

T2: 8 (0.8, 5.9)

T3: 18 (1.8, 13.3)

T4: 33 (3.4, 24.3)

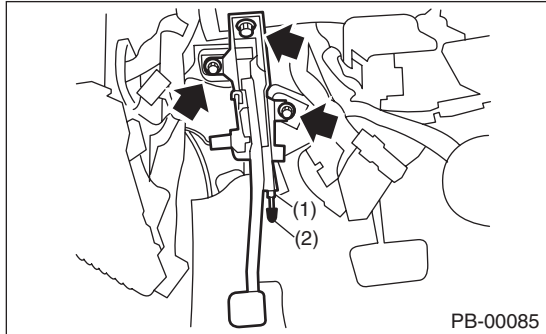
C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.
- Make sure grease does not come into contact with the parking shoes.

2. Parking Brake Pedal

A: REMOVAL

- 1) Set the wheel stoppers to tires.
- 2) Remove the instrument panel lower cover. <Ref. to EI-38, REMOVAL, Instrument Panel Lower Cover.>
- 3) Disconnect the parking brake switch connector.
- 4) Remove the parking brake lever.



- (1) Adjusting nut (self-locking nut)
- (2) Adjuster cap

- 5) Remove the adjuster cap and parking cable adjusting nut (self-locking nut).
- 6) Remove the clip from the parking brake pedal, and remove the front parking brake cable.



- (1) Clip

B: INSTALLATION

- 1) Install in the reverse order of removal.

Tightening torque:

Parking brake pedal

18 N·m (1.8 kgf-m, 13.3 ft-lb)

- 2) Install a new adjusting nut (self-locking nut).
- 3) Adjust the pedal stroke. <Ref. to PB-4, ADJUSTMENT, Parking Brake Pedal.>

C: INSPECTION

- 1) Operate the parking brake pedal 3 to 4 times and fully return the pedal.
- 2) Step on the parking brake pedal slowly and count the notches.

Pedal stroke:

When stepped on with a force of 300 N (30.6 kgf, 67 lb): 5-6 notches

If it is not within the specified value, adjust the parking brake. <Ref. to PB-9, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

D: ADJUSTMENT

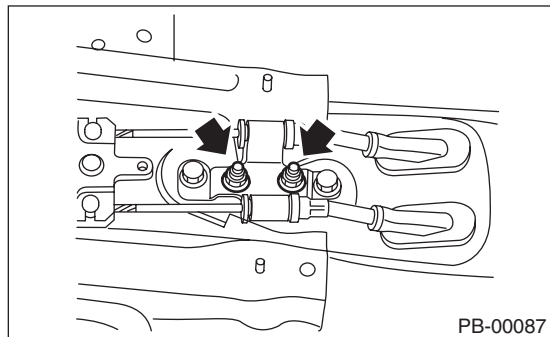
Adjust the parking brake pedal stroke. <Ref. to PB-9, PEDAL STROKE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

3. Parking Brake Cable

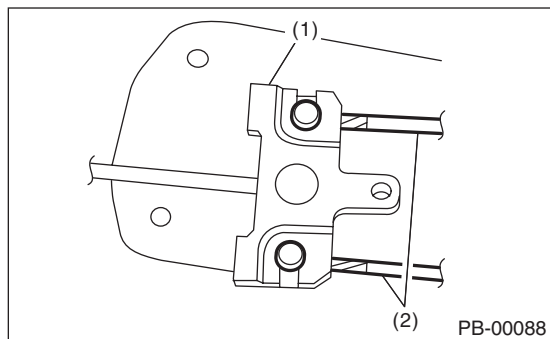
A: REMOVAL

1. FRONT PARKING BRAKE CABLE

- 1) Remove the driver's seat.
- 2) Remove the console box.
- 3) Lift the floor mat.
- 4) Remove the parking brake pedal. <Ref. to PB-4, REMOVAL, Parking Brake Pedal.>
- 5) Roll up the floor mat and remove the clamps.

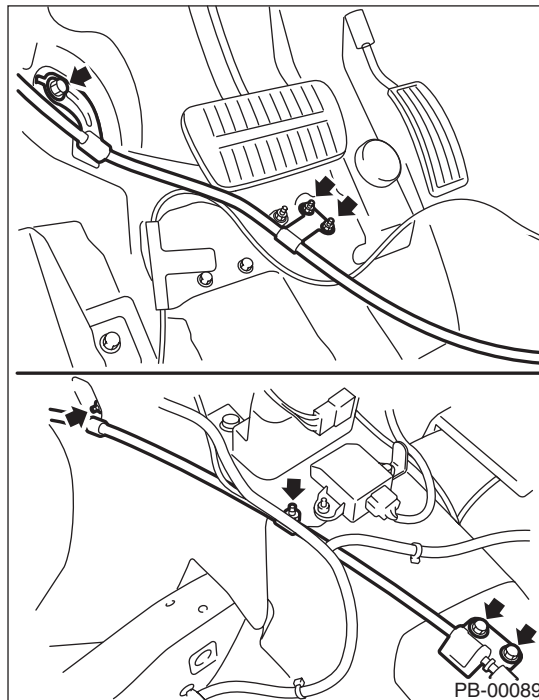


- 6) Remove the cable end from the equalizer.



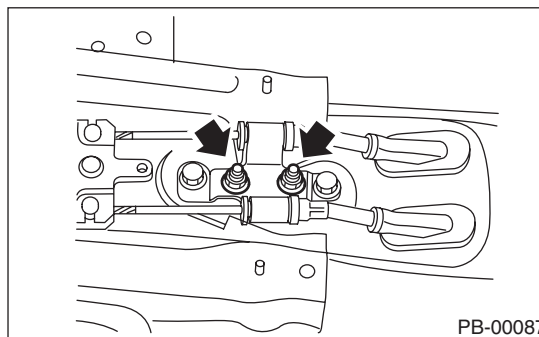
- (1) Equalizer
- (2) Cable end

- 7) Remove the parking brake cable bracket on the driver's side floor, and remove the front parking brake cable.

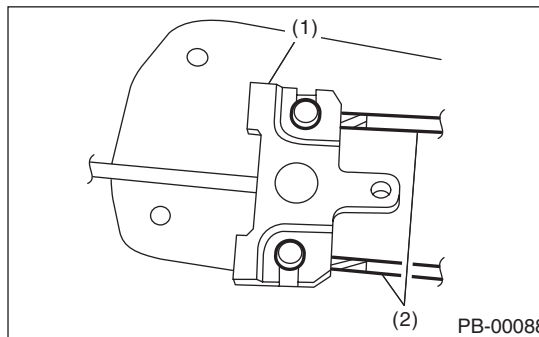


2. REAR PARKING BRAKE CABLE

- 1) Set the vehicle on a lift.
- 2) Remove the console box.
- 3) Roll up the floor mat and remove the clamps.



- 4) Remove the cable end from the equalizer.

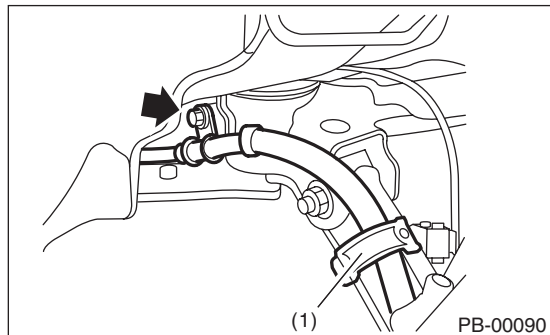


- (1) Equalizer
- (2) Cable end

Parking Brake Cable

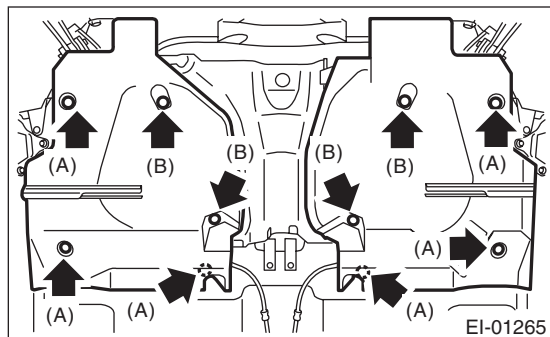
PARKING BRAKE

- 5) Lift up the vehicle, and remove the rear wheels.
- 6) Remove the rear parking brake cable from the rear brake. <Ref. to PB-7, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>
- 7) Remove the cable clamp, and remove the parking brake cable from the guide.

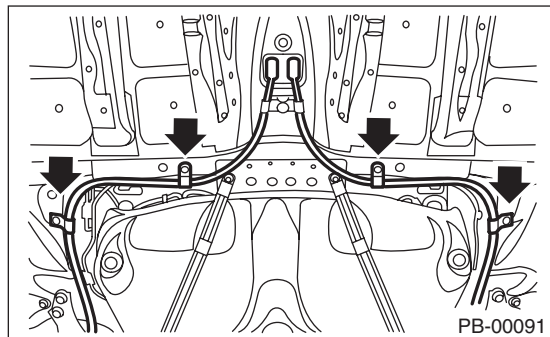


(1) Guide

- 8) Remove the bolts (A) and nuts (B), and then remove the fuel tank protector.



- 9) Remove the cable clamp from rear floor.



- 10) Remove the cable assembly.

B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Adjust the parking brake pedal stroke. <Ref. to PB-4, ADJUSTMENT, Parking Brake Pedal.>

Tightening torque:

<Ref. to PB-2, COMPONENT, General Description.>

C: INSPECTION

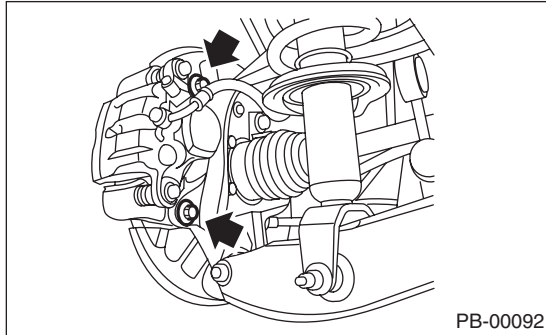
Check and replace the removed cable if damaged, rusty or faulty.

- 1) Check the cable for smooth operation.
- 2) Check the front parking brake cable for damage and rust.
- 3) Check the rear parking brake cable for damage, bends and cracks.
- 4) Check the boot for damage, cracks, and corrosion.

4. Parking Brake Assembly (Rear Disc Brake)

A: REMOVAL

- 1) Release the parking brake.
- 2) Lift up the vehicle, and then remove the rear wheels.
- 3) Remove the two mounting bolts and remove the disc brake caliper assembly.

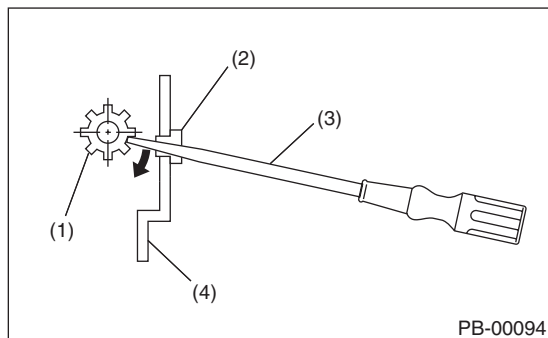


- 4) Suspend the rear disc brake caliper assembly so that the brake hose is not stretched.
- 5) Remove the rear disc brake rotor.

NOTE:

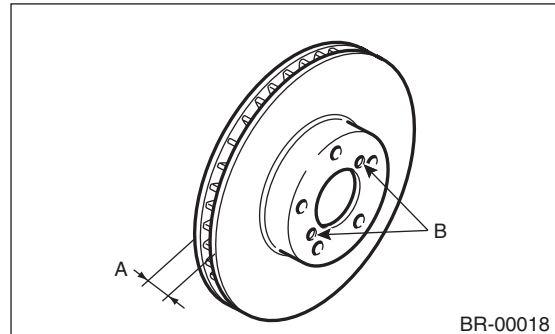
If the disc rotor is difficult to remove, try the following two methods in order.

- (1) Turn the adjusting screw using a flat tip screwdriver until the brake shoe moves adequately away from the disc rotor.

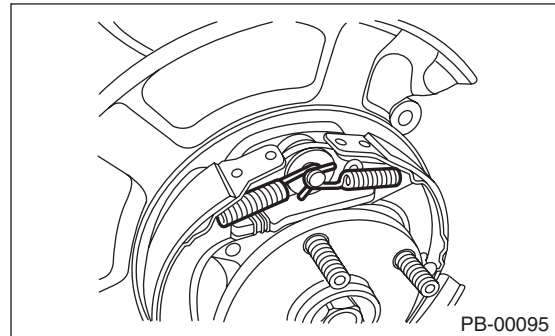


- (1) Adjuster
- (2) Adjusting hole cover (rubber)
- (3) Flat tip screwdriver
- (4) Disc rotor

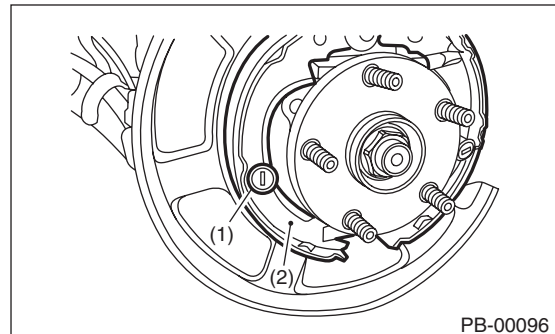
- (2) If disc rotor is seized up on the hub, drive the disc rotor out by pushing two 8-mm bolts in holes B on the rotor.



- 6) Remove the shoe return spring.



- 7) Remove the brake shoe cup and brake shoe spring, then remove the primary brake shoe.



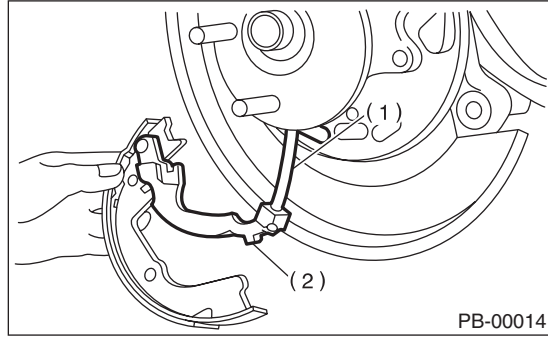
- (1) Brake shoe cup
- (2) Primary brake shoe

- 8) Remove the strut and strut spring.
- 9) Remove the adjuster assembly.
- 10) Remove the brake shoe cup and brake shoe spring, then remove the secondary brake shoe.

Parking Brake Assembly (Rear Disc Brake)

PARKING BRAKE

11) Remove the parking brake cable from lever.



- (1) Parking brake cable
- (2) Lever

12) Remove the retainer from the secondary side brake shoe. Remove the parking lever and washer from brake shoe.

B: INSTALLATION

CAUTION:

Be sure the lining surface is free from oil and grease.

1) Apply brake grease to the following locations.

Brake grease:

Brake Grease (Part No. 003602002)

- Six contact surfaces of brake shoe rim and back plate gasket
- Contact surface of the brake shoe and the anchor pin
- Contact surface of the lever and strut
- Contact surface of the brake shoe and the adjuster assembly
- Contact surface of the brake shoe and the strut
- Contact surface of the lever and brake shoe

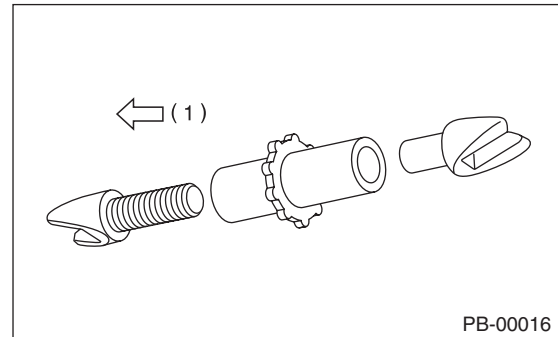
2) Install the parking lever to the secondary side brake shoe, then clamp and lock the retainer securely.

3) Attach the parking brake cable to the parking brake lever.

4) Attach the adjuster assembly and adjusting spring to the brake shoe.

NOTE:

Install the adjuster assembly so that the screw section will be towards the rear of the vehicle.



- (1) Rearward

5) Check the parking brake cable is not fallen from the cable guide.

6) Install the brake shoe to the back plate using shoe hold pins, brake shoe spring and brake shoe cup.

7) Install the strut and strut spring to the brake shoe.

NOTE:

Install the strut spring so that it is placed on the front of vehicle.

8) Install the primary side return spring, then the secondary side return spring.

9) Adjust the parking brake. <Ref. to PB-9, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

10) When replacing with a new brake shoe, drive the vehicle to break-in the parking brake lining.

(1) Drive the vehicle at about 35 km/h (22 MPH).

(2) Lightly step on the parking brake pedal.

(3) Drive the vehicle for about 200 m (0.12 mile) in this condition.

(4) Wait 5 to 10 minutes for the parking brake to cool down. Repeat again from step (1).

(5) After breaking-in, readjust the parking brakes.

C: INSPECTION

1) Measure the brake disc rotor inside diameter. If the disc is scored or worn, replace the brake disc rotor.

Disc rotor inside diameter:

Standard:

210 mm (8.27 in)

Service limit:

211 mm (8.31 in)

2) Measure the lining thickness. If it exceeds the limit, replace shoe assembly.

Lining thickness:

Standard:

4.0 mm (0.157 in)

Service limit:

1.5 mm (0.059 in)

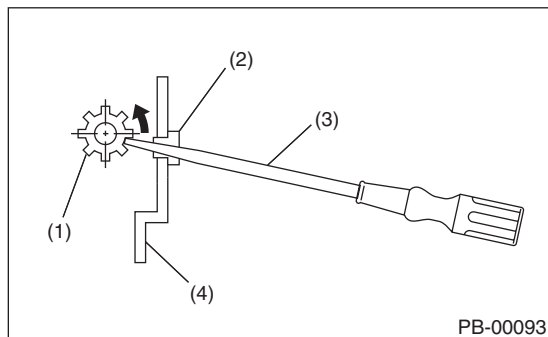
NOTE:

Replace the right and left brake shoe as a set.

D: ADJUSTMENT

1. SHOE CLEARANCE

- 1) Return the parking brake lever fully.
- 2) Remove the adjusting hole cover from the disc rotor.
- 3) Turn the adjusting screw using a flat tip screwdriver until the brake shoe is in close contact with the disc rotor.



- (1) Adjusting screw
- (2) Adjusting hole cover (rubber)
- (3) Flat tip screwdriver
- (4) Disc rotor

4) Turn back (downward) the adjusting screw 3 to 4 notches.

CAUTION:

Check there is no brake drag.

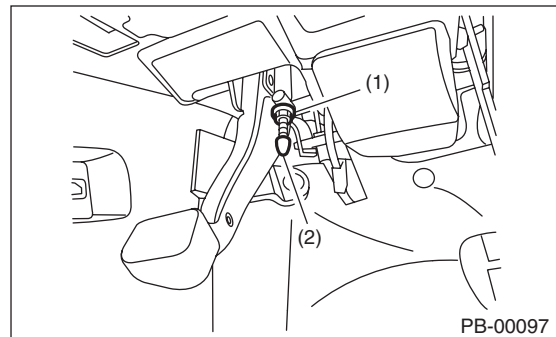
- 5) Install the adjusting hole cover to the disc rotor.
- 6) Adjust the parking brake pedal stroke. <Ref. to PB-9, PEDAL STROKE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

2. PEDAL STROKE

- 1) Adjust the shoe clearance before adjusting pedal stroke. <Ref. to PB-9, SHOE CLEARANCE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>
- 2) Operate the parking brake pedal 3 to 4 times.
- 3) Remove the adjuster cap from the parking brake pedal.
- 4) Turn the adjusting nut until the pedal stroke is at the specified value.

Pedal stroke:

When stepped on with a force of 300 N (30.6 kgf, 67 lb): 5-6 notches



- (1) Adjusting nut (self-locking nut)
- (2) Adjuster cap

- 5) Check there is no brake drag.
- 6) Install the adjuster cap.

General Diagnostic Table

PARKING BRAKE

5. General Diagnostic Table

A: INSPECTION

Symptom	Possible cause	Corrective action
Brake drag	Parking brake pedal is misadjusted.	Adjust.
	Parking brake cable does not move.	Correct or replace.
	Parking brake shoe clearance is maladjusted.	Adjust.
	Return spring is faulty.	Replace.
Noise from brake	Return spring is faulty.	Replace.
	Brake shoe spring fault	Replace.

POWER ASSISTED SYSTEM (POWER STEERING)

PS

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General Description

POWER ASSISTED SYSTEM (POWER STEERING)

1. General Description

A: SPECIFICATION

Whole system	Minimum turning radius		m (ft)	5.7 (18.7)
	Steering angle	Inner wheel		37.0°±1.5°
		Outer wheel		32.0°±1.5
	Steering wheel diameter		mm (in)	375 (14.76)
	Lock to lock turn			3.44
Gearbox	Type			Rack and Pinion, Integral
	Backlash			0 (automatic adjusting)
	Valve (power steering system)			Rotary valve
Pump (Power steering system)	Type			Vane pump
	Oil tank			Installed on body
	Specific output		cm ³ (cu in)/rev.	9.6 (0.586)
	Relief pressure		kPa (kg/cm ² , psi)	8,800 — 9,400 (90 — 96, 1,276 — 1,363)
	Hydraulic fluid control			Engine speed sensitive
	Hydraulic fluid		L (US qt, Imp qt)	1,000 rpm: 7.0 (7.4, 6.2) 3,000 rpm: 6.0 (6.3, 5.3)
	RPM range		rpm	500 — 8,600
	Direction of rotation			Clockwise
Hydraulic oil (Power steering system)	Capacity	Oil tank		0.2 (0.2, 0.2)
		Whole system		0.9 (1.0, 0.8)

Steering wheel	Free play		mm (in)	17 (0.67)
Steering shaft	Clearance between the steering wheel and column cover		mm (in)	3.0 (0.12)
Steering gearbox (Power steering system)	Sliding resistance		N (kgf, lb)	343 (35, 77) or less Difference between right and left sliding resistance: 20% or less
	Rack shaft play in the radial direction	Right-turn steering	mm (in)	0.4 (0.016) or less
		Left-turn steering	mm (in)	Play in the vertical direction: 0.6 (0.024) or less Play in the horizontal direction: 0.4 (0.016) or less
	Input shaft play	In radial direction	mm (in)	0.26 (0.0102) or less
		In axial direction	mm (in)	Without play
	Rotational resistance		N (kgf, lb)	Maximum allowable value: 13 (1.3, 2.9) or less Difference between right and left sliding resistance: 20% or less
Oil pump (Power steering system)	Pulley shaft	Radial play	mm (in)	0.2 (0.008) or less
		Axial play	mm (in)	0.6 (0.024) or less
	Pulley	Ditch deflection	mm (in)	1.0 (0.039) or less
		Rotational resistance	N (kgf, lb)	9.22 (0.94, 2.07) or less
	Regular pressure (unloaded)		kPa (kg/cm ² , psi)	981 (10, 142) or less
Steering wheel effort (Power steering system)	At standstill with engine idling on paved road		N (kgf, lb)	29.4 (3.0, 6.6) or less
	At standstill with engine stalled on paved road		N (kgf, lb)	294.2 (30, 66.2) or less

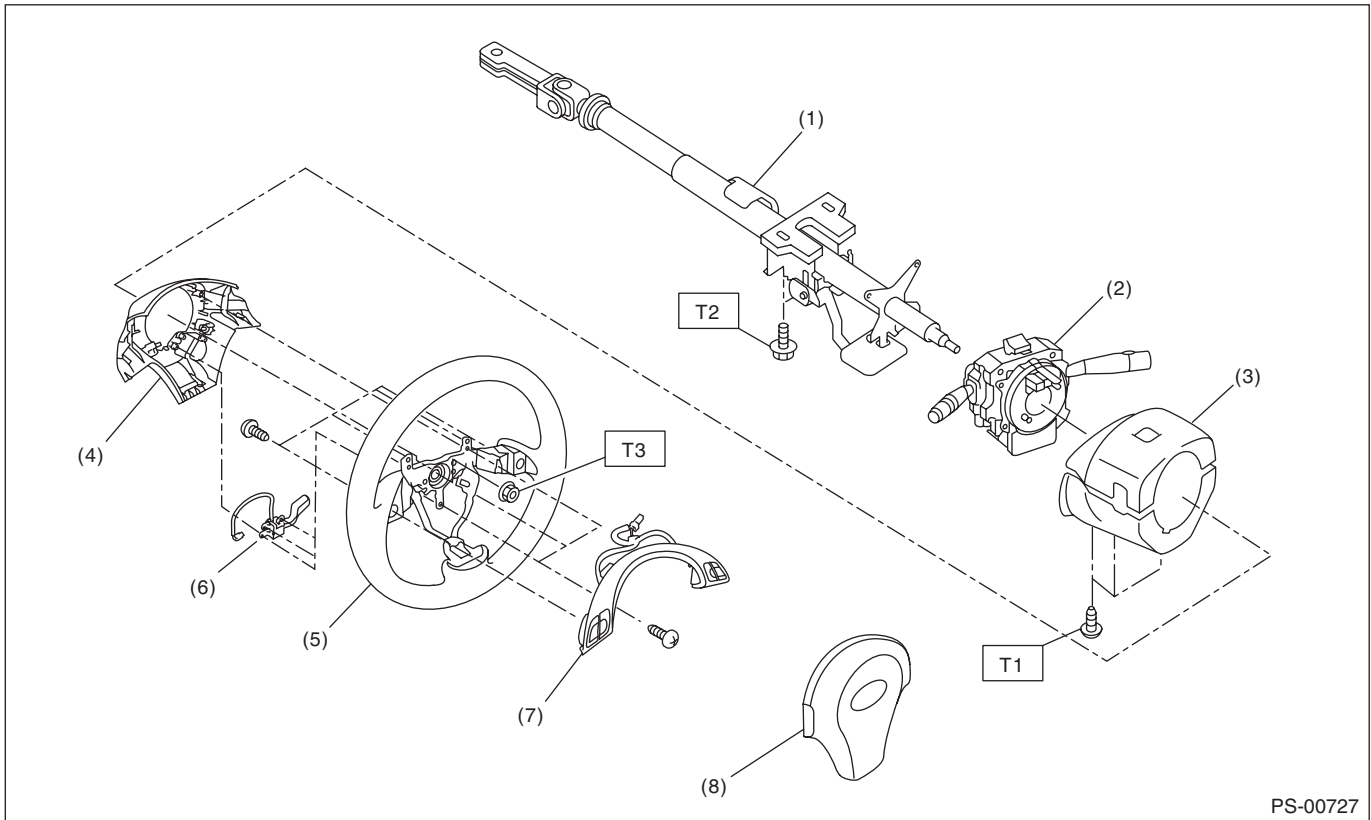
Recommended power steering fluid
SUBARU ATF or ATF DEXRON III

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

B: COMPONENT

1. STEERING WHEEL AND COLUMN



- | | |
|--------------------------------|---------------------------|
| (1) Steering shaft | (5) Steering wheel |
| (2) Steering roll connector | (6) Cruise control switch |
| (3) Column cover | (7) Satellite switch |
| (4) Steering wheel lower cover | (8) Airbag module |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.2 (0.12, 0.89)

T2: 20 (2.0, 14.8)

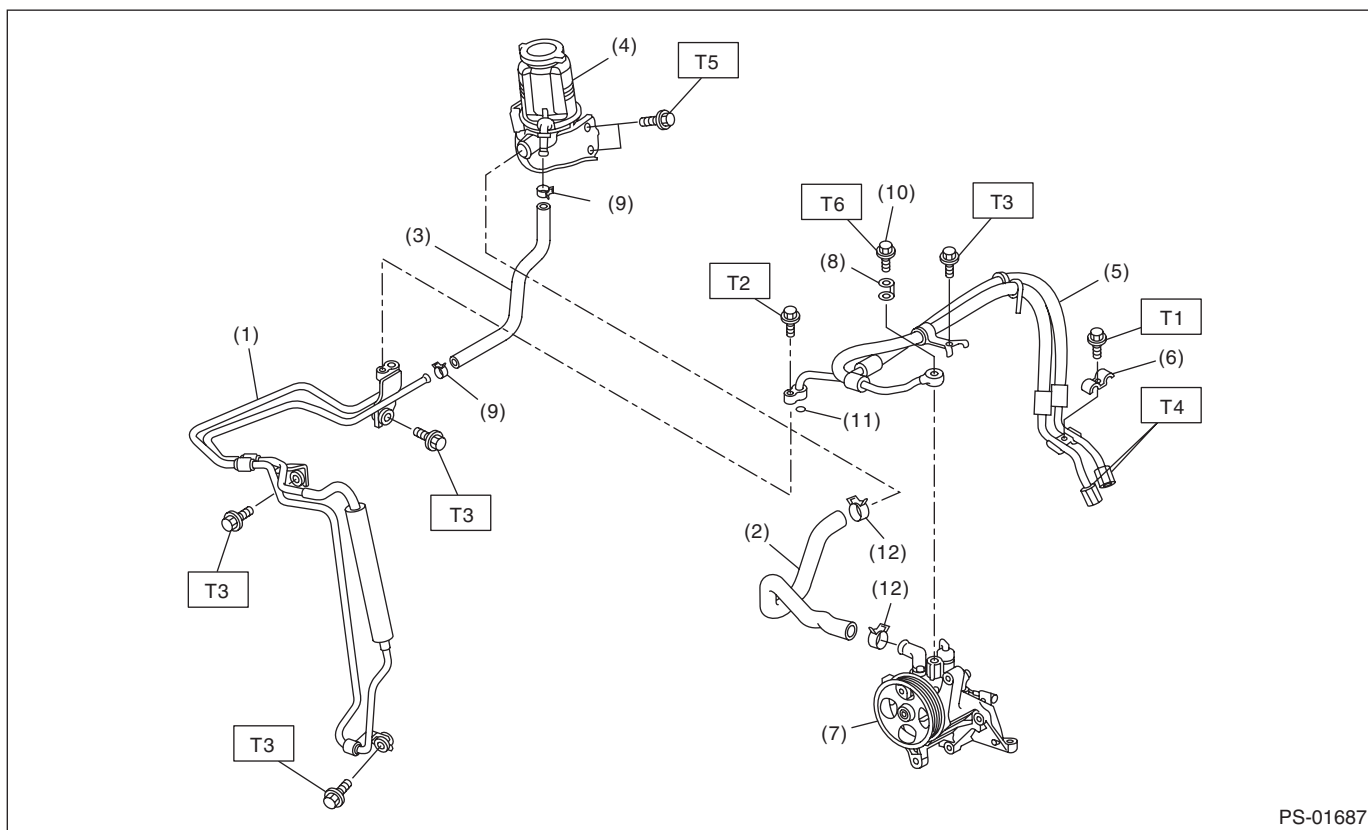
T3: 39 (4.0, 28.8)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

2. POWER ASSISTED SYSTEM

- Hose and tank



PS-01687

- | | |
|---------------------|------------------------|
| (1) Oil cooler pipe | (8) Eyebolt gasket |
| (2) Suction hose | (9) Clip |
| (3) Return hose | (10) Eyebolt |
| (4) Reservoir tank | (11) O-ring |
| (5) Hose | (12) Clip hose suction |
| (6) Clamp E | |
| (7) Oil pump | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 8 (0.8, 5.9)

T2: 10 (1.0, 7.4)

T3: 13 (1.3, 9.6)

T4: 15 (1.5, 11.1)

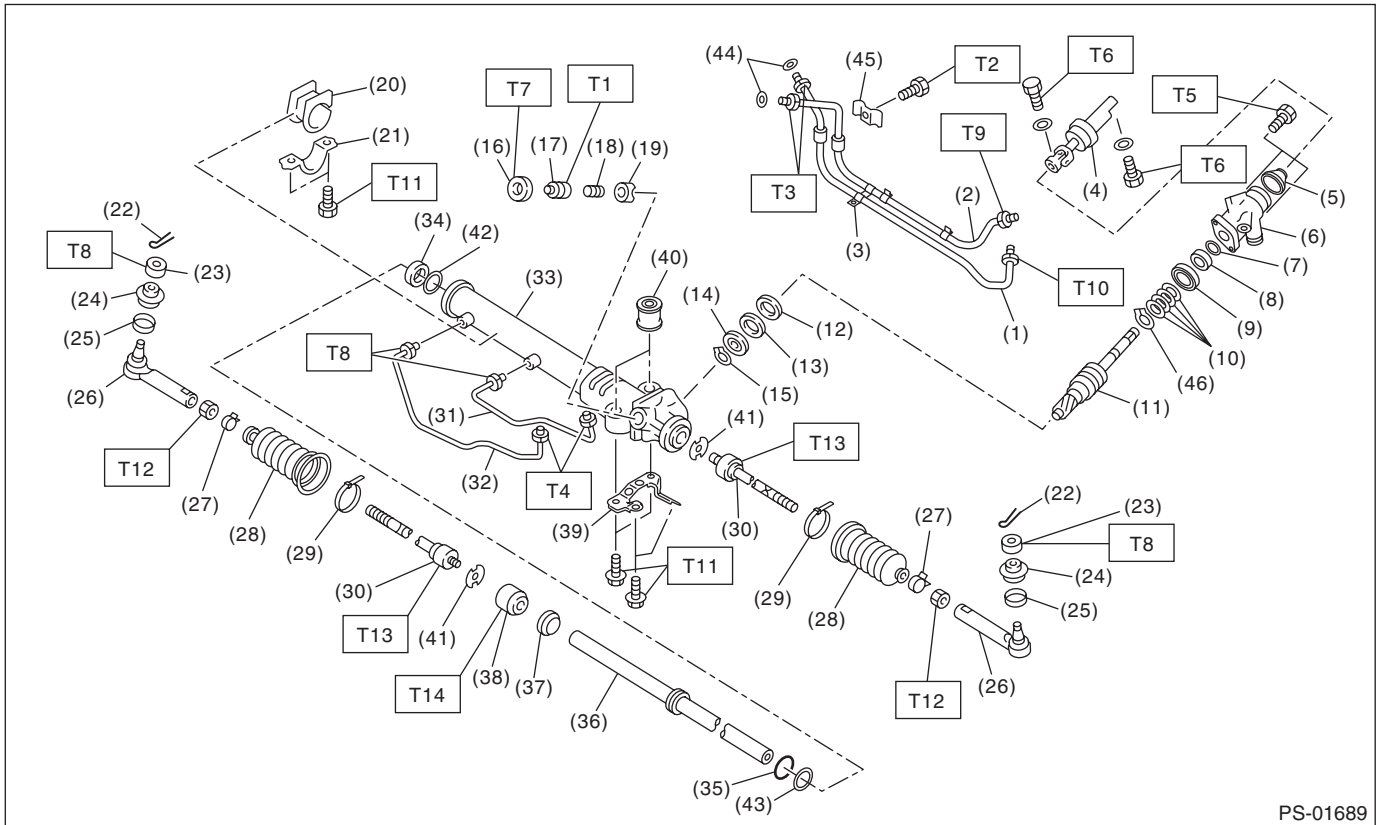
T5: 33 (3.4, 24.3)

T6: 40 (4.1, 29.5)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

• Gearbox



PS-01689

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

- | |
|----------------|
| (43) O-ring |
| (44) O-ring |
| (45) Bracket |
| (46) Snap ring |

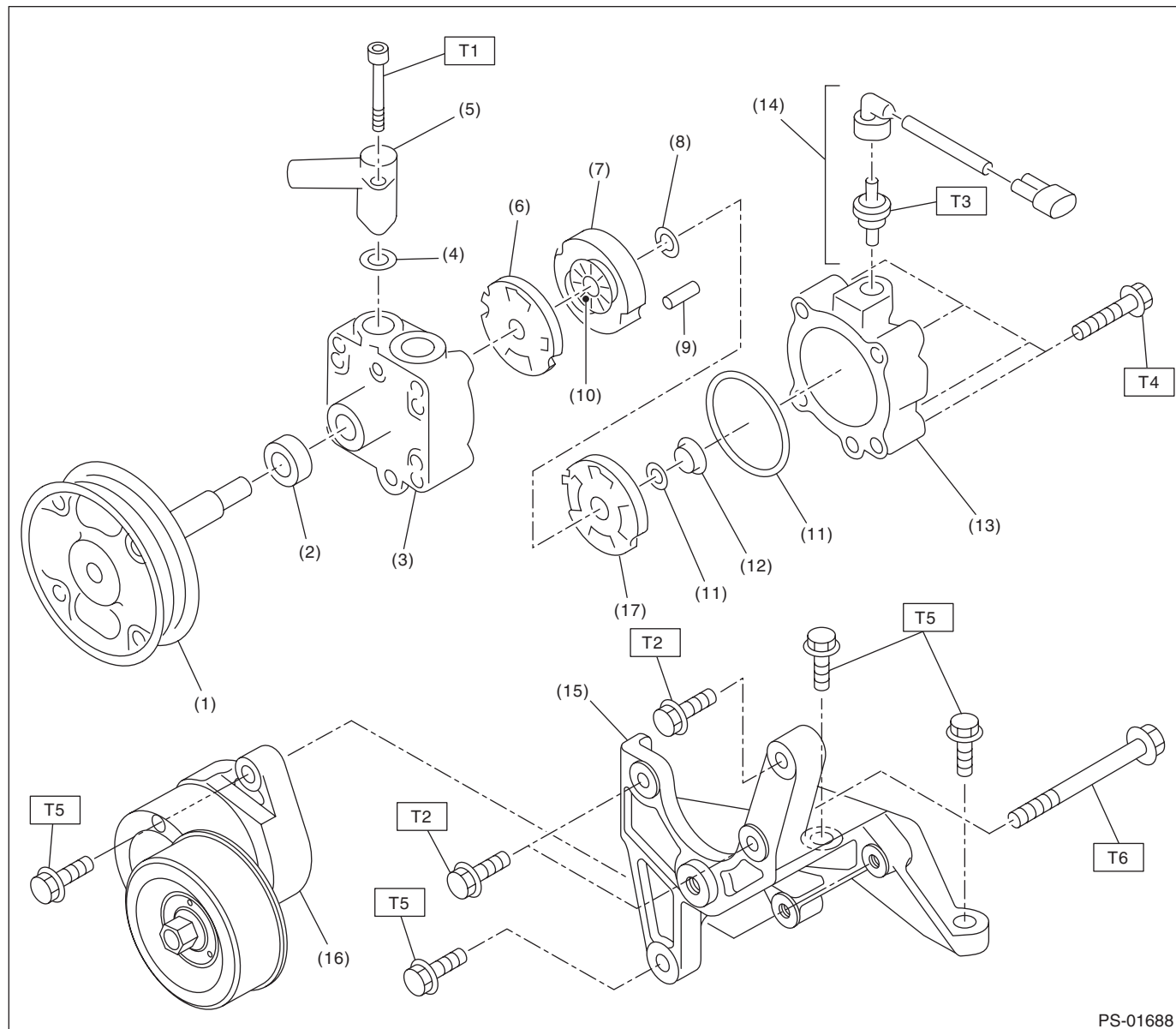
Tightening torque: N·m (kgf·m, ft·lb)

- | | |
|-------------|-------------------------|
| T1: | 5.9 (0.6, 4.4) |
| T2: | 9 (0.9, 6.6) |
| T3: | 15 (1.5, 11.1) |
| T4: | 17 (1.7, 12.5) |
| T5: | 20 (2.0, 14.8) |
| T6: | 24 (2.4, 17.7) |
| T7: | 25 (2.5, 18.1) |
| T8: | 27 (2.8, 19.9) |
| T9: | 29 (3.0, 21.4) |
| T10: | 37 (3.8, 27.3) |
| T11: | 60 (6.1, 44.3) |
| T12: | 85 (8.7, 62.7) |
| T13: | 128 (13.1, 94.4) |
| T14: | 79 (8.1, 58.3) |

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

3. OIL PUMP



PS-01688

- | | |
|-----------------------|---------------------------|
| (1) Pulley | (10) Rotor |
| (2) Oil seal | (11) O-ring |
| (3) Front casing | (12) Back-up ring |
| (4) O-ring | (13) Rear body |
| (5) Suction connector | (14) Pressure switch ASSY |
| (6) Side plate front | (15) Bracket |
| (7) Cam ring | (16) Belt tensioner |
| (8) Snap ring | (17) Side plate rear |
| (9) Straight pin | |

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

T1: 3.73 (0.38, 2.75)

T2: 15.7 (1.6, 11.6)

T3: 19.6 (2.0, 14.5)

T4: 27.5 (2.8, 20.3)

T5: 33 (3.4, 24.3)

T6: 36.8 (3.8, 27.1)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

C: CAUTION

Please clearly understand and adhere to the following general precautions. They must be strictly followed to avoid any injury to the person doing the work or people in the area.

1. OPERATION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine power steering fluid, grease etc. or the equivalent. Do not mix fluid, grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before securing a part on a vise, place cushioning material such as wooden blocks, aluminum plate or cloth between the part and the vise.

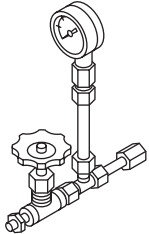
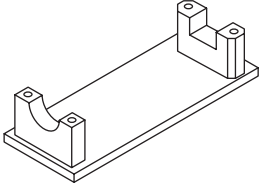
2. OIL

When handling oil, follow the rules below to prevent unexpected accidents.

- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

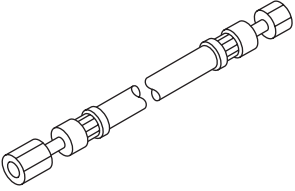
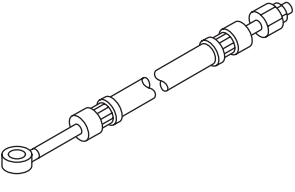
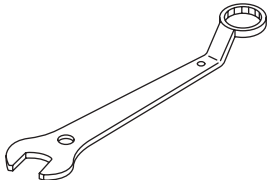
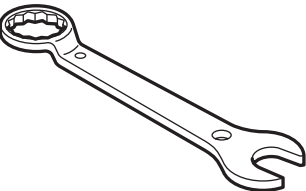
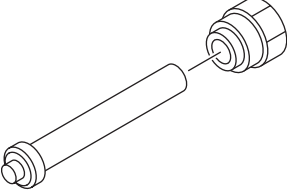
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-925711000	925711000	PRESSURE GAUGE	Used for measuring oil pressure.
 ST-926200000	926200000	STAND	• Used when inspecting characteristic of gear-box assembly and disassembling it. • Used together with BOSS D (34199AG000).

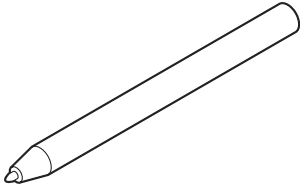
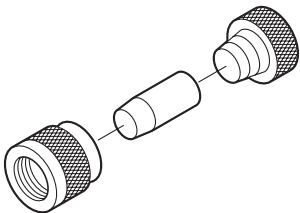
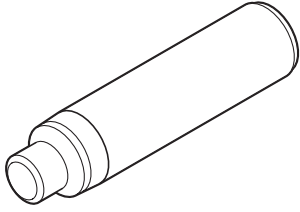
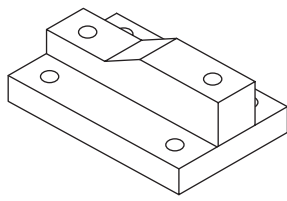
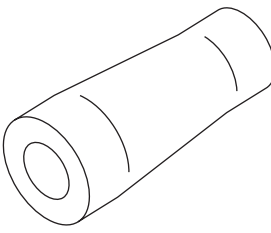
General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099AC010	34099AC010	ADAPTER HOSE A	Used together with PRESSURE GAUGE (925711000).
 ST34099AC020	34099AC020	ADAPTER HOSE B	Used together with PRESSURE GAUGE (925711000).
 ST-926230000	926230000	SPANNER	For the lock nut when adjusting backlash of gearbox.
 ST34099PA100	34099PA100	SPANNER	Used when measuring the rotational resistance of gearbox assembly.
 ST-926420000	926420000	PLUG	When fluid leaks from pinion side of gearbox assembly, remove pipe B from valve housing, attach this tool and check fluid leaking points.

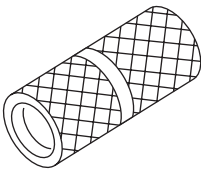
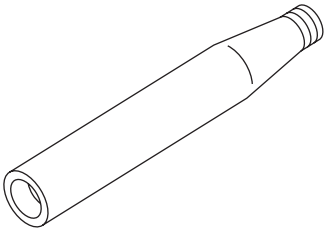
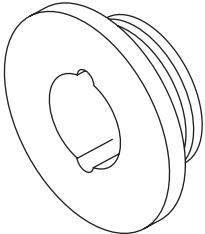
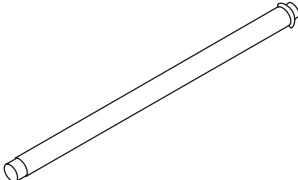
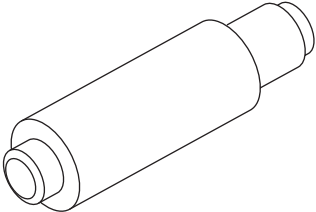
General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34099FA060	34099FA060	PUNCH HOLDER	Used for crimping.
 ST34199FE040	34199FE040	INSTALLER A, B, C	Used for installing the oil seal to the rack assembly.
 ST34199XA030	34199XA030	INSTALLER & REMOVER 44	Used for removing and installing the rack oil seal (outer and inner).
 ST34199AG000	34199AG000	BOSS D	• Used when inspecting characteristic of gear-box assembly and disassembling it. • Used together with STAND (926200000).
 ST34199XA010	34199XA010	GUIDE 44	Used for installing seal ring of rack.

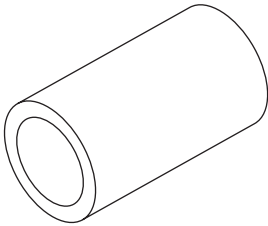
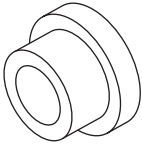
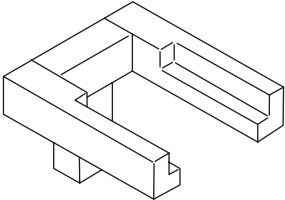
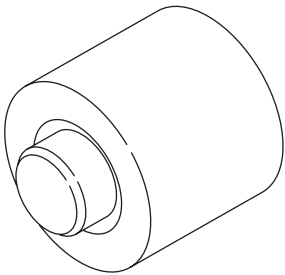
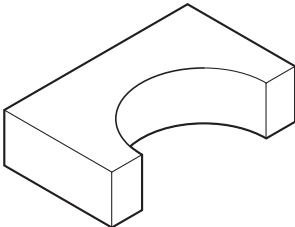
General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AG070	34199AG070	FORMER	Used for forming seal ring of pinion.
 ST34199AG020	34199AG020	GUIDE	Used for installing seal ring of pinion.
 ST34199AG060	34199AG060	GUIDE G (26)	• Used for forming seal ring of rack. • Used with FORMER PISTON (34199XA020).
 ST34199XA060	34199XA060	OIL SEAL REMOVER	Used for removing oil seal.
 ST34199AG090	34199AG090	INSTALLER & REMOVER	• Used for installing oil seal of valve housing. • Used for installing ball bearing of valve housing. • Used for removing oil seal and ball bearing from valve housing.

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199XA020	34199XA020	FORMER PISTON 44	- Used for forming seal ring of rack. - Used together with GUIDE G (26) (34199AG060).
 ST34199XA000	34199XA000	INSTALLER 44	Used for pressing-fit oil seal of gearbox cylinder.
 ST34199AE020	34199AE020	ATTACHMENT	Used for removing oil pump.
 ST34199AE030	34199AE030	INSTALLER	Used for installing the oil seal to the oil pump.
 ST34199XA050	34199XA050	BASE	Used for crimping.

Steering Wheel

POWER ASSISTED SYSTEM (POWER STEERING)

2. Steering Wheel

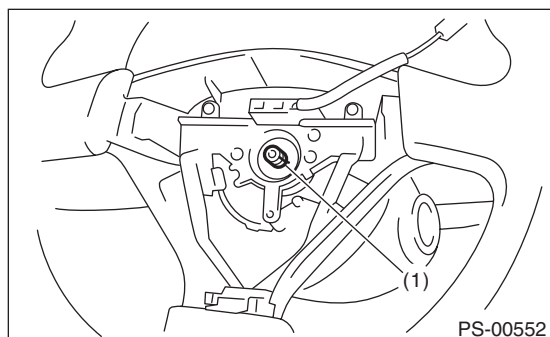
A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Set the tire to the straight-ahead position.
- 3) Remove the airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

WARNING:

Always refer to "Airbag System" before performing service on the airbag modules. <Ref. to AB-4, CAUTION, General Description.>

- 4) Place alignment marks on the steering wheel and steering shaft.



(1) Alignment mark

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

B: INSTALLATION

WARNING:

Always refer to "Airbag System" before performing service on the airbag modules. <Ref. to AB-4, CAUTION, General Description.>

- 1) Align the center position of the roll connector. <Ref. to AB-25, ADJUSTMENT, Roll Connector.>
- 2) Install in the reverse order of removal.

NOTE:

Align the alignment marks on the steering wheel and steering shaft.

Tightening torque:

39 N·m (4.0 kgf-m, 28.8 ft-lb)

Column cover-to-steering wheel clearance:

2 — 4 mm (0.08 — 0.16 in)

CAUTION:

Insert the roll connector guide pin into the guide hole on the lower end of the steering wheel surface. Avoid damaging the pin.

C: INSPECTION

- 1) Check the steering wheel for deformation. If the deformation is excessive, replace the steering wheel.

Specification:

Runout of steering wheel

17 mm (0.67 in) or less

Deflection of steering wheel

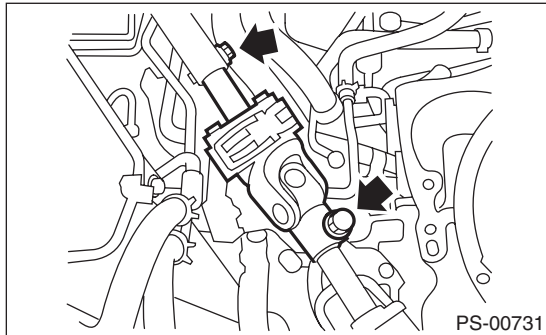
6 mm (0.24 in) or less

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

3. Universal Joint

A: REMOVAL

- 1) Remove the steering wheel. <Ref. to PS-12, REMOVAL, Steering Wheel.>
- 2) Place alignment marks on the universal joint and gear box assembly input shaft.
- 3) Remove the universal joint bolt and remove the universal joint.



B: INSTALLATION

- 1) Align the cutout portion at serrated section of the column shaft and yoke, then install the universal joint into column shaft.
- 2) Install the universal joint to the serrations of gearbox assembly by matching alignment marks.
- 3) Tighten the bolts on the gearbox side first, and then the column shaft side.

Tightening torque:

24 N·m (2.4 kgf-m, 17.7 ft-lb)

CAUTION:

Be sure to follow the tightening order and tightening torque of universal joint to avoid the steering effort from becoming heavy.

Clearance between coupling of universal joint to AT level gauge:

10 mm (0.39 in) or more

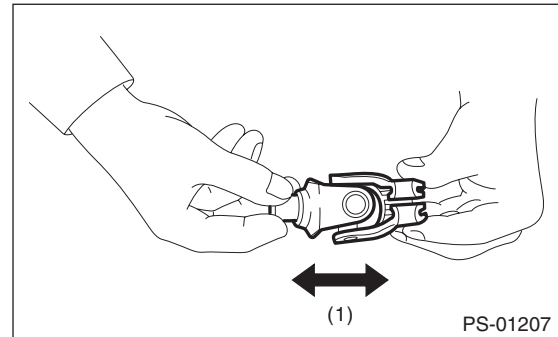
- 4) Align the center position of the roll connector. <Ref. to AB-25, ADJUSTMENT, Roll Connector.>
- 5) Install the steering wheel. <Ref. to PS-12, INSTALLATION, Steering Wheel.>

C: INSPECTION

Check for wear, damage or any other faults. Replace as necessary

Service limit:

Universal joint play: 0 mm (0 in)

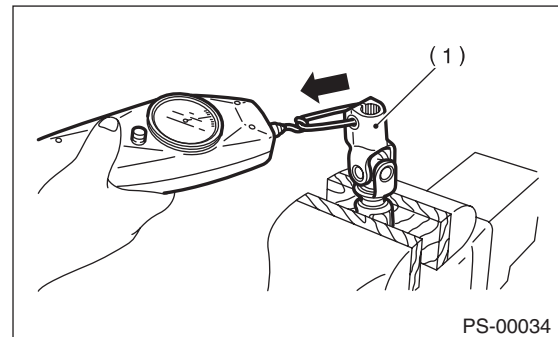


(1) Play

Measure the swing torque of universal joint.

Service limit:

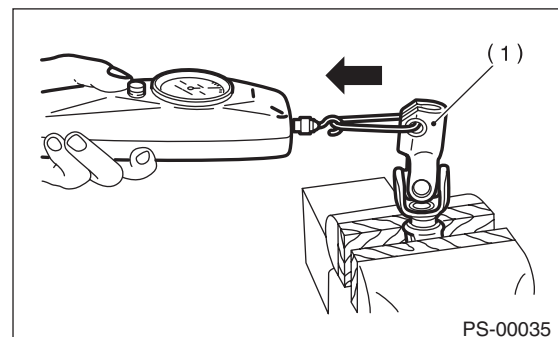
Maximum load: 4.5 N (0.46 kgf, 1.01 lb) or less



(1) Yoke (gearbox side)

Service limit:

Maximum load: 4.5 N (0.46 kgf, 1.01 lb) or less



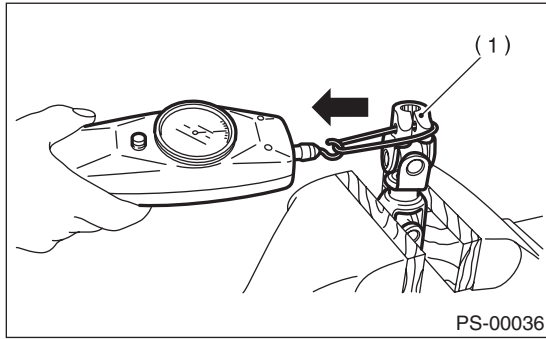
(1) Yoke (gearbox side)

Universal Joint

POWER ASSISTED SYSTEM (POWER STEERING)

Service limit:

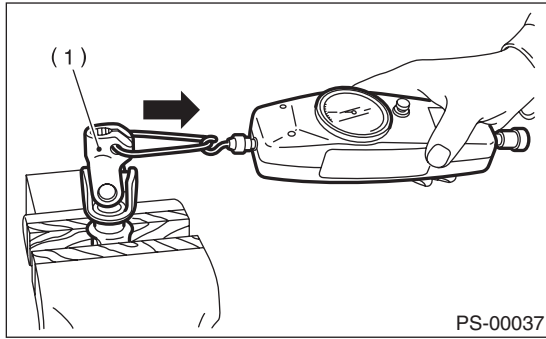
Maximum load: 2.0 N (0.20 kgf, 0.45 lb) or less



(1) Yoke (steering column side)

Service limit:

Maximum load: 2.0 N (0.20 kgf, 0.45 lb) or less



(1) Yoke (steering column side)

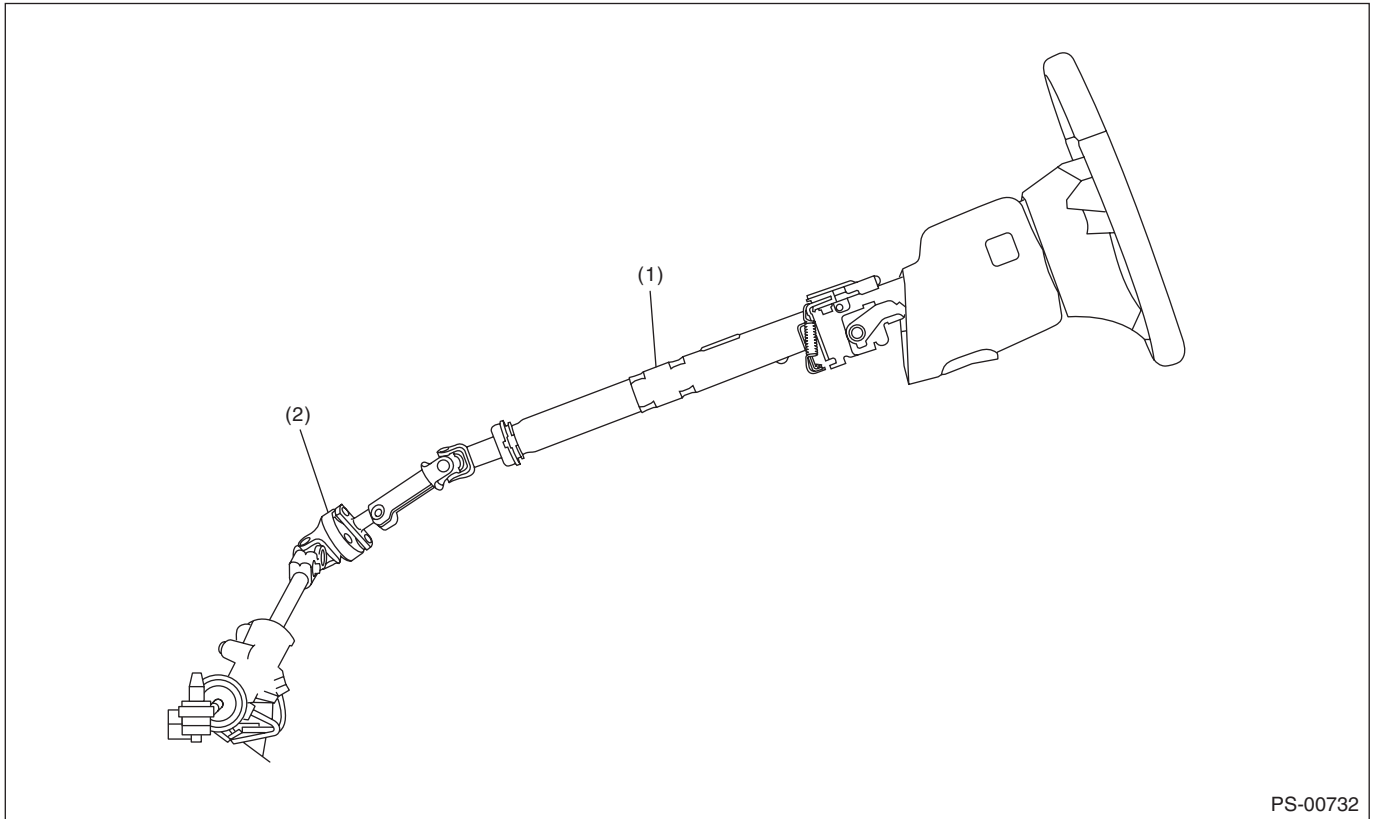
Measure it in column assembly for column side.

Tilt Steering Column

POWER ASSISTED SYSTEM (POWER STEERING)

4. Tilt Steering Column

A: REMOVAL



PS-00732

(1) Tilt steering column

(2) Universal joint

Tilt Steering Column

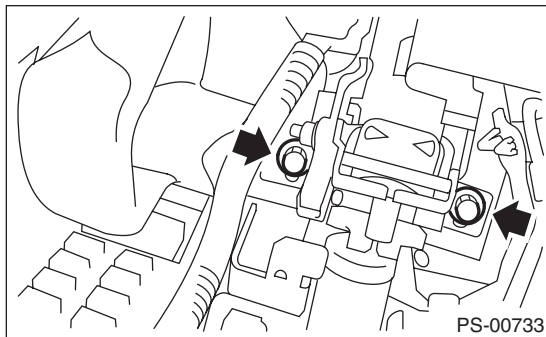
POWER ASSISTED SYSTEM (POWER STEERING)

- 1) Remove the steering wheel. <Ref. to PS-12, REMOVAL, Steering Wheel.>
- 2) Remove the universal joint. <Ref. to PS-13, REMOVAL, Universal Joint.>

CAUTION:

Always remove the universal joint before removing the steering column installation bolt to avoid damage to the universal joint.

- 3) Remove the instrument panel lower cover under.
- 4) Remove the instrument panel lower cover upper.
- 5) Remove the screws which secure the column cover lower, then remove the column cover lower.
- 6) Remove all connectors from the steering column.
- 7) Remove the two bolts under instrument panel securing the steering column.



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

CAUTION:

- Always remove the universal joint before removing the steering column installation bolt to avoid damage to the universal joint.
- Be sure to remove the universal joint before removing the parts, if the relative position between steering shaft and gearbox changes when removing steering shaft assembly or when lowering it and gearbox for servicing other parts.

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

B: INSTALLATION

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

Tightening torque:

20 N·m (2.0 kgf-m, 14.8 ft-lb)

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

NOTE:

Make sure to apply double lock.

- 5) Install the instrument panel lower cover with tilt lever held in the lowered position.
- 6) Install the universal joint. <Ref. to PS-13, INSTALLATION, Universal Joint.>

CAUTION:

- Always install the universal joint after installing the steering column to avoid damage to the universal joint.
- Be sure to follow the tightening order and tightening torque of universal joint to avoid the steering effort from becoming heavy.

- 7) Align the center position of the roll connector. <Ref. to AB-25, ADJUSTMENT, Roll Connector.>
- 8) Install the steering wheel. <Ref. to PS-12, INSTALLATION, Steering Wheel.>

CAUTION:

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

C: DISASSEMBLY

Remove the one screw which secures the lower steering column cover, and then remove the lower steering column cover. Remove the two screws securing the upper steering column covers, and the two screws securing the combination switch, and then remove related parts.

D: ASSEMBLY

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

Tightening torque:

1.2 N·m (0.12 kgf-m, 0.89 ft-lb)

CAUTION:

Do not overtorque the screw.

E: INSPECTION

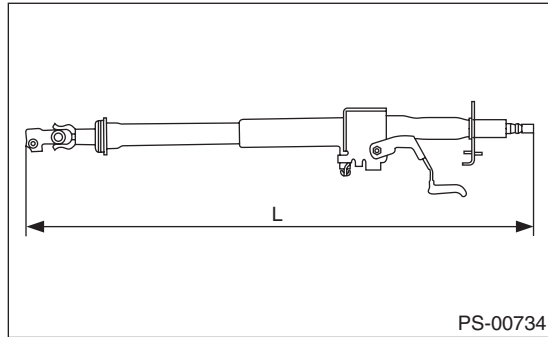
1. BASIC INSPECTION

Measure the overall length of steering column. If not within specification, replace it.

Overall length L:

Specification

$917.5^{+1.3}_{-0.3} \text{ mm}$ ($36.12^{+0.051}_{-0.020} \text{ in}$)



2. INSPECTION OF AIRBAG SYSTEM

WARNING:

Refer to “Airbag System” for airbag inspection procedure. <Ref. to AB-14, INSPECTION, Driver’s Airbag Module.>

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5. Steering Gearbox

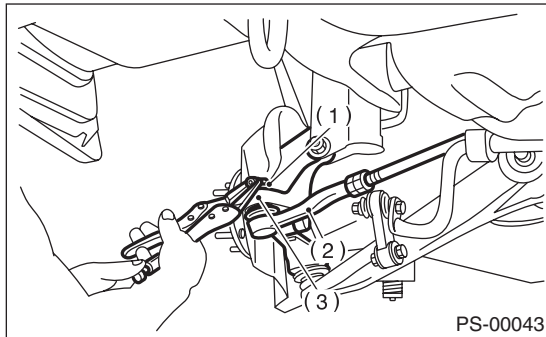
A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.
- 3) Lift up the vehicle, and remove the front wheels.
- 4) Remove the under cover. <Ref. to EI-18, REMOVAL, Front Under Cover.>
- 5) Remove the front exhaust pipe assembly. <Ref. to EX(H6DO)-5, REMOVAL, Front Exhaust Pipe.>

WARNING:

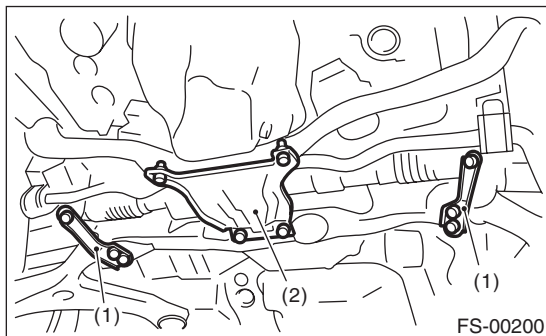
Be careful not to burn yourself because the exhaust pipe is hot.

- 6) After pulling off the cotter pin and removing the castle nut, use a puller to remove the tie-rod end from the knuckle arm.



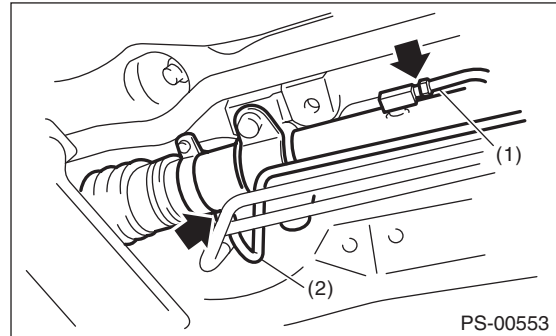
- (1) Castle nut
- (2) Tie-rod end
- (3) Knuckle arm

- 7) Remove the front crossmember support plate, jack-up plate and front stabilizer. <Ref. to FS-14, REMOVAL, Front Stabilizer.>



- (1) Crossmember support plate
- (2) Jack-up plate

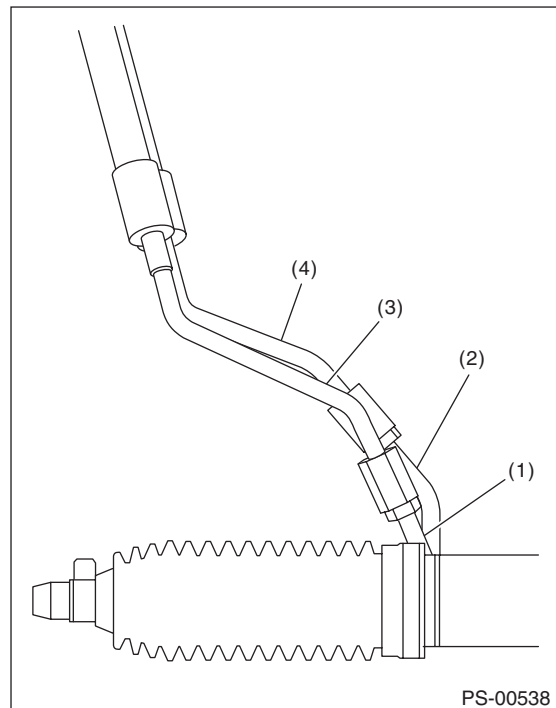
- 8) Remove the one pipe joint at the center of the gearbox, and connect the vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



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

- 9) Remove the universal joint. <Ref. to PS-13, REMOVAL, Universal Joint.>

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

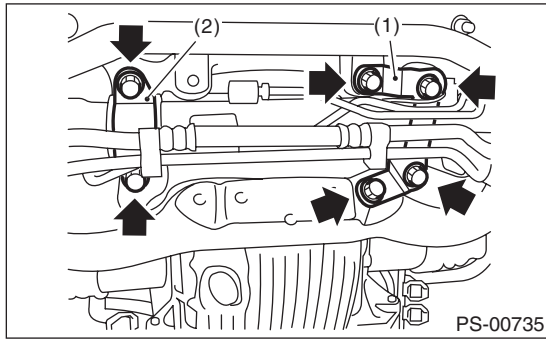


- (1) Feed pipe
- (2) Return pipe
- (3) Pressure hose
- (4) Return hose

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

11) Remove the gear box bracket and clamp, and remove the gearbox.



