

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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BRAKE

NOTE:

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

Item		Specification	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)

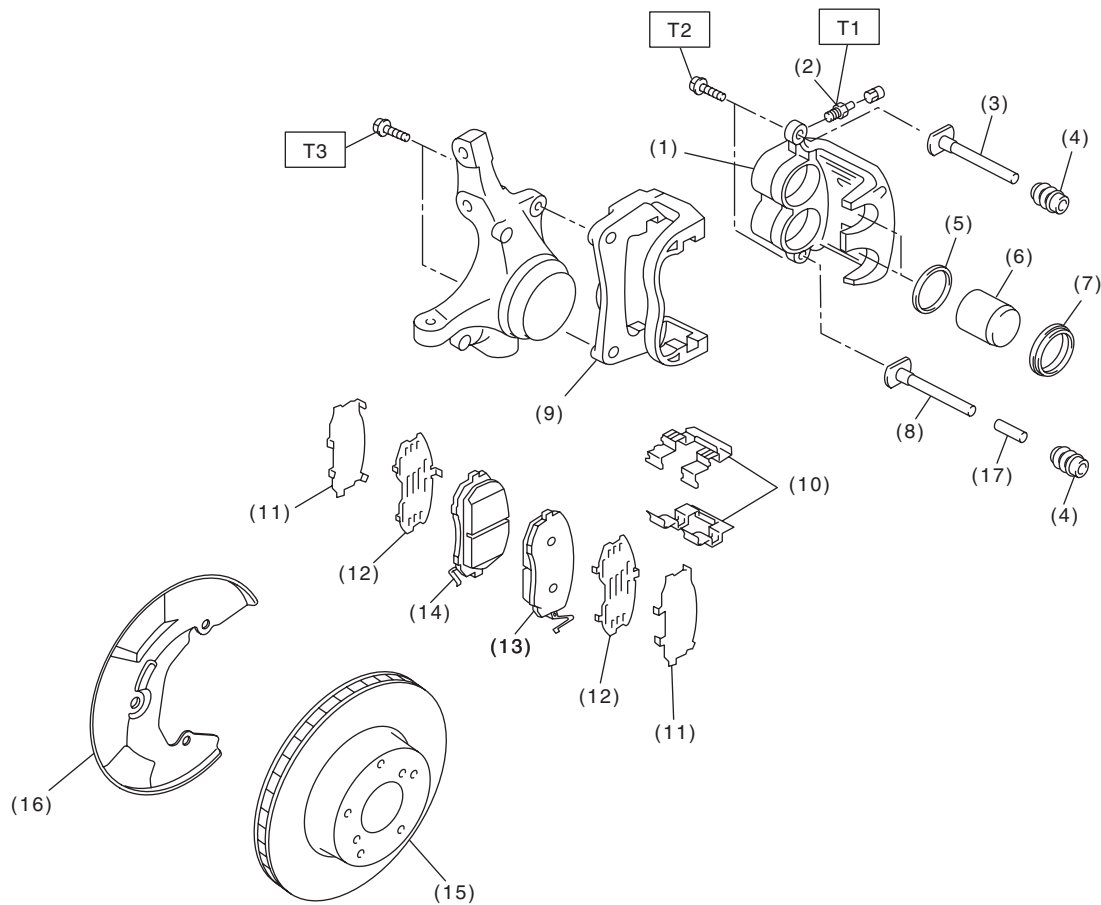
Brake pedal	Free play mm (in)	0.5 — 2 (0.02 — 0.08) [When pulling the brake pedal upward with a force of less than 10 N (1 kgf, 2 lb).]
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General Description

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B: COMPONENT

1. FRONT DISC BRAKE



BR-00490

- (1) Caliper body
- (2) Air bleeder screw
- (3) Guide pin (Green)
- (4) Pin boot
- (5) Piston seal
- (6) Piston
- (7) Piston boot
- (8) Lock pin (Yellow)

- (9) Support
- (10) Pad clip
- (11) Outer shim
- (12) Inner shim
- (13) Pad (Outside)
- (14) Pad (Inside)
- (15) Disc rotor

- (16) Disc cover
- (17) Bushing

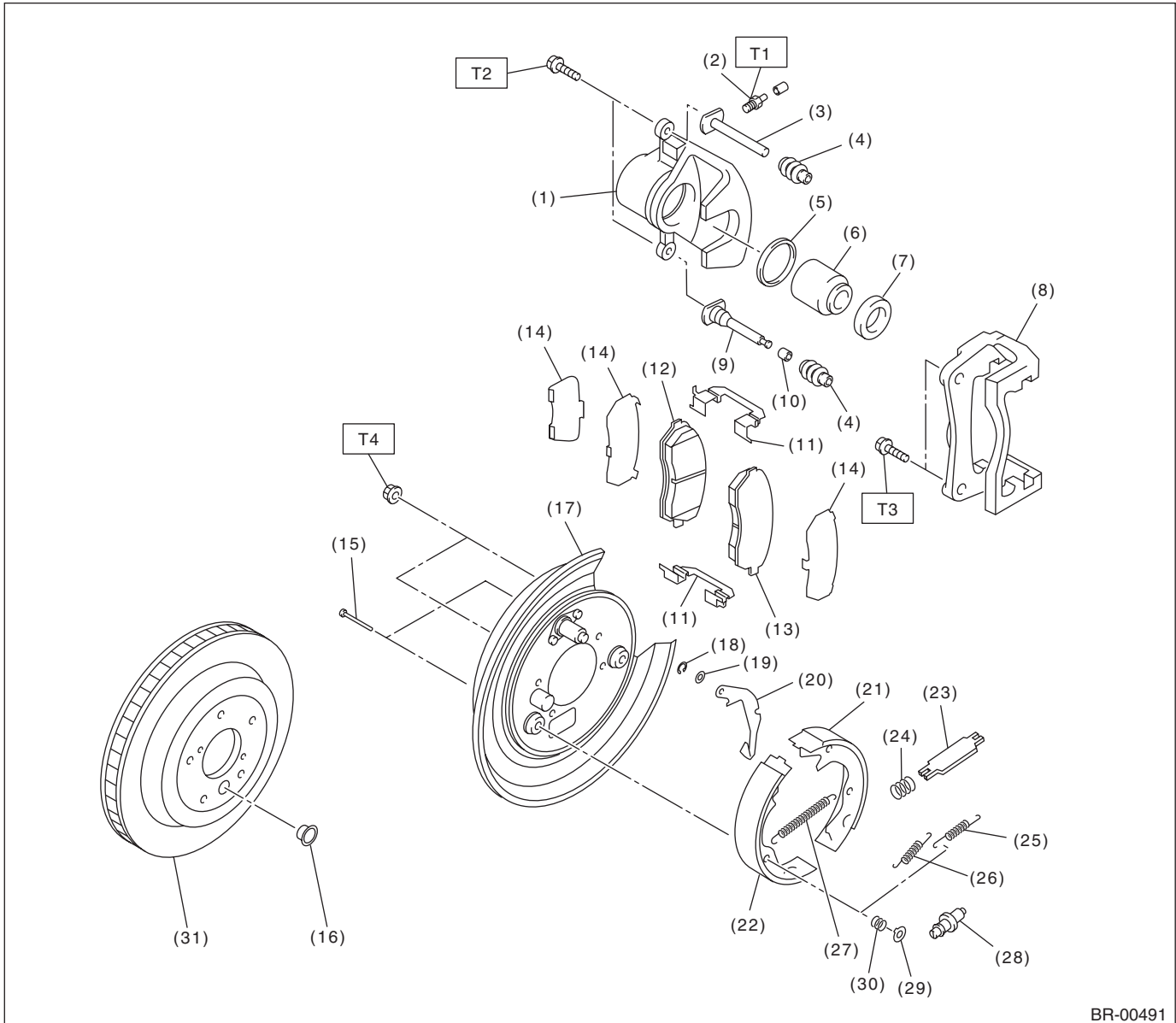
Tightening torque: N·m (kgf·m, ft·lb)

T1: 8 (0.8, 5.8)

T2: 27 (2.8, 19.9)

T3: 120 (12.2, 88.5)

2. REAR DISC BRAKE



BR-00491

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

Tightening torque: N·m (kgf-m, ft-lb)

T1: 8 (0.8, 5.8)

T2: 27 (2.8, 19.9)

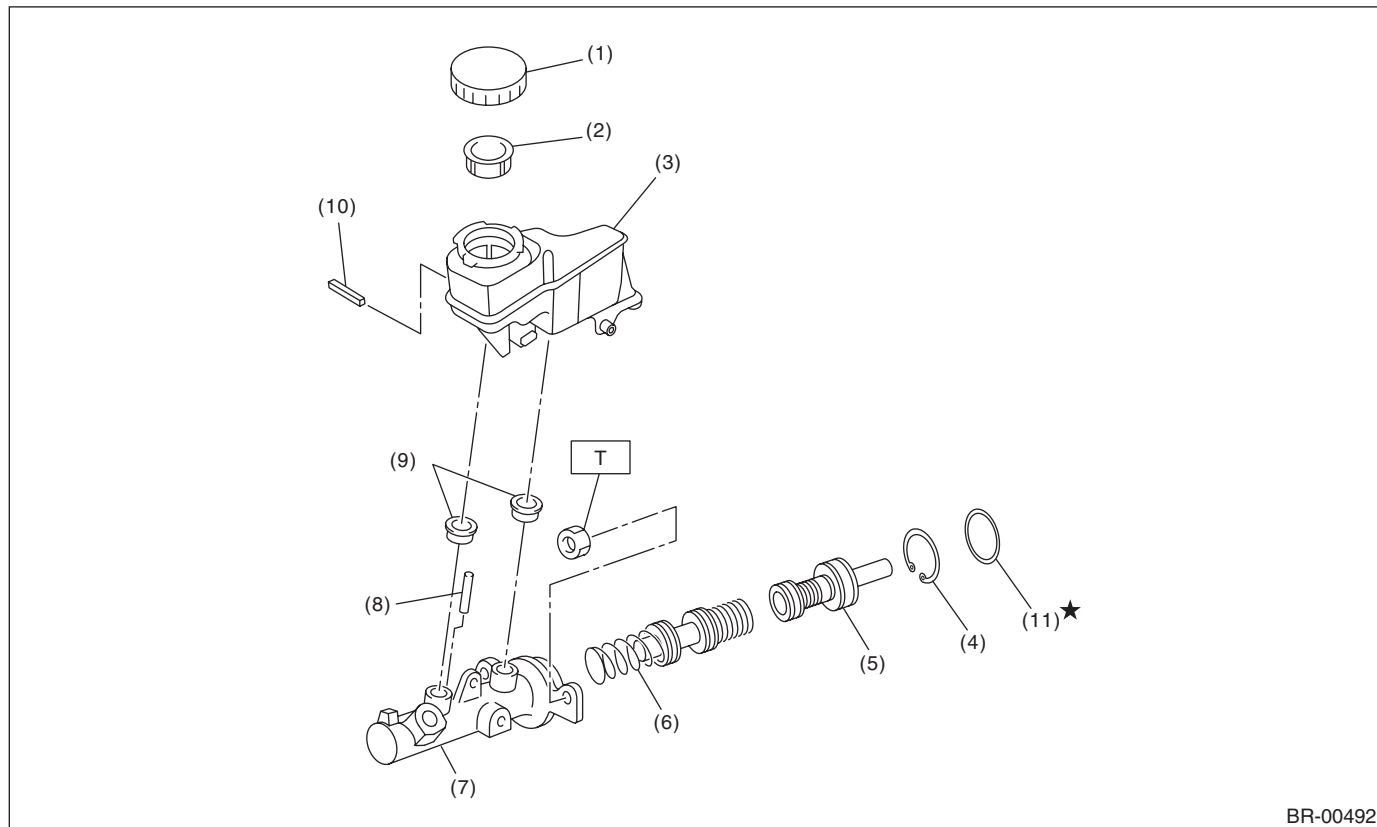
T3: 66 (6.7, 48.7)

T4: 75 (7.6, 55.3)

General Description

BRAKE

3. MASTER CYLINDER



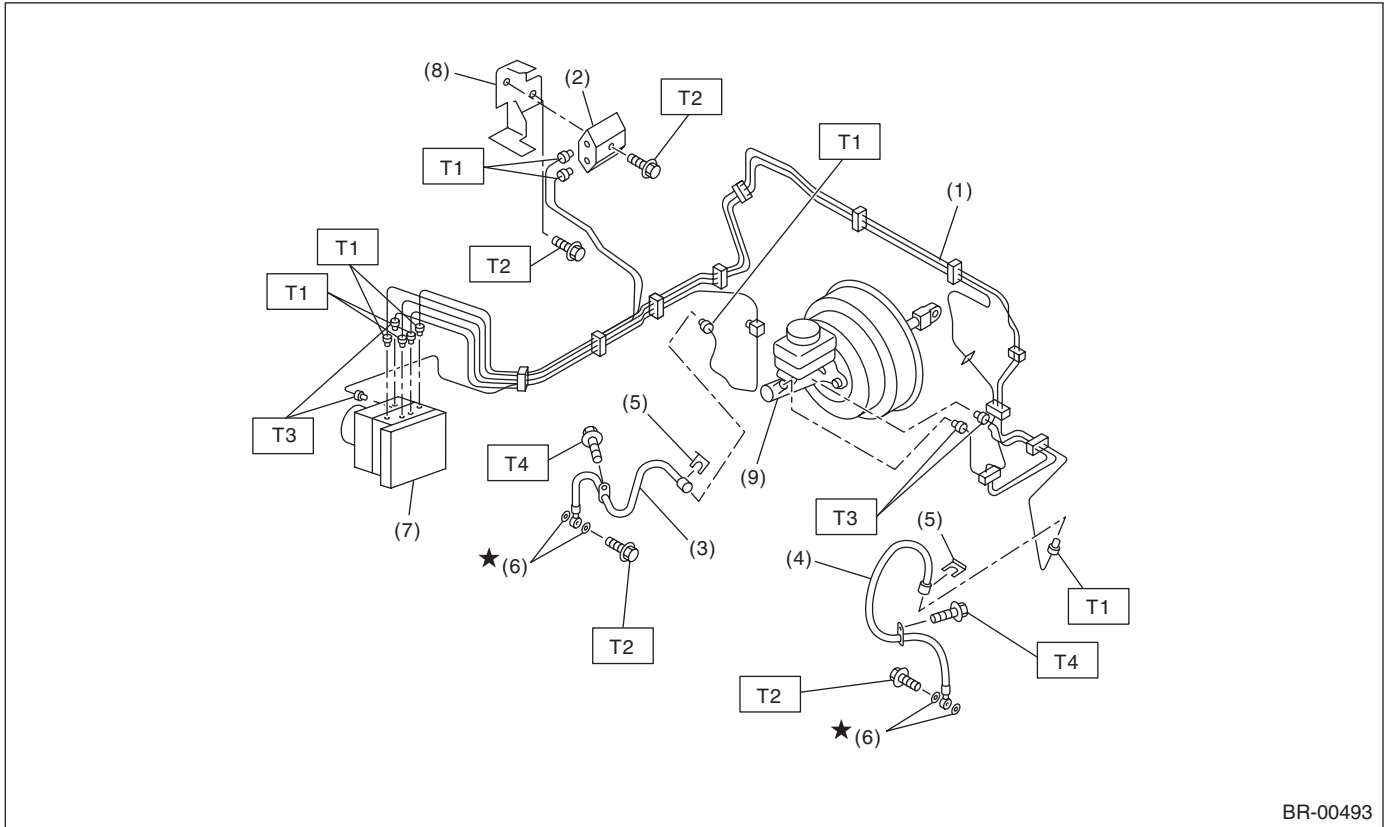
- (1) Cap
- (2) Filter
- (3) Reservoir tank
- (4) C-ring
- (5) Primary piston

- (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 HOSE



- | | |
|---------------------------|---|
| (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, 13.0)

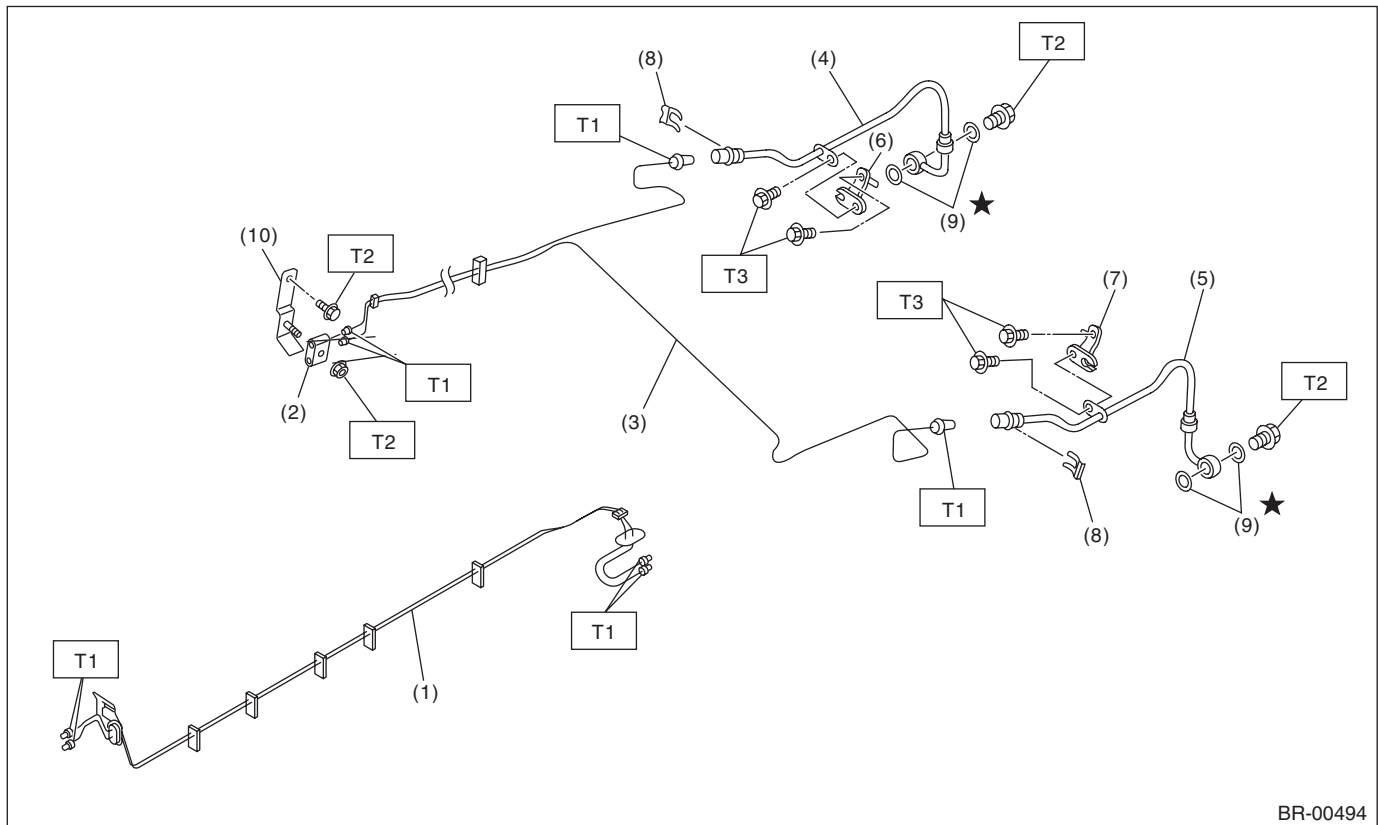
T3: 19 (1.9, 14.0)

T4: 33 (3.4, 24.3)

General Description

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5. CENTER AND REAR BRAKE PIPES AND HOSE



BR-00494

- | | |
|----------------------------|--------------------------------|
| (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 |

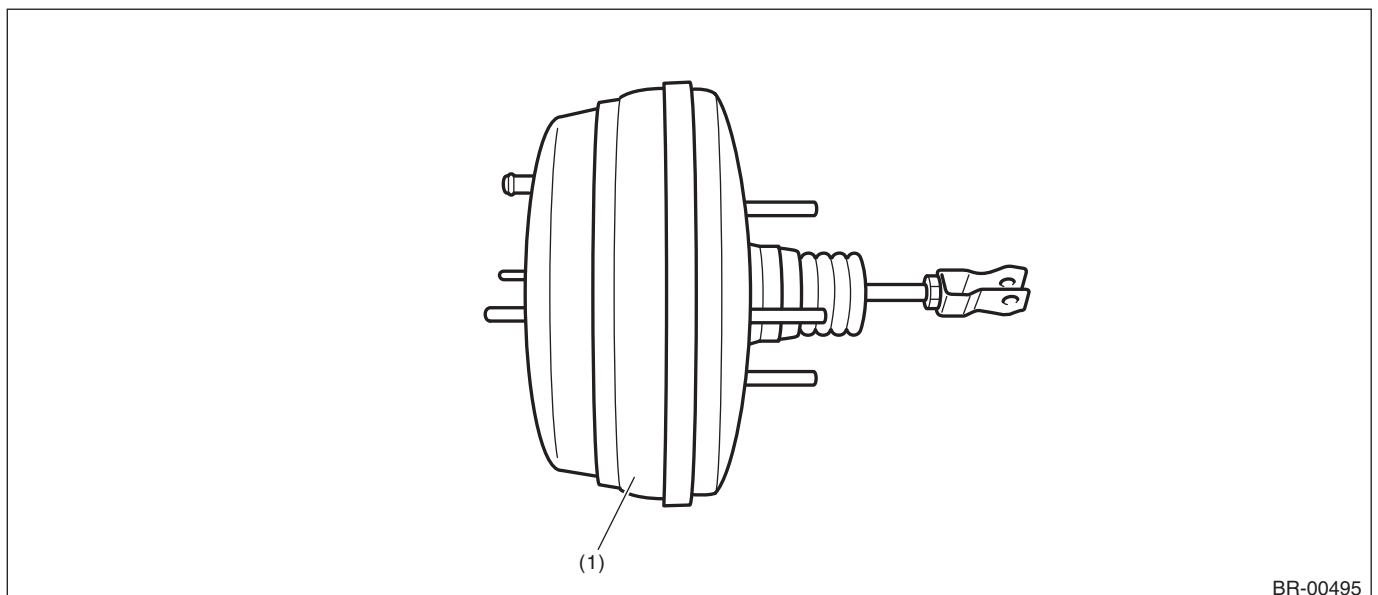
Tightening torque: N·m (kgf-m, ft-lb)

T1: 15 (1.5, 10.8)

T2: 18 (1.8, 13.0)

T3: 33 (3.4, 24.3)

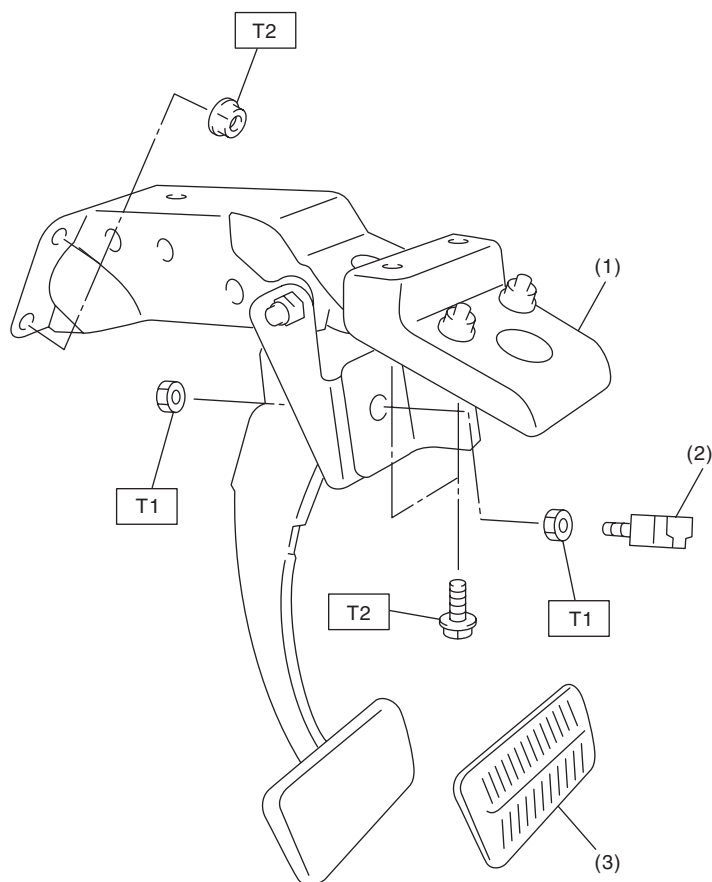
6. BRAKE BOOSTER



BR-00495

- (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)

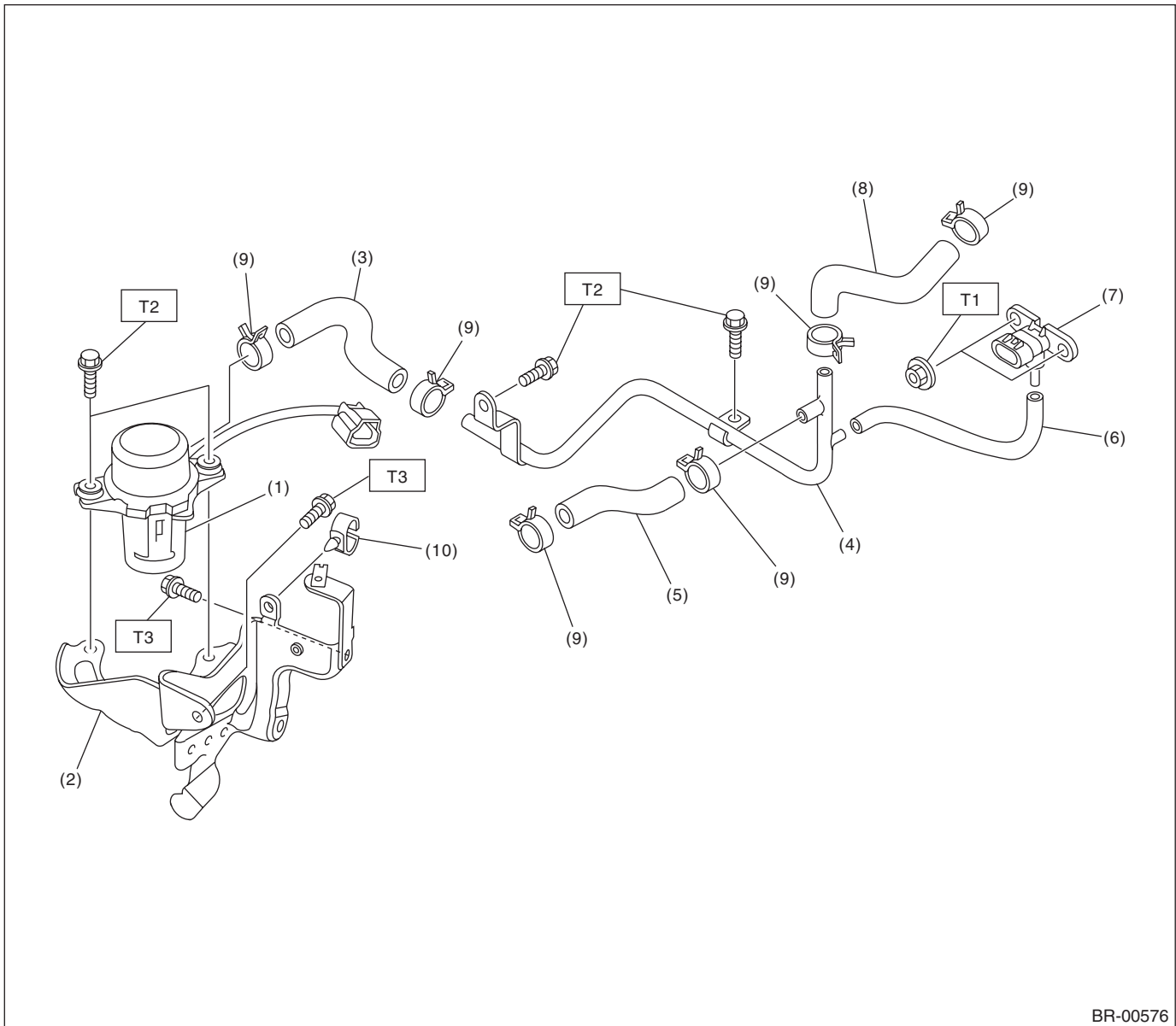
T1: 8 (0.8, 5.8)

T2: 18 (1.8, 13.0)

General Description

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8. BRAKE VACUUM PUMP



- | | |
|-------------------------------|---------------------------------|
| (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) | (10) Clip |

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 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 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.

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

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

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 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.