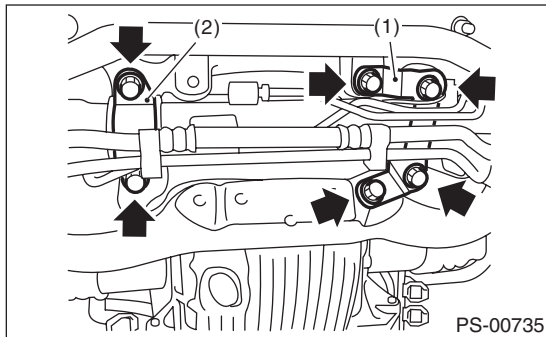
- (1) Bracket
- (2) Clamp

B: INSTALLATION

- 1) Insert the gearbox into crossmember, being careful not to damage gearbox boot.
- 2) Attach the gearbox bracket and clamp.

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

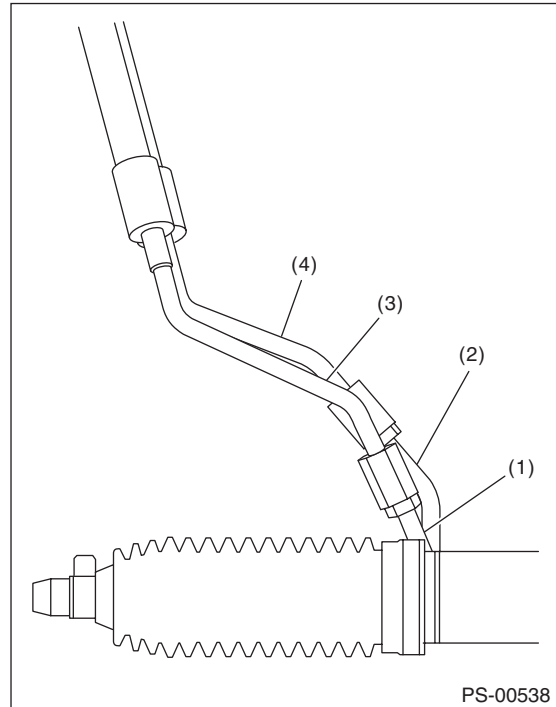


- (1) Bracket
- (2) Clamp

3) Connect the return pipe to the return hose and then connect the feed pipe to the pressure hose.

Tightening torque:

15 N·m (1.5 kgf-m, 11.1 ft-lb)



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

4) Install the universal joint. <Ref. to PS-13, INSTALLATION, Universal Joint.>

5) Connect the tie-rod end and knuckle arm, and tighten with castle nut.

Castle nut tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

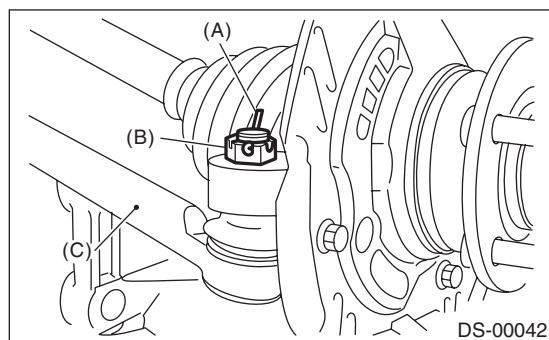
CAUTION:

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

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

6) After tightening the castle nut to the specified tightening torque, tighten it further within 60° until the cotter pin hole is aligned with slot in the nut. Fit the cotter pin into the nut, and then bend the pin to lock.



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

- 7) Install the front stabilizer. <Ref. to FS-14, INSTALLATION, Front Stabilizer.>
- 8) Install the front crossmember support plate and jack-up plate.
- 9) Install the front exhaust pipe assembly. <Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.>
- 10) Install the under cover. <Ref. to EI-18, INSTALLATION, Front Under Cover.>
- 11) Install the front wheels.
- 12) Tighten the wheel nuts to the specified torque.

Tightening torque:

Chromed plated wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

- 13) Lower the vehicle.
- 14) Remove the steering wheel. <Ref. to PS-12, REMOVAL, Steering Wheel.>
- 15) Align the center position of the roll connector. <Ref. to AB-25, ADJUSTMENT, Roll Connector.>
- 16) Install the steering wheel. <Ref. to PS-12, INSTALLATION, Steering Wheel.>
- 17) Connect the battery ground terminal.
- 18) Pour fluid into the oil tank, and bleed air. <Ref. to PS-50, Power Steering Fluid.>
- 19) Check for fluid leaks.
- 20) Check the fluid level in oil tank.

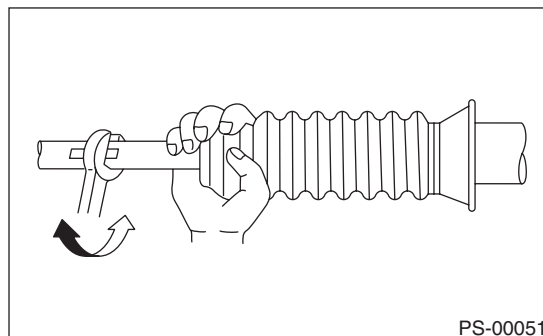
21) After adjusting toe-in and steering angle, tighten the lock nut on tie-rod end.

Tightening torque:

85 N·m (8.7 kgf-m, 62.7 ft-lb)

NOTE:

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



C: DISASSEMBLY

1. RACK HOUSING ASSEMBLY

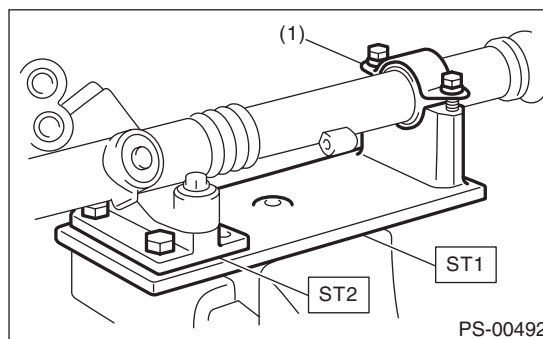
- 1) Disconnect the four pipes from gearbox.
- 2) Secure the gearbox removed from vehicle in a vise using ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

CAUTION:

Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.



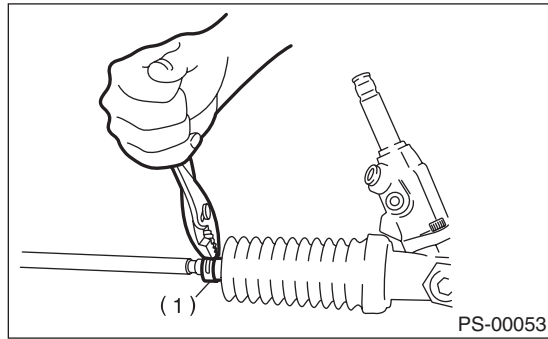
- (1) Clamp

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

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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

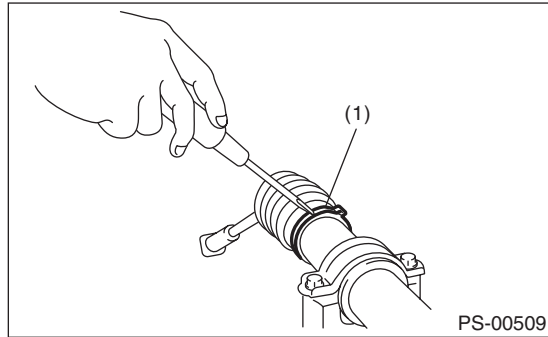


(1) Clip

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

NOTE:

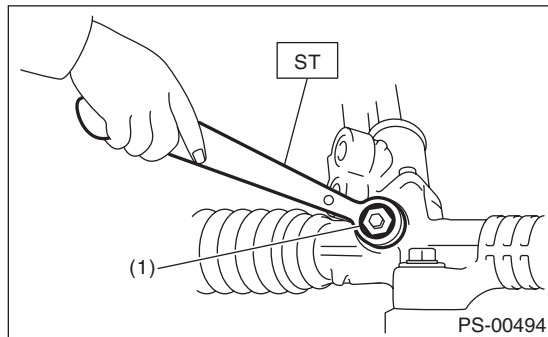
Replace the boot if there is damage, cracks or deterioration.



(1) Band

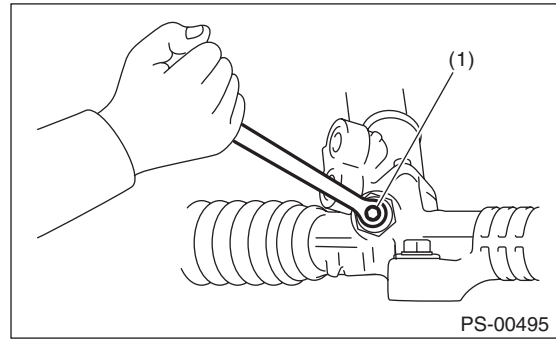
6) Using the ST, loosen the lock nut.

ST 926230000 SPANNER



(1) Lock nut

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

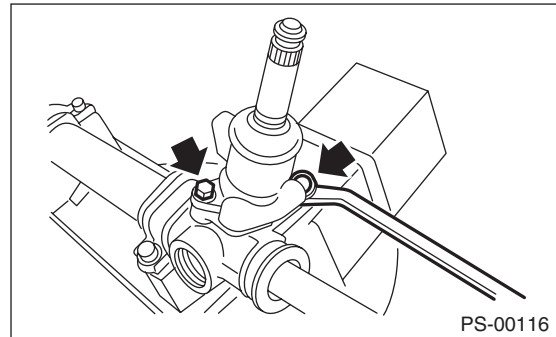


(1) Adjusting screw

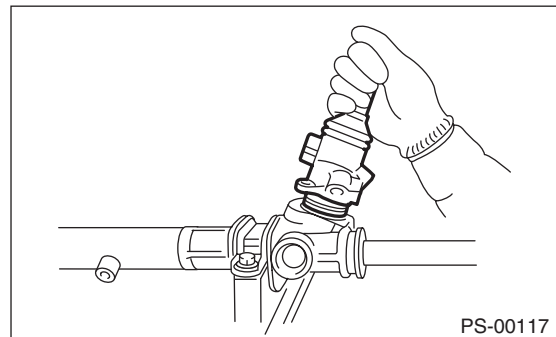
8) Remove the tie-rod.

9) Loosen the adjusting screw, and remove the spring and sleeve.

10) Remove the two bolts securing valve assembly.



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



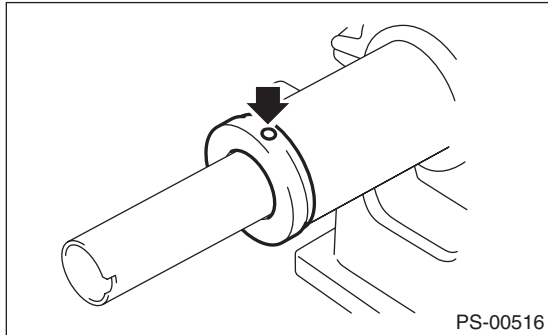
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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

CAUTION:

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



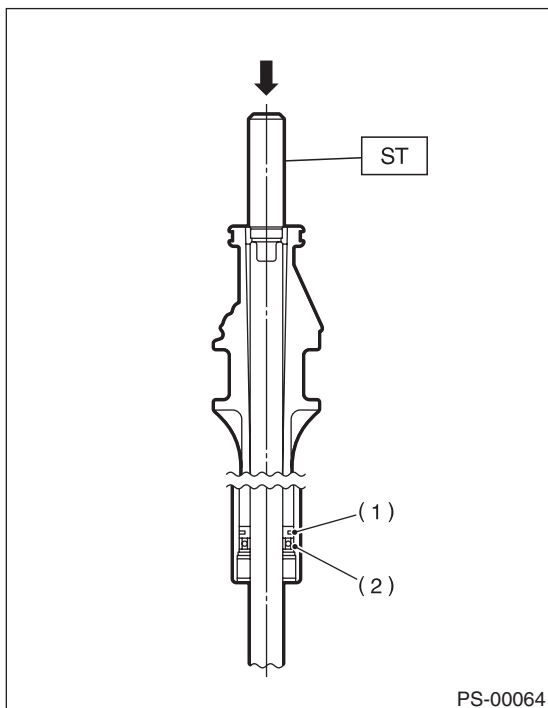
13) Remove the holder.

14) Attach the ST to the pinion housing side of the rack, and push out the rack together with the outer side oil seal.

ST 34199XA030 INSTALLER & REMOVER 44

NOTE:

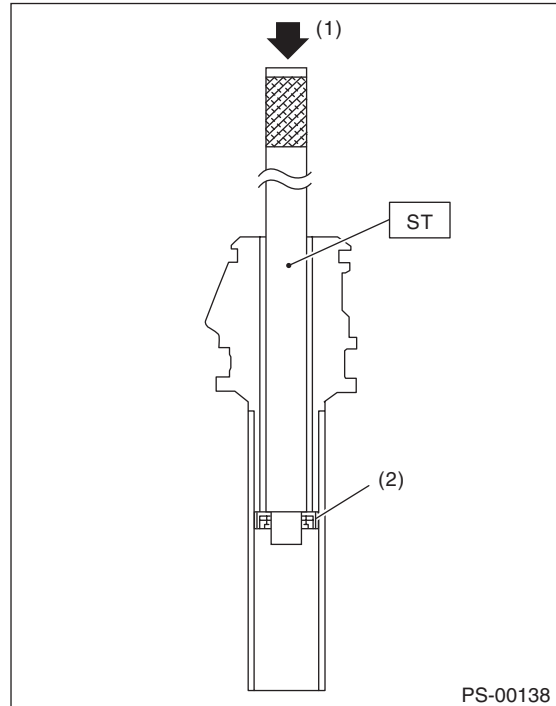
Block the pipe connection of steering body to prevent fluid from flowing out.



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

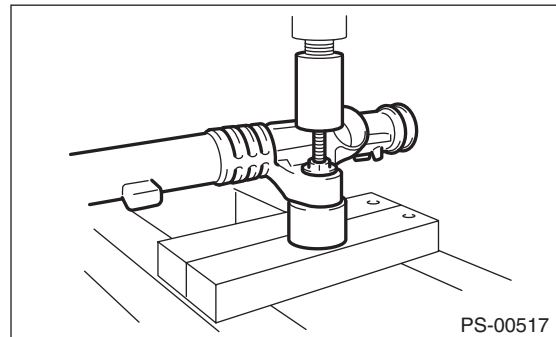
15) Insert the ST from pinion housing side and remove the oil seal using a press.

ST 34199XA060 OIL SEAL REMOVER



- (1) Press
- (2) Oil seal

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



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

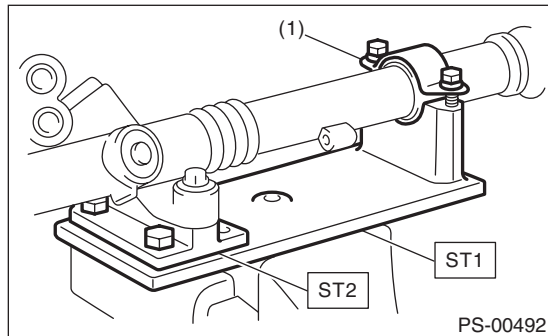
2. CONTROL VALVE

- 1) Disconnect the pipes A and B from gearbox.
- 2) Secure the gearbox removed from vehicle in a vise using ST.

ST1 926200000 STAND
ST2 34199AG000 BOSS D

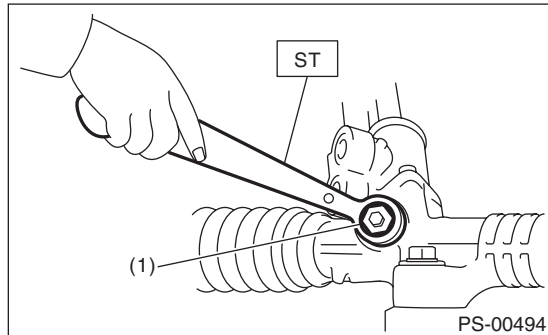
CAUTION:

Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.



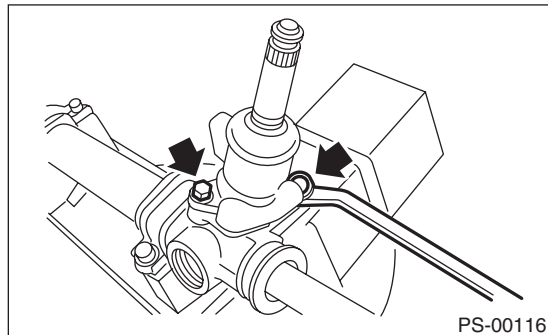
(1) Clamp

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

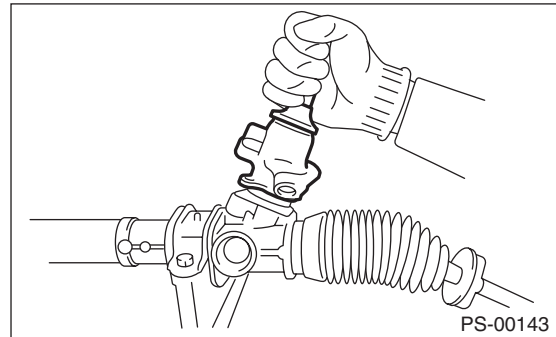


(1) Lock nut

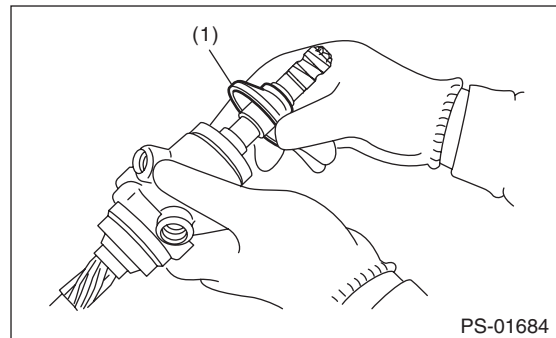
- 4) Loosen the adjusting screw, and remove the spring and sleeve.
- 5) Remove the two bolts securing valve assembly.



- 6) Carefully draw out the input shaft and remove the valve assembly.

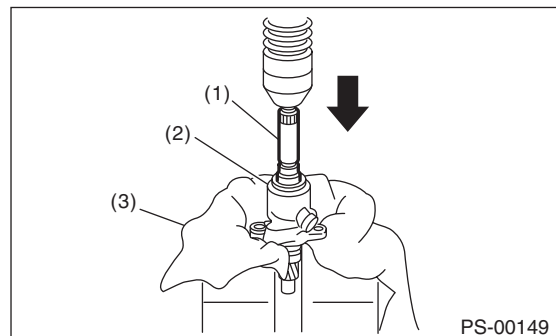


- 7) Put a vinyl tape around the spline portion, and slide the dust cover to remove.



(1) Dust cover

- 8) Using a press, remove the pinion & valve assembly from valve housing.



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

Steering Gearbox

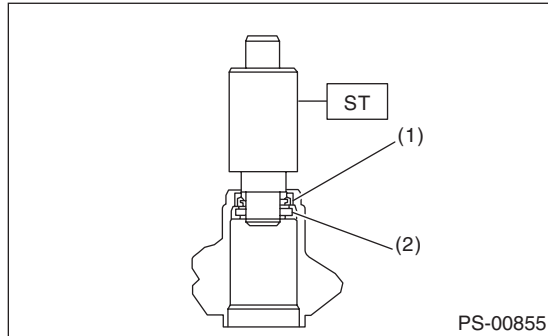
POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 34199AG090 INSTALLER & REMOVER

CAUTION:

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

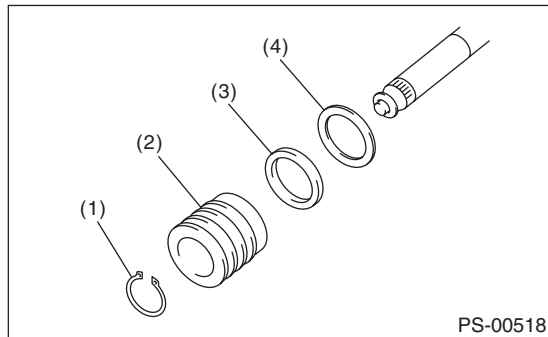


- (1) Oil seal
- (2) Bushing

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

CAUTION:

Be careful not to scratch the pinion and valve assembly.

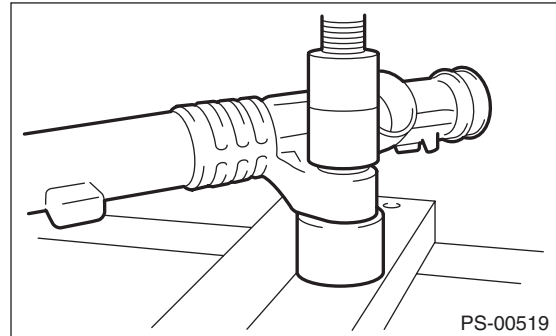


- (1) Snap ring
- (2) Valve
- (3) Oil seal
- (4) Wave washer

D: ASSEMBLY

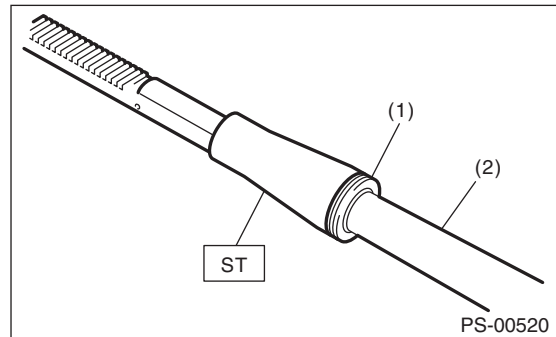
1. RACK HOUSING ASSEMBLY

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



2) Insert the ST to rack.

ST 34199XA010 GUIDE 44



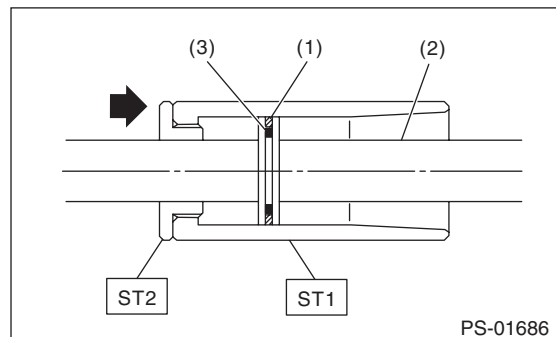
- (1) Piston
- (2) Rack

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

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

ST1 34199XA020 FORMER PISTON 44

ST2 34199AG060 GUIDE G (26)



- (1) Piston seal ring
- (2) Rack
- (3) O-ring

Steering Gearbox

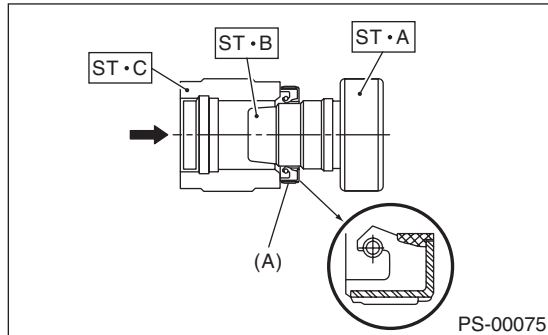
POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 34199FE040 INSTALLER A, B, C

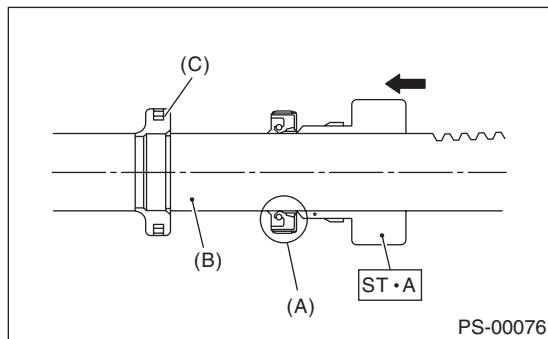
NOTE:

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



(A) Oil seal

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

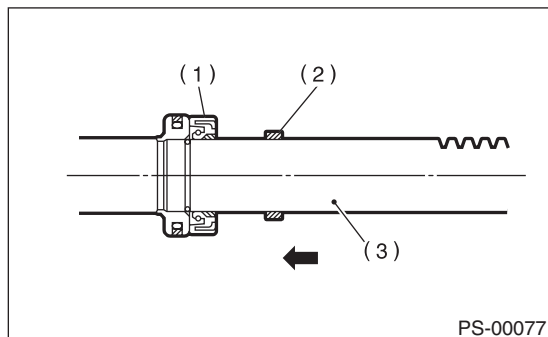


(A) Oil seal

(B) Rack

(C) Piston

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



(1) Oil seal

(2) Back-up ring

(3) Rack

8) Check the threaded end of holder and gearbox cylinder end for burrs, damage, etc. Correct if faulty.

9) Apply a coat of grease to the grooves in rack, sliding surface of sleeve and sealing surface of piston. Then insert the rack into steering body from cylinder side.

10) Attach the ST on gearbox cylinder.

ST 34199XA000 INSTALLER 44

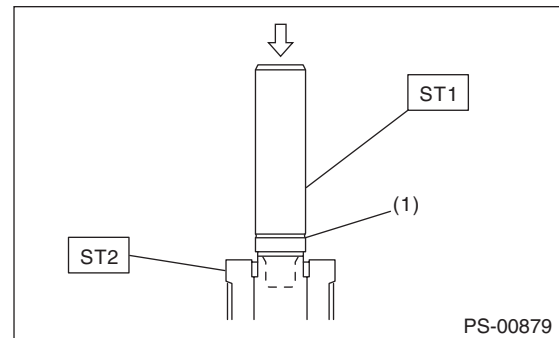
11) Set the ST to the end of rack.

ST 34199XA030 INSTALLER & REMOVER 44

12) Using a press, press-fit until the groove of ST1 is aligned to the end surface of ST2.

ST1 34199XA030 INSTALLER & REMOVER 44

ST2 34199XA000 INSTALLER 44



(1) Groove

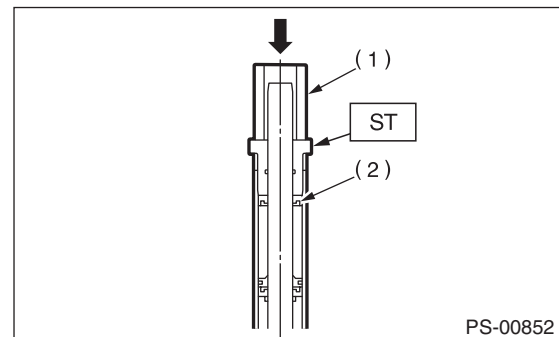
13) Remove the ST.

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

ST 34199FE040 INSTALLER A, B, C

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

ST 34199XA000 INSTALLER 44



(1) Pipe

(2) Outer side oil seal

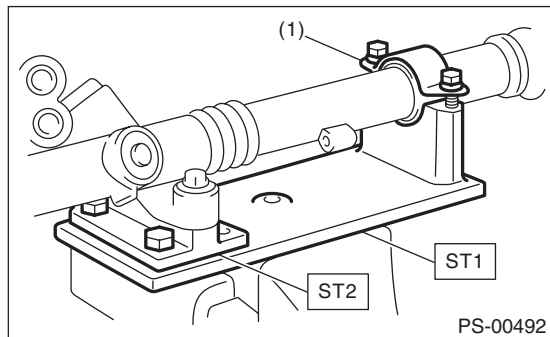
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

16) Secure the gearbox in a vise using ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D



(1) Clamp

17) Tighten the holder.

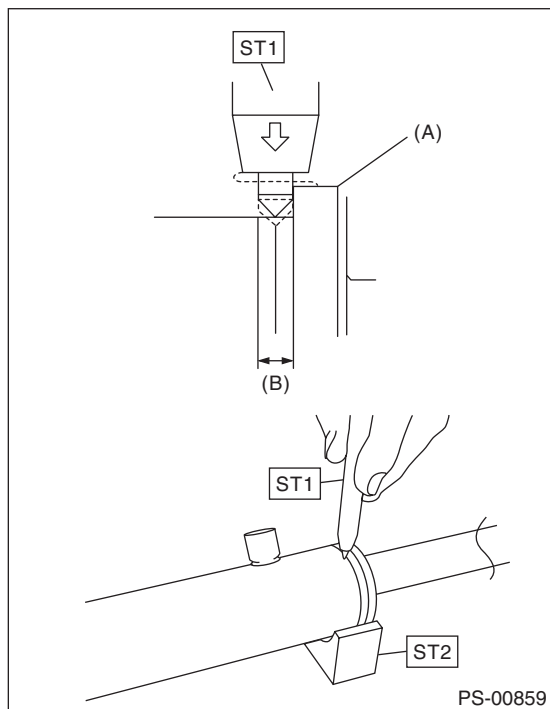
Tightening torque:

79 N·m (8.1 kgf-m, 58.3 ft-lb)

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

ST1 34099FA060 PUNCH HOLDER

ST2 34199XA050 BASE



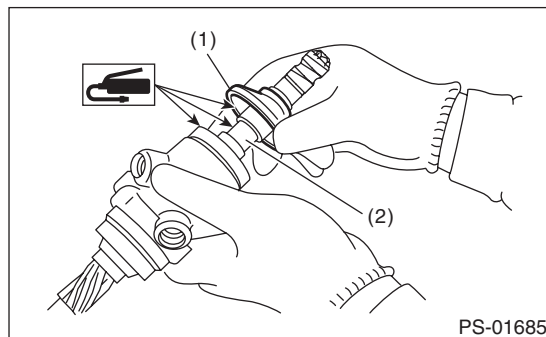
(A) Holder

(B) 2 mm (0.08 in)

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

CAUTION:

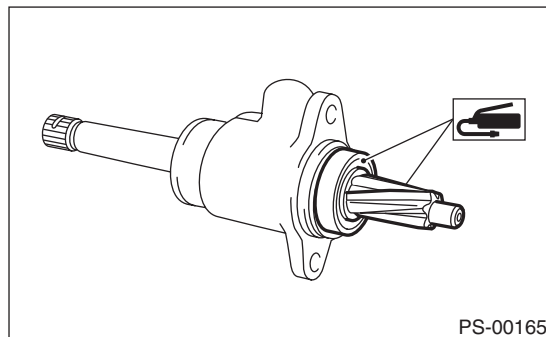
Be sure to install the dust cover to groove of shaft.



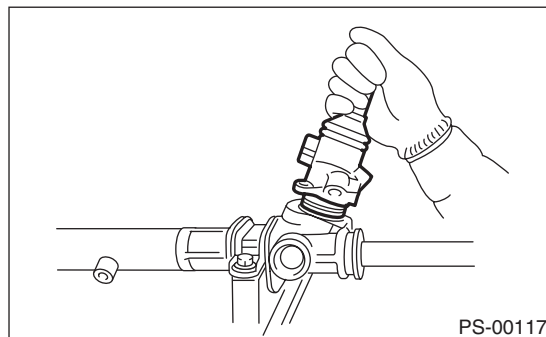
(1) Dust cover

(2) Groove

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



21) Apply grease to the entire perimeter of a new O-ring and attach it to the valve assembly. Insert the valve assembly into place while facing the rack teeth toward pinion.



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

22) Tighten the bolts alternately to secure the valve assembly.

Tightening torque:

20 N·m (2.0 kgf-m, 14.8 ft-lb)

CAUTION:

Be sure to alternately tighten the bolts.

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

CAUTION:

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

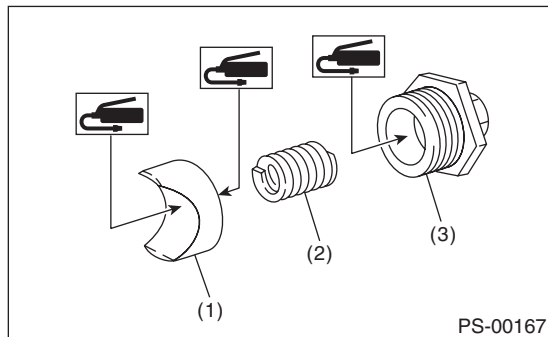
24) Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

Liquid gasket:

THREE BOND 1102 or 1215

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

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



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

26) Tighten the adjusting screw to the specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)

27) Tighten the adjusting screw to the specified torque, then loosen it 20°.

Tightening torque:

5.9 N·m (0.6 kgf-m, 4.4 ft-lb)

CAUTION:

Adjust the adjusting screw with the rack set in a straight-ahead position.

28) Remove the tie-rod.

29) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-35, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>

30) Attach the lock nut into adjusting screw, and while holding the adjusting screw with wrench, tighten the lock nut using ST.

ST 926230000 SPANNER

Tightening torque (lock nut):

25 N·m (2.5 kgf-m, 18.4 ft-lb)

NOTE:

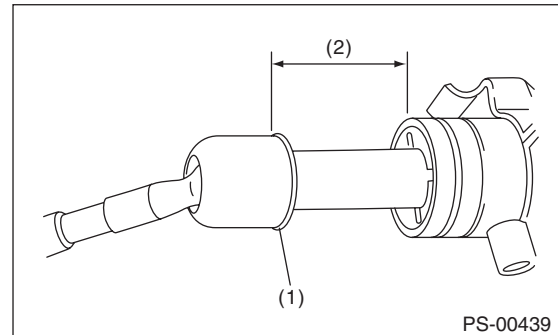
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

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

32) Install the tie-rod and new lock washer into rack.

Tightening torque:

128 N·m (13.1 kgf-m, 94.4 ft-lb)



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

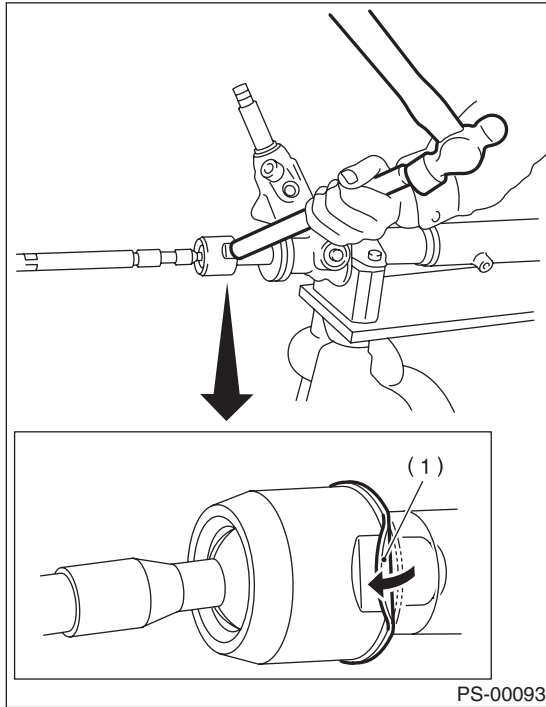
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

33) Bend the lock washer and crimp it.

CAUTION:

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

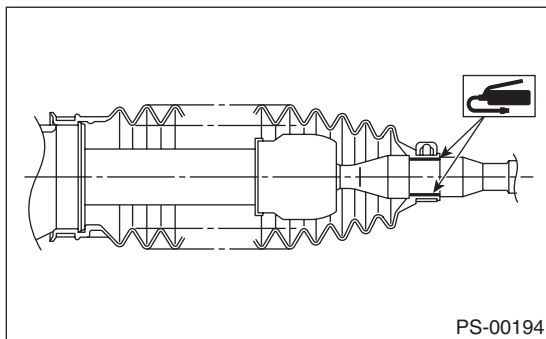


(1) Lock washer

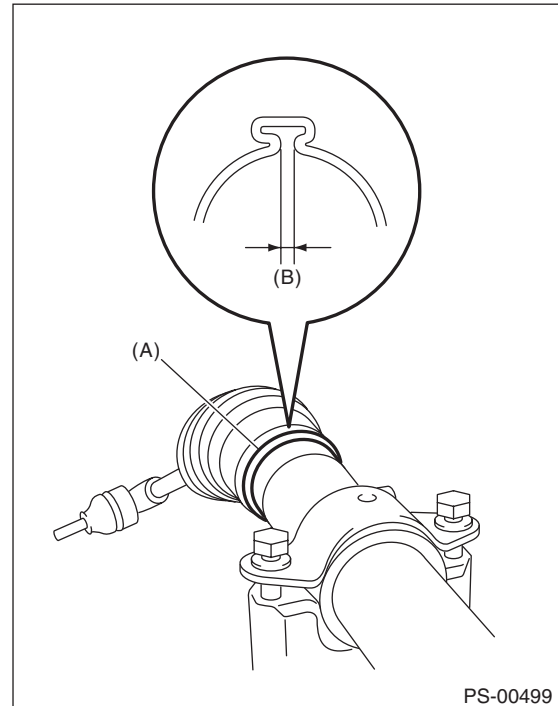
34) Apply a coat of grease to the tie-rod groove, and then install the boot to the housing.

NOTE:

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



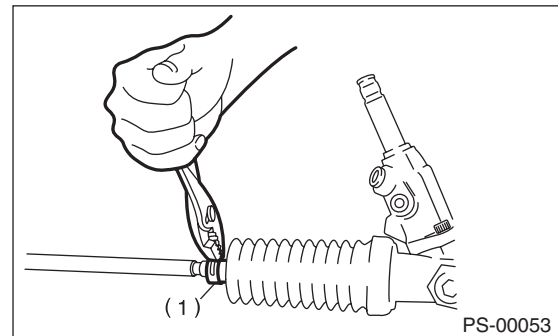
35) Install a new boot band. Using band clamp pliers, crimp it so that the clearance of crimping portion becomes 2 mm (0.079 in) or less.



(A) Boot band

(B) 2 mm (0.079 in) or less

36) Fix the boot end with small clip.



(1) Clip

Steering Gearbox

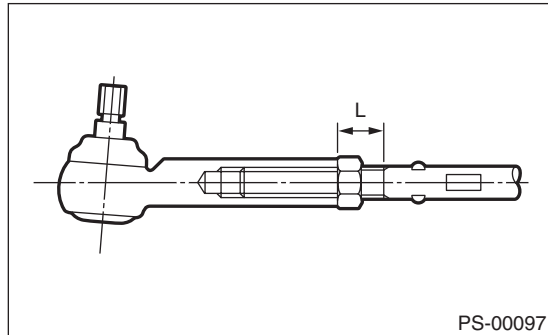
POWER ASSISTED SYSTEM (POWER STEERING)

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

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

Installed tie-rod length L:

28 mm (1.1 in)

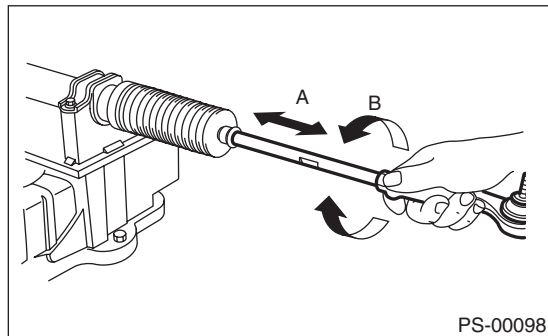


39) Inspect the gearbox as follows:

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

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

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



40) Remove the gearbox from ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

41) Install the four pipes on gearbox.

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

Tightening torque:

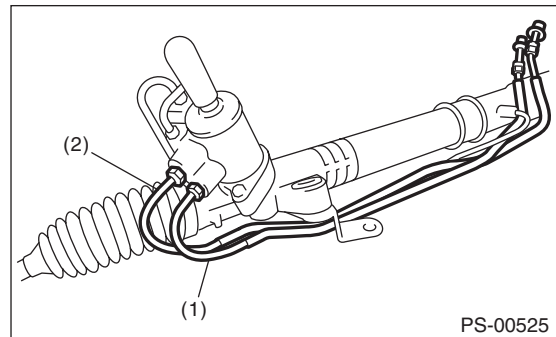
Refer to the component parts. <Ref. to PS-4, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

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

Tightening torque:

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

Return pipe: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(1) Feed pipe

(2) Return pipe

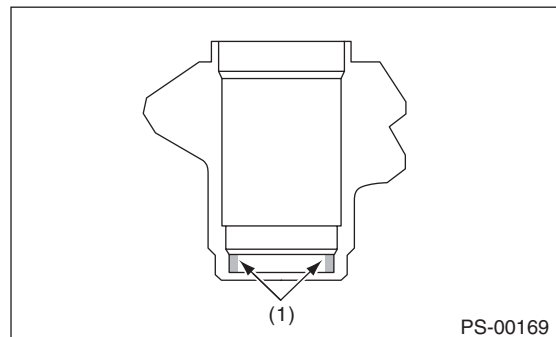
2. CONTROL VALVE ASSEMBLY

Specified steering grease:

VALIANT GREASE M2 (Part No. 003608001)

1) Clean all parts and tools before reassembling.

2) Apply a coat of specified power steering fluid to the inner wall of valve housing.



(1) Apply fluid.

3) Apply grease to the oil seal.

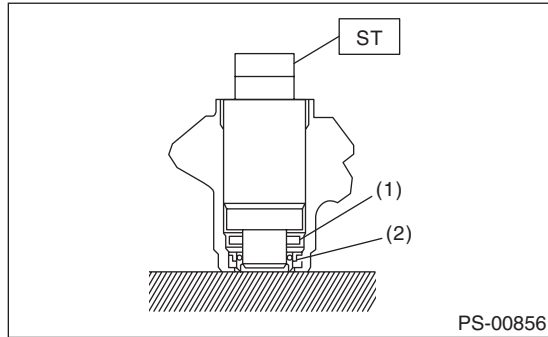
4) Verify the direction of oil seal.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5) Using the ST and a press, install the oil seal and the bushing in valve housing.

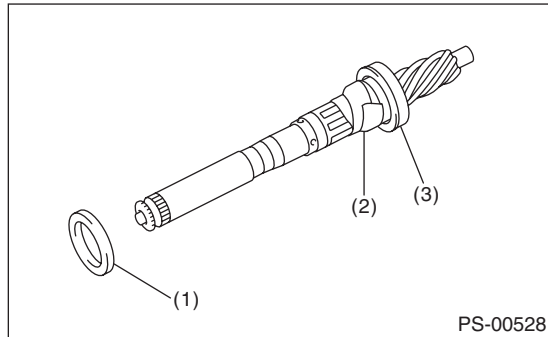
ST 34199AG090 INSTALLER & REMOVER



- (1) Bushing
- (2) Oil seal

6) Apply vinyl tape to the groove of pinion.

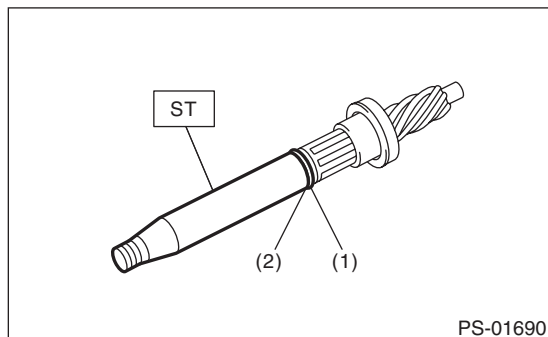
7) Install the wave washer and oil seal to pinion, and then remove the vinyl tape.



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

8) Attach the ST to pinion, and install the O-ring and seal ring.

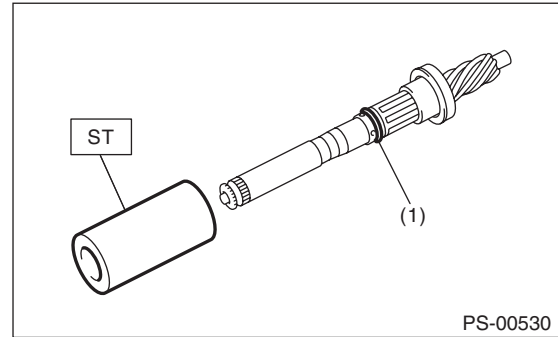
ST 34199AG020 GUIDE



- (1) Seal ring
- (2) O-ring

9) Remove the ST GUIDE, and form the seal ring properly using ST FORMER.

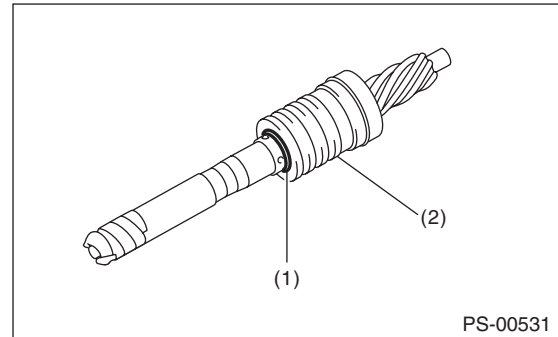
ST 34199AG070 FORMER



- (1) Seal ring

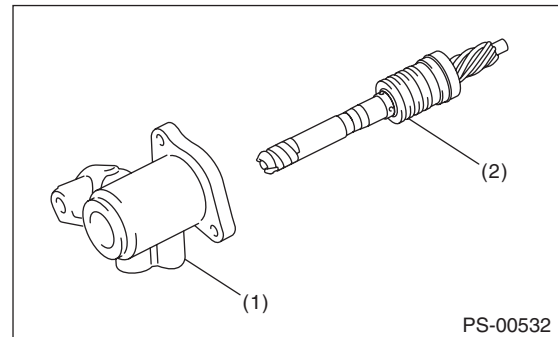
10) Put vinyl tape around pinion shaft spline to protect oil seal from damage.

11) Install the valve to pinion, and install the snap ring.



- (1) Snap ring
- (2) Valve

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



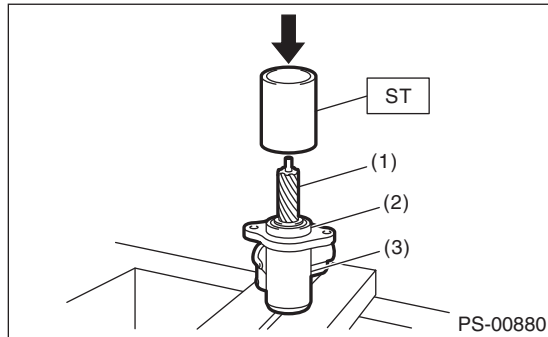
- (1) Valve housing
- (2) Pinion & valve ASSY

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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

ST 34199XA020 FORMER PISTON 44



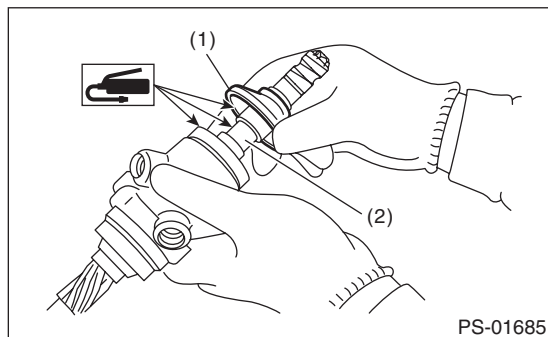
- (1) Pinion & valve ASSY
- (2) Bearing
- (3) Housing

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

15) Install the dust cover on valve assembly.

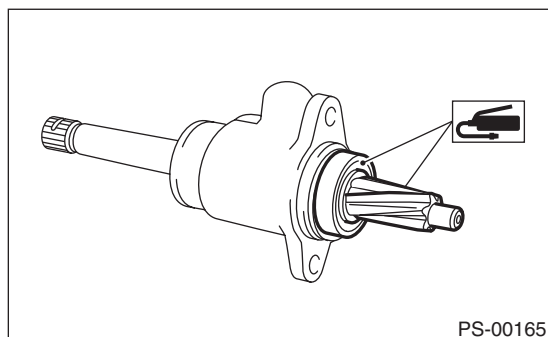
CAUTION:

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

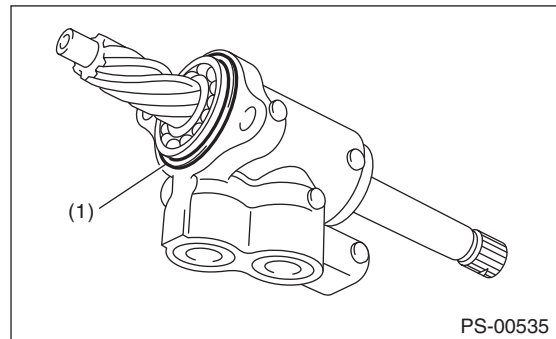


- (1) Dust cover
- (2) Groove

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

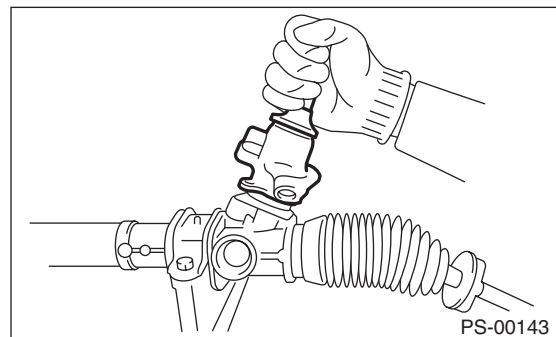


17) Apply grease to the entire perimeter of a new O-ring and attach it to the valve assembly.



- (1) O-ring

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



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

Tightening torque:

20 N·m (2.0 kgf-m, 14.8 ft-lb)

CAUTION:

Be sure to alternately tighten the bolts.

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

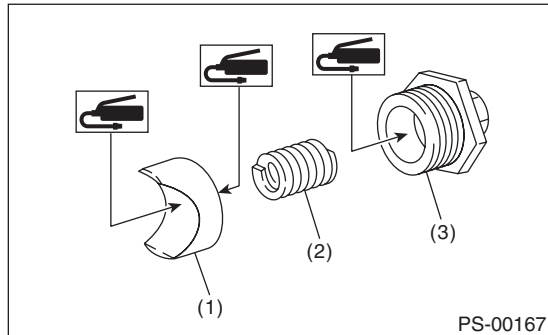
Liquid gasket:

THREE BOND 1102 or 1215

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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



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

22) Tighten the adjusting screw to the specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)

23) Tighten the adjusting screw to the specified torque, then loosen it 20°.

Tightening torque:

5.9 N·m (0.6 kgf-m, 4.4 ft-lb)

24) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw.
<Ref. to PS-35, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>

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

ST 926230000 SPANNER

Tightening torque (lock nut):

25 N·m (2.5 kgf-m, 18.4 ft-lb)

NOTE:

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

26) Remove the gearbox from ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

27) Install the four pipes on gearbox.

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

Tightening torque:

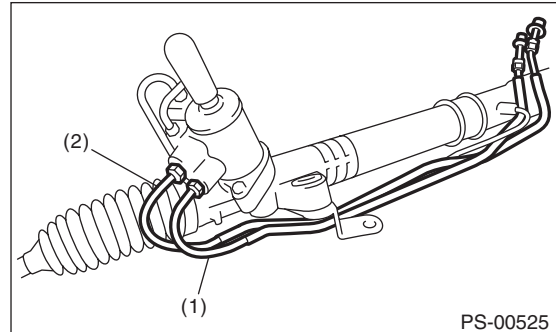
Refer to the component parts. <Ref. to PS-4, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

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

Tightening torque:

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

Return pipe: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



- (1) Feed pipe
- (2) Return pipe

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

E: INSPECTION

1. BASIC INSPECTION

1) Clean all the disassembled parts, and check for wear, damage or any other faults, then repair or replace as necessary.

2) When disassembling, check the inside of gearbox for water. If any water is found, carefully check the boot for damage, input shaft dust seal, adjusting screw and boot clips for poor sealing. If faulty, replace with new parts.

No.	Parts	Inspection	Corrective action
1	Input shaft	(1) Bent input shaft (2) Damage on serration	If the bend or damage is excessive, replace the entire gearbox.
2	Dust seal	(1) Crack or damage (2) Wear	If the outer wall slips, the lip is worn out or damage is found, replace it with a new part.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust the backlash properly. By measuring the turning torque of the gearbox and sliding resistance of rack, check if the rack & pinion engage uniformly and smoothly with each other. (Refer to "Service limit".) (2) Pull out the entire rack to allow viewing of the teeth, and check for damage. Even if abnormality is found in either (1) or (2), replace the entire gearbox.
4	Gearbox unit	(1) Bending of the rack shaft (2) Bending of the cylinder portion (3) Crack or damage on the aluminum portion	Replace the gearbox with a new part.
		(4) Wear or damage on rack bushing	If the free play of rack shaft in radial direction is out of the specified range, replace the gearbox with new part. (Refer to "Service limit".)
		(5) Wear on input shaft bearing	If the free play of input shaft in radial and axial direction is out of the specified range, replace the gearbox with a new part. (Refer to "Service limit".)
5	Boot	Crack, damage or deterioration	Replace.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration of dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipe	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

2. LIMIT

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

NOTE:

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

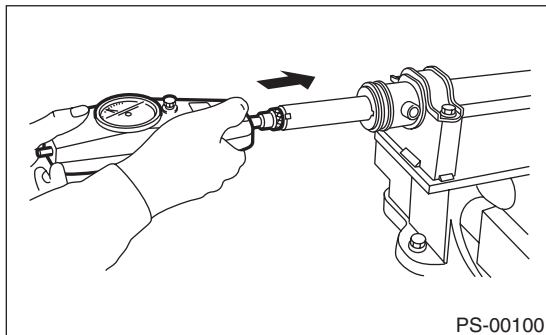
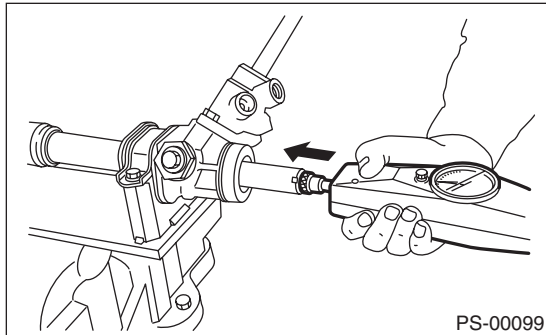
ST1 926200000 STAND

ST2 34199AG000 BOSS D

Rack shaft sliding resistance:

Limit

343 N (35 kgf, 77 lb) or less



3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

Right-turn steering:

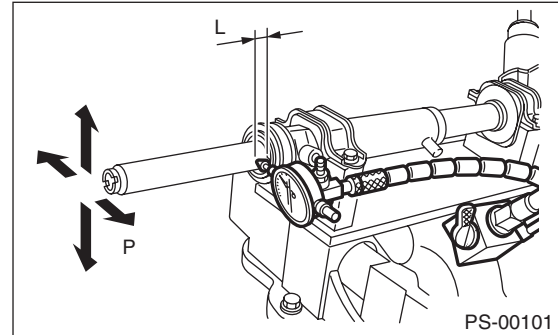
Limit

0.4 mm (0.016 in) or less

Condition

L: 5 mm (0.20 in)

P: 98 N (10 kgf, 22 lb)



Left-turn steering:

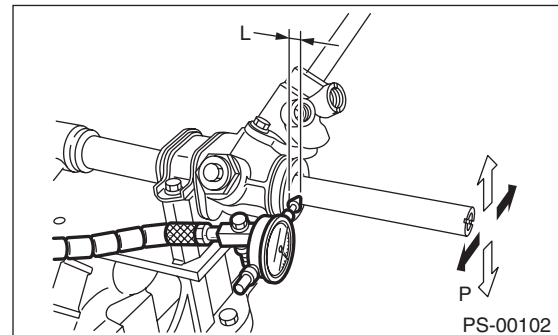
Limit

Direction ⇐ ⇨

0.6 mm (0.024 in) or less

Direction ⇐ ⇨

0.4 mm (0.016 in) or less



4. INPUT SHAFT PLAY

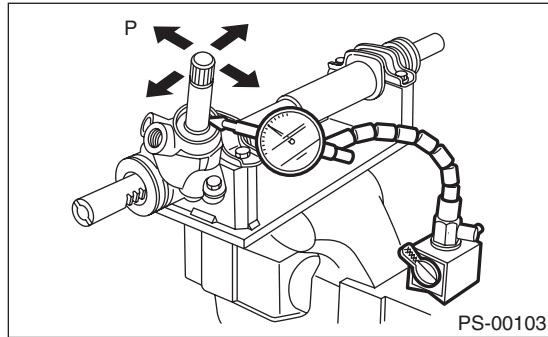
In radial direction:

Limit

0.26 mm (0.0102 in) or less

Condition

P: 98 N (10 kgf, 22 lb)



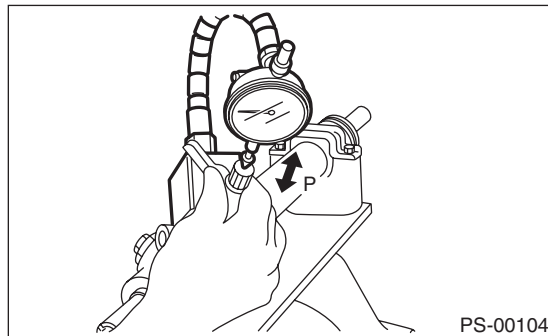
In axial direction:

Service limit

Without play

Condition

P: 20 — 49 N (2 — 5 kgf, 4 — 11 lb)



5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the gearbox turning resistance.

ST 34099PA100 SPANNER

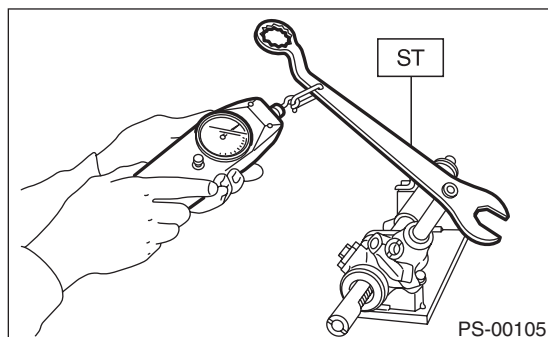
Service limit:

Maximum allowable resistance:

13 N (1.3 kgf, 2.9 lb) or less

Difference between right and left turning resistance:

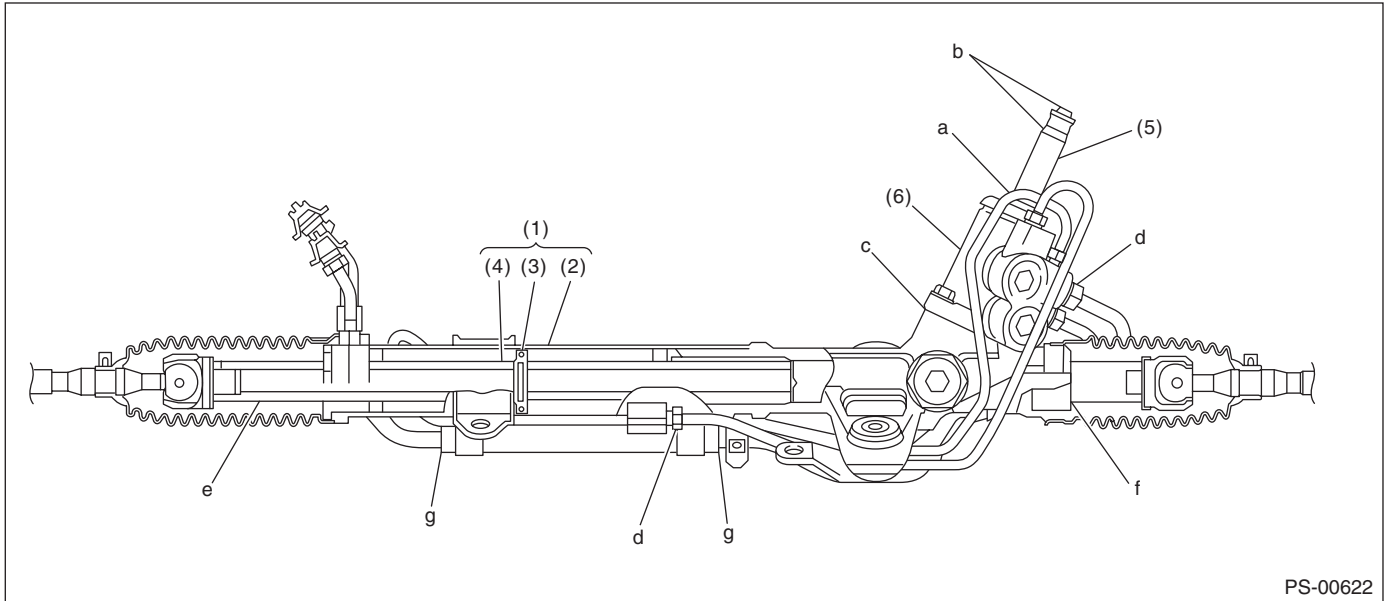
20% or less



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

6. OIL LEAKAGE



PS-00622

(1) Power cylinder

(2) Cylinder

(3) Rack piston

(4) Rack axle

(5) Input shaft

(6) Valve housing

1) Lift up the vehicle.

2) If a fluid leak is found, clean the fluid completely from the suspect area, and turn the steering wheel 30 to 40 times to the left and right from lock to lock, with the engine running, and check again for leaks immediately, and also after a few hours have passed.

3) Cause and solution for oil leakage from "a"

The oil seal is damaged. Replace the valve assembly or oil seal with a new part.

4) Cause and solution for oil leakage from "b"

The torsion bar O-ring is damaged. Replace the valve assembly with a new part.

5) Cause and solution for oil leakage from "c"

The oil seal is damaged. Replace the valve assembly or oil seal with a new part.

6) Cause and solution for oil leakage from "d"

The pipe is damaged. Replace the faulty pipe or O-ring.

7) Cause and solution for oil leakage from "g".

The hose is damaged. Replace the hose with a new part.

8) If leak is other than a, b, c, d or g, or if oil is leaking from gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove fluid from surrounding portions. Then, turn the steering wheel from lock to lock about 30 to 40 times with the engine running, then re-inspect the leaking area immediately after and several hours after this operation.

(1) Leakage from "e"

The cylinder seal is damaged. Replace the rack bushing with a new part.

(2) Leakage from "f"

There are two possible causes. Perform the following step first. Remove the pipe assembly B from the valve housing, and close the circuit using ST.

ST 926420000 PLUG

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

- If leakage from "f" is noted again:

The oil seal of pinion and valve assembly is damaged. Replace the pinion & valve assembly with a new part. Or replace the oil seal and the parts that are damaged during disassembly with new parts.

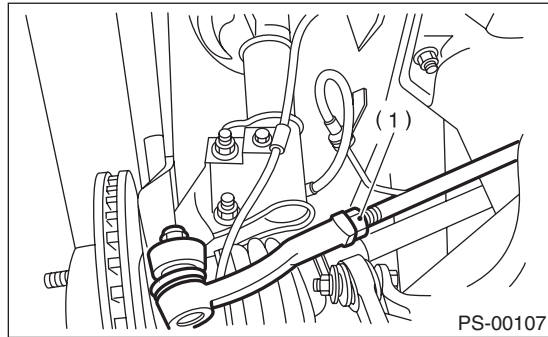
- If oil stops leaking from "f":

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

F: ADJUSTMENT

1) Adjust the front toe.

<Ref. to FS-10, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>



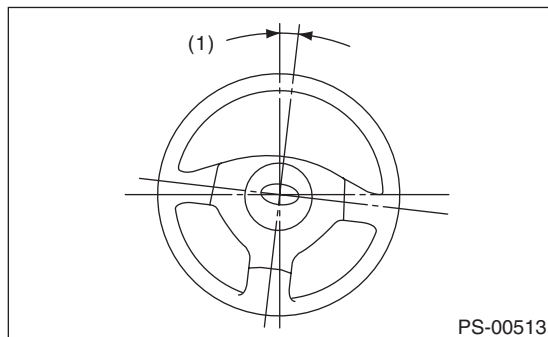
(1) Lock nut

2) Check the steering angle of the wheels.

Standard of steering angle:

Inner wheel	$37.0^{\circ} \pm 1.5^{\circ}$
Outer wheel	$32.0^{\circ} \pm 1.5^{\circ}$

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



(1) 5° or less

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

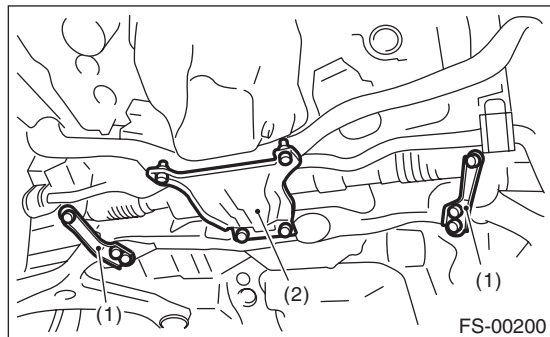
Pipe Assembly

POWER ASSISTED SYSTEM (POWER STEERING)

6. Pipe Assembly

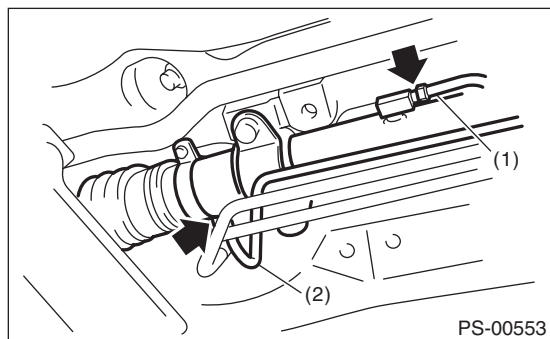
A: REMOVAL

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



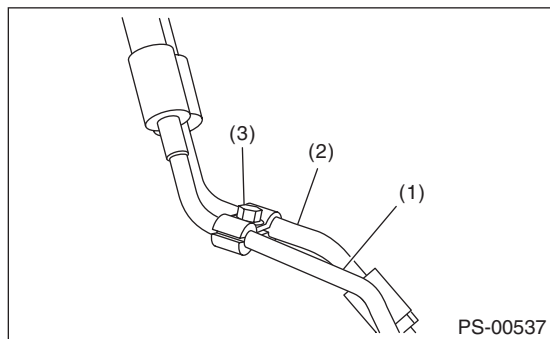
- (1) Front crossmember support plate
- (2) Jack-up plate

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



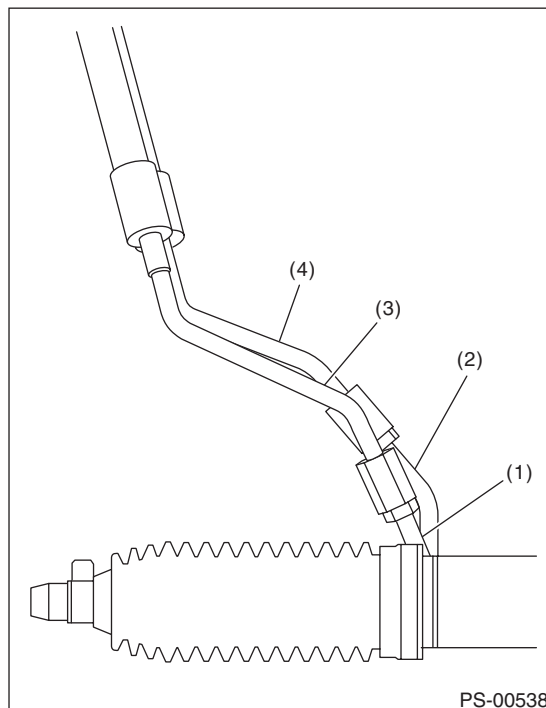
- (1) Pipe A
- (2) Pipe B

- 4) Remove the clamp E from return hose and pressure hose.



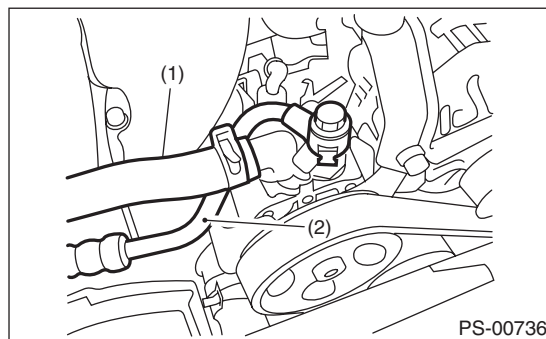
- (1) Return hose
- (2) Pressure hose
- (3) Clamp E

- 5) Disconnect the return hose from return pipe and disconnect the pressure hose from feed pipe.



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

- 6) Remove the air intake duct. <Ref. to IN(H6DO)-9, REMOVAL, Air Intake Duct.>
- 7) Disconnect the suction hose and pressure hose from oil pump.

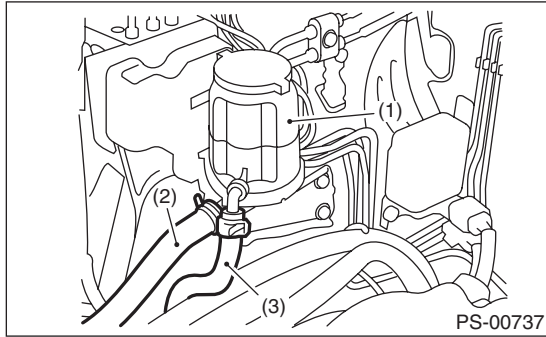


- (1) Suction hose
- (2) Pressure hose

Pipe Assembly

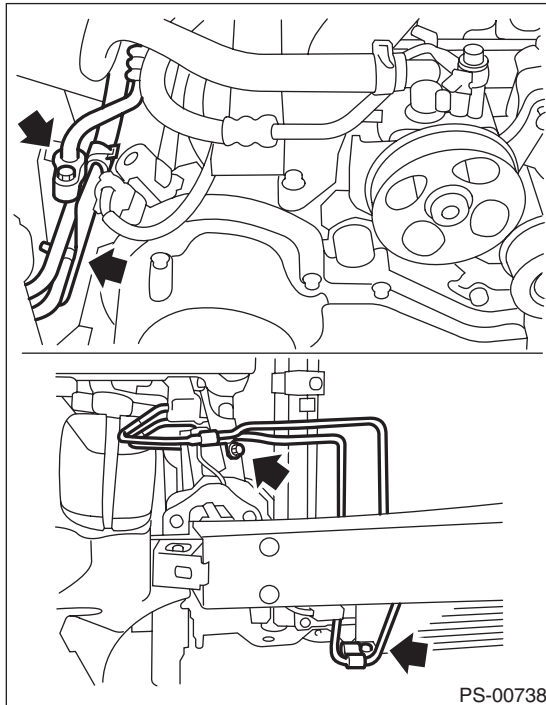
POWER ASSISTED SYSTEM (POWER STEERING)

8) Disconnect the suction hose and return hose from the reservoir tank.

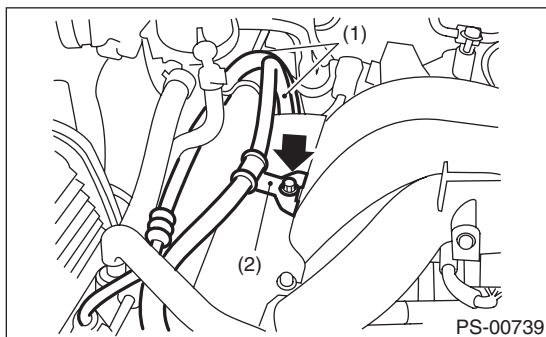


- (1) Reservoir tank
- (2) Suction hose
- (3) Return hose

9) Remove the oil cooler pipe.



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



- (1) Hose ASSY
- (2) Hose bracket

B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:

<Ref. to PS-4, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

2) Fill with the specified fluid.

CAUTION:

Never start the engine before filling with fluid; otherwise the vane pump may become seized.

3) Finally, check the clearance between pipes or hoses as shown in the figure indicated in "General Diagnostic Table". <Ref. to PS-55, INSPECTION OF CLEARANCE, INSPECTION, General Diagnostic Table.>

Pipe Assembly

POWER ASSISTED SYSTEM (POWER STEERING)

C: INSPECTION

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

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

CAUTION:

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

Continuous discharge of the relief valve for 5 seconds or more will reduce the service lives of hoses, oil pump, fluid, etc., due to over heating.

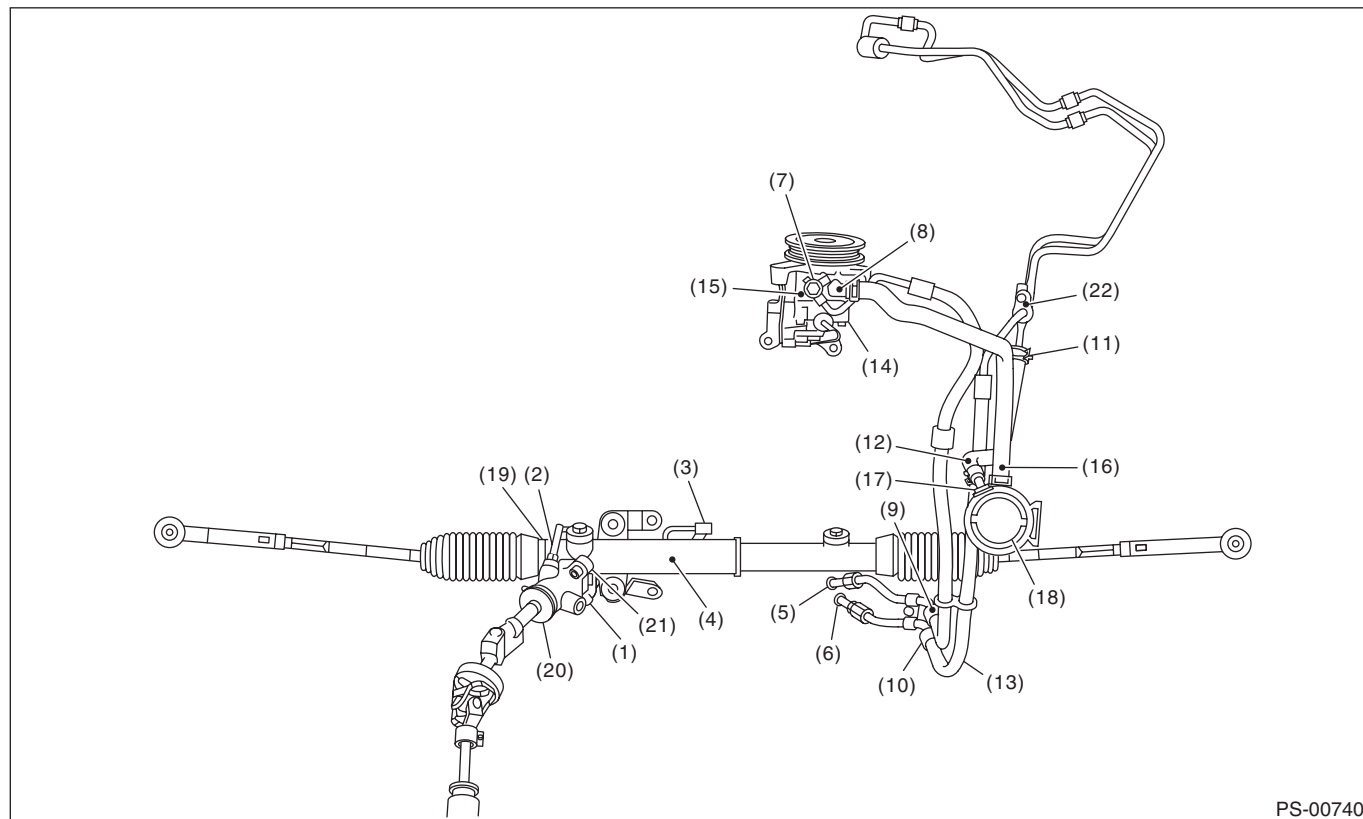
Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct customers.
	Malfunction of the relief valve	Replace the oil pump.
	Poor cold characteristic of fluid	Replace fluid.
Disconnection of the return hose	Improper connection	Repair.
	Loosening of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

Pipe Assembly

POWER ASSISTED SYSTEM (POWER STEERING)

NOTE:

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



PS-00740

Fluid leaking area	Possible cause	Corrective action
Leakage from the connections of pipes and hoses, numbered (1) through (8) in the figure	Insufficient tightening of flare nut, adhesion of dirt, damage to flare or flare nut or eyebolt	Loosen and retighten. Replace if ineffective.
	Improper installation of hose or clamp	Replace.
	Damaged O-ring or gasket	Replace the O-ring, gasket pipe or hose with new part, if still no improvement, replace the gearbox or oil pump as well.
Leakage from hose (9) through (13) in the figure	Crack or damage in hose	Replace with a new part.
	Crack or damage in hose hardware	Replace with a new part.
Leakage from surrounding of aluminum portion of oil pump, (14) and (15) in the figure	Damaged O-ring	Replace the oil pump.
	Damaged gasket	Replace the oil pump.
Leakage from oil tank, (16) and (17) in the figure	Crack in oil tank	Replace the oil tank.
Leakage from filler neck of (18)	Damaged cap packing	Replace the cap.
	Crack in root of filler neck	Replace the oil tank.
	Fluid level too high	Adjust the fluid level.
Leakage from power cylinder of gearbox area (19) in the figure	Damaged oil seal	Replace the oil seal.
Leakage from (20), (21) in the figure and control valve of gearbox	Damaged packing or oil seal	Replace the faulty parts.
	Damage in control valve	Replace the control valve.
(22) Leakage from the joints between cooler pipe and hose.	Insufficient tightening of connecting portion.	Loosen and retighten.

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

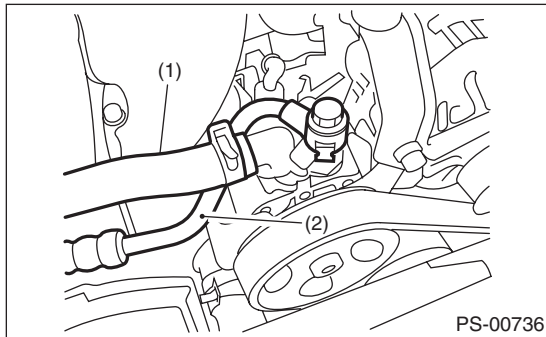
7. Oil Pump

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the air intake duct. <Ref. to IN(H6DO)-9, REMOVAL, Air Intake Duct.>
- 3) Remove the pulley belt cover.
- 4) Remove the V-belts.
- 5) Disconnect the connector from power steering pump switch.
- 6) Disconnect the pressure hose and suction hose from power steering pump.

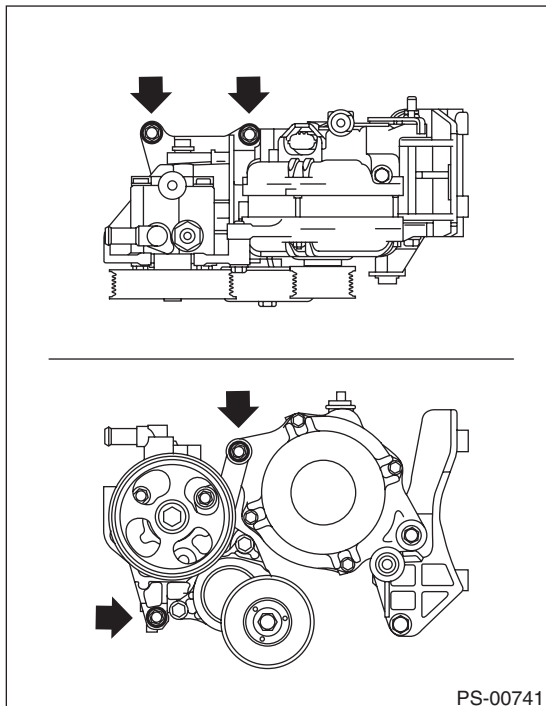
CAUTION:

- Do not spill power steering fluid.
- To prevent foreign matter from entering the hose and pipe, cover the open ends with clean cloth.



- (1) Suction hose
(2) Pressure hose

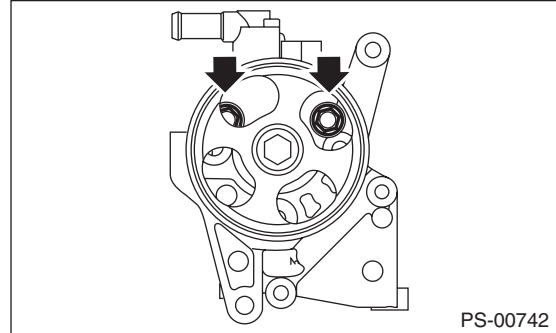
- 7) Remove the installation bolt of the power steering pump bracket.



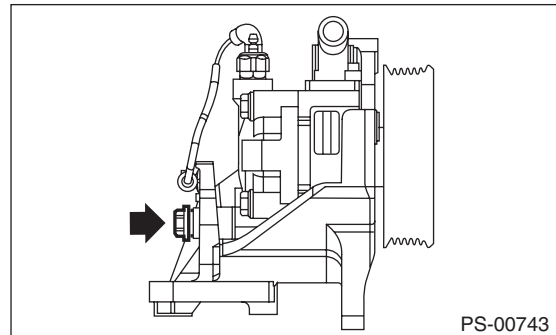
- 8) Place the oil pump bracket in a vise, and remove the two bolts from the front side of the oil pump.

CAUTION:

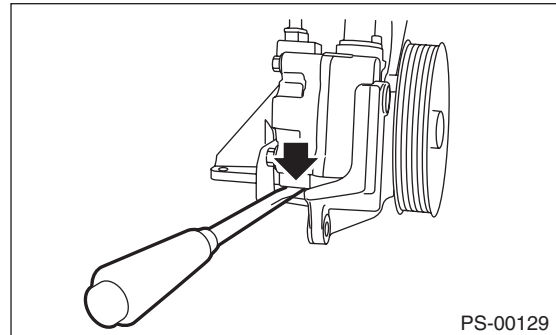
When securing the oil pump bracket in a vise, hold the oil pump bracket with the least possible force between two pieces of wood.



- 9) Remove the bolt from the rear side of oil pump.



- 10) Disassemble the oil pump and bracket by inserting a flat tip screwdriver as shown in the figure.



Oil Pump

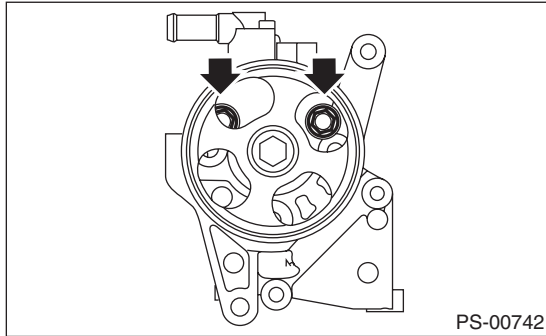
POWER ASSISTED SYSTEM (POWER STEERING)

B: INSTALLATION

1) Install the oil pump to bracket.

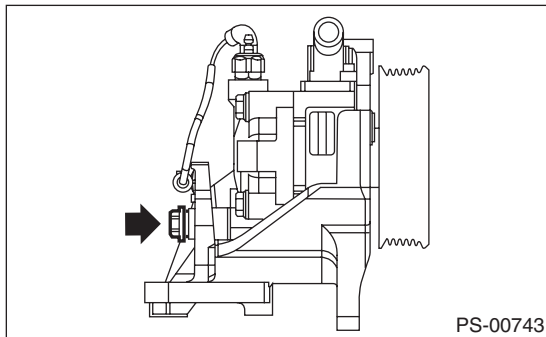
Tightening torque:

15.7 N·m (1.6 kgf-m, 11.6 ft-lb)



Tightening torque:

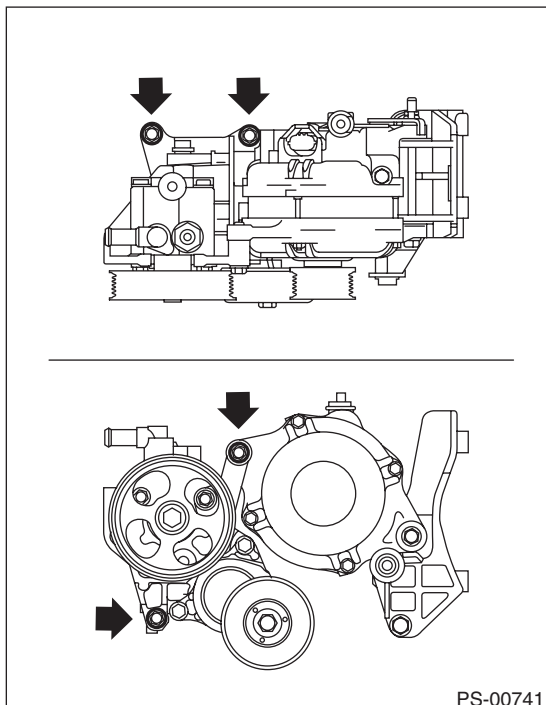
36.8 N·m (3.8 kgf-m, 27.1 ft-lb)



2) Install the power steering pump bracket.

Tightening torque:

<Ref. to PS-6, OIL PUMP, COMPONENT, General Description.>



3) Connect the pressure hose and suction hose.

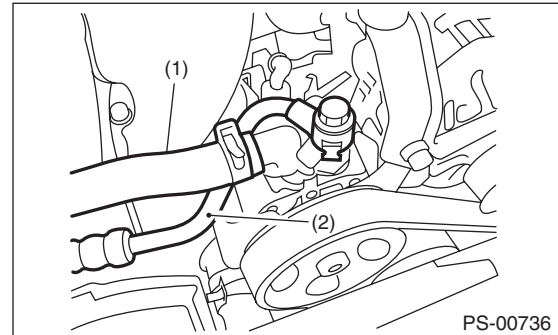
Tightening torque:

Eyebolt

40 N·m (4.1 kgf-m, 29.5 ft-lb)

CAUTION:

Be careful when installing; If the hose is twisted it may come into contact with other parts.



(1) Suction hose

(2) Pressure hose

4) Connect the connector to the power steering oil pressure switch.

5) After installing the oil pump, fill the oil pump with as much fluid as possible by rotating the pulley by hand.

6) Install the tensioner adjuster.

7) Install the V-belts.

8) Install the cover of the pulley belt.

9) Connect the ground cable to battery.

10) Pour the specified power steering fluid. <Ref. to PS-50, Power Steering Fluid.>

CAUTION:

Never start the engine before filling with fluid; otherwise the vane pump may become seized.

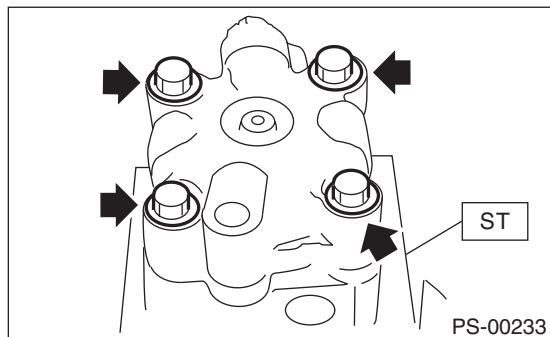
Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

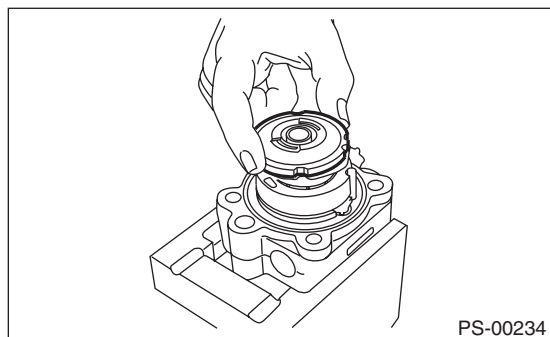
C: DISASSEMBLY

1) Using the ST, place the oil pump in the vise, and remove the 4 bolts holding the rear body.

ST 34199AE020 ATTACHMENT



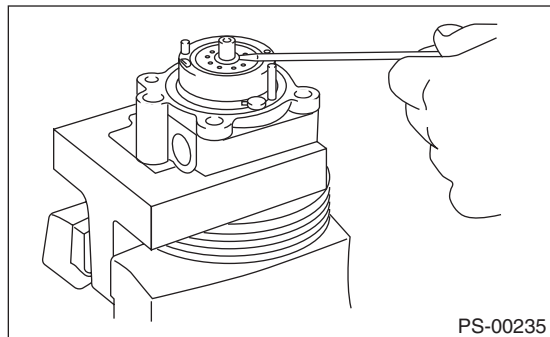
2) Remove the side plate rear.



3) Use a screwdriver to pry the snap ring.

CAUTION:

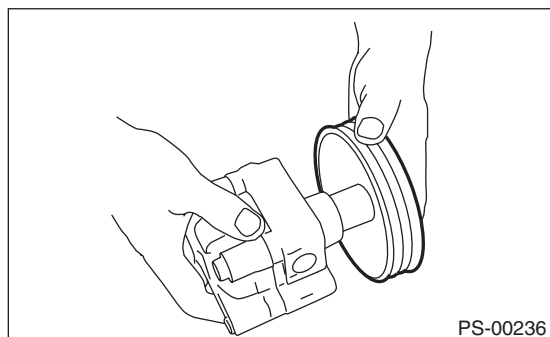
Do not remove the cam rings and rotors.



4) Attach the side plate rear.

5) Temporarily tighten the rear body to the front casing.

6) Remove the oil pump pulley.



7) Place the oil pump in the vice.

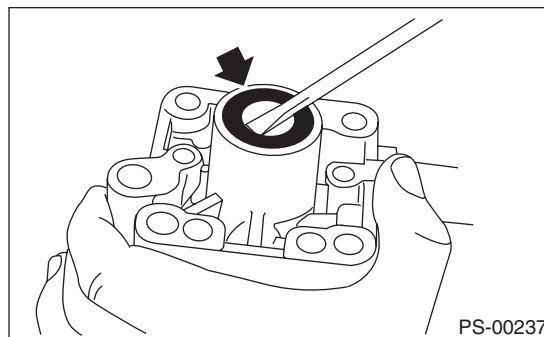
CAUTION:

Do not place the oil pump in the vise directly. Support the oil pump lightly using soft pads to protect it.

8) Use a screwdriver to pry the oil seal out.

CAUTION:

Be careful not to scratch the inner surface of the casing.



D: ASSEMBLY

1) Caution during reassembly

(1) When removing O-rings, oil seals and snap rings, always replace with new parts.

(2) Thoroughly wash the parts and allow to dry. Make sure the parts do not come into contact with cleaning oil or dust.

(3) The reassembly must be performed in a clean place. Make sure lint or other foreign objects do not stick to parts.

(4) Cleaning oil tends to remain inside the front casing. Use compressed air to completely clean out any remaining cleaning oil.

(5) Make sure the parts are not rusted. Once the parts are washed and dried, use a specified hydraulic oil to prevent rust.

(6) Reassemble in the reverse order of removal.

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

2) At the bearing positions, apply grease to the oil seal and front casing inner surfaces.

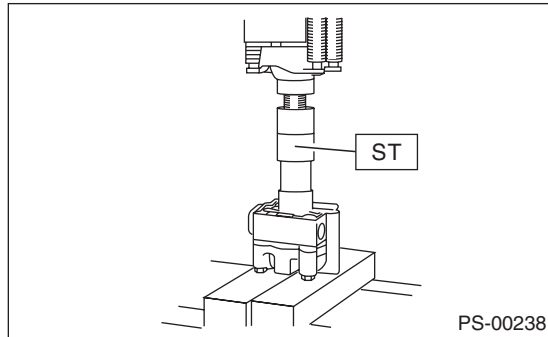
CAUTION:

Make sure the inner surface of the front casing is not damaged.

3) Temporarily tighten the rear body to the front casing.

4) Attach ST to the front casing. Using the press, install the oil seal.

ST 34199AE030 INSTALLER



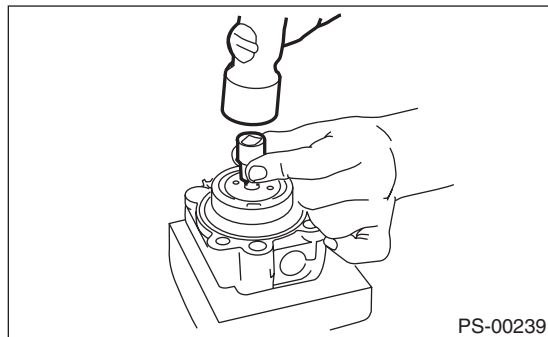
5) Install the pump pulley to front casing.

6) Using the ST, place the oil pump in a vise.

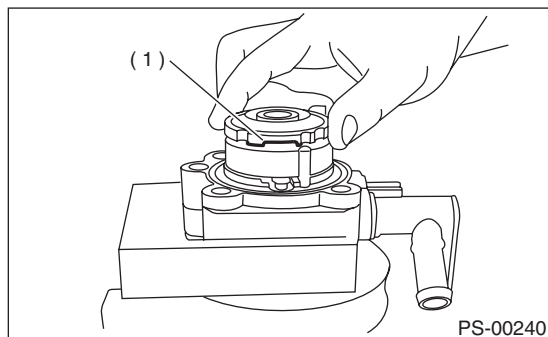
ST 34199AE020 ATTACHMENT

7) Remove the rear body.

8) Using a 10 mm box wrench, tap the snap ring into the shaft groove.



9) Install the side plate rear as shown in the figure.



(1) Groove

10) Apply the specified power steering fluid to the O-rings, and attach to the front casing and side plate rear.

11) Install the back-up ring to the side plate rear.

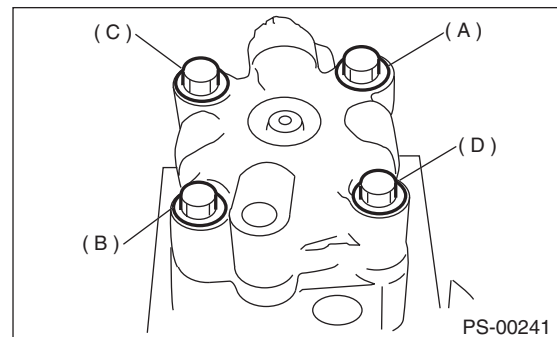
12) With knock pin positions aligned, install the rear body.

Tightening torque:

27.5 N·m (2.8 kgf·m, 20.3 ft·lb)

CAUTION:

Temporarily tighten the bolts in the order of (A), (B), (C), (D) as shown in the figure. Then, tighten in the same sequence.



13) When reassembly is complete, turn the shaft by hand to make sure that rotation is smooth. If it is excessively tight or there is a clear problem, detach and check for foreign objects on the slide surface, or whether there is any problems in the attachment, and remove the cause of the problem.

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

E: INSPECTION

1. BASIC INSPECTION

Perform the following inspection procedures and replace faulty parts.

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

2. SERVICE LIMIT

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

CAUTION:

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

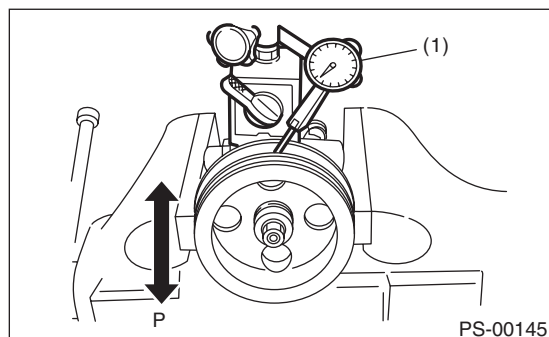
1) Play of the pulley shaft

Condition:

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

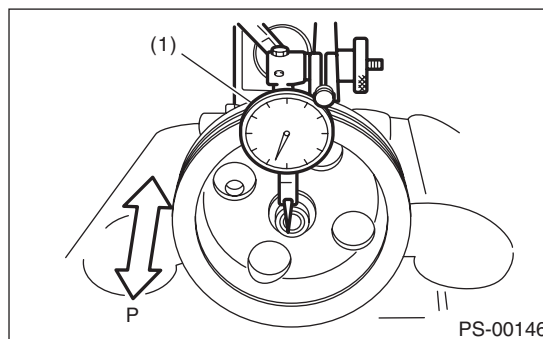
Service limit:

Play in the radial direction (Direction ◀ ▶)
0.2 mm (0.008 in) or less



(1) Dial gauge

Axial play (Direction ⇐ ⇒)
0.6 mm (0.024 in) or less



(1) Dial gauge

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

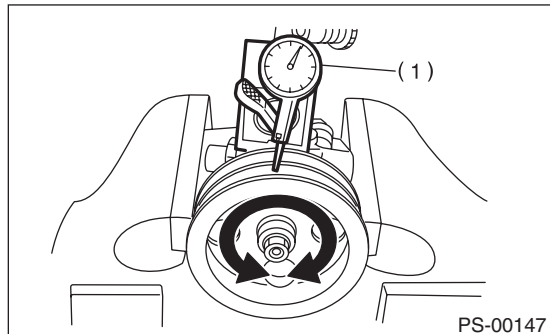
2) Deflection of the pulley groove

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 gauge

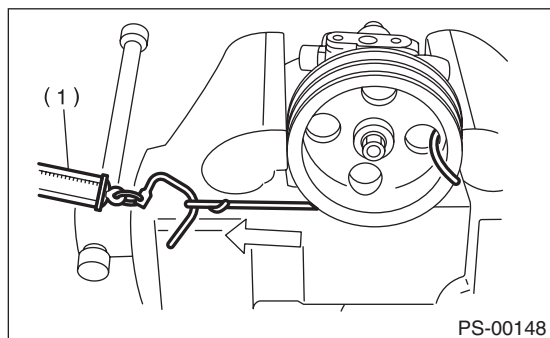
3) Rotating resistance of pulley

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 to make a judgment.



(1) Spring scale

3. HYDRAULIC PRESSURE

NOTE:

- To measure hydraulic pressure correctly, be sure to complete all the items in "INSPECTION", prior to performing the measurement. <Ref. to PS-51, INSPECTION, General Diagnostic Table.>
- Do not leave the valve of pressure gauge closed or hold the steering wheel at lock for 5 seconds or more in any case, this can damage the oil pump.
- Before attaching a pressure gauge, place cloth at locations where fluid is expected to spill. Wipe off any spilt fluid completely after the measurement.

1) Regular pressure measurement

(1) Connect the ST1, ST2 and ST3.

ST1 925711000 PRESSURE GAUGE

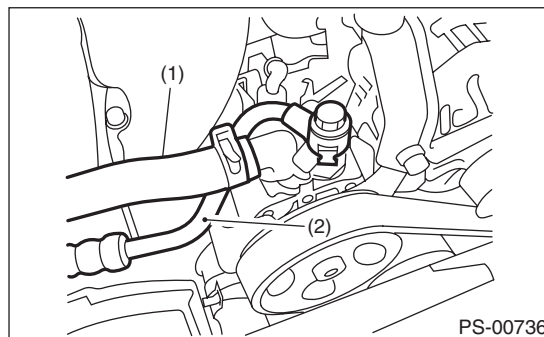
ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A

(2) Remove the air intake duct.

(3) Disconnect the pressure hose from the pump.

(4) Using the gasket (Part No. 34621AC024) and bolt (Part No. 34620AC010), install the ST2 to pump instead of pressure hose.



(1) Suction hose

(2) Pressure hose

(5) Attach the ST3 to the end of pressure hose which is removed from pump.

(6) Replenish power steering fluid up to the specified level.

(7) Open the valve, and start the engine.

Oil Pump

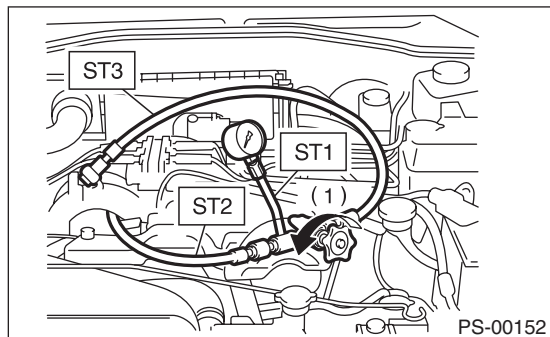
POWER ASSISTED SYSTEM (POWER STEERING)

(8) Measure the regular pressure.

ST1 925711000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A



(1) Valve

Service limit:

981 kPa (10 kg/cm², 142 psi), or less

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

2) Measure the relief pressure.

(1) Using the ST, measure the relief pressure.

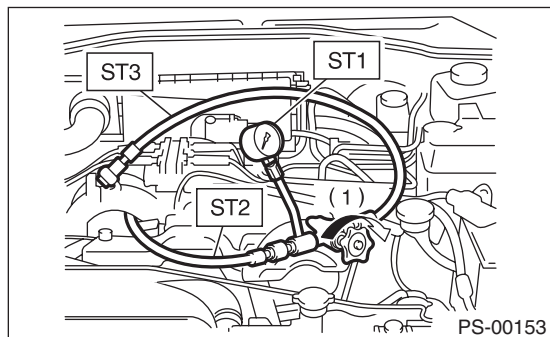
(2) Close the valve.

(3) Measure the relief pressure.

ST1 925711000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A



(1) Valve

Service limit:

8,800 — 9,400 kPa (90 — 96 kg/cm², 1,276 — 1,363 psi)

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

3) Measure the working pressure.

(1) Using the ST, measure the working pressure.

(2) Open the valve.

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

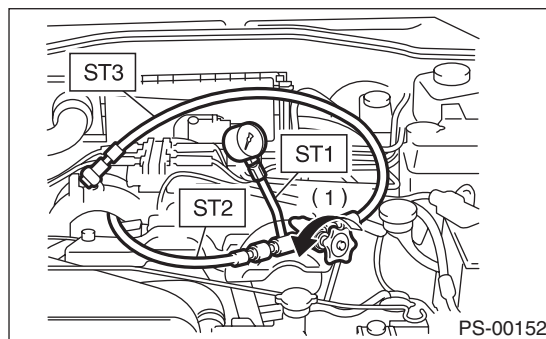
NOTE:

Because of the power steering system setup, there are conditions where the pressure will not rise to the repair limit value even if the steering wheel is turned to the maximum steering angle. In this case, turn the steering wheel further than the maximum steering angle to measure the operational pressure.

ST1 925711000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A



(1) Valve

Service limit:

8,800 — 9,400 kPa (90 — 96 kg/cm², 1,276 — 1,363 psi)

(4) If it is out of specification, measure the steering effort. <Ref. to PS-54, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.> If it is not within specification, replace the control valve itself or control valve and pinion as a single unit, using new parts.

8. Reservoir Tank

A: REMOVAL

- 1) Drain fluid from the reservoir tank.
- 2) Disconnect the hose from reservoir tank.

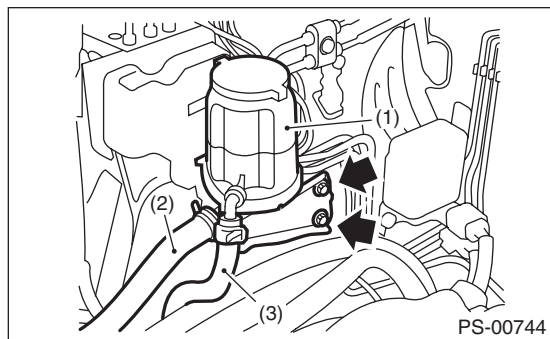
CAUTION:

To prevent foreign matter from entering the hose and pipe, cover the open ends of them with clean cloth.

- 3) Remove the bolt and remove the reservoir tank from the body.

CAUTION:

Do not separate the reserve tank and bracket.



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

B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Replenish power steering fluid up to the specified level. <Ref. to PS-50, Power Steering Fluid.>

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

C: INSPECTION

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

Power Steering Fluid

POWER ASSISTED SYSTEM (POWER STEERING)

9. Power Steering Fluid

A: SPECIFICATION

Recommended power steering fluid
SUBARU ATF or ATF DEXRON III

B: INSPECTION

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

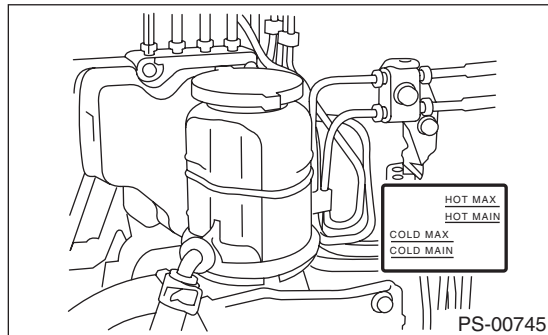
2) Check the joints and units for oil leakage. If any oil leaks are found, repair or replace the applicable part.

3) Inspect the fluid level of reservoir tank with vehicle on level surface and engine stopped.

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

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

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



C: REPLACEMENT

1) Lift up the vehicle.

2) Remove the crossmember support.

3) Remove the pipe joint in the center of gearbox, and connect the vinyl hose to the pipe and joint. Wipe fluid off while turning the steering wheel.

4) Add the specified fluid to reservoir tank at "MAX" level.

5) Continue to turn the steering wheel slowly from lock to lock until the bubbles stop appearing on oil surface while keeping the fluid at the level in the Step 4).

6) If the steering wheel is turned in a low fluid level condition, air will be sucked into the pipe. If sucked, leave it about half an hour and then do the step 5) again.

7) Start the engine and let it idle.

8) Continue to turn the steering wheel slowly from lock to lock again until the bubbles stop appearing on oil surface while keeping the fluid at the level in Step 4).

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

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

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

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

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

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

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

(3) Grinding noise is generated from oil pump.

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

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

10.General Diagnostic Table

A: INSPECTION

Trouble	Possible cause	Corrective action
- Steering effort is heavy in all ranges. - Steering effort is heavy at stand still. - Steering wheel vibrates when turning.	1. Pulley belt - Unequal length of pulley belts - Contact with oil or grease - Looseness or damage of the pulley belt - Poor uniformity of the pulley belt cross section - Pulley belt touches to pulley bottom - Poor revolution of pulleys (except oil pump pulley) - Poor revolution of oil pump pulley	Adjust or replace the faulty parts.
	2. Tire and wheel - Improper tire out of specifications^{*1} - Improper wheel out of specifications^{*1} - Tires not properly inflated	Replace or reinflate the tire and wheel. Instruct customers.
	3. Fluid - Low fluid level - Air entry in fluid - Dust entry in fluid - Fluid deterioration - Inadequate warm up of fluid^{*2}	Refill the fluid, bleed air, replace or instruct customer.
	4. Idle speed - Lower idle speed - Excessive drop of idle speed at start or when turning the steering wheel^{*3}	Adjust the idle speed or instruct customer.
	5. Measure the hydraulic pressure. <Ref. to PS-47, HYDRAULIC PRESSURE, INSPECTION, Oil Pump.>	Replace the faulty parts.
	6. Measure the steering wheel effort. <Ref. to PS-54, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>	Adjust the idle speed or replace the faulty parts.
	7. Fluid line - Folded hose - Flattened pipe - Fluid leakage	Replace the faulty parts.
- Vehicle leads to one side or the other. - Returning force of steering wheel to center is poor. - Steering wheel vibrates when turning.	1. Tire and wheel - Flat tire - Mixed use of different tires - Mixed use of different wheels - Abnormal wear of tire - Unequal tread remaining - Unequal pressure of tire	Adjust, repair or replace the tire and wheel.
	2. Front alignment - Improper or unequal caster - Improper or unequal toe-in - Loose suspension connections	Adjust or retighten.
	3. Others - Damaged joint assembly - Unbalance of ground clearance - Unbalance of load	Replace or adjust the faulty parts, or instruct customer.
	4. Measure the steering wheel effort. <Ref. to PS-54, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>	Adjust or replace the faulty parts.

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

^{*2} In cold weather, flow resistance will increase due to the cold hydraulic fluid, and steering effort will be heavier. After warming-up engine, turn the steering wheel from stop to stop several times to warm up fluid. If steering effort reduces normally, function is normal.

^{*3} In cold weather or with insufficient warm up of the engine, steering effort may be heavy due to excessive drop of idle rpm when turning the steering wheel. In this case, start the vehicle with increasing engine speed than usual. If steering effort reduces normally, function is normal.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

1. NOISE & VIBRATION

CAUTION:

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

NOTE:

- A screeching noise may be heard immediately after the engine start in extremely cold conditions. In this case, if the noise goes off during warm up there is no abnormal function in the system. This is due to the fluid characteristics in extremely cold condition.
- The oil pump normally makes a small whining noise due to its mechanism. Even if a noise is heard when steering wheel is turned at stand still, there is no abnormal function in the system provided that the noise eliminates when the vehicle is driving.
- When turning the steering wheel with the brake applied when the vehicle is parked, a screeching noise may be generated by the brake disc and pads. This is not a fault in the steering system.
- There may be a small vibration around the steering devices when turning the steering wheel at standstill, even though the component parts are operating properly.

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

These conditions do not indicate a problem in the system.

Confirm vibration for an AT model, by applying the parking brake on a concrete surface, shifting into the "D" range, and turning the steering wheel repeatedly from slow to rapid, step by step.

Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Do not keep this condition for five seconds or more.)	Normal operation
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is defective.	Replace the oil pump.
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check the clearance. Correct if necessary. <Ref. to PS-40, INSPECTION, Pipe Assembly.>
	Loosened installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Loose oil pump pulley or other pulley(s)	Retighten.
	Looseness of linkage, play of steering, improper tightening (looseness) of suspension joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace faulty parts in the gearbox or oil pump.
Knocking When turning steering wheel in both directions with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Insufficient tightening or play in the tie-rod or tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Air in vane pump	Inspect and retighten the fluid line connection. Refill the fluid and vent air.
	Vane pump seizing	Replace the oil pump.
	Oil pump pulley bearing seized	Replace the oil pump.
	Folded hose, flattened pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Improper adjustment of pulley belt Damaged or over tensioned pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Runout or dirty V-groove surface of oil pump pulley	Clean or replace.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

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

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 paved road. 2) Start the engine. 3) Run the engine at idle. 4) Install a spring scale on the steering wheel. 5) Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts. NOTE: When turning the steering more quickly than necessary from a direction to the other direction at an engine speed of 2,000 rpm or higher, steering effort may be heavy. This is caused by flow characteristic of the fluid in the oil pump and is not a defect.	Is the steering effort less than 29.4 N (3.0 kgf, 6.6 lb)?	Steering effort is normal.	Go to step 2.
2 CHECK STEERING EFFORT. 1) Stop the engine and lift up the vehicle. 2) Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.	Is the steering effort less than 15 N (1.5 kgf, 3.3 lb)?	Go to step 3.	Adjust the back-lash.
3 CHECK STEERING WHEEL EFFORT. 1) Remove the universal joint. 2) Measure the steering wheel effort.	Is steering effort less than 2.26 N (0.23 kgf, 0.51 lb)?	Go to step 4.	Replace the steering column.
4 CHECK STEERING WHEEL EFFORT. Measure the steering wheel effort.	Is the difference of steering effort between right and left less than 20%?	Go to step 5.	Replace the steering column.
5 CHECK UNIVERSAL JOINT. Measure the swing torque of the joint (yoke of steering column side). <Ref. to PS-13, INSPECTION, Universal Joint.>	Is the swing torque of the universal joint less than 2.0 N (0.20 kgf, 0.45 lb)?	Go to step 6.	Replace the steering column with a new part.
6 CHECK UNIVERSAL JOINT. Measure the swing torque of the joint (yoke of gearbox side). <Ref. to PS-13, INSPECTION, Universal Joint.>	Is the swing torque of the universal joint less than 4.5 N (0.46 kgf, 1.01 lb)?	Go to step 7.	Replace the universal joint.
7 CHECK FRONT WHEEL. Check the front wheels.	Does the front wheels have unsteady revolution or rattling, or does the brake drag?	Inspect, readjust and replace if necessary.	Go to step 8.
8 CHECK TIE-ROD ENDS. Remove the tie-rod ends from housing.	Does the tie-rod ends have unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 9.
9 CHECK GEARBOX. Measure the rotating of gearbox. <Ref. to PS-35, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>	Is the rotating resistance of steering gearbox less than 13 N (1.3 kgf, 2.9 lb)? Is the difference between the right and left rotational resistances less than 20%?	Go to step 10.	Readjust the back-lash, and if ineffective, replace the faulty parts.
10 CHECK GEARBOX. Measure the sliding of gearbox. <Ref. to PS-34, LIMIT, INSPECTION, Steering Gearbox.>	Is the sliding resistance of steering gearbox less than 343 N (35 kgf, 77 lb)? Is the difference of sliding resistance between right and left sides less than 20%?	Steering effort is normal.	Readjust the back-lash, and if ineffective, replace the faulty parts.

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

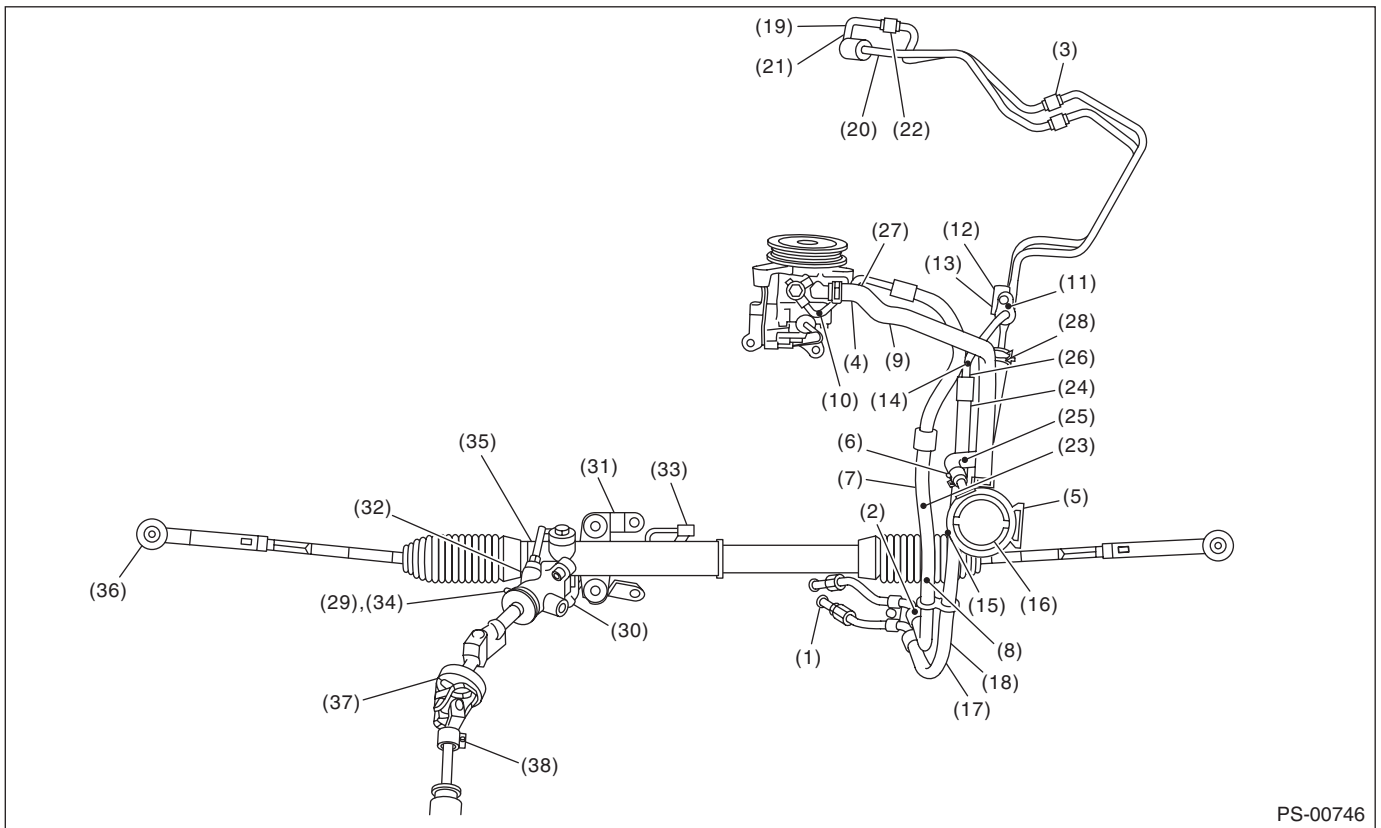
3. INSPECTION OF CLEARANCE

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

Install locations	Minimum allowance mm (in)
(1) Crossmember-to-Hose assembly	10 (0.39)
(2) Front frame side-to-Hose assembly	15 (0.59)
(3) Airbag sensor to Cooler pipe assembly	10 (0.39)
(4) Engine cover-to-Suction hose	10 (0.39)
(5) VDCH/U to Reservoir tank bracket	10 (0.39)
(6) Air boots to Hose clip	15 (0.59)
(7) Air boot-to-Hose assembly	15 (0.59)
(8) Protector to Hose assembly	10 (0.39)
(9) Intake manifold to Suction hose	10 (0.39)
(10) Intake manifold to Hose assembly	10 (0.39)
(11) Air cleaner case to Cooler pipe joint block	5 (0.20)
(12) Chain cover to Cooler pipe joint block	20 (0.78)
(13) Oil pipe to Cooler pipe joint block	20 (0.78)
(14) Suction hose to Hose assembly	10 (0.39)
(15) Air boot to Reservoir tank	10 (0.39)
(16) Brake pipe to Reservoir tank	10 (0.39)
(17) Harness to Hose assembly	10 (0.39)
(18) Relay box to Hose assembly	15 (0.59)
(19) Bumper beam to Cooler pipe assembly	10 (0.39)
(20) Radiator bracket to Cooler pipe assembly	10 (0.39)
(21) ATF cooler to Cooler pipe assembly	10 (0.39)
(22) Undercover to Cooler pipe assembly	10 (0.39)
(23) Protector to Hose assembly	10 (0.39)
(24) Protector to Hose assembly	15 (0.59)
(25) Return hose to Hose assembly	10 (0.39)
(26) Air cleaner case to Hose assembly	10 (0.39)
(27) Suction hose to Hose assembly	10 (0.39)
(28) Air cleaner case to Return hose	3 (0.12)
(29) Valve housing to DOJ	12 (0.47)
(30) Valve housing to Crossmember	1 (0.04)
(31) Mount to Crossmember	There must be no contact.
(32) Feed tube to Crossmember	3 (0.12)
(33) Elbow to Crossmember	3 (0.12)
(34) Cylinder pipe to Crossmember	3 (0.12)
(35) Feed tube to Exhaust pipe	18 (0.71)
(36) Tie-rod end to Brake dust cover	2.5 (0.10)
(37) Coupling rubber to AT level gauge	10 (0.39)
(38) Yoke to Brake booster	5 (0.20)

General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)



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

**HVAC SYSTEM (AUTO A/C)
(DIAGNOSTICS)** AC(diag)

AIRBAG SYSTEM AB

AIRBAG SYSTEM (DIAGNOSTICS) AB(diag)

**OCCUPANT DETECTION SYSTEM
(DIAGNOSTICS)** OD(diag)

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

BODY SECTION**EXTERIOR BODY PANELS****EB****CRUISE CONTROL SYSTEM****CC****CRUISE CONTROL SYSTEM
(DIAGNOSTICS)****CC(diag)****IMMOBILIZER (DIAGNOSTICS)****IM(diag)****LAN SYSTEM (DIAGNOSTICS)****LAN(diag)**

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

AC

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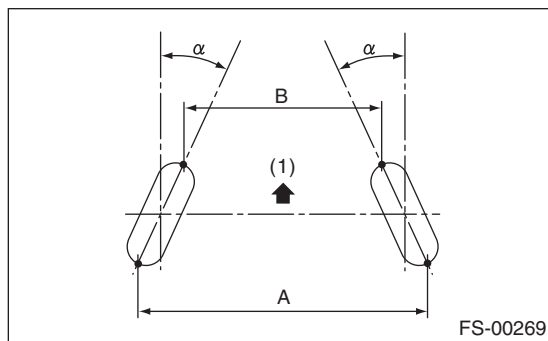
1. General Description

A: SPECIFICATION

Refer to “FS” section for rear suspension specifications. <Ref. to FS-2, SPECIFICATION, General Description.>

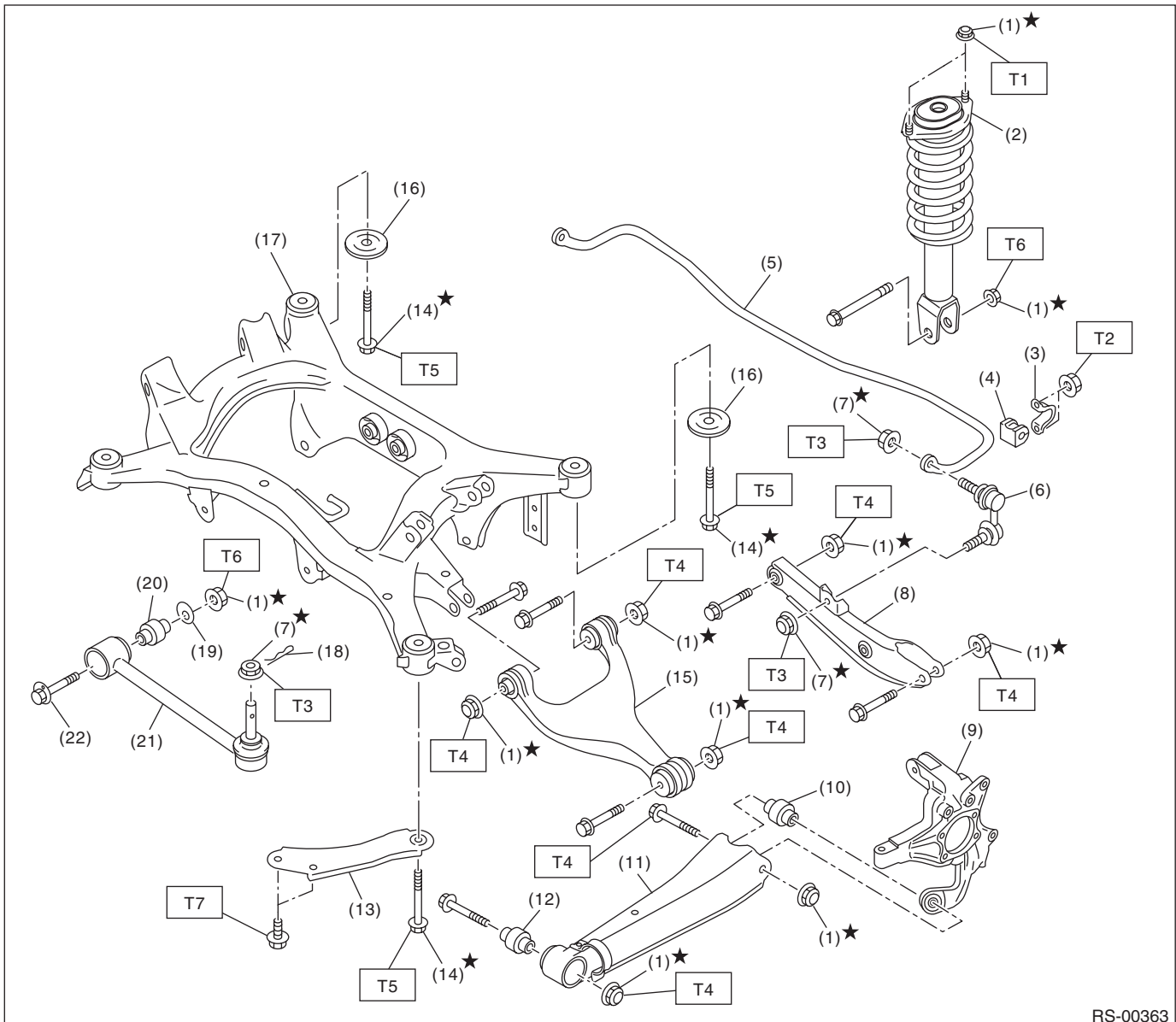
NOTE:

- Front and rear toe-in and front camber can be adjusted. Adjust if the toe-in or camber tolerance exceeds specifications.
- Other items indicated in the specifications table cannot be adjusted. If other items exceed specifications, check the suspension parts and connections for deformation, and replace with new parts as required.



(1) Front

$A - B = \text{Positive: Toe-in, Negative: Toe-out}$
 $\alpha = \text{Individual toe angles}$

B: COMPONENT**1. REAR SUSPENSION**

RS-00363

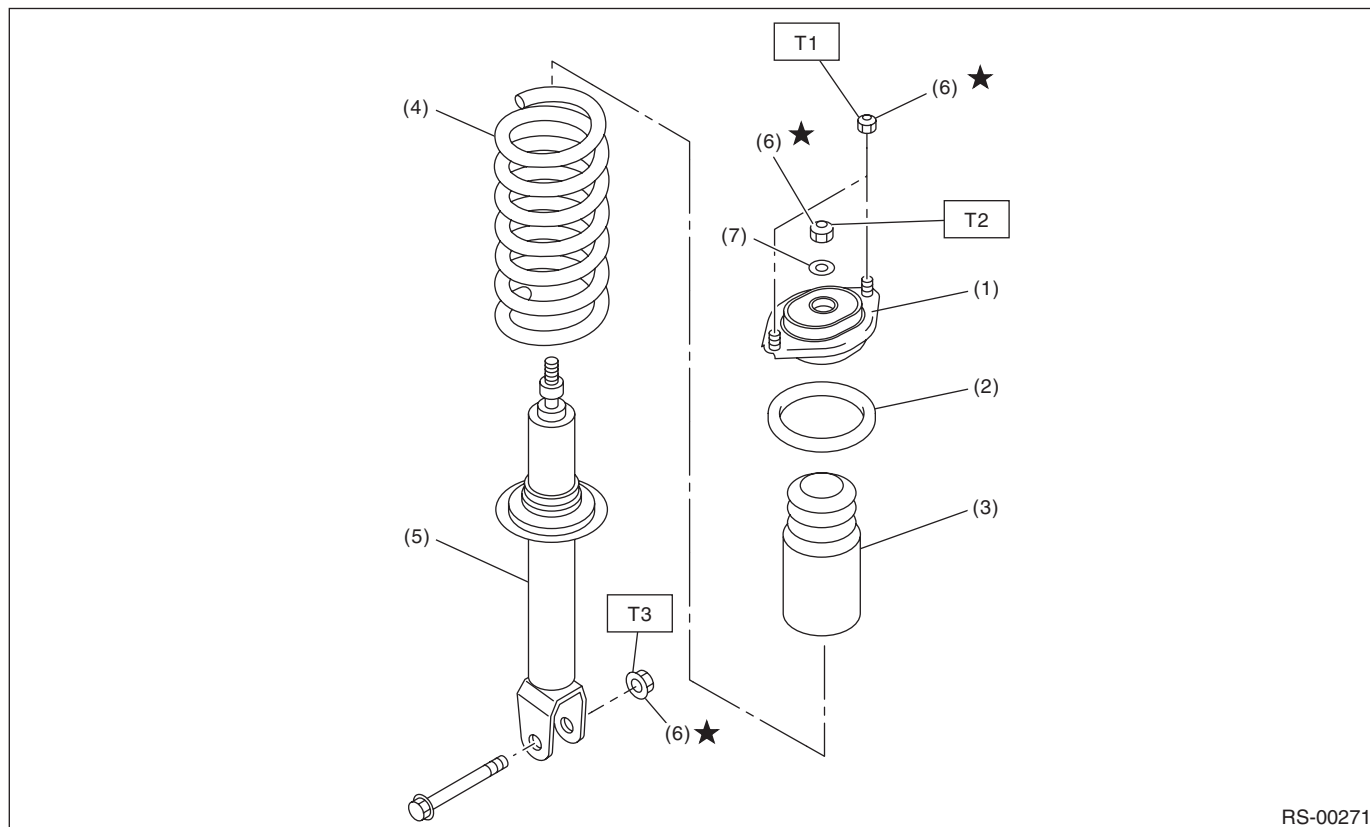
- | | |
|---------------------------|------------------------------------|
| (1) Self-locking nut | (12) Trailing link bushing |
| (2) Shock absorber | (13) Front sub frame support plate |
| (3) Stabilizer clamp | (14) Bolt |
| (4) Stabilizer bushing | (15) Upper arm |
| (5) Rear stabilizer | (16) Rear sub frame stopper plate |
| (6) Stabilizer link | (17) Rear sub frame |
| (7) Flange nut | (18) Snap pin |
| (8) Rear lateral link | (19) Adjusting washer |
| (9) Rear housing | (20) Front lateral link bushing |
| (10) Rear housing bushing | (21) Front lateral link |
| (11) Trailing link | (22) Adjusting bolt |

Tightening torque:N·m (kgf-m, ft-lb)**T1: 30 (3.1, 22.4)****T2: 38 (3.9, 28)****T3: 60 (6.1, 44)****T4: 80 (8.2, 59)****T5: 95 (9.7, 70)****T6: 120 (12.2, 89)****T7: 125 (12.7, 92)**

General Description

REAR SUSPENSION

2. SHOCK ABSORBER



- | | |
|------------------------|----------------------|
| (1) Mount | (5) Shock absorber |
| (2) Upper rubber sheet | (6) Self-locking nut |
| (3) Dust cover | (7) Washer |
| (4) Coil spring | |

Tightening torque:N·m (kgf-m, ft-lb)

T1: 30 (3.1, 22.4)

T2: 35 (3.6, 26)

T3: 120 (12.2, 89)

C: CAUTION

Please clearly understand and adhere to the following general precautions. They must be strictly followed to avoid minor or serious injury to the person doing the work or people in the area.

1. OPERATION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before disposing of shock absorbers, be sure to bleed the gas out completely. Also, do not expose to flames or fire.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

2. OIL

When handling oil, adhere to the following to prevent unexpected accident.

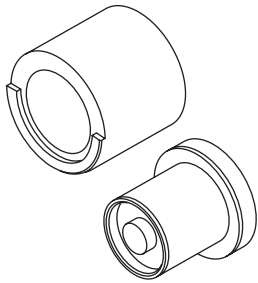
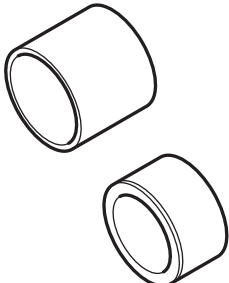
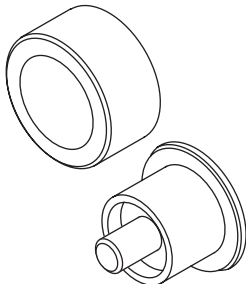
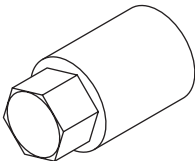
- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government regulations concerning disposal of refuse when disposing.

General Description

REAR SUSPENSION

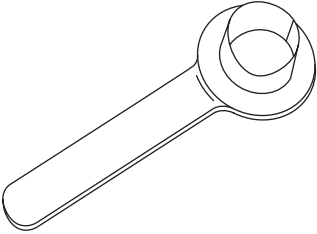
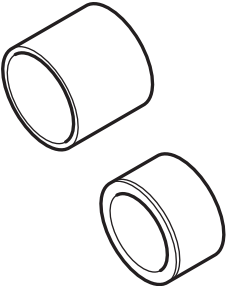
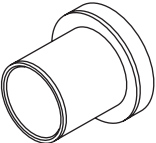
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST20099AE000	20099AE000	INSTALLER & REMOVER	Used for replacing the front lateral link bushing.
 ST20099PA010	20099PA010	INSTALLER & REMOVER	Used for replacing the rear trailing link bushing.
 ST20099AE040	20099AE040	INSTALLER & REMOVER SET	Used for replacing the rear trailing link bushing.
 ST20399AG000	20399AG000	STRUT MOUNT SOCKET	Used for removing and installing shock mount.

General Description

REAR SUSPENSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST28099PA090	28099PA090	OIL SEAL PROTECTOR	- Used for installing the rear drive shaft to the rear differential. - For oil seal protection.
 ST20099PA010	20099PA010	INSTALLER & REMOVER	- Used for replacing rear housing bushing. - Used together with the BUSHING REMOVER (20099FG000).
 ST20099FG000	20099FG000	BUSHING REMOVER	- Used for replacing rear housing bushing. - Used together with INSTALLER & REMOVER (20099PA010) base.

2. GENERAL TOOL

TOOL NAME	REMARKS
Alignment tester	Used for measuring wheel alignment.
Toe-in gauge	Used for toe-in measurement.
Jack	Used for removing and installing suspension.
Bearing puller	Used for removing bushings.
Coil spring compressor	Used for disassembling and assembling shock absorber.

2. Wheel Alignment

A: INSPECTION

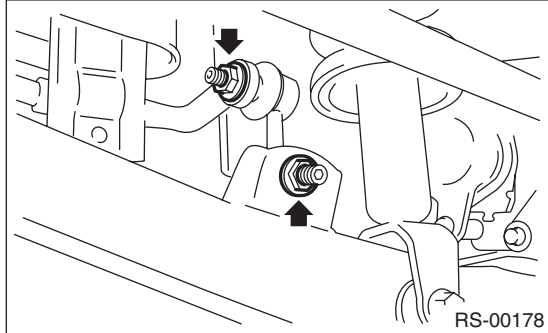
NOTE:

Measure and adjust the front and rear wheel alignment at a time. Refer to the section “FS” for measurement and adjustment of wheel alignment.
<Ref. to FS-6, INSPECTION, Wheel Alignment.>

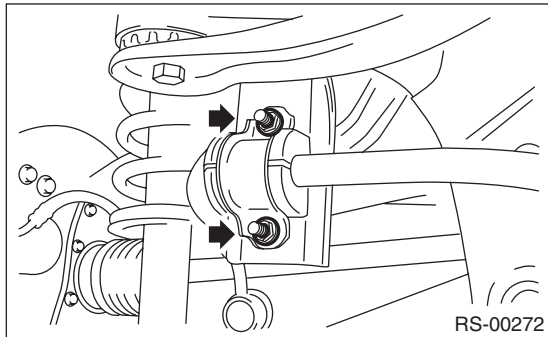
3. Rear Stabilizer

A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the stabilizer link.



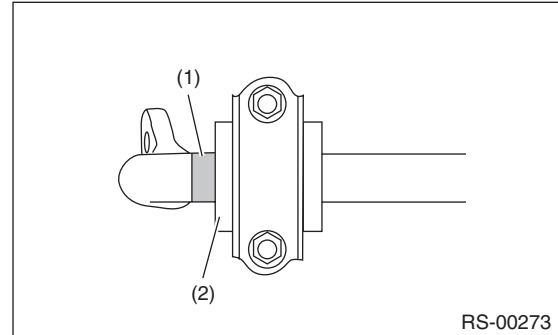
- 3) Remove the stabilizer clamp.