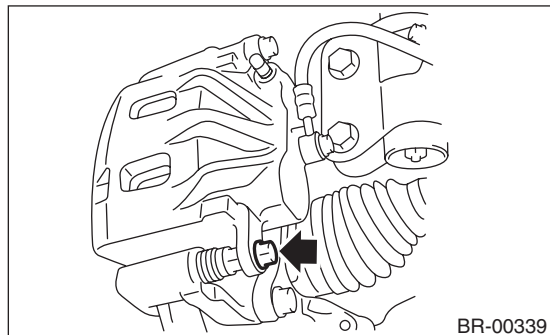
Front Brake Pad

BRAKE

2. Front Brake Pad

A: REMOVAL

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

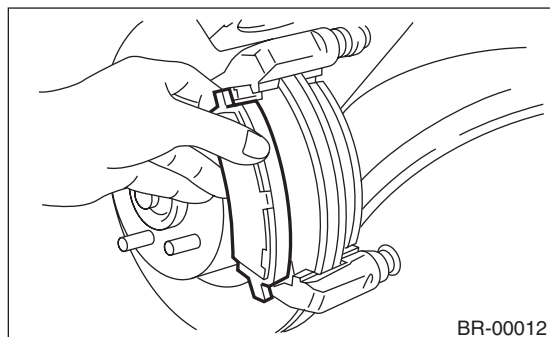


- 3) Raise the caliper body and support it.

NOTE:

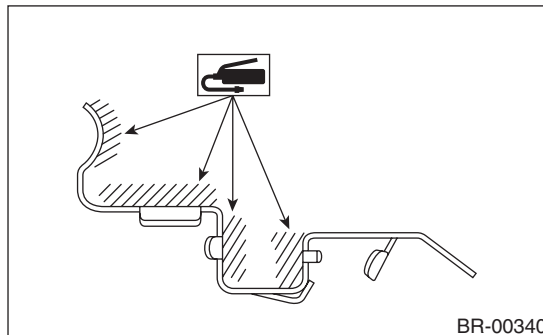
Do not disconnect the brake hose from the caliper body.

- 4) Remove the pad.

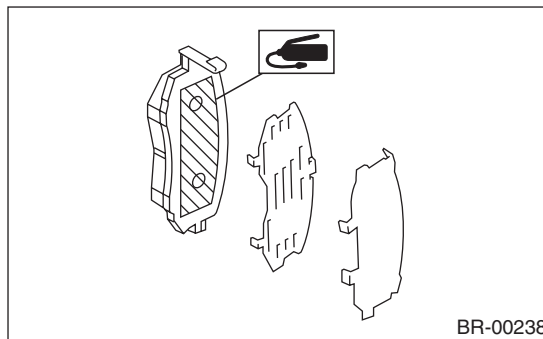


B: INSTALLATION

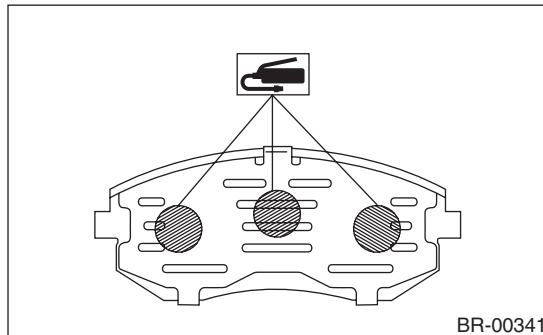
- 1) Apply a thin coat of Molykote M7439 to the pad clip.



- 2) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to the contact surface between the pad and pad inner shim.



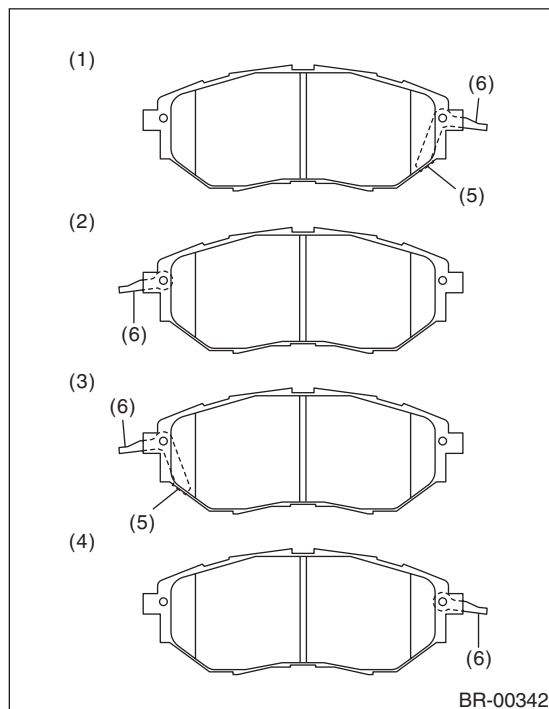
- 3) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to the three contact surfaces between inner shim and outer shim of outer pads.



4) Install the pad to support.

NOTE:

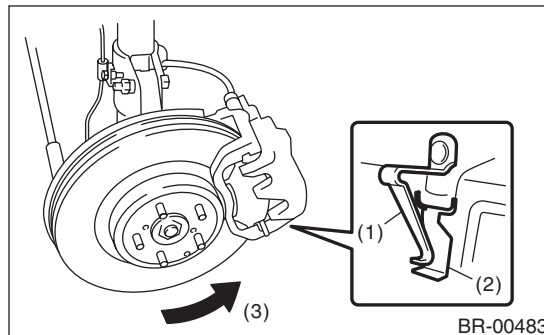
Install the pad indicator in proper direction.



- (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

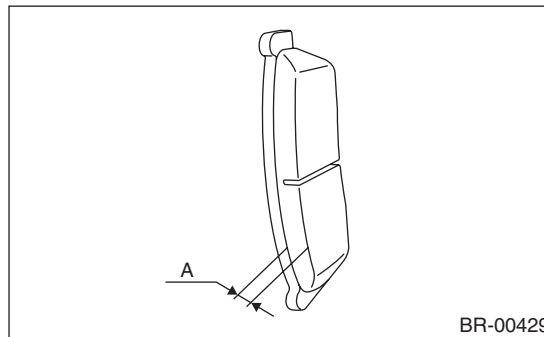
5) Install the caliper body to the support.

Tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

C: INSPECTION

Check thickness A of the pad.



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

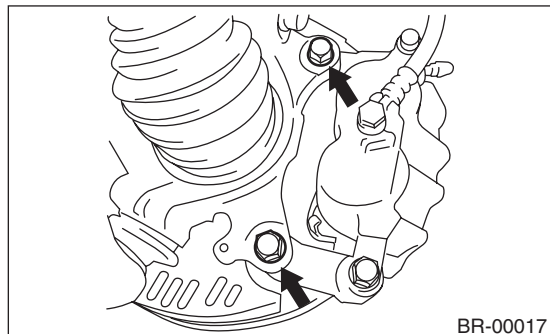
NOTE:

- Always replace the pads on both sides as a set.
- Replace pad clips if they are twisted or worn.
- Replace the pad if there is oil or grease on it.

3. Front Disc Rotor

A: REMOVAL

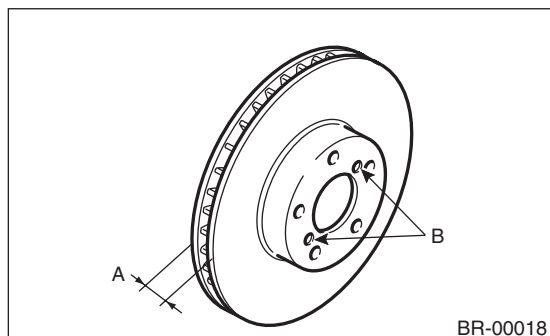
- 1) Lift-up the vehicle, and remove the front wheels.
- 2) Remove the caliper body and the support from housing, and suspend it from the strut using a wire.



- 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 support.

B: INSTALLATION

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

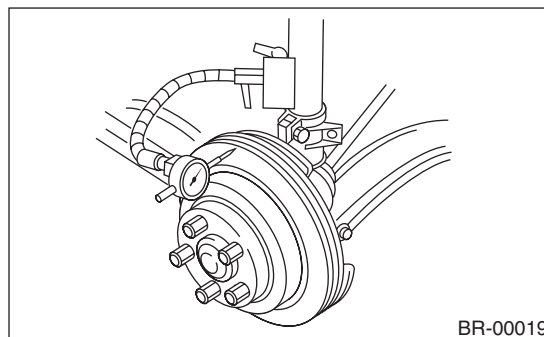
Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

- 3) Install the front wheels.

C: INSPECTION

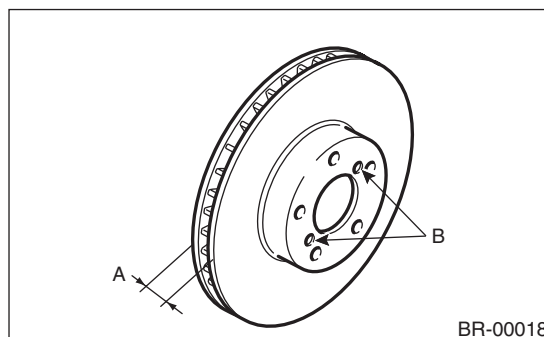
- 1) Check the front wheel bearing play and axle hub runout before the inspection of disc rotor runout limit. <Ref. to DS-16, INSPECTION, Front Axle.>
- 2) Secure the disc rotor by tightening the five wheel nuts.
- 3) Set a dial gauge 10 mm (0.39 in) inward from the disc rotor outer circumference. Rotate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



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

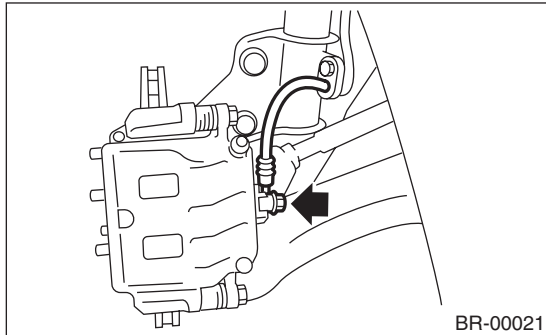
4. Front Disc Brake Assembly

A: REMOVAL

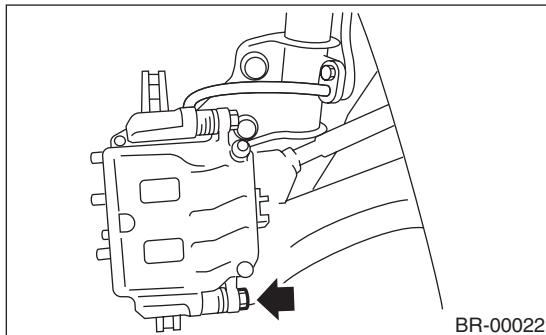
CAUTION:

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.



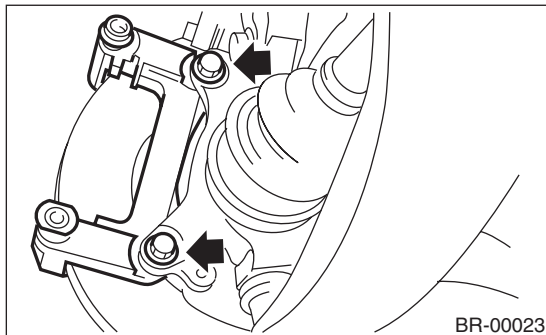
- 3) Remove the bolt securing the lock pin to caliper body.



- 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 need not be removed when servicing the caliper body assembly.



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

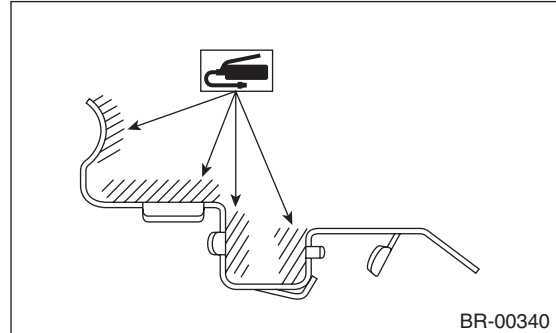
B: INSTALLATION

- 1) Install the support to the housing.

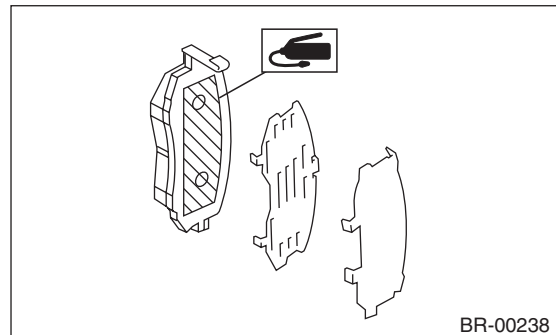
Tightening torque:

120 N·m (12.2 kgf-m, 88.5 ft-lb)

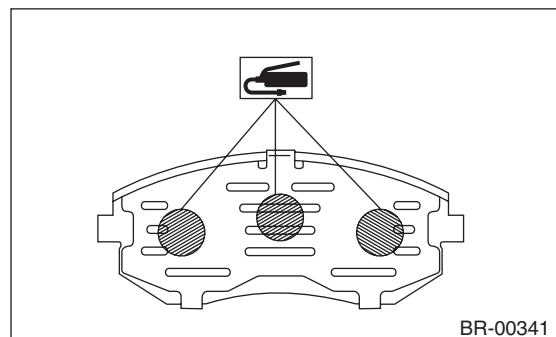
- 2) Apply a thin coat of Molykote M7439 to the pad clip.



- 3) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) to the contact surface between pad and inner shim.



- 4) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to the three contact surfaces between inner shim and outer shim of outer pads.



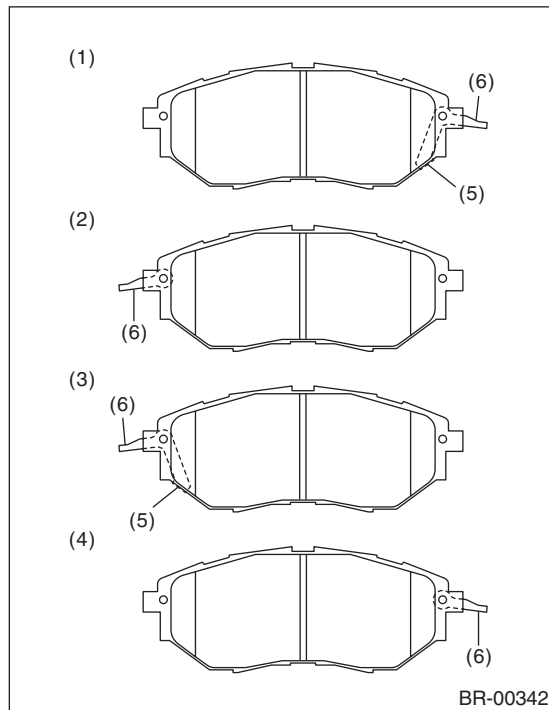
Front Disc Brake Assembly

BRAKE

5) Install the pad to support.

NOTE:

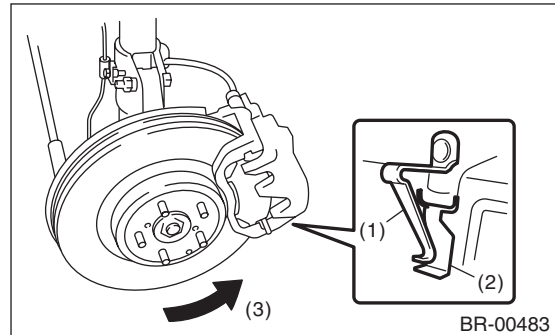
Install the pad indicator in proper direction.



- (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, 13.0 ft-lb)

8) Bleed air from the brake system.

C: DISASSEMBLY

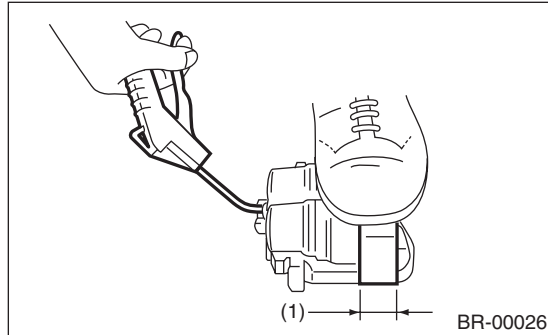
1) Remove mud and foreign matter from the caliper body assembly and support.

CAUTION:

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

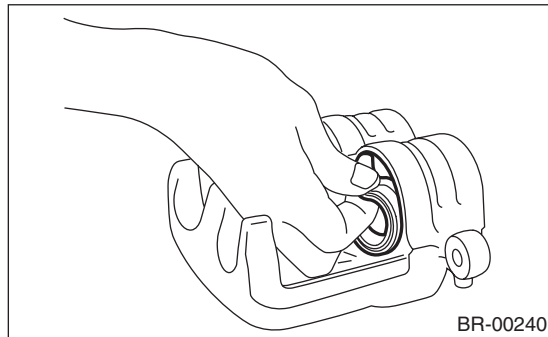
2) Place a wooden block in the caliper body as shown in the figure to prevent the piston from jumping out and being damaged.

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.

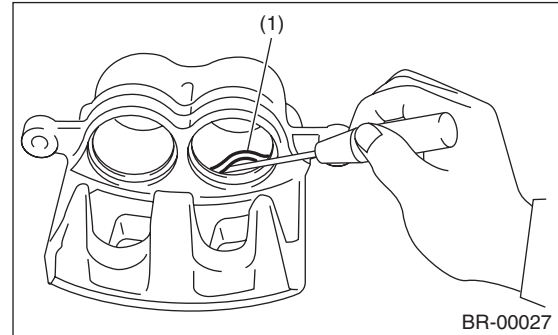
4) Remove the piston boot.



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.

Front Disc Brake Assembly

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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 piston seal in the groove on caliper body.
- 3) Apply a coat of brake fluid to the inner surface of cylinder and the entire outer surface of the piston.
- 4) Apply a coat of specified grease to the boot, and fit to the groove on the ends of the cylinder.

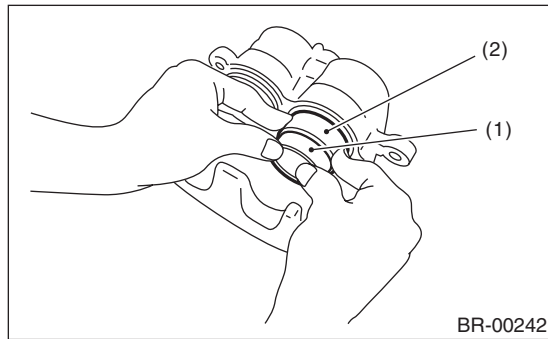
Grease:

NIGLUBE RX-2 (Part No. K0779GA102)

- 5) Insert the piston into cylinder.

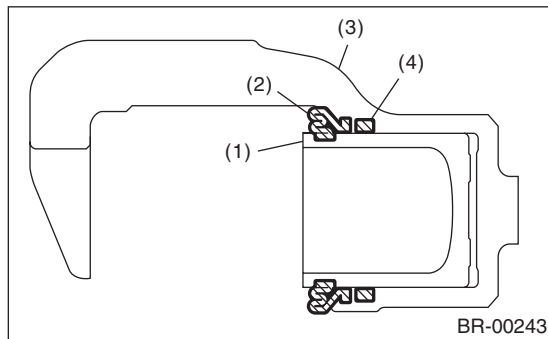
CAUTION:

Do not force the piston into cylinder.



- (1) Piston
- (2) Piston boot

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



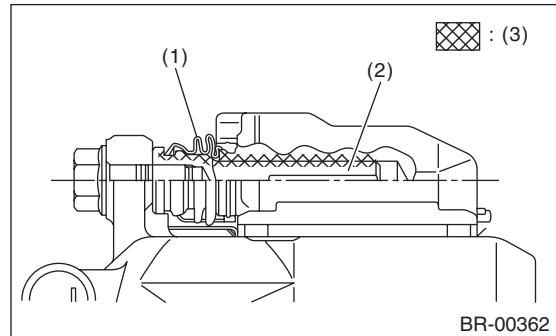
- (1) Piston
- (2) Piston boot
- (3) Caliper body
- (4) Piston seal

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

Grease:

NIGLUBE RX-2 (Part No. K0779GA102)

- 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

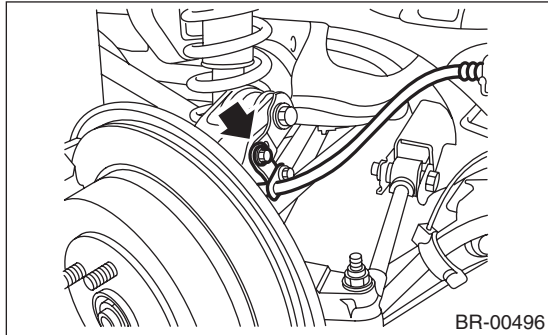
E: INSPECTION

- 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.

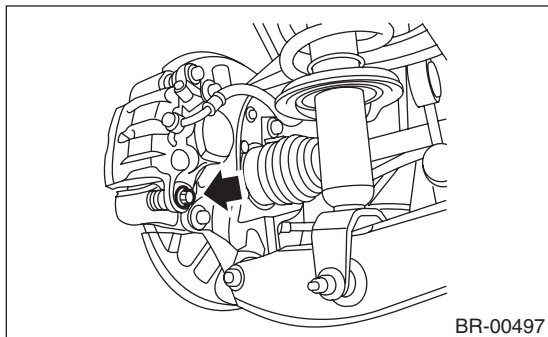
5. Rear Brake Pad

A: REMOVAL

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



- 3) Remove the caliper bolt.

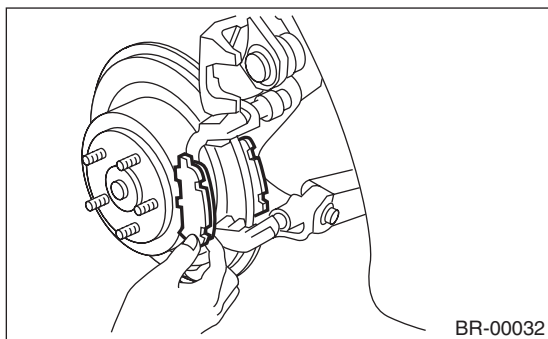


- 4) Raise the caliper body and support it.

NOTE:

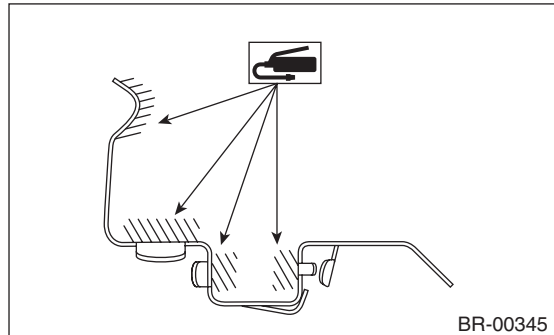
Do not disconnect the brake hose from the caliper body.

- 5) Remove the pad.



B: INSTALLATION

- 1) Apply a thin coat of Molykote M7439 to the pad clip.



- 2) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) to the contact surface between the pad and shim.
- 3) Install the pad to support.
- 4) Install the caliper body to the support.

Tightening torque:

27 N·m (2.8 kgf-m, 19.9 ft-lb)

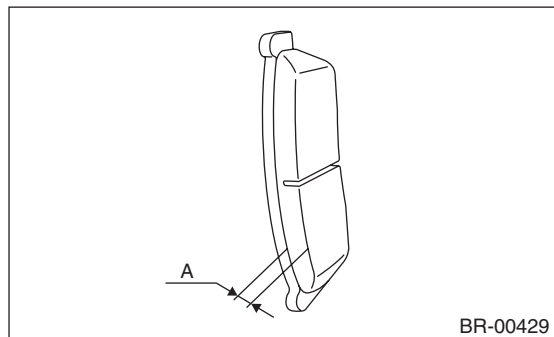
- 5) Install the brake hose bracket.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

C: INSPECTION

Check thickness A of the pad.



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

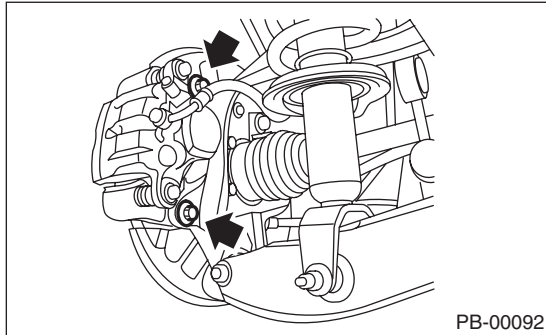
NOTE:

- Always replace the pads on 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.

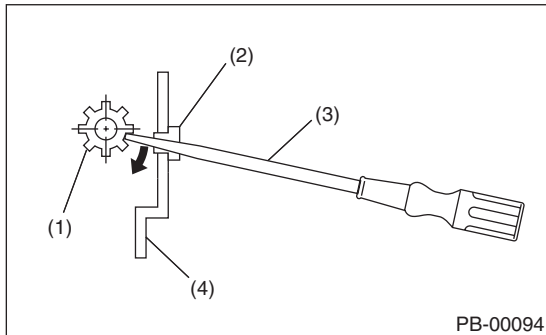


- 4) Suspend the rear disc brake assembly so that the hose is not stretched.
- 5) Remove the rear disc brake rotor.

NOTE:

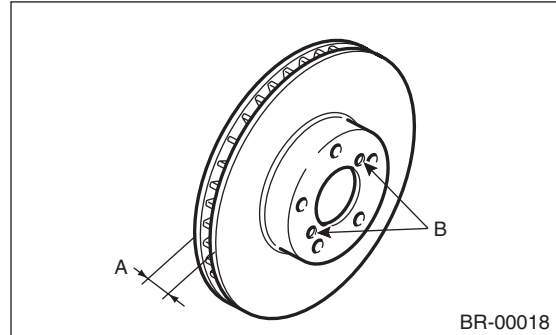
If the disc rotor is difficult to remove, try the following two methods in order.

- (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.

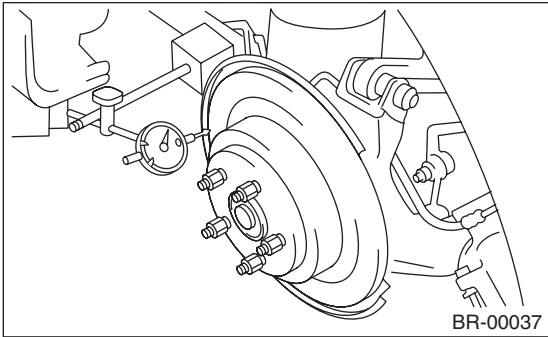
Tightening torque:

66 N·m (6.7 kgf-m, 48.7 ft-lb)

- 2) Adjust the parking brake. <Ref. to PB-10, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

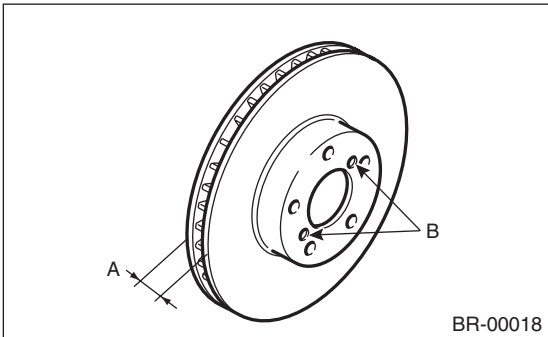
C: INSPECTION

- 1) Check the rear wheel bearing play and axle hub runout before inspecting the disc rotor runout limit.
<Ref. to DS-23, 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 the disc rotor exceeds the service limit, replace with a new disc rotor.



	Specification	Limit	Disc rotor outer diameter
Disc rotor thickness A mm (in)	18 (0.71)	16 (0.63)	320 (12.59)

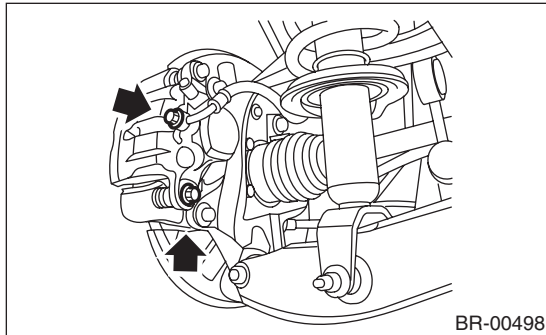
7. Rear Disc Brake Assembly

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 need not be removed when servicing the caliper body assembly.

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

CAUTION:

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

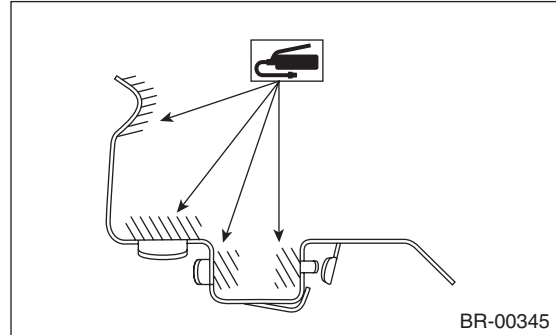
B: INSTALLATION

- 1) Install the support to the housing.

Tightening torque:

66 N·m (6.7 kgf-m, 48.7 ft-lb)

- 2) Apply a thin coat of Molykote M7439 to the pad clip.



- 3) Apply a thin coat of Molykote AS880N (Part No. K0777YA010) to the contact surface between the pad and 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) Connect the brake hose using a new brake hose gasket.

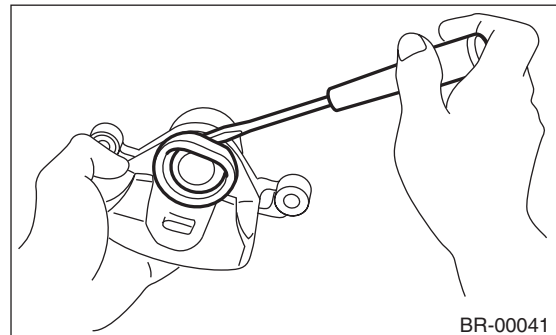
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

- 7) Bleed air from the brake system.

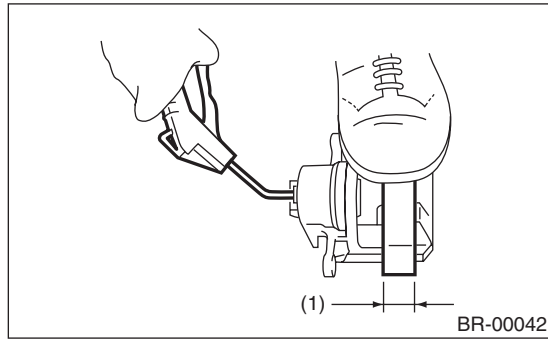
C: DISASSEMBLY

- 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.

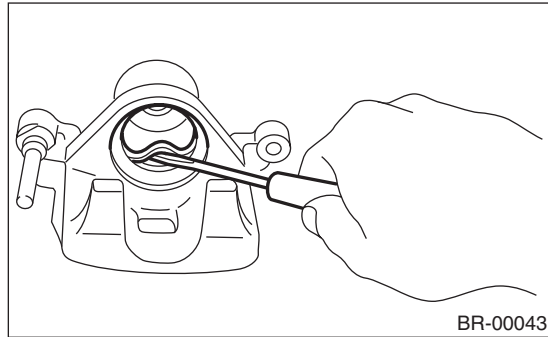


(1) Place a wood block of 30 mm (1.18 in) width.

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 piston seal in the groove on caliper body.

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

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

Grease:

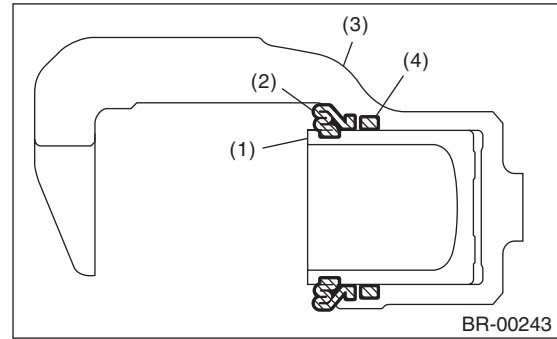
NIGLUBE RX-2 (Part No. K0779GA102)

5) Insert the piston into cylinder.

CAUTION:

Do not force the piston into cylinder.

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

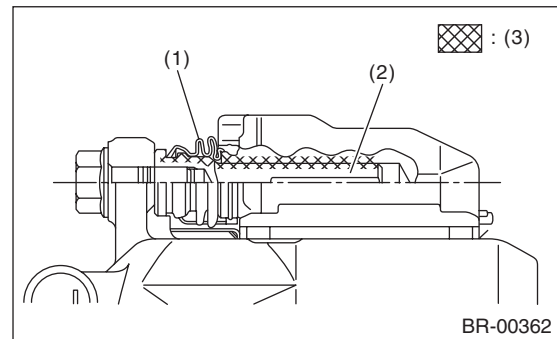


- (1) Piston
- (2) Piston boot
- (3) Caliper body
- (4) Piston seal

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

Grease:

NIGLUBE RX-2 (Part No. K0779GA102)



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

8) Install the guide pin boot to the support.

9) Install 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-32, PROCEDURE, Air Bleeding.>

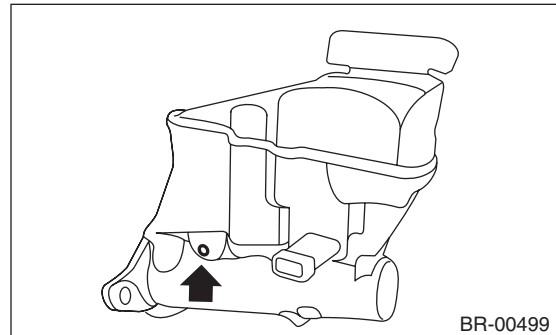
C: REPLACEMENT

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

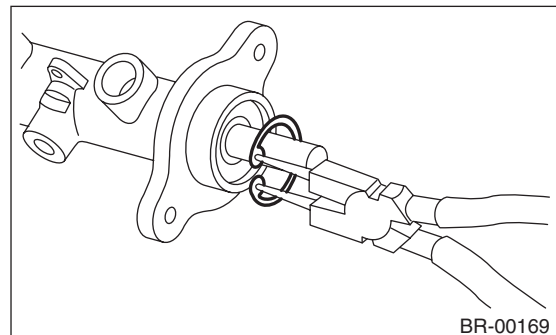
NOTE:

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

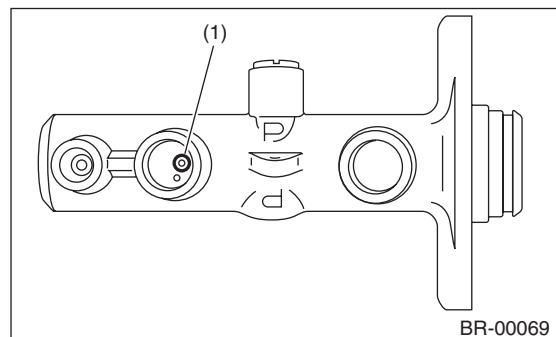
- 3) Remove the pin which secures the master cylinder and reservoir tank, then remove the reservoir tank and seal.



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

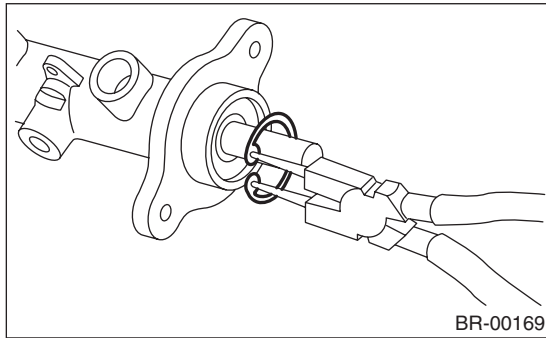


- 5) While pushing in the primary piston, remove the straight pin from the port on the reservoir tank attachment location using a magnet pick-up tool.



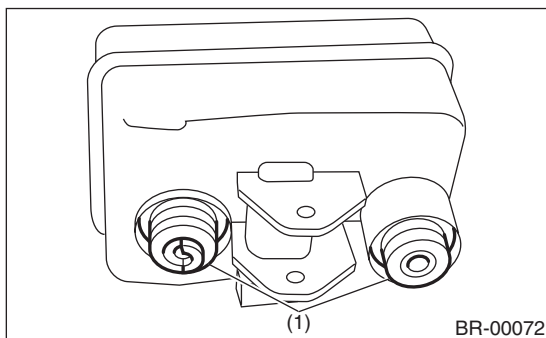
(1) Straight pin

- 6) Extract the primary piston assembly and secondary piston assembly straight out while taking care not to scratch the inner surface of the cylinders.
- 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.
- 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

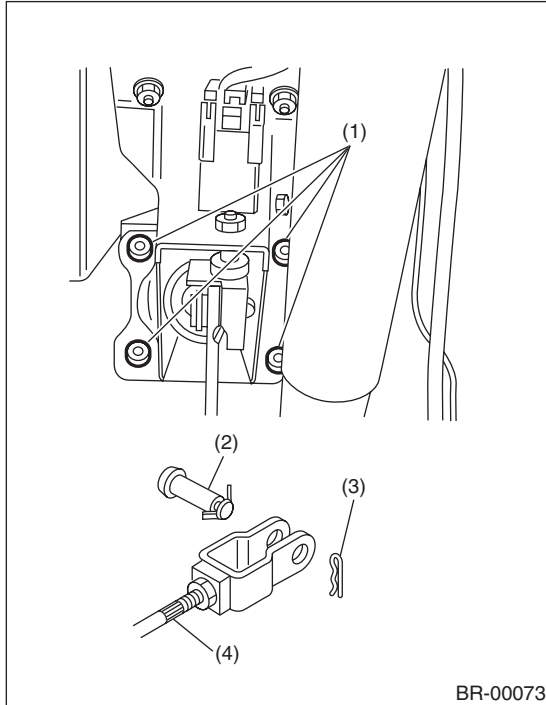
A: REMOVAL

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

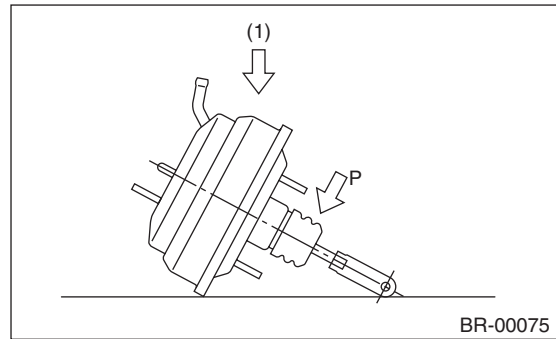
3) Remove the brake booster while avoiding the brake pipe.

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

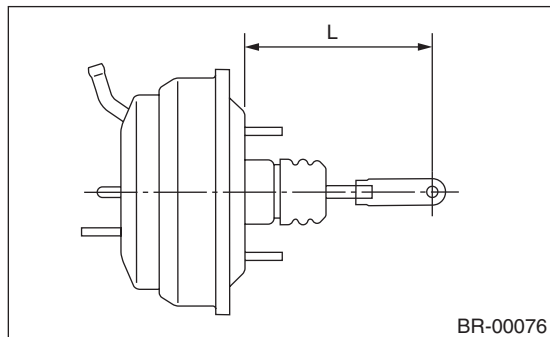
B: INSTALLATION

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

Specification L:

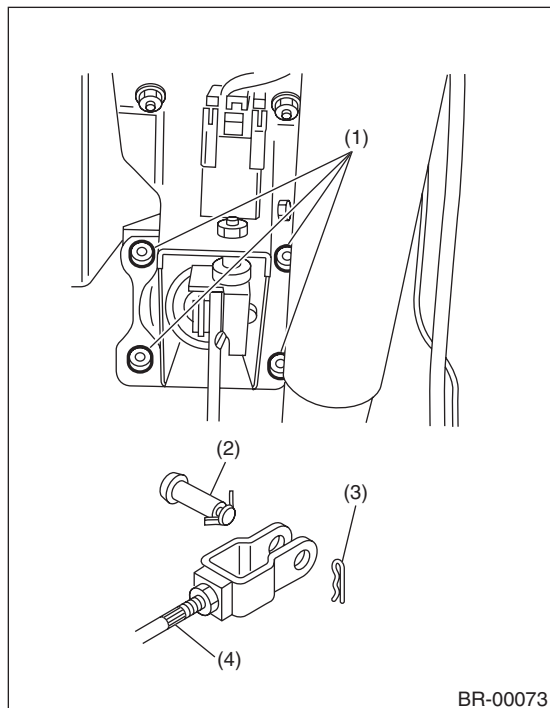
137.6 mm (5.42 in)

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 the clevis pin and snap pin.



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

NOTE:

Apply a thin coat of KOPR-KOTE (Part No. 003603001) 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.

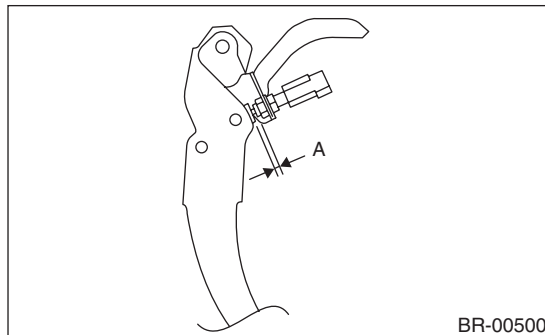
If it is not within the specification, adjust it by adjusting the position of the stop light switch. <Ref. to BR-39, ADJUSTMENT, Stop Light Switch.>

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 brake does not drag.

C: INSPECTION

1. OPERATION CHECK (WITHOUT GAUGES)

CAUTION:

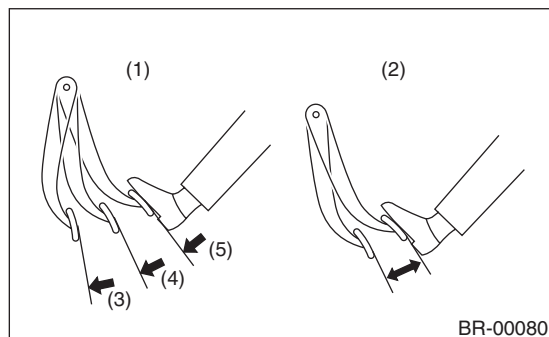
When checking operation, be sure to apply the parking brake securely.

Check without gauges

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.



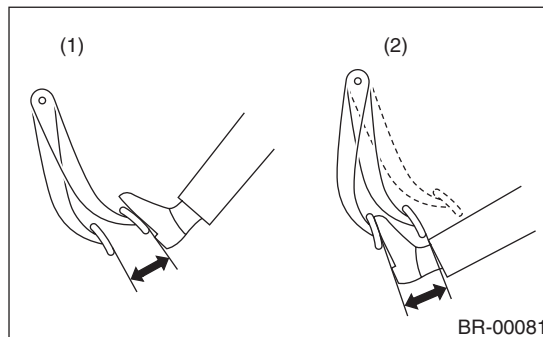
- (1) Normal
- (2) Not OK
- (3) 1st
- (4) 2nd
- (5) 3rd

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 pressed, 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.

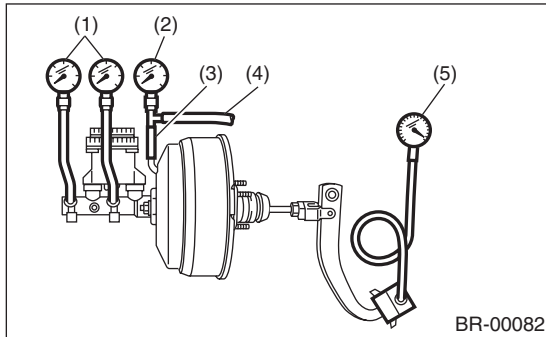
2. OPERATION CHECK (WITH GAUGE)

CAUTION:

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

Check with gauge

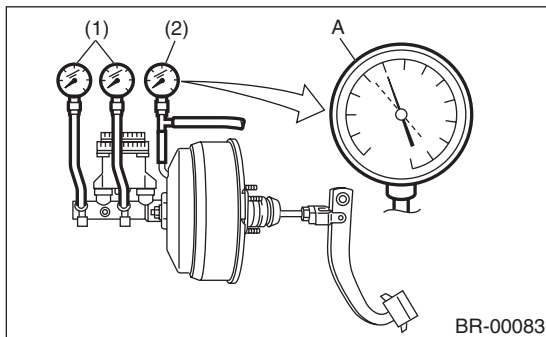
Connect the gauge as shown in the figure. After bleeding air from the pressure gauge, perform the checks.



- (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.



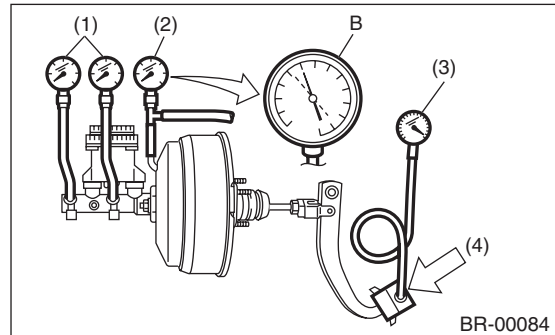
- (1) Pressure gauge
- (2) Vacuum gauge

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

If defective, refer to "AIR TIGHTNESS CHECK".

<Ref. to BR-28, 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)

Brake Booster

BRAKE

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 fluids 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 eliminate entry of air.
 - Operate the brake pedal slowly.
 - For convenience and safety, perform work with 2 people.
 - The required amount of brake fluid is approximately 600 mℓ (20 US fl oz, 21 Imp fl oz) for 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 the recommended brake fluid.

Recommended brake fluid:

Refer to the specification. <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-32, PROCEDURE, Air Bleeding.>

NOTE:

Perform the brake fluid replacement starting in order from the farthest wheel cylinder from the master cylinder.

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-32, BRAKE LINE, PROCEDURE, Air Bleeding.>

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

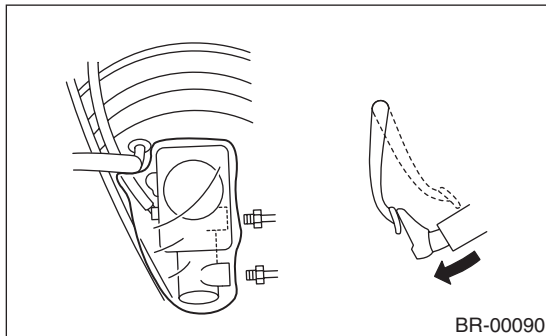
NOTE:

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

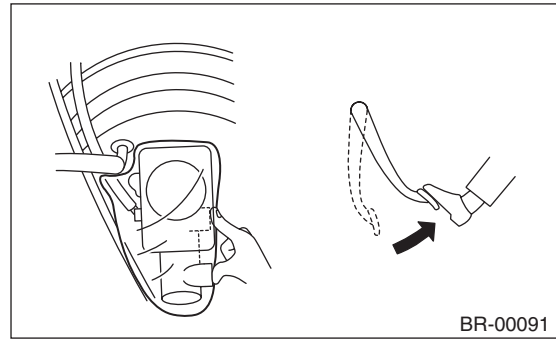
2) Disconnect the brake line at primary and secondary sides.

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-32, BRAKE LINE, PROCEDURE, Air Bleeding.>

2. BRAKE LINE

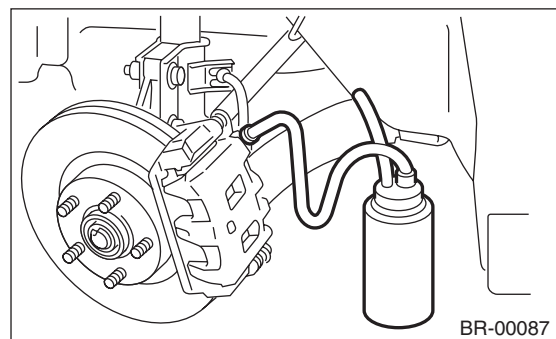
1) When the master cylinder is disassembled or the reservoir tank is empty, bleed the master cylinder before bleeding the brake line. <Ref. to BR-32, MASTER CYLINDER, PROCEDURE, Air Bleeding.>

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 the operation in the order from closest wheel cylinder to the master cylinder.

8) Securely tighten the air bleeder screws.

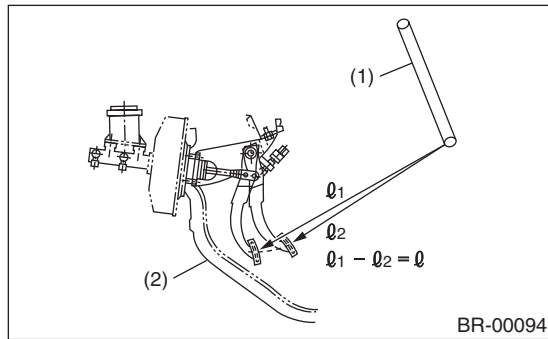
Tightening torque:

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-16, 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 brake fluid up to the "MAX" level of the reservoir tank.

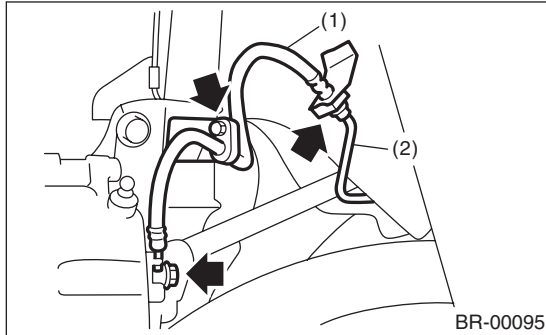
16) Test run the vehicle and ensure that the brakes operate normally.

12.Brake Hose

A: REMOVAL

1. FRONT BRAKE HOSE

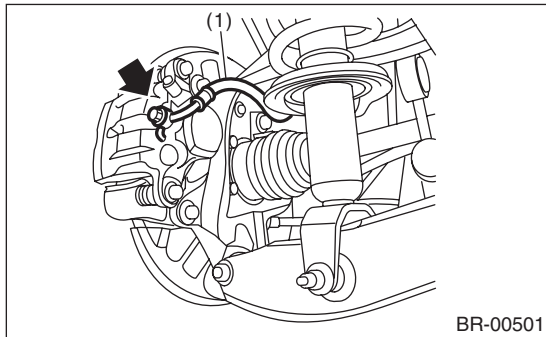
- 1) Separate the brake pipe from brake hose using a flare nut wrench.
- 2) Remove the clamp, bolt of the strut mount and union bolt.



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

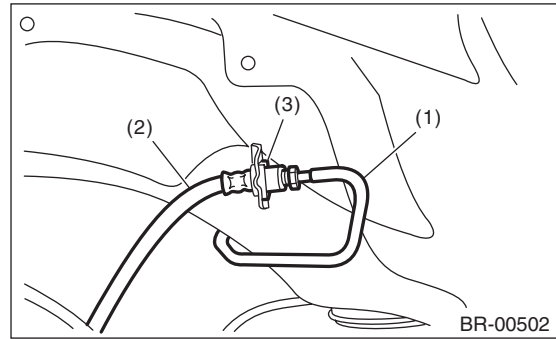
2. REAR BRAKE HOSE

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



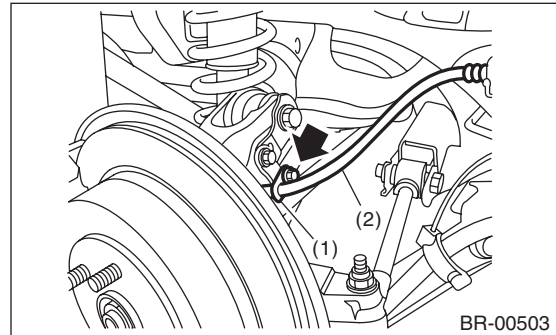
- (1) Brake hose

- 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.

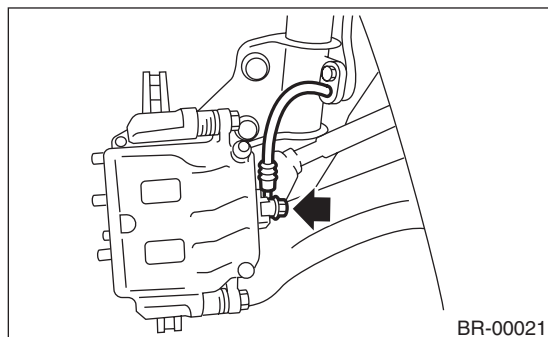
Tightening torque:

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, 13.0 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)

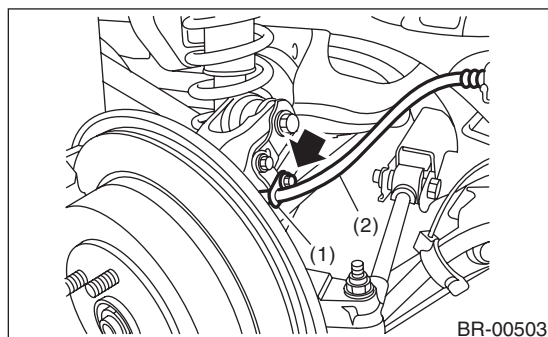
7) Bleed air from brake system.

2. REAR BRAKE HOSE

1) Install the brake hose bracket.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

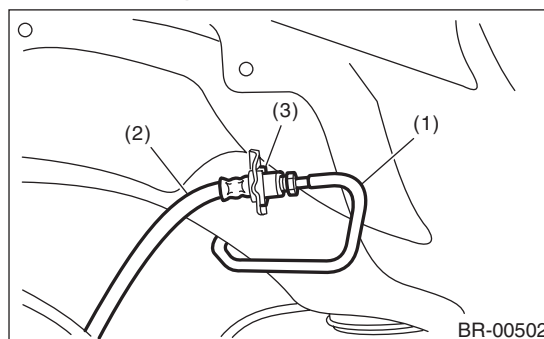


(1) Brake hose bracket

(2) Brake hose

2) Connect the brake hose to the brake pipe.

3) Insert the clamp to secure brake hose.



(1) Brake pipe

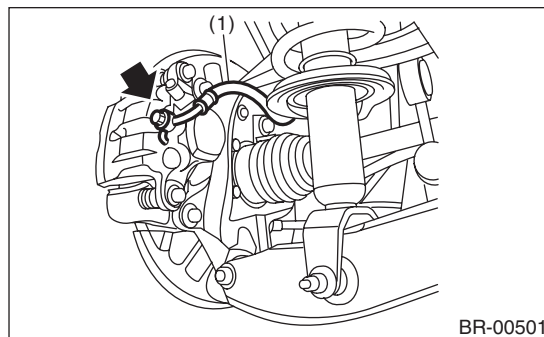
(2) Brake hose

(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, 13.0 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.

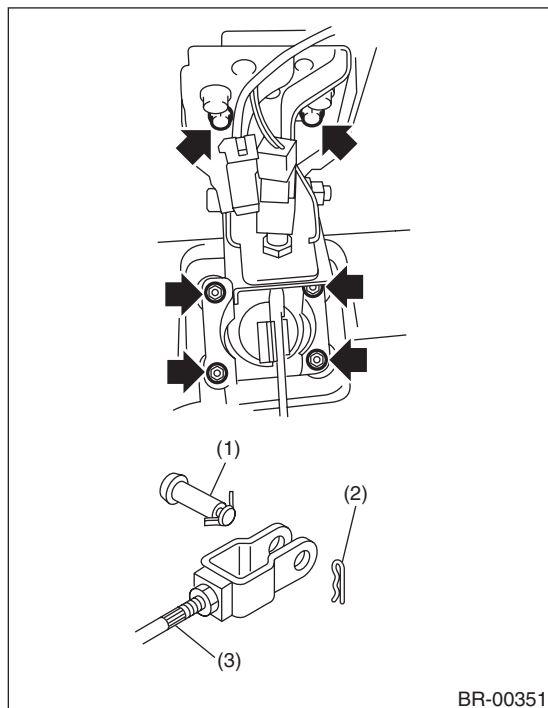
NOTE:

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.

CAUTION:

Always use a new clevis pin.

- 2) Check the brake pedal after installation. <Ref. to BR-37, 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.

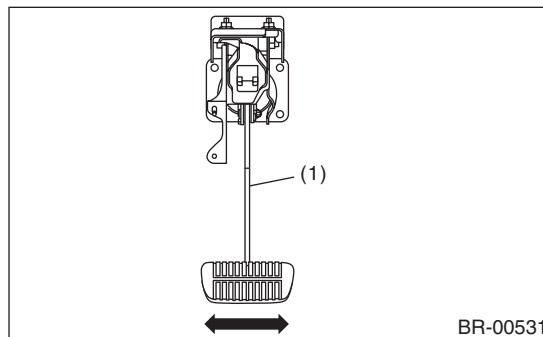
CAUTION:

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

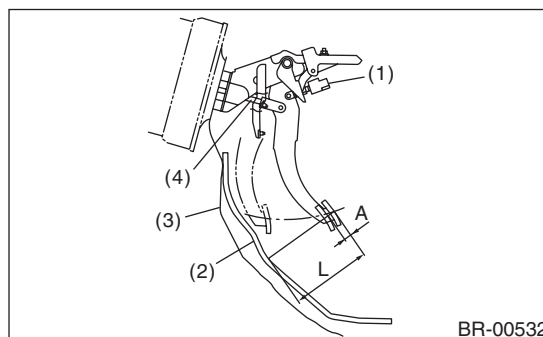
- 2) Check the position of the pedal pad.

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.