B: INSTALLATION

CAUTION:

- Be sure to use a new flange nut.
- Always tighten bushings with wheels in full contact with the ground and the vehicle at curb weight.
- When installing, align the edge of identification paint on the stabilizer to the end face of the bushing.



- (1) Identification paint
(2) Bushing

Install in the reverse order of removal.

Tightening torque:

Stabilizer link

60 N·m (6.1 kgf-m, 44 ft-lb)

Stabilizer clamp

38 N·m (3.9 kgf-m, 28 ft-lb)

C: INSPECTION

- 1) Check the bushing for cracks, fatigue or damage.
- 2) Check the stabilizer link for damage.

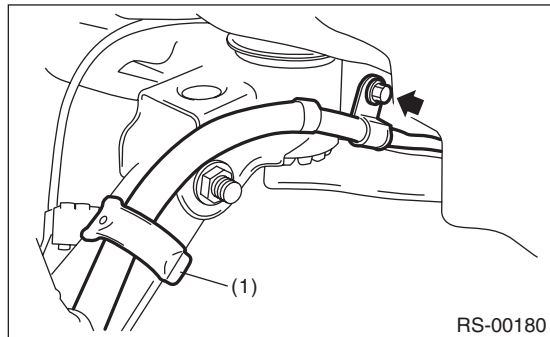
Rear Trailing Link

REAR SUSPENSION

4. Rear Trailing Link

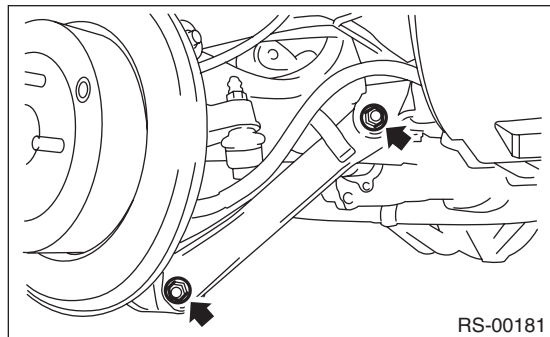
A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the bracket, and remove the parking brake cable from the guide.



(1) Guide

- 3) Remove the ABS wheel speed sensor harness from the trailing link.
- 4) Remove the trailing link.



B: INSTALLATION

CAUTION:

- Be sure to use a new self-locking nut.
- Always tighten bushings with wheels in full contact with the ground and the vehicle at curb weight.

Install in the reverse order of removal.

Tightening torque:

Trailing link

80 N·m (8.2 kgf-m, 59 ft-lb)

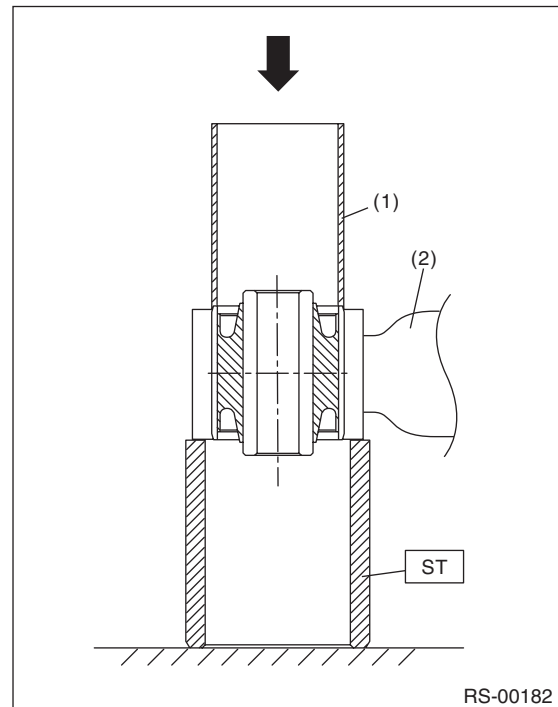
Parking Brake Cable bracket

33 N·m (3.4 kgf-m, 24 ft-lb)

C: DISASSEMBLY

1. REAR TRAILING LINK BUSHING

Using the ST and a pipe, press the bushing out.
ST 20099PA010 INSTALLER & REMOVER

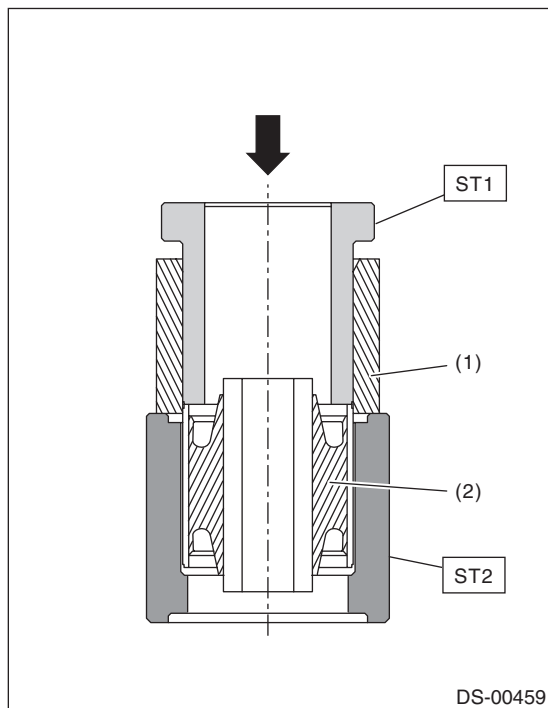
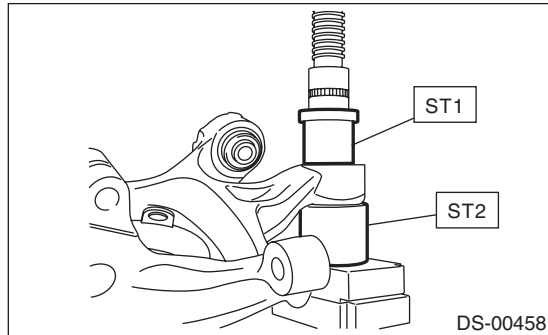


- (1) 39 mm (1.54 in) dia., 50 mm (1.97 in) length pipe
- (2) Trailing link

2. REAR HOUSING BUSHING

- 1) Remove the rear housing. <Ref. to DS-17, REMOVAL, Rear Axle.>
- 2) Using the ST and a hydraulic press, push out the bushing.

ST1 20099FG000 BUSHING REMOVER
ST2 20099PA110 INSTALLER & REMOVER (BASE)



- (1) Rear housing
- (2) Bushing

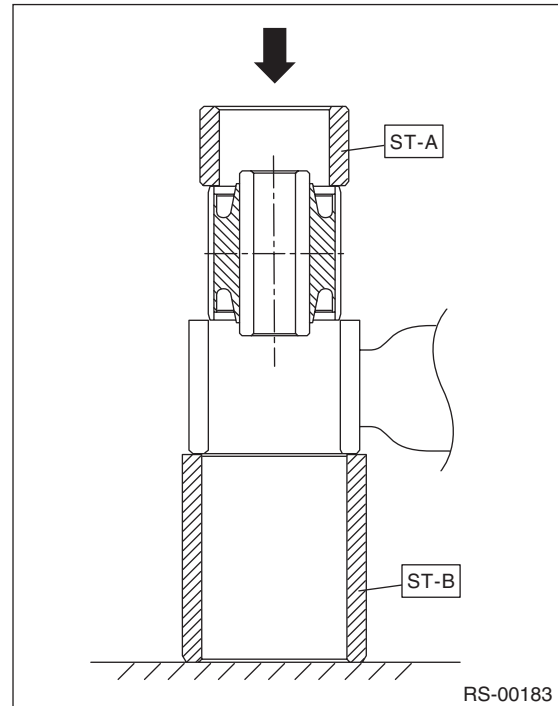
D: ASSEMBLY

1. REAR TRAILING LINK BUSHING

Using the ST A and ST B, press-fit the bushing.
STA 20099AE040 INSTALLER & REMOVER
STB 20099PA010 INSTALLER & REMOVER

CAUTION:

Press the bushing straight in.



Rear Trailing Link

REAR SUSPENSION

2. REAR HOUSING BUSHING

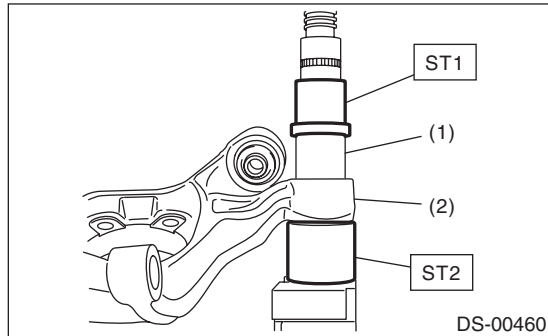
Using the ST and a hydraulic press, press the bushing into place.

ST1 20099FG000 BUSHING REMOVER

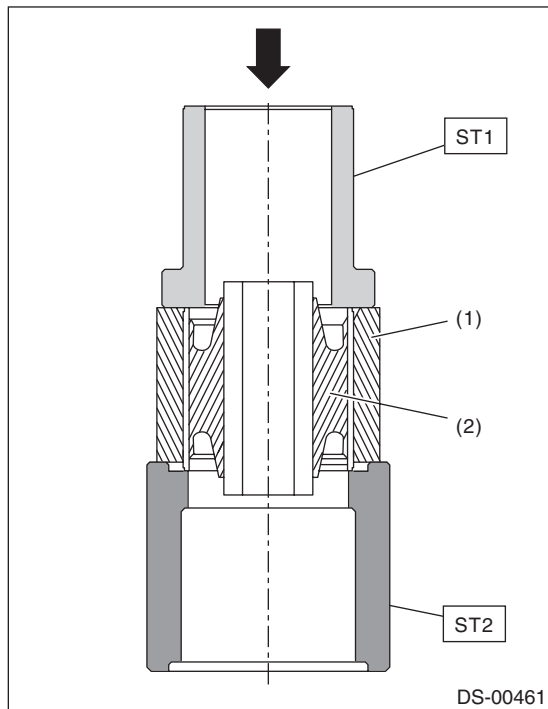
ST2 20099PA110 INSTALLER & REMOVER
(BASE)

CAUTION:

Press the bushing straight in.



- (1) Bushing
- (2) Rear housing



- (1) Rear housing
- (2) Bushing

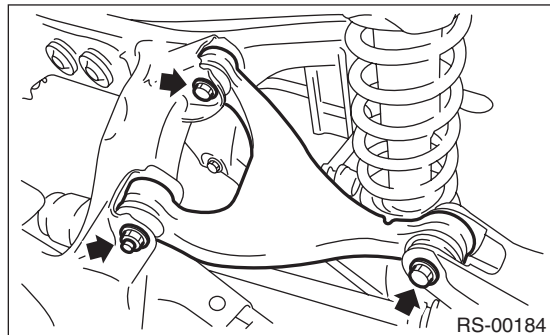
E: INSPECTION

Check the trailing link for bending, corrosion or damage.

5. Upper Arm

A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the bolts, and then remove the upper arm.



B: INSTALLATION

CAUTION:

- Be sure to use a new self-locking nut.
- Always tighten the bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

- 1) Install in the reverse order of removal.
- 2) Inspect the wheel alignment and adjust if necessary.

Tightening torque:

80 N·m (8.2 kgf-m, 59 ft-lb)

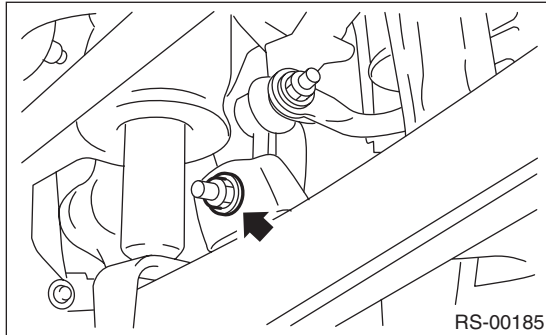
C: INSPECTION

- 1) Visually check the upper arm for damage and deformation.
- 2) Visually check the bushing for crack, damage and fatigue.

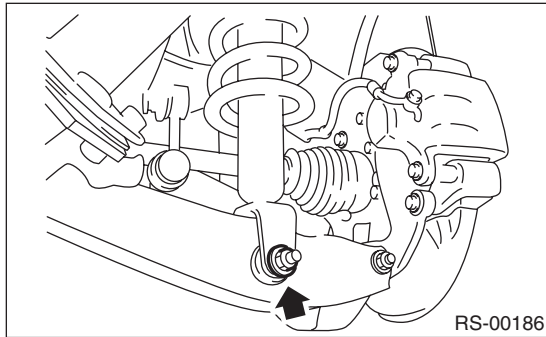
6. Rear Shock Absorber

A: REMOVAL

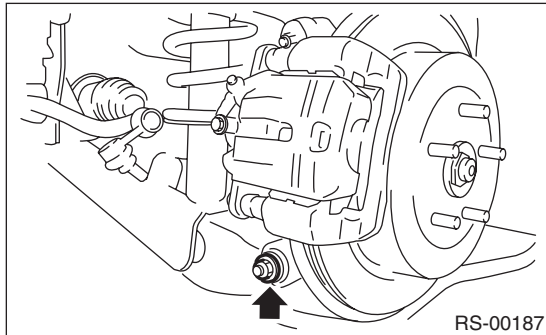
- 1) Remove the strut cap of quarter trim.
- 2) Lift up the vehicle, and then remove the rear wheels.
- 3) Remove the nut and disconnect the rear stabilizer link.



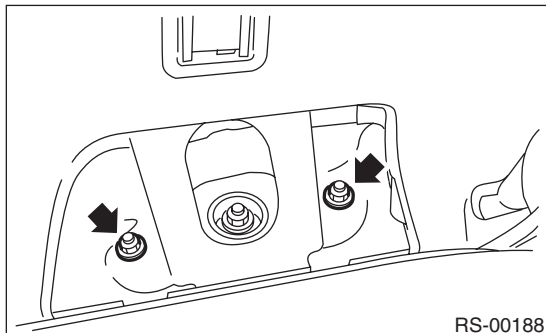
- 4) Remove the bolts on the bottom side of the shock absorber.



- 5) Detach the rear lateral link.



- 6) Remove the nuts of the shock absorber mount.



- 7) Remove the shock absorber.

B: INSTALLATION

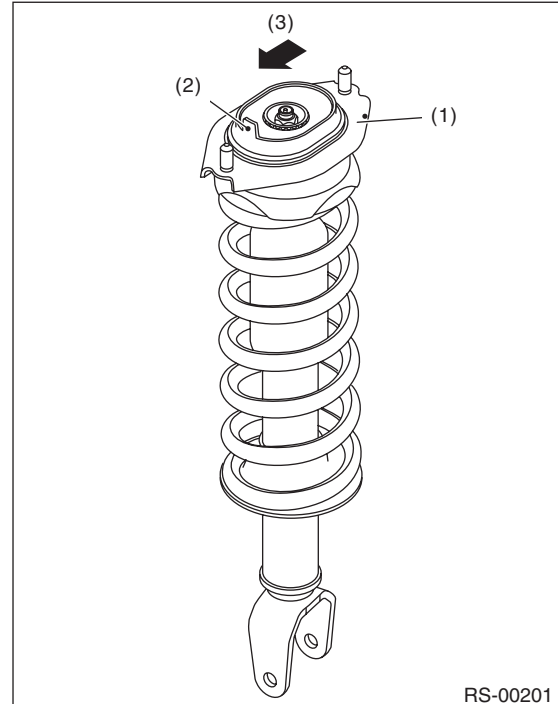
CAUTION:

- Be sure to use a new self-locking nut.
- Always tighten the bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

- 1) Install in the reverse order of removal.

CAUTION:

Attach so that the protrusion on the top of the mount is pointed towards the front of the vehicle.



- (1) Mount
- (2) Protrusion portion
- (3) Front side of vehicle

Tightening torque:

Refer to "COMPONENT" of "General Description" for the tightening torque. <Ref. to RS-3, COMPONENT, General Description.>

- 2) Check the wheel alignment and adjust it if necessary.

C: DISASSEMBLY

Refer to “Front Strut” for disassembly procedure.
<Ref. to FS-20, DISASSEMBLY, Front Strut.>

D: ASSEMBLY

Refer to “Front Strut” for installation procedures.
<Ref. to FS-20, ASSEMBLY, Front Strut.>

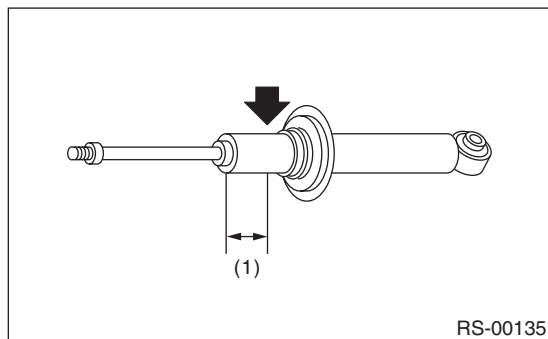
E: INSPECTION

Refer to “Front Strut” for inspection procedures.
<Ref. to FS-21, INSPECTION, Front Strut.>

F: DISPOSAL

CAUTION:

- Before handling the shock absorber, be sure to wear goggles to protect eyes from gas, oil and cutting powder.
 - Do not disassemble the shock absorber or place it into a fire.
 - Drill a hole into shock absorbers in case of discarding shock absorbers filled with gas.
- 1) Place the shock absorber on a level surface with the piston rod fully expanded.
 - 2) Make a hole into the specified position 30 mm (1.18 in) deep using a drill with 2 — 3 mm (0.08 — 0.12 in) diameter.

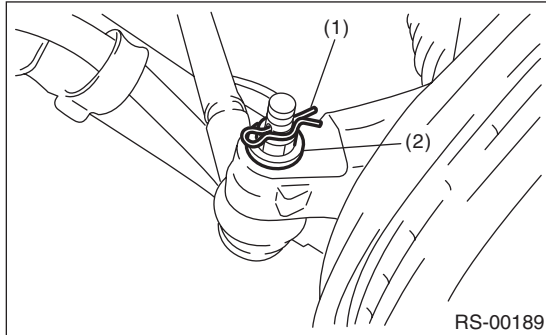


(1) 40 mm (1.57 in)

7. Front Lateral Link

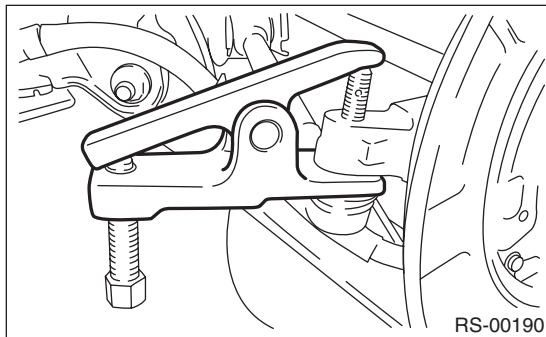
A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the snap pin and nut.



- (1) Snap pin
- (2) Nut

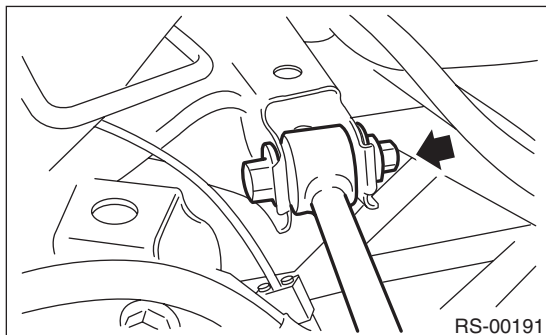
- 3) Use a puller to detach the ball joint.



- 4) Scribe an alignment mark on the front lateral link adjustment bolt and the rear sub frame.
- 5) Remove the adjusting bolt, and then remove the front lateral link.

CAUTION:

When removing the adjusting bolt, loosen the nut with the bolt head secured.



B: INSTALLATION

CAUTION:

- Be sure to use a new self-locking nut.
- Always tighten the bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

- 1) Install in the reverse order of removal.

Tightening torque:

Front lateral link — Sub frame
120 N·m (12.2 kgf-m, 89 ft-lb)

Front lateral link — Rear axle housing
60 N·m (6.1 kgf-m, 44 ft-lb)

- 2) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

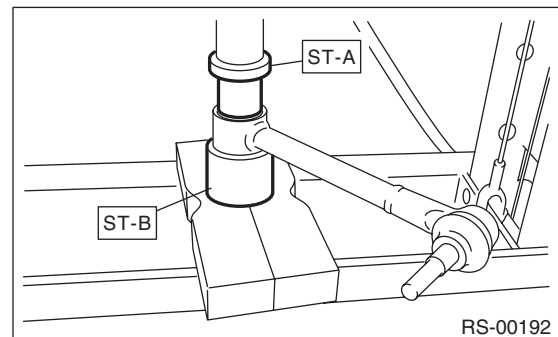
Visually check the front lateral link for damage or deformation.

D: DISASSEMBLY

Using the ST A and ST B, press the bushing out.

STA 20099AE000 INSTALLER & REMOVER

STB 20099AE000 INSTALLER & REMOVER



E: ASSEMBLY

Using the ST A and ST B, press-fit the bushing.

STA 20099AE000 INSTALLER & REMOVER

STB 20099AE000 INSTALLER & REMOVER

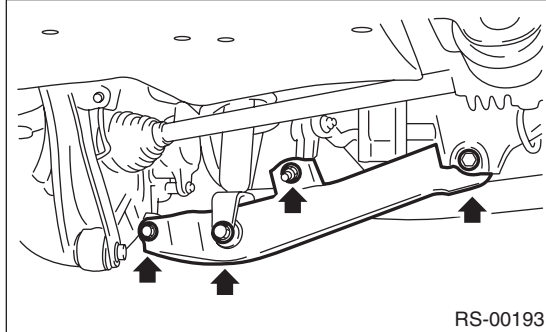
CAUTION:

Press the bushing straight in.

8. Rear Lateral Link

A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the nut and detach the stabilizer link.
- 3) Remove the bolts on the bottom side of the shock absorber.
- 4) Remove the bolt to remove the rear lateral link.



B: INSTALLATION

CAUTION:

- Be sure to use a new self-locking nut.
- Always tighten bushings with wheels in full contact with the ground and the vehicle at curb weight.

- 1) Install in the reverse order of removal.

Tightening torque:

Rear lateral link

80 N·m (8.2 kgf-m, 59 ft-lb)

Shock absorber

120 N·m (12.2 kgf-m, 89 ft-lb)

Stabilizer link

60 N·m (6.1 kgf-m, 44 ft-lb)

- 2) Inspect the wheel alignment and adjust if necessary.

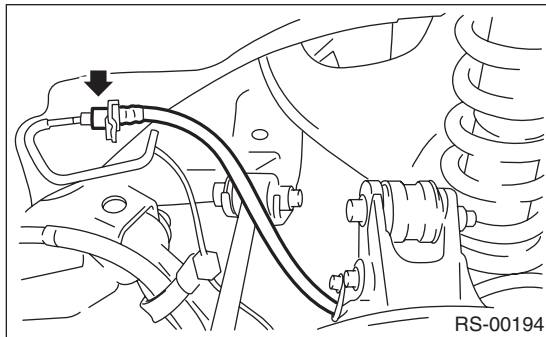
C: INSPECTION

Visually check the rear lateral link for damage and deformation.

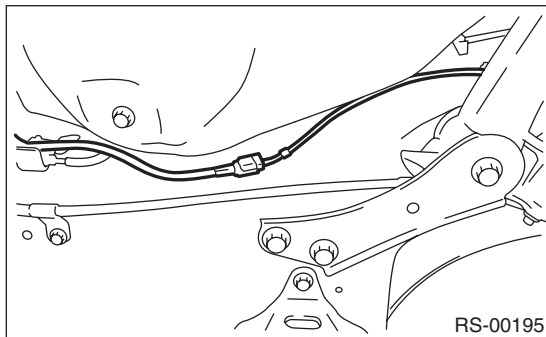
9. Rear Sub Frame

A: REMOVAL

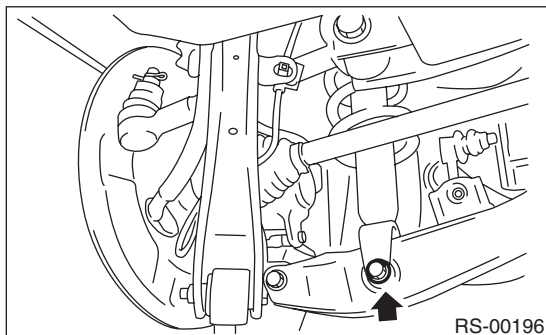
- 1) Separate the front exhaust pipe and rear exhaust pipe.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the propeller shaft.
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 4) Remove the spare tire hoist. <Ref. to WT-11, REMOVAL, Spare Tire Hoist.>
- 5) Remove the rear parking brake cable from the parking brake assembly. <Ref. to PB-7, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>
- 6) Detach the brake hose, and remove the rear brake caliper from the vehicle.



- 7) Disconnect the ABS wheel speed sensor connector.

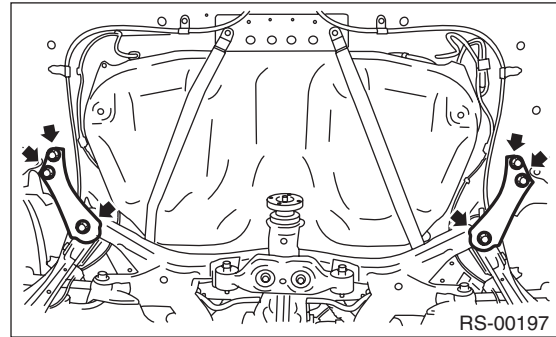


- 8) Remove the bolts on the bottom side of the shock absorber.

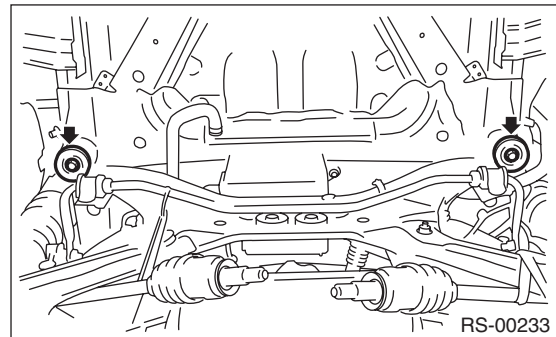


- 9) Support the sub frame using a jack.

- 10) Remove the front sub frame.



- 11) Remove the rear sub frame.



B: INSTALLATION

CAUTION:

- Be sure to use a new self-locking nut.
- Always tighten bushings with wheels in full contact with the ground and the vehicle at curb weight.

- 1) Install in the reverse order of removal.

Tightening torque:

Refer to “**COMPONENT**” of “**General Description**” for the tightening torque. <Ref. to RS-3, **COMPONENT**, **General Description**.>

- 2) Bleed air from brake system.
- 3) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

Check the removed parts for wear, damage and crack, and repair or replace them if faulty.

10. General Diagnostic Table

A: INSPECTION

1. IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible cause	Corrective action
(1) Permanent distortion or damaged coil spring	Replace.
(2) Rough operation of strut or shock absorber	Replace.
(3) Improper installation of strut or shock absorber	Replace with proper parts.
(4) Installation of the wrong coil spring	Replace with proper parts.

2. POOR RIDE COMFORT

- 1) Large rebound shock
- 2) Rocking of the vehicle continues too long after running over bump and hump.
- 3) Excessive shock in bumping

Possible cause	Corrective action
(1) Damaged coil spring	Replace.
(2) Overinflation of tires	Adjust.
(3) Improper wheel arch height	Replace the coil springs with new parts.
(4) Fault in operation of strut or shock absorber	Replace.
(5) Damage or deformation of strut mount or shock absorber mount	Replace.
(6) Unsuitable length (maximum or minimum) of strut or shock absorber	Replace with appropriate parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly or shock absorber	Replace.
(9) Oil leakage from the strut or shock absorber	Replace.

3. NOISE

Possible cause	Corrective action
(1) Wear or damage of strut or shock absorber component parts	Replace.
(2) Loosening of the suspension link installing bolt	Tighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Unsuitable length (maximum or minimum) of strut or shock absorber	Replace with appropriate parts.
(5) Damaged coil spring	Replace.
(6) Wear or damage of the ball joint	Replace.
(7) Deformation of the stabilizer clamp	Replace.

General Diagnostic Table

REAR SUSPENSION

WHEEL AND TIRE SYSTEM

WT

	Page
1. General Description	2
2. Tire and Wheel	5
3. "T-type" Tire	8
4. Tire Pressure Monitoring System	9
5. Spare Tire Hoist	11
6. General Diagnostic Table	12

Basic Diagnostic Procedure

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

CAUTION:

Remove foreign matter (dust, water, oil etc.) from the TPMS & keyless entry control module connector when removing and installing.

NOTE:

To check harness for open or short circuits, shake the suspected trouble spot or connector.

Step	Check	Yes	No
1 CHECK PRE-INSPECTION. 1) Check with the user regarding when the warning light lit or started blinking. 2) Before performing diagnostics, check all components which may adversely affect the tire pressure monitor system. <Ref. to TPM(diag)-3, INSPECTION, General Description.>	Is the component that might affect the tire pressure monitor system normal?	Go to step 2.	Repair or replace each component.
2 CHECK DIAGNOSTIC TROUBLE CODE (DTC). 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON and run the Subaru Select Monitor. NOTE: If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. <Ref. to TPM(diag)-10, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.> 4) Read the DTC. <Ref. to TPM(diag)-13, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Go to step 4.	Go to step 3.
3 PERFORM GENERAL DIAGNOSTICS. 1) Perform the inspection by referring to "General Diagnostic Table". <Ref. to TPM(diag)-34, General Diagnostic Table.> 2) Perform the Clear Memory Mode. <Ref. to TPM(diag)-8, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 3) Perform the Inspection Mode. <Ref. to TPM(diag)-14, Inspection Mode.> 4) Read the DTC. <Ref. to TPM(diag)-7, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> Check the DTC is not displayed.	Does the tire pressure warning light illuminates for about 2 seconds and then goes off after turning on the ignition switch, and then go out?	Finish the diagnosis.	Check "Tire inflation pressure warning light blinking patterns". <Ref. to TPM(diag)-16, INSPECTION, Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern.>
4 PERFORM DIAGNOSIS. 1) Refer to "List of Diagnostic Trouble Code (DTC)". 2) Correct the cause of trouble. 3) Perform the Clear Memory Mode. <Ref. to TPM(diag)-8, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 4) Perform the drive test. Drive the vehicle at 40 km/h (25 MPH) or faster for at least 10 minutes. 5) Read the DTC. <Ref. to TPM(diag)-7, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Repeat steps 1 to 4 until DTC is not shown.	Finish the diagnosis.

2. General Description

A: CAUTION

1. SRS AIRBAG SYSTEM

Airbag system wiring harness is routed near the TPM control module.

CAUTION:

- Do not use electrical test equipment on any of the airbag system wiring harness circuits.
- Be careful not to damage the wiring harness of the airbag system when servicing the TPMS & keyless entry control module.

2. TPMS & KEYLESS ENTRY CONTROL MODULE

- The location of the valve (transmitter) with the ID registered is not shown on the Select Monitor display.
- If the transmitter is replaced, ID registration for the transmitter is required. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>
- When adjusting tire pressure indoors in winter, there is a big temperature difference between the indoor facilities and outside. Once the car is outside where the temperature is lower, the tire pressure will drop, causing the tire pressure warning light to come on, even if the tire pressure was adjusted to standard values indoors. To avoid this, it is necessary to adjust the tire pressure to the high side in consideration of the difference in temperature between inside and outside.

Temperature °C (°F)	Indoor temperature	15.6 (60)			
	Ambient temperature	15.6 (60)	-1 (30)	-12 (10)	-23 (-10)
Reference for adjusting tire pressure kPa (psi)	Front	230 (33)	250 (36)	265 (38)	280 (40)
	Rear	220 (32)	240 (35)	255 (37)	270 (39)

B: INSPECTION

Before performing diagnosis, check the following item which might affect the quality of the tire pressure monitoring system.

1. TIRE

- Inspect that the tire pressure is within the specification while the tire is cool. (Refer to Tire Caution Label.)
- Check the tires for damage or the insertion of foreign matters.

2. BATTERY

Check that amount of battery fluid, gravity and voltage are within the specifications.

Standard voltage: 12 V or more

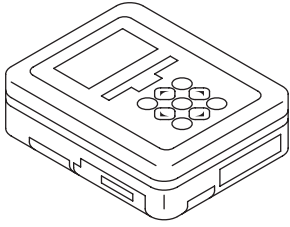
Specific gravity: 1.260 or more

General Description

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

C: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

2. GENERAL TOOL

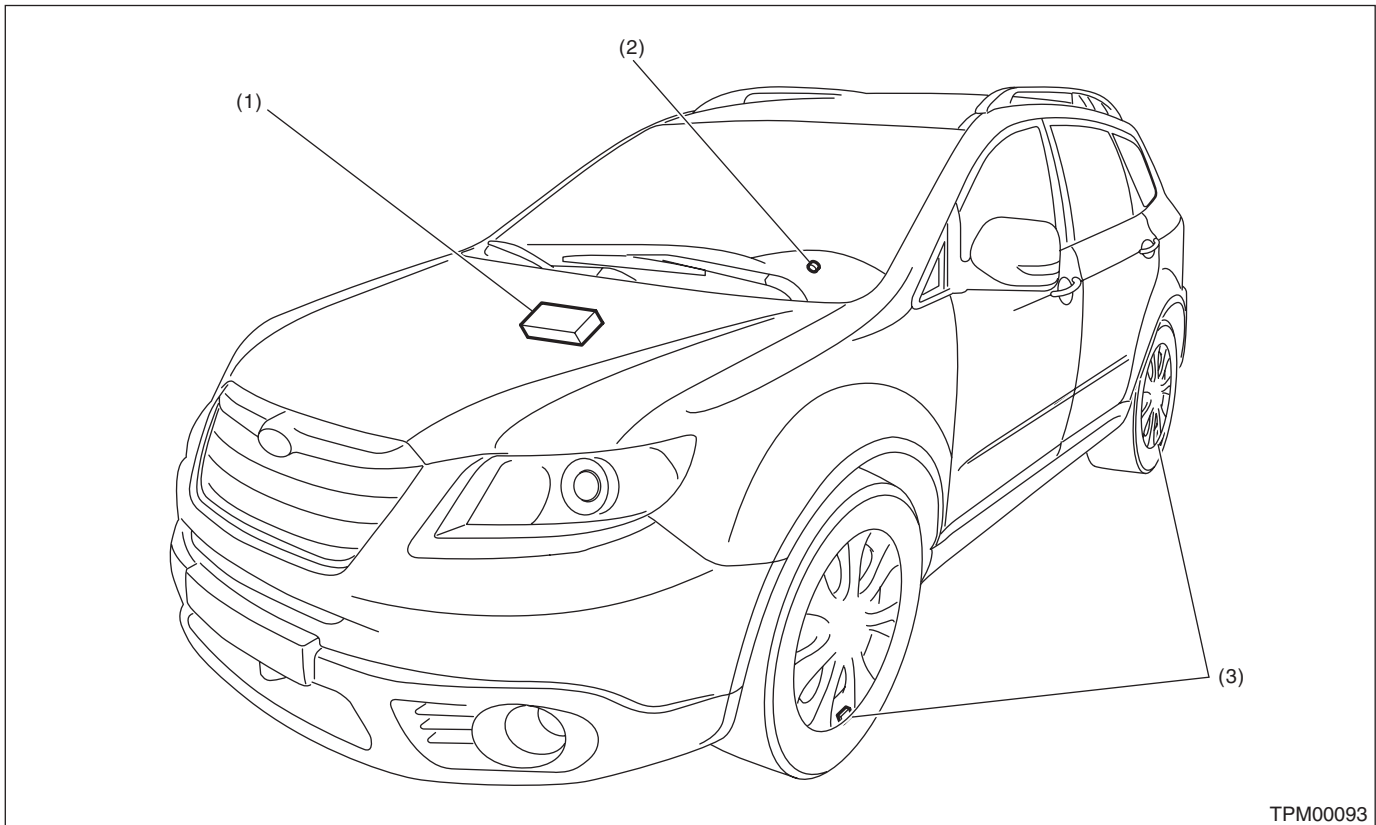
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Transmitter registration tool	Used to register the transmitter ID. Manufacturer: Kent-Moore Item number: J45295

Electrical Component Location

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

3. Electrical Component Location

A: LOCATION

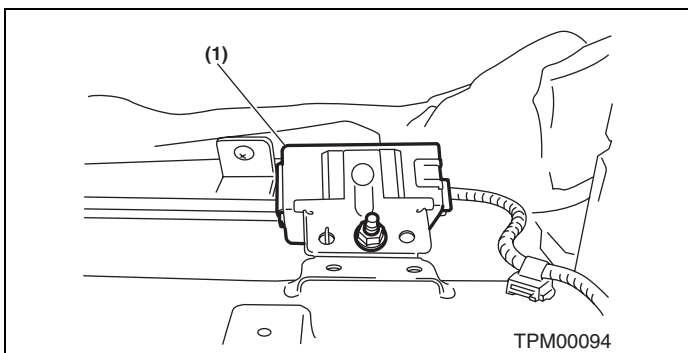


TPM00093

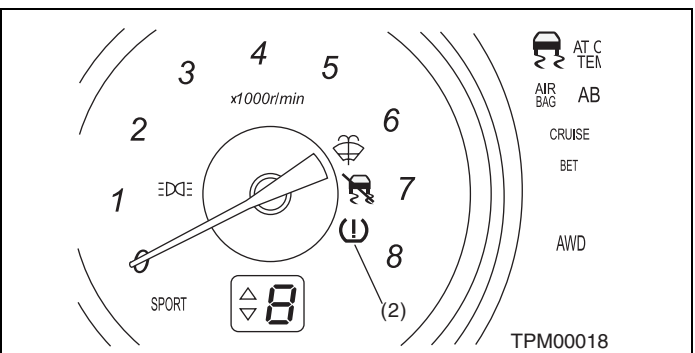
(1) TPMS & keyless entry control module

(2) Tire pressure warning light

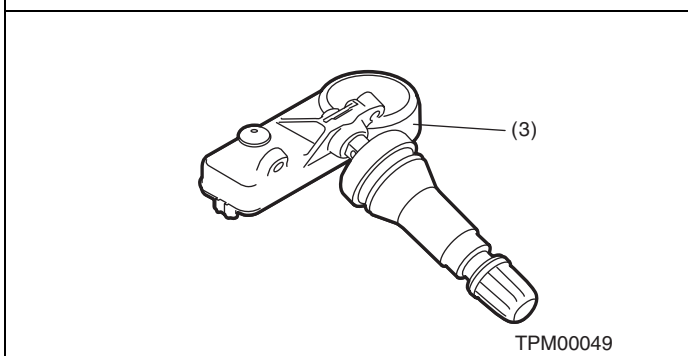
(3) Transmitter 1 — 4



TPM00094



TPM00018



TPM00049

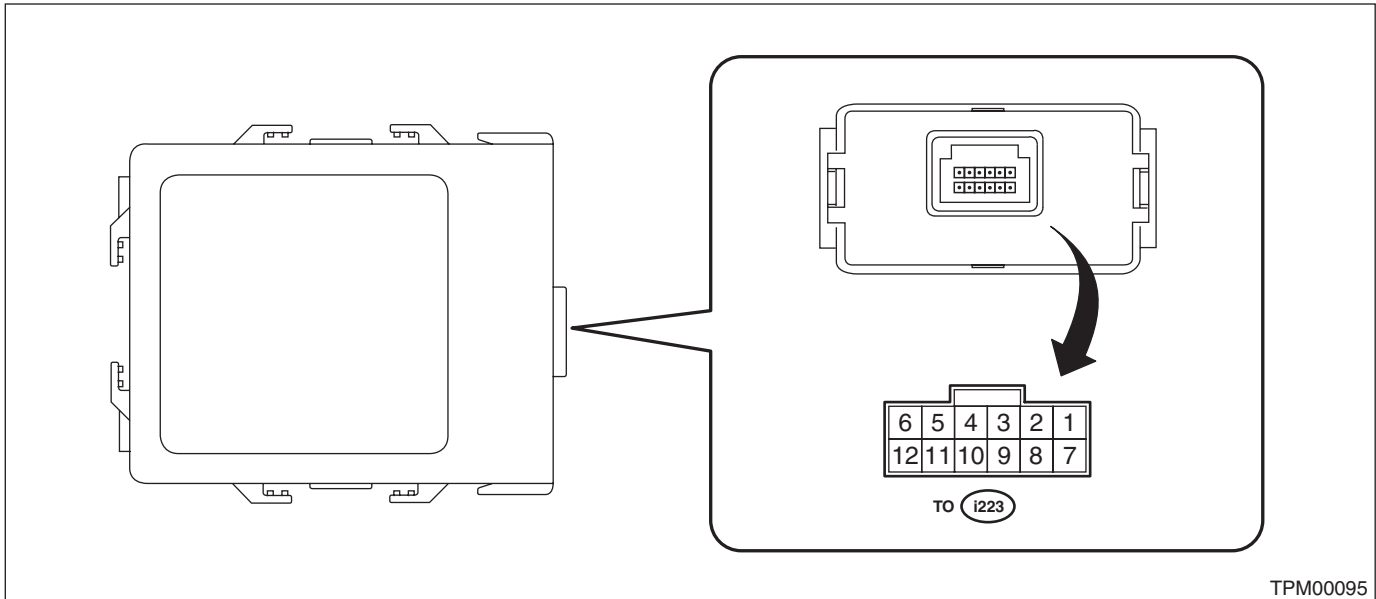
SUBARU.

Control Module I/O Signal

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

4. Control Module I/O Signal

A: ELECTRICAL SPECIFICATION



Terminal No.	Contents	Measured value and measuring conditions	Remarks
1	—	—	—
2	Tire pressure warning light output	Illuminate when malfunction occurs, or tire pressure decreases	System failure: blinks 25 times → illuminates Tire pressure decreases: turns on
3	Speed sensor signal	While driving (Pulse signal)	Change according to vehicle speed
4	Ignition power supply	IG switch ON (Battery voltage)	—
5	GND	0 V (Always)	—
6	Battery power supply	Battery voltage (Always)	—
7	—	—	—
8	—	—	—
9	—	—	—
10	—	—	—
11	Body integrated unit	—	—
12	Select monitor communication	Serial communication	—

B: WIRING DIAGRAM

<Ref. to WI-62, WIRING DIAGRAM, Tire Pressure Monitoring System.>

5. Subaru Select Monitor

A: OPERATION

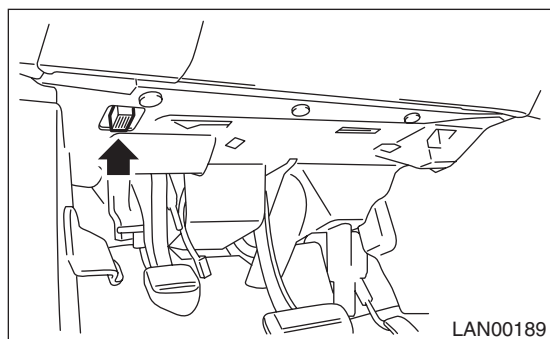
1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare the Subaru Select Monitor kit. <Ref. to TPM(diag)-4, SPECIAL TOOL, PREPARATION TOOL, General Description.>

2) Connect the diagnosis cable to Subaru Select Monitor.

3) Connect the Subaru Select Monitor to data link connector.

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



(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect scan tools other than the Subaru Select Monitor.

4) Turn the ignition switch to ON and run the Subaru Select Monitor.

5) On «Main Menu» display, select {Each System Check}.

6) On «System Selection Menu» display, select {Tire pressure monitor}.

7) After {System Name} is displayed, select [OK].

8) On «Tire pressure monitor diagnosis» display, select {Diagnostic Code(s) Display}.

NOTE:

- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
- For details concerning DTCs, refer to List of Diagnostic Trouble Code (DTC). <Ref. to TPM(diag)-22, List of Diagnostic Trouble Code (DTC).>
- All DTCs detected will be displayed.
- If a particular DTC is not properly stored in memory (due to a voltage drop of the TPMS & keyless entry control module power supply, etc.) when a problem occurs, a DTC suffixed with a question mark will appear on the Subaru Select Monitor display. This shows it may be an unreliable reading.

9) If TPMS & keyless entry control module and Subaru Select Monitor cannot communicate, check the communication circuit. <Ref. to TPM(diag)-10, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

10) When DTC is not displayed, check the indicator circuit and communication circuit. <Ref. to TPM(diag)-16, Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern.>

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

2. DATA DISPLAY

- 1) On «Main Menu» display, select {Each System Check}.
 - 2) On «System Selection Menu» display, select {Tire pressure monitor}.
 - 3) After the {Tire pressure monitor} is displayed, select [OK].
 - 4) On «Tire pressure monitor diagnosis» display, select {Data Display}, and then necessary data will be displayed.
- A list of the support data is shown in the following table.

Display	Contents to be displayed	Unit of measure
Tire 1 FN code	LEARN, LOW BAT, OFF, WAKE, RE ME, NORMAL	LEARN: Transmitted transmitter ID using the transmitter registration tool LOW BAT: Transmitter battery voltage running low OFF: Transmitter function stops (no data transmission) RE ME: Tire air changes ± 8.4 kPa WAKE: When data transmission is started from a stopped state. NORMAL: Conditions other than above
Tire 2 FN code		
Tire 3 FN code		
Tire 4 FN code		
Tire 1 air pressure	Value converted to tire pressure from data delivered from transmitter is displayed. (The figure may differ from the actual measured values.)	kPa, psig, mmHg, inHg
Tire 2 air pressure		kPa, psig, mmHg, inHg
Tire 3 air pressure		kPa, psig, mmHg, inHg
Tire 4 air pressure		kPa, psig, mmHg, inHg
Vehicle Speed	Vehicle speed signal which is input in control module	km/h, MPH
Pressure warning	Threshold where tire pressure warning light illuminates	kPa, psig, mmHg, inHg
Return pressure	Threshold where tire pressure warning light goes out	kPa, psig, mmHg, inHg

3. CLEAR MEMORY

- 1) On «Main Menu» display, select {Each System Check}.
- 2) On «System Selection Menu» display, select {Tire pressure monitor}.
- 3) After the {Tire pressure monitor} is displayed, select [OK].
- 4) On «Tire pressure monitor diagnosis» display, select {Clear Memory}.
- 5) When “Done” “Turn ignition switch to OFF” are shown on the display screen, end the Subaru Select Monitor and turn the ignition switch to OFF.

NOTE:

For details concerning the operation procedure, refer to “PC application help for Subaru Select Monitor”.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

4. REGISTER TRANSMITTER (ID)

Perform the registration procedure of the transmitter in the following cases:

- Transmitter replaced.
- TPMS & keyless entry control module replaced.

NOTE:

- If registration of the transmitter ID is not possible after 2 attempts, replace TPMS & keyless entry control module. <Ref. to WT-9, TPMS & KEYLESS ENTRY CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>
- If the ignition switch is turned OFF or the Subaru Select Monitor is shut down while registering the transmitter, or if the registration is not performed for 5 minutes or more, the registration mode is cancelled.
- When rotating tires, there is no affect on the performance or functions of the tire pressure monitoring control module even if the transmitter (ID) is not registered, however, the tire position displayed on the Subaru Select Monitor will be incorrect.

1) Adjust all tire pressures to the specifications.

NOTE:

Refer to the tire caution label on the driver's side door for the correct tire pressure.

2) Connect Subaru Select Monitor and select the {Each System Check} on the «Main Menu».

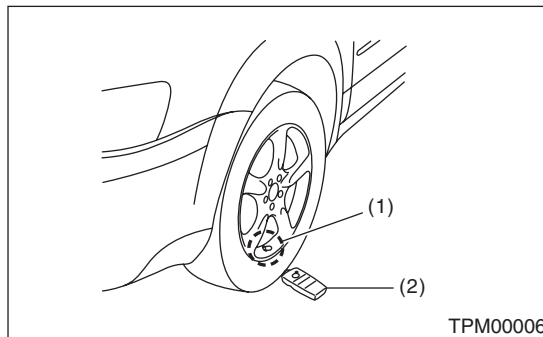
3) On «System Selection Menu» display, select {Tire pressure monitor}.

4) After the {Tire pressure monitor} is displayed, select [OK].

5) On «Tire pressure monitor diagnosis» display, select {Transmitter ID regist confirm}.

6) {ID registration mode When execute Registered ID is deleted. Continue?} is displayed, select [OK].

7) Contact the transmitter registration tool to the side wall area near the air valve on the tire, and press the switch. The transmitter ID is sent to the TPMS & keyless entry control module. (At this time, the tire pressure warning light blinks to confirm that the registration has started.)



(1) Air valve (transmitter)

(2) Transmitter registration tool

NOTE:

- The registration order of transmitter ID is not specified.
 - The transmitter registration tool is used by touching the side wall area near the transmitter.
 - If registration procedure stop in the halfway (turning ignition switch to OFF, wrong registration order, etc), proceed from step 5).
- 8) When ID registration is completed, the tire pressure warning light remains lit for approximately 2 seconds, to end the registration. Switch to the screen displaying the transmitter ID on the Subaru Select Monitor display. <Ref. to TPM(diag)-9, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>
- 9) Check the transmitter ID that was registered, then perform a driving test. <Ref. to TPM(diag)-14, PROCEDURE, Inspection Mode.>

5. DISPLAY TRANSMITTER (ID)

1) On the «Main Menu», select {Each System Check}.

2) On the «System Selection Menu», select {Tire pressure monitor}.

3) After the {Tire pressure monitor} is displayed, select [OK].

4) On the «Tire pressure monitor diagnosis», select {Transmitter ID regist confirm}.

5) Select the {Transmitter ID data monitor} to display the transmitter ID.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

B: INSPECTION

1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

DETECTING CONDITION:

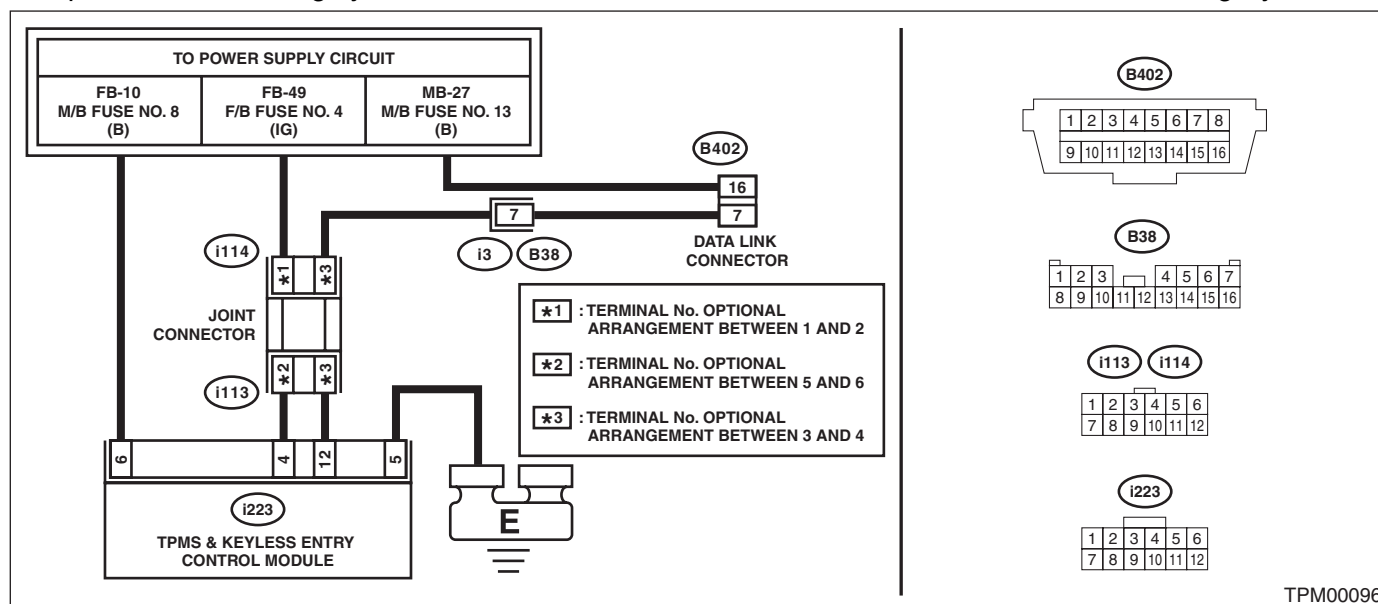
Defective harness connector

TROUBLE SYMPTOM:

Communication is impossible between the TPMS & keyless entry control module and the Subaru Select Monitor.

WIRING DIAGRAM:

Tire pressure monitoring system <Ref. to WI-62, WIRING DIAGRAM, Tire Pressure Monitoring System.>



TPM00096

Step	Check	Yes	No
1	CHECK IGNITION SWITCH.	Go to step 2.	Turn the ignition switch to ON, and select TPM mode using Subaru Select Monitor.
2	CHECK BATTERY.	Go to step 3.	Charge or replace the battery.
3	CHECK BATTERY TERMINAL.	Repair or tighten the battery terminal.	Go to step 4.
4	CHECK SUBARU SELECT MONITOR COMMUNICATION. 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be executed normally.	Go to step 8.	Go to step 5.
5	CHECK SUBARU SELECT MONITOR COMMUNICATION. 1) Turn the ignition switch to OFF. 2) Disconnect the TPMS & keyless entry control module connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Replace the TPMS & keyless entry control module. <Ref. to WT-9, TPMS & KEYLESS ENTRY CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Go to step 6.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the TPMS & keyless entry control module. 3) Measure the resistance between data link connector and chassis ground. <i>Connector & terminal</i> <i>(B402) No. 7 — Chassis ground:</i>	Is the resistance 1 M Ω or more?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
7 CHECK OUTPUT SIGNAL TO TPMS & KEYLESS ENTRY CONTROL MODULE. 1) Turn the ignition switch to ON. 2) Measure the voltage between TPMS & keyless entry control module and chassis ground. <i>Connector & terminal</i> <i>(B402) No. 7 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Go to step 8.	Repair the harness and connector between each control module and data link connector.
8 CHECK HARNESS CONNECTOR BETWEEN TPMS & KEYLESS ENTRY CONTROL MODULE AND DATA LINK CONNECTOR. Measure the resistance between the TPMS & keyless entry control module connector and the data link connector. <i>Connector & terminal</i> <i>(i223) No. 12 — (B402) No. 7:</i>	Is the resistance less than 0.5 Ω ?	Go to step 9.	Repair the harness and connector between TPMS & keyless entry control module and data link connector.
9 CHECK TPMS & KEYLESS ENTRY CONTROL MODULE CONNECTOR. Turn the ignition switch to OFF.	Is TPMS & keyless entry control module connector inserted into the TPMS & keyless entry control module until it locks?	Go to step 10.	Insert the TPMS & keyless entry control module connector into the TPMS & keyless entry control module.
10 CHECK POWER SUPPLY CIRCUIT. 1) Turn the ignition switch to ON. 2) Measure the ignition power supply voltage between TPMS & keyless entry control module connector and chassis ground. <i>Connector & terminal</i> <i>(i223) No. 4 (+) — Chassis ground (-):</i>	Is the voltage 10 — 15 V?	Go to step 11.	Repair open circuit of the harness between TPMS & keyless entry control module and battery.
11 CHECK HARNESS CONNECTOR BETWEEN TPMS & KEYLESS ENTRY CONTROL MODULE AND CHASSIS GROUND. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the TPMS & keyless entry control module. 3) Measure the resistance of harness between TPMS & keyless entry control module and chassis ground. <i>Connector & terminal</i> <i>(i223) No. 5 — Chassis ground:</i>	Is the resistance less than 0.5 Ω ?	Go to step 12.	Repair open circuit of the harness of the TPMS & keyless entry control module.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
12 CHECK POOR CONTACT OF CONNECTOR.	Is there poor contact of TPMS & keyless entry control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the TPMS & keyless entry control module. <Ref. to WT-9, TPMS & KEYLESS ENTRY CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>

Read Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

6. Read Diagnostic Trouble Code (DTC)

A: OPERATION

For details about reading DTCs, refer to “Subaru Select Monitor”. <Ref. to TPM(diag)-7, Subaru Select Monitor.>

7. Inspection Mode

A: PROCEDURE

Reproduce the malfunction occurrence condition as possible. Drive the vehicle at 40 km/h (25 MPH) or faster for at least ten minutes.

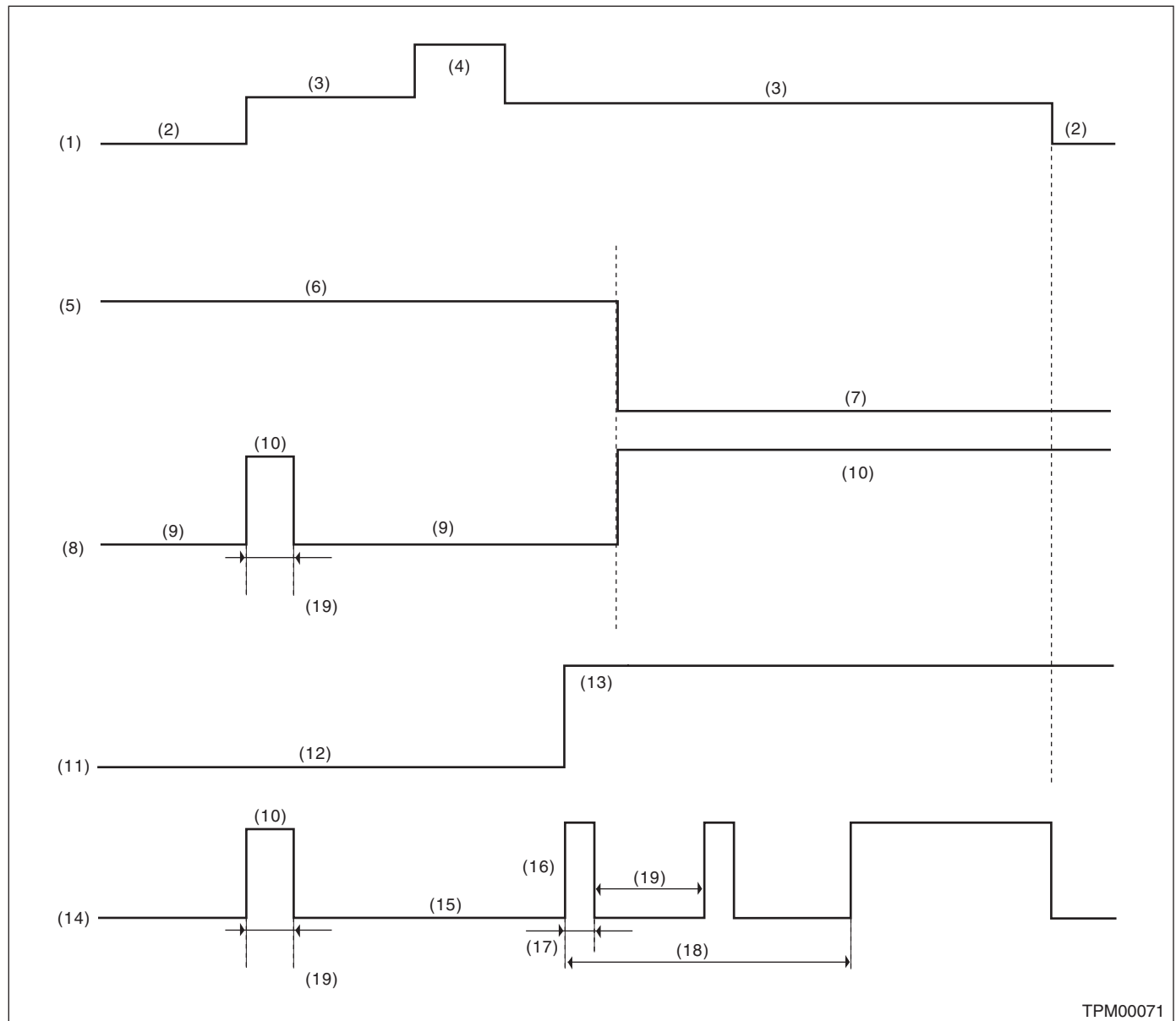
8. Clear Memory Mode

A: OPERATION

For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to TPM(diag)-7, Subaru Select Monitor.>

9. Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

A: INSPECTION



TPM00071

- | | | |
|---|---|---|
| (1) Ignition switch | (8) Tire pressure warning light (tire pressure condition) | (14) Tire inflation pressure warning light (system condition) |
| (2) OFF | (9) Light OFF | (15) Light OFF |
| (3) ON | (10) Light ON | (16) Blink |
| (4) Start | (11) System status | (17) 1 seconds |
| (5) Tire inflation pressure condition | (12) Normal | (18) Blinks 25 times |
| (6) Meet the specification | (13) Malfunction | (19) 2 seconds |
| (7) Less than standard value
(For the pressure warning level, refer to "CURRENT DATA".) <Ref. to TPM(diag)-8, DATA DISPLAY, OPERATION, Subaru Select Monitor.> | | |

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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

2) If the tire pressure warning light does not go off, check the TPMS & keyless entry control module/warning light circuit and the combination meter circuit. <Ref. to TPM(diag)-19, TIRE PRESSURE WARNING LIGHT DOES NOT COME OFF, Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern.>

NOTE:

If the problem is fixed while driving at approximately 40 km/h (25 MPH) after the tire pressure warning light blinks/lights, the warning light goes out and the tire pressure monitor system operates normally. (If there is a decrease in tire pressure, or a malfunction of the system, the malfunction history is displayed.)

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

B: TIRE PRESSURE WARNING LIGHT DOES NOT COME ON

DETECTING CONDITION:

Defective combination meter

TROUBLE SYMPTOM:

When the ignition switch is turned to ON, the tire pressure warning light does not turn on (for approx. 2 seconds).

Step	Check	Yes	No
1 CHECK DIAGNOSTIC TROUBLE CODE (DTC). Connect the Subaru Select Monitor, and read the Diagnostic Trouble Code. <Ref. to TPM(diag)-7, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is diagnostics code (DTC) displayed?	Perform the diagnosis according to the DTC. <Ref. to TPM(diag)-22, List of Diagnostic Trouble Code (DTC).>	Replace the combination meter. <Ref. to IDI-11, REMOVAL, Combination Meter.>

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

C: TIRE PRESSURE WARNING LIGHT DOES NOT COME OFF

DETECTING CONDITION:

- Defective combination meter
- Tires pressure drop
- Transmitter ID not registered

TROUBLE SYMPTOM:

Tire pressure warning light remains illuminating after engine starts.

Step	Check	Yes	No
1 CHECK DTC. Connect the Subaru Select Monitor, and read the Diagnostic Trouble Code. <Ref. to TPM(diag)-7, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is a DTC displayed?	Perform the diagnosis according to the DTC. <Ref. to TPM(diag)-22, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK TRANSMITTER (ID). Display the transmitter ID of the tire pressure monitor system. <Ref. to TPM(diag)-9, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>	Is the transmitter ID registered?	Go to step 3.	Register the transmitter ID. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>
3 CHECK TRANSMITTER DATA OUTPUT. 1) Select data display of the tire pressure monitoring. 2) Start the engine and check the tire pressure warning light output.	Is the warning light output ON?	Replace the TPMS & keyless entry control module. <Ref. to WT-9, TPMS & KEYLESS ENTRY CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Replace the combination meter. <Ref. to IDI-11, REMOVAL, Combination Meter.>

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

D: TIRE PRESSURE WARNING LIGHT IS 25 TIMES BLINKING AND TURN ON DETECTING CONDITION:

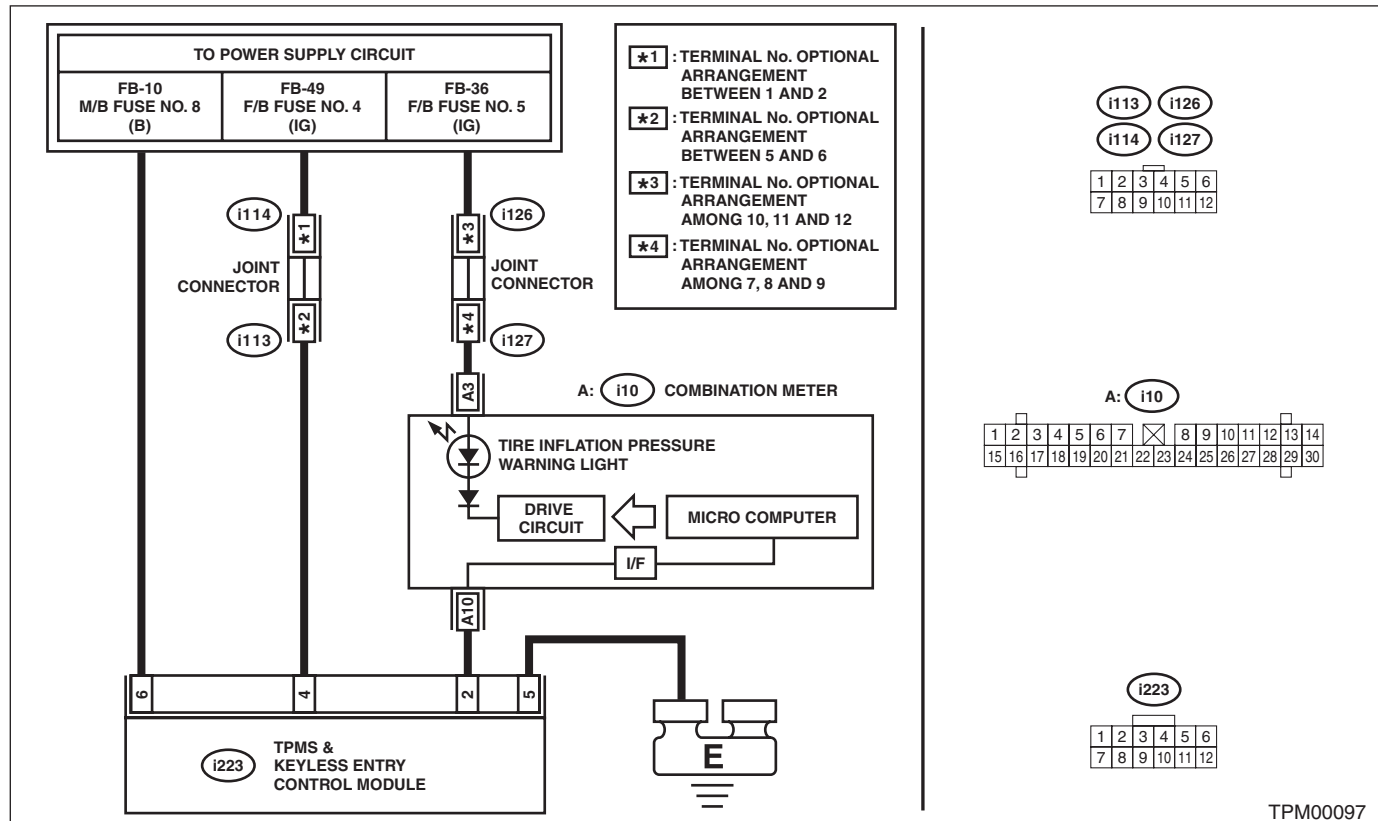
- Defective TPMS & keyless entry control module
- Defective harness
- Transmitter is faulty.

TROUBLE SYMPTOM:

Every time the engine starts, tire pressure warning light blinks 25 times and then illuminates.

WIRING DIAGRAM:

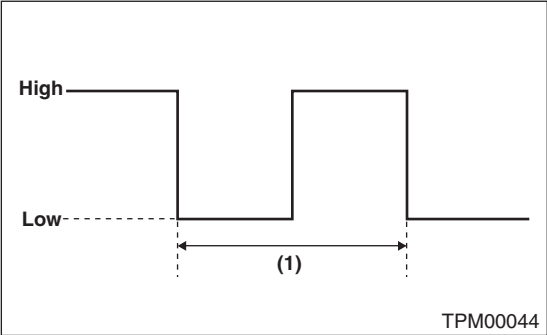
Tire pressure monitoring system <Ref. to WI-62, WIRING DIAGRAM, Tire Pressure Monitoring System.>



Step	Check	Yes	No
1	CHECK DTC. Connect the Subaru Select Monitor, and read the Diagnostic Trouble Code. <Ref. to TPM(diag)-7, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is diagnostics code (DTC) displayed?	Perform the diagnosis according to the DTC. <Ref. to TPM(diag)-22, List of Diagnostic Trouble Code (DTC).>
2	CHECK HARNESS. 1) Connect the Subaru Select Monitor to the terminal No. 2 of the TPMS & keyless entry control module connector (i223). Connector & terminal (i223) No. 2 (+) — Chassis ground (-): 2) Turn the ignition switch to ON, and select "Oscilloscope" from the Main Menu of Subaru Select Monitor. 3) Check the voltage displayed.	Is the voltage 10 V or more?	Go to step 2. Go to step 4.

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
3 CHECK HARNESS. 1) Check the output waveform displayed in the oscilloscope of Subaru Select Monitor. 	Is the pattern the same output waveform as shown in the figure? (1) 400 ± 9 ms Duty 50% High: Battery voltage Low: 1.5 V or less	Check the combination meter.	Replace the TPMS & keyless entry control module. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK HARNESS. 1) Disconnect the TPMS & keyless entry control module connector. 2) Connect the Subaru Select Monitor to the terminal No. 2 of the TPMS & keyless entry control module connector (i223). Connector & terminal (i223) No. 2 (+) — Chassis ground (-): 3) Turn the ignition switch to ON, and select "Oscilloscope" from the Main Menu of Subaru Select Monitor. 4) Check the voltage displayed.	Is the voltage 10 V or more?	Replace the TPMS & keyless entry control module. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>	The harness between the combination meter connector and the TPMS & keyless entry control module connector is shorted or open. Repair or replace the harness.

List of Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

10. List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Contents of diagnosis	Remarks
11	Tire 1 Air Pressure Decrease	FL tire pressure is reduced.	<Ref. to TPM(diag)-24, DTC 11 TIRE 1 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
12	Tire 2 Air Pressure Decrease	FR tire pressure is reduced.	<Ref. to TPM(diag)-24, DTC 12 TIRE 2 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
13	Tire 3 Air Pressure Decrease	RR tire pressure is reduced.	<Ref. to TPM(diag)-24, DTC 13 TIRE 3 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
14	Tire 4 Air Pressure Decrease	RL tire pressure is reduced.	<Ref. to TPM(diag)-25, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	Transmitter 1 No Data	Data cannot be received from FL sensor.	<Ref. to TPM(diag)-25, DTC 21 TRANSMITTER 1 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	Transmitter 2 No Data	Data cannot be received from FR sensor.	<Ref. to TPM(diag)-25, DTC 22 TRANSMITTER 2 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	Transmitter 3 No Data	Data cannot be received from RR sensor.	<Ref. to TPM(diag)-25, DTC 23 TRANSMITTER 3 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	Transmitter 4 No Data	Data cannot be received from RL sensor.	<Ref. to TPM(diag)-26, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
31	Transmitter 1 Pressure Data Abnormal	FL sensor data contents are abnormal.	<Ref. to TPM(diag)-27, DTC 31 TRANSMITTER 1 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
32	Transmitter 2 Pressure Data Abnormal	FR sensor data contents are abnormal.	<Ref. to TPM(diag)-27, DTC 32 TRANSMITTER 2 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
33	Transmitter 3 Pressure Data Abnormal	RR sensor data contents are abnormal.	<Ref. to TPM(diag)-27, DTC 33 TRANSMITTER 3 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
34	Transmitter 4 Pressure Data Abnormal	RL sensor data contents are abnormal.	<Ref. to TPM(diag)-28, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
41	Transmitter 1 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-29, DTC 41 TRANSMITTER 1 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

DTC	Item	Contents of diagnosis	Remarks
42	Transmitter 2 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-29, DTC 42 TRANSMITTER 2 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
43	Transmitter 3 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-29, DTC 43 TRANSMITTER 3 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
44	Transmitter 4 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-30, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
51	Transmitter 1 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-31, DTC 51 TRANSMITTER 1 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
52	Transmitter 2 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-31, DTC 52 TRANSMITTER 2 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
53	Transmitter 3 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-31, DTC 53 TRANSMITTER 3 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
54	Transmitter 4 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-32, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
61	Vehicle Speed is Abnormal	Vehicle speed signal is not input to the control module when the vehicle speed is 6 km/h (3.7 MPH) or more.	<Ref. to TPM(diag)-33, DTC 61 VEHICLE SPEED IS ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

11.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC 11 TIRE 1 AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for diagnostic procedure. <Ref. to TPM(diag)-25, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

B: DTC 12 TIRE 2 AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for diagnostic procedure. <Ref. to TPM(diag)-25, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

C: DTC 13 TIRE 3 AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for diagnostic procedure. <Ref. to TPM(diag)-25, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

D: DTC 14 TIRE 4 AIR PRESSURE DECREASE

DTC DETECTING CONDITION:

Inflation pressure of tires dropped below the specified value.

NOTE:

For the specifications, refer to "CURRENT DATA". <Ref. to TPM(diag)-8, DATA DISPLAY, OPERATION, Subaru Select Monitor.>

TROUBLE SYMPTOM:

Tire pressure warning light illuminates.

Step	Check	Yes	No
1 CHECK TIRES. Lift up the vehicle and check for damage in the tires.	Are there cracks or damage?	Repair or replace the tire. <Ref. to WT-5, Tire and Wheel.>	Go to step 2.
2 CHECK TIRES. Check the tire air pressure.	Is the tire pressure in the specifications?	Go to step 3.	Adjust the air pressure.
3 CHECK TRANSMITTER. Drive the vehicle at 40 km/h (25 MPH) or faster and compare the data from the transmitter on the four wheels.	Is there a transmitter with different data?	Replace the transmitter (tire pressure sensor). <Ref. to WT-9, Tire Pressure Monitoring System.>	Go to step 4.
4 PERFORM DRIVING TEST. 1) Perform the Clear Memory Mode. <Ref. to TPM(diag)-8, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 2) Perform a driving test. <Ref. to TPM(diag)-14, PROCEDURE, Inspection Mode.> 3) Read the DTC. <Ref. to TPM(diag)-7, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Record the DTC. Perform the repair according to DTC. <Ref. to TPM(diag)-22, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

CAUTION:

When driving vehicle to perform driving test, there should be always 2 persons (driver and checker) to check.

E: DTC 21 TRANSMITTER 1 NO DATA

NOTE:

Refer to DTC 24 for diagnostic procedure. <Ref. to TPM(diag)-26, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

F: DTC 22 TRANSMITTER 2 NO DATA

NOTE:

Refer to DTC 24 for diagnostic procedure. <Ref. to TPM(diag)-26, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

G: DTC 23 TRANSMITTER 3 NO DATA

NOTE:

Refer to DTC 24 for diagnostic procedure. <Ref. to TPM(diag)-26, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

H: DTC 24 TRANSMITTER 4 NO DATA

DTC DETECTING CONDITION:

Data from each transmitter is not received for 8 minutes.

TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

Step	Check	Yes	No
1 START FL TRANSMITTER. 1) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 2) Select "Transmit ID Monitor". <Ref. to TPM(diag)-9, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 2.	Replace front left transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
2 CHECK FL TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 1 registered ID.	Are the two IDs same?	Go to step 3.	Record the received ID update as the FL transmitter. Go to step 3.
3 START FR TRANSMITTER. Use the transmitter registration tool and transmit the ID from the FR transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 4.	Replace the front right transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK FR TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 2 registered ID.	Are the two IDs same?	Go to step 5.	Record the received ID update as the FR transmitter. Go to step 5.
5 START RR TRANSMITTER. Use the transmitter registration tool and transmit the ID from the RR transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 6.	Replace the RR transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
6 CHECK RR TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 3 registered ID.	Are the two IDs same?	Go to step 7.	Record the received ID update as the RR transmitter. Go to step 7.
7 START RL TRANSMITTER. Use the transmitter registration tool and transmit the ID from the RL transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 8.	Replace the RL transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
8 CHECK RL TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 4 registered ID.	Are the two IDs same?	Go to step 9.	Record the received ID update as the RL transmitter. Go to step 9.
9 CHECK MALFUNCTION TRANSMITTER.	Is ID recorded by this procedure?	Go to step 10.	Go to step 1.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK MALFUNCTION TRANSMITTER. Check the registered ID of the transmitter indicated by DTC.	Is there checked ID in the record?	Replace the transmitter of the recorded position. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>	Replace the transmitter showing the latest ID that is not included in the registered IDs. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>

CAUTION:

When driving vehicle to perform driving test, there should be always 2 persons (driver and checker) to check.

I: DTC 31 TRANSMITTER 1 PRESSURE DATA ABNORMAL

NOTE:

Refer to DTC 34 for diagnostic procedure. <Ref. to TPM(diag)-28, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

J: DTC 32 TRANSMITTER 2 PRESSURE DATA ABNORMAL

NOTE:

Refer to DTC 34 for diagnostic procedure. <Ref. to TPM(diag)-28, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

K: DTC 33 TRANSMITTER 3 PRESSURE DATA ABNORMAL

NOTE:

Refer to DTC 34 for diagnostic procedure. <Ref. to TPM(diag)-28, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

L: DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL

DTC DETECTING CONDITION:

- When comparing the data from each transmitter to the previous data, the change is large.
- The pressure exceeds what the transmitter can measure. (Excessive pressure)

TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

Step	Check	Yes	No
1 START FL TRANSMITTER. 1) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 2) Select "Transmitter ID data monitor". <Ref. to TPM(diag)-9, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 2.	Replace front left transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
2 CHECK FL TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 1 registered ID.	Are the two IDs same?	Go to step 3.	Record the received ID update as the FL transmitter. Go to step 3.
3 START FR TRANSMITTER. Use the transmitter registration tool and transmit the ID from the FR transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 4.	Replace the front right transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK FR TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 2 registered ID.	Are the two IDs same?	Go to step 5.	Record the received ID update as the FR transmitter. Go to step 5.
5 START RR TRANSMITTER. Use the transmitter registration tool and transmit the ID from the RR transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 6.	Replace the RR transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
6 CHECK RR TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 3 registered ID.	Are the two IDs same?	Go to step 7.	Record the received ID update as the RR transmitter. Go to step 7.
7 START RL TRANSMITTER. Use the transmitter registration tool and transmit the ID from the RL transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 8.	Replace the RL transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
8 CHECK RL TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 4 registered ID.	Are the two IDs same?	Go to step 9.	Record the received ID update as the RL transmitter. Go to step 9.
9 CHECK MALFUNCTION TRANSMITTER.	Is ID recorded by this procedure?	Go to step 10.	Go to step 1.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK MALFUNCTION TRANSMITTER. Check the registered ID of the transmitter indicated by DTC.	Is there checked ID in the record?	Replace the transmitter of the recorded position. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>	Replace the transmitter showing the latest ID that is not included in the registered IDs. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>

M: DTC 41 TRANSMITTER 1 FUNCTION CODE ABNORMAL

NOTE:

Refer to DTC 44 for diagnostic procedure. <Ref. to TPM(diag)-30, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

N: DTC 42 TRANSMITTER 2 FUNCTION CODE ABNORMAL

NOTE:

Refer to DTC 44 for diagnostic procedure. <Ref. to TPM(diag)-30, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

O: DTC 43 TRANSMITTER 3 FUNCTION CODE ABNORMAL

NOTE:

Refer to DTC 44 for diagnostic procedure. <Ref. to TPM(diag)-30, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

P: DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL

DTC DETECTING CONDITION:

Unexpected function codes received from each transmitter.

TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

Step	Check	Yes	No
1 START FL TRANSMITTER. 1) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 2) Select "Transmit ID Monitor". <Ref. to TPM(diag)-9, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 2.	Replace front left transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
2 CHECK FL TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 1 registered ID.	Are the two IDs same?	Go to step 3.	Record the received ID update as the FL transmitter. Go to step 3.
3 START FR TRANSMITTER. Use the transmitter registration tool and transmit the ID from the FR transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 4.	Replace the front right transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK FR TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 2 registered ID.	Are the two IDs same?	Go to step 5.	Record the received ID update as the FR transmitter. Go to step 5.
5 START RR TRANSMITTER. Use the transmitter registration tool and transmit the ID from the RR transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 6.	Replace the RR transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
6 CHECK RR TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 3 registered ID.	Are the two IDs same?	Go to step 7.	Record the received ID update as the RR transmitter. Go to step 7.
7 START RL TRANSMITTER. Use the transmitter registration tool and transmit the ID from the RL transmitter to check "Latest reception ID".	Is "Latest reception ID" updated?	Go to step 8.	Replace the RL transmitter. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>
8 CHECK RL TRANSMITTER ID. Check the ID displayed in the updated ID display and the tire 4 registered ID.	Are the two IDs same?	Go to step 9.	Record the received ID update as the RL transmitter. Go to step 9.
9 CHECK MALFUNCTION TRANSMITTER.	Is ID recorded by this procedure?	Go to step 10.	Go to step 1.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK MALFUNCTION TRANSMITTER. Check the registered ID of the transmitter indicated by DTC.	Is there checked ID in the record?	Replace the transmitter of the recorded position. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>	Replace the transmitter showing the latest ID that is not included in the registered IDs. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>

Q: DTC 51 TRANSMITTER 1 BATTERY VOLTAGE DECREASE

NOTE:

Refer to DTC 54 for diagnostic procedure. <Ref. to TPM(diag)-32, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

R: DTC 52 TRANSMITTER 2 BATTERY VOLTAGE DECREASE

NOTE:

Refer to DTC 54 for diagnostic procedure. <Ref. to TPM(diag)-32, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

S: DTC 53 TRANSMITTER 3 BATTERY VOLTAGE DECREASE

NOTE:

Refer to DTC 54 for diagnostic procedure. <Ref. to TPM(diag)-32, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

T: DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE

DTC DETECTING CONDITION:

Low battery signals received 20 times from each transmitter.

TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

Step	Check	Yes	No
1 CHECK TRANSMITTER. 1) Replace all transmitters and register their IDs. <Ref. to WT-9, TRANSMITTER (SNAP IN TYPE), REMOVAL, Tire Pressure Monitoring System.> <Ref. to TPM(diag)-9, REGISTER TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 2) Perform the Clear Memory Mode, and perform driving test.	Is the fault eliminated?	Internal battery of the transmitter had worn out. <Ref. to WT-9, TRANSMITTER (SNAP IN TYPE), REMOVAL, Tire Pressure Monitoring System.>	Replace the TPMS & keyless entry control module. <Ref. to WT-9, TPMS & KEYLESS ENTRY CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

U: DTC 61 VEHICLE SPEED IS ABNORMAL

DTC DETECTING CONDITION:

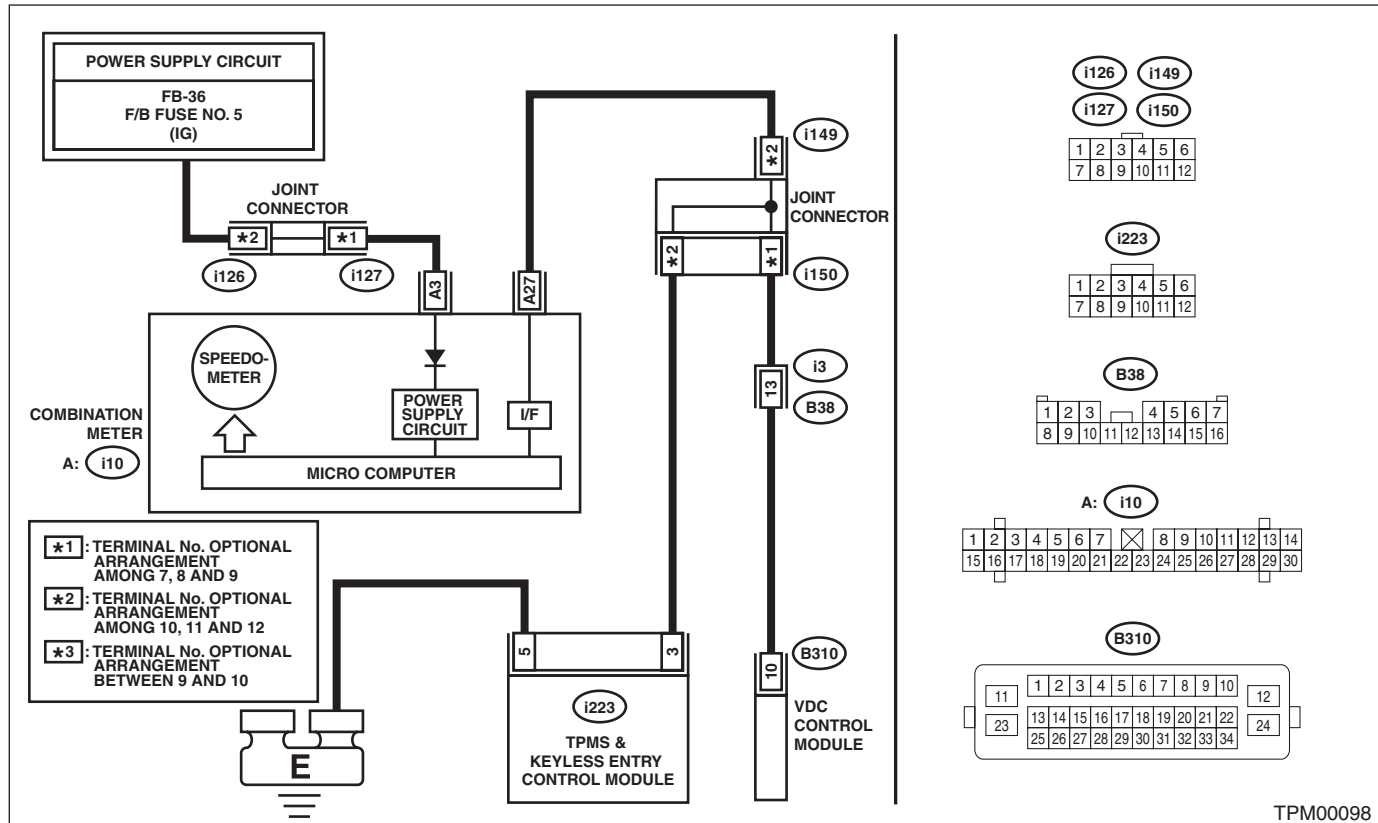
Vehicle speed function codes were received from the transmitter, but the vehicle speed signal was not input to the module.

TROUBLE SYMPTOM:

Tire pressure warning light blinks.

WIRING DIAGRAM:

Tire pressure monitoring system <Ref. to WI-62, WIRING DIAGRAM, Tire Pressure Monitoring System.>



Step	Check	Yes	No
1	CHECK TPMS & KEYLESS ENTRY CONTROL MODULE. 1) Connect an oscilloscope to the terminal No. 3 of the TPMS & keyless entry control module connector (i223). Connector & terminal (i223) No. 3 (+) — Chassis ground (—): 2) Lift up the vehicle and then drive the vehicle at 40 km/h (25 MPH) and check the vehicle speed signal at that time.	Replace the TPMS & keyless entry control module. <Ref. to WT-9, REMOVAL, Tire Pressure Monitoring System.>	Go to step 2.
2	CHECK HARNESS. 1) Disconnect the combination meter connector (i10). 2) Connect the tester to the TPMS & keyless entry control module connector (i223) and combination meter connector (i10), and measure the resistance. Connector & terminal (i223) No. 3 — (i10) No. 27:	Check the combination meter. <Ref. to IDI-11, REMOVAL, Combination Meter.>	Repair or replace the open circuit of the harness.

General Diagnostic Table

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

12.General Diagnostic Table

A: INSPECTION

Symptoms		Faulty parts
Tire pressure warning light illuminates.	Tire pressure is reduced.	• Improper tire pressure adjustment. • Punctured tire
Tire pressure warning light blinks 25 times and then illuminates.	Tire pressure monitoring system has malfunction.	• Air pressure sensor malfunction • Air pressure sensor is out of battery. • Defective TPMS & keyless entry control module • Defective combination meter • Defective vehicle harness
Tire pressure is dropping but the warning light does not illuminate.	Tire pressure warning light does not illuminate.	• Air pressure sensor is faulty. • Defective TPMS & keyless entry control module • Defective combination meter

DIFFERENTIALS

DI

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1. General Description

A: NOTE

For general description, refer to the "5AT" section.
<Ref. to 5AT-2, General Description.>

2. Transfer Clutch

A: NOTE

For removal, installation and inspection, refer to "5AT" section. <Ref. to 5AT-65, Transfer Clutch.>

3. Extension Case

A: NOTE

For removal, installation and inspection, refer to
“5AT” section. <Ref. to 5AT-63, Extension Case.>

4. Oil Seal

A: NOTE

For replacement and inspection, refer to the “5AT” section. <Ref. to 5AT-46, Extension Case Oil Seal.>

5. Center Differential Carrier

A: NOTE

For removal, installation and inspection, refer to "5AT" section. <Ref. to 5AT-72, Center Differential Carrier.>

6. Reduction Driven Gear

A: NOTE

For removal, installation and inspection, refer to "5AT" section. <Ref. to 5AT-69, Reduction Driven Gear.>

Transfer Clutch Pressure Test

TRANSFER CASE

7. Transfer Clutch Pressure Test

A: NOTE

For inspection, refer to the “5AT” section.

<Ref. to 5AT-36, Transfer Clutch Pressure Test.>

DRIVE SHAFT SYSTEM

DS

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Basic Diagnostic Procedure

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

NOTE:

- To check the harness for open or short circuits, shake problem spot or connector.
- Refer to "Check List for Interview". <Ref. to VDC(diag)-4, Check List for Interview.>

Step	Check	Yes	No
1 CHECK PRE-INSPECTION. 1) Ask the customer when and how the trouble occurred using the interview check list. <Ref. to VDC(diag)-4, Check List for Interview.> 2) Before performing diagnostics, check the component which might affect VDC problems. <Ref. to VDC(diag)-11, INSPECTION, General Description.>	Is the component that might influence the VDC problem normal?	Go to step 2.	Repair or replace each component.
2 CHECK INDICATION OF DTC. 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON and run the Subaru Select Monitor. 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).> NOTE: If the communication function of the Subaru Select Monitor cannot be executed properly, check the communication circuit. <Ref. to VDC(diag)-22, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>	Is DTC displayed?	Record the DTC. Go to step 4.	Go to step 3.
3 PERFORM GENERAL DIAGNOSTICS. 1) Perform the inspection by referring to "General Diagnostic Table". <Ref. to VDC(diag)-106, INSPECTION, General Diagnostic Table.> 2) Perform the Clear Memory Mode. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).> 5) Check the DTC is not displayed.	Do the VDC warning light and ABS warning light go off after starting the engine?	Finish the diagnosis.	Check the combination meter circuit. <Ref. to VDC(diag)-35, ABS WARNING LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-38, VDC WARNING LIGHT AND TCS OFF INDICATOR LIGHT DO NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-39, VDC WARNING LIGHT AND VDC INDICATOR LIGHT DO NOT GO OFF, Warning Light Illumination Pattern.>
4 CHECK FREEZE FRAME DATA. Using the Subaru Select Monitor, check the freeze frame data of the VDC control module.	Are freeze frame data recorded?	Record the freeze frame data. Go to step 5.	Go to step 5.

Basic Diagnostic Procedure

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step		Check	Yes	No
5	PERFORM DIAGNOSIS. 1) Refer to "List of Diagnostic Trouble Code (DTC)". NOTE: For the DTC list, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to VDC(diag)-45, LIST, List of Diagnostic Trouble Code (DTC).> 2) Correct the cause of trouble. 3) Perform the Clear Memory Mode. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Repeat step 5 until DTC is not shown.	Finish the diagnosis.

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

2. Check List for Interview

A: CHECK

Check the following item about the vehicle's state.

1. STATE OF ABS WARNING LIGHT

ABS warning light come on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not illuminate • When/How long does it come on?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, while engine is running) ☐ ON (after starting engine, engine is stopped)		
Timing	☐ Immediately after turning the ignition switch to ON ☐ Immediately after turning the ignition switch to START		
	☐ Accelerating	—	km/h
		—	MPH
	☐ While traveling at a constant speed	km/h	MPH
	☐ Decelerating	—	km/h
		—	MPH
	☐ When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	☐ When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	☐ When operating other electrical parts		
	• Part name: • Operating condition:		

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

2. STATE OF VDC WARNING LIGHT AND TCS OFF INDICATOR LIGHT

NOTE:

This Check List for Interview is applied to C4 model.

VDC warning light & TCS OFF indicator light come on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not illuminate ☐ When/How long does it illuminate?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, engine is running) ☐ ON (after starting engine, engine is at a standstill)		
Timing	☐ Immediately after turning the ignition switch to ON ☐ Immediately after turning the ignition switch to START		
	☐ While accelerating	—	km/h
		—	MPH
	☐ While driving at a constant speed	km/h	MPH
	☐ While decelerating	—	km/h
		—	MPH
	☐ When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	☐ When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	☐ When other electrical parts are operating		
	• Part name: • Operating condition:		

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

3. STATE OF VDC WARNING LIGHT & VDC INDICATOR LIGHT

NOTE:

This Check List for Interview is applied to other models than C4 model.

VDC warning light & VDC indicator light illuminates.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not illuminate • When/How long does it illuminate?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, engine is running) ☐ ON (after starting engine, engine is at a standstill)		
Timing	☐ Immediately after turning the ignition switch to ON ☐ Immediately after turning the ignition switch to START		
	☐ While accelerating	—	km/h
		—	MPH
	☐ While driving at a constant speed	km/h	MPH
	☐ While decelerating	—	km/h
		—	MPH
	☐ When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	☐ When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	☐ When other electrical parts are operating		
	• Part name: • Operating condition:		

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

4. STATE OF VDC INDICATOR LIGHT

NOTE:

This Check List for Interview is applied to C4 model.

VDC operation indicator light illuminate.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not illuminate • When/How long does it illuminate?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, engine is running) ☐ ON (after starting engine, engine is at a standstill)		
Timing	☐ Immediately after turning the ignition switch to ON ☐ Immediately after turning the ignition switch to START		
	☐ While accelerating	— km/h	
		— MPH	
	☐ While driving at a constant speed	km/h	MPH
	☐ While decelerating	— km/h	
		— MPH	
	☐ When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	☐ When turning to the left	Steering angle:	deg
		Steering time:	Sec.
☐ When other electrical parts are operating • Part name: • Operating condition:			

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

5. STATE OF TCS OFF INDICATOR LIGHT

NOTE:

This Check List for Interview is applied to other models than C4 model.

TCS OFF indicator light comes on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not illuminate ☐ When/How long does it illuminate?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, engine is running) ☐ ON (after starting engine, engine is at a standstill)		
Timing	☐ Immediately after turning the ignition switch to ON ☐ Immediately after turning the ignition switch to START		
	☐ While accelerating	—	km/h
		—	MPH
	☐ While driving at a constant speed	km/h	MPH
	☐ While decelerating	—	km/h
		—	MPH
	☐ When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	☐ When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	☐ When other electrical parts are operating		
	• Part name: • Operating condition:		

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

6. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Others:
	b) Ambient temperature	°C (°F)
	c) Road	☐ Inner city ☐ Suburbs ☐ Highway ☐ Local street ☐ Uphill ☐ Downhill ☐ Paved road ☐ Gravel road ☐ Muddy road ☐ Sandy place ☐ Straight road ☐ Sharp curve ☐ Gentle curve ☐ S-curve ☐ Road with a slope on both sides ☐ Others:
	d) Road surface	☐ Dry ☐ Wet ☐ Covered with fresh snow ☐ Covered with hardened snow ☐ Frozen slope ☐ Others:

Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Condition	a) Brakes	Deceleration: G	
		☐ continuous / ☐ intermittent	
	b) Accelerator	Acceleration: G	
		☐ continuous / ☐ intermittent	
	c) Vehicle speed	km/h	MPH
		☐ Advancing ☐ When accelerating ☐ While decelerating ☐ At low speed ☐ When 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:	mm (in)
		Front LH tire:	mm (in)
		Rear RH tire:	mm (in)
		Rear LH tire:	mm (in)
	f) Steering wheel	☐ Sharp turning ☐ Gentle turning ☐ Straight forward motion ☐ Gentle return ☐ Sharp return	
	g) Tire/Wheel size	☐ Specified size ☐ Except specification ()	
	h) Tire variation	☐ Summer tire ☐ Studless tire (Brand:)	
	i) Tire chain is attached:	☐ Yes / ☐ No	
	j) Using T-type tires:	☐ Yes / ☐ No	
	k) Condition of suspension alignment:		
l) Load condition:			
m) Repaired parts are used:	☐ Yes / ☐ No		
• Content:			
n) Others:			

3. General Description

A: CAUTION

1. SRS AIRBAG SYSTEM

Airbag system wiring harness is routed near the ABS wheel speed sensor and VDCCM&H/U.

CAUTION:

- Do not use electrical test equipment on wiring harness and connector circuits of the airbag system.
- Be careful not to damage the airbag system wiring harness when servicing the ABS wheel speed sensor and VDCCM&H/U.

B: INSPECTION

Before performing diagnosis, check the following items which might affect VDC problems.

1. BATTERY

Measure the battery voltage and check electrolyte.

Standard voltage: 12 V or more

Specific gravity: 1.260 or more

2. GROUND

Check the tightening torque of ground (GB-7) bolt of VDC.

Tightening torque:

13 N·m (1.3 kgf-m, 9.6 ft-lb)

3. BRAKE FLUID

- 1) Check the brake fluid level.
- 2) Check the brake fluid for leaks.

4. HYDRAULIC UNIT

Check the hydraulic unit.

- With brake tester <Ref. to VDC-9, CHECKING THE HYDRAULIC UNIT VDC OPERATION WITH BRAKE TESTER, INSPECTION, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
- Without brake tester <Ref. to VDC-8, CHECKING THE HYDRAULIC UNIT VDC OPERATION USING A PRESSURE GAUGE, INSPECTION, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

5. BRAKE DRAG

Check for brake drag.

6. BRAKE PAD AND ROTOR

Check the brake pad and rotor.

- Front <Ref. to BR-13, INSPECTION, Front Brake Pad.> <Ref. to BR-14, INSPECTION, Front Disc Rotor.>
- Rear <Ref. to BR-20, INSPECTION, Rear Brake Pad.> <Ref. to BR-22, INSPECTION, Rear Disc Rotor.>

7. TIRE

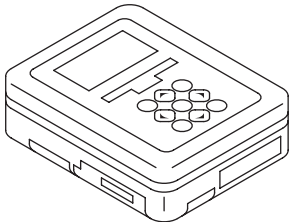
Check the tire specifications, tire wear and air pressure. <Ref. to WT-2, SPECIFICATION, General Description.>

General Description

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

C: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for the electrical system.

2. GENERAL TOOL

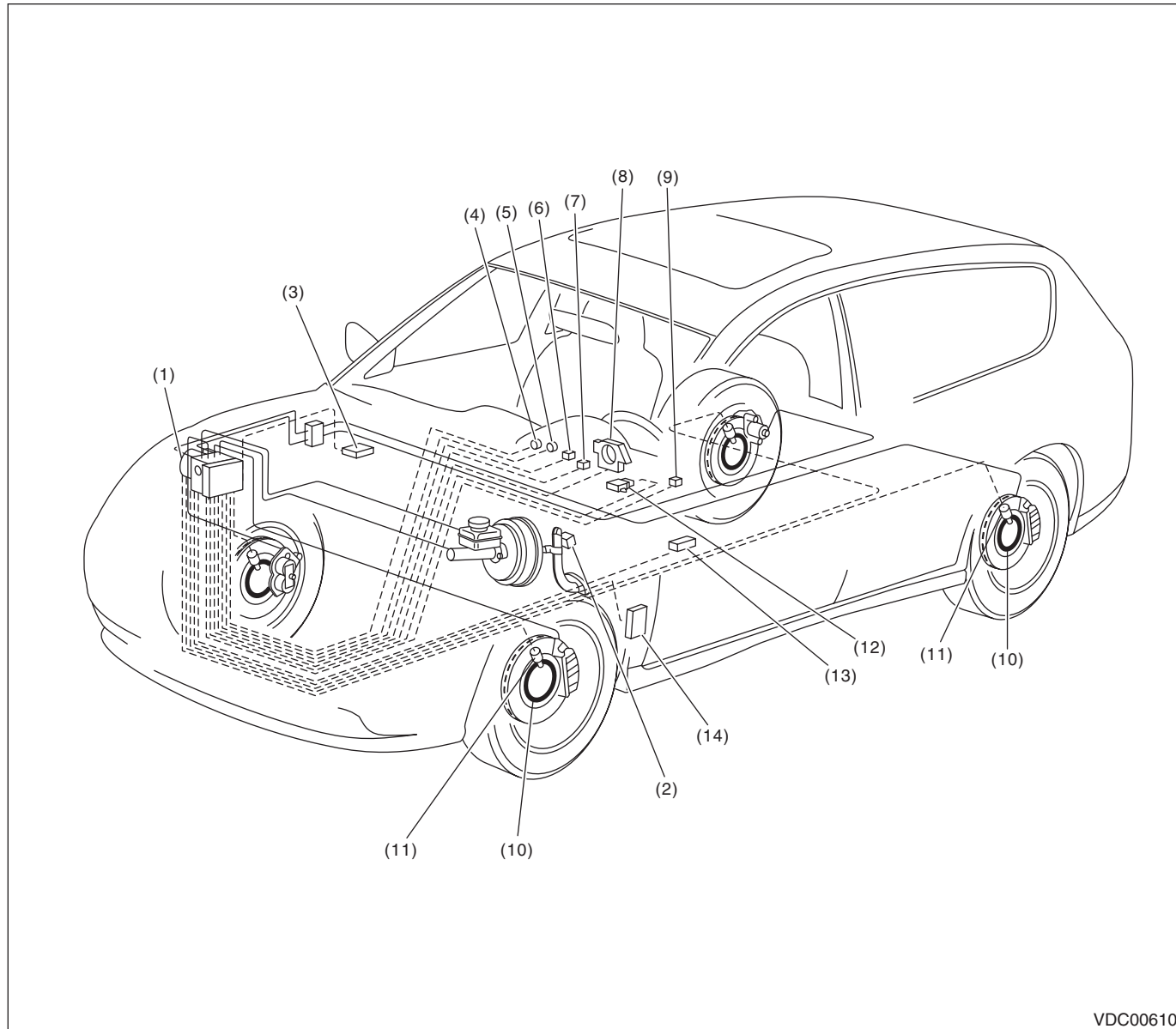
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

Electrical Component Location

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

4. Electrical Component Location

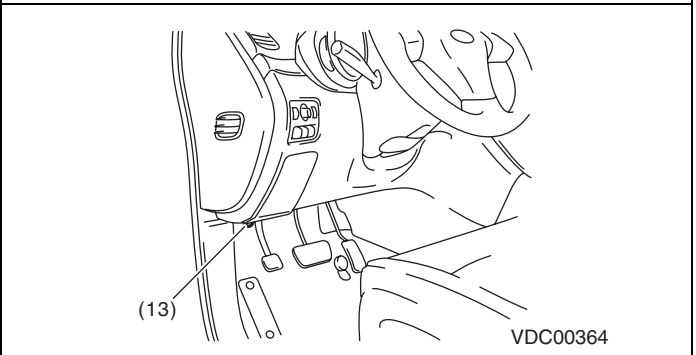
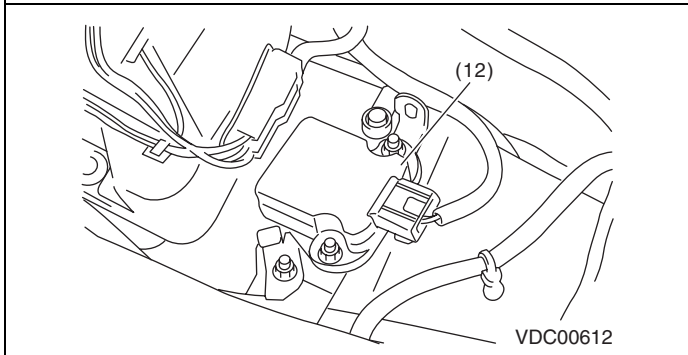
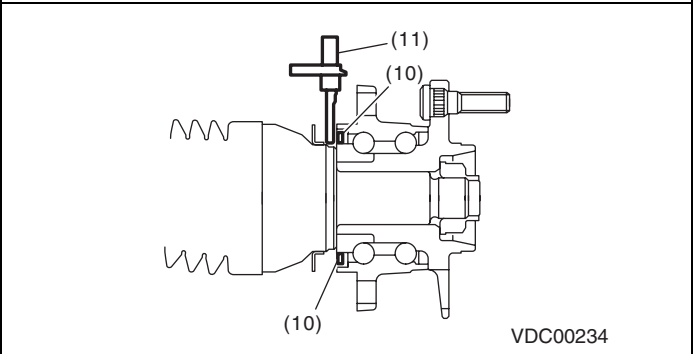
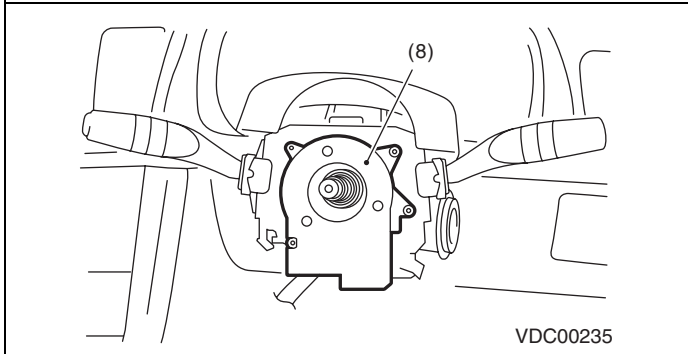
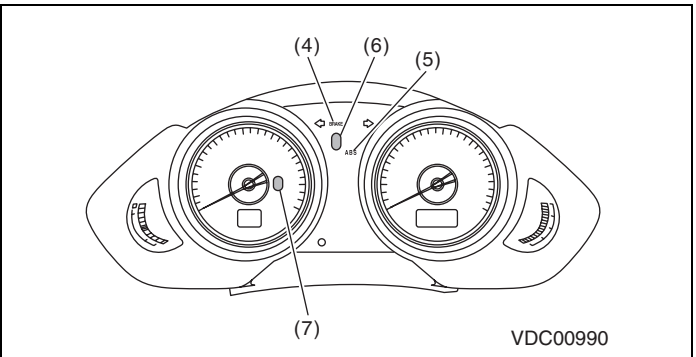
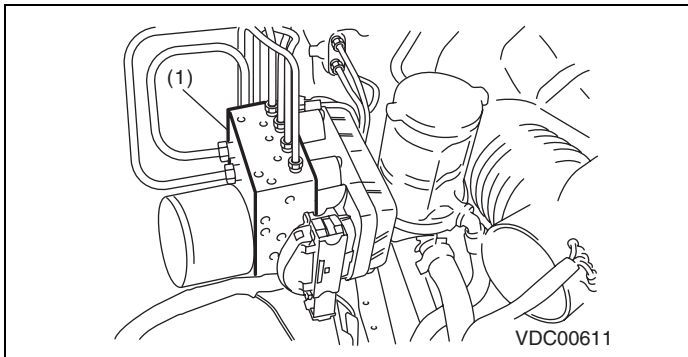
A: LOCATION



- | | | |
|---|---|--|
| (1) VDC control module and hydraulic control unit (VDCCM&H/U) | (6) VDC indicator light (C4 model)
TCS OFF indicator light (except for C4 model) | (11) ABS wheel speed sensor |
| (2) Stop light and brake switch | (7) VDC warning light & TCS OFF indicator light (C4 model)
VDC warning light & VDC indicator light (except for C4 model) | (12) Yaw rate & G sensor |
| (3) Engine control module (ECM) | (8) Steering angle sensor | (13) Data link connector |
| (4) Brake warning light (EBD warning light) | (9) TCS OFF switch | (14) Transmission control module (TCM) |
| (5) ABS warning light | (10) Magnetic encoder | |

Electrical Component Location

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

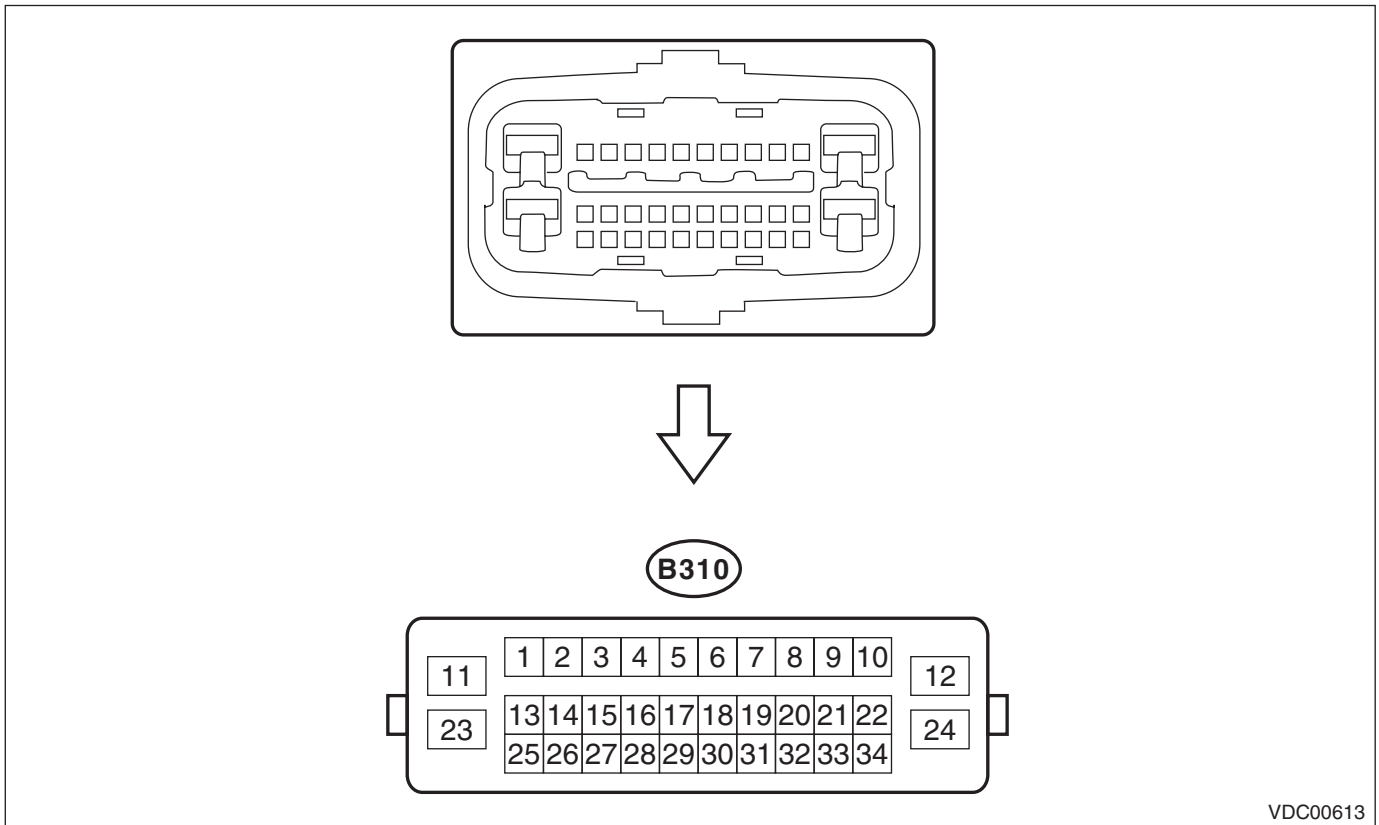


Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

5. Control Module I/O Signal

A: ELECTRICAL SPECIFICATION



Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

NOTE:

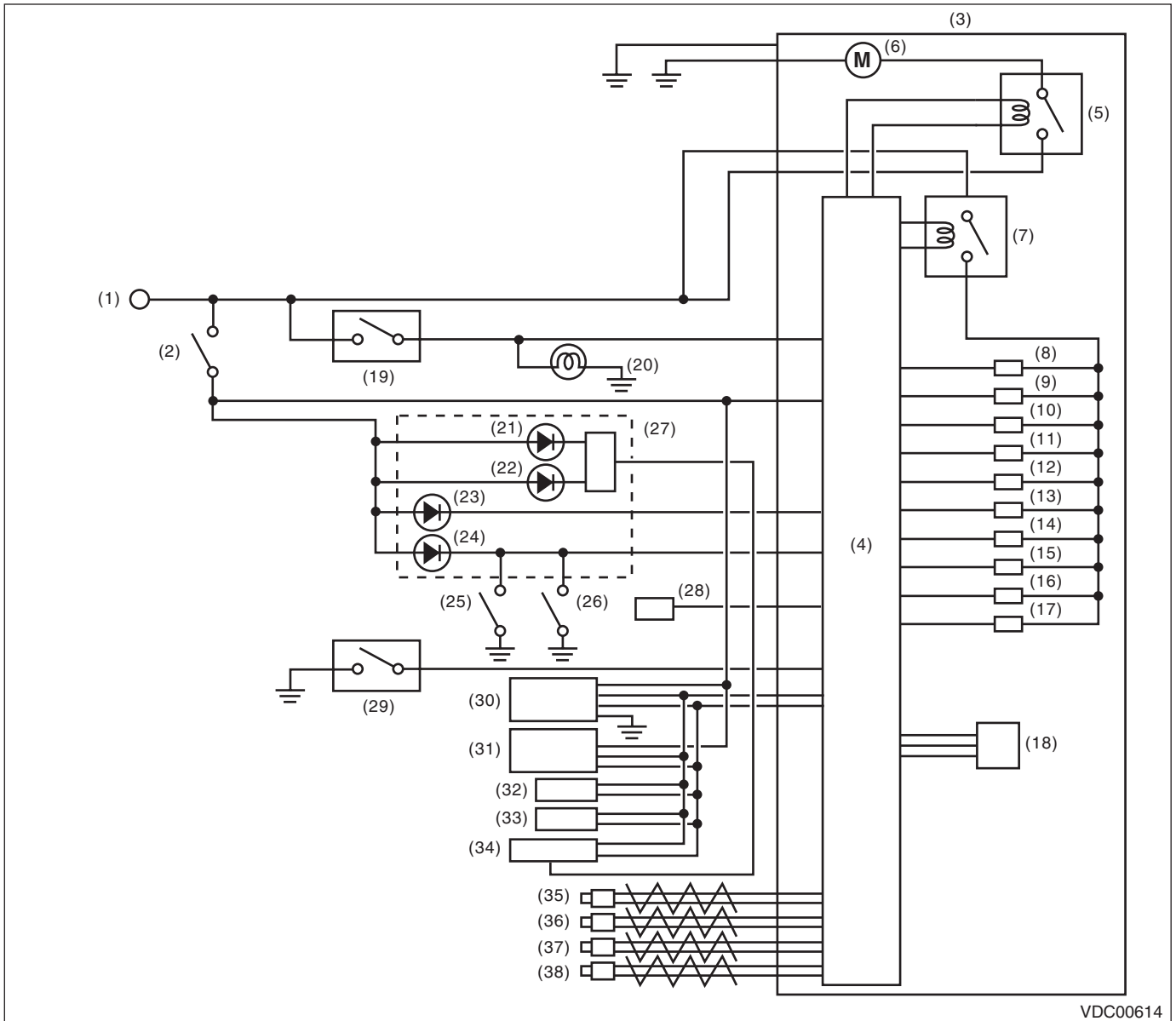
- Terminal numbers in VDCCM&H/U connector are shown in the figure.
- When the connector is removed from VDCCM&H/U, the ABS warning light, EBD warning light, VDC warning light & TCS OFF indicator light illuminate.

Content			Terminal No. (+) — (–)	Input/Output signal
				Measured value and measuring conditions
Power supply			34 — 11	10 — 15 V when the ignition switch is ON.
ABS wheel speed sensor	Front LH wheel	Power supply	18 — 11	8 — 15 V
		Signal	17	5 — 17 mA: Rectangle waveform
	Front RH wheel	Power supply	6 — 11	8 — 15 V
		Signal	5	5 — 17 mA: Rectangle waveform
	Rear LH wheel	Power supply	4 — 11	8 — 15 V
		Signal	3	5 — 17 mA: Rectangle waveform
	Rear RH wheel	Power supply	16 — 11	8 — 15 V
		Signal	15	5 — 17 mA: Rectangle waveform
Yaw rate & G sensor			25 — 13	Serial communication
Steering angle sensor				
CAN communication line (+)			25	Serial communication
CAN communication line (–)			13	Serial communication
Valve relay power supply			12 — 11	Normally 10 — 15V
Motor power supply			24 — 23	10 — 15 V when motor is ON
ABS warning light			8 — 11	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds, and 1.5 V or less after 1.5 seconds passed
Brake warning light (EBD warning light)			7 — 11	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds, and 1.5 V or less after 1.5 seconds passed
Stop light switch			1 — 11	1.5 V or less when the stop light is OFF; otherwise, 10 — 15 V when the stop light is ON.
Subaru Select Monitor			19 — 11	0 ↔ 12 V pulse (in communication)
Vehicle speed output signal			10	Models without vehicle speed sensitive windshield wipers: 0 ↔ 5 V pulse Models with vehicle speed sensitive windshield wipers: 0 ↔ 12 V pulse
TCS OFF switch			30 — 11	0.5 Ω or less when the OFF switch is ON; 1 MΩ or more when the switch is OFF.
Ground			11	—

Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

B: WIRING DIAGRAM



Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

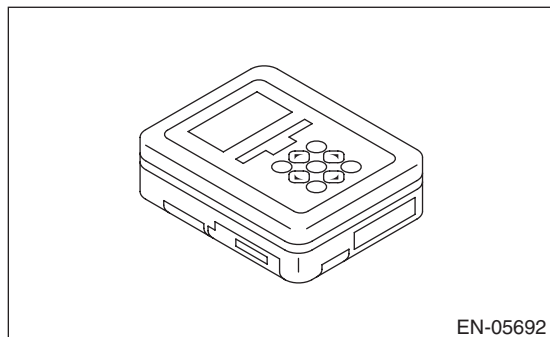
(1) Battery	(14) Rear inlet solenoid valve RH	(27) Combination meter
(2) Ignition switch	(15) Rear outlet solenoid valve RH	(28) Data link connector
(3) VDC control module and hydraulic control unit (VDCCM&H/U)	(16) Linear valve 1	(29) TCS OFF switch
(4) VDC control module	(17) Linear valve 2	(30) Steering angle sensor
(5) Motor relay	(18) Pressure sensor	(31) Yaw rate & G sensor
(6) Motor	(19) Stop light and brake switch	(32) Transmission control module (TCM)
(7) Valve relay	(20) Stop light	(33) Engine control module (ECM)
(8) Front inlet solenoid valve LH	(21) VDC indicator light (C4 model) TCS OFF indicator light (except for C4 model)	(34) Body integrated unit
(9) Front outlet solenoid valve LH	(22) VDC warning light & TCS OFF indicator light (C4 model) VDC warning light & VDC indicator light (except for C4 model)	(35) Front ABS wheel speed sensor LH
(10) Front inlet solenoid valve RH	(23) ABS warning light	(36) Front ABS wheel speed sensor RH
(11) Front outlet solenoid valve RH	(24) Brake warning light	(37) Rear ABS wheel speed sensor LH
(12) Rear inlet solenoid valve LH	(25) Parking brake switch	(38) Rear ABS wheel speed sensor RH
(13) Rear outlet solenoid valve LH	(26) Brake fluid level switch	

6. Subaru Select Monitor

A: OPERATION

1. HOW TO USE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to VDC(diag)-12, SPECIAL TOOL, PREPARATION TOOL, General Description.>



2) Prepare PC with Subaru Select Monitor installed.

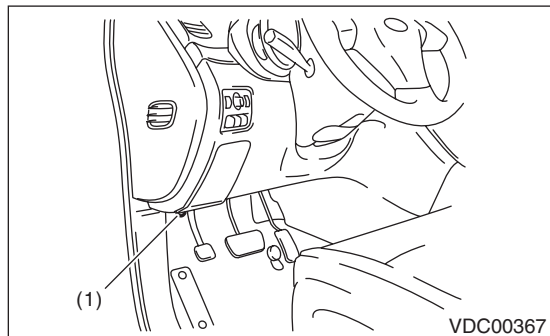
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to SDI.

5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



(1) Data link connector

CAUTION:

Do not connect the scan tools other than the Subaru Select Monitor.

6) Start the PC.

7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".

NOTE:

For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

8) If VDC and Subaru Select Monitor cannot communicate, check the communication circuit. <Ref. to VDC(diag)-22, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

9) Record the DTC and data.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

2. READ CURRENT DATA

- 1) On «Main Menu» display, select {Each System Check}.
 - 2) On «System Selection Menu» display, select {Brake Control System}.
 - 3) Click the [OK] button after {VDC} is displayed.
 - 4) On «Brake Control Diagnosis» display, select {Current Data Display & Save}.
 - 5) On «Data Display Menu» display, select the data display method.
 - 6) Using the scroll key, scroll the display screen up or down until necessary data is shown.
- A list of the support data is shown in the following table.

Display	Contents to be displayed	Unit of measure
FR Wheel Speed	Wheel speed detected by front ABS wheel speed sensor RH is displayed.	km/h or MPH
FL Wheel Speed	Wheel speed detected by front ABS wheel speed sensor LH is displayed.	km/h or MPH
RR Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor RH is displayed.	km/h or MPH
RL Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor LH is displayed.	km/h or MPH
Longitudinal G Sensor	Vehicle longitudinal acceleration detected by G sensor is displayed.	m/s ²
Lateral G Sensor	Vehicle lateral acceleration detected by G sensor is displayed.	m/s ²
IG power supply voltage	Voltage supplied to VDCCM&H/U is displayed.	V
Steering Angle Sensor	Steering angle detected by steering angle sensor is displayed.	deg
Yaw Rate Sensor	Vehicle angular speed detected by yaw rate sensor is displayed.	deg/s
Pressure Sensor	Brake fluid pressure detected by pressure sensor is displayed.	bar
ABS Control Flag	ABS control condition is displayed.	ON or OFF
EBD Control Flag	EBD control condition is displayed.	ON or OFF
Brake Switch	Brake ON/OFF is displayed.	ON or OFF
ABS Warning Light	ON operation of the ABS warning light is displayed.	ON or OFF
EBD Warning Light	ON operation of the EBD warning light is displayed.	ON or OFF
Motor Relay Signal	Motor relay operation signal is displayed.	ON or OFF
Motor Relay Monitor	Motor relay monitor signal is displayed.	ON or OFF
TCS Control Flag	TCS control condition is displayed.	ON or OFF
Valve Relay Signal	Valve relay operation signal is displayed.	ON or OFF
VDC Control Flag	VDC control condition is displayed.	ON or OFF
VDC Warning Light	ON operation of the VDC warning light is displayed.	ON or OFF
OFF Lamp	ON/OFF condition of TCS OFF indicator light is displayed.	ON or OFF
E/G Control Stop Flag	Engine control command signal is displayed.	1 or 0
OFF SW Signal	Operation condition of TCS OFF switch is displayed.	ON or OFF
Fail Safe Relay Signal	Motor fail safe relay operation signal is displayed.	ON or OFF

NOTE:

For details concerning the operation procedure, refer to “PC application help for Subaru Select Monitor”.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

3. FUNCTION CHECK

Display	Contents to be displayed	Reference
ABS Sequence Control Mode	Operate the valve and pump motor continuously to perform the ABS sequence control.	<Ref. to VDC-11, ABS Sequence Control.>
VDC Check Mode	Operate the valve and pump motor continuously to perform the VDC sequence control.	<Ref. to VDC-14, VDC Sequence Control.>
Set up mode for Neutral of Steering Angle Sensor & Lateral G Sensor 0 point	Set the steering angle sensor neutral position and the yaw rate & G sensor "0" point.	<Ref. to VDC-18, Steering Angle Sensor.>

4. FREEZE FRAME DATA

NOTE:

- Data stored at the time of trouble occurrence is shown on display.
- Each time a trouble occurs, the latest information is stored in the freeze frame data in memory.

Display	Contents to be displayed
IG counter	Number of ignition switch ON is displayed.
Trouble Code	Recorded trouble code is displayed.
FR Wheel Speed	Wheel speed detected by front ABS wheel speed sensor RH is displayed in km/h or MPH.
FL Wheel Speed	Wheel speed detected by front ABS wheel speed sensor LH is displayed in km/h or MPH.
RR Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor RH is displayed in km/h or MPH.
RL Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor LH is displayed in km/h or MPH.
Vehicle Speed	Vehicle speed calculated by VDC control module is displayed.
G Sensor First Axis(GL1)	The sensor value for a 45° angle crossed 2 axis G sensor is displayed.
G Sensor Sec Axis(GL2)	
Yaw Rate Sensor Output	Vehicle angular speed detected by yaw rate sensor is displayed.
ABS_CM Power Voltage	Voltage supplied to VDC control module is displayed.
Steer Angle Sensor Op	Steering angle detected by steering angle sensor is displayed.
Pressure Sensor Output	Brake fluid pressure detected by pressure sensor is displayed.
Engine Speed	Engine speed on malfunction occurrence is displayed.
Accel. Opening Angle	Acceleration opening is displayed.
Gear Position	Gear position on malfunction occurrence is displayed.
Steering Angle Sens Code	Recorded trouble code of steering angle sensor is displayed.
ABS Control Flag	ABS control condition is displayed.
EBD Control Flag	EBD control condition is displayed.
Brake Switch	Brake ON/OFF is displayed.
TCS Control Flag	TCS control condition is displayed.
VDC Control Flag	VDC control condition is displayed.
E/G Control Stop Flag	Engine control command signal is displayed.
Steering angle flag	Whether the absolute angle was determined is displayed.
OFF SW Signal	Operation condition of TCS OFF switch is displayed.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

B: INSPECTION

1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

DETECTING CONDITION:

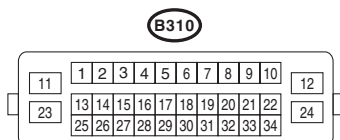
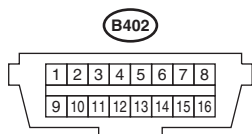
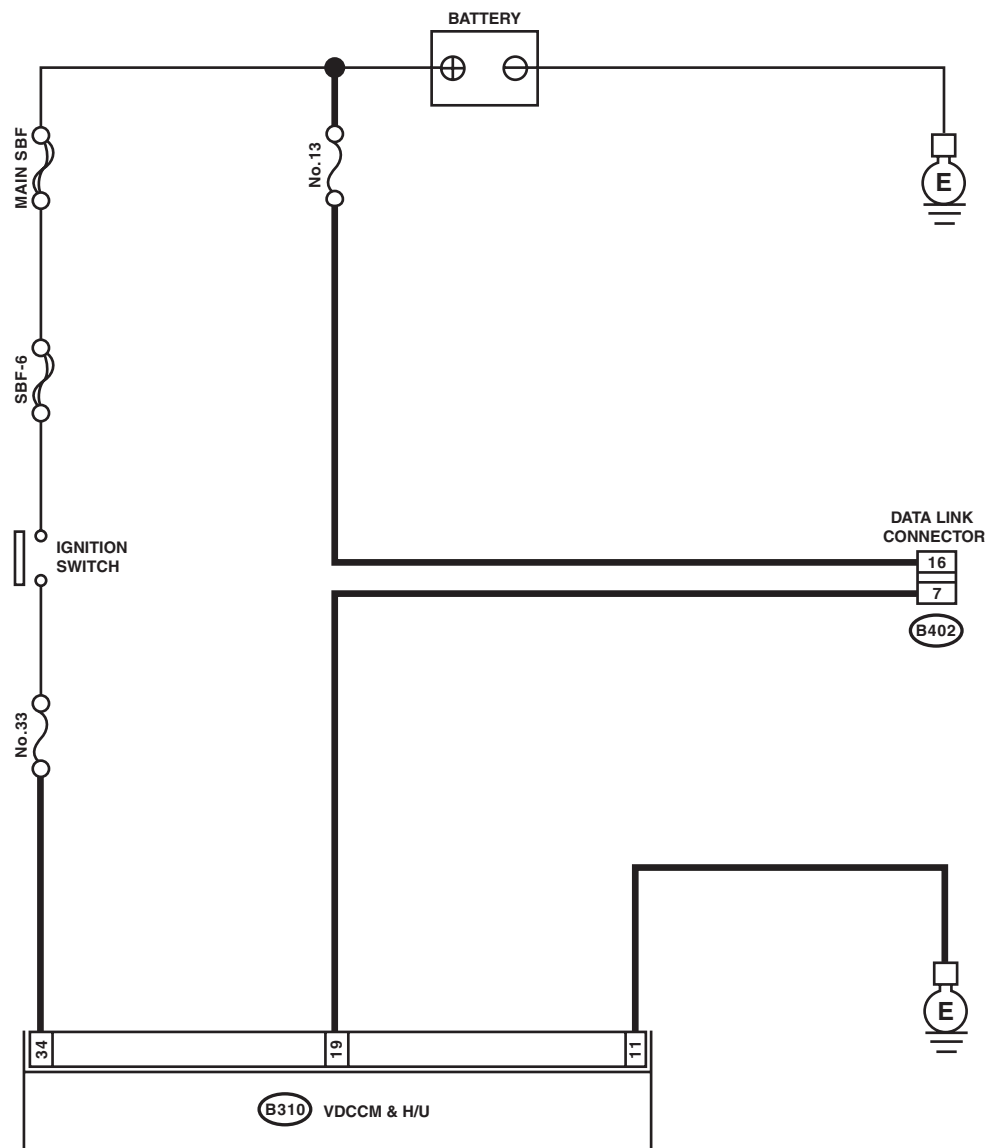
Defective harness connector

TROUBLE SYMPTOM:

Communication is impossible between VDC and Subaru Select Monitor.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00660

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK IGNITION SWITCH.	Is the ignition switch ON?	Go to step 2.	Turn the ignition switch to ON, and select VDC mode using Subaru Select Monitor.
2 CHECK BATTERY. 1) Turn the ignition switch to OFF. 2) Measure the battery voltage.	Is the voltage 11 V or more?	Go to step 3.	Charge or replace the battery.
3 CHECK BATTERY TERMINAL.	Is there poor contact at battery terminal?	Repair or tighten the battery terminal.	Go to step 4.
4 CHECK SUBARU SELECT MONITOR COMMUNICATION. 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be executed normally.	Is the system name displayed on Subaru Select Monitor?	Go to step 8.	Go to step 5.
5 CHECK SUBARU SELECT MONITOR COMMUNICATION. 1) Turn the ignition switch to OFF. 2) Disconnect the VDCCM&H/U connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Is the system name displayed on Subaru Select Monitor?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
6 CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the VDCCM&H/U, ECM and TCM. 3) Measure the resistance between data link connector and chassis ground. Connector & terminal (B402) No. 7 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
7 CHECK HARNESS CONNECTOR BETWEEN VDCCM&H/U AND DATA LINK CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between data link connector and chassis ground. Connector & terminal (B402) No. 7 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 8.	Repair the harness and connector between each control module and data link connector.
8 CHECK HARNESS CONNECTOR BETWEEN VDCCM&H/U AND DATA LINK CONNECTOR. Measure the resistance between VDCCM&H/U connector and data link connector. Connector & terminal (B310) No. 19 — (B402) No. 7:	Is the resistance less than 1 Ω?	Go to step 9.	Repair harness and connector between VDCCM&H/U and data link connector.
9 CHECK INSTALLATION OF VDCCM&H/U CONNECTOR. Turn the ignition switch to OFF.	Is the VDCCM&H/U connector inserted into VDCCM&H/U until the clamp locks onto it?	Go to step 10.	Insert VDCCM&H/U connector into VDCCM&H/U.
10 CHECK POWER SUPPLY CIRCUIT. 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the ignition power supply voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 34 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 11.	Repair open circuit in harness between VDCCM&H/U and battery.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
11 CHECK HARNESS CONNECTOR BETWEEN VDCCM&H/U AND CHASSIS GROUND. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Measure the resistance of harness between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 12.	Repair the open circuit of VDCCM&H/U ground harness and poor contact of connector.
12 CHECK POOR CONTACT OF CONNECTOR.	Is there poor contact of control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

7. Read Diagnostic Trouble Code (DTC)

A: OPERATION

- 1) On «Main Menu» display, select {Each System Check}.
- 2) On «System Selection Menu» display, select {Brake Control System}.
- 3) Click the [OK] button after {VDC} is displayed.
- 4) On «Brake Control Diagnosis» display, select {Diagnostic Code(s) Display}.
- 5) Record the DTC and data.

NOTE:

- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
- For details concerning DTCs, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>
- Up to 3 DTCs are displayed in the order of detection.

Display	Contents to be displayed
Latest	The latest DTC is displayed on Subaru Select Monitor display screen.
(Old)	The latest DTC from the history of previous problems is displayed on Subaru Select Monitor display screen.
(Older)	The second latest DTC from the history of previous problems is displayed on the Subaru Select Monitor display screen.

8. Inspection Mode

A: PROCEDURE

Reproduce the malfunction occurrence condition as much as possible.

Drive the vehicle at least ten minutes.

NOTE:

Make sure the vehicle is not dragged to one side under usual driving condition.

9. Clear Memory Mode

A: OPERATION

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu», select the {Brake Control System}.
- 3) Click the [OK] button after the {VDC} is displayed.
- 4) On the «Brake Control Diagnosis» display screen, select the {Clear Memory}.
- 5) When the “Clear Memory?” is shown on the screen, click the “YES” button.
- 6) When “Done” and “Turn off the ignition switch” is shown on the display screen, turn the ignition switch to OFF.