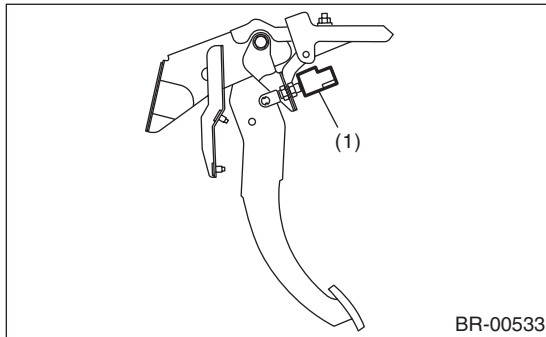
Stop Light Switch

BRAKE

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.



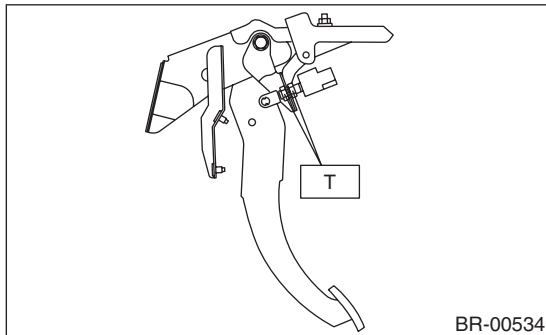
(1) Stop light switch

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-39, ADJUSTMENT, Stop Light Switch.>

Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)

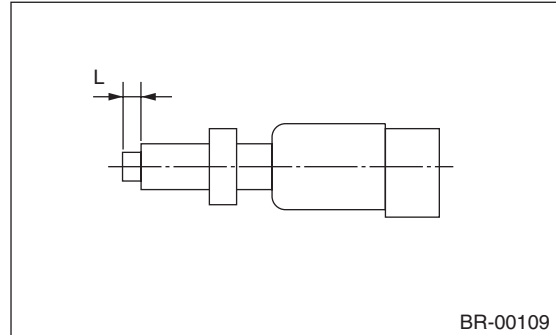


C: INSPECTION

- 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.

Specified position L:

2 mm (0.079 in)



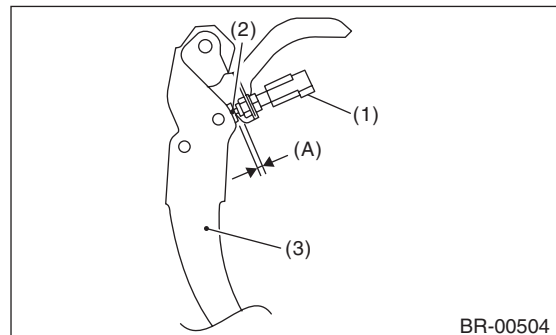
- 2) Measure the clearance between the threaded end of the stop light switch and the stopper.

CAUTION:

Be careful not to rotate the stop light switch.

Stop light switch clearance A:

0.8 mm (0.031 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:

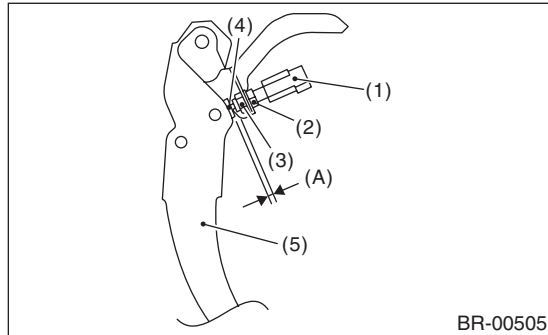
Be careful not to rotate the stop light switch.

D: ADJUSTMENT

Loosen the lock nut, and adjust the stop light switch position until the clearance between the threaded end of the stop light switch and stopper (A) becomes 0.8 mm (0.031 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:

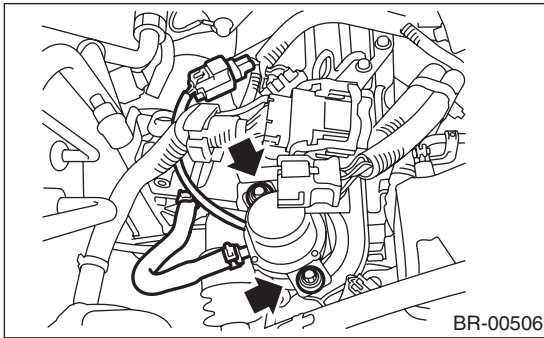
Tighten lock nut B until the threaded end of switch contacts the stopper. Hold the switch so that it does not rotate, and loosen the lock nut B approx. 60°. The clearance (A) will become 0.3 mm (0.012 in).

16. 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:

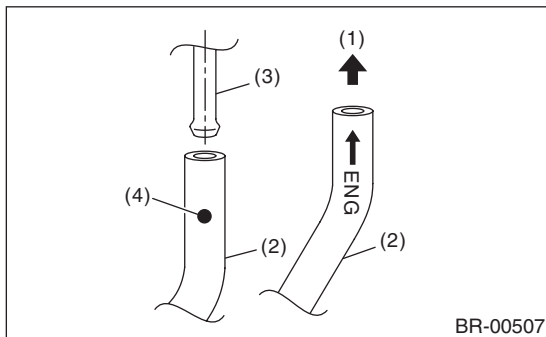
7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

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.

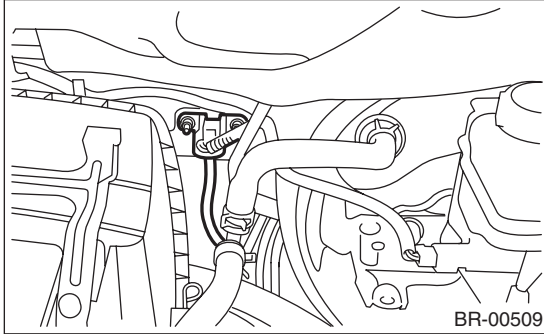
2. VACUUM HOSE

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

17. 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:

7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

General Diagnostic Table

BRAKE

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 wear lining material	Repair by grinding, or replace.
	(4) Deformed back plate	Repair or replace.
	(5) Over inflation 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 effect 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.

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

BVC(diag)

	Page
1. Basic Diagnostic Procedure	2
2. Check List for Interview	3
3. General Description	5
4. Electrical Component Location	6
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	30

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 broken wires 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 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 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. Inspect using "General Diagnostic Table". <Ref. to VDC(diag)-84, INSPECTION, General Diagnostic Table.>	Is result of inspection OK?	Finish the diagnosis.	Go to step 5.
5 PERFORM THE DIAGNOSIS. 1) Correct the cause of trouble according to 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 4 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 item 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 come on • 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
	☐ Reducing speed	—	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 curve ☐ 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 ☐ Reducing speed ☐ 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

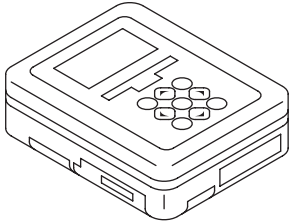
Airbag system wiring harness is routed near the ABS wheel speed sensor and VDCCM&H/U.

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.

C: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B020XU0	1B020XU0	SUBARU SELECT MONITOR 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.

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: 1.260 or more

2. BRAKE VACUUM HOSE

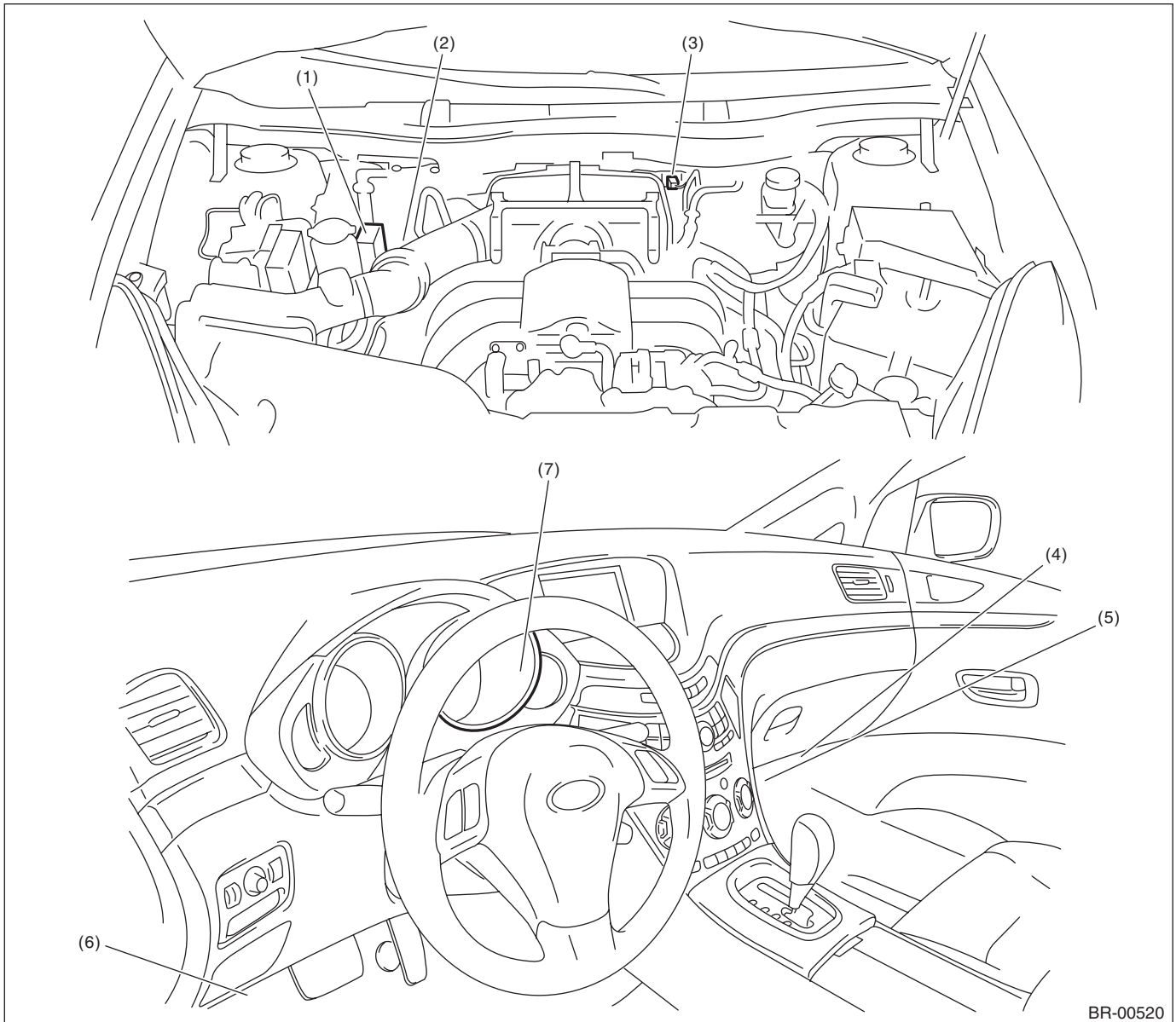
Make sure the brake vacuum hose is not cracked or loose.

Electrical Component Location

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

4. Electrical Component Location

A: LOCATION

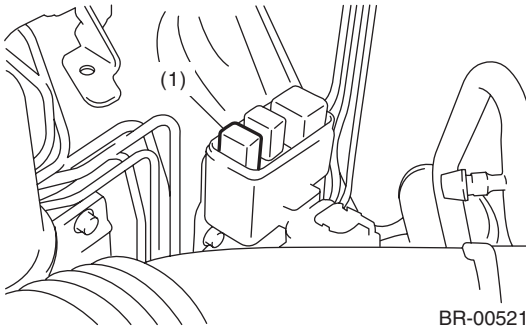


BR-00520

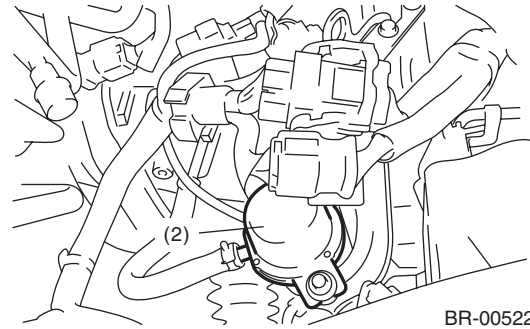
- | | | |
|-----------------------------|---------------------------------|-------------------------|
| (1) Brake vacuum pump relay | (4) Test mode connector | (6) Data link connector |
| (2) Brake vacuum pump | (5) Engine control module (ECM) | (7) Odo/trip meter |
| (3) Brake vacuum sensor | | |

Electrical Component Location

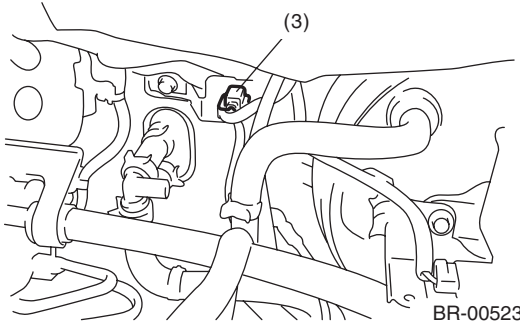
BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)



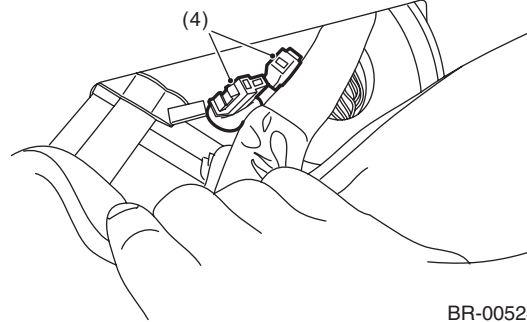
BR-00521



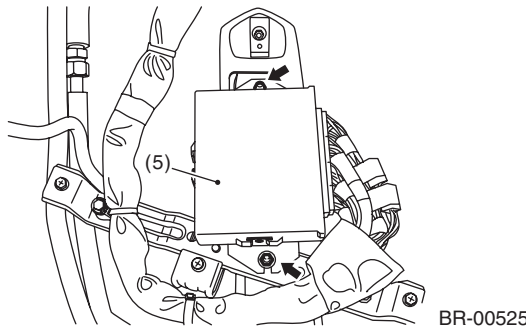
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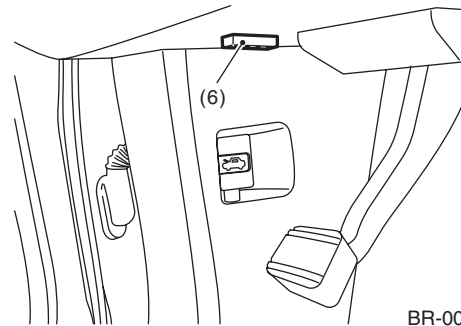
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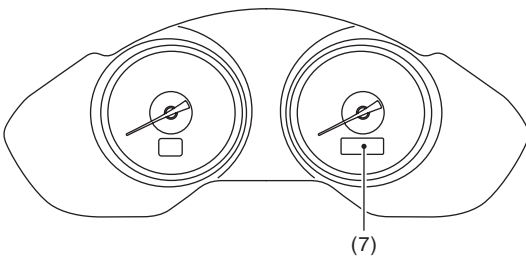
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BR-00525



BR-00526



BR-00527

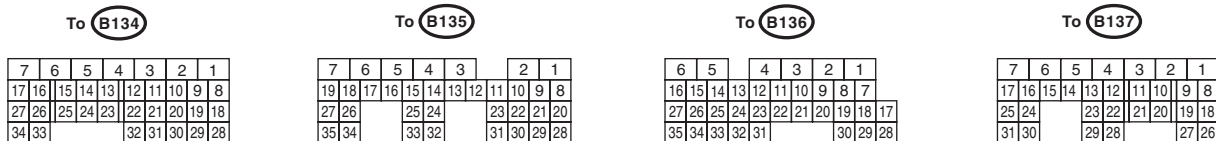
SUBARU®

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)		NOTE
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Brake vacuum sensor	Signal	B134	27	1 — 3.8	1 — 3.8	—
	Power supply	B135	22	5	5	—
	Ground	B135	30	0	0	—
Self-shutoff control		B136	23	0	0	—
Brake vacuum pump	Relay drive	B136	8	10 — 13 (When the pump is OFF)	12 — 14 (When the pump is ON)	—
				0 (When the pump is ON)	0 (When the pump is ON)	
	Electric load	B135	25	0 (When the pump is OFF)	0 (When the pump is OFF)	—
				10 — 13 (When the pump is ON)	12 — 14 (When the pump is ON)	
SSM communication line		B136	16	1 or less ↔ 4 or more	1 or less ↔ 4 or more	—

6. Subaru Select Monitor

A: OPERATION

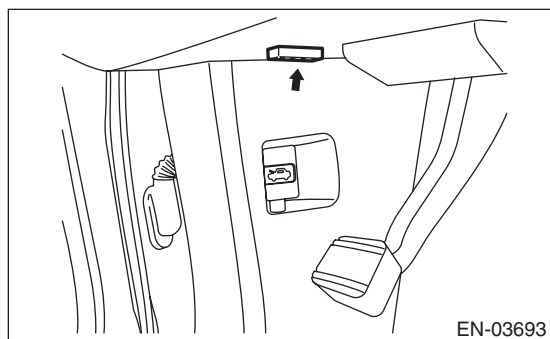
1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare the Subaru Select Monitor kit. <Ref. to BVC(diag)-5, 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 the scan tools except for Subaru Select Monitor.

4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.

5) On the «Main Menu» display screen, select the {Each System Check}.

6) On the «System Selection Menu» display screen, select the {Brake Negative Pressure Pump System}.

7) Select the [OK] after the {3.0 DOHC} is displayed.

8) On the «Negative Pressure Pump Diagnosis Menu» display screen, select the {Diagnostic Code(s) Display}.

NOTE:

- For details concerning operation procedure, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".
- For details concerning DTCs, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to BVC(diag)-14, List of Diagnostic Trouble Code (DTC).>

Subaru Select Monitor

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

2. READ CURRENT DATA

- 1) On the «Main Menu» display screen, select the {Each System Check}.
 - 2) On the «System Selection Menu» display screen, select the {Brake Negative Pressure Pump System}.
 - 3) Select the [OK] after the {3.0 DOHC} is displayed.
 - 4) On the «Negative Pressure Diagnosis Menu» display screen, select the {Current Data Display/Save}.
 - 5) On the «Data Display Menu» screen, select the {Data Display}.
 - 6) Using a 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 monitored	Unit of measure
Atmospheric pressure	Atmospheric pressure is displayed.	mmHg, kPa or psig
Brake booster pressure	Brake booster pressure is displayed.	mmHg, kPa or psig
Test mode terminal	Test mode terminal connection status is displayed.	D Check or U Check
Negative pressure pump motor	Negative pressure pump motor operating status is displayed.	ON or OFF
Negative pressure pump motor relay	Negative pressure pump motor relay operating status is displayed.	ON or OFF

NOTE:

For details concerning operation procedure, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

3. CLEAR MEMORY MODE

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Brake Negative Pressure Pump System}.
- 3) Select the [OK] after the {3.0 DOHC} is displayed.
- 4) On the «Negative Pressure Pump Diagnosis Menu» display screen, select the {Clear Memory}.

Display	Contents to be monitored
Clear Memory?	DTC deleting function

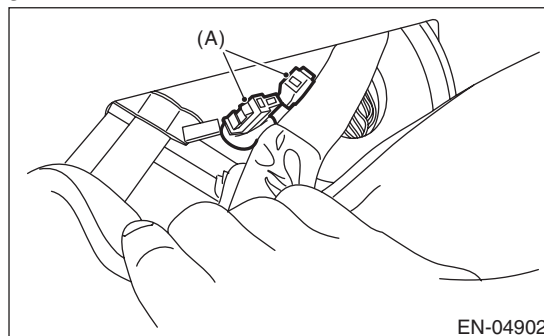
- 5) When “Done” and “Turn ignition switch OFF” are shown on the display screen, turn the ignition switch to OFF and close the Subaru Select Monitor.

NOTE:

For details concerning operation procedure, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

4. FUNCTION CHECK MODE

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



(A) Test mode connector

- 2) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.
- 3) On the «Main Menu» display screen, select the {Each System Check}.
- 4) On the «System Selection Menu» display screen, select the {Brake Negative Pressure Pump System}.
- 5) Select the [OK] after the {3.0 DOHC} is displayed.
- 6) On the «Negative Pressure Pump Diagnosis Menu» display screen, select the {Function Check Mode}.
- 7) When the “Start Function Check Mode” is shown on the screen, select the [OK].
- 8) When the “Depress the Brake Pedal 5 Times” is shown on the screen, depress the brake pedal 5 times, and select the [OK] while brake pedal is not depressed.
- 9) Select the [OK] after the {OK} is displayed.

Read Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

7. Read Diagnostic Trouble Code (DTC)

A: OPERATION

For details concerning DTC reading procedure, refer to "Subaru Select Monitor". <Ref. to BVC(diag)-9, Subaru Select Monitor.>

8. Inspection Mode

A: PROCEDURE

Reproduce the malfunction occurrence condition as possible.

Drive the vehicle at least ten minutes.

9. Clear Memory Mode

A: OPERATION

For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to BVC(diag)-9, Subaru Select Monitor.>

List of Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

10.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Display	Content of diagnosis	Reference target
11	Sensor output out of range	Brake vacuum sensor output error	<Ref. to BVC(diag)-15, DTC11 SENSOR OUTPUT OUT OF RANGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
12	Compare error in other sensor	Error in comparison with other brake booster relative pressure	<Ref. to BVC(diag)-17, DTC12 COMPARE ERROR IN OTHER SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
13	Pressure sensor output	Brake vacuum sensor seizure malfunction	<Ref. to BVC(diag)-20, DTC13 PRESSURE SENSOR OUTPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	Discrepancy in relays (ON)	Drive does not match between the brake vacuum pump relay and the brake vacuum pump.	<Ref. to BVC(diag)-23, DTC21 DISCREPANCY IN RELAYS(ON), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	Discrepancy in relays (OFF)	Drive does not match between the brake vacuum pump relay and the brake vacuum pump.	<Ref. to BVC(diag)-26, DTC22 DISCREPANCY IN RELAYS(OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	Pump continuous work	Malfunction in brake vacuum pump continuous operation	<Ref. to BVC(diag)-28, DTC23 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: DTC11 SENSOR OUTPUT OUT OF RANGE

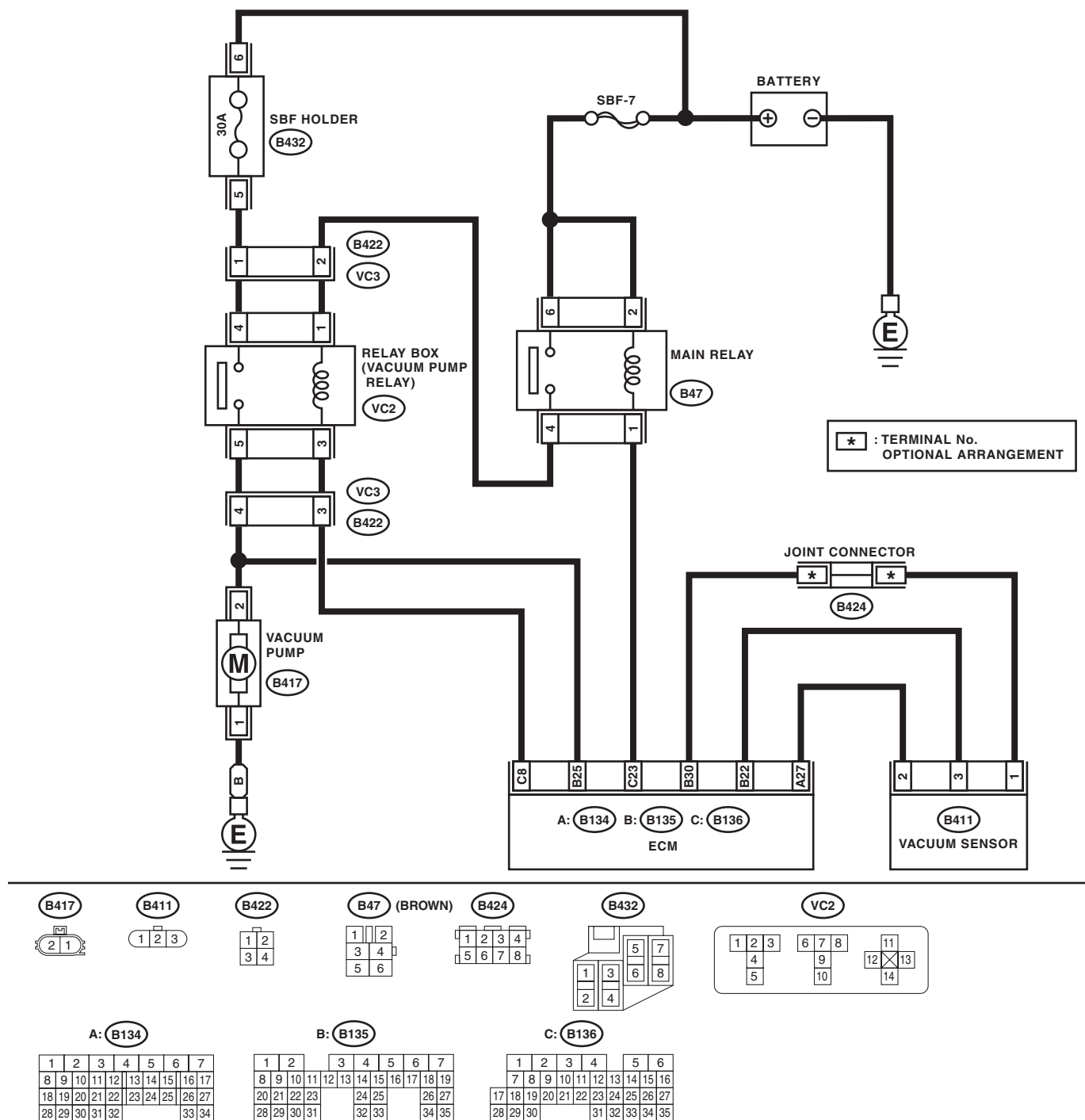
DTC DETECTING CONDITION:

Brake vacuum sensor output error

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:



BR-00684

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-41, REMOVAL, 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-41, Vacuum Sensor.>
2 CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. 1) Disconnect the connectors from the ECM. 2) Measure the resistance of the harness between ECM and the brake vacuum sensor connector. Connector & terminal (B135) No. 30 — (B411) No. 1: (B135) No. 22 — (B411) No. 3: (B134) No. 27 — (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.
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: (B134) No. 27 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the ground short of the harness between ECM and brake vacuum sensor connector.
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 (-): (B134) No. 27 (+) — 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 THE 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)-33, 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 negative pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the atmospheric pressure — brake booster pressure between -8 — +8 mmHg?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-33, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

B: DTC12 COMPARE ERROR IN OTHER SENSOR

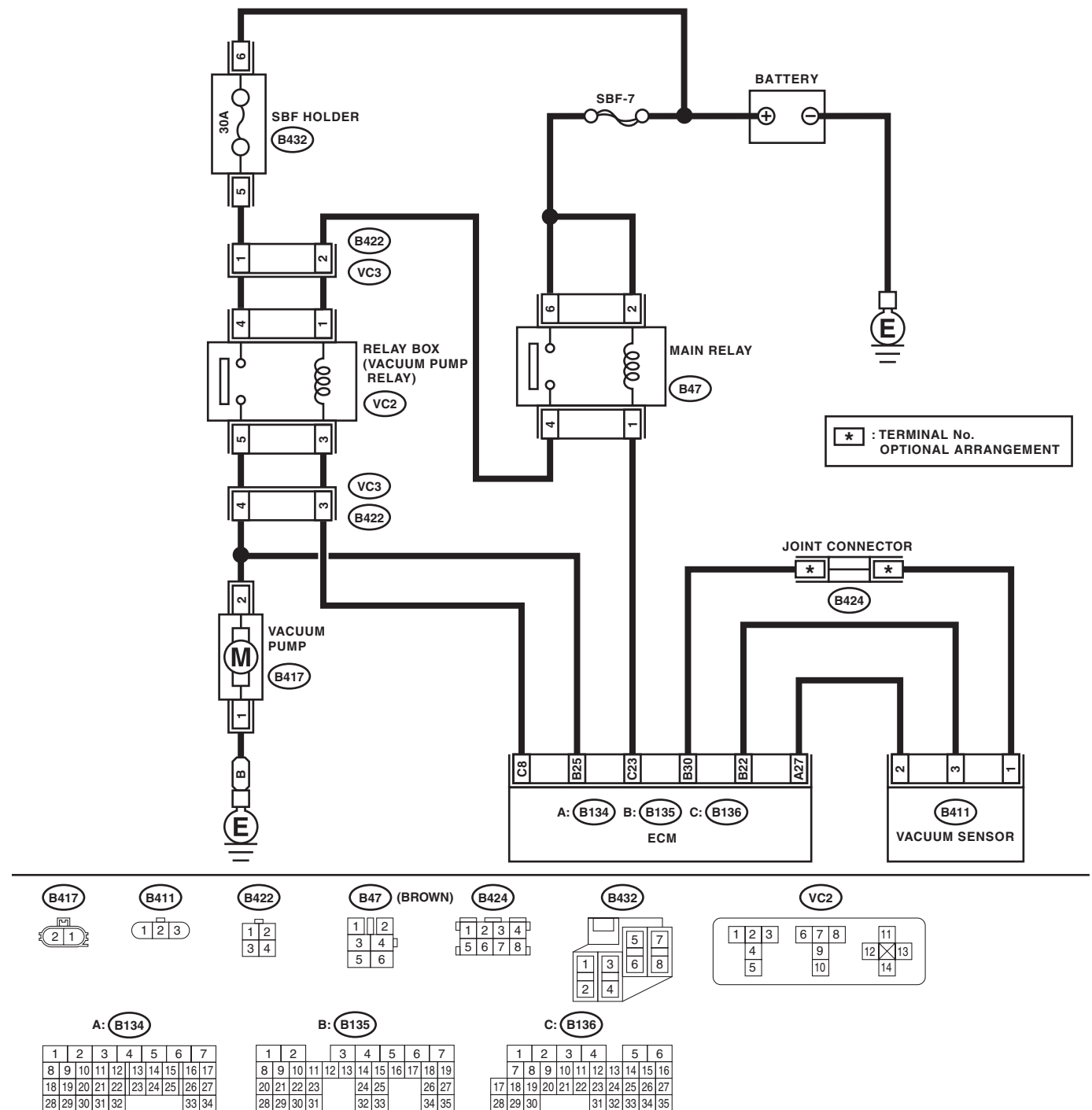
DTC DETECTING CONDITION:

Error in comparison with other brake booster relative pressure

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:



BR-00684

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 that 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-41, REMOVAL, 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-41, Vacuum Sensor.>
4	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. 1) Disconnect the connectors from ECM. 2) Measure the resistance of the harness between ECM and the brake vacuum sensor connector. Connector & terminal (B135) No. 30 — (B411) No. 1: (B135) No. 22 — (B411) No. 3: (B134) No. 27 — (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.
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: (B134) No. 27 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 6.	Repair the ground short circuit between ECM and brake vacuum sensor connector.
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 (-): (B134) No. 27 (+) — 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 THE 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)-33, 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 negative pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the atmospheric pressure — brake booster pressure between -8 — +8 mmHg?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-33, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

C: DTC13 PRESSURE SENSOR OUTPUT

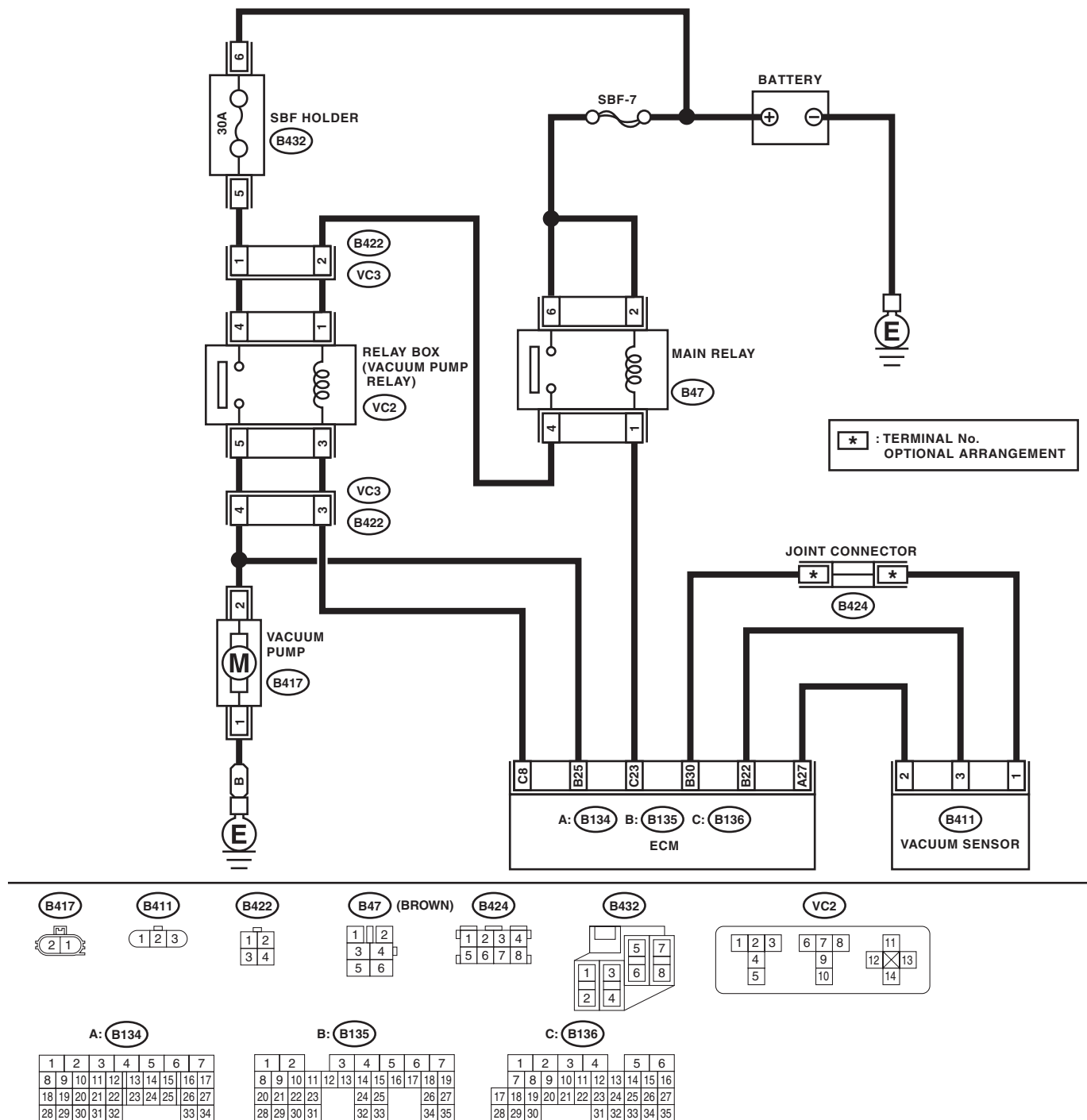
DTC DETECTING CONDITION:

Brake vacuum sensor seizure malfunction

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:



BR-00684

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 that 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 that 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-41, REMOVAL, 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-41, Vacuum Sensor.>
5	CHECK HARNESS BETWEEN ECM AND BRAKE VACUUM SENSOR CONNECTOR. 1) Disconnect the connectors from the ECM. 2) Measure the resistance of the harness between ECM and the brake vacuum sensor connector. Connector & terminal (B135) No. 30 — (B411) No. 1: (B135) No. 22 — (B411) No. 3: (B134) No. 27 — (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.
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: (B134) No. 27 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the ground short of the harness between ECM and brake vacuum sensor connector.
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 (-): (B134) No. 27 (+) — 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 THE 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)-33, 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 negative pressure pump system using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the atmospheric pressure — brake booster pressure between -8 — +8 mmHg?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-33, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

D: DTC21 DISCREPANCY IN RELAYS(ON)

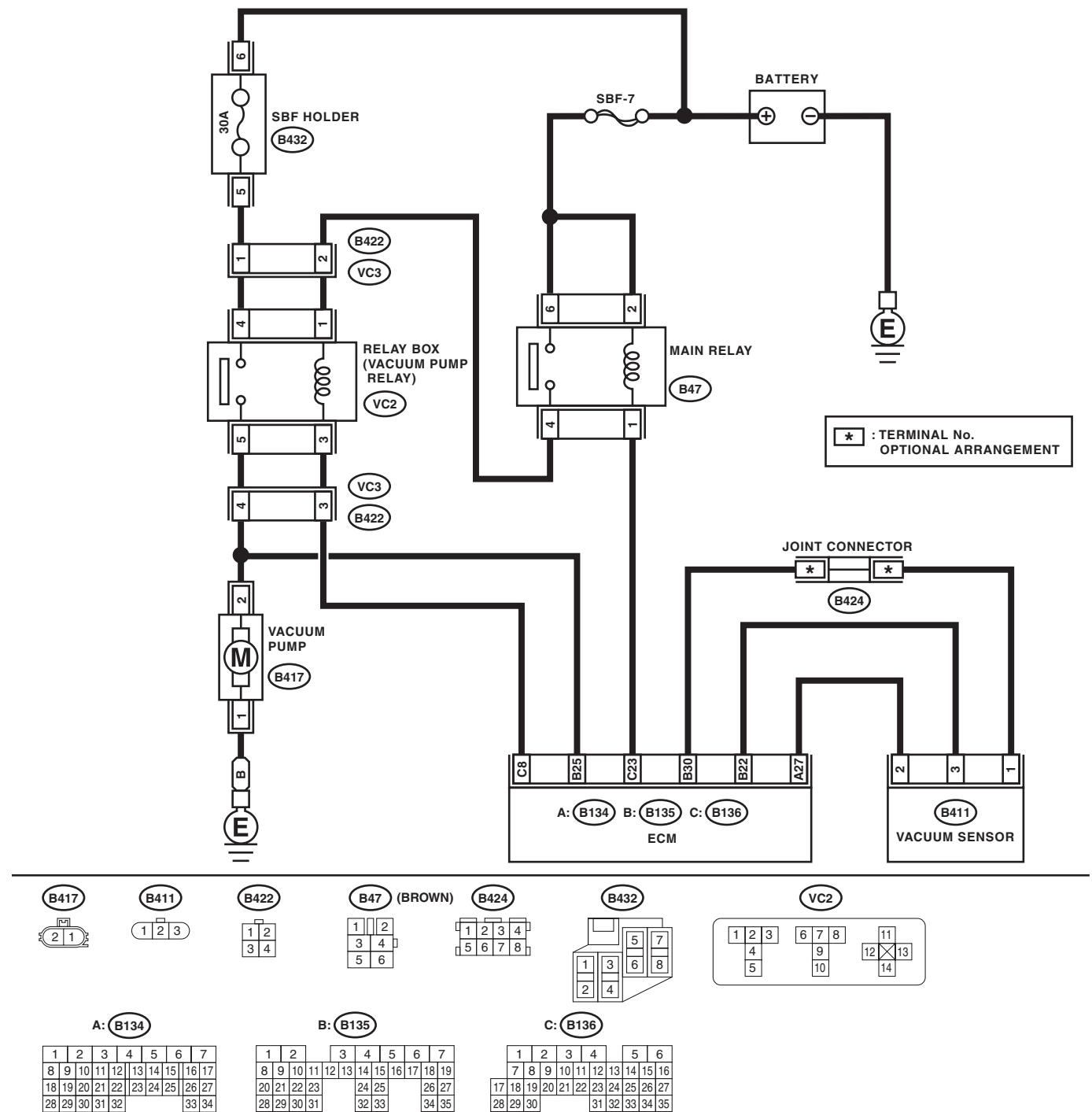
DTC DETECTING CONDITION:

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

TROUBLE SYMPTOM:

Brake vacuum pump does not operate.

WIRING DIAGRAM:



BR-00684

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CONNECTOR. Check that 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 the relay box. 3) Connect the battery to terminals No. 1 and No. 3 of the brake vacuum pump relay. 4) Measure the resistance between the brake vacuum pump relay terminals. Terminals No. 4 — No. 5:	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 (VC2) No. 1 (+) — Chassis ground (-): (VC2) 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 connector of ECM. 3) Measure the resistance of the harness between ECM and the brake vacuum pump relay connector. Connector & terminal (B136) No. 8 — (VC2) 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.
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 the harness between the brake vacuum pump and brake vacuum pump relay connector. Connector & terminal (VC2) No. 5 — (B417) No. 2:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair the open circuit of the harness between the brake vacuum pump and the brake vacuum pump relay connector.
7 CHECK THE HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP CONNECTOR. Measure the resistance of the harness between brake vacuum pump connector and the 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 of the harness between ECM and brake vacuum pump connector.
8 CHECK THE HARNESS BETWEEN ECM AND BRAKE VACUUM PUMP CONNECTOR. Measure the voltage between brake vacuum pump connector and the 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.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

Step	Check	Yes	No
9 CHECK BRAKE VACUUM PUMP. 1) Turn the ignition switch to OFF. 2) Remove the brake vacuum pump. <Ref. to BR-40, REMOVAL, Vacuum Pump.> 3) Connect the battery positive terminal to the brake vacuum pump terminal No. 2, and the negative terminal to terminal No. 1.	Is the brake vacuum pump operating?	Go to step 10.	Replace the brake vacuum pump. <Ref. to BR-40, 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 brake negative pressure pump system function check mode using the Subaru Select Monitor. <Ref. to BVC(diag)-9, Subaru Select Monitor.>	Is the brake vacuum pump operating?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-33, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

E: DTC22 DISCREPANCY IN RELAYS(OFF)

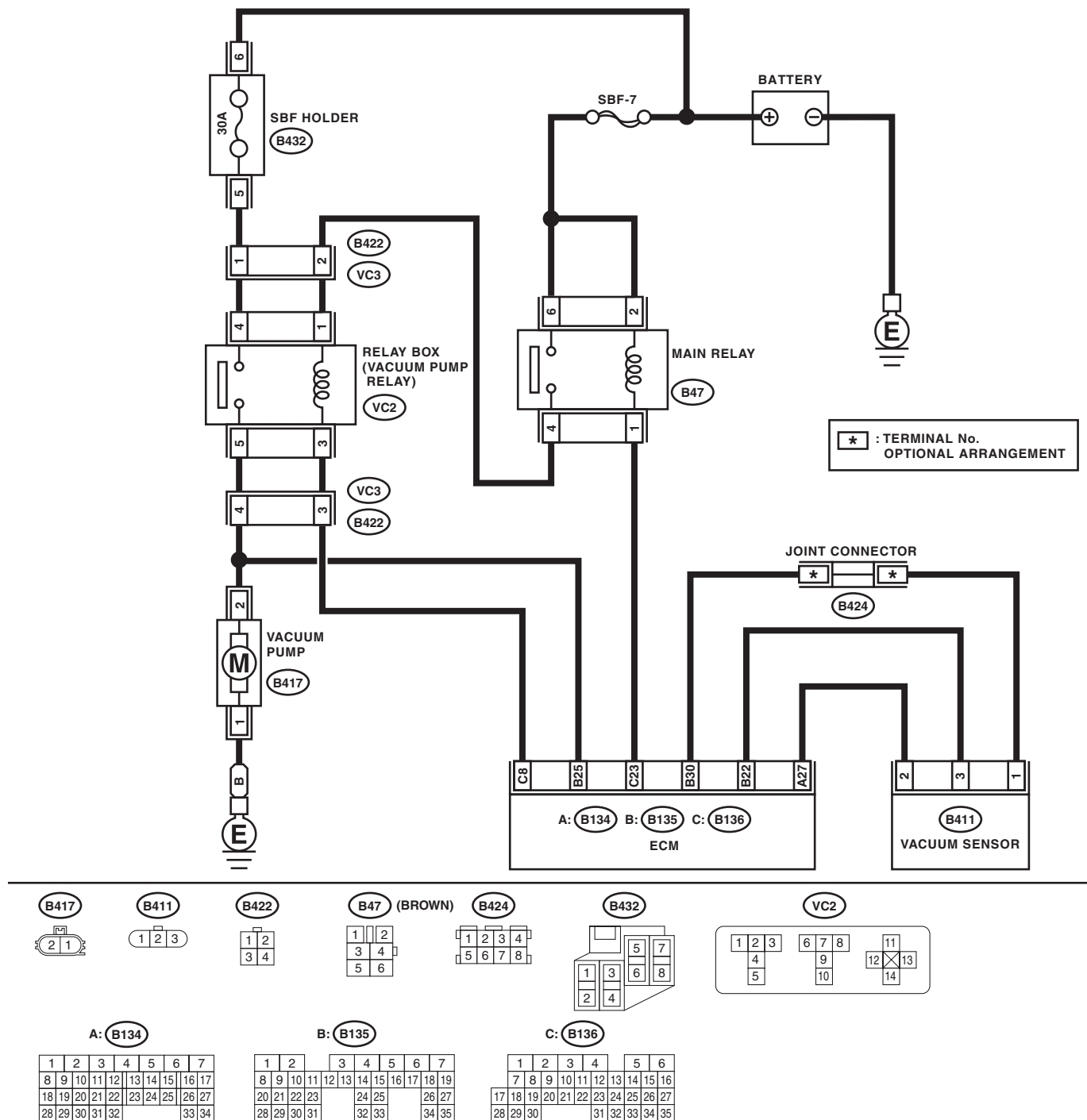
DTC DETECTING CONDITION:

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

TROUBLE SYMPTOM:

Vacuum pump does not operate properly.

WIRING DIAGRAM:



BR-00684

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 the relay box. 3) Connect the battery to terminals No. 1 and No. 3 of the brake vacuum pump relay. 4) Measure the resistance between the brake vacuum pump relay terminals. Terminals No. 4 — No. 5:	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 (VC2) No. 1 (+) — Chassis ground (-): (VC2) 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 connector of ECM. 3) Measure the resistance of the harness between ECM and the brake vacuum pump relay connector. Connector & terminal (B136) No. 8 — (VC2) No. 3: (B135) No. 25 — (VC2) No. 5:	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.
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 the harness between the brake vacuum pump and brake vacuum pump relay connector. Connector & terminal (VC2) No. 5 — (B417) No. 2:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair the open circuit of the harness between the brake vacuum pump and the brake vacuum pump relay connector.
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 the 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. 3) Connect the battery to terminals No. 2 (+) and No. 1 (-) of the brake vacuum pump.	Is the brake vacuum pump operating?	Go to step 7.	Replace the brake vacuum pump.
7 CHECK ECM. 1) Connect the brake vacuum pump, brake vacuum pump relay and connector. 2) Perform the Function Check Mode. <Ref. to BVC(diag)-10, FUNCTION CHECK MODE, OPERATION, Subaru Select Monitor.>	Is the brake vacuum pump operating?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-33, INSTALLATION, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

F: DTC23 PUMP CONTINUOUS WORK

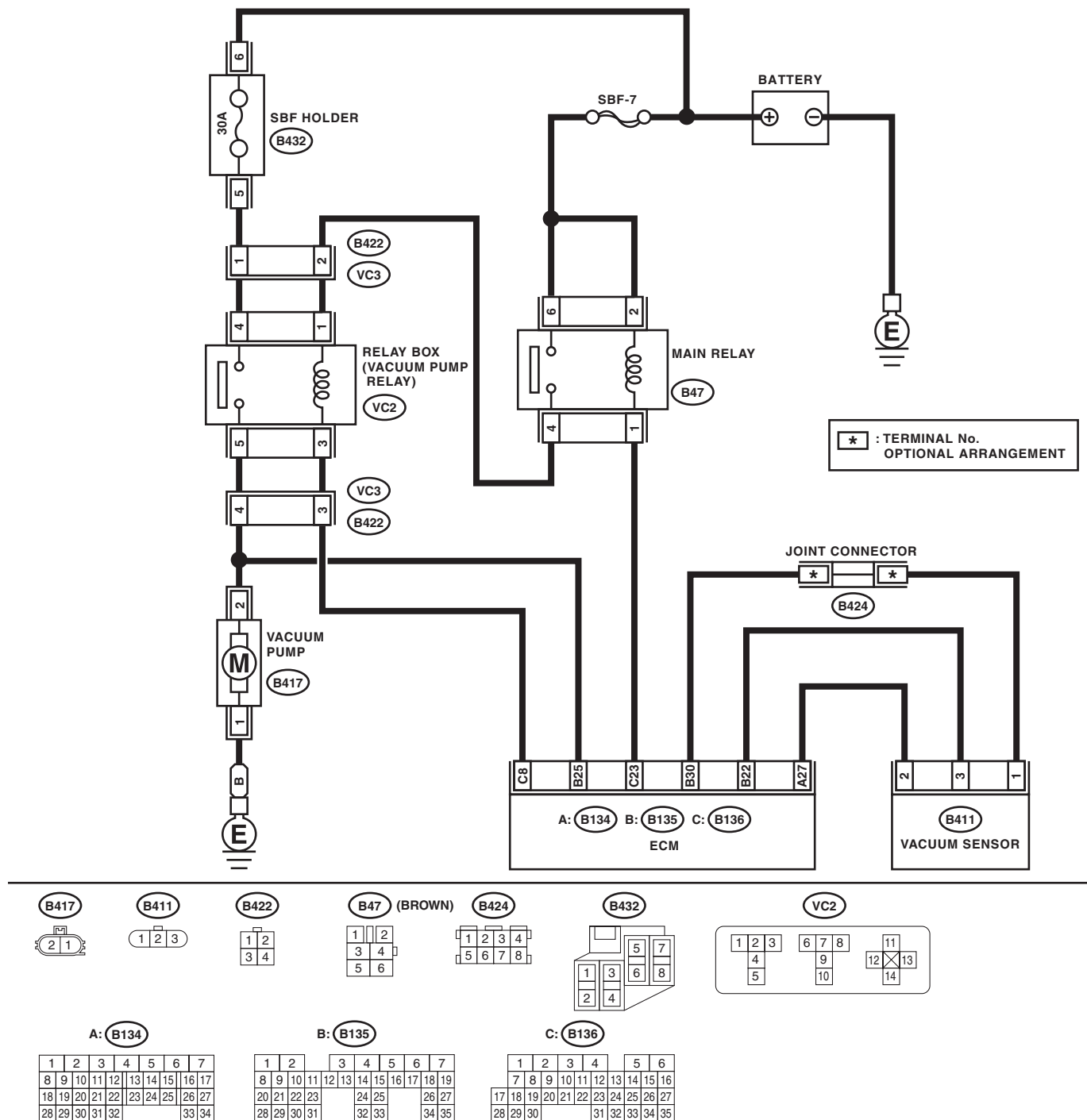
DTC DETECTING CONDITION:

Malfunction in brake vacuum pump continuous operation

TROUBLE SYMPTOM:

Break vacuum pump operates continuously.

WIRING DIAGRAM:



BR-00684

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 that 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 the relay box. 3) Connect the battery to terminals No. 1 and No. 3 of the brake vacuum pump relay. 4) Measure the resistance between the brake vacuum pump relay terminals. Terminals No. 4 — No. 5:	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 (VC2) No. 1 (+) — Chassis ground (-): (VC2) 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 connector of ECM. 3) Measure the resistance of the harness between ECM and the brake vacuum pump relay connector. Connector & terminal (B136) No. 8 — (VC2) No. 3: (B135) No. 25 — (VC2) No. 5:	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.
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 the harness between the brake vacuum pump and brake vacuum pump relay connector. Connector & terminal (VC2) No. 5 — (B417) No. 2:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair the open circuit of the harness between the brake vacuum pump and the brake vacuum pump relay connector.
7 CHECK ECM. 1) Connect the brake vacuum pump, brake vacuum pump relay and connector. 2) Perform the Function Check Mode. <Ref. to BVC(diag)-10, FUNCTION CHECK MODE, OPERATION, Subaru Select Monitor.>	Is the brake vacuum pump operating?	Temporary poor contact occurs.	Replace the ECM. <Ref. to FU(H6DO)-33, Engine Control Module (ECM).>

General Diagnostic Table

BRAKE VACUUM CONTROL (BVC)(DIAGNOSTICS)

12.General Diagnostic Table

A: INSPECTION

Symptom		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

PARKING BRAKE

PB

	Page
1. General Description	2
2. Parking Brake Pedal	5
3. Parking Brake Cable	6
4. Parking Brake Assembly (Rear Disc Brake)	8
5. General Diagnostic Table	11

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.

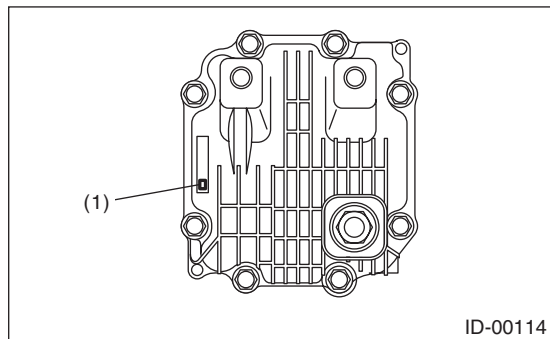
NOTE:

- 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	XX
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. IDENTIFICATION

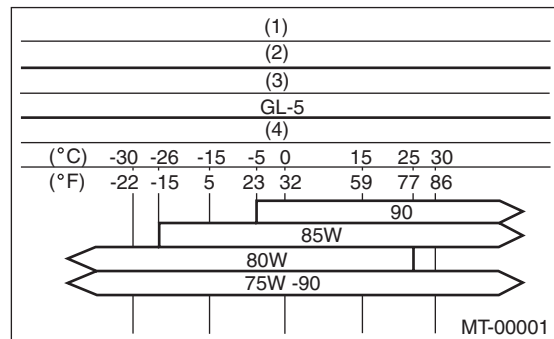
Identification label positions are shown in the following figures. For details concerning identification, refer to the "ID" section.



(1) Identification

NOTE:

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



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

3. REAR DIFFERENTIAL GEAR OIL

Recommended gear oil:
GL-5 (75W-90)

4. SERVICE DATA

Drive pinion bearing preload	Measure with spring measurement. (Measured from the companion flange bolt)	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
	Measure with torque wrench N·m (kgf-m, ft-lb)	0.48 — 1.22 (0.05 — 0.12, 0.35 — 0.90)
Hypoid driven gear to drive pinion backlash	mm (in)	0.10 — 0.15 (0.004 — 0.006)

General Description

DIFFERENTIALS

5. ADJUSTING PARTS

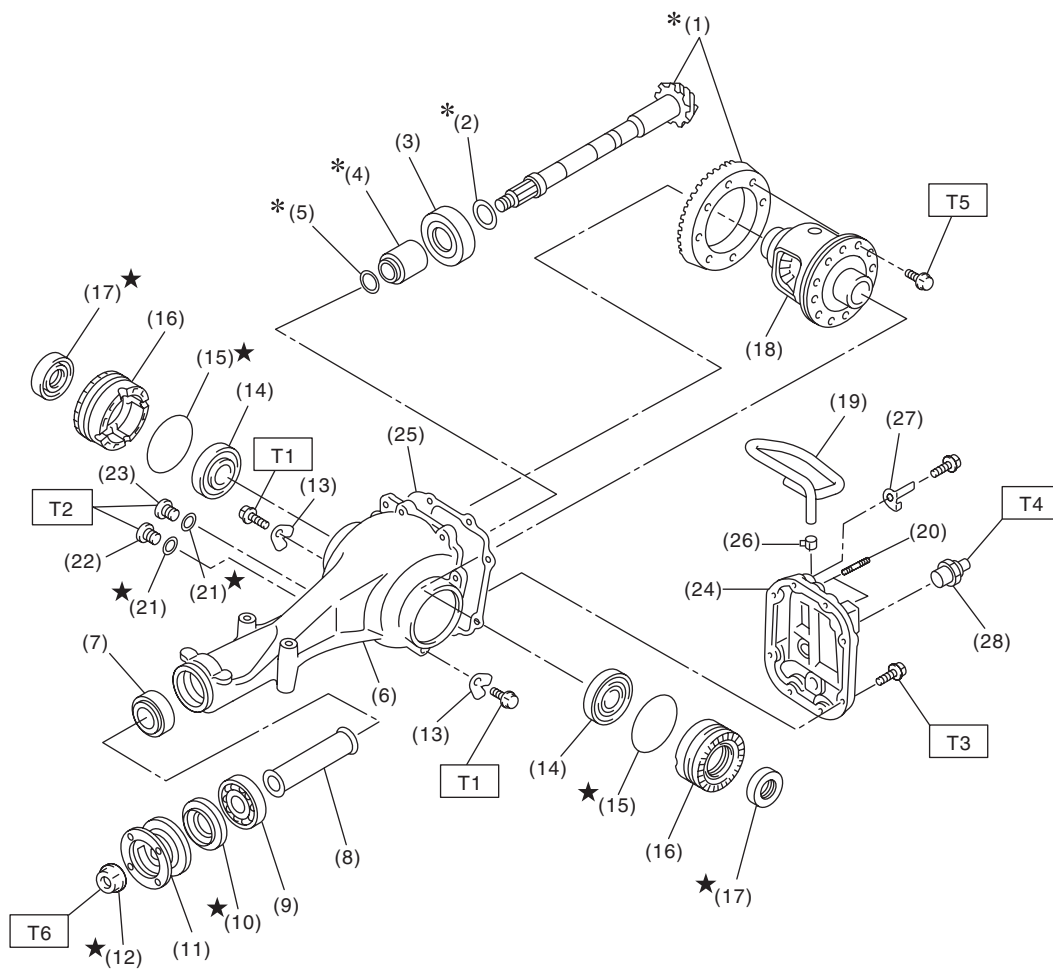
Drive pinion bearing preload	Measure with spring measurement. (Measured from the companion flange bolt) N (kgf, lb)	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
	Measure with torque wrench N·m (kgf-m, ft-lb)	0.48 — 1.22 (0.05 — 0.12, 0.35 — 0.90)
Preload adjusting collar	Part No.	Length mm (in)
	31454AA250	51.05 (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)
Hypoid driven gear to drive pinion backlash	32295AA400	0.275 (0.0108)
	Limit mm (in)	0.10 — 0.15 (0.004 — 0.006)

General Description

DIFFERENTIALS

B: COMPONENT

1. REAR DIFFERENTIAL (VA2-TYPE)



DI-00469

General Description

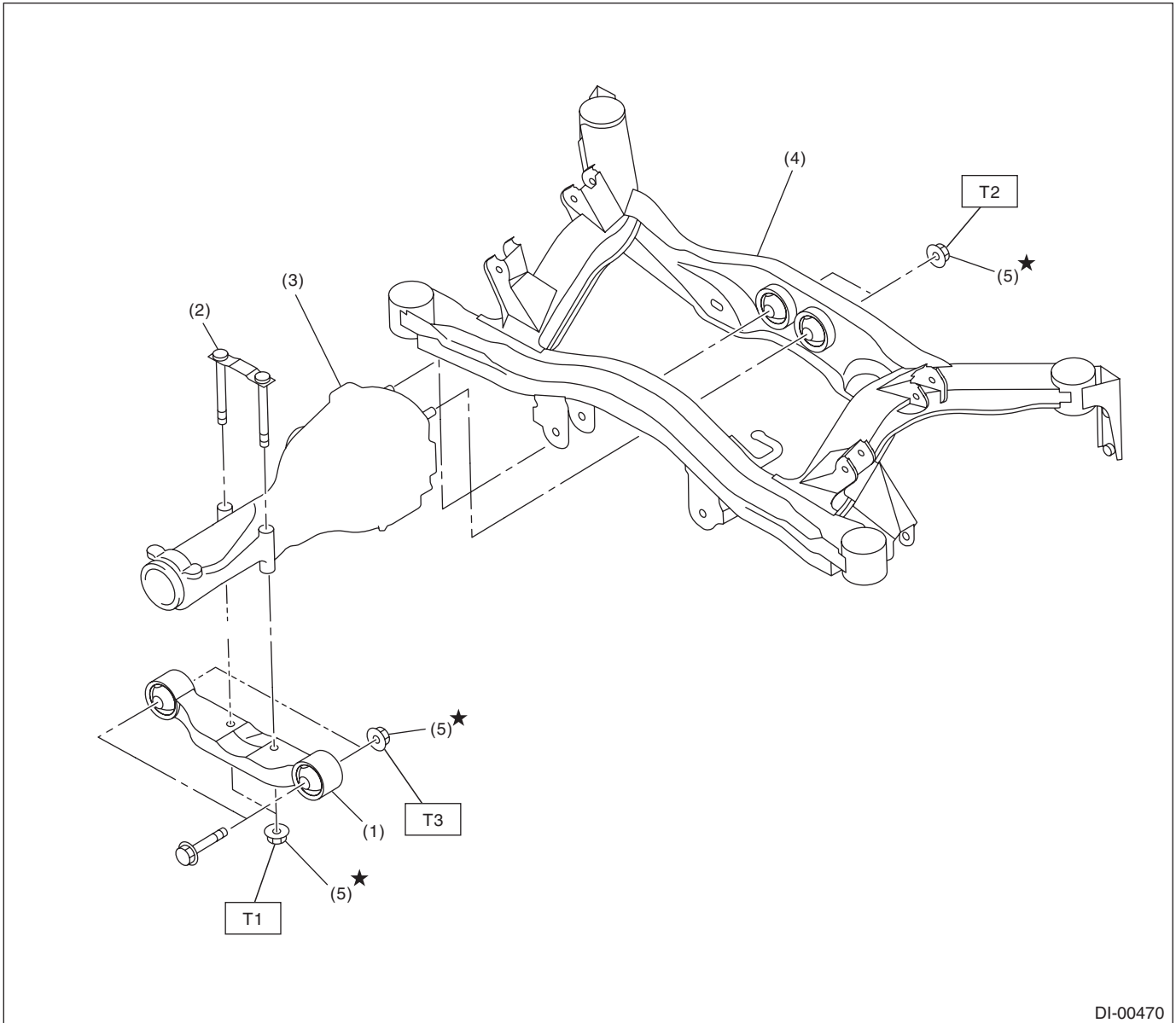
DIFFERENTIALS

(1) Hypoid driven gear and drive pinion set	(13) Lock plate	(26) Clip
(2) Pinion height adjusting washer	(14) Side bearing	(27) Stay ground
(3) Rear bearing	(15) O-ring	(28) Rear differential oil temperature switch
(4) Bearing preload adjusting collar	(16) Axle shaft holder	
(5) Bearing preload adjusting washer	(17) Side oil seal	
(6) Differential carrier	(18) Differential case ASSY	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(7) Front bearing	(19) Air breather hose	<i>T1: 25 (2.5, 18.5)</i>
(8) Collar	(20) Stud bolt	<i>T2: 29 (3.0, 21.4)</i>
(9) Pilot bearing	(21) Gasket	<i>T3: 34 (3.5, 25.1)</i>
(10) Front oil seal	(22) Oil filler plug	<i>T4: 60 (6.1, 44.3)</i>
(11) Companion flange	(23) Oil drain plug	<i>T5: 62 (6.3, 45.8)</i>
(12) Self-locking nut	(24) Rear cover	<i>T6: 191 (19.5, 141.0)</i>
	(25) Gasket	

General Description

DIFFERENTIALS

2. REAR DIFFERENTIAL MOUNTING SYSTEM



DI-00470

- | | |
|------------------------------------|----------------------|
| (1) Rear differential front member | (4) Sub Frame |
| (2) Rear differential member plate | (5) Self-locking nut |
| (3) Rear differential ASSY | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 50 (5.1, 36.9)

T2: 70 (7.1, 51)

T3: 110 (11.2, 81)

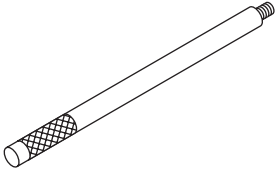
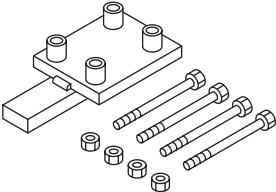
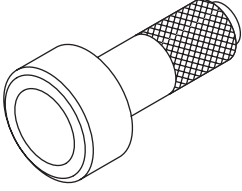
C: CAUTION

- 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 grease etc. or equivalent. Do not mix gear oil, grease, etc. with those of different grades or from other 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 front and rear bearing cones.
 ST-398217700	398217700	ATTACHMENT SET	Stand for rear differential carrier disassembly and assembly.
 ST-498447120	498447120	INSTALLER	Used for installing the front oil seal.

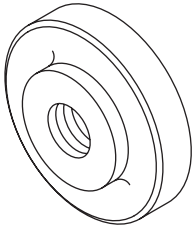
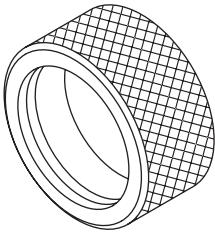
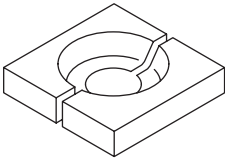
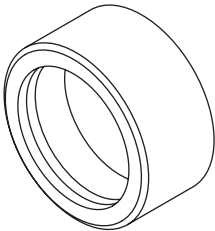
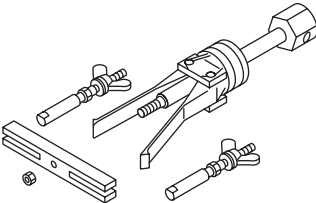
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
ST-498427200	498427200	FLANGE WRENCH	Used for stopping rotation of companion flange when removing and tightening self-lock nut.
ST-399780104	399780104	WEIGHT	Used for installing the front bearing cone and the pilot bearing 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.

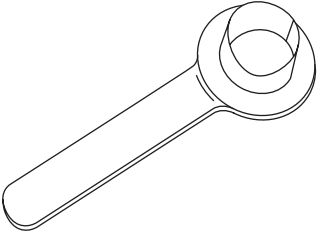
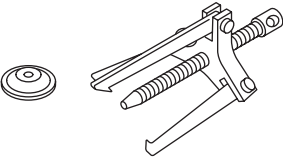
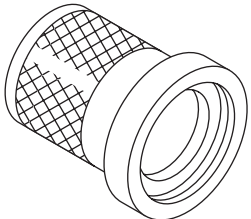
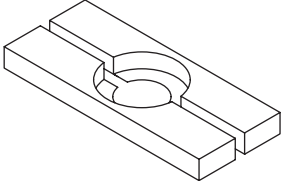
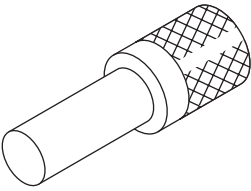
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-398477703	398477703	DRIFT 2	Used for press-fitting bearing race (rear) of differential carrier.
 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.

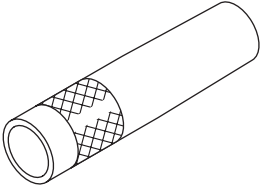
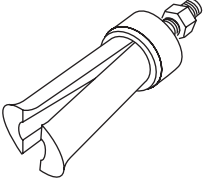
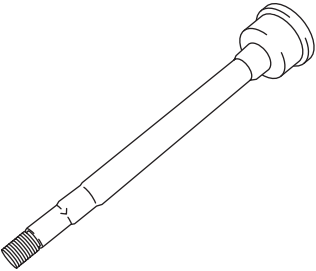
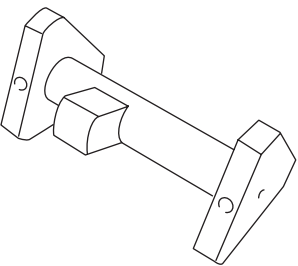
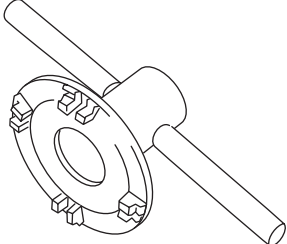
General Description

DIFFERENTIALS

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
 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 differential side bearing.

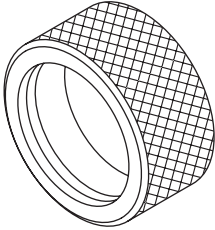
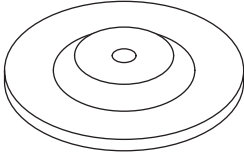
General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499277200	499277200	INSTALLER	Used for installing the front bearing cone.
 ST18758AA000	18758AA000	PULLER	Used for removing side bearing cup.
 ST18678AA000	18678AA000	DUMMY SHAFT	Used for adjusting pinion height and preload.
 ST18831AA010	18831AA010	DIFFERENTIAL CARRIER GAUGE	Used for adjusting pinion height.
 ST18630AA010	18630AA010	WRENCH COMPL RETAINER	Used for removing and installing the side oil seal holder.

General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498447100	498447100	INSTALLER	Used for installing the oil seal.
 ST-399520105	399520105	SEATS	• Used for removing the side bearing cone. • Used together with PULLER SET (899524100).

2. GENERAL TOOL

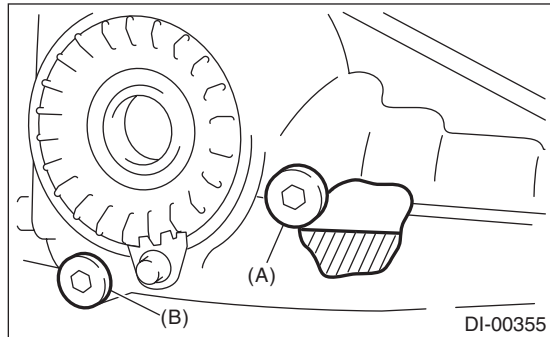
TOOL NAME	REMARKS
Transmission jack	Used for assembly/disassembly of the rear differential.
Puller	Used for removing the side bearing retainer.
Thickness gauge	Used for measuring clearance.
Hexagon wrench	Used for installing and removing the filler and drain plug.
Tire lever	Used for removing the front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

2. Differential Gear Oil

A: INSPECTION

1) Remove the filler plug, and then check the gear oil. Replace the gear oil if it is contaminated or deteriorated. <Ref. to DI-13, REPLACEMENT, Differential Gear Oil.>

2) Check that the gear oil level is up to the bottom of the filler plug hole. If the level is low, verify that there is no oil leakage, refill up to the bottom of filler plug.



(A) Filler plug
(B) Drain plug

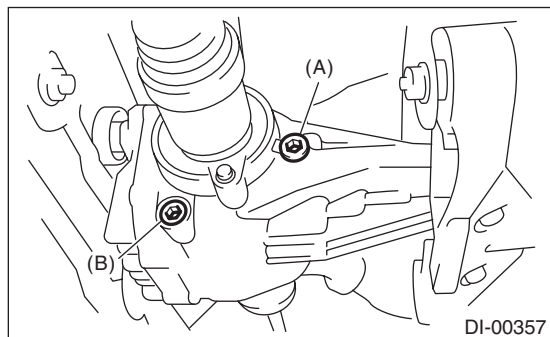
B: REPLACEMENT

1) Jack-up the vehicle and support it with rigid racks.

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

CAUTION:

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



(A) Filler plug
(B) Drain plug

3) Tighten the oil drain plug.

NOTE:

Use a new metal gasket.

Tightening torque:

29 N·m (3.0 kgf-m, 21.4 ft-lb)

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

NOTE:

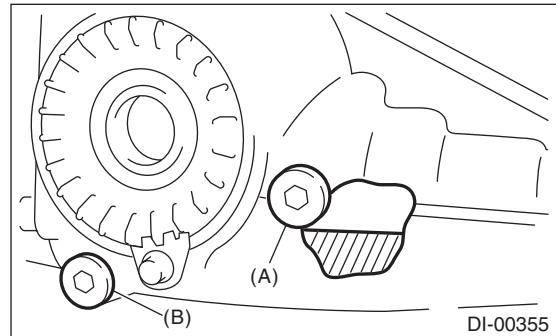
Carefully refill oil while watching the level. Excessive or insufficient oil must be avoided.

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) Drain plug

5) Install the filler plug.

NOTE:

Use a new metal gasket.

Tightening torque:

29 N·m (3.0 kgf-m, 21.4 ft-lb)

3. Front Differential Assembly

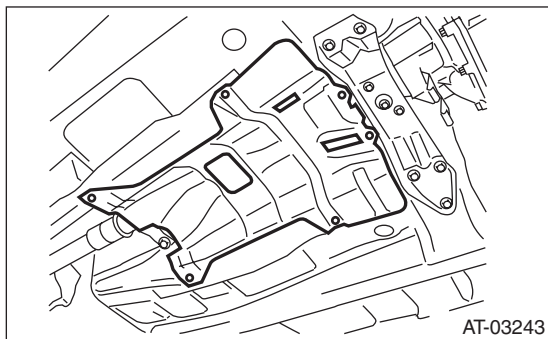
A: NOTE

Regarding the front differential, refer to the “5AT” section. <Ref. to 5AT-89, Front Differential Assembly.>

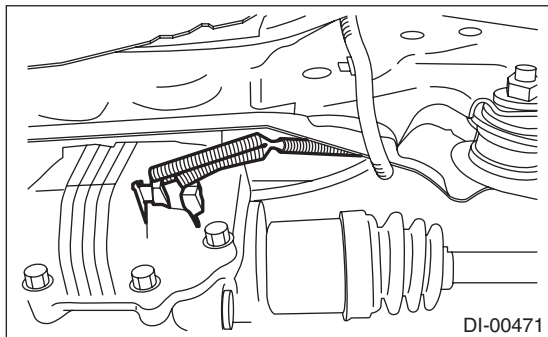
4. Rear Differential (VA-type)

A: REMOVAL

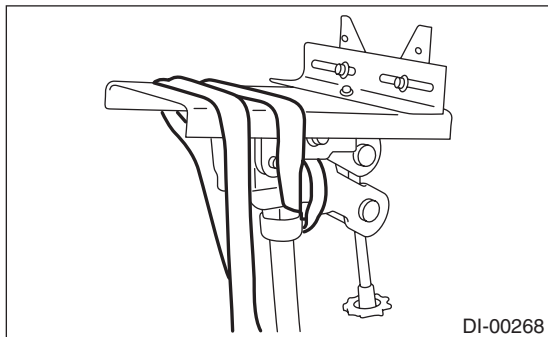
- 1) Disconnect the ground cable from the battery.
- 2) Release the parking brake.
- 3) Jack-up the vehicle.
- 4) Remove the rear exhaust pipe and muffler.
<Ref. to EX(H6DO)-6, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-8, REMOVAL, Muffler.>
- 5) Remove the heat shield cover.



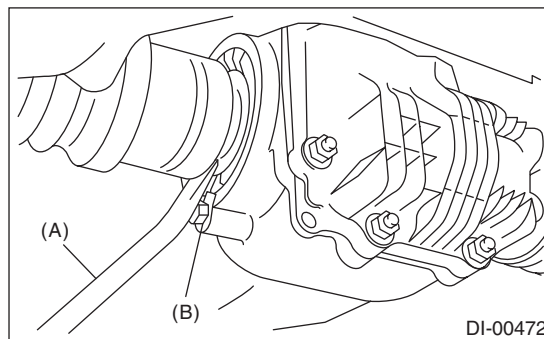
- 6) Remove the propeller shaft.
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 7) Remove the connector from the rear differential oil temperature switch.



- 8) Prepare the transmission jack and band.

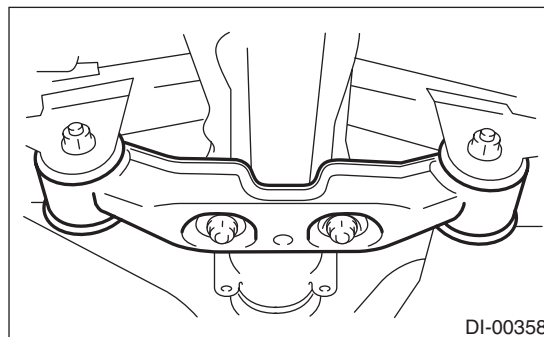


- 9) Remove the DOJ of rear drive shaft from rear differential.

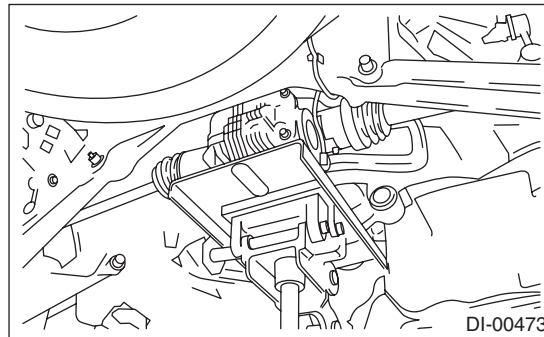


- (A) Tire lever
(B) Bolt

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



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



- 12) Loosen the self-lock nuts which hold the rear differential to rear crossmember.



- 13) Remove the rear differential front member.
- 14) Secure the rear differential using band.

Rear Differential (VA-type)

DIFFERENTIALS

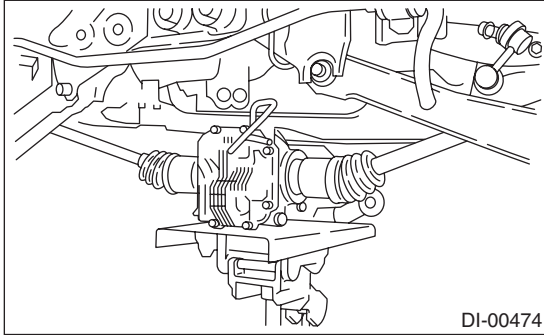
15) Remove the self-lock nuts which hold the rear differential to rear crossmember.

16) Remove the air breather hose from the sub frame.

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

NOTE:

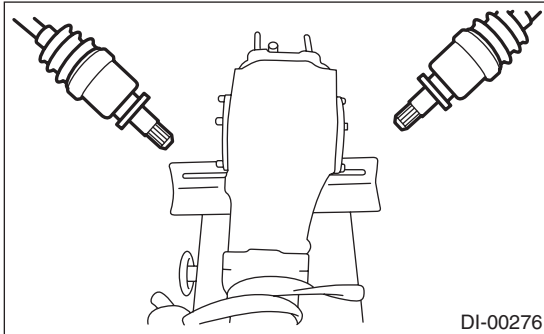
When removing the stud bolt, carefully adjust the angle and location of transmission jack and jack stand, if necessary



18) Pull out the axle shaft from rear differential.

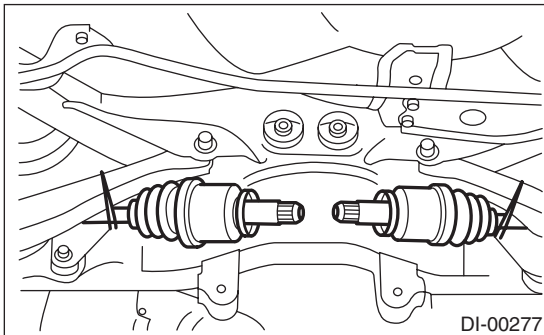
NOTE:

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

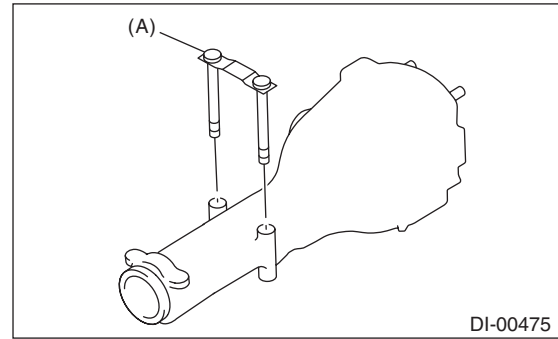


19) Lower the transmission jack.

20) Secure the rear drive shaft to lateral link using wire.



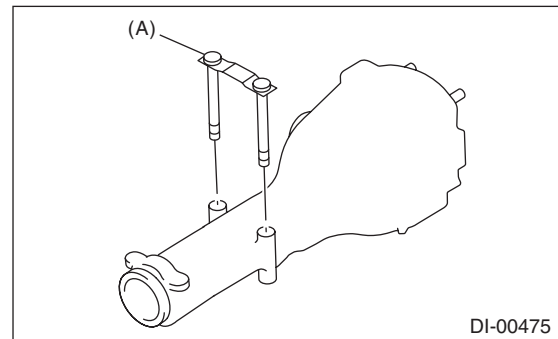
21) Remove the rear differential member plate from rear differential.



(A) Rear differential member plate

B: INSTALLATION

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



(A) Rear differential member plate

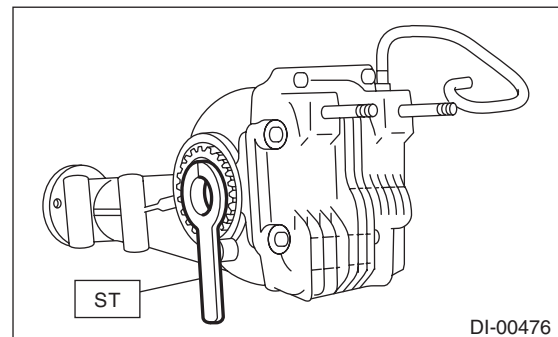
2) Set the rear differential to transmission jack.

NOTE:

Secure the rear differential to transmission jack using band.

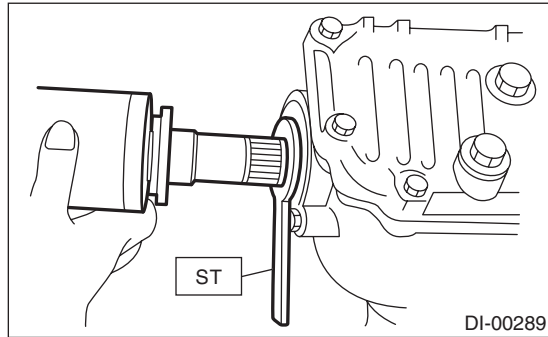
3) Attach the ST to rear differential.

ST 28099PA090 OIL SEAL PROTECTOR



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

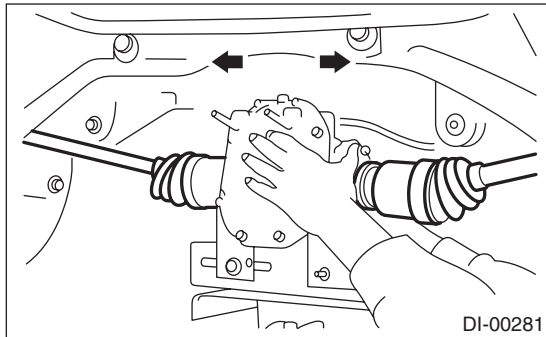
ST 28099PA090 OIL SEAL PROTECTOR



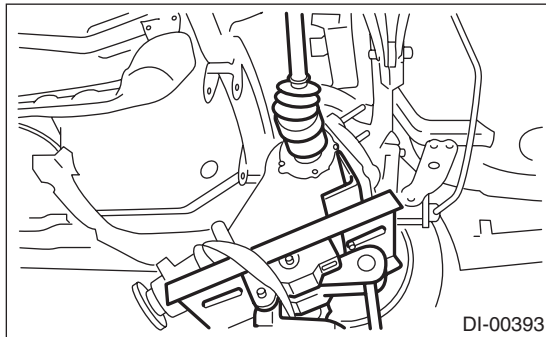
5) Remove ST from rear differential.

ST 28099PA090 OIL SEAL PROTECTOR

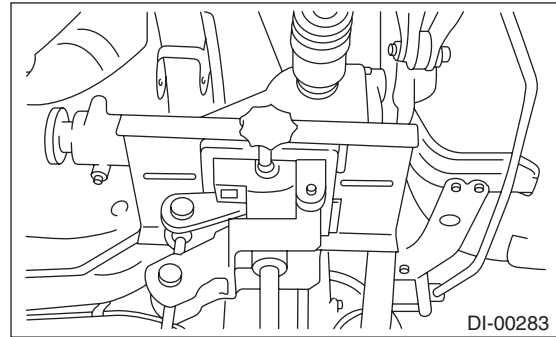
6) Push the rear differential to insert the axle shaft into rear differential.



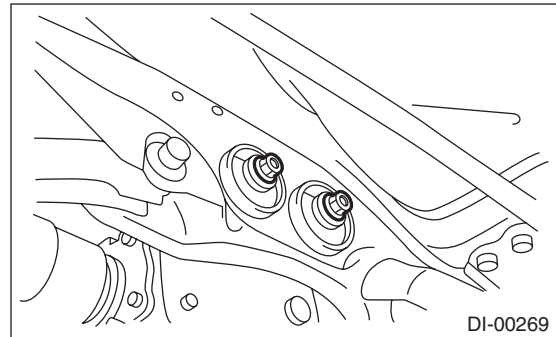
7) Adjust the transmission jack, if necessary, and insert the rear differential stud bolt into rear crossmember bushing properly.



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



9) Tighten a new self-locking nut temporarily to rear crossmember.



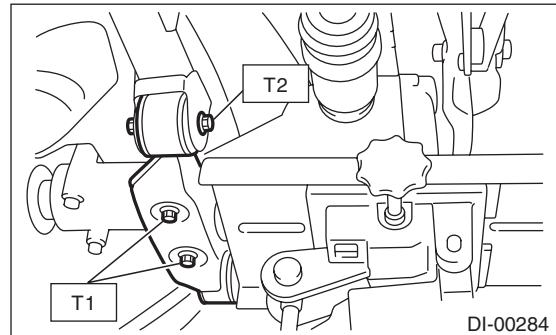
10) Remove the band from rear differential. Lift up the rear differential until the rear differential is separated from the transmission jack.

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 ft-lb)



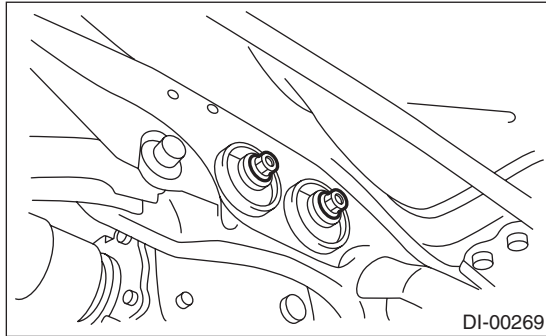
Rear Differential (VA-type)

DIFFERENTIALS

12) Tighten the self-locking nut.

Tightening torque:

70 N·m (7.1 kgf-m, 51 ft-lb)



13) Lower the transmission jack.