NOTE:

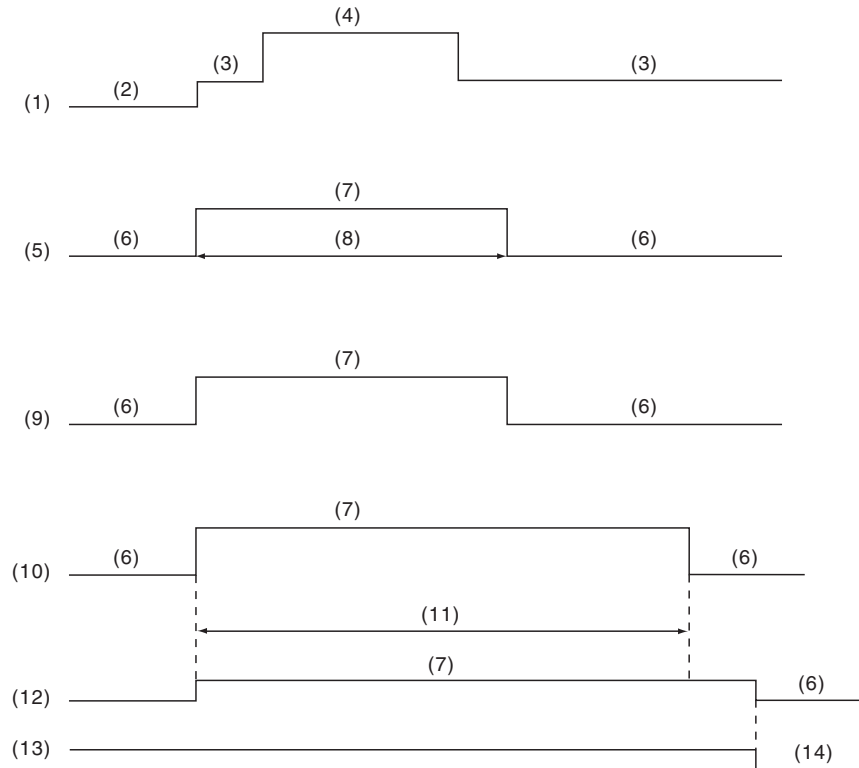
For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

10.Warning Light Illumination Pattern

A: INSPECTION



VDC00214

- | | | |
|-----------------------|--|--|
| (1) Ignition switch | (6) Light OFF | (11) Several seconds (depending on engine coolant temperature) |
| (2) OFF | (7) Light ON | (12) Brake warning light (EBD warning light) |
| (3) ON | (8) 1.5 seconds | (13) Parking brake |
| (4) Engine start | (9) VDC indicator light (C4 model)
TCS OFF indicator light (except for C4 model) | (14) Released |
| (5) ABS warning light | (10) VDC warning light & TCS OFF indicator light (C4 model)
VDC warning light & VDC indicator light (except for C4 model) | |

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

1) When warning lights or indicator lights do not illuminate in accordance with this illumination pattern, there must be an electrical malfunction.

2) When warning lights or indicator lights remain constantly OFF, check the combination meter circuit or CAN communication circuit. <Ref. to VDC(diag)-30, VDC WARNING LIGHT, TCS OFF INDICATOR LIGHT AND VDC INDICATOR LIGHT DO NOT COME ON, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-31, VDC WARNING LIGHT AND VDC INDICATOR LIGHT, TCS OFF INDICATOR LIGHT DO NOT COME ON, Warning Light Illumination Pattern.>

3) When ABS warning light does not go off, check the combination meter circuit. <Ref. to VDC(diag)-35, ABS WARNING LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.>

4) When the VDC warning light & TCS OFF indicator light (C4 model), VDC warning light & VDC indicator light (except for C4 model), VDC indicator light (C4 model) or TCS OFF indicator light (except for C4 model) does not go off, check the combination meter circuit or CAN communication circuit. <Ref. to VDC(diag)-38, VDC WARNING LIGHT AND TCS OFF INDICATOR LIGHT DO NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-39, VDC WARNING LIGHT AND VDC INDICATOR LIGHT DO NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-40, VDC INDICATOR LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-41, TCS OFF INDICATOR LIGHT DO NOT GO OFF, Warning Light Illumination Pattern.>

NOTE:

- Even though the ABS warning light does not go off after 1.5 seconds from ABS warning light illumination, the ABS system operates normally when the warning light goes off while driving at approximately 12 km/h (7 MPH). However, the ABS system does not work while the ABS warning light is illuminated.
- If the vehicle is parked under a low temperature for a specified time, it may take several minutes before VDC warning light & TCS OFF indicator light (C4 model) or VDC warning light & VDC indicator light (except for C4 model) goes off. This is not defective because it is resulted from low engine coolant temperature.
- With the vehicle jacked-up/lifted-up or set on free rollers, when the wheels lock or spin after starting the engine, the ABS warning light, VDC warning light & TCS OFF indicator light (C4 model) or VDC warning light & VDC indicator light (except for C4 model) may illuminate because the VDCCM&H/U detects the abnormal condition from the ABS wheel speed sensors. In this case, this is not a malfunction. Perform the Clear Memory Mode.

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

B: VDC WARNING LIGHT, TCS OFF INDICATOR LIGHT AND VDC INDICATOR LIGHT DO NOT COME ON

NOTE:

This diagnosis is applied to C4 model.

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication

TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), the VDC indicator light, VDC warning light & TCS OFF indicator light do not become lit.

NOTE:

When the TCS OFF switch is pressed for 10 seconds or more, the TCS OFF indicator light turns off and switch operations thereafter will not be accepted. When turning the ignition switch from OFF to ON, the OFF operation enabled status is restored.

Step	Check	Yes	No
1 CHECK OTHER INDICATOR LIGHT. Turn the ignition switch to ON.	Does other indicator light illuminate soon after "ON"?	Go to step 2.	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>
2 CHECK VDCCM. Connect the Subaru Select Monitor, and display the current data of VDCCM without starting the engine. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>	Is "VDC Warning Light" output set to ON?	Go to step 3.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
3 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 4.
4 CHECK COMBINATION METER. Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is combination meter OK?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Replace the combination meter. <Ref. to IDI-11, Combination Meter.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

C: VDC WARNING LIGHT AND VDC INDICATOR LIGHT, TCS OFF INDICATOR LIGHT DO NOT COME ON

NOTE:

This diagnosis is applied to models other than C4 model.

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication

TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), VDC warning light & VDC indicator light and TCS OFF indicator light do not illuminate.

NOTE:

When the TCS OFF switch is pressed for 10 seconds or more, the TCS OFF indicator light turns off and switch operations thereafter will not be accepted. When turning the ignition switch from OFF to ON, the OFF operation enabled status is restored.

Step	Check	Yes	No
1 CHECK OTHER INDICATOR LIGHT. Turn the ignition switch to ON.	Does other indicator light illuminate soon after "ON"?	Go to step 2.	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>
2 CHECK VDCCM. Connect the Subaru Select Monitor, and display the current data of VDCCM without starting the engine. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>	Is "VDC Warning Light" output set to ON?	Go to step 3.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
3 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 4.
4 CHECK COMBINATION METER. Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is combination meter OK?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Replace the combination meter. <Ref. to IDI-11, Combination Meter.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

D: ABS WARNING LIGHT DOES NOT COME ON

DETECTING CONDITION:

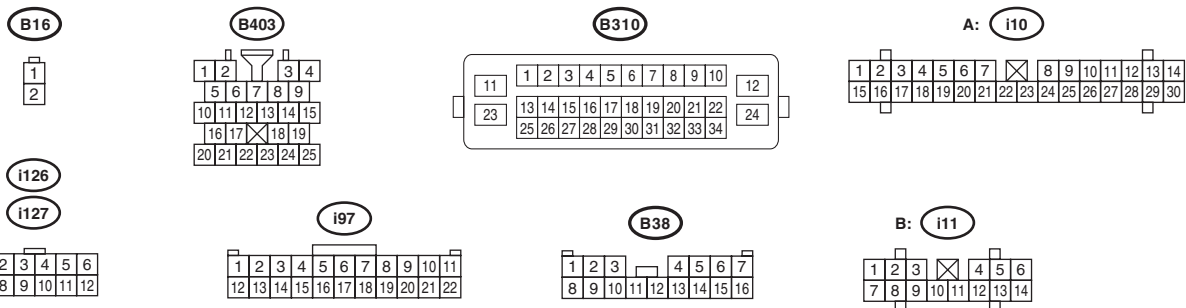
- Defective combination meter
- Defective harness

TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), ABS warning light does not illuminate.

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Parking brake / brake fluid level warning light system <Ref. to WI-156, Parking Brake / Brake Fluid Level Warning Light System.>



VDC(diag)-33

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OTHER LIGHTS TURN ON. Turn the ignition switch to ON. (engine OFF)	Do other warning lights illuminate?	Go to step 2.	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>
2 READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 3.
3 CHECK GROUND SHORT CIRCUIT OF HARNESS. 1) Turn the ignition switch to OFF. 2) Disconnect the connector (B310) from the VDCCM&H/U. 3) Disconnect the connector (i11) from combination meter. 4) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 8 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the harness connector between VDCCM&H/U and combination meter.
4 CHECK VDCCM. 1) Connect the connector (B310) to VDCCM&H/U. 2) Turn the ignition switch to ON. 3) Measure the resistance between the combination meter connector and chassis ground soon after the ignition switch is turned to ON (within 1.5 seconds). Connector & terminal (i11) No. 6 — Chassis ground:	Is the resistance 1 MΩ or more?	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

E: ABS WARNING LIGHT DOES NOT GO OFF

DETECTING CONDITION:

- Defective combination meter
- Open circuit of harness

TROUBLE SYMPTOM:

When starting the engine, the ABS warning light is kept ON.

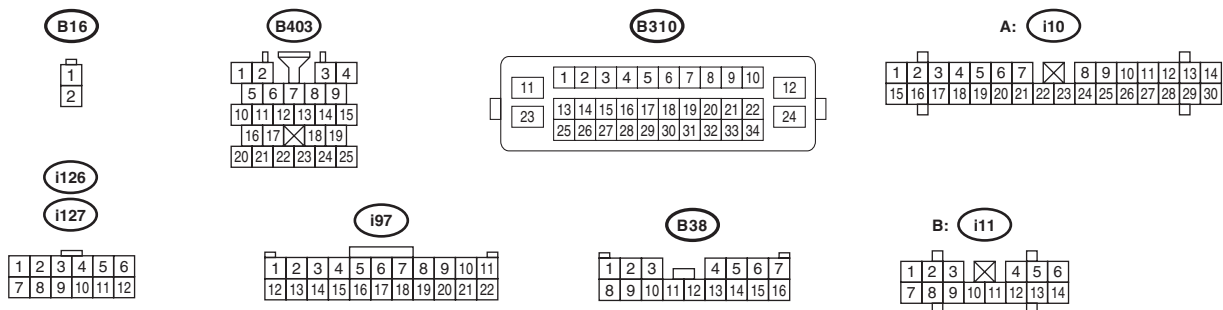
VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>

Wiring diagram for the ABS system. The diagram shows the power flow from the BATTERY through the MAIN SBF and SBF-6 to the IGNITION SWITCH. The IGNITION SWITCH is connected to a No. 5 terminal, which then splits to terminals *1 and *2. Terminal *1 is connected to the BRAKE WARNING LIGHT, and terminal *2 is connected to the ABS WARNING LIGHT. The BRAKE WARNING LIGHT is also connected to the BRAKE FLUID LEVEL SWITCH (B16) and the PARKING BRAKE SWITCH (B404). The ABS WARNING LIGHT is connected to the ABS REVERSE CIRCUIT. The diagram also shows the connection of the BRAKE FLUID LEVEL SWITCH (B16) to the BRAKE FLUID LEVEL SWITCH (B16) and the PARKING BRAKE SWITCH (B404). The diagram includes a legend for terminal arrangements: *1: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 10, 11 AND 12; *2: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 7, 8, AND 9; *3: TERMINAL No. OPTIONAL ARRANGEMENT BETWEEN 3 AND 4. The diagram also shows the connection of the BRAKE FLUID LEVEL SWITCH (B16) to the BRAKE FLUID LEVEL SWITCH (B16) and the PARKING BRAKE SWITCH (B404).

Legend:

- *1 : TERMINAL No. OPTIONAL ARRANGEMENT AMONG 10, 11 AND 12
- *2 : TERMINAL No. OPTIONAL ARRANGEMENT AMONG 7, 8, AND 9
- *3 : TERMINAL No. OPTIONAL ARRANGEMENT BETWEEN 3 AND 4



VDC(diag)-36

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INSTALLATION OF VDCCM&H/U CONNECTOR. 1) Turn the ignition switch to OFF. 2) Check that the VDCCM&H/U connector is inserted until it is locked by clamp.	Is the connector firmly inserted?	Go to step 2.	Insert the VDCCM&H/U connector until it is locked by clamp.
2 READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 3.
3 CHECK WIRING HARNESS. 1) Turn the ignition switch to OFF. 2) Disconnect the connector (B310) from the VDCCM&H/U. 3) Disconnect the connector (i11) from combination meter. 4) Measure the resistance between VDCCM&H/U connector and combination meter connector. Connector & terminal (B310) No. 8 — (i11) No. 6:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the harness connector between VDCCM&H/U and combination meter.
4 CHECK POOR CONTACT OF CONNECTOR. Check for poor contact of all connectors.	Is there poor contact?	Repair the poor contact of connector.	Go to step 5.
5 CHECK VDCCM. 1) Connect the connector (B310) to VDCCM&H/U. 2) Turn the ignition switch to ON. 3) After turning the ignition switch to ON, wait 1.5 seconds or more, then measure the voltage between the combination meter connector and chassis ground. Connector & terminal (i11) No. 6 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

F: VDC WARNING LIGHT AND TCS OFF INDICATOR LIGHT DO NOT GO OFF

NOTE:

This diagnosis is applied to C4 model.

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication
- Defective engine
- TCS OFF switch is shorted.

TROUBLE SYMPTOM:

When starting the engine, TCS OFF indicator light is kept ON.

NOTE:

When the TCS OFF switch is pressed for 10 seconds or more, the TCS OFF indicator light turns off and switch operations thereafter will not be accepted. When turning the ignition switch from OFF to ON, the OFF operation enabled status is restored.

Step	Check	Yes	No
1 READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK ENGINE.	Does the malfunction indicator light illuminate?	Repair the engine. <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>	Go to step 3.
3 CHECK ENGINE COOLANT TEMPERATURE. Warm up the engine and check for whether the VDC warning light & TCS OFF indicator light illumination condition changes.	When the engine coolant temperature is too low, the VDC warning light & TCS OFF indicator light illuminates. Do the lights go off when the engine is warmed up?	Normal	Go to step 4.
4 CHECK TCS OFF SWITCH. Remove and check TCS OFF switch. <Ref. to VDC-25, TCS OFF Switch.>	Is the TCS OFF switch operating normally?	Go to step 5.	Replace the TCS OFF switch. <Ref. to VDC-25, TCS OFF Switch.>
5 CHECK VDCCM&H/U. 1) Connect the Subaru Select Monitor to the vehicle. 2) Start the engine, and select "Current Data Display & Save" in the Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>	Is the VDC warning light and TCS OFF light output displayed as being OFF?	Go to step 6.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
6 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 7.
7 CHECK COMBINATION METER. Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is combination meter OK?	Temporary poor contact occurs.	Replace the combination meter. <Ref. to IDI-11, Combination Meter.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

G: VDC WARNING LIGHT AND VDC INDICATOR LIGHT DO NOT GO OFF

NOTE:

This diagnosis is applied to models other than C4 model.

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication

TROUBLE SYMPTOM:

When starting the engine, the VDC warning light & VDC indicator light remains lit.

Step		Check	Yes	No
1	READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK ENGINE.	Does the malfunction indicator light illuminate?	Repair the engine. <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>	Go to step 3.
3	CHECK ENGINE COOLANT TEMPERATURE. Warm up the engine, and check if the VDC warning light & VDC indicator light illumination condition changes.	When the engine coolant temperature is too low, the VDC warning light & VDC indicator light illuminates. Do the lights go off when the engine is warmed up?	Normal	Go to step 4.
4	CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 5.
5	CHECK COMBINATION METER. Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is combination meter OK?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Replace the combination meter. <Ref. to IDI-11, Combination Meter.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

H: VDC INDICATOR LIGHT DOES NOT GO OFF

NOTE:

This diagnosis is applied to C4 model.

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication

TROUBLE SYMPTOM:

When starting the engine, VDC indicator light is kept ON.

	Step	Check	Yes	No
1	READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK VDCCM&H/U. 1) Connect the Subaru Select Monitor to the vehicle. 2) Start the engine, and select "Current Data Display & Save" in the Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>	Is the ABS warning light output displayed as being OFF?	Go to step 3.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
3	CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 4.
4	CHECK COMBINATION METER. Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is combination meter OK?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Replace the combination meter. <Ref. to IDI-11, Combination Meter.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

I: TCS OFF INDICATOR LIGHT DO NOT GO OFF

NOTE:

This diagnosis is applied to models other than C4 model.

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication
- Defective engine
- TCS OFF switch is shorted.

TROUBLE SYMPTOM:

When starting the engine, TCS OFF indicator light is kept ON.

NOTE:

When the TCS OFF switch is pressed for 10 seconds or more, the TCS OFF indicator light turns off and switch operations thereafter will not be accepted. When turning the ignition switch from OFF to ON, the OFF operation enabled status is restored.

Step	Check	Yes	No
1 READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK TCS OFF SWITCH. Remove and check TCS OFF switch. <Ref. to VDC-25, TCS OFF Switch.>	Is the TCS OFF switch operating normally?	Go to step 3.	Replace the TCS OFF switch. <Ref. to VDC-25, TCS OFF Switch.>
3 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 4.
4 CHECK COMBINATION METER. Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is combination meter OK?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Replace the combination meter. <Ref. to IDI-11, Combination Meter.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

J: BRAKE WARNING LIGHT DOES NOT GO OFF

DETECTING CONDITION:

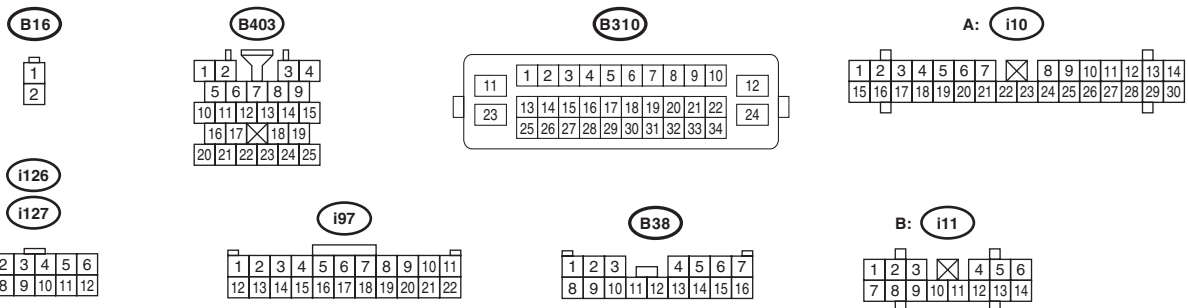
- Brake warning light circuit is shorted.
- Defective sensor/connector

TROUBLE SYMPTOM:

After starting the engine, the brake warning light remains lit though the parking lever is released.

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Parking brake / brake fluid level warning light system <Ref. to WI-156, Parking Brake / Brake Fluid Level Warning Light System.>



VDC(diag)-43

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INSTALLATION OF VDCCM&H/U CONNECTOR. 1) Turn the ignition switch to OFF. 2) Check that the VDCCM&H/U connector is inserted until it is locked by clamp.	Is the connector firmly inserted?	Go to step 2.	Insert the VDCCM&H/U connector until it is locked by clamp.
2 READ DTC. Read the DTC. <Ref. to VDC(diag)-25, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Go to step 3.
3 CHECK BRAKE FLUID AMOUNT. Check the amount of brake fluid in the reservoir tank of master cylinder.	Does the level of the brake fluid amount fall between the lines of "MAX" and "MIN"?	Go to step 4.	Replenish brake fluid to the specified value.
4 CHECK BRAKE FLUID LEVEL SWITCH. 1) Turn the ignition switch to OFF. 2) Disconnect the level switch connector (B16) from master cylinder. 3) Measure the resistance between the brake fluid level switch terminals. Terminals No. 1 — No. 2:	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the master cylinder. <Ref. to BR-25, Master Cylinder.>
5 CHECK PARKING BRAKE SWITCH. 1) Disconnect the connector (B404) from parking brake switch. 2) Release the parking brake. 3) Measure the resistance between parking brake switch terminal and chassis ground.	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the parking brake switch.
6 CHECK GROUND SHORT OF HARNESS. 1) Disconnect the connector (i11) from combination meter. 2) Measure the resistance between combination meter connector and chassis ground. Connector & terminal (i11) No. 7 — Chassis ground: (i11) No. 14 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the harness connector between combination meter and brake fluid level switch or parking brake switch.
7 CHECK HARNESS CONNECTOR. 1) Disconnect the connector (B310) from the VDCCM&H/U. 2) Disconnect the connector (i11) from combination meter. 3) Measure the resistance between VDCCM&H/U connector and combination meter connector. Connector & terminal (B310) No. 7 — (i11) No. 8:	Is the resistance less than 1 Ω?	Go to step 8.	Repair the harness connector between VDCCM&H/U and combination meter.
8 CHECK POOR CONTACT OF CONNECTOR. Check for poor contact of all connectors.	Is there poor contact?	Repair the connector.	Go to step 9.
9 CHECK VDCCM. 1) Connect the connector (B310) to VDCCM&H/U. 2) Turn the ignition to ON. 3) After turning the ignition switch to ON, wait 1.5 seconds or more, then measure the voltage between the combination meter connector and chassis ground. Connector & terminal (i11) No. 8 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

11.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Detailed code	Item	Content of diagnosis	Reference
C0021	4211	Front Right ABS Sensor Circuit Open	Front ABS wheel speed sensor RH is open	<Ref. to VDC(diag)-49, DTC C0021 FRONT RIGHT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0022	4221	Front Right ABS Sensor Signal	Front ABS wheel speed sensor RH signal malfunction	<Ref. to VDC(diag)-54, DTC C0022 FRONT ABS WHEEL SPEED SENSOR RH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4222	FR Wheel Speed Sensor Noise	Front ABS wheel speed sensor RH signal noise	<Ref. to VDC(diag)-54, DTC C0022 FRONT RIGHT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0023	4231	Front Left ABS Sensor Circuit Open	Front ABS wheel speed sensor LH is open	<Ref. to VDC(diag)-49, DTC C0023 FRONT LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0024	4241	Front Left ABS Sensor Signal	Front ABS wheel speed sensor LH signal malfunction	<Ref. to VDC(diag)-54, DTC C0024 FRONT ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4242	FL Wheel Speed Sensor Noise	Front ABS wheel speed sensor LH signal noise	<Ref. to VDC(diag)-54, DTC C0024 FRONT LEFT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0025	4251	Rear Right ABS Sensor Circuit Open	Rear ABS wheel speed sensor RH is open	<Ref. to VDC(diag)-49, DTC C0025 REAR RIGHT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0026	4261	Rear Right ABS Sensor Signal	Rear ABS wheel speed sensor RH signal malfunction	<Ref. to VDC(diag)-54, DTC C0026 REAR ABS WHEEL SPEED SENSOR RH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4262	RR Wheel Speed Sensor Noise	Rear ABS wheel speed sensor RH signal noise	<Ref. to VDC(diag)-54, DTC C0026 REAR RIGHT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0027	4271	Rear Left ABS Sensor Circuit Open	Rear ABS wheel speed sensor LH is open	<Ref. to VDC(diag)-50, DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0028	4281	Rear Left ABS Sensor Signal	Rear ABS wheel speed sensor LH signal malfunction	<Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4282	RL Wheel Speed Sensor Noise	Rear ABS wheel speed sensor LH signal noise	<Ref. to VDC(diag)-54, DTC C0028 REAR LEFT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0031	4311	FR Hold Valve Malfunction	Front inlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0031 FRONT INLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0032	4321	FR Pressure Reducing Valve Malfunction	Front outlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0032 FRONT OUTLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Item	Content of diagnosis	Reference
C0033	4331	FL Hold Valve Malfunction	Front inlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0033 FRONT INLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0034	4341	FL Pressure Reducing Valve Malfunction	Front outlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0034 FRONT OUTLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0035	4351	RR Hold Valve Malfunction	Rear inlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0035 REAR INLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0036	4361	RR Pressure Reducing Valve Malfunction	Rear outlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0036 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0037	4371	RL Hold Valve Malfunction	Rear inlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0037 REAR INLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0038	4381	RL Pressure Reducing Valve Malfunction	Rear outlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0038 REAR OUTLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0061	4611	VDC Switchover Valve (P)	Primary linear valve malfunction in VDCCM&H/U	<Ref. to VDC(diag)-59, DTC C0061 VDC SWITCHOVER VALVE (P), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0062	4621	VDC Switchover Valve (S)	Secondary linear valve malfunction in VDCCM&H/U	<Ref. to VDC(diag)-60, DTC C0062 VDC SWITCHOVER VALVE (S), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0063	4631	VDC Switchover Valve	Linear valve malfunction in VDCCM&H/U	<Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0041	4411	Internal ECM	VDC control module malfunction	<Ref. to VDC(diag)-63, DTC C0041 ECM INTERNAL PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0042	4421	Power Supply Voltage Low	Power voltage malfunction	<Ref. to VDC(diag)-65, DTC C0042 POWER VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4422	Power Supply Voltage High		
C0047	C471	Improper CAN Communication	Improper CAN communication	<Ref. to VDC(diag)-68, DTC C0047 IMPROPER CAN COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0051	4511	Valve Relay Open Circuit	Open valve relay	<Ref. to VDC(diag)-69, DTC C0051 VALVE RELAY OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4512	Valve Relay Short Circuit	Shorted valve relay	<Ref. to VDC(diag)-72, DTC C0051 VALVE RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Item	Content of diagnosis	Reference
C0052	4521	Motor Relay Circuit Open	Open motor/motor relay	<Ref. to VDC(diag)-74, DTC C0052 MOTOR AND MOTOR RELAY OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4522	Motor Relay Short Circuit	Shorted motor/motor relay	<Ref. to VDC(diag)-74, DTC C0052 MOTOR AND MOTOR RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4523	Motor Do Not Work	Motor does not rotate	<Ref. to VDC(diag)-75, DTC C0052 MOTOR DO NOT WORK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4524	Motor Malfunction	Motor malfunction	<Ref. to VDC(diag)-74, DTC C0052 MOTOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4525	Motor Fail Safe Relay Short	Shorted motor fail safe relay	<Ref. to VDC(diag)-74, DTC C0052 MOTOR FAIL SAFE RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0054	4541	Brake Lamp SW Open Circuit	Open brake light switch	<Ref. to VDC(diag)-77, DTC C0054 BRAKE LAMP SWITCH OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0056	4561	G Sensor Signal Stick	G sensor output is stuck	<Ref. to VDC(diag)-79, DTC C0056 G SENSOR OUTPUT FREEZE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4562	G Sensor Signal	Faulty G sensor signal	<Ref. to VDC(diag)-80, DTC C0056 G SENSOR SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4563	Yaw Rate G Sensor Power Supply V	Yaw rate & G sensor power supply voltage malfunction	<Ref. to VDC(diag)-81, DTC C0056 YAW RATE G SENSOR POWER SUPPLY VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4564	G Sensor Output	Faulty G sensor output	<Ref. to VDC(diag)-83, DTC C0056 G SENSOR OUTPUT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	C565	G Sensor Communication	Faulty G sensor communication	<Ref. to VDC(diag)-97, DTC C0056 G SENSOR COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4566	G Sensor Internal Problem	Malfunction in G sensor	<Ref. to VDC(diag)-96, DTC C0056 G SENSOR INTERNAL PROBLEM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0057	C571	ECM Communication Circuit	EGI communication	<Ref. to VDC(diag)-84, DTC C0057 ECM COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	C573	TCM Communication Circuit	AT communication	<Ref. to VDC(diag)-85, DTC C0057 AT COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4574	Transmission System	Transmission system failure	<Ref. to VDC(diag)-86, DTC C0057 TRANSMISSION SYSTEM FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4575	VDC Control Interruption Because of Engine Instructions	Engine system failure	<Ref. to VDC(diag)-87, DTC C0057 ENGINE SYSTEM FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Item	Content of diagnosis	Reference
C0071	4711	Steering Angle Sensor Counter	Steering angle sensor internal malfunction	<Ref. to VDC(diag)-88, DTC C0071 STEERING ANGLE SENSOR INTERNAL PROBLEM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	C712	No Signal from Steering Angle Sensor	Steering angle sensor communication malfunction	<Ref. to VDC(diag)-90, DTC C0071 STEERING ANGLE SENSOR COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4715	Steering Angle Sensor at 0 Degree		
	4713	Steering Sensor Signal Freeze	Steering angle sensor signal is stuck	<Ref. to VDC(diag)-93, DTC C0071 STEERING ANGLE SENSOR SIGNAL FREEZE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4714	Steering Sensor Not Calibration	Steering angle sensor calibration not completed	<Ref. to VDC(diag)-94, DTC C0071 STEERING ANGLE SENSOR CALIBRATION NON COMPLETION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0072	4721	Yaw Rate Sensor Signal	Yaw rate sensor signal malfunction	<Ref. to VDC(diag)-95, DTC C0072 YAW RATE SENSOR SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4722	Yaw Rate Sensor Internal Problem	Yaw rate sensor internal malfunction	<Ref. to VDC(diag)-97, DTC C0072 YAW RATE SENSOR INTERNAL PROBLEM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	C723	Yaw Rate Sensor Communication	Yaw rate sensor communication malfunction	<Ref. to VDC(diag)-98, DTC C0072 YAW RATE SENSOR COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4724	Yaw Rate Sensor Oscillation	Yaw rate sensor oscillation malfunction	<Ref. to VDC(diag)-94, DTC C0072 YAW RATE SENSOR OSCILLATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0074	4741	Pressure Sensor Open Circuit	Pressure sensor is open	<Ref. to VDC(diag)-100, DTC C0074 PRESSURE SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4742	Pressure Sensor Signal Freeze	Pressure sensor signal is stuck	<Ref. to VDC(diag)-99, DTC C0074 PRESSURE SENSOR SIGNAL FREEZE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4743	Pressure Sensor 0 Point	Pressure sensor 0 point	<Ref. to VDC(diag)-103, DTC C0074 PRESSURE SENSOR 0 POINT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4744	Pressure Sensor Noise	Pressure sensor noise	<Ref. to VDC(diag)-104, DTC C0074 PRESSURE SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4745	Pressure Sensor Output Rise	Pressure sensor output rise	<Ref. to VDC(diag)-99, DTC C0074 PRESSURE SENSOR OUTPUT RISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

12.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC C0021 FRONT RIGHT ABS SENSOR OPEN CIRCUIT

NOTE:

For the diagnostic procedure, refer to “DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT”. <Ref. to VDC(diag)-50, DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

B: DTC C0023 FRONT LEFT ABS SENSOR OPEN CIRCUIT

NOTE:

For the diagnostic procedure, refer to “DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT”. <Ref. to VDC(diag)-50, DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

C: DTC C0025 REAR RIGHT ABS SENSOR OPEN CIRCUIT

NOTE:

For the diagnostic procedure, refer to “DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT”. <Ref. to VDC(diag)-50, DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

D: DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT

DTC DETECTING CONDITION:

- Faulty ABS wheel speed sensor (harness open line)
- Defective harness connector

TROUBLE SYMPTOM:

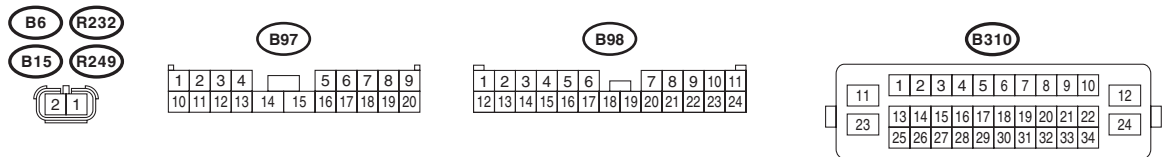
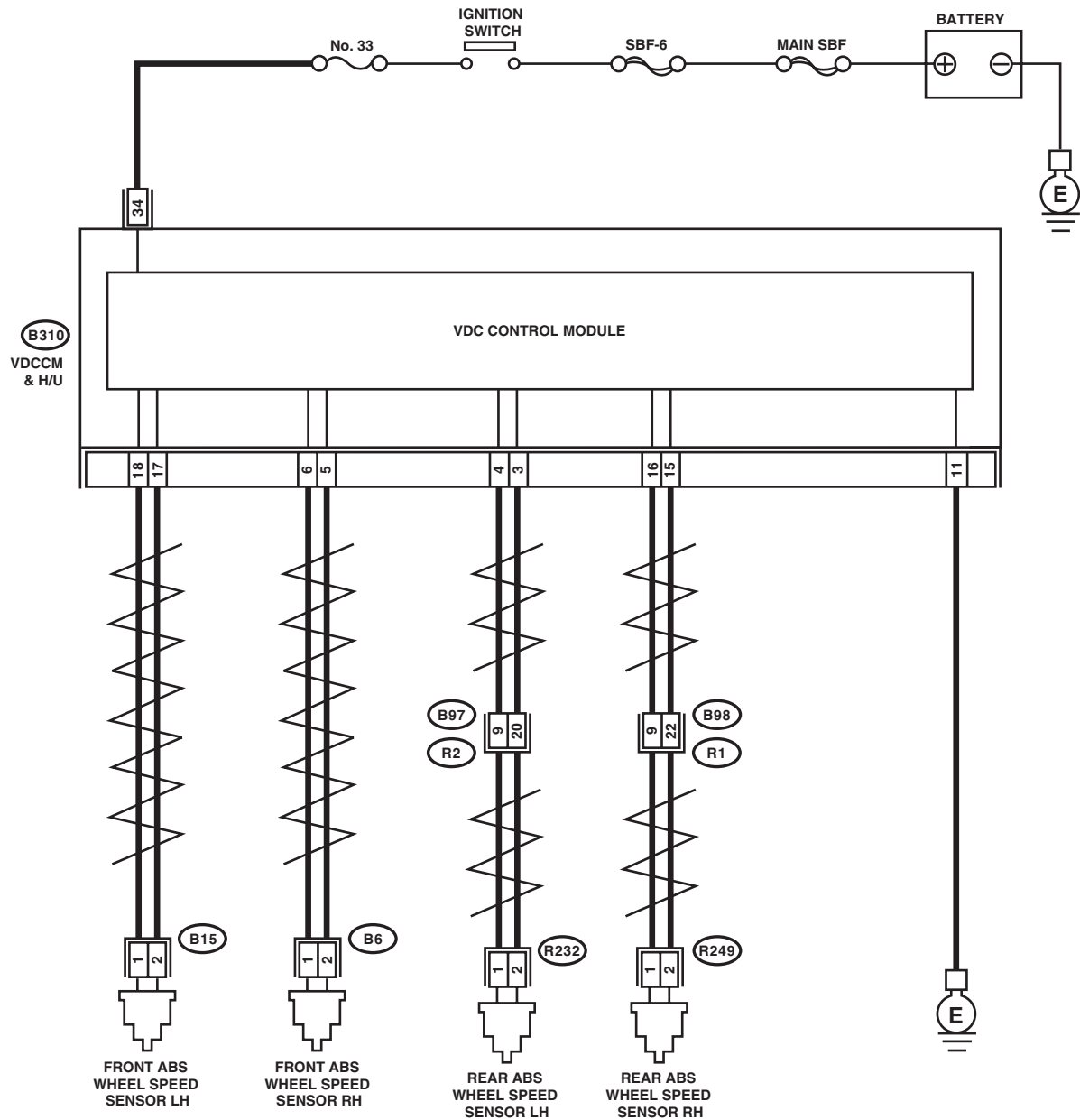
- ABS does not operate.
- VDC does not operate.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00791

Step	Check	Yes	No
1	CHECK POOR CONTACT OF CONNECTOR. Check if there is poor contact between VDCCM&H/U and ABS wheel speed sensor.	Is there poor contact? Repair the connector.	Go to step 2.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK HARNESS CONNECTOR BETWEEN VDCCM&H/U AND ABS WHEEL SPEED SENSOR. 1) Disconnect the connector (B310) from the VDCCM&H/U. 2) Disconnect the connector from ABS wheel speed sensor. 3) Measure the resistance between VDCCM&H/U connector and ABS wheel speed sensor connector. Connector & terminal DTC C0021 (B310) No. 6 — (B6) No. 1: (B310) No. 5 — (B6) No. 2: DTC C0023 (B310) No. 18 — (B15) No. 1: (B310) No. 17 — (B15) No. 2: DTC C0025 (B310) No. 16 — (R249) No. 1: (B310) No. 15 — (R249) No. 2: DTC C0027 (B310) No. 4 — (R232) No. 1: (B310) No. 3 — (R232) No. 2:	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness connector between VDCCM&H/U and ABS wheel speed sensor.
3 CHECK GROUND SHORT OF HARNESS. Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal DTC C0021 (B310) No. 5 — Chassis ground: DTC C0023 (B310) No. 17 — Chassis ground: DTC C0025 (B310) No. 15 — Chassis ground: DTC C0027 (B310) No. 3 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the harness connector between VDCCM&H/U and ABS wheel speed sensor.
4 CHECK ABS WHEEL SPEED SENSOR POWER SUPPLY CIRCUIT. 1) Connect the VDCCM&H/U connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ABS wheel speed sensor connector and chassis ground. Connector & terminal DTC C0021 (B6) No. 1 (+) — Chassis ground (–): DTC C0023 (B15) No. 1 (+) — Chassis ground (–): DTC C0025 (R249) No. 1 (+) — Chassis ground (–): DTC C0027 (R232) No. 1 (+) — Chassis ground (–):	Is the voltage 8 — 15 V?	Go to step 6.	Go to step 5.
5 CHECK VDCCM&H/U POWER SUPPLY CIRCUIT. 1) Turn the ignition switch to OFF. 2) Disconnect the VDCCM&H/U connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector terminals. Connector & terminal (B310) No. 34 (+) — (B310) No. 11 (–):	Is the voltage 10 — 15 V?	Go to step 7.	Check the generator, battery and VDCCM&H/U power supply circuit.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK ABS WHEEL SPEED SENSOR SIGNAL. 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to VDC-21, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>	Is the pattern the same waveform as shown in the figure?	Go to step 7.	Replace the ABS wheel speed sensor. <Ref. to VDC-20, Front ABS Wheel Speed Sensor.> <Ref. to VDC-22, Rear ABS Wheel Speed Sensor.>
7 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
8 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

E: DTC C0022 FRONT RIGHT ABS SENSOR NOISE

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

F: DTC C0024 FRONT LEFT ABS SENSOR NOISE

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

G: DTC C0026 REAR RIGHT ABS SENSOR NOISE

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

H: DTC C0028 REAR LEFT ABS SENSOR NOISE

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

I: DTC C0022 FRONT ABS WHEEL SPEED SENSOR RH SIGNAL MALFUNCTION

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

J: DTC C0024 FRONT ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

K: DTC C0026 REAR ABS WHEEL SPEED SENSOR RH SIGNAL MALFUNCTION

NOTE:

For the diagnostic procedure, refer to “DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-55, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

L: DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION

DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor signal (noise, irregular signal, etc.)
- Defective harness connector

TROUBLE SYMPTOM:

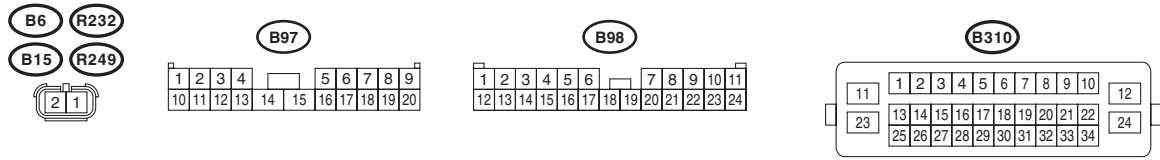
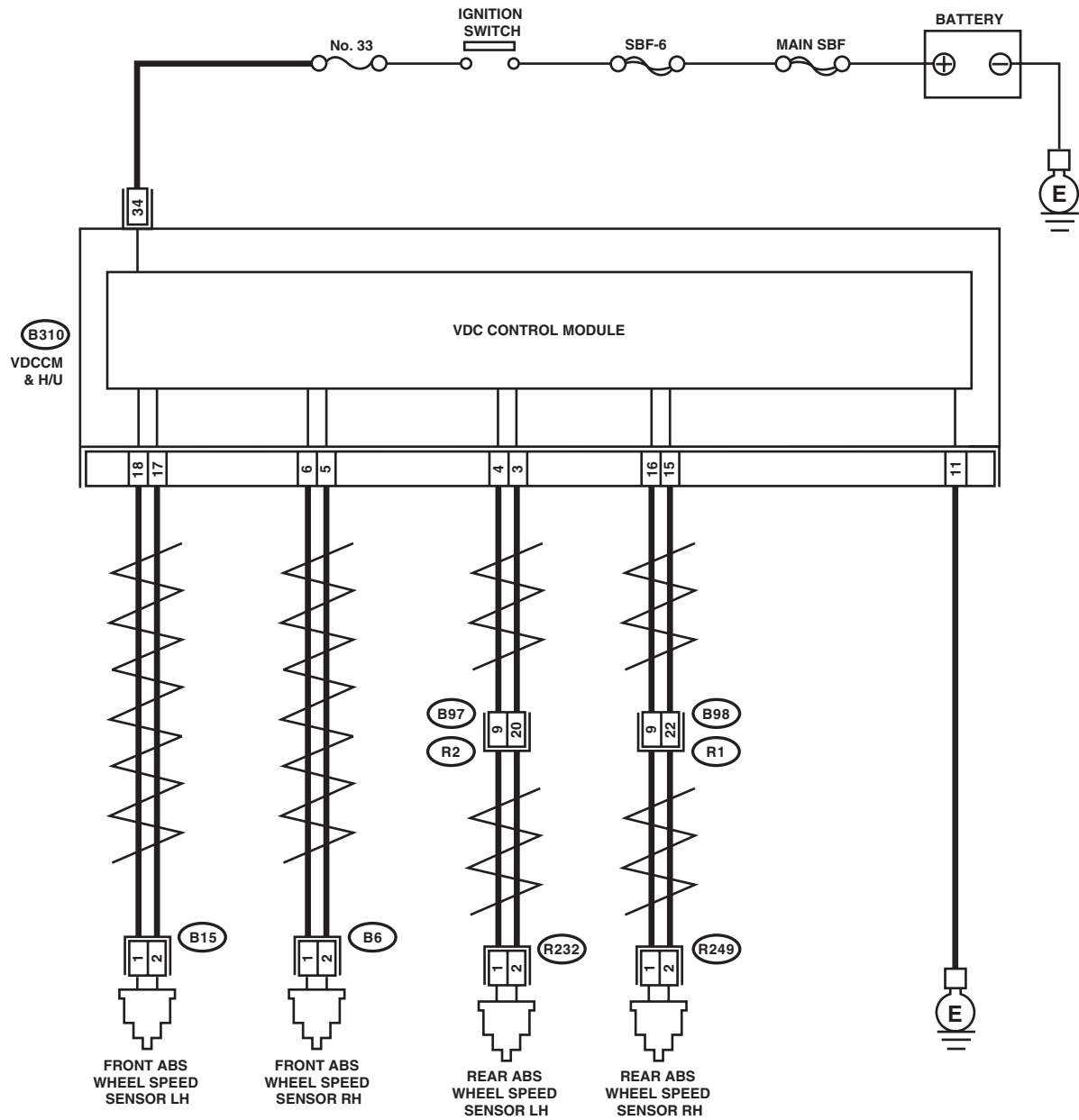
- ABS does not operate.
- VDC does not operate.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00791

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK VDCCM&H/U POWER SUPPLY CIRCUIT. 1) Turn the ignition switch to OFF. 2) Disconnect the VDCCM&H/U connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector terminals. Connector & terminal (B310) No. 34 (+) — (B310) No. 11 (-):	Is the voltage 10 — 15 V?	Go to step 2.	Check the generator, battery and VDCCM&H/U power supply circuit.
2 CHECK OUTPUT OF ABS WHEEL SPEED SENSOR USING SUBARU SELECT MONITOR. 1) Select "Current Data Display & Save" on the Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 2) Read the defective ABS wheel speed sensor output.	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 3.	Go to step 8.
3 CHECK POOR CONTACT OF CONNECTOR. Turn the ignition switch to OFF.	Is there poor contact of connectors between VDCCM&H/U and ABS wheel speed sensor?	Repair the connector.	Go to step 4.
4 CHECK CAUSE OF SIGNAL NOISE. Make sure the radio wave devices and electronic components are installed correctly.	Are the radio wave devices and electronic components installed correctly?	Go to step 5.	Install the radio wave devices and electronic components properly.
5 CHECK CAUSE OF SIGNAL NOISE. Check if the noise sources (such as an antenna) are installed near the sensor harness.	Are noise sources installed?	Install the noise sources apart from sensor harness.	Go to step 6.
6 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
7 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	It results from a temporary noise interference.
8 CHECK INSTALLATION OF ABS WHEEL SPEED SENSOR.	Is the ABS wheel speed sensor installation bolt tightened to 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 9.	Tighten the ABS wheel speed sensor installation bolts.
9 CHECK ABS WHEEL SPEED SENSOR SIGNAL. 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to VDC-21, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>	Does the oscilloscope indicate the waveform pattern like shown in the figure when the tire is slowly turned? Does the oscilloscope indication repeat the waveform pattern like shown in the figure when the tire is slowly turned in equal speed for one rotation or more?	Go to step 11.	Go to step 10.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK ABS WHEEL SPEED SENSOR OR MAGNETIC ENCODER.	Are there foreign matter, breakage or damage at the tip of ABS wheel speed sensor or magnetic encoder?	Remove dirt thoroughly. Also replace the ABS wheel speed sensor or magnetic encoder as a unit with hub unit bearing if it is broken or damaged.	Go to step 11.
11 CHECK CAUSE OF SIGNAL NOISE. Make sure the radio wave devices and electronic components are installed correctly.	Are the radio wave devices and electronic components installed correctly?	Go to step 12.	Install the radio wave devices and electronic components properly.
12 CHECK CAUSE OF SIGNAL NOISE. Check if the noise sources (such as an antenna) are installed near the sensor harness.	Are noise sources installed?	Install the noise sources apart from sensor harness.	Go to step 13.
13 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 14.
14 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	It results from a temporary noise interference. NOTE: Though the ABS warning light remains on at this time, this is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

M: DTC C0031 FRONT INLET SOLENOID VALVE RH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

N: DTC C0032 FRONT OUTLET SOLENOID VALVE RH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

O: DTC C0033 FRONT INLET SOLENOID VALVE LH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

P: DTC C0034 FRONT OUTLET SOLENOID VALVE LH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Q: DTC C0035 REAR INLET SOLENOID VALVE RH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

R: DTC C0036 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

S: DTC C0037 REAR INLET SOLENOID VALVE LH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

T: DTC C0038 REAR OUTLET SOLENOID VALVE LH MALFUNCTION IN VDC-CM&H/U

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

U: DTC C0061 VDC SWITCHOVER VALVE (P)

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

V: DTC C0062 VDC SWITCHOVER VALVE (S)

NOTE:

For the diagnostic procedure, refer to “DTC C0063 VDC SWITCHOVER VALVE”. <Ref. to VDC(diag)-60, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

W: DTC C0063 VDC SWITCHOVER VALVE

DTC DETECTING CONDITION:

- Defective harness connector
- Defective VDCH/U solenoid valve

TROUBLE SYMPTOM:

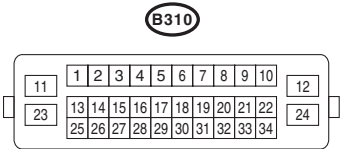
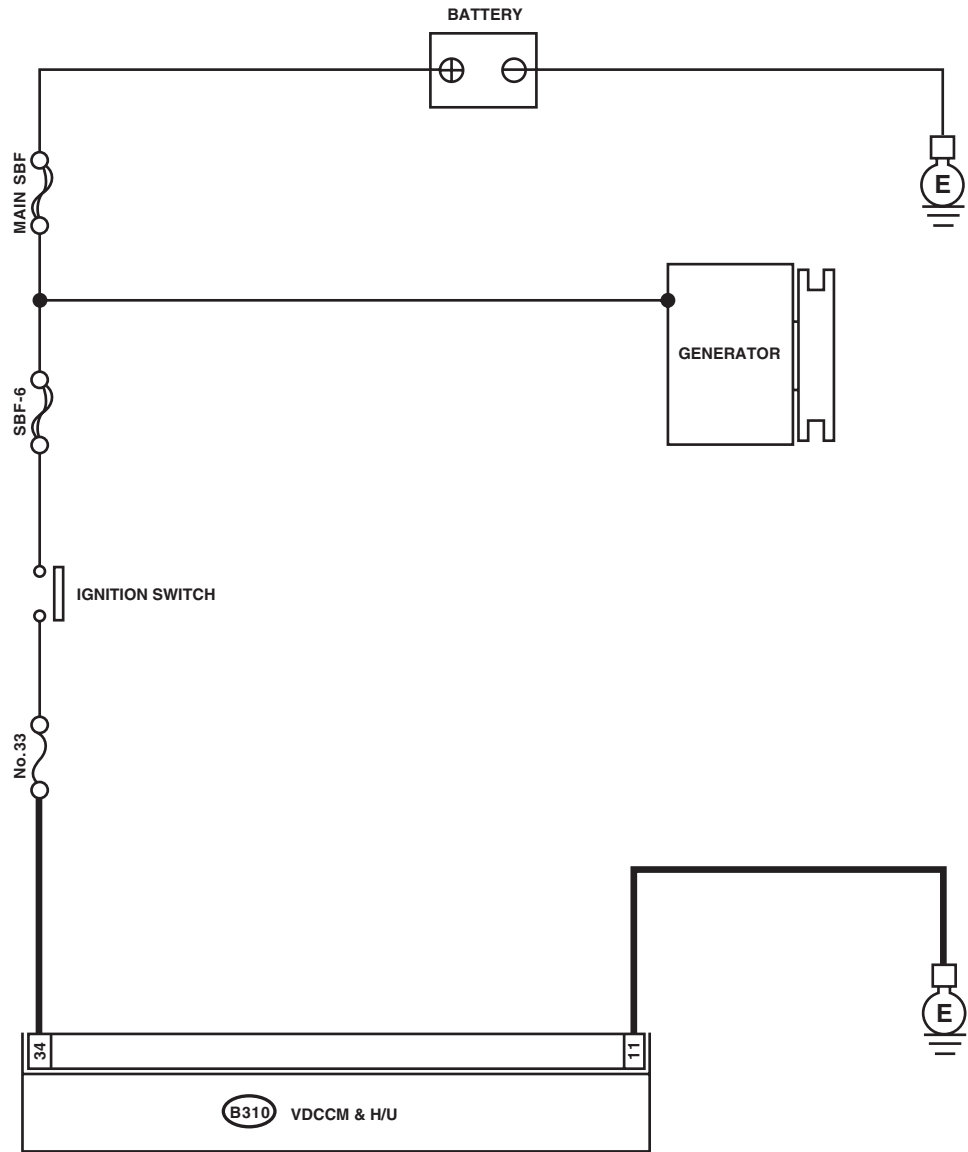
- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00624

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK VDCCM&H/U INPUT VOLTAGE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Run the engine at idle. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 34 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
2	CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 4.
4	CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

X: DTC C0041 ECM INTERNAL PROBLEM

DTC DETECTING CONDITION:

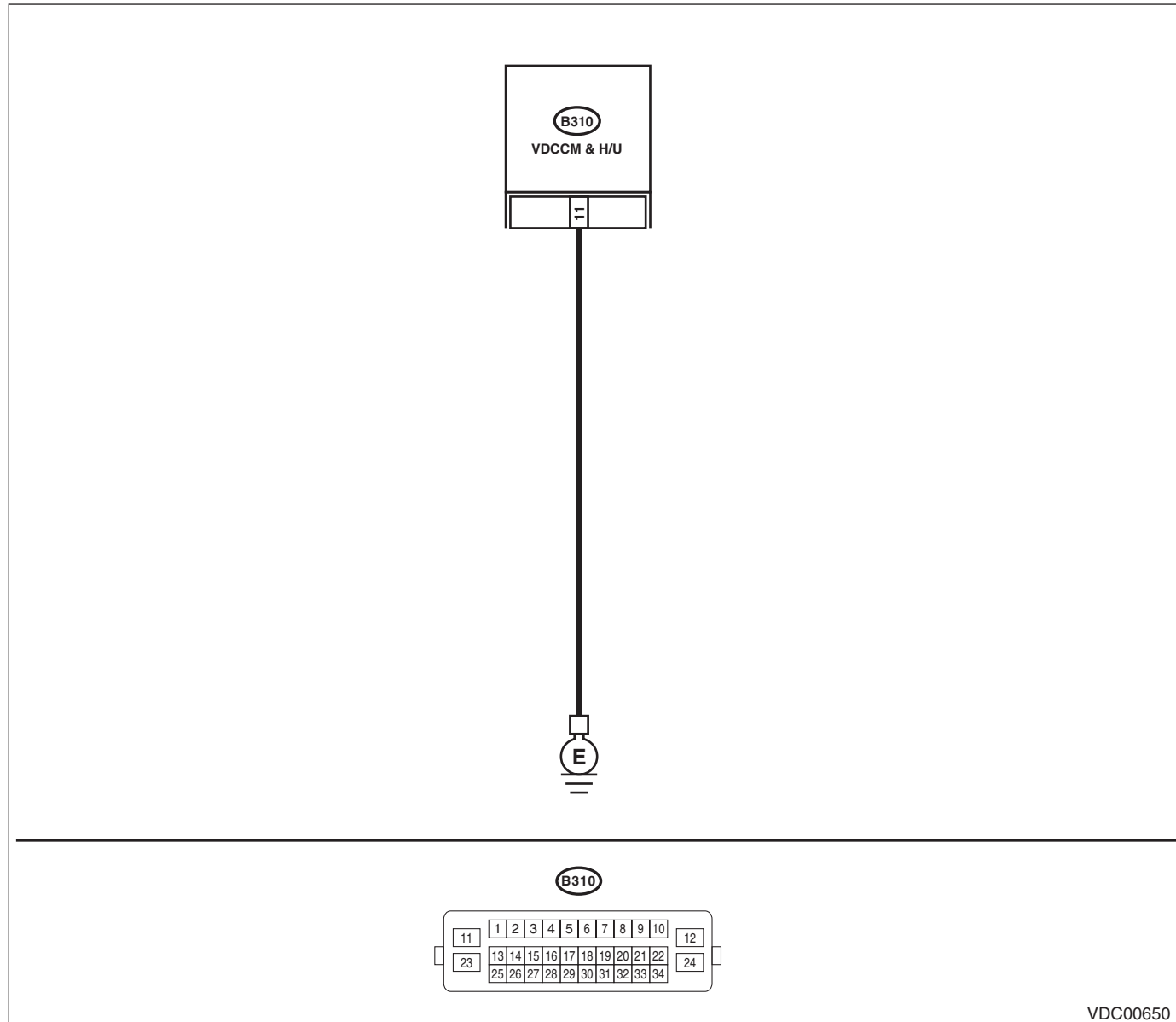
Defective VDCCM&H/U

TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



Step	Check	Yes	No
1 CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Measure the resistance between VDCCM&H/U and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 2.	Repair the VDCCM&H/U ground harness.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
2	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of the connector between the battery, ignition switch and VDCCM&H/U?	Repair the connector. Go to step 3.
3	CHECK CAUSE OF SIGNAL NOISE.	Are the radio wave devices and electronic components installed correctly?	Go to step 4. Install the radio wave devices and electronic components properly.
4	CHECK CAUSE OF SIGNAL NOISE.	Is there a noise source (such as an antenna) installed near the sensor harness?	Install the noise sources apart from sensor harness. Go to step 5.
5	CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).> Go to step 6.
6	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).> Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Y: DTC C0042 POWER VOLTAGE MALFUNCTION

DTC DETECTING CONDITION:

Improper VDCCM&H/U power supply voltage

TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

NOTE:

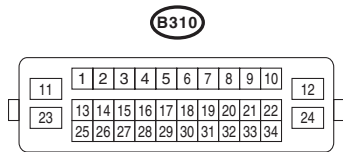
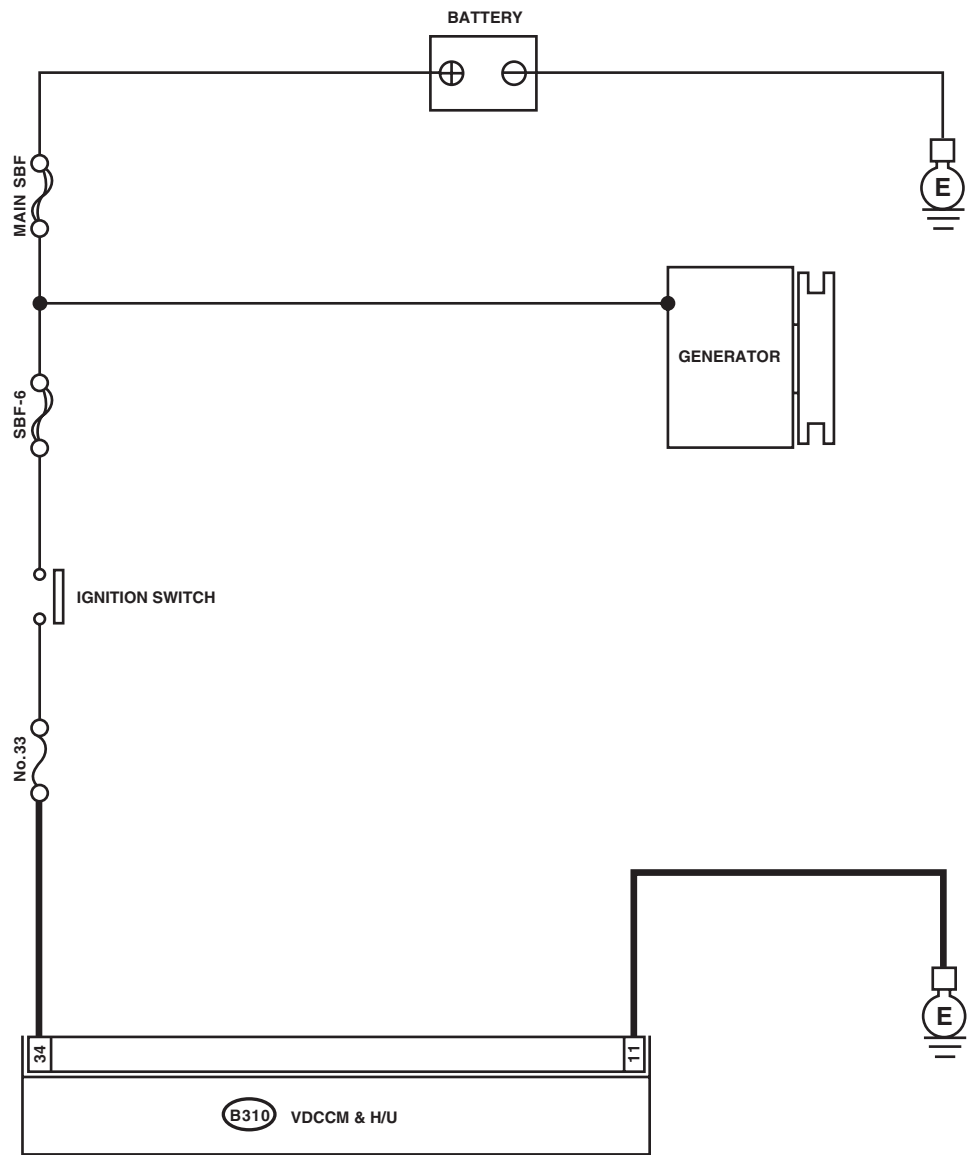
Warning lights go off if voltage returns.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00624

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GENERATOR. 1) Start the engine. 2) Run the engine at idle after warming up. 3) Measure the voltage between generator terminal B and chassis ground. Terminals Generator terminal B (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the generator. <Ref. to SC(H6DO)-13, Generator.>
2 CHECK BATTERY TERMINAL. Turn the ignition switch to OFF.	Are the positive and negative battery terminals clamped tightly?	Go to step 3.	Tighten the battery terminals.
3 CHECK VDCCM&H/U INPUT VOLTAGE. 1) Disconnect the connector from the VDCCM&H/U. 2) Run the engine at idle. 3) Operate devices such as headlights, air conditioner, defogger, etc. which produce an electrical load. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 34 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 4.	Repair the power supply circuit.
4 CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 5.	Repair the VDCCM&H/U ground harness.
5 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 6.
6 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
7 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Z: DTC C0047 IMPROPER CAN COMMUNICATION

DTC DETECTING CONDITION:

CAN communication line circuit is open or shorted.

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of VDCCM&H/U connector?	Repair the connector.	Go to step 3.
3 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AA:DTC C0051 VALVE RELAY OPEN CIRCUIT

DTC DETECTING CONDITION:

Defective valve relay

TROUBLE SYMPTOM:

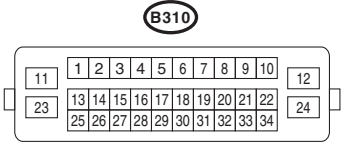
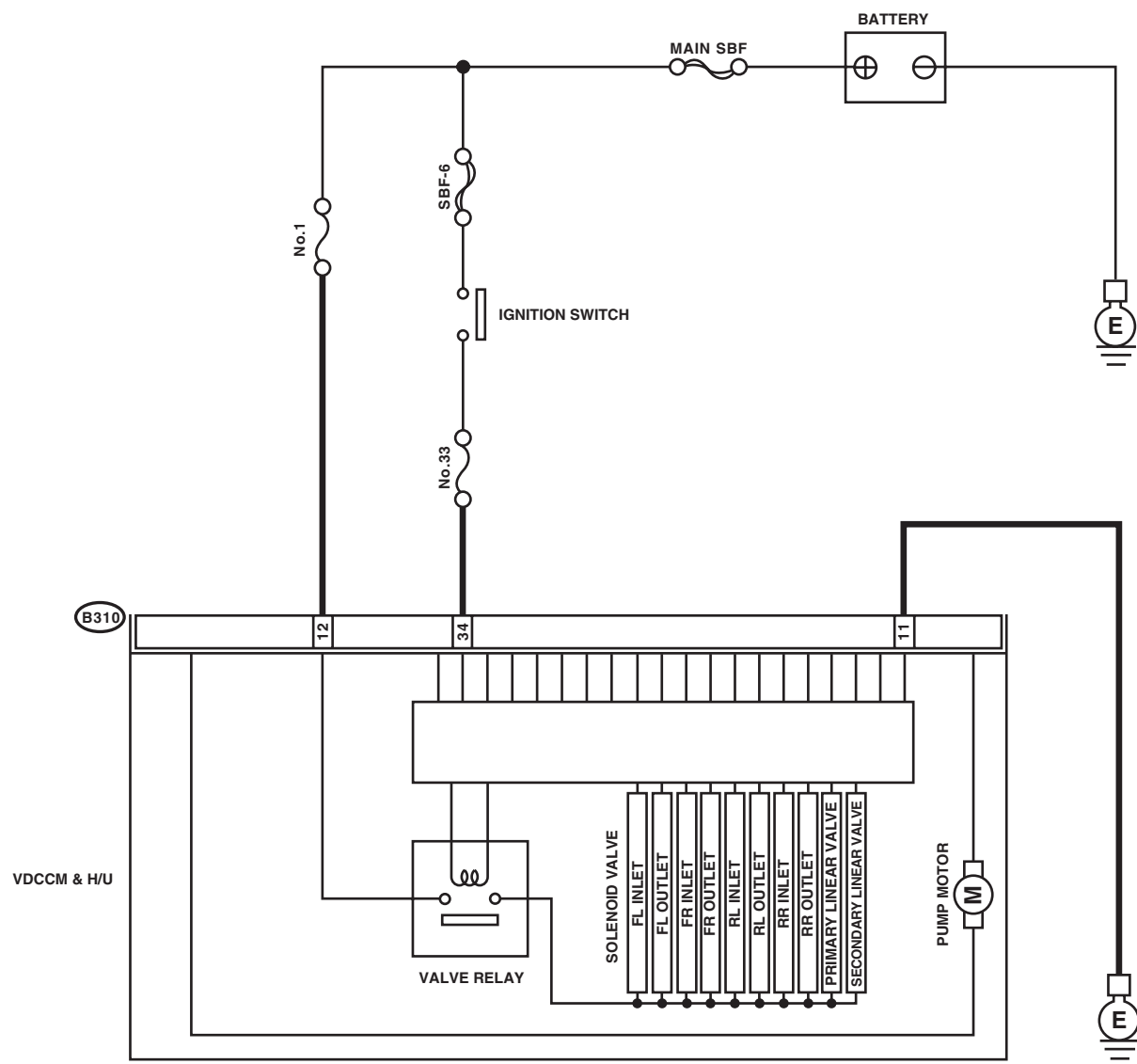
- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00620

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK VDCCM&H/U INPUT VOLTAGE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Run the engine at idle. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 12 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the harness connector between battery and VDCCM&H/U.
2 CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 4.
4 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AB:DTC C0051 VALVE RELAY SHORT CIRCUIT

DTC DETECTING CONDITION:

Defective valve relay

TROUBLE SYMPTOM:

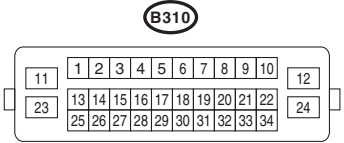
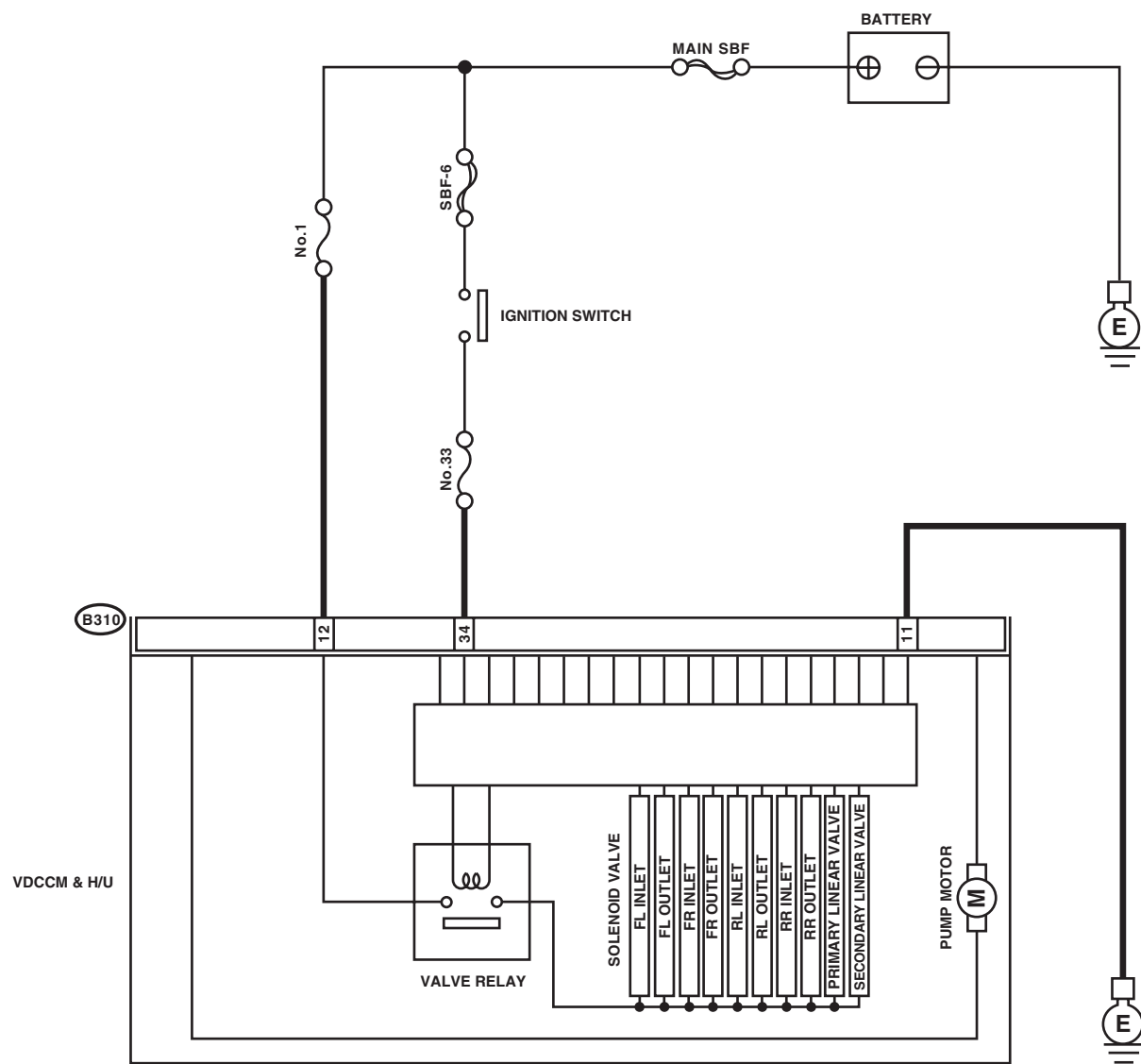
- ABS does not operate.
- VDC does not operate.
- EBD does not operate.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00620

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK VDCCM&H/U VALVE RELAY. 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U terminals. Terminals No. 12 — No. 11:	Is the resistance 1 MΩ or more?	Go to step 2.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
2 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 3.
3 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 4.
4 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

AC:DTC C0052 MOTOR AND MOTOR RELAY OPEN CIRCUIT

NOTE:

For the diagnostic procedure, refer to “DTC C0052 MOTOR DO NOT WORK”. <Ref. to VDC(diag)-75, DTC C0052 MOTOR DO NOT WORK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AD:DTC C0052 MOTOR MALFUNCTION

NOTE:

For the diagnostic procedure, refer to “DTC C0052 MOTOR DO NOT WORK”. <Ref. to VDC(diag)-75, DTC C0052 MOTOR DO NOT WORK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AE:DTC C0052 MOTOR AND MOTOR RELAY SHORT CIRCUIT

NOTE:

For the diagnostic procedure, refer to “DTC C0052 FAIL SAFE RELAY SHORT CIRCUIT”. <Ref. to VDC(diag)-74, DTC C0052 MOTOR FAIL SAFE RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AF:DTC C0052 MOTOR FAIL SAFE RELAY SHORT CIRCUIT

DTC DETECTING CONDITION:

- Defective motor relay
- Fail safe relay malfunction
- Defective harness connector

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD does not operate.

NOTE:

Motor relay and fail safe relay are built-in to the VDCCM&H/U.

Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK VDCCM&H/U INPUT VOLTAGE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 24 (+) — Chassis ground (-): (B310) No. 34 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the VDCCM&H/U power supply circuit.
2	CHECK INSTALLATION OF MOTOR GROUND.	Is the motor ground terminal installation bolt tightened 33 N·m (3.3 kgf-m, 24.3 ft-lb)?	Go to step 3.	Tighten the motor ground terminal installation bolt.
3	CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground: (B310) No. 23 — Chassis ground:	Is the resistance less than 10 Ω?	Go to step 4.	Repair the VDCCM&H/U ground harness.
4	CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AH:DTC C0054 BRAKE LAMP SWITCH OPEN CIRCUIT

DTC DETECTING CONDITION:

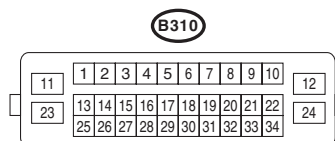
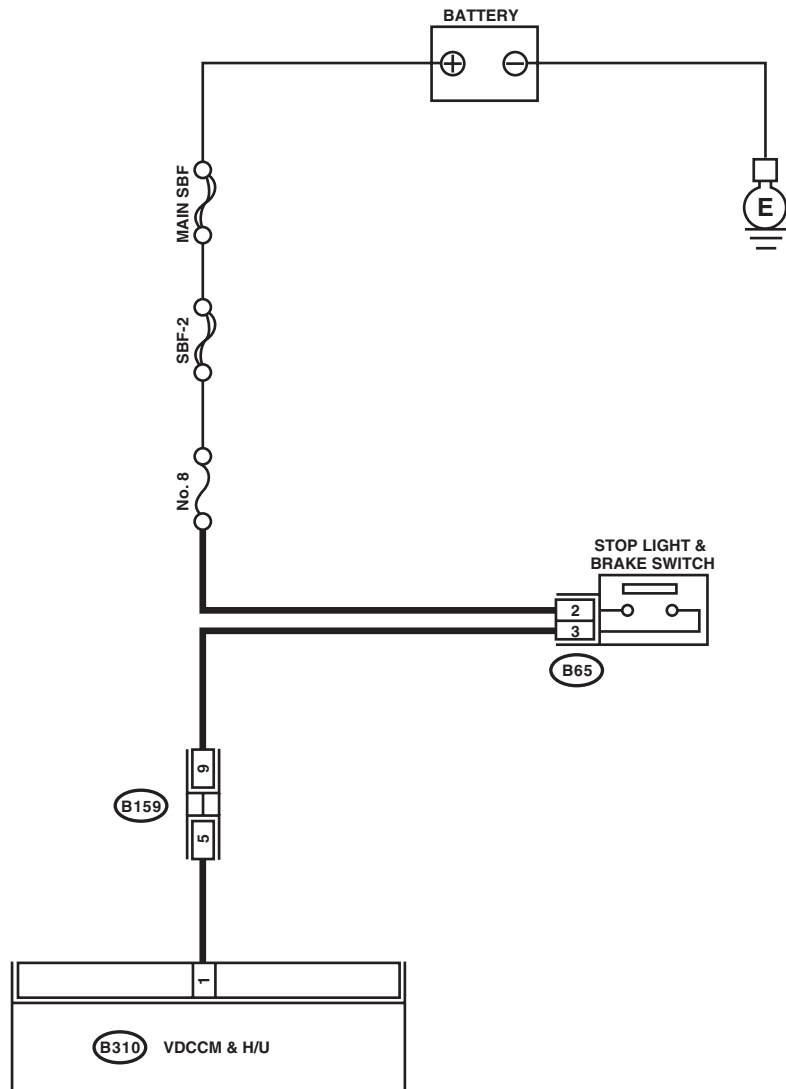
Defective stop light switch

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00826

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT OF STOP LIGHT SWITCH WITH SUBARU SELECT MONITOR. 1) Select "Current Data Display & Save" on the Subaru Select Monitor. 2) Release the brake pedal. 3) Read the stop light switch output in Subaru Select Monitor.	Is OFF displayed on the display screen?	Go to step 2.	Go to step 3.
2 CHECK OUTPUT OF STOP LIGHT SWITCH WITH SUBARU SELECT MONITOR. 1) Depress the brake pedal. 2) Read the stop light switch output in Subaru Select Monitor.	Is ON displayed on the display screen?	Go to step 5.	Go to step 3.
3 CHECK IF STOP LIGHTS ILLUMINATE. Depress the brake pedal.	Does the stop light illuminate?	Go to step 4.	Repair the stop light circuit.
4 CHECK OPEN CIRCUIT OF HARNESS. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Depress the brake pedal. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 1 (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Go to step 5.	Repair the harness between stop light switch and VDCCM&H/U connector.
5 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of connector between stop light switch and VDCCM&H/U?	Repair the connector.	Go to step 6.
6 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
7 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AI: DTC C0056 G SENSOR OUTPUT FREEZE

DTC DETECTING CONDITION:

Defective G sensor.

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK G SENSOR OUTPUT. 1) Connect the Subaru Select Monitor to the vehicle. 2) Select {Current Data Display & Save} in Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 3) Read the G sensor output when braking.	Do the values on the monitor display change?	Go to step 2.	Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.>
2 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 3.
3 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AJ:DTC C0056 G SENSOR SIGNAL MALFUNCTION

DTC DETECTING CONDITION:

Defective G sensor.

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK YAW RATE & G SENSOR INSTALLATION. Check the yaw rate & lateral G sensor installation.	Is the yaw rate & lateral G sensor and bracket tightened to 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 2.	Tighten the yaw rate & lateral G sensor.
2 CHECK G SENSOR OUTPUT. 1) Connect the Subaru Select Monitor to the vehicle. 2) Select {Current Data Display & Save} in Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 3) Read the G sensor output displayed on screen.	Is the value on the monitor display $-1.5 \sim 1.5 \text{ m/s}^2$?	Go to step 3.	Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.>
3 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 4.
4 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AK:DTC C0056 YAW RATE G SENSOR POWER SUPPLY VOLTAGE MALFUNCTION

DTC DETECTING CONDITION:

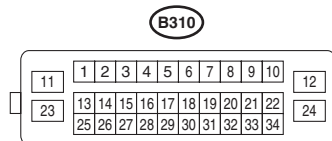
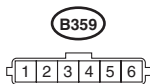
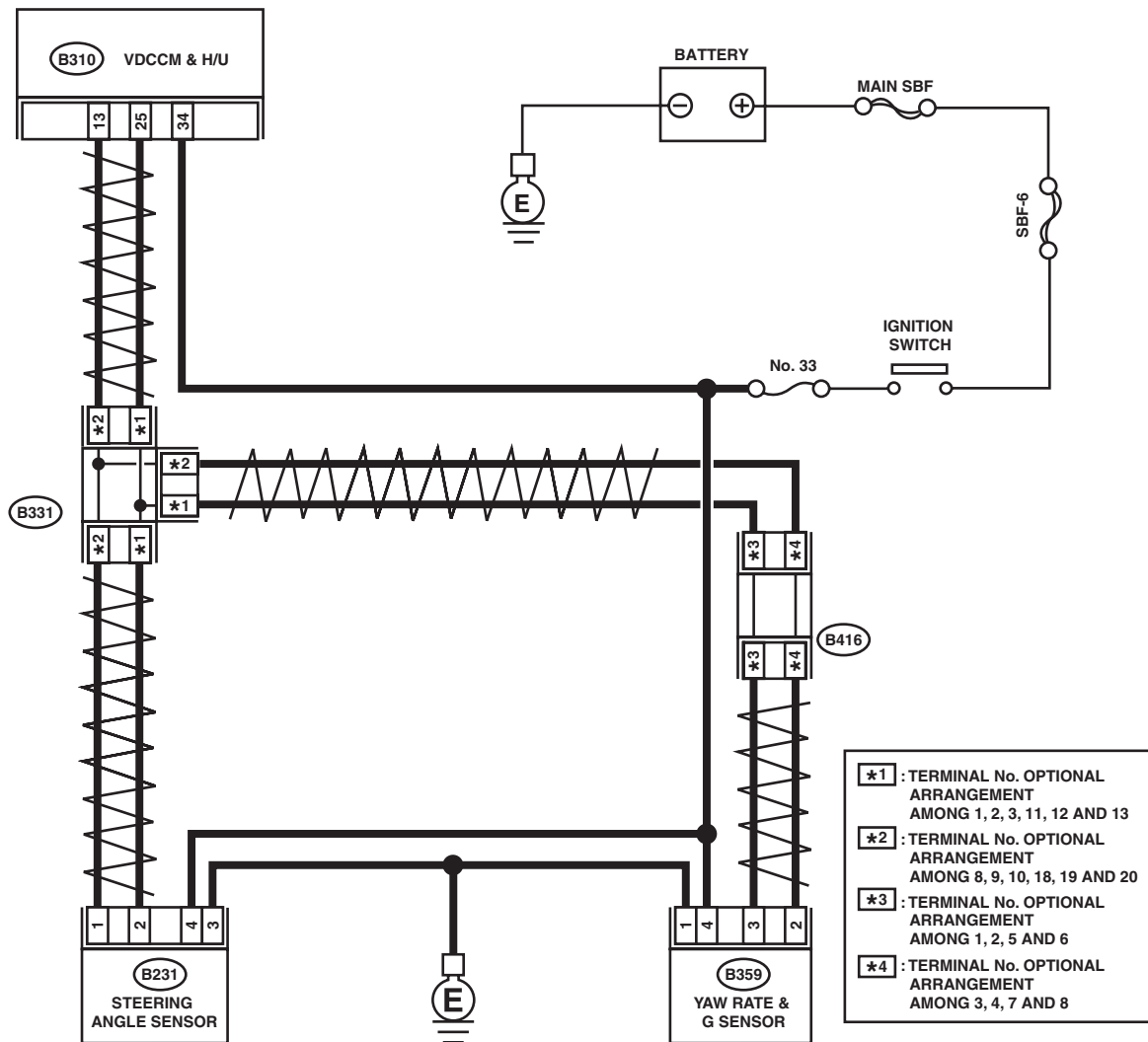
Defective G sensor.

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00794

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK YAW RATE & LATERAL G SENSOR POWER SUPPLY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from yaw rate & G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & G sensor and chassis ground. Connector & terminal (B359) No. 4 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Replace the yaw rate & lateral G sensor power supply circuit.
2	CHECK YAW RATE & G SENSOR GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between yaw rate & lateral G sensor connector and chassis ground. Connector & terminal (B359) No. 1 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 3.	Repair the yaw rate & G sensor ground circuit.
3	CHECK YAW RATE & G SENSOR. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 4.
4	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AL:DTC C0056 G SENSOR OUTPUT MALFUNCTION

DTC DETECTING CONDITION:

Defective G sensor.

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK YAW RATE & G SENSOR INSTALLATION. Check the yaw rate & lateral G sensor installation.	Is the yaw rate & lateral G sensor and bracket tightened to 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 2.	Tighten the yaw rate & lateral G sensor.
2 CHECK G SENSOR OUTPUT. 1) Connect the Subaru Select Monitor to the vehicle. 2) Select {Current Data Display & Save} in Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 3) Drive at a constant speed of approximately 40 km/h (25 MPH) and read the G sensor output at that time.	Is the indicated reading on the monitor display $-1.5 \text{ — } 1.5 \text{ m/s}^2$?	Go to step 3.	Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.>
3 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 4.
4 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AM:DTC C0057 ECM COMMUNICATION

DTC DETECTING CONDITION:

No CAN signal from ECM.

TROUBLE SYMPTOM:

VDC does not operate.

Step	Check	Yes	No
1 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of ECM connector?	Repair the connector.	Go to step 3.
3 CHECK ECM. Perform the diagnosis for the engine system. <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>	Is ECM normal?	Go to step 4.	Perform the diagnosis according to DTC for the engine system. <Ref. to EN(H6DO)(diag)-88, List of Diagnostic Trouble Code (DTC).>
4 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AN:DTC C0057 AT COMMUNICATION

DTC DETECTING CONDITION:

No CAN signal from TCM.

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact of TCM connector?	Repair the connector.	Go to step 3.
3 CHECK TCM. Perform the diagnosis for AT system. <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>	Is the TCM normal?	Go to step 4.	Perform the diagnosis according to DTC for AT system. <Ref. to 5AT(diag)-32, List of Diagnostic Trouble Code (DTC).>
4 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AO:DTC C0057 TRANSMISSION SYSTEM FAILURE

DTC DETECTING CONDITION:

Transmission System Defect

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK AT SYSTEM. 1) Start the engine. 2) Check the DTC in AT system. <Ref. to 5AT(diag)-16, OPERATION, Subaru Select Monitor.>	Is DTC of AT system displayed?	Perform the diagnosis according to DTC for AT system. <Ref. to 5AT(diag)-32, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 3.
3 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AP:DTC C0057 ENGINE SYSTEM FAILURE

DTC DETECTING CONDITION:

Defective engine system

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK ECM. Read the DTC of the ECM. <Ref. to EN(H6DO)(diag)-46, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC for the engine system. <Ref. to EN(H6DO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 3.
3 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AQ:DTC C0071 STEERING ANGLE SENSOR INTERNAL PROBLEM MALFUNCTION

DTC DETECTING CONDITION:

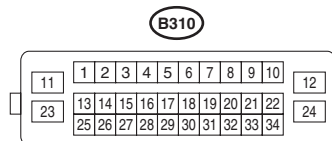
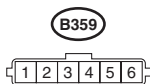
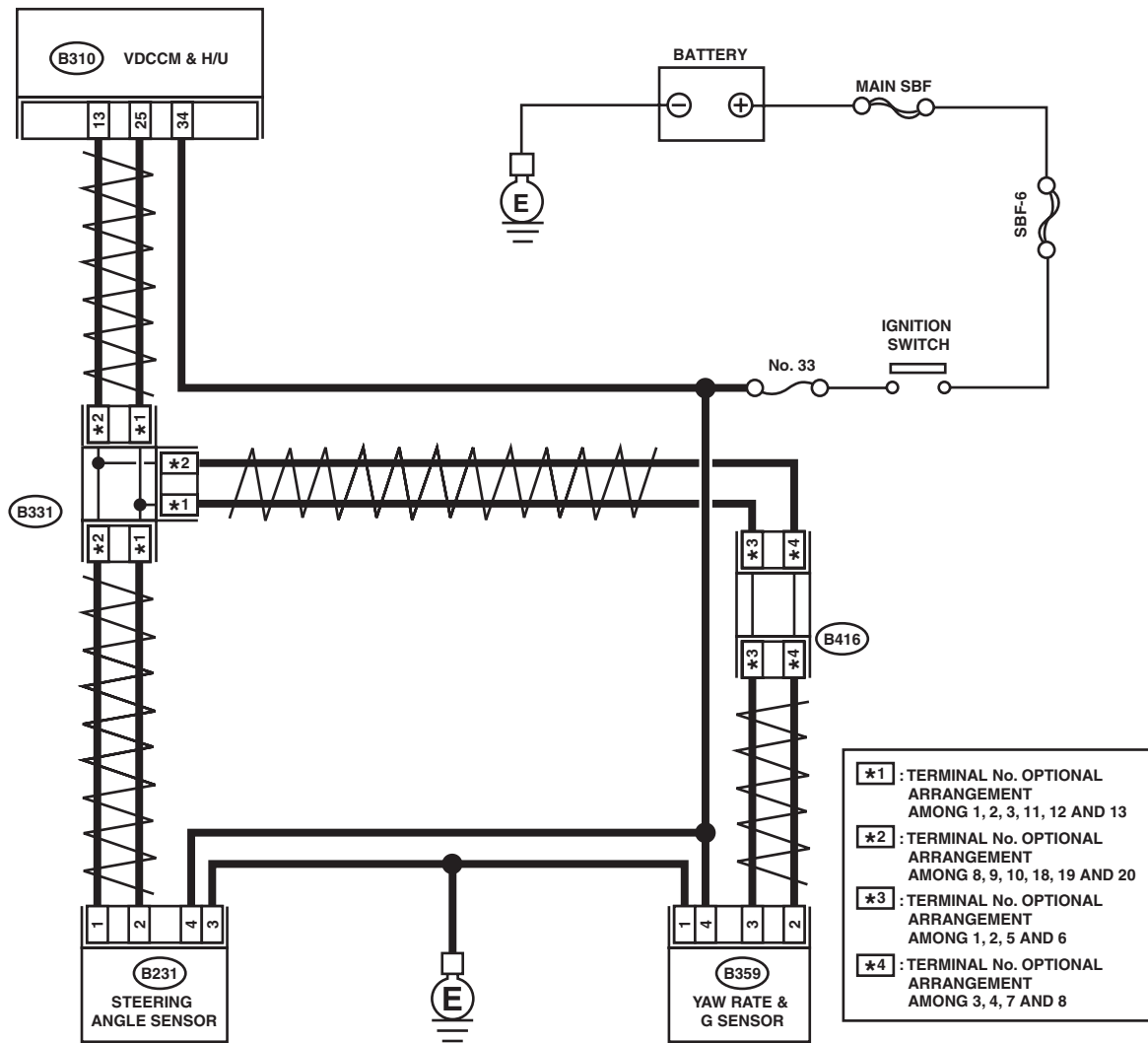
Defective steering angle sensor

TROUBLE SYMPTOM:

VDC does not operate.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00794

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK POWER SUPPLY OF STEERING ANGLE SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from steering angle sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between steering angle sensor and chassis ground. Connector & terminal (B231) No. 4 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the steering angle sensor power supply circuit.
2	CHECK GROUND CIRCUIT OF STEERING ANGLE SENSOR. Measure the resistance between steering angle sensor and chassis ground. Connector & terminal (B231) No. 3 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 3.	Repair ground circuit in the steering angle sensor.
3	CHECK POOR CONTACT OF STEERING ANGLE SENSOR CONNECTOR.	Is there poor contact of connector?	Repair or replace the steering angle sensor connector.	Go to step 4.
4	CHECK STEERING ANGLE SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the steering angle sensor. <Ref. to VDC-18, REPLACEMENT, Steering Angle Sensor.>	Go to step 5.
5	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AR:DTC C0071 STEERING ANGLE SENSOR COMMUNICATION MALFUNCTION

DTC DETECTING CONDITION:

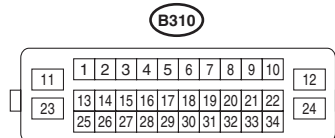
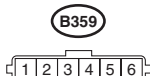
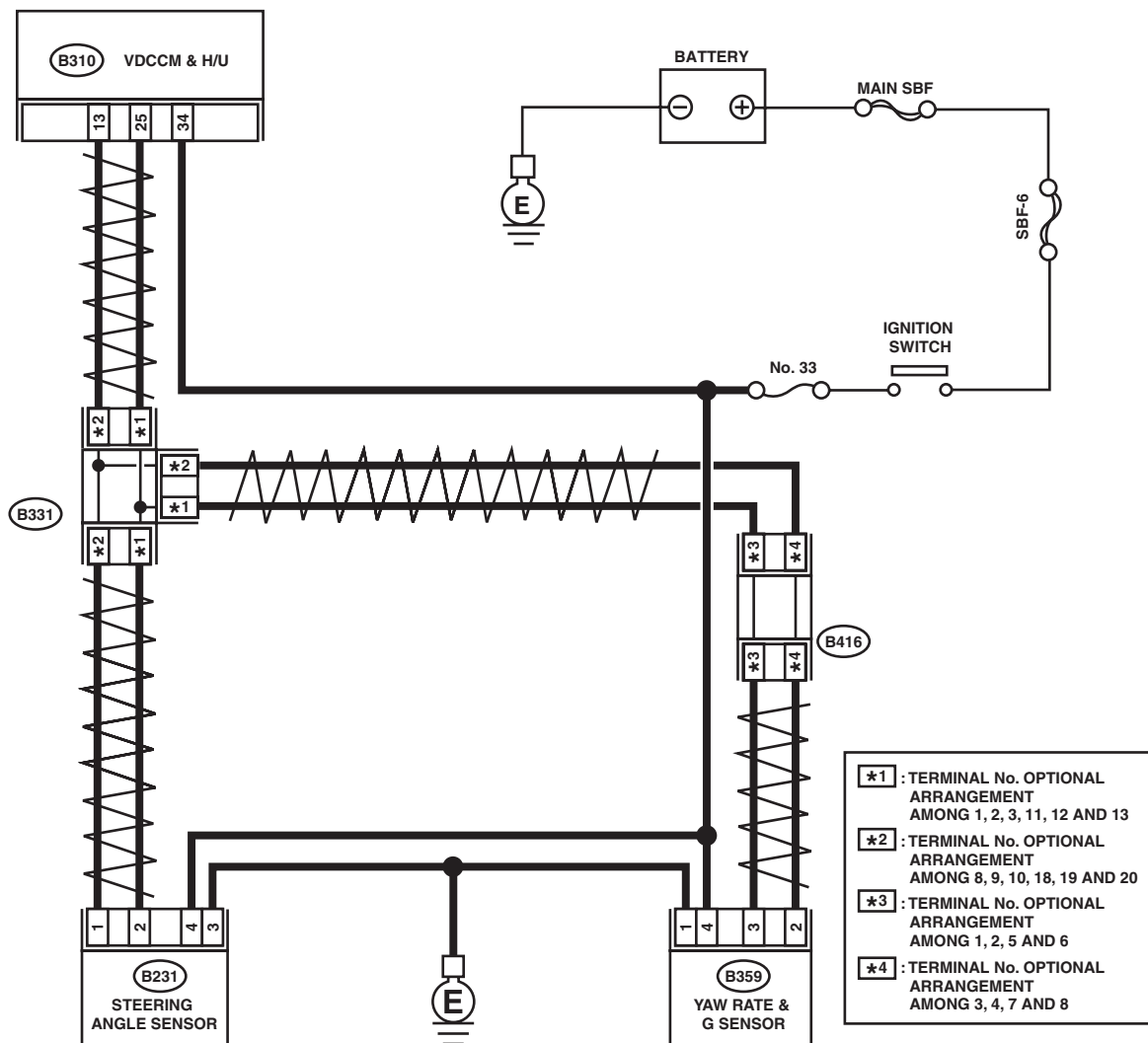
Signal does not come from steering angle sensor.

TROUBLE SYMPTOM:

VDC does not operate.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00794

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK STEERING WHEEL. 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Check the steering wheel for deviation from center.	Is the deviation from the center of steering wheel less than 5°?	Go to step 2.	Perform the centering adjustment of steering wheel.
2 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 3.
3 CHECK POWER SUPPLY FOR STEERING ANGLE SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from steering angle sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between steering angle sensor and chassis ground. Connector & terminal (B231) No. 4 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 4.	Repair the power supply circuit.
4 CHECK GROUND CIRCUIT OF STEERING ANGLE SENSOR. Measure the resistance between steering angle sensor and chassis ground. Connector & terminal (B231) No. 3 — Chassis ground:	Is the resistance less than 10 Ω?	Go to step 5.	Repair ground circuit in the steering angle sensor.
5 CHECK STEERING ANGLE SENSOR HARNESS. 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U and steering angel sensor. Connector & terminal (B231) No. 1 — (B310) No. 13: (B231) No. 2 — (B310) No. 25:	Is the resistance less than 1 Ω?	Go to step 6.	Repair the harness between the steering angle sensor and VDCCM&H/U.
6 CHECK GROUND SHORT CIRCUIT OF STEERING ANGLE SENSOR HARNESS. Measure the resistance between steering angle sensor and chassis ground. Connector & terminal (B231) No. 1 — Chassis ground: (B231) No. 2 — Chassis ground:	Is the resistance 10 Ω or more?	Go to step 7.	Repair the harness between the steering angle sensor and VDCCM&H/U.
7 CHECK STEERING ANGLE SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Go to step 8.	Go to step 9.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK VDCCM&H/U. 1) Turn the ignition switch to OFF. 2) Replace the steering angle sensor. <Ref. to VDC-18, REPLACEMENT, Steering Angle Sensor.> 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 10.
9 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.
10 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Original steering angle sensor malfunction

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AS:DTC C0071 STEERING ANGLE SENSOR SIGNAL FREEZE

DTC DETECTING CONDITION:

Defective steering angle sensor

TROUBLE SYMPTOM:

VDC does not operate.

Step	Check	Yes	No
1 CHECK STEERING WHEEL. 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Check the steering wheel for deviation from center.	Is the deviation from the center of steering wheel less than 5°?	Go to step 2.	Perform the centering adjustment of steering wheel.
2 CHECK DRIVING PLACE. Check if the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Did the vehicle run the road with banks or sandy surface (which does not mean a dirt road)?	VDCCM&H/U may record DTC when the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Go to step 3.
3 CHECK OUTPUT OF STEERING ANGLE SENSOR WITH SUBARU SELECT MONITOR. 1) Select {Current Data Display & Save} in Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 2) Read the steering angle sensor output displayed on display.	Does the steering angle sensor output value on the display vary in accordance with steering operation when turning the steering wheel to the right or left?	Go to step 4.	Replace the steering angle sensor. <Ref. to VDC-18, REPLACEMENT, Steering Angle Sensor.>
4 CHECK VDCCM&H/U. 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AT:DTC C0071 STEERING ANGLE SENSOR CALIBRATION NON COMPLETION

DTC DETECTING CONDITION:

Steering angle sensor calibration is incomplete.

TROUBLE SYMPTOM:

VDC does not operate.

Calibrate the steering angle sensor. <Ref. to VDC-10, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

AU:DTC C0072 YAW RATE SENSOR OSCILLATION MALFUNCTION

NOTE:

For the diagnostic procedure, refer to “DTC C0072 YAW RATE SENSOR SIGNAL MALFUNCTION”. <Ref. to VDC(diag)-95, DTC C0072 YAW RATE SENSOR SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AV:DTC C0072 YAW RATE SENSOR SIGNAL MALFUNCTION

DTC DETECTING CONDITION:

Defective yaw rate sensor

TROUBLE SYMPTOM:

VDC does not operate.

Step	Check	Yes	No
1 CHECK DRIVING PLACE. Check if the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Did the vehicle run the road with banks or sandy surface (which does not mean a dirt road)?	VDCCM&H/U may record DTC when the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Go to step 2.
2 CHECK YAW RATE & G SENSOR INSTALLATION.	Is the yaw rate & G sensor installation bolt tightened to 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 3.	Tighten the yaw rate & G sensor attachment bolt.
3 CHECK OUTPUT OF YAW RATE & G SENSOR WITH SUBARU SELECT MONITOR. 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Select {Current Data Display & Save} in Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 4) Read the yaw rate output displayed on display.	Is the reading indicated on monitor display -4 — 4 deg/s?	Go to step 4.	Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.>
4 CHECK OUTPUT OF STEERING ANGLE SENSOR WITH SUBARU SELECT MONITOR. 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Select {Current Data Display & Save} in Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 4) Read the steering angle sensor output displayed on display.	Is the reading indicated on monitor display -5 — 5°?	Go to step 5.	Calibrate the steering angle sensor. <Ref. to VDC-10, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
5 CHECK YAW RATE & G SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Go to step 6.	Go to step 7.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK VDCCM&H/U. 1) Turn the ignition switch to OFF. 2) Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.> 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
7 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.
8 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Malfunction is found in original yaw rate & G sensor.

AW:DTC C0056 G SENSOR INTERNAL PROBLEM MALFUNCTION

NOTE:

For the diagnostic procedure, refer to "DTC C0072 YAW RATE SENSOR INTERNAL PROBLEM MALFUNCTION". <Ref. to VDC(diag)-97, DTC C0072 YAW RATE SENSOR INTERNAL PROBLEM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AX:DTC C0072 YAW RATE SENSOR INTERNAL PROBLEM MALFUNCTION

DTC DETECTING CONDITION:

Defective yaw rate & G sensor

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK YAW RATE & G SENSOR. 1) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 2) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 3) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.>	Go to step 2.
2 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

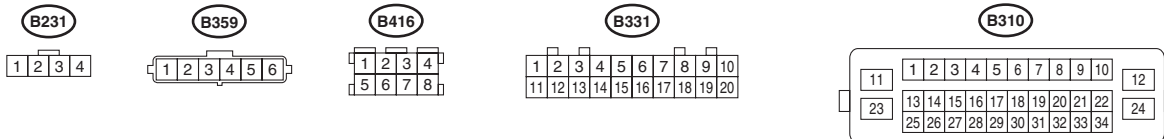
AY:DTC C0056 G SENSOR COMMUNICATION MALFUNCTION

NOTE:

For the diagnostic procedure, refer to “DTC C0072 YAW RATE SENSOR COMMUNICATION FAILURE”. <Ref. to VDC(diag)-98, DTC C0072 YAW RATE SENSOR COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC(diag)-98

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. <Ref. to LAN(diag)-31, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK POWER SUPPLY OF YAW RATE & G SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from yaw rate & G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & G sensor and chassis ground. Connector & terminal (B359) No. 4 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 3.	Replace the yaw rate & lateral G sensor power supply circuit.
3 CHECK YAW RATE & G SENSOR GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between yaw rate & lateral G sensor connector and chassis ground. Connector & terminal (B359) No. 1 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 4.	Repair the yaw rate & G sensor ground circuit.
4 CHECK POOR CONTACT OF YAW RATE & G SENSOR CONNECTOR.	Is there poor contact of connector?	Repair or replace the yaw rate & G sensor connector.	Go to step 5.
5 CHECK YAW RATE & G SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the yaw rate & G sensor. <Ref. to VDC-17, Yaw Rate and G Sensor.>	Go to step 6.
6 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

BA:DTC C0074 PRESSURE SENSOR SIGNAL FREEZE

NOTE:

For the diagnostic procedure, refer to “DTC C0074 PRESSURE SENSOR OPEN CIRCUIT”. <Ref. to VDC(diag)-100, DTC C0074 PRESSURE SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BB:DTC C0074 PRESSURE SENSOR OUTPUT RISE

NOTE:

For the diagnostic procedure, refer to “DTC C0074 PRESSURE SENSOR OPEN CIRCUIT”. <Ref. to VDC(diag)-100, DTC C0074 PRESSURE SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

BC:DTC C0074 PRESSURE SENSOR OPEN CIRCUIT

DTC DETECTING CONDITION:

Defective pressure sensor

TROUBLE SYMPTOM:

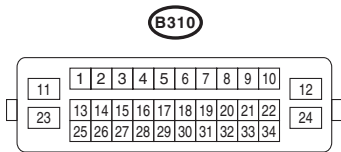
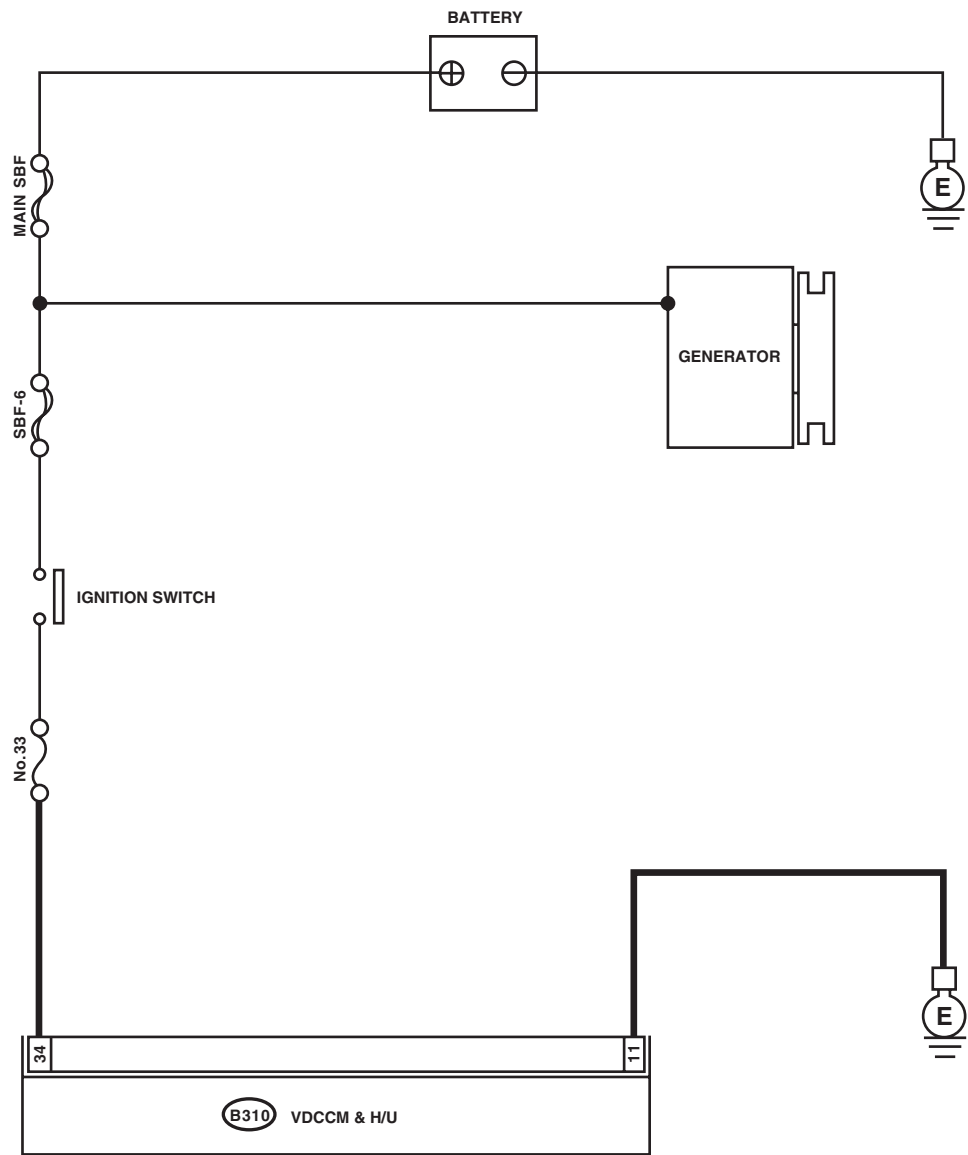
- ABS does not operate.
- VDC does not operate.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00624

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK VDCCM&H/U POWER VOLTAGE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 34 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
2 CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3 CHECK PRESSURE SENSOR. 1) Connect the Subaru Select Monitor to the vehicle. 2) Select “Current Data Display & Save” in the Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 3) Depress the brake pedal. 4) Read the pressure sensor output using the Subaru Select Monitor.	Do the values on the monitor display change when the pedal is depressed?	Go to step 4.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
4 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

BD:DTC C0074 PRESSURE SENSOR 0 POINT

DTC DETECTING CONDITION:

Defective pressure sensor

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
1 CHECK OUTPUT OF STOP LIGHT SWITCH WITH SUBARU SELECT MONITOR. 1) Select "Current Data Display & Save" in the Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 2) Release the brake pedal. 3) Read the stop light switch output in Subaru Select Monitor.	Is OFF displayed on the display screen?	Go to step 2.	Go to step 3.
2 CHECK OUTPUT OF STOP LIGHT SWITCH WITH SUBARU SELECT MONITOR. 1) Depress the brake pedal. 2) Read the stop light switch output in Subaru Select Monitor.	Is ON displayed on the display screen?	Go to step 4.	Go to step 3.
3 CHECK IF STOP LIGHTS ILLUMINATE. Depress the brake pedal.	Does the stop light illuminate?	Go to step 4.	Repair the stop light circuit.
4 CHECK PRESSURE SENSOR. 1) Depress the brake pedal. 2) Read the pressure sensor output in the Subaru Select Monitor.	Do the output values on the monitor display change as the pedal is depressed?	Go to step 5.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
5 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
6 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

BE:DTC C0074 PRESSURE SENSOR NOISE

DTC DETECTING CONDITION:

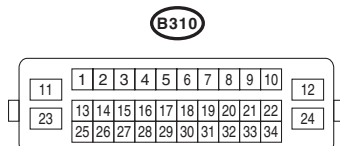
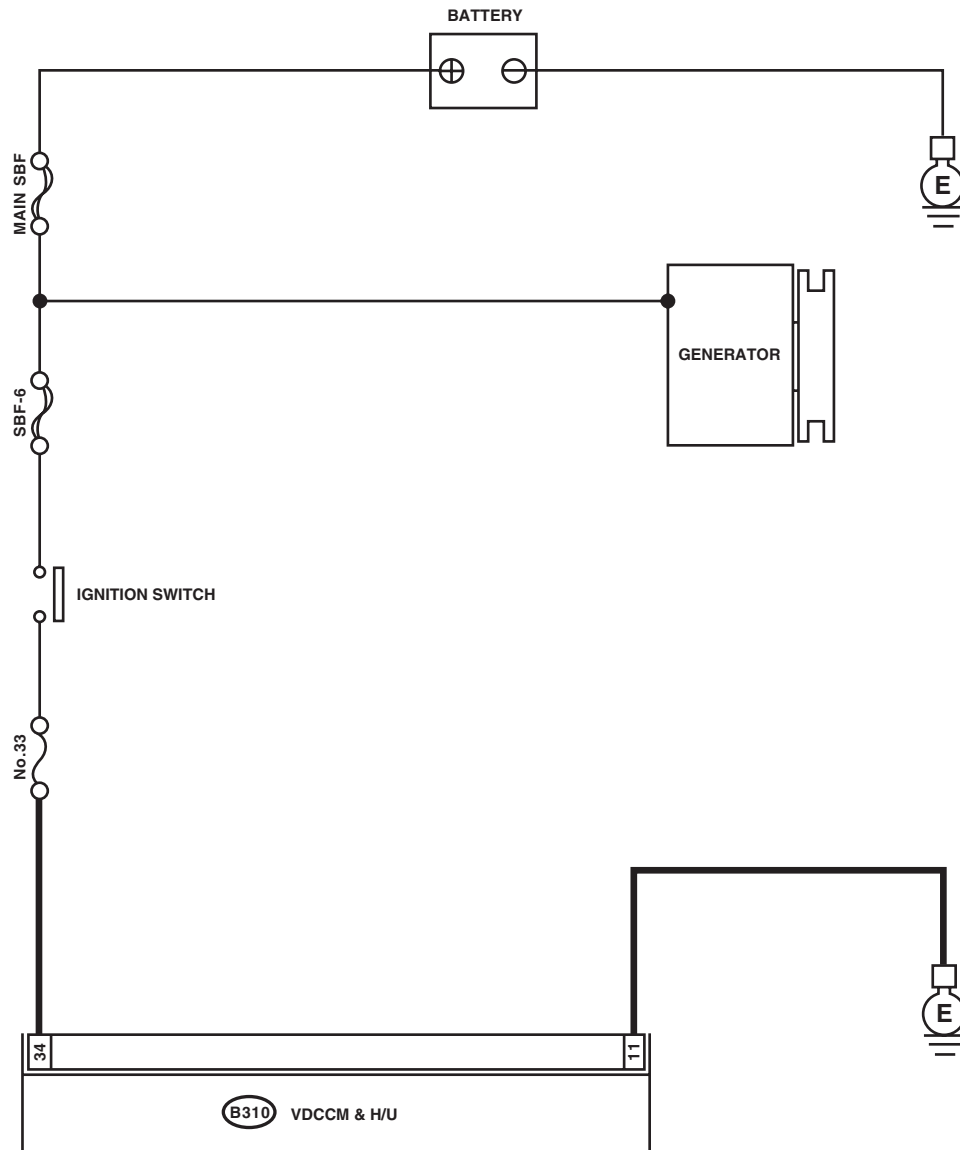
Defective pressure sensor

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:

Vehicle dynamics control system <Ref. to WI-58, Vehicle Dynamics Control System.>



VDC00624

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK VDCCM&H/U POWER VOLTAGE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 34 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
2 CHECK VDCCM&H/U GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. Connector & terminal (B310) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3 CHECK CAUSE OF SIGNAL NOISE. Check if noise sources (such as an antenna) are installed near the VDCCM&H/U.	Is there a source of noise installed nearby?	Install the noise sources away from the VDCCM&H/U.	Go to step 4.
4 CHECK PRESSURE SENSOR. 1) Select "Current Data Display & Save" on the Subaru Select Monitor. <Ref. to VDC(diag)-20, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> 2) Depress the brake pedal. 3) Read the pressure sensor output using the Subaru Select Monitor.	Do the output values on the monitor display change as the pedal is depressed?	Go to step 5.	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
5 CHECK VDCCM&H/U. 1) Connect all connectors. 2) Clear the memory. <Ref. to VDC(diag)-27, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-26, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-25, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-6, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
6 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-45, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

13.General Diagnostic Table

A: INSPECTION

Symptoms		Main probable cause	Other probable cause
Poor brake performance	Long braking/stopping distance	• VDCCM&H/U • Brake pad • Aeration to brake line • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections	• Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Master cylinder • Brake caliper • Disc rotor • Brake pipe • Brake booster
	Wheel lock	• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Incorrect wiring or piping connections	• Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Brake caliper • Brake pipe
	Brake drag	• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Master cylinder • Brake caliper • Parking brake • Axle and wheels • Brake pedal play	• Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Brake pad • Brake pipe
	Long brake pedal stroke	• Aeration to brake line • Brake pedal play	• VDCCM&H/U • Master cylinder • Brake caliper • Brake pad • Brake pipe • Brake booster
	Vehicle vertical pitching	• VDCCM&H/U • Road surface (uneven) • Suspension play or fatigue (reduced damping) • Incorrect wiring or piping connections	• Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation
Poor brake performance	Unstable or uneven braking	• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Brake caliper • Brake pad • Road surface (uneven) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections	• Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Master cylinder • Disc rotor • Brake pipe • Axle and wheels • Road with crowns or banks • Suspension play or fatigue (reduced damping)

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptoms		Main probable cause	Other probable cause
Vibration or noise • When braking suddenly • When accelerating suddenly • While driving on a slippery road	Excessive brake pedal vibration	- Road surface (uneven) - Incorrect wiring or piping connections	- VDCCM&H/U - Brake booster - Suspension play or fatigue (reduced damping)
	Noise from VDCH/U	- VDCCM&H/U (mount bushing) - Defective ABS wheel speed sensor or sensor gap - Brake pipe	- VDCCM&H/U - Defective steering angle sensor or improper neutral position - Defective yaw rate & G sensor or improper installation
	Noise from the front side of vehicle	- VDCCM&H/U (mount bushing) - Defective ABS wheel speed sensor or sensor gap - Master cylinder - Brake caliper - Brake pad - Disc rotor - Brake pipe - Brake booster - Suspension play or fatigue (reduced damping)	- Axle and wheels - Tire specifications, tire wear and air pressures
	Noise inside passenger seat		- VDCCM&H/U - Defective steering angle sensor or improper neutral position - Defective yaw rate & G sensor or improper installation
	Noise from the rear side of vehicle	- Defective ABS wheel speed sensor or sensor gap - Brake caliper - Brake pad - Disc rotor - Parking brake - Brake pipe - Suspension play or fatigue (reduced damping)	- Axle and wheels - Tire specifications, tire wear and air pressures
Engine does not accelerate or goes into a stall when accelerating suddenly or driving on a slippery surface.		- VDCCM&H/U - Defective ABS wheel speed sensor or sensor gap - Master cylinder - Brake caliper - Parking brake - Incorrect wiring or piping	- Defective steering angle sensor or improper neutral position - Defective yaw rate & G sensor or improper installation - Brake pad - Brake pipe

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptoms		Main probable cause	Other probable cause
Poor change-direction-operation stability of TCS	Deviation to right or left direction	• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Brake caliper • Brake pad • Wheel alignment • Road surface (uneven) • Road with crowns or banks • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections	• Disc rotor • Brake pipe • Axle and wheels • Suspension play or fatigue (reduced damping)
	Vehicle spin	• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Brake pad • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections	• Brake caliper • Brake pipe
Steering wheel drag while driving		• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Incorrect wiring or piping connections • Power steering system	• Brake caliper • Brake pad • Disc rotor • Wheel alignment • Road surface (uneven) • Road with crowns or banks • Suspension play or fatigue (reduced damping) • Tire specifications, tire wear and air pressures
VDC operates while driving normally.		• VDCCM&H/U • Defective ABS wheel speed sensor or sensor gap • Defective steering angle sensor or improper neutral position • Defective yaw rate & G sensor or improper installation • Wheel alignment • Road surface (uneven) • Road with crowns or banks • Suspension play or fatigue (reduced damping) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections • Power steering system	

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptoms	Main probable cause	Other probable cause
TCS OFF indicator light does not come on when the TCS OFF switch is depressed. NOTE: When pressing the TCS OFF switch for 10 seconds or more, the TCS OFF indicator light turns off and operation cannot be continued. When turning the ignition switch from OFF to ON, the previous status is restored.	• Harness • Combination meter • TCS OFF switch	

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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General Description

VEHICLE DYNAMICS CONTROL (VDC)

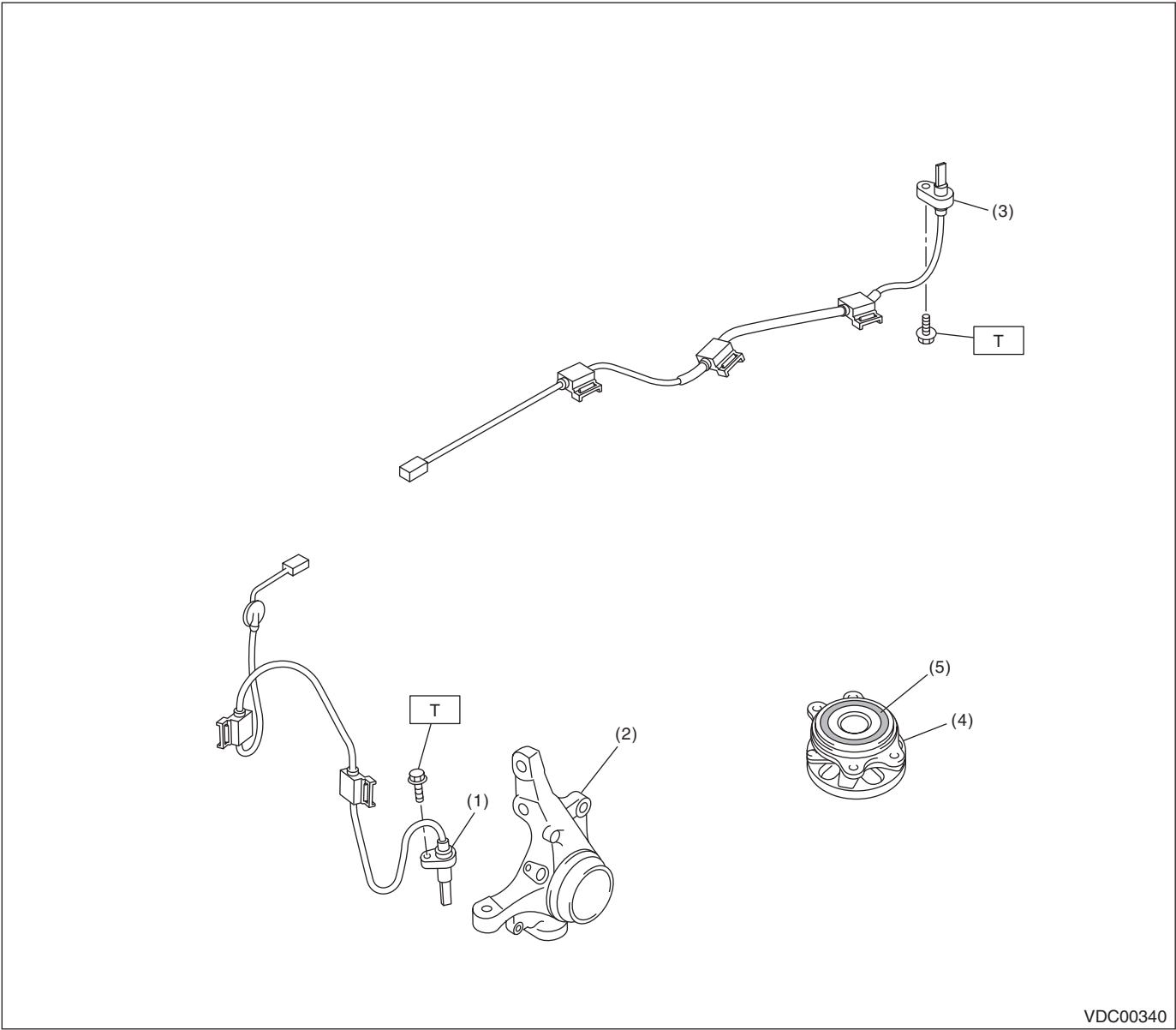
1. General Description

A: SPECIFICATION

Item			Specification or identification
ABS wheel speed sensor	ABS wheel speed sensor gap (for reference)	Front	0.55 — 1.45 mm (0.022 — 0.057 in)
		Rear	0.50 — 1.50 mm (0.020 — 0.059 in)
	Identifications of harness (marks, color)	Front	W1 (White)
		Rear	W3 (White)
VDCCM&H/U Identification			W3

B: COMPONENT

1. ABS WHEEL SPEED SENSOR

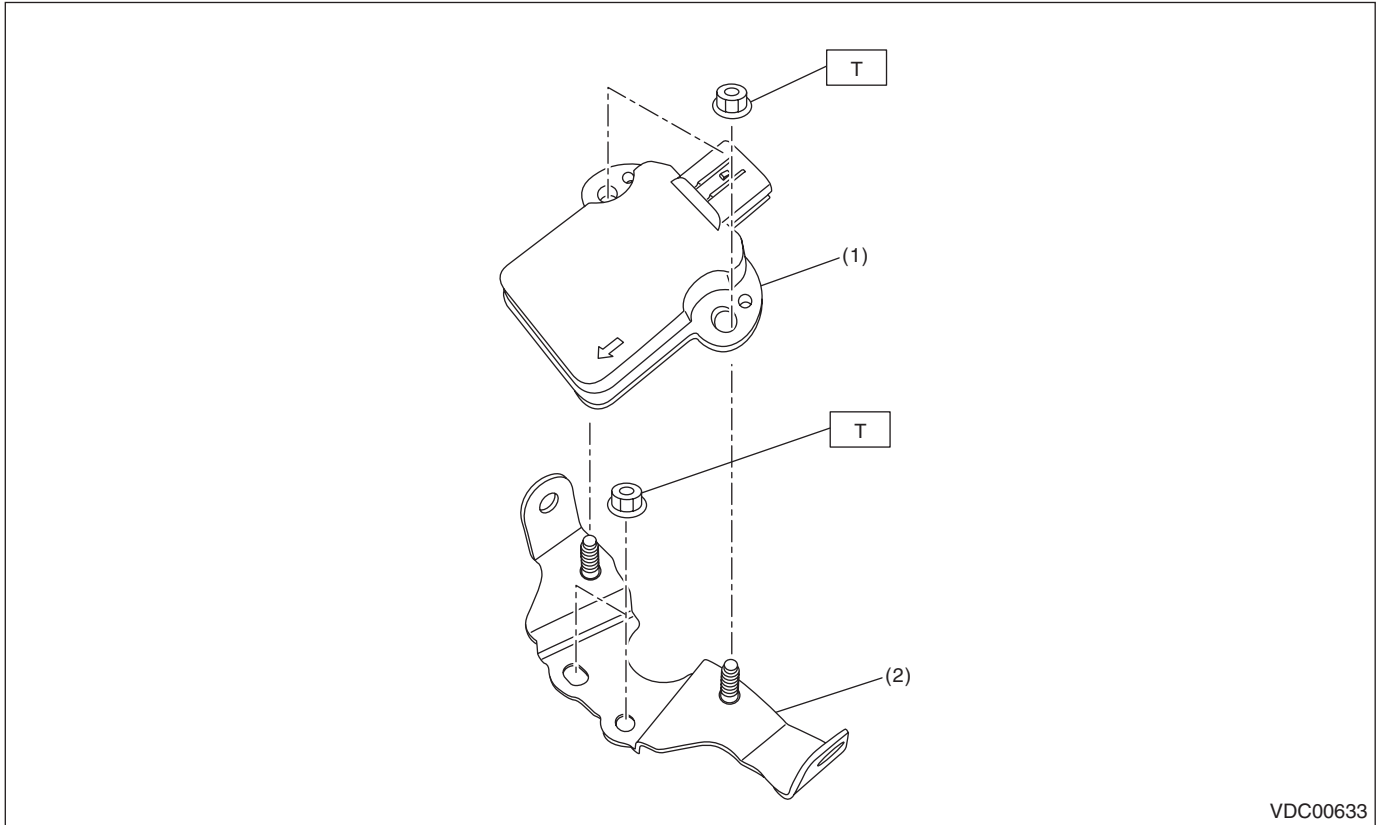


VDC00340

- | | |
|----------------------------------|----------------------|
| (1) Front ABS wheel speed sensor | (4) Hub unit bearing |
| (2) Front housing | (5) Magnetic encoder |
| (3) Rear ABS wheel speed sensor | |

Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.76, 5.53)

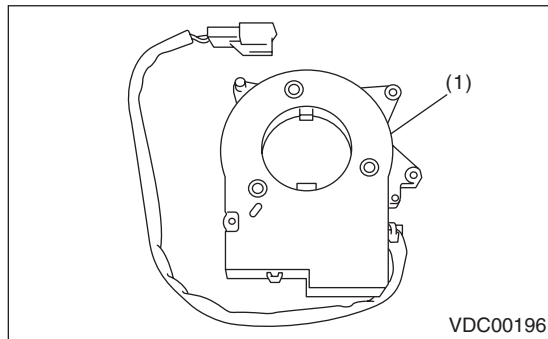
2. YAW RATE & LATERAL G SENSOR



- (1) Yaw rate & lateral G sensor
- (2) Bracket

Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.76, 5.53)

3. STEERING ANGLE SENSOR

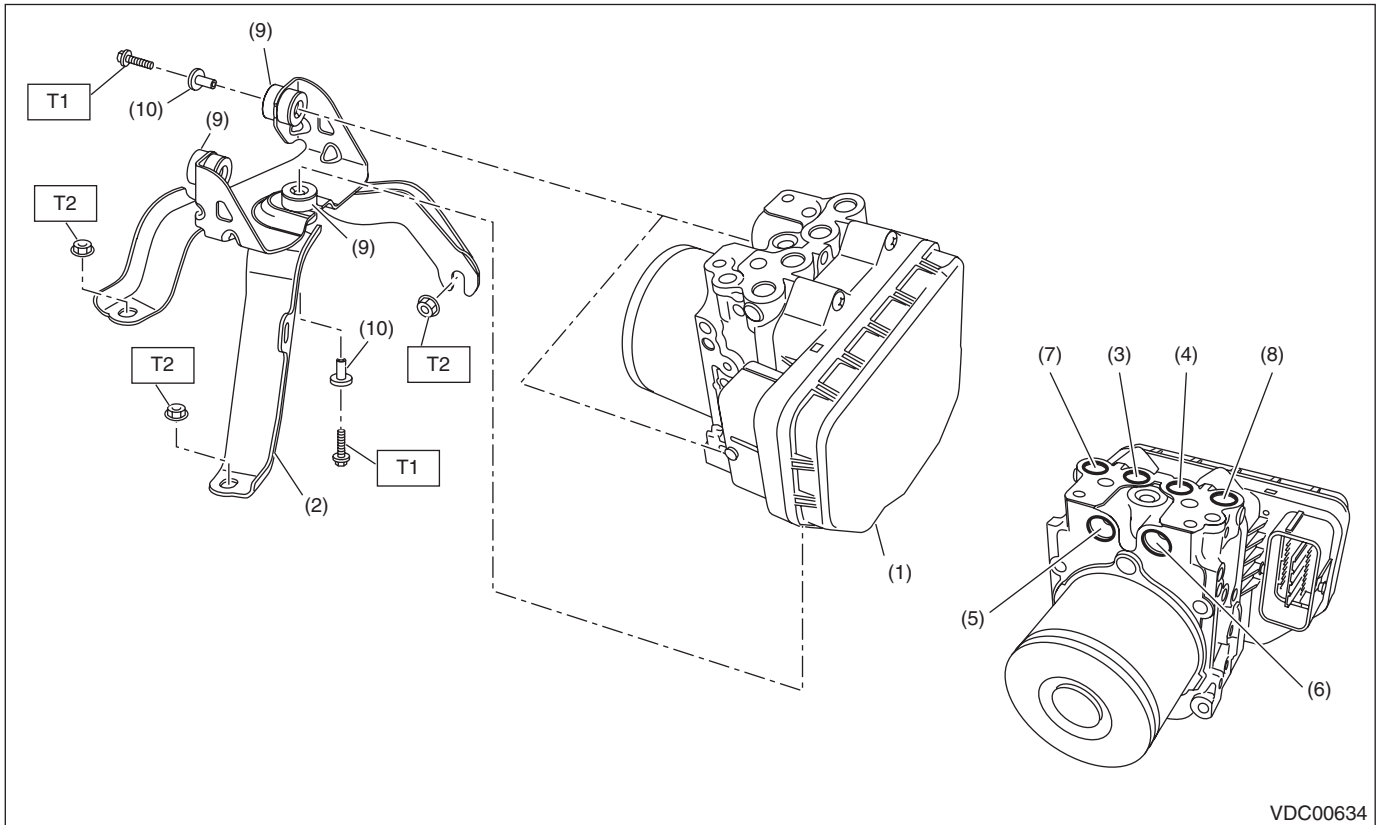


- (1) Steering angle sensor

General Description

VEHICLE DYNAMICS CONTROL (VDC)

4. VDC CONTROL MODULE AND HYDRAULIC CONTROL UNIT (VDCCM&H/U)



- | | |
|---|---------------------|
| (1) VDC control module & hydraulic control unit (VDCCM&H/U) | (6) Primary inlet |
| (2) Bracket | (7) Front LH outlet |
| (3) Rear RH outlet | (8) Front RH outlet |
| (4) Rear LH outlet | (9) Damper |
| (5) Secondary inlet | (10) Spacer |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 7.5 (0.76, 5.53)

T2: 33 (3.4, 24.3)

C: CAUTION

Please understand and adhere to the following general precautions. They must be strictly followed to avoid any injury to the person performing the work or persons in the area.

1. OPERATION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

2. OIL

When handling oil, follow the rules below to prevent unexpected accidents.

- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

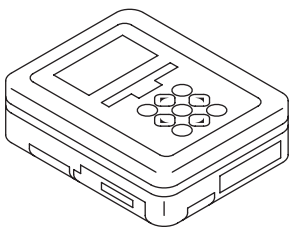
3. BRAKE FLUID

If brake fluid gets in your eyes or on your skin, do the following:

- Wash out your eyes and seek immediate medical attention.
- Wash your skin with soap and then rinse thoroughly with water.
- Follow all government and local regulations concerning waste disposal.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Pressure gauge	Used for measuring oil pressure.
Oscilloscope	Used for measuring the sensor.

VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

VEHICLE DYNAMICS CONTROL (VDC)

2. VDC Control Module and Hydraulic Control Unit (VDC-CM&H/U)

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the air intake duct and air cleaner case.
- 3) Use compressed air to remove moisture and dust around the VDCCM&H/U.

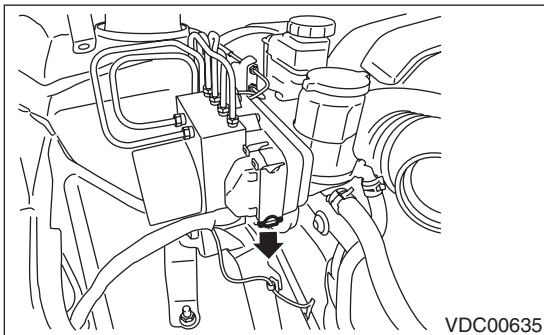
NOTE:

If the terminals become dirty, it may cause improper contact.

- 4) Pull down the lock lever and disconnect the VDCCM&H/U connector.

CAUTION:

Do not pull on the harness when disconnecting the connector.

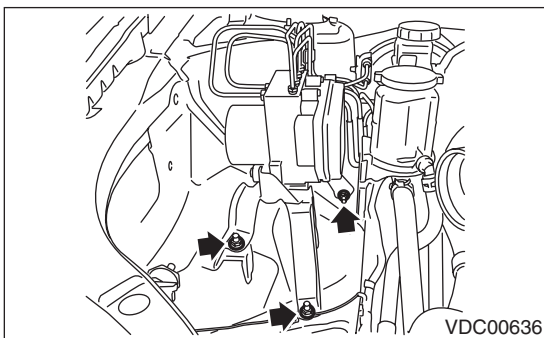


- 5) Disconnect the brake pipes from the VDC-CM&H/U.
- 6) Wrap the brake pipe with a vinyl bag so as not to spill the brake fluid on the vehicle body.

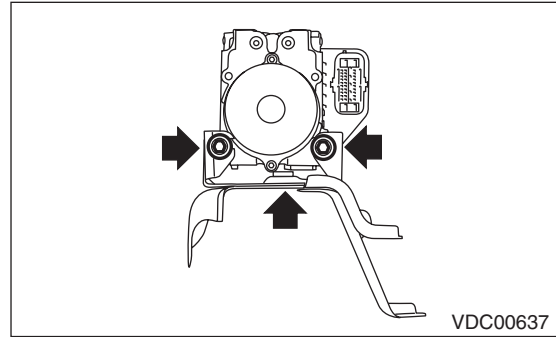
CAUTION:

If brake fluid is spilled on the vehicle body, wash it off immediately with water and wipe clean.

- 7) Remove the nuts and remove the VDCCM&H/U with the bracket as a unit.



- 8) Remove the bolts and remove the VDCCM&H/U.



CAUTION:

- The VDCCM&H/U cannot be disassembled. Do not attempt to loosen the bolts and nuts.
- Do not drop or bump the VDCCM&H/U.
- Do not turn the VDCCM&H/U upside down or place it sideways for storage.
- Be careful not to let foreign matter enter the VDCCM&H/U.
- Be careful that no water enters the connectors.

B: INSTALLATION

- 1) Install the VDCCM&H/U to the bracket.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.53 ft-lb)

- 2) Install the VDCCM&H/U bracket.

Tightening torque:

33 N·m (3.3 kgf-m, 24.3 ft-lb)

- 3) Connect the brake pipes to their correct VDC-CM&H/U positions.

Tightening torque:

<Ref. to BR-7, FRONT BRAKE PIPES AND HOSES, COMPONENT, General Description.>

- 4) Connect the VDCCM&H/U connector.

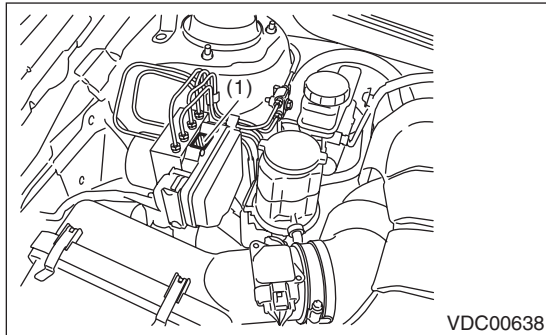
NOTE:

- Be sure to remove all foreign matter from inside the connector before connecting.
- Make sure the VDCCM&H/U connector is securely locked.
- 5) Bleed air from the brake system.

C: INSPECTION

- 1) Check the condition of connection and settlement of connector.
- 2) Check the mark used for VDCCM&H/U identification.

Refer to "SPECIFICATION" for the identification mark. <Ref. to VDC-2, SPECIFICATION, General Description.>



(1) Identification mark

1. CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE

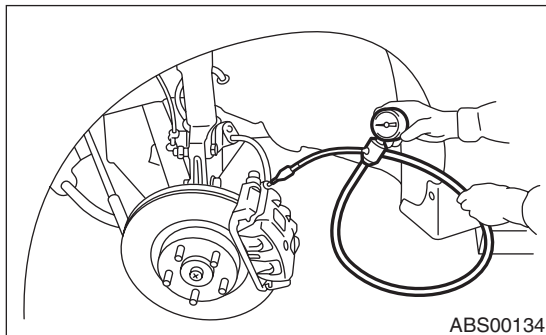
- 1) Lift up the vehicle and remove the wheel.
- 2) Remove the air bleeder screws from FL and FR caliper bodies.
- 3) Connect two pressure gauges to FL and FR caliper bodies.

CAUTION:

- Use a pressure gauge used exclusively for brake fluid measurement.
- Do not use the pressure gauge used for the measurement of transmission oil. Doing so will cause the piston seal to expand and deform.

NOTE:

Wrap sealing tape around the pressure gauge.



- 4) Bleed air from the pressure gauges and the FL and FR caliper bodies.
- 5) Perform ABS sequence control.
<Ref. to VDC-11, ABS Sequence Control.>
- 6) When the hydraulic unit begins to work, first the FL side performs decompression, hold and compression, and then the FR side performs decompression, hold 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. Depress the brake pedal and check that the kick-back is normal, and tightness is normal.