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

15) Install the propeller shaft.

<Ref. to DS-11, INSTALLATION, Propeller Shaft.>

16) Install the heat shield cover.

17) Install the rear exhaust pipe and muffler.

C: DISASSEMBLY

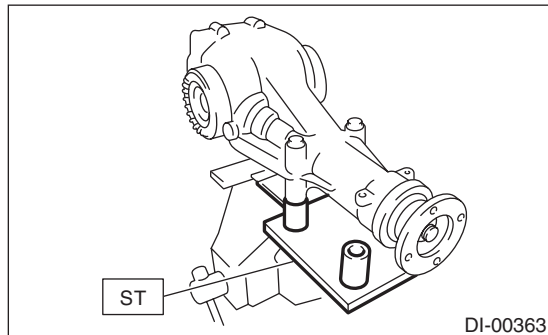
To detect the real cause of trouble, inspect the following items before disassembling.

- Tooth contact and backlash between hypoid driven gear and drive pinion
- Total preload of drive pinion

1) Remove the air breather hose.

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

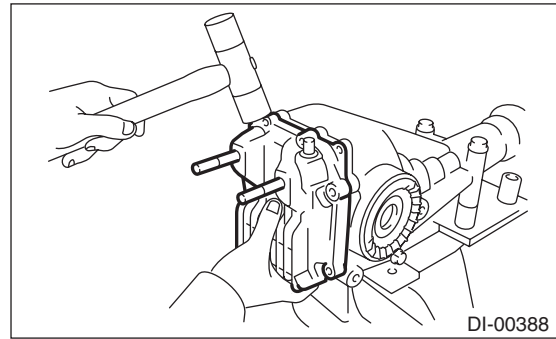
ST 398217700 ATTACHMENT SET



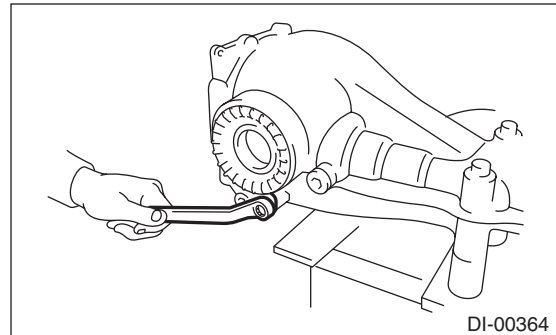
3) Drain the gear oil by removing the plug.

4) Remove the rear differential oil temperature switch.

5) Remove the rear cover by loosening retaining bolts.



6) Remove the lock plate RH and LH.

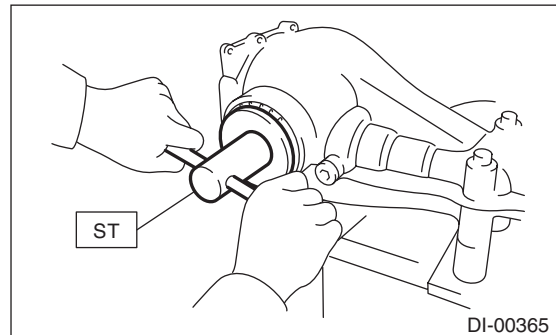


7) Remove the holder RH and LH with ST.

ST 18630AA010 WRENCH COMPL RETAINER

NOTE:

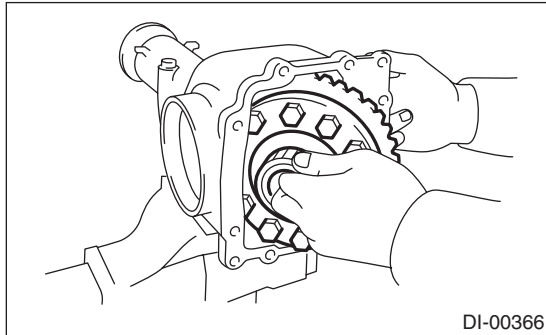
Never mix up the RH and LH retainers.



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

NOTE:

Be careful so that the teeth do not hit against the case.

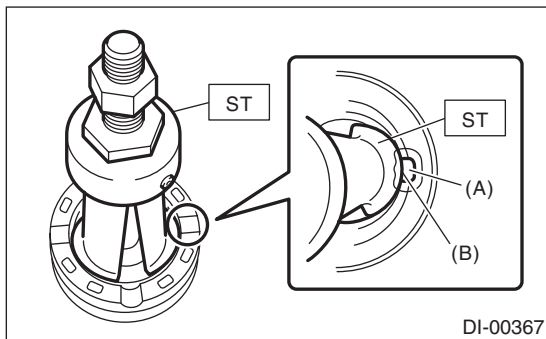


9) Remove the bearing race from holder RH and LH with ST and press.

ST 18758AA000 PULLER

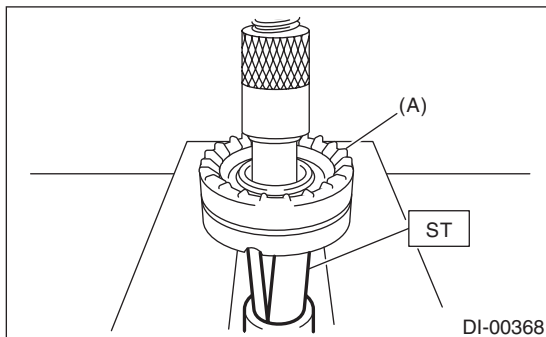
NOTE:

- Make sure the bolt of puller turn manually.
- Set the puller so that its claws catch the groove of holder.



(A) Groove

(B) Claw

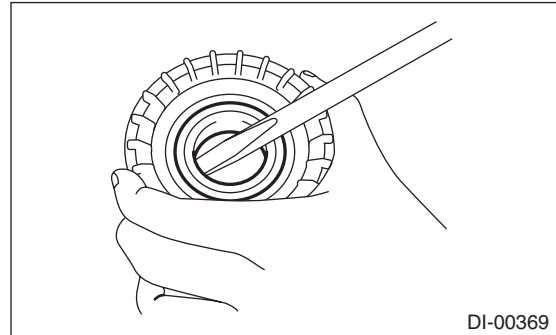


(A) Holder

10) Remove the oil seal from holder RH and LH using screwdriver.

NOTE:

Perform this operation only when changing oil seal.



11) Extract the bearing cone with ST1, ST2 and ST3

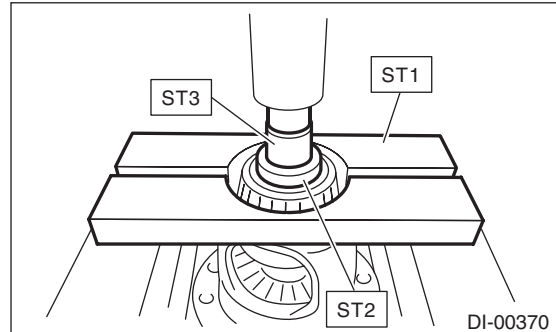
NOTE:

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

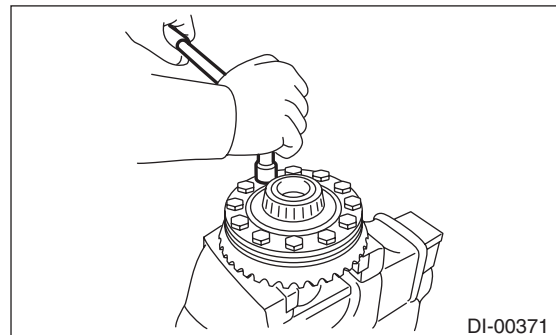
ST1 498077000 REMOVER

ST2 399520105 SEATS

ST3 899864100 REMOVER



12) Remove the hypoid driven gear by loosening hypoid driven gear bolts.

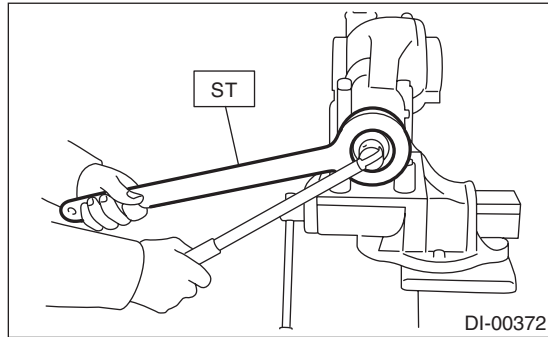


Rear Differential (VA-type)

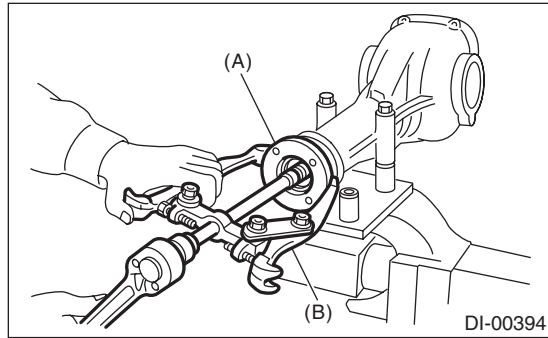
DIFFERENTIALS

13) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



14) Extract the companion flange with a puller.



(A) Companion flange

(B) Puller

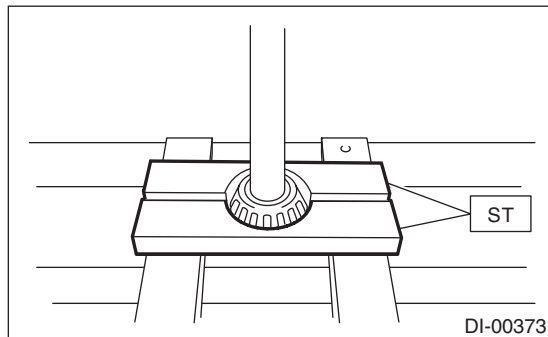
15) Removes the drive pinion shaft.

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

NOTE:

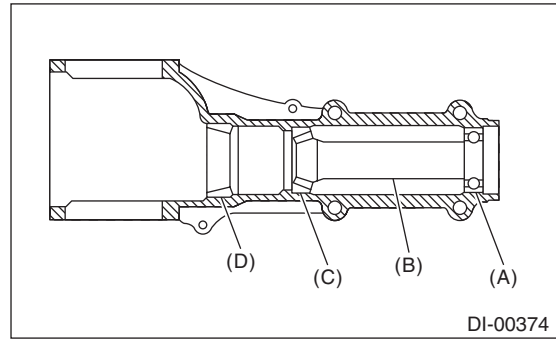
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



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

18) Remove the pilot bearing, front bearing cone and collar.



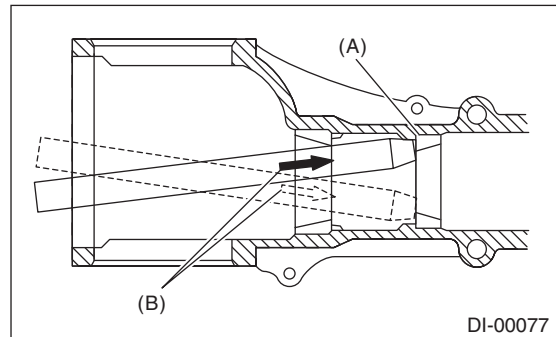
(A) Pilot bearing

(B) Collar

(C) Front bearing

(D) Rear bearing cup

19) When replacing the bearings, hit out the front bearing cup and rear bearing cup in this order out of case using a brass bar.



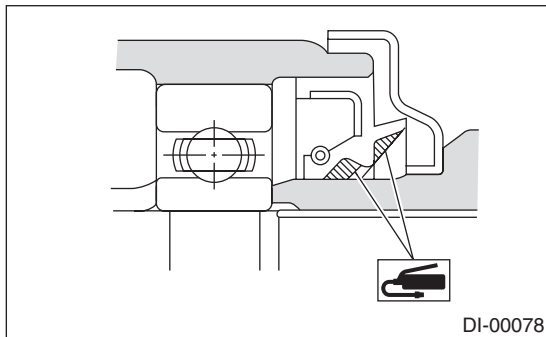
(A) 2 cutout portions along diagonal lines

(B) Tap alternately with brass bar.

D: ASSEMBLY

NOTE:

- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use a new gasket.
- 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.
- Be careful not to mix up the RH and LH bearing races.
- Replace the oil seal with a new part at every disassembly.
- Apply grease to the lips.
- Be careful not to mix up the differential oil seal RH and LH.

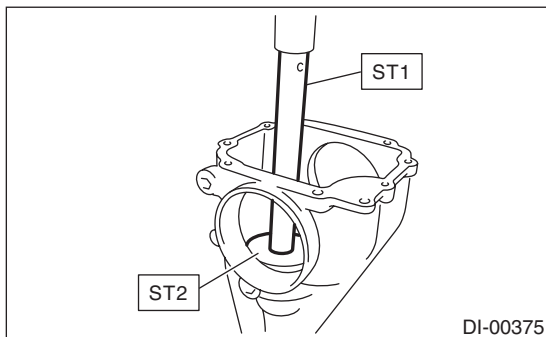


1) Adjusting preload for front and rear bearings
Adjust the bearing preload between front and rear bearings with collar and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

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

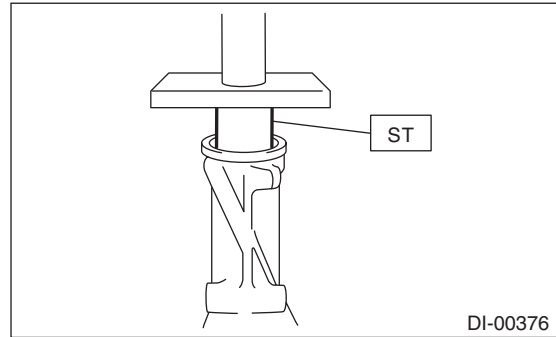
ST1 398477701 HANDLE

ST2 398477703 DRIFT 2



(2) Using the ST, install the front bearing race to the differential carrier.

ST 499277200 INSTALLER



(3) Insert the front bearing cone.

NOTE:

Use new front bearing cone.

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

NOTE:

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

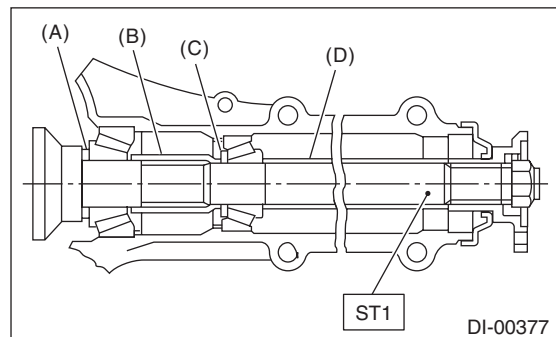
(5) Insert the ST1 into carrier with the pinion height adjusting washer and rear bearing cone fitted onto it.

NOTE:

Use new rear bearing cone.

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

ST1 18678AA000 DUMMY SHAFT



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer
- (D) Collar

Rear Differential (VA-type)

DIFFERENTIALS

(7) Turn ST1 by hand to seat the bearing, and measure the initial load and initial torque with a spring scale while tightening the selflocking nut. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.

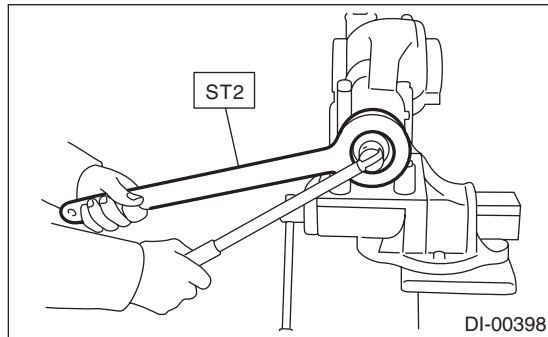
NOTE:

- 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

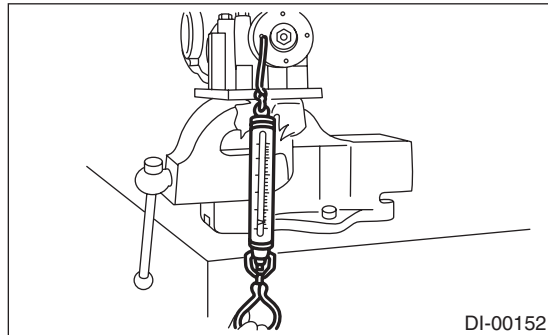
Tightening torque:

191 N·m (19.5 kgf·m, 141.0 ft-lb)



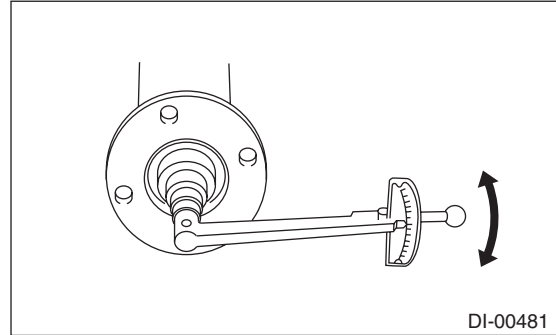
Initial load:

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



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 collar

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)

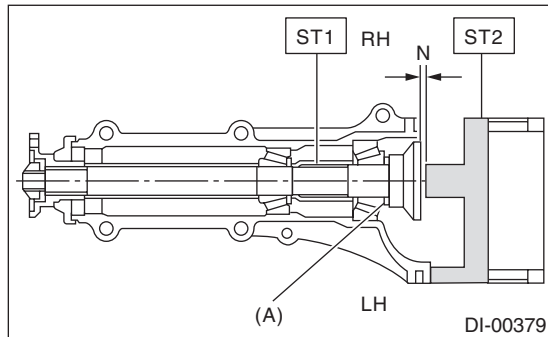
2) Adjusting drive pinion height:

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

(1) Attach the ST2.

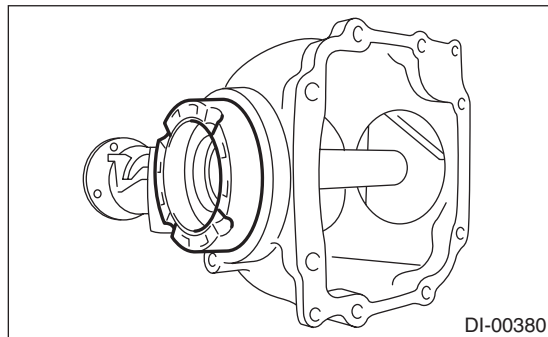
ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(A) Pinion height adjusting washer

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



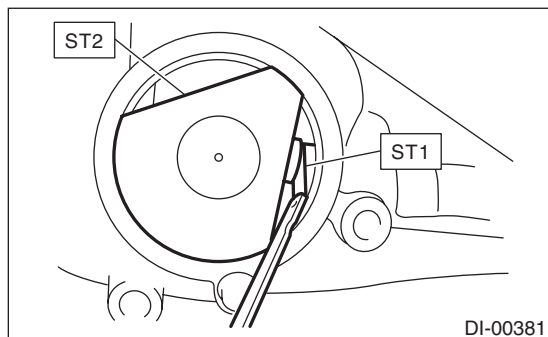
(3) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the case 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 0 — 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)

$$T_o = 0.15 \text{ mm (0.0020 in)}$$

$$N = 0.1 \text{ mm (0.0039 in)}$$

$$T = 0.15 \text{ mm (0.0020 in)} + 0.1 \text{ mm (0.0039 in)} - 0.05 \text{ mm (0.0020 in)} = 0.2 \text{ mm (0.0079 in)}$$

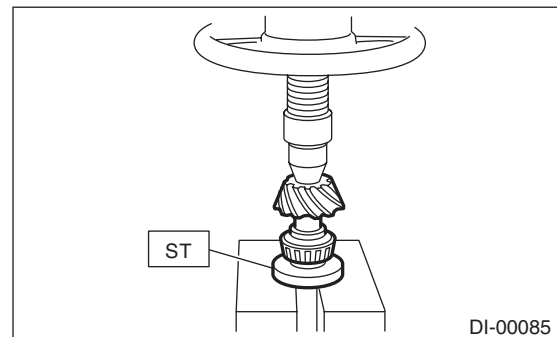
Result: Thickness = 0.2 mm (0.0079 in)

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.

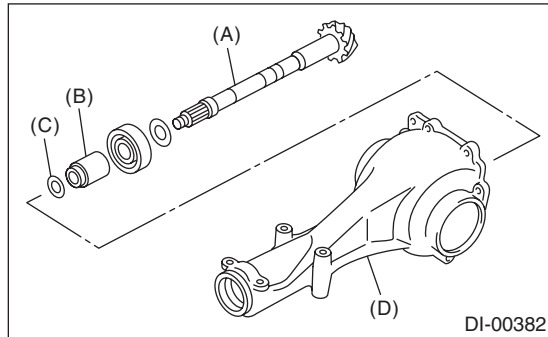
ST 398177700 INSTALLER



Rear Differential (VA-type)

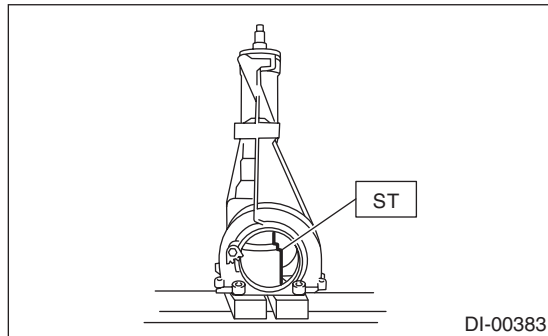
DIFFERENTIALS

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



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

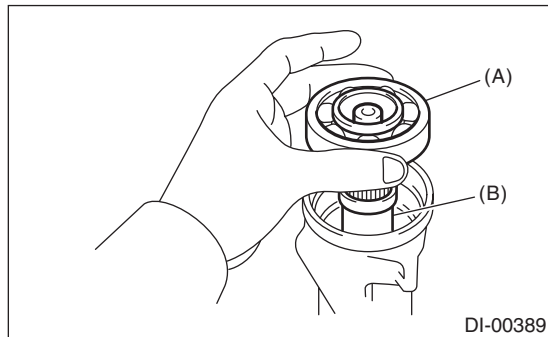
5) Set ST and differential carrier to the press and install the front bearing cone.
ST 399780104 WEIGHT



NOTE:

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

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



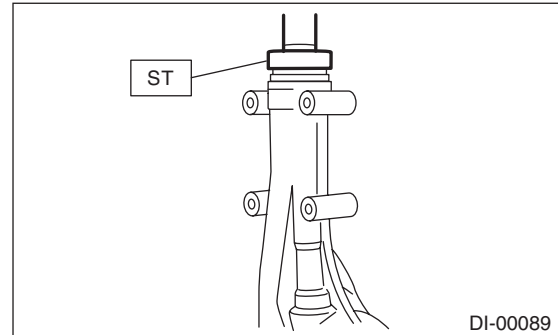
- (A) Pilot bearing
- (B) Collar

7) Fit a new oil seal with ST.

NOTE:

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

ST 499277200 INSTALLER

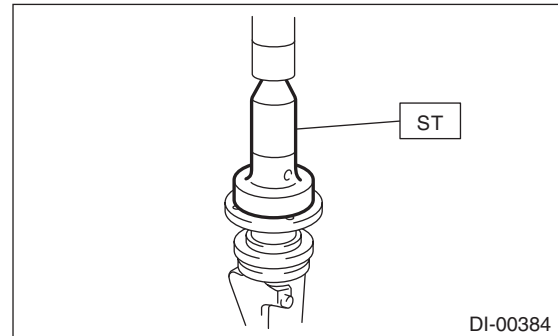


8) Press-fit the companion flange with ST.

NOTE:

Be careful not to damage the bearing.

ST 899874100 INSTALLER



9) Apply Lock-Tite to the drive pinion shaft screw threads and on the new nut seat.

Lock Tite:

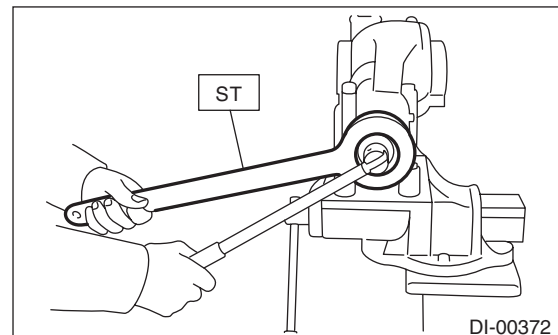
THREE BOND 1324 (Part No. 004403042) or equivalent

10) Attach the nut and use the ST to fix the companion flange in place, then tighten.

ST 498427200 FLANGE WRENCH

Tightening torque:

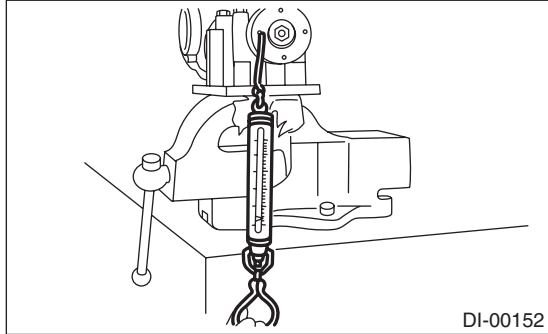
191 N·m (19.5 kgf-m, 141.0 ft-lb)



11) Measure the initial torque and initial load.

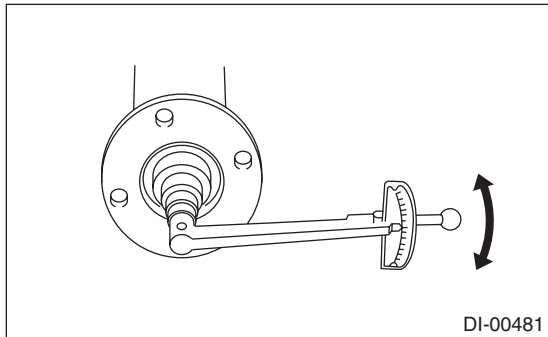
Initial load:

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



Initial torque:

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



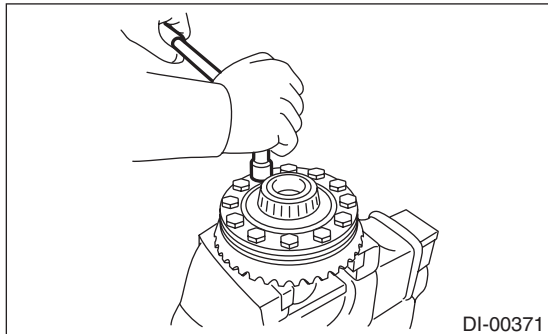
12) Install the hypoid driven gear to differential case.

NOTE:

- Tighten diagonally while tapping the bolt heads.
- 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.

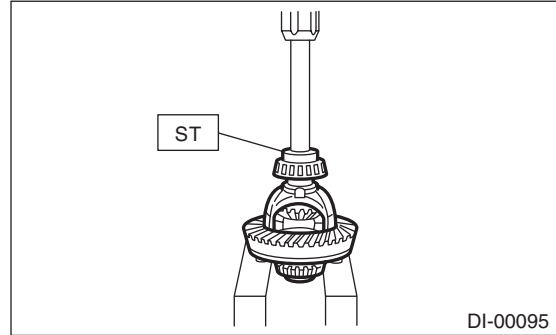
Tightening torque:

62 N·m (6.3 kgf-m, 45.8 ft-lb)



13) Press the side bearing into differential case using ST.

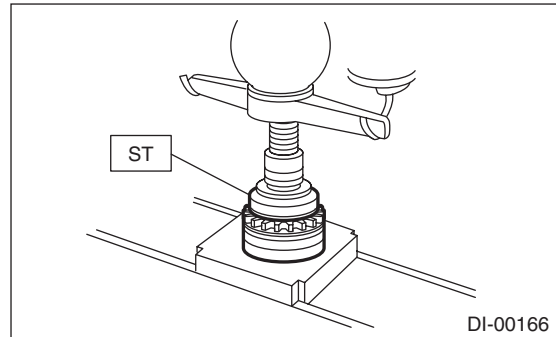
ST 398487700 DRIFT



14) Assemble holders.

(1) Install the new oil seal into holder RH and LH.

ST 498447100 INSTALLER

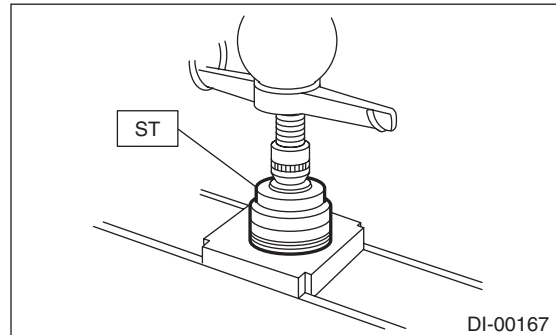


(2) Install the bearing race into holder RH and LH.