	Front wheel	Rear wheel
Initial value	3,500 kPa (36 kgf/cm ² , 511 psi)	3,500 kPa (36 kgf/cm ² , 511 psi)
When depressurized	500 kPa (5 kgf/cm ² , 73 psi) or less	500 kPa (5 kgf/cm ² , 73 psi) or less
When pressurized	3,500 kPa (36 kgf/cm ² , 511 psi) or more	3,500 kPa (36 kgf/cm ² , 511 psi) or more

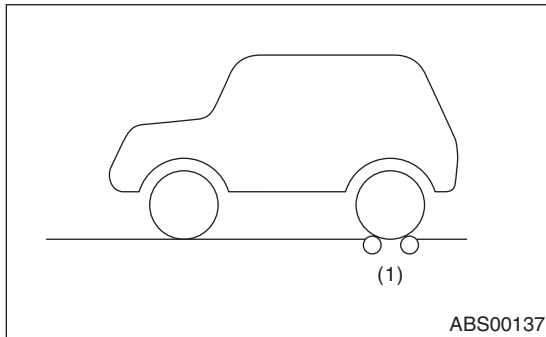
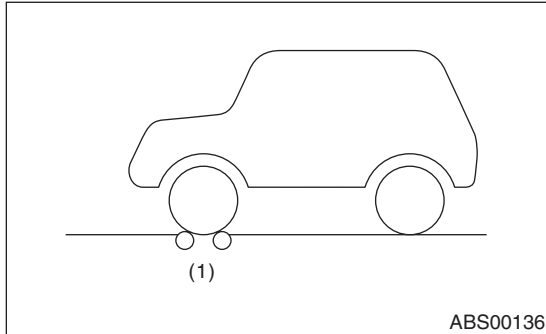
- 8) Disconnect the pressure gauges from FL and FR caliper bodies.
- 9) Install the air bleeder screws of FL and FR caliper bodies.
- 10) Remove the air bleeder screws from RL and RR caliper bodies.
- 11) Connect two pressure gauges to RL and RR caliper bodies.
- 12) Bleed air from the brake system.
- 13) Bleed air from RL and RR caliper bodies, and pressure gauge.
- 14) Perform ABS sequence control.
<Ref. to VDC-11, ABS Sequence Control.>
- 15) When the hydraulic unit begins to work, first the RR side performs decompression, hold and compression, and then the RL side performs decompression, hold and compression.
- 16) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets specification. Depress the brake pedal and check that the kick-back is normal, and tightness is normal.
- 17) Disconnect the pressure gauge from the RL and RR caliper bodies.
- 18) Install the air bleeder screws of RL and RR caliper bodies.
- 19) Bleed air from the brake system.

VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

VEHICLE DYNAMICS CONTROL (VDC)

2. CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER

- 1) Set wheels other than the one to measure on free rollers.
- 2) Prepare for the ABS sequence control operation.
<Ref. to VDC-11, ABS Sequence Control.>
- 3) Set the front wheels or rear wheels on the brake tester and set the select lever position to the "N" range.



(1) Brake tester

- 4) Operate the brake tester.
- 5) Perform ABS sequence control.
<Ref. to VDC-11, ABS Sequence Control.>
- 6) When the hydraulic unit begins to work, check the following work sequence.
 - (1) The FL wheel performs decompression, hold and compression in sequence, and subsequently the FR wheel repeats the cycle.
 - (2) The RR wheel performs decompression, hold and compression in sequence, and subsequently the RL wheel repeats the cycle.

7) Read values indicated on the brake tester and check if the fluctuation of the values between decompression and compression meets specification.

	Front wheel	Rear wheel
Initial value	2,000 N (204 kgf, 450 lb)	2,000 N (204 kgf, 450 lb)
When depressurized	500 N (51 kgf, 112 lb) or less	500 N (51 kgf, 112 lb) or less
When pressurized	2,000 N (204 kgf, 450 lb) or more	2,000 N (204 kgf, 450 lb) or more

8) After the inspection, depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

3. CHECKING THE HYDRAULIC UNIT VDC OPERATION USING A PRESSURE GAUGE

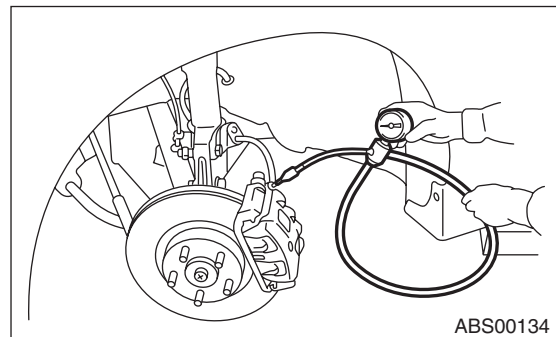
- 1) Lift up the vehicle and remove the wheel.
- 2) Remove the air bleeder screws from FL and FR caliper bodies.
- 3) Connect two pressure gauges to FL and FR caliper bodies.

CAUTION:

- Use a pressure gauge used exclusively for brake fluid measurement.
- Do not use a pressure gauge used for the measuring transmission oil pressure, as the piston seal may expand and deform.

NOTE:

Wrap sealing tape around the pressure gauge.



- 4) Bleed air from the pressure gauge.
- 5) Perform VDC sequence control.
<Ref. to VDC-14, VDC Sequence Control.>
- 6) When the hydraulic unit begins to work, first the FL side performs compression, hold, and decompression, and then the FR side performs compression, hold, and decompression.

7) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets specification. Depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

	Front wheel	Rear wheel
When pressurized	3,000 kPa (31 kgf/cm ² , 441 psi) or more	3,000 kPa (31 kgf/cm ² , 441 psi) or more
When depressurized	500 kPa (5 kgf/cm ² , 73 psi) or less	500 kPa (5 kgf/cm ² , 73 psi) or less

8) Disconnect the pressure gauges from FL and FR caliper bodies.

9) Install the air bleeder screws of FL and FR caliper bodies.

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

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

12) Bleed air from RL and RR caliper bodies, and pressure gauge.

13) Perform VDC sequence control.

<Ref. to VDC-14, VDC Sequence Control.>

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

15) Read the values indicated on the pressure gauges and check if it is within specification. Depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

16) Disconnect the pressure gauge from the RL and RR caliper bodies.

17) Install the air bleeder screws of RL and RR caliper bodies.

18) Bleed air from the brake line.

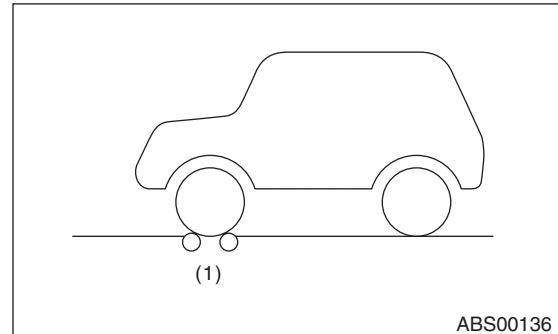
4. CHECKING THE HYDRAULIC UNIT VDC OPERATION WITH BRAKE TESTER

1) Set wheels other than the one to measure on free rollers.

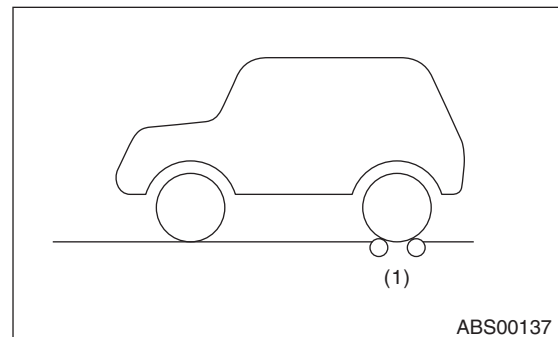
2) Prepare to operate the VDC sequence control.

<Ref. to VDC-14, VDC Sequence Control.>

3) Set the front wheels or rear wheels on the brake tester and set the select lever position to the "N" range.



ABS00136



ABS00137

(1) Brake tester

4) Operate the brake tester.

5) Perform VDC sequence control.

<Ref. to VDC-14, VDC Sequence Control.>

6) When the hydraulic unit begins to work, check the following work sequence.

(1) The FL wheel performs compression, hold and decompression in sequence, and subsequently the FR wheel repeats the cycle.

(2) The RR wheel performs compression, hold and decompression in sequence, and subsequently the RL wheel repeats the cycle.

7) Read values indicated on the brake tester and check if the fluctuation of the values between decompression and compression meets specification.

	Front wheel	Rear wheel
When pressurized	2,000 N (204 kgf, 450 lb) or more	2,000 N (204 kgf, 450 lb) or more
When depressurized	500 N (51 kgf, 112 lb) or less	500 N (51 kgf, 112 lb) or less

8) After the inspection, depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

D: ADJUSTMENT

When the following replacement, removal and installation are performed, be sure to perform the centering of the steering angle sensor and zero point setting of the yaw rate & lateral G sensor.

- VDCCM&H/U
- Steering angle sensor
- Yaw rate & lateral G sensor
- Steering wheel parts (Including airbag)
- Suspension parts
- Wheel alignment adjustment

1) Park the vehicle straight on a level surface. (Engine operation in the “P” or “N” range)

2) Check that steering wheel is positioned at the center. (When the center position is not correct, adjust the wheel alignment.)

3) Set the Subaru Select Monitor III to the vehicle, and select {Set up mode for Neutral of Steering Angle Sensor & Lateral G Sensor 0 point} in the “Function check sequence” screen. (Follow the steps on the display.)

4) On the “Brake Control System” display screen, select {Current Data Display & Save}, and check that the steering angle sensor shows “0 deg”.

5) When the “0 deg” is not displayed, repeat the above steps and check that the “0 deg” is displayed.

6) Drive the vehicle for 10 minutes, and check that the ABS and VDC warning light is not illuminated.

7) Check that there is no unnecessary VDC operation or steering control loss. If there is a problem, repeat the steps above.

3. ABS Sequence Control

A: OPERATION

- 1) While the ABS sequence control is being performed, the operation of the hydraulic unit can be checked using the brake tester or pressure gauge after the hydraulic unit solenoid valve operation.
- 2) ABS sequence control can be started by the Subaru Select Monitor.

1. ABS SEQUENCE CONTROL WITH SUBARU SELECT MONITOR

NOTE:

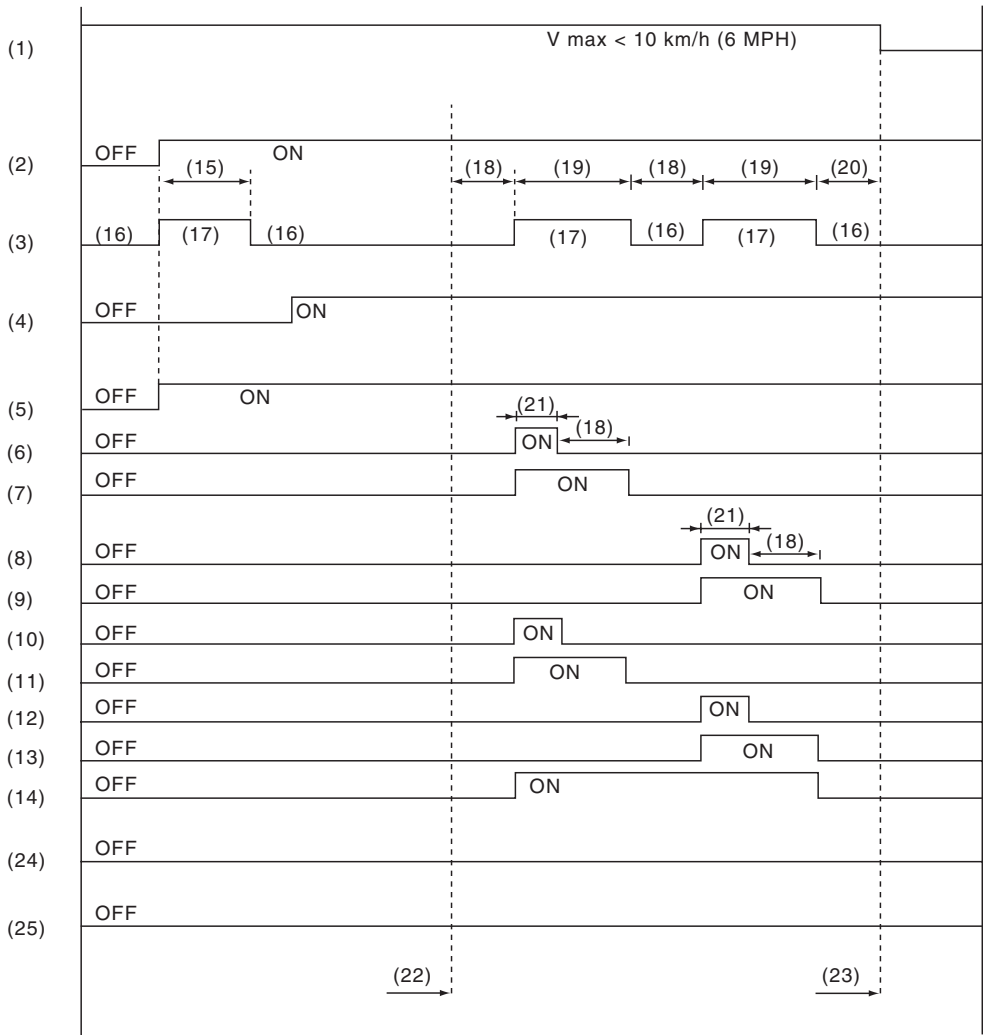
In the event of any trouble, the ABS sequence control will not operate.

- 1) Connect the Subaru Select Monitor to data link connector under the driver's side instrument panel lower cover.
- 2) Turn the ignition switch to ON.
- 3) Run the "PC application for Subaru Select Monitor".
- 4) Set the Subaru Select Monitor to "Brake Control System" mode.
- 5) When the "Function Check Sequence" is selected, the "ABS Sequence Control" will start.
- 6) Execute the following operations when the message "Press Brake Pedal Firmly" is displayed.
 - (1) When the brake tester is used, press brake pedal pad with a force of 1,000 N (102 kgf, 225 lb).
 - (2) When using a pressure gauge, press the brake pedal so that the pressure gauge indicates 3,500 kPa (36 kg/cm², 511 psi).
- 7) "Press "OK"" will be displayed. Press the [OK] key.
- 8) The brake system being operated is displayed on the Subaru Select Monitor.

ABS Sequence Control

VEHICLE DYNAMICS CONTROL (VDC)

2. CONDITIONS FOR ABS SEQUENCE CONTROL



VDC00357

ABS Sequence Control

VEHICLE DYNAMICS CONTROL (VDC)

(1) All wheel speed	(10) RR decompression valve	(18) 1.0 second
(2) Ignition key	(11) RR hold valve	(19) 1.4 seconds
(3) ABS warning light	(12) RL decompression valve	(20) 0.6 seconds
(4) Stop light switch	(13) RL hold valve	(21) 0.4 seconds
(5) Valve relay	(14) Pump motor	(22) Point A
(6) FL decompression valve	(15) 1.5 seconds	(23) Reset
(7) FL hold valve	(16) Light OFF	(24) Linear valve 1
(8) FR decompression valve	(17) Light ON	(25) Linear valve 2
(9) FR hold valve		

NOTE:

The control operation starts from point A.

B: SPECIFICATION

1. ABS SEQUENCE CONTROL COMPLETE CONDITION

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 ABS sequence control and the stop light switch becomes OFF.
- 3) After completion of ABS sequence control.
- 4) When a malfunction is detected.

4. VDC Sequence Control

A: OPERATION

- 1) While the VDC sequence control is performed, the operation of the hydraulic unit can be checked using the brake tester or pressure gauge after the hydraulic unit solenoid valve is operated.
- 2) VDC sequence control can be started by Subaru Select Monitor.

1. VDC SEQUENCE CONTROL WITH SUBARU SELECT MONITOR

NOTE:

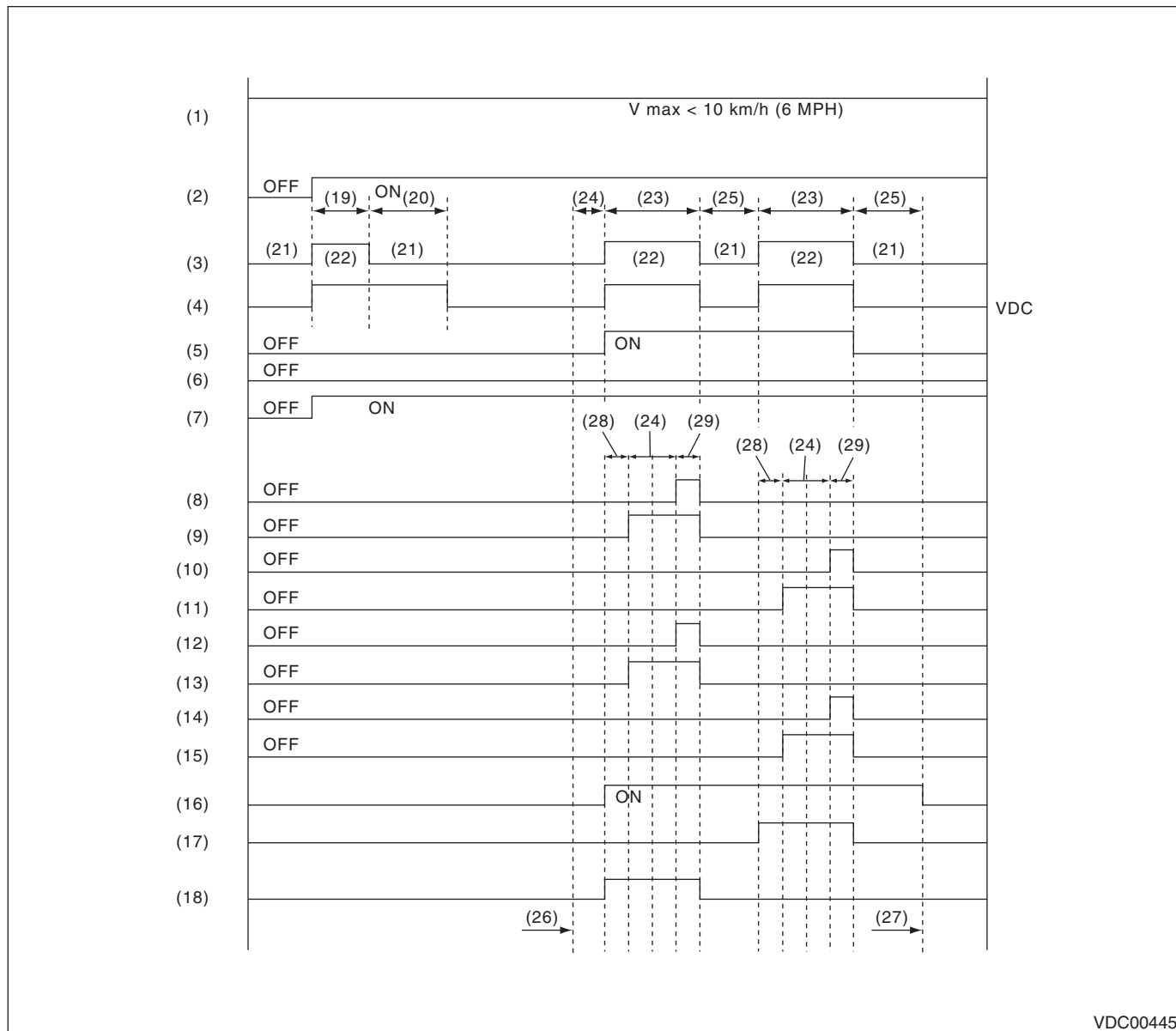
In the event of any trouble, sequence control will not operate.

- 1) Connect the Subaru Select Monitor to data link connector under the driver's side instrument panel lower cover.
- 2) Turn the ignition switch to ON.
- 3) Run the "PC application for Subaru Select Monitor".
- 4) Set the Subaru Select Monitor to "Brake Control System" mode.
- 5) When the "VDC Inspection Mode" is selected from the "Function check sequence" menu, the "VDC sequence control" will start.
- 6) "Press "OK"" will be displayed. Press the [OK] key.
- 7) Operation points will be displayed on Subaru Select Monitor.

VDC Sequence Control

VEHICLE DYNAMICS CONTROL (VDC)

2. CONDITIONS FOR VDC SEQUENCE CONTROL



VDC00445

(1) All wheel speed	(11) FR compression valve	(21) Light OFF
(2) Ignition key	(12) RR decompression valve	(22) Light ON
(3) ABS warning light	(13) RR compression valve	(23) 3.4 seconds
(4) VDC warning light	(14) RL decompression valve	(24) 2.2 seconds
(5) VDC operation light (CAN output)	(15) RL compression valve	(25) 1.6 seconds
(6) Stop light switch	(16) Pump motor	(26) Point A
(7) Valve relay	(17) Linear valve 1	(27) Reset
(8) FL decompression valve	(18) Linear valve 2	(28) 0.8 seconds
(9) FL compression valve	(19) 1.5 seconds	(29) 0.4 seconds
(10) FR decompression valve	(20) Approx. 3 seconds	

NOTE:

The control operation starts from point A.

B: SPECIFICATION

1. CONDITIONS FOR COMPLETION OF VDC SEQUENCE CONTROL

When the following conditions develop, the VDC sequence control stops and VDC 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 pressed during sequence control and the stop light switch is set to ON.
- 3) After completion of VDC sequence control.
- 4) When a malfunction is detected.

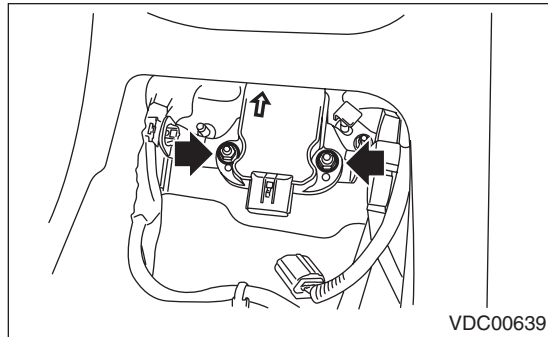
5. Yaw Rate and G Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the console box.
<Ref. to EI-40, Console Box.>
- 3) Disconnect the connector from the yaw rate & lateral G sensor.
- 4) Remove the yaw rate & lateral G sensor.

CAUTION:

Do not drop or bump the yaw rate & lateral G sensor.

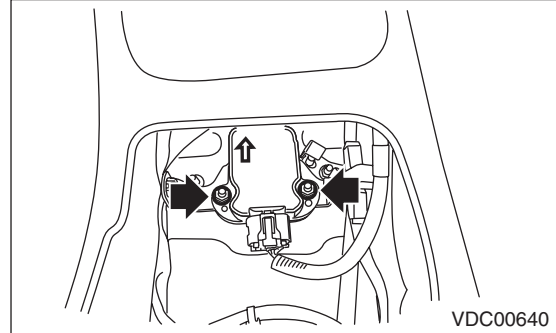


B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Install the yaw rate & lateral G sensor to the body while pointing the arrow mark on the sensor to the front of the vehicle.



Tightening torque:

7.5 N·m (0.76 kgf-m, 5.53 ft-lb)

CAUTION:

After completion of installation, set the following two positions.

- Positioning to the center of steering angle sensor
- Positioning of the yaw rate & lateral G sensors to zero

The above procedure is required VDCCM&H/U to identify the vehicle position afterward. For the setting procedures of the 2 steps above, refer to "VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)". <Ref. to VDC-10, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

Steering Angle Sensor

VEHICLE DYNAMICS CONTROL (VDC)

6. Steering Angle Sensor

A: REPLACEMENT

CAUTION:

- Do not perform the removal except when the replacement.
- When replacing three times or more, replace the combination switch as assembly to protect the threads.

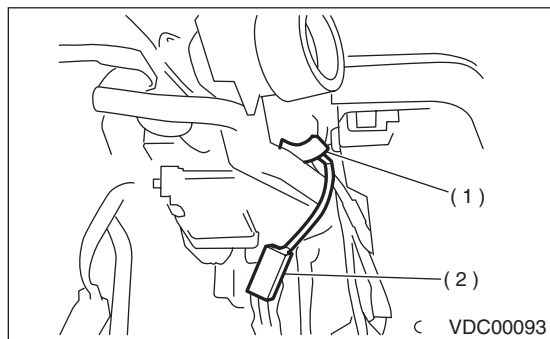
- 1) Set the steering wheel in a straight-ahead position.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the airbag module.
<Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

WARNING:

Always refer to "Airbag System" when performing the airbag module repair service.

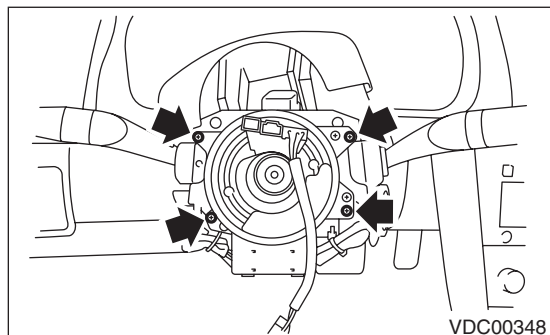
<Ref. to AB-4, CAUTION, General Description.>

- 4) Remove the steering wheel.
<Ref. to PS-12, REMOVAL, Steering Wheel.>
- 5) Remove the screws and remove the steering column lower cover.
- 6) Remove the two screws securing the steering column upper cover.
- 7) Unlock the harness band and disconnect the connector of the steering angle sensor.

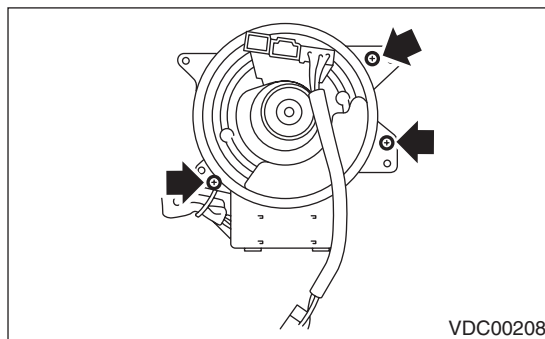


- (1) Harness band
- (2) Connector

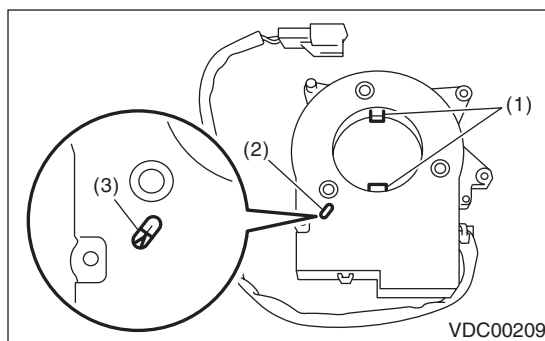
- 8) Remove the screws which secure the roll connector to steering column.



- 9) Remove the steering angle sensor from roll connector.



- 10) Turn the protrusion portion of new steering angle sensor to match the alignment mark of inspection hole.

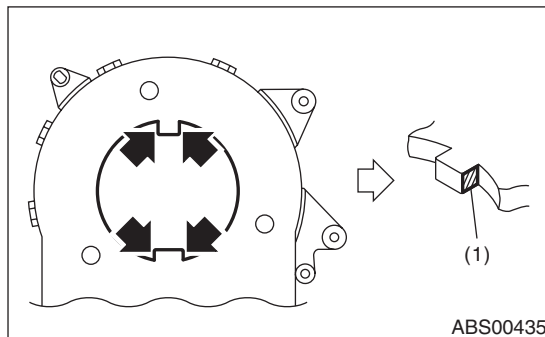


- (1) Protrusion portion
- (2) Inspection hole
- (3) Alignment mark

CAUTION:

Be careful not to allow foreign matter to enter into inspection hole.

- 11) Align the center of roll connector.
<Ref. to AB-25, ADJUSTMENT, Roll Connector.>
- 12) Apply a thin coat of grease that is supplied with the new part, to the 4 protruding sections of the steering angle sensor.

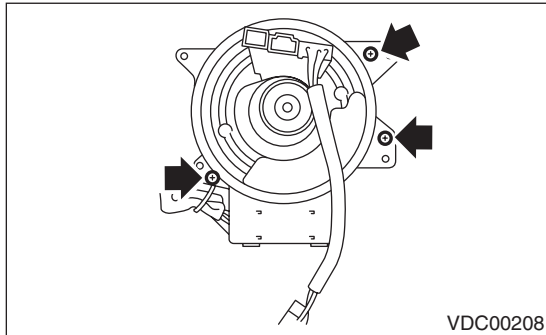


- (1) Apply grease.

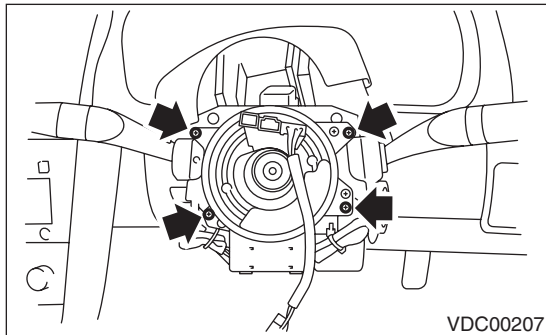
13) Align the position of the protrusion and install roll connector to steering angle sensor.

Tightening torque:

0.5 N·m (0.05 kgf-m, 0.36 ft-lb)



14) Install the roll connector to combination switch.



15) Install the steering wheel.
<Ref. to PS-12, INSTALLATION, Steering Wheel.>

Tightening torque:

45 N·m (4.6 kgf-m, 33.2 ft-lb)

16) Install the airbag module to the steering wheel.
<Ref. to AB-14, INSTALLATION, Driver's Airbag Module.>

WARNING:

Always refer to "Airbag System" before performing the service operation.

<Ref. to AB-4, CAUTION, General Description.>

17) Connect the ground cable to battery.

CAUTION:

After completion of installation, adjust the following two positions.

- Positioning to the center of steering angle sensor

- Positioning the yaw rate & G sensors to zero

The above procedure is required for the VDC-CM to identify vehicle position afterward. For the setting procedures of the 2 steps above, refer to "VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)". <Ref. to VDC-10, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

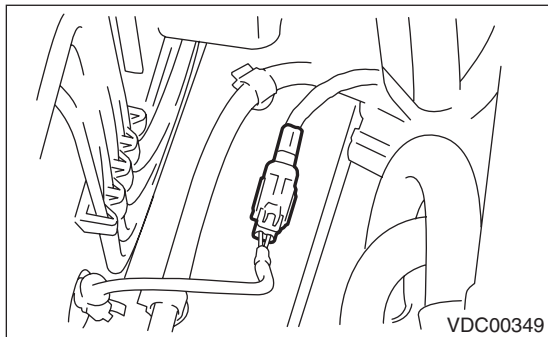
Front ABS Wheel Speed Sensor

VEHICLE DYNAMICS CONTROL (VDC)

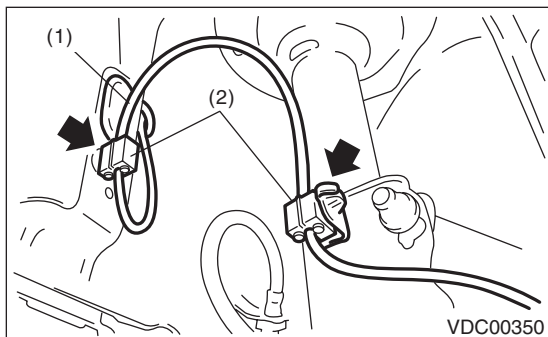
7. Front ABS Wheel Speed Sensor

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the ABS wheel speed sensor connector in the engine compartment.



- 3) Remove the sensor harness from the clip.

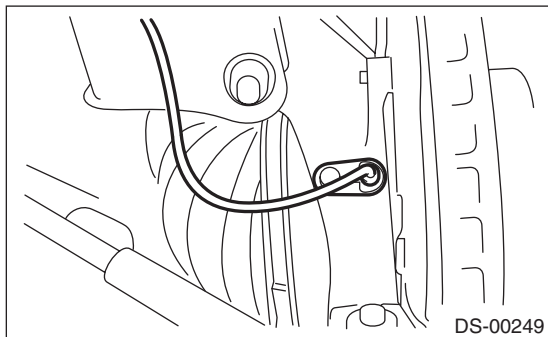


- (1) To the front ABS wheel speed sensor connector
- (2) Clip

- 4) Remove the clip which secures the sensor harness to the front strut.
- 5) Remove the front ABS wheel speed sensor from housing.

CAUTION:

- Be careful not to damage the sensor.
- Do not apply excessive force to the sensor harness.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.53 ft-lb)

CAUTION:

Be careful not to damage the sensor.

NOTE:

- Check the identification (mark) on the harness to make sure there is no warpage. (W1 (White))
- Check if the harness is not pulled and does not come in contact with the suspension or body during steering wheel effort.

C: INSPECTION

1. CHECK WITH SUBARU SELECT MONITOR

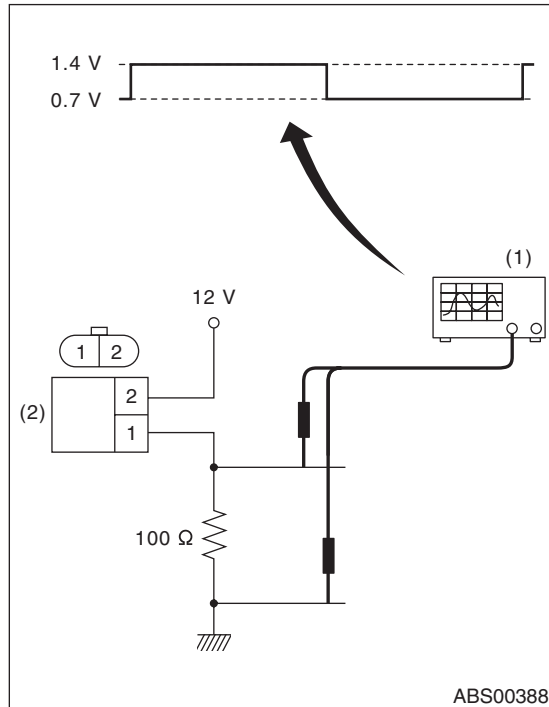
- 1) Connect the Subaru Select Monitor to the data link connector.
- 2) Select {Current Data Display & Save}. Check if the speed indicated on the display changes in the same manner as the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position.
- 3) If the speed indicated on the display does not change, check the ABS wheel speed sensor. <Ref. to VDC-21, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>

2. ABS WHEEL SPEED SENSOR

- 1) Check the tip of the ABS wheel speed sensor for foreign particles or damage. If necessary, clean the tip or replace the ABS wheel speed sensor.
- 2) Connect a 12 V power supply to No. 2 terminal of sensor connector as shown in the figure, then attach resistance to the No. 1 terminal. Rotate the wheel at about 2.75 km/h (2 MPH), and measure the voltage using an oscilloscope.

Standard value of output voltage:

0.7 — 1.4 V



- (1) Oscilloscope
(2) ABS wheel speed sensor

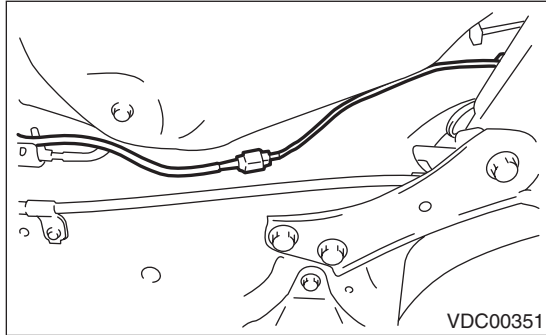
Rear ABS Wheel Speed Sensor

VEHICLE DYNAMICS CONTROL (VDC)

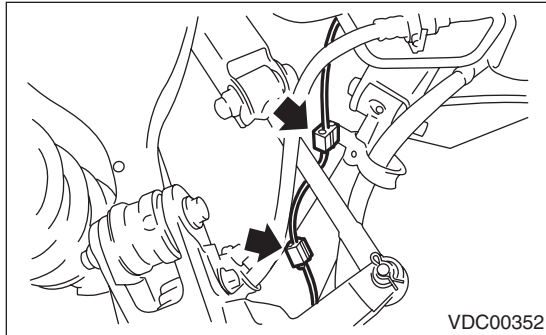
8. Rear ABS Wheel Speed Sensor

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the connector from the rear ABS wheel speed sensor.



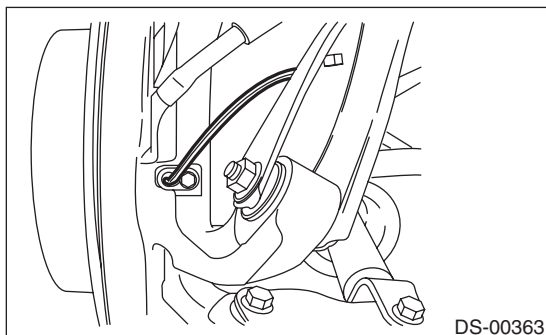
- 3) Remove the sensor harness from the rear arm clip.



- 4) Remove the rear ABS wheel speed sensor from the rear housing.

CAUTION:

- Be careful not to damage the sensor.
- Do not apply excessive force to the sensor harness.



B: INSTALLATION

Install in the reverse order of removal.

CAUTION:

Be careful not to damage the sensor.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.53 ft-lb)

NOTE:

Check the identification (mark) on the harness to make sure there is no warpage. (W3 (White))

C: INSPECTION

1. ABS WHEEL SPEED SENSOR

<Ref. to VDC-21, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>

9. Front Magnetic Encoder

A: REMOVAL

Refer to “Front Hub Bearing” for removal, because the front magnetic encoder is integrated with front hub bearing.

<Ref. to DS-20, REMOVAL, Front Hub Unit Bearing.>

B: INSTALLATION

Refer to “Front Hub Bearing” for installation, because the front magnetic encoder is integrated with front hub bearing.

<Ref. to DS-20, INSTALLATION, Front Hub Unit Bearing.>

C: INSPECTION

Visually check the magnetic encoder for any damage. If necessary, replace with a new hub unit bearing.

NOTE:

Because the magnetic encoder is integrated with hub unit bearing assembly, replace the hub unit bearing with a new part if there is any defect found on the magnetic encoder.

10. Rear Magnetic Encoder

A: REMOVAL

Refer to “Rear Hub Unit Bearing” for removal, because the rear magnetic encoder is integrated with rear hub unit bearing.

<Ref. to DS-22, REMOVAL, Rear Hub Unit Bearing.>

B: INSTALLATION

Refer to “Rear Hub Unit Bearing” for installation, because the rear magnetic encoder is integrated with rear hub unit bearing.

<Ref. to DS-23, INSTALLATION, Rear Hub Unit Bearing.>

C: INSPECTION

Visually check the magnetic encoder parts for any damage. If necessary, replace with a new hub unit bearing.

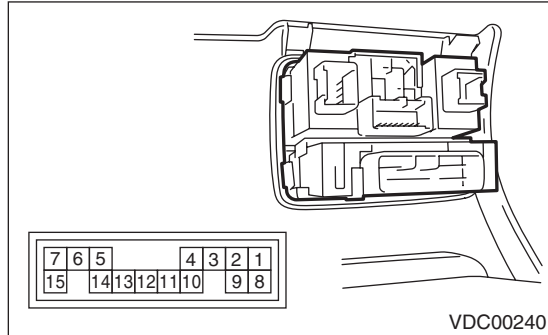
NOTE:

Because the magnetic encoder is integrated with hub unit bearing assembly, replace the hub unit bearing with a new part if there is any defect found on the magnetic encoder.

11.TCS OFF Switch

A: REMOVAL

- 1) Remove the instrument panel lower cover.
- 2) Remove the screws, and then remove the TCS OFF switch.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

Measure the resistance between the TCS OFF switch terminals.

Switch position	Terminal No.	Standard value
ON	5 — 15	Less than 1 Ω
OFF	5 — 15	1 M Ω or more

If NG, replace the TCS OFF switch.

TCS OFF Switch

VEHICLE DYNAMICS CONTROL (VDC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

VDC(diag)

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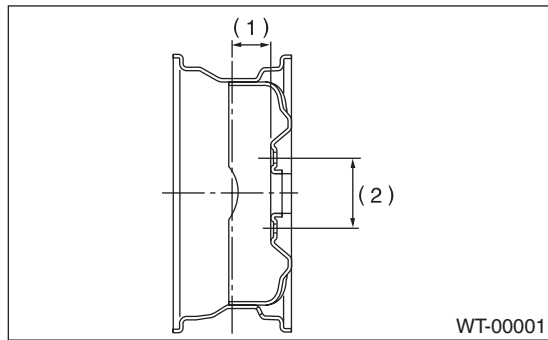
General Description

WHEEL AND TIRE SYSTEM

1. General Description

A: SPECIFICATION

1. WHEEL AND TIRE SIZE



- (1) Inset
(2) P.C.D.

Specifications	Tire size	Wheel size	Inset mm (in)	P.C.D. mm (in)	Tire inflation pressure kPa (kgf/cm ² , psi)	
					Front wheel	Rear wheel
Standard type	255/55R18 105H	18 × 8JJ	55 (2.17)	114.3 (4.50)	230 (2.3, 33)	220 (2.2, 32)
“T-type” Tire	T165/80R17 104M	17 × 4T	40 (1.57)		—	420 (4.2, 60)

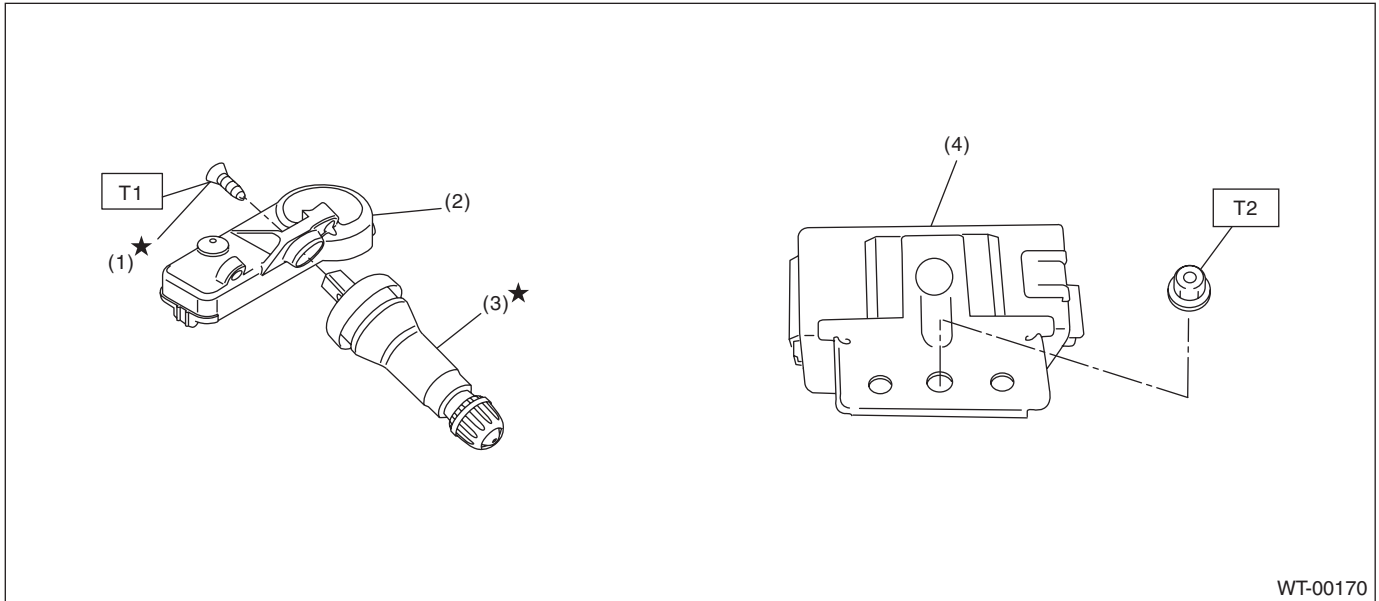
2. SERVICE DATA

Part	Axial runout	Radial runout
Aluminum wheel	1.0 mm (0.039 in)	

Wheel balancing	Standard	Service limit
Dynamic unbalance	10 g (0.35 oz) or less	

B: COMPONENT

1. TIRE PRESSURE MONITORING SYSTEM



(1) Screw

(2) Transmitter (snap in type)

(3) Valve

(4) TPMS & keyless entry control module

Tightening torque: N·m (kgf-m, ft-lb)

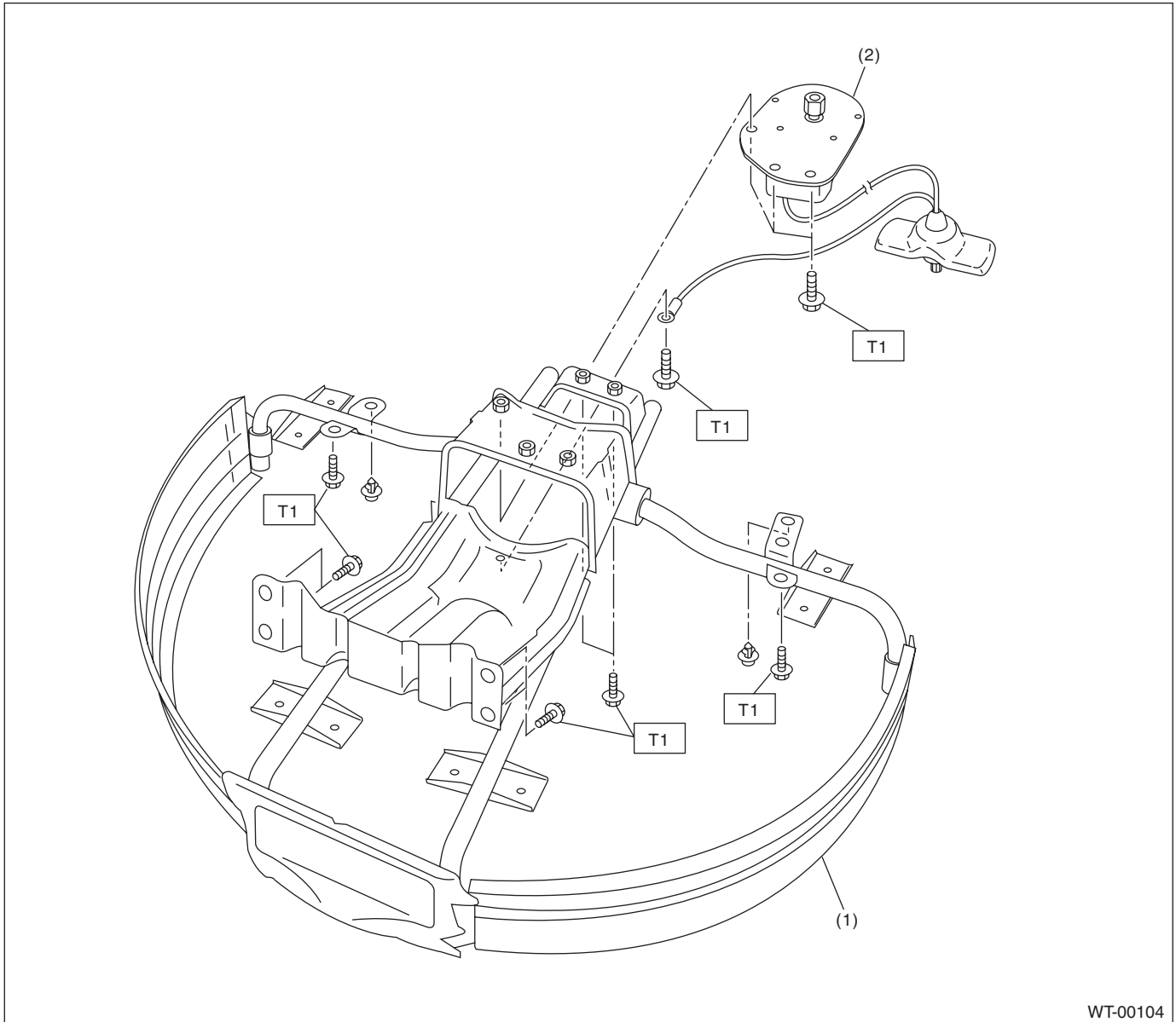
T1: 1.4 (0.14, 1)

T2: 7.5 (0.76, 5.5)

General Description

WHEEL AND TIRE SYSTEM

2. SPARE TIRE HOIST



(1) Spare tire guide

(2) Spare tire hoist

Tightening torque: N·m (kgf-m, ft-lb)

T1: 33 (3.7, 24.3)

C: PREPARATION TOOL

1. GENERAL TOOL

TOOL NAME	REMARKS
Air pressure gauge	Used for measuring tire air pressure.
Dial gauge with magnet stand	Used for measuring wheel runout.
Wheel balancer	Used for adjusting wheel balance.

2. Tire and Wheel

A: REMOVAL

- 1) Lift up the vehicle.
- 2) Remove the wheel nut.
- 3) Remove the wheels.

CAUTION:

When removing the wheels, be careful not to damage the hub bolts.

B: INSTALLATION

- 1) Install the wheels to vehicle.
- 2) Tighten the wheel nuts to the specified torque.

Tightening torque:

Chromed plated wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

C: INSPECTION

1. TIRES

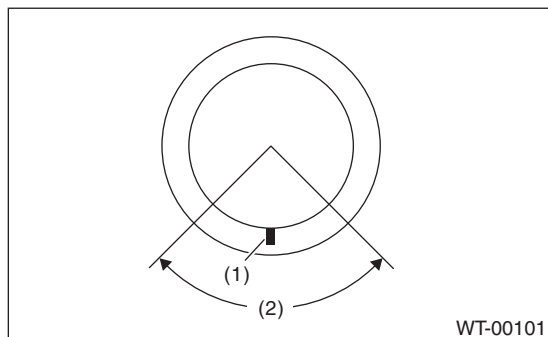
CAUTION:

When replacing a tire, make sure to use only tires of the same size, construction and load range as originally installed.

- 1) Tire size and tire inflation pressure check <Ref. to WT-2, SPECIFICATION, General Description.>
- 2) Check for cracks, damage and wear. Replace tires in the following cases.

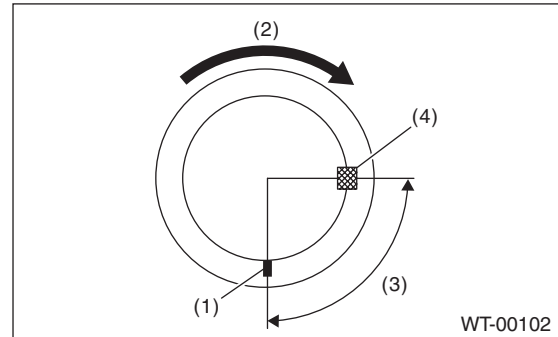
CAUTION:

- When replacing a tire, make sure to use only tires of the same size, construction and load range as originally installed.
- Use a tire changer when removing the tire from the wheel.
- On models equipped with tire pressure monitoring systems, do not use the bead breaker in a 90° area centered on the transmitter to prevent damaging the transmitter.



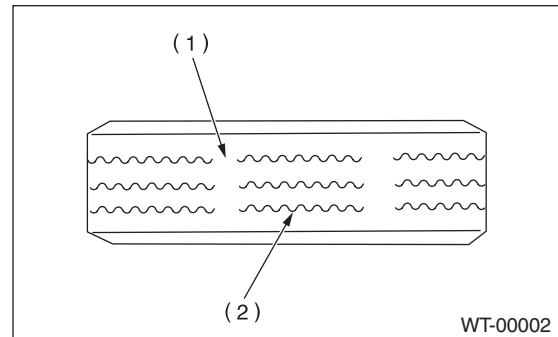
- (1) Transmitter
- (2) 90°(use of a bead breaker is prohibited in this area.)

- To prevent damaging the transmitter, set the tire changer boom in the position as shown in the figure.



- (1) Transmitter
- (2) Direction of turn table rotation
- (3) 90°
- (4) Tire changer boom

- (1) If large cracks on side wall, damage or cracks on the tread is found.
- (2) When the "tread wear indicator" appears as a solid band across the tread.



- (1) Tread wear indicator
- (2) Tire tread

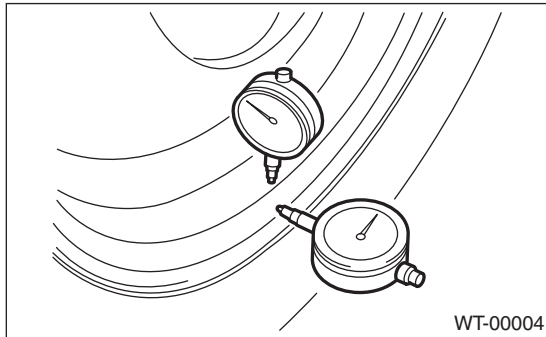
- 3) When a crack on tire valve is found, replace the tire valve.

Tire and Wheel

WHEEL AND TIRE SYSTEM

4) Tire runout check

- (1) Lift up the vehicle.
- (2) Slowly rotate the wheel to check rim "runout" using a dial gauge.



Axial runout limit	Radial runout limit
1.0 mm (0.039 in)	

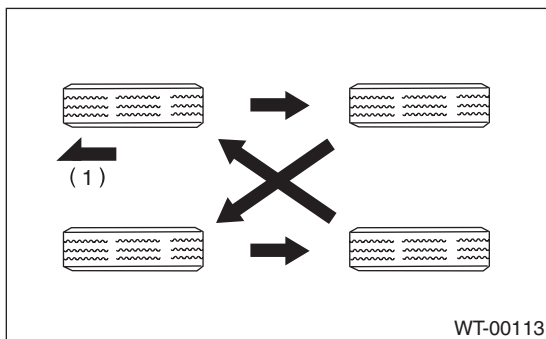
- (3) If the rim runout exceeds service limit, replace the wheel.

2. TIRE ROTATION

NOTE:

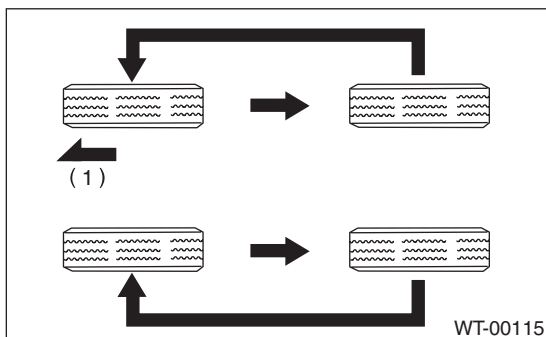
Rotate tires periodically (12,500 km/7,500 miles) in order to prolong life and to prevent uneven wear. Rotate tires as shown in the figure depending on whether or not the direction of the tire rotation is specified.

- When the direction of tire rotation is not specified



(1) Front side of vehicle

- When the direction of tire rotation is specified



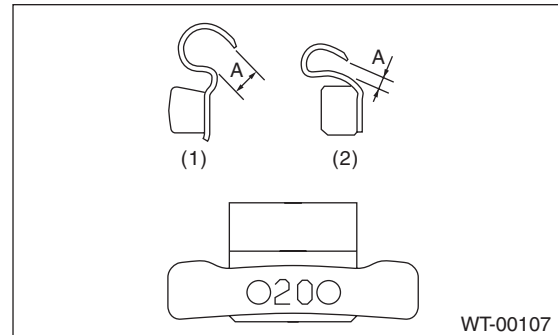
(1) Front side of vehicle

3. WHEEL BALANCING

- 1) Using the wheel balancer, measure wheel balance.
- 2) Adjust the wheel balancing.

NOTE:

- Unbalance after adjusting the wheel balancing should be 5 g (0.18 oz) or less.
- When using the adhesive type weight, degrease the surface where the adhesive type weight will be applied securely.
- After applying the adhesive type weight, apply a force to the weight and attain full adhesion.
- Using the knock-on type weight, check the size of the knock-on part.



- (1) Knock-on type weight for aluminum wheel
- (2) Knock-on type weight for steel wheel

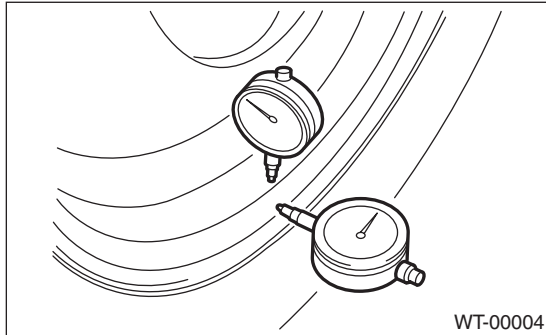
Service limit A:

Knock-on type weight for steel wheel:
2.0 mm (0.079 in)

Knock-on type weight for aluminum wheel:
5.0 mm (0.197 in)

4. ALUMINUM WHEEL

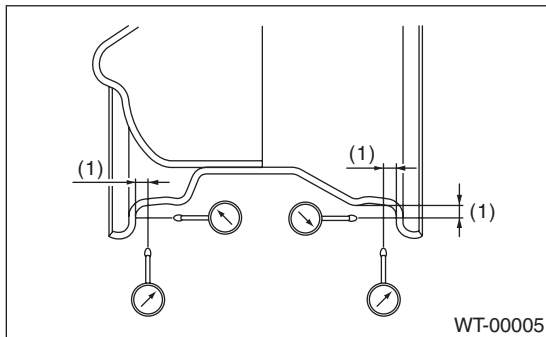
- 1) Deformation or damage to the rim may cause air leakage. Check the rim flange for deformation, cracks or damage, and repair or replace as necessary.
- 2) Jack-up the vehicle until wheels clear the floor.
- 3) Slowly rotate the wheel to check rim "runout" using a dial gauge.



Rim runout:

Axial runout limit	Vertical run-out limit
1.0 mm (0.039 in)	

- 4) If the rim runout exceeds specifications, remove the tire from wheel and check runout while attaching dial gauge to positions shown in the figure.



(1) Approx. 7 mm (0.28 in)

- 5) If the measured runout still exceeds specifications, replace the wheel.

3. “T-type” Tire

A: NOTE

CAUTION:

- The “T-type” tire is only for temporary use. Replace with a conventional tire as soon as possible.
- Do not drive at a speed greater than 80 km/h (50 MPH).
- For the model with tire pressure monitoring system, the indicator light may illuminate after blinking 25 times when running with the T-type tire.

“T-type” tire for temporary use is equipped as a spare tire.

B: REPLACEMENT

CAUTION:

The “T-type” tire is only for temporary use. Replace with a conventional tire as soon as possible.

Refer to “Tire & Wheels” for removal and installation procedures of the “T-type” tire. <Ref. to WT-5, Tire and Wheel.>

C: INSPECTION

- 1) Check the tire air pressure.

Specifications:

420 kPa (4.2 kg/cm², 60 psi)

- 2) Take stones, glass, nails, etc. out of the tread groove.
- 3) Check the tires for deformation, cracks, partial wear, or wear.

CAUTION:

Replace the tire with a new part if defective.

4. Tire Pressure Monitoring System

A: REMOVAL

1. TRANSMITTER (SNAP IN TYPE)

- 1) Remove the wheels from the vehicle. <Ref. to WT-5, REMOVAL, Tire and Wheel.>
- 2) Remove the tires from wheels.

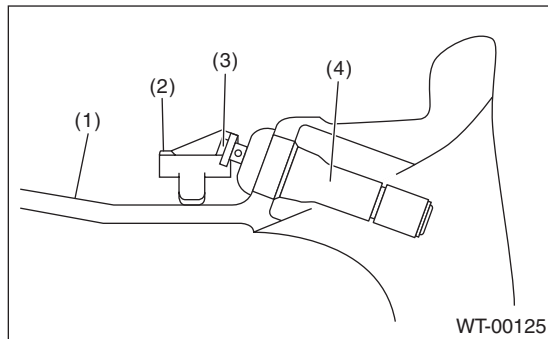
CAUTION:

Use a tire changer when removing the tire from the wheel.

- 3) Loosen the screw to remove the transmitter from the valve stem.

NOTE:

Replace the valve and screw with a new part when reusing transmitter.



- (1) Wheel
- (2) Transmitter
- (3) Screw
- (4) Valve

- 4) Remove the valve from the wheel.

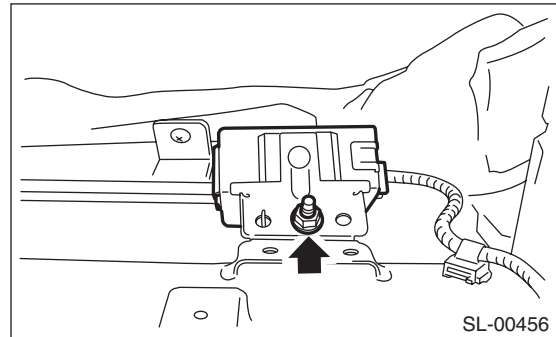
2. TPMS & KEYLESS ENTRY CONTROL MODULE

NOTE:

TPMS control module is integrated into keyless entry control module.

- 1) Disconnect the ground cable from battery.
- 2) Remove the glove box. <Ref. to EI-39, REMOVAL, Glove Box.>

- 3) Remove the nut, disconnect the connector, and then remove the TPMS & keyless entry control module.



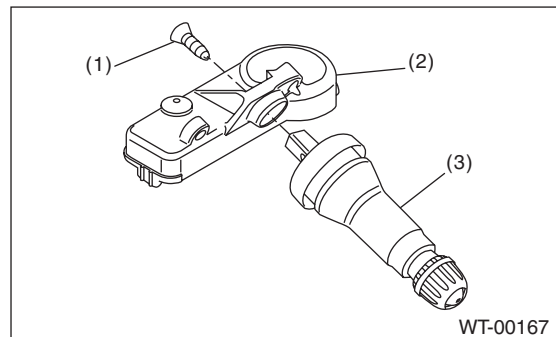
B: INSTALLATION

1. TRANSMITTER (SNAP IN TYPE)

CAUTION:

Use the new transmitter assembly or replace the new valve and screw, when installing.

- 1) Replace the valve and screw with a new part when reusing transmitter.



- (1) Screw
- (2) Transmitter
- (3) Valve

Tightening torque:

1.4 N·m (0.14 kgf-m, 1 ft-lb)

- 2) Install the transmitter to the wheel by aligning it with valve hole.

NOTE:

When using the jig that pulls the valve cap by hooking its neck part, use another short-type cap.

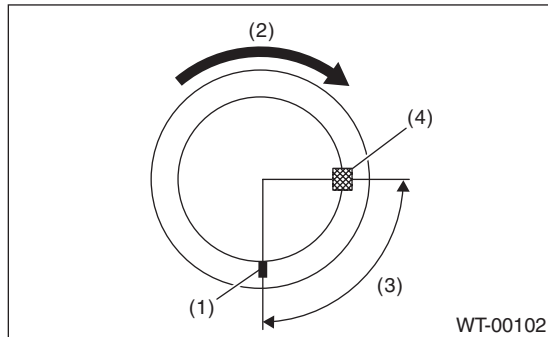
Tire Pressure Monitoring System

WHEEL AND TIRE SYSTEM

3) Install the tires to wheels.

CAUTION:

- Use a tire changer when installing tire to wheel.
- To prevent damaging the transmitter, set the tire changer boom in the position as shown in the figure.



- (1) Transmitter
- (2) Direction of turn table rotation
- (3) 90°
- (4) Tire changer boom

4) Install the wheels to vehicle. <Ref. to WT-5, INSTALLATION, Tire and Wheel.>

5) Register the transmitter ID to the TPMS & keyless entry control module. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>

2. TPMS & KEYLESS ENTRY CONTROL MODULE

Install each part in the reverse order of removal.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

C: ADJUSTMENT

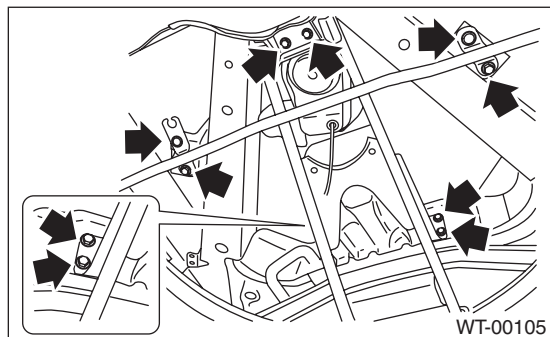
Re-register the transmitter ID when transmitter has been replaced. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>

Re-register the keyless transmitter when TPMS & keyless entry control module has been replaced. <Ref. to SL-50, REGISTRATION OF KEYLESS TRANSMITTER WITH SUBARU SELECT MONITOR, REPLACEMENT, Transmitter.>

5. Spare Tire Hoist

A: REMOVAL

- 1) Remove the spare tire from the vehicle.
- 2) Lift up the vehicle.
- 3) Remove the spare tire guide.



B: INSTALLATION

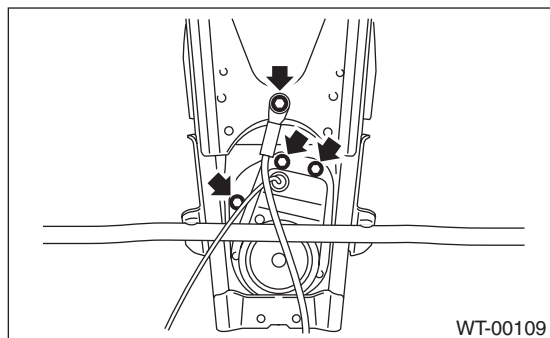
Install each part in the reverse order of removal.

Tightening torque:

33 N·m (3.7 kgf-m, 24.3 ft-lb)

C: DISASSEMBLY

Remove the spare tire hoist.



D: ASSEMBLY

Assemble each part in the reverse order of disassembly.

Tightening torque:

33 N·m (3.7 kgf-m, 24.3 ft-lb)

General Diagnostic Table

WHEEL AND TIRE SYSTEM

6. General Diagnostic Table

A: INSPECTION

Symptoms	Possible cause	Corrective action
Wheel is out of balance.	Improperly inflated tire.	Adjust the tire pressure.
	Uneven wear	Check the tire referring to abnormal tire wear in this table, carry out the procedure and replace the tire.
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-6, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-8, INSPECTION, Wheel Alignment.>
	Front strut	Check the front strut. <Ref. to FS-21, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-15, INSPECTION, Rear Shock Absorber.>
	Front axle	Check the front axle. <Ref. to DS-16, INSPECTION, Front Axle.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-21, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-24, INSPECTION, Rear Hub Unit Bearing.>
Vehicle is abnormally out of balance.	Improperly inflated tire.	Adjust the tire pressure.
	Uneven wear	Check the tire referring to abnormal tire wear in this table, carry out the procedure and replace the tire.
	Front stabilizer	Inspect the front stabilizer. <Ref. to FS-14, INSPECTION, Front Stabilizer.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-6, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-8, INSPECTION, Wheel Alignment.>
Abnormal wheel vibration	Improperly inflated tire.	Adjust the tire pressure.
	Uneven wear	Check the tire referring to abnormal tire wear in this table, carry out the procedure and replace the tire.
	Improper wheel balancing	Check the wheel balance. <Ref. to WT-6, WHEEL BALANCING, INSPECTION, Tire and Wheel.>
	Front axle	Check the front axle. <Ref. to DS-16, INSPECTION, Front Axle.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-21, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-24, INSPECTION, Rear Hub Unit Bearing.>
Abnormal tire wear	Improperly inflated tire.	Adjust the tire pressure.
	Improper wheel balancing	Check the wheel balance. <Ref. to WT-6, WHEEL BALANCING, INSPECTION, Tire and Wheel.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-6, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-8, INSPECTION, Wheel Alignment.>

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

TPM(diag)

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