ST 398177700 INSTALLER

NOTE:

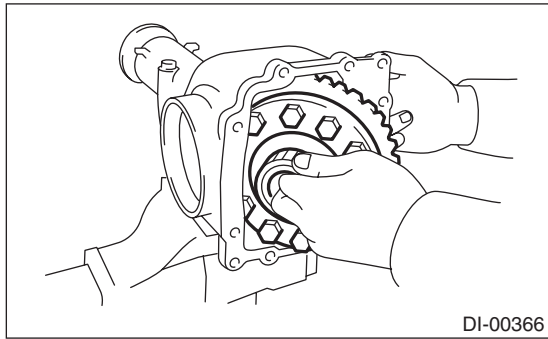
Make sure that the RH and LH oil seals, bearing outer races and cones are properly assembled.



Rear Differential (VA-type)

DIFFERENTIALS

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

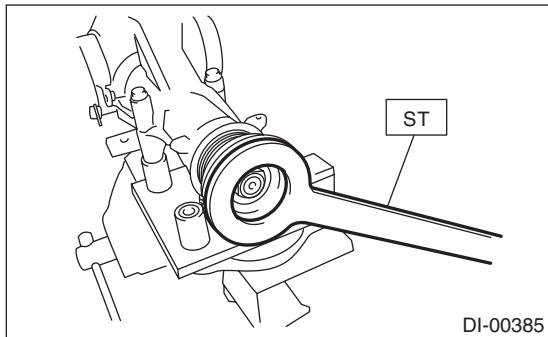


(4) Temporarily tighten the side holders RH and LH in differential carrier to install.

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

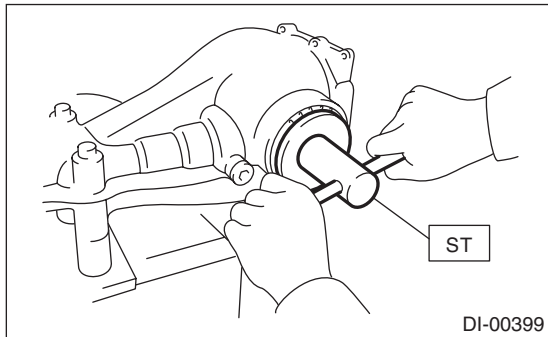
(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Screw in the side holder LH until light contact is made with ST.

ST 18630AA010 WRENCH COMPL RETAINER



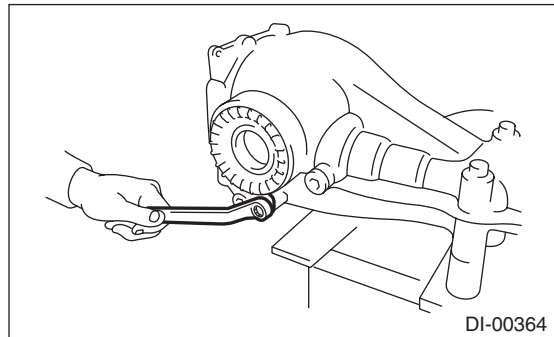
(3) Back off the holder on the hypoid driven gear side by approx. 1 and 1/2 teeth, and tighten the other side holder by approx. 2 teeth (amount that the hypoid driven gear is turned back (1 and 1/2) + 1/2 teeth).

[Back off amount of side (hypoid driven gear side) holder + 1/2 tooth.] This + 1/2 tooth gives preload.

(4) Temporarily tighten the lock plate.

NOTE:

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



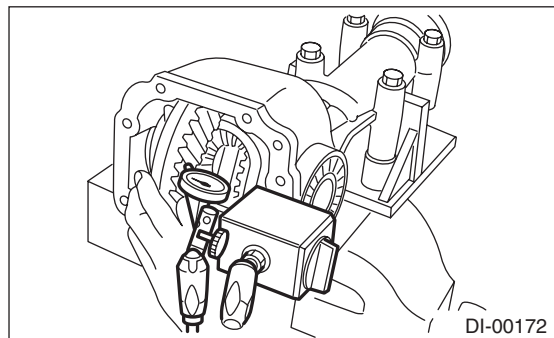
(5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

NOTE:

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

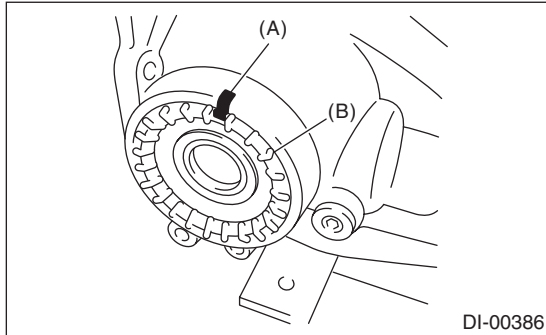
Backlash:

0.10 — 0.15 mm (0.004 — 0.006 in)



16) Put alignment marks on both the differential carrier and holder. Remove the holder side at a time.

Replace them in the original position after inserting an O-ring and applying grease to the threaded portion.



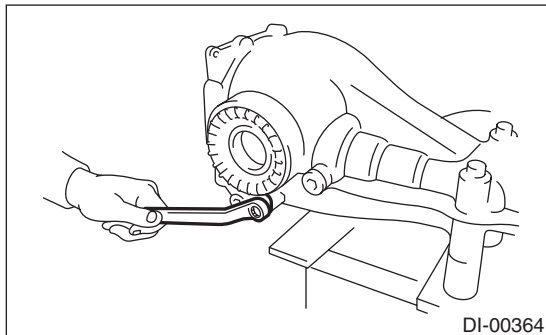
(A) Alignment mark

(B) Holder

17) Tighten the bolt of lock plate to specified torque.

Tightening torque:

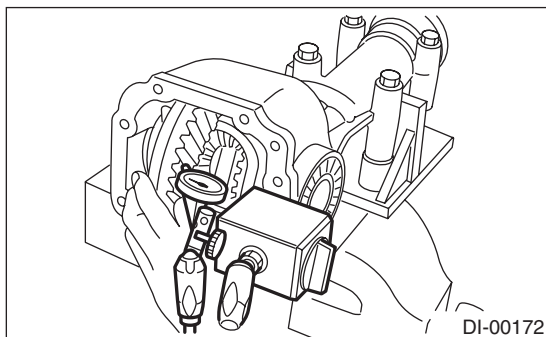
25 N·m (2.5 kgf-m, 18.5 ft-lb)



18) Recheck the hypoid driven gear to pinion backlash.

Backlash:

0.10 — 0.15 mm (0.004 — 0.006 in)



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

(1) Apply an even coat of red lead on both sides of three or four teeth on 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.

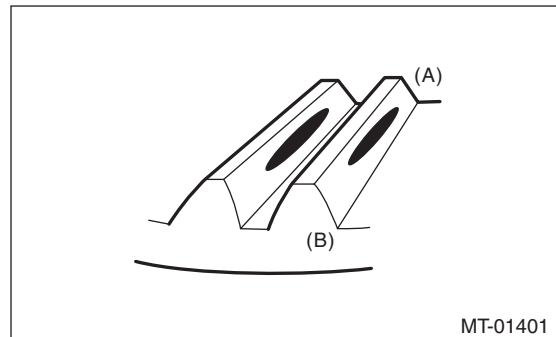
(2) When the contact pattern is not correct, re-adjust.

NOTE:

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

- Correct tooth contact

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



(A) Toe side

(B) Heel side

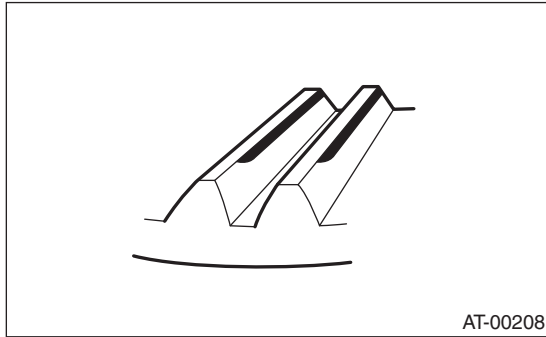
Rear Differential (VA-type)

DIFFERENTIALS

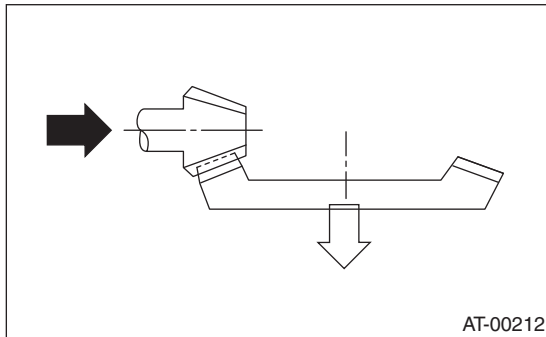
- Face contact

Check item: Backlash is too large.

Contact pattern



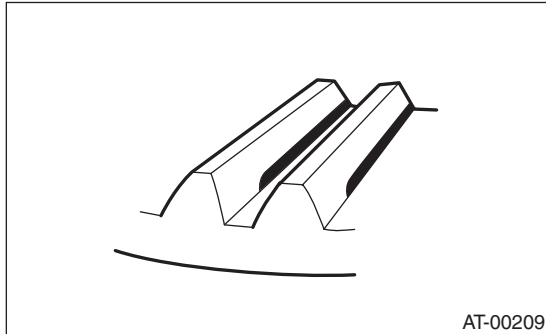
Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.



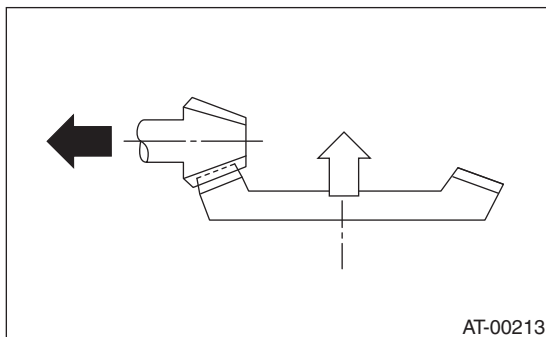
- Flank contact

Check item: Backlash is too small.

Contact pattern



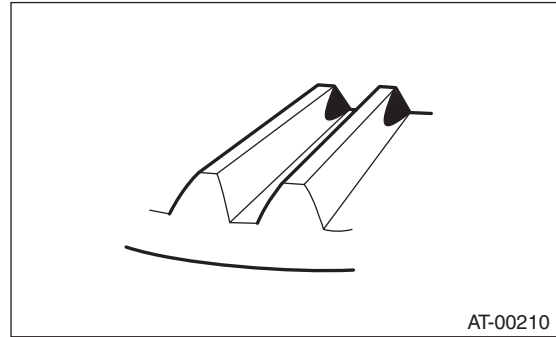
Corrective action: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive pinion away from hypoid driven gear.



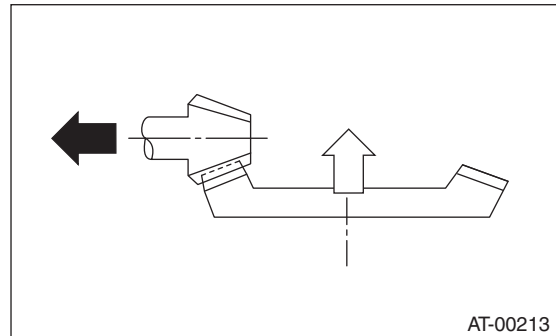
- Toe contact (inner side contact)

Check item: Teeth contact area is too small.

Contact pattern



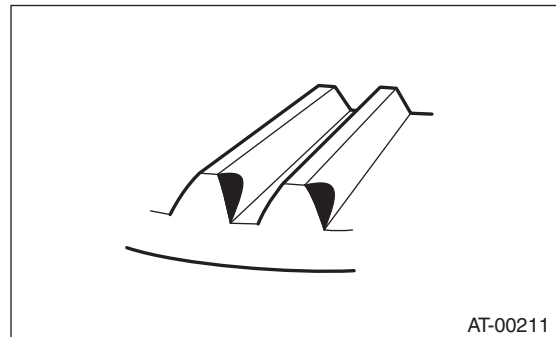
Corrective action: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive pinion away from hypoid driven gear.



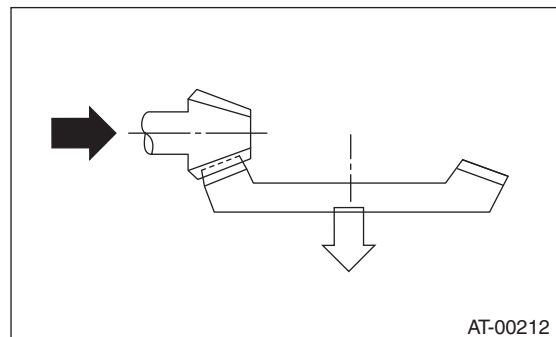
- Heel contact (outside end contact)

Check item: Teeth contact area is too small.

Contact pattern



Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.

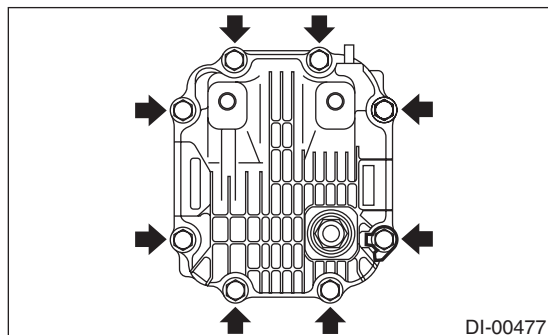


20) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

21) Attach a new gasket, rear cover, and ground stay to the differential carrier.

Tightening torque:

34 N·m (3.5 kgf-m, 25.1 ft-lb)

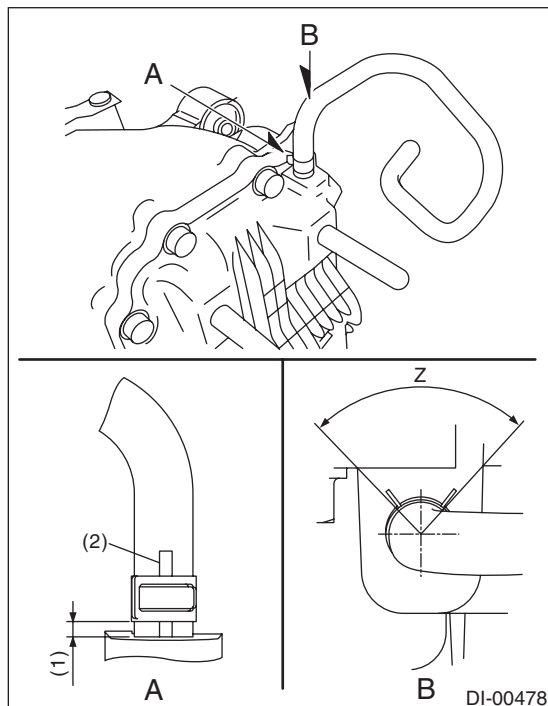


22) Using new gaskets, install the rear differential oil temperature switch.

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

23) 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

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 the differential case assembly if cracks, scoring or other defects are evident on tooth surface.

3) Bearing

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

4) Oil seal

Replace if deformed or damaged, and at every disassembling.

5) Differential carrier

Replace if the bearing bores are worn or damaged.

6) Differential case

Replace if its sliding surfaces are worn or cracked.

7) Companion flange

Replace if the oil seal lip contact surface shows cracking.

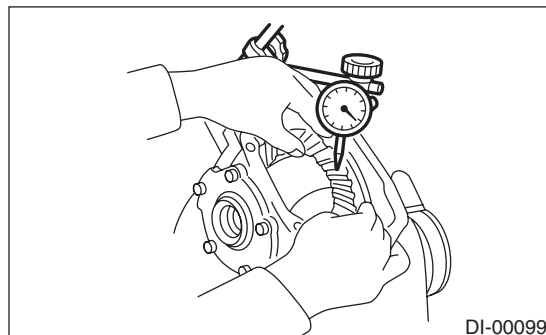
1. HYPOID DRIVEN GEAR BACKLASH

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 not within the specification, adjust the side bearing preload or repair if necessary.



2. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Inspect the tooth contact between the hypoid driven gear and drive pinion. <Ref. to DI-21, ASSEMBLY, Rear Differential (VA-type).>

Rear Differential (VA-type)

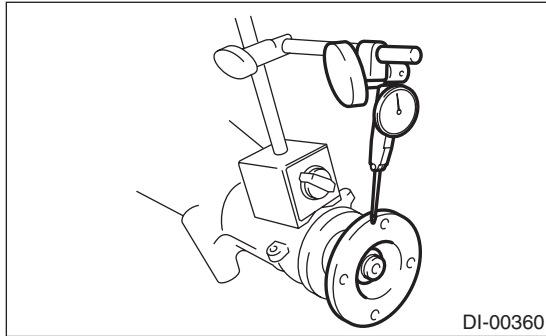
DIFFERENTIALS

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:

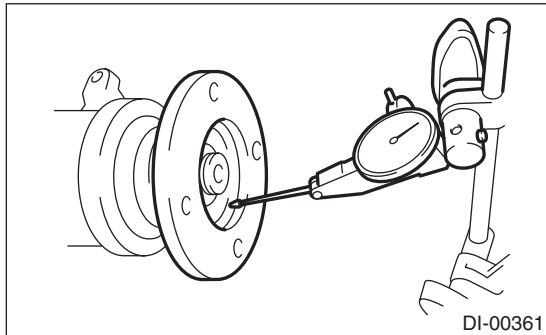
0.08 mm (0.003 in)



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

Limit of runout:

0.08 mm (0.003 in)

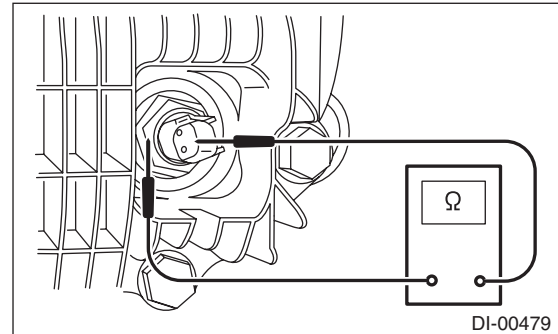


- 4) If either runout exceeds the limit, move the phase of companion flange and drive pinion 90° each, and find the point where the runout will be within the limit.
- 5) If the runout exceeds the limit when changing the phase, replace the companion flange and re-check the runout.
- 6) If the runout exceeds the limit after replacing the companion flange, the drive pinion may be assembled incorrectly or bearing is faulty.

4. REAR DIFFERENTIAL OIL TEMPERATURE SWITCH

Inspect the continuity of the rear differential oil temperature switch.

Specified resistance	Criteria
Less than 1 Ω	Normal
1 M Ω or more	Replacement



F: ADJUSTMENT

1. HYPOID DRIVEN GEAR BACKLASH

Adjust hypoid driven gear backlash.

<Ref. to DI-21, ASSEMBLY, Rear Differential (VA-type).>

2. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Adjust the tooth contact between hypoid driven gear and drive pinion gear.

<Ref. to DI-21, ASSEMBLY, Rear Differential (VA-type).>

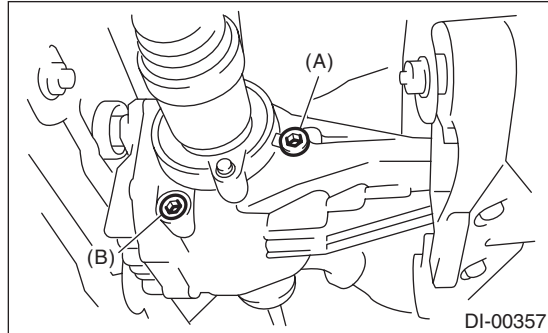
5. Rear Differential Front Oil Seal

A: INSPECTION

Make sure 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) Release the parking brake.
- 2) Remove the oil drain plug, and drain gear oil.



- (A) Filler plug
(B) Drain plug

- 3) Install the oil drain plug.

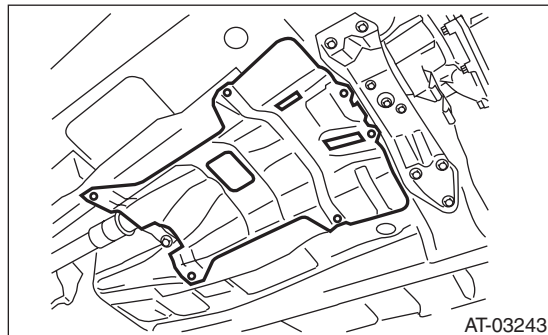
NOTE:

Use a new metal gasket.

Tightening torque:

29 N·m (3.0 kgf-m, 21.4 ft-lb)

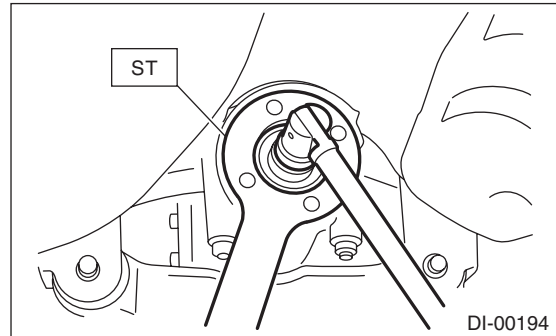
- 4) Jack-up the rear wheel and support the body with rigid racks.
- 5) Remove the rear exhaust pipe and muffler.
- 6) Remove the heat shield cover.



- 7) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

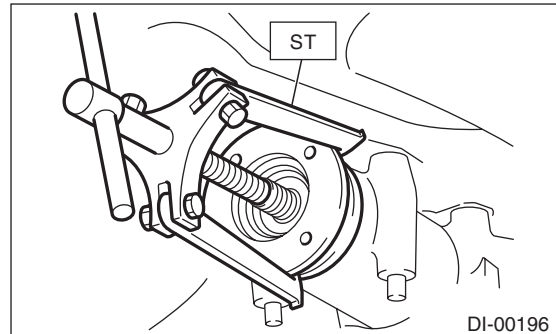
- 8) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



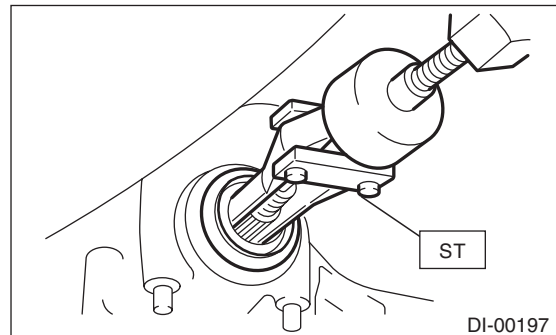
- 9) Extract the companion flange using ST.

ST 399703600 PULLER ASSY



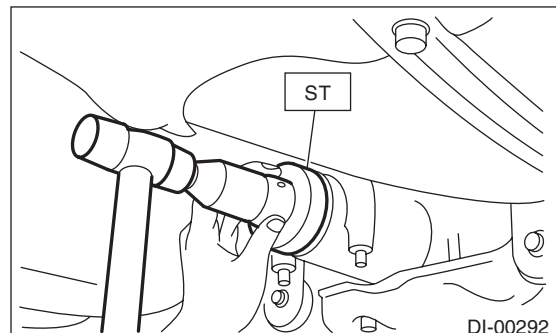
- 10) Remove the oil seal using ST or screwdriver.

ST 398527700 PULLER ASSY



- 11) Install a new oil seal with ST.

ST 498447120 OIL SEAL INSTALLER



Rear Differential Front Oil Seal

DIFFERENTIALS

12) Install the companion flange.

NOTE:

Use a plastic hammer to install companion flange.

13) Apply Lock Tite to the drive pinion shaft screw threads and the nut seat surface.

Lock Tite:

THREE BOND 1324 (Part No. 004403042) or equivalent

14) Tighten the self-locking nut within the specified torque range so that the rotating resistance of companion flange becomes the same as that of before oil seal replacement.

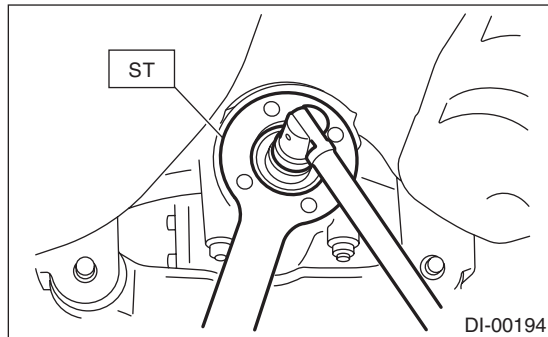
ST 498427200 FLANGE WRENCH

NOTE:

Use a new self-locking nut.

Tightening torque:

191 N·m (19.5 kgf-m, 141.0 ft-lb)



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

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.

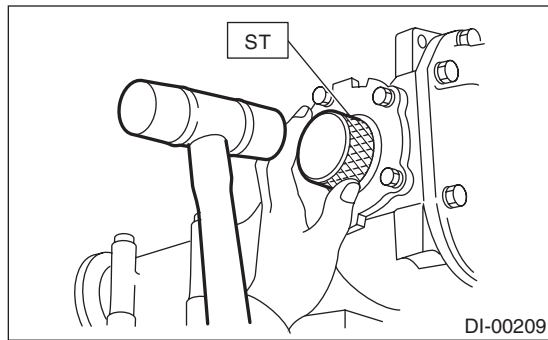
B: REPLACEMENT

1) Remove the rear differential. <Ref. to DI-15, REMOVAL, Rear Differential (VA-type).>

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

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

ST 398437700 DRIFT

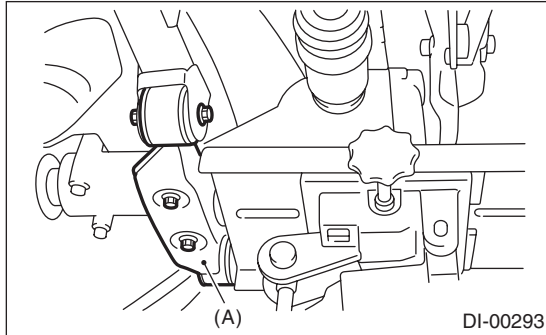


4) Install the rear differential. <Ref. to DI-16, INSTALLATION, Rear Differential (VA-type).>

7. Rear Differential Front Member

A: REMOVAL

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



(A) Rear differential front member

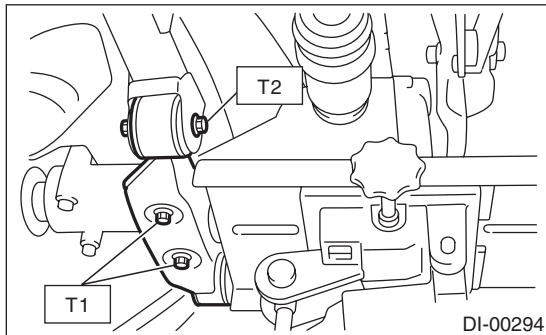
B: INSTALLATION

Using new self-locking nuts, install the rear differential front member.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 110 N·m (11.2 kgf-m, 81 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 member for cracking, hardening and damage.
If cracking, hardening or damage is excessive, replace rear differential front member.

8. 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.	Correct or replace.
	(2) Clogged or damaged air breather.	Clean, repair or replace.
	(3) Loose bolts on differential spindle or side retainer, or incorrectly fitted O-ring.	Tighten the bolts to specified torque. Replace the O-ring.
	(4) Loose rear cover attaching bolts or damaged gasket.	Tighten the bolts to specified torque. Replace gasket and apply liquid gasket.
	(5) Loose oil filler or drain plug.	Retighten and apply liquid gasket.
	(6) Wear, damage or incorrect fitting of spindle, side retainer or oil seal.	Correct 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 gear.	Readjust or replace.
	(2) Excessive preload for side, rear or front bearing.	Readjust or replace.
	(3) Insufficient or improper oil used.	Replace seized part and fill with specified oil to specified level.
3. Damage NOTE: Damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	(1) Improper backlash for hypoid gear.	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) Excessive backlash for hypoid gear.	Readjust.
	(2) Excessive backlash for differential gear.	Replace the differential case assembly.
	(3) Insufficient preload for front or rear bearing.	Readjust.
	(4) Loose drive pinion nut.	Tighten to the specified torque.
	(5) Loose bolts and nuts such as side bearing retainer attaching bolt.	Tighten to the specified torque.
5. Noises when cornering	(1) Damaged differential gear.	Replace the differential case assembly.
	(2) Excessive wear or damage of thrust washer.	Replace the differential case assembly.
	(3) Broken pinion mate shaft.	Replace the differential case assembly.
	(4) Seized 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 gear.	Readjust or replace hypoid gear set.
	(2) Improper backlash of the hypoid gear.	Readjust.
	(3) Scored or chipped teeth of hypoid gear.	Replace hypoid gear set.
	(4) Seized hypoid gear.	Replace hypoid gear set.
	(5) Improper preload for front or rear bearings.	Readjust.
	(6) Seized, cut-away or chipped front or rear bearing.	Replace.
	(7) Seized, cut-away or chipped side bearing.	Replace.
	(8) Differential carrier is vibrating.	Replace the differential case assembly.

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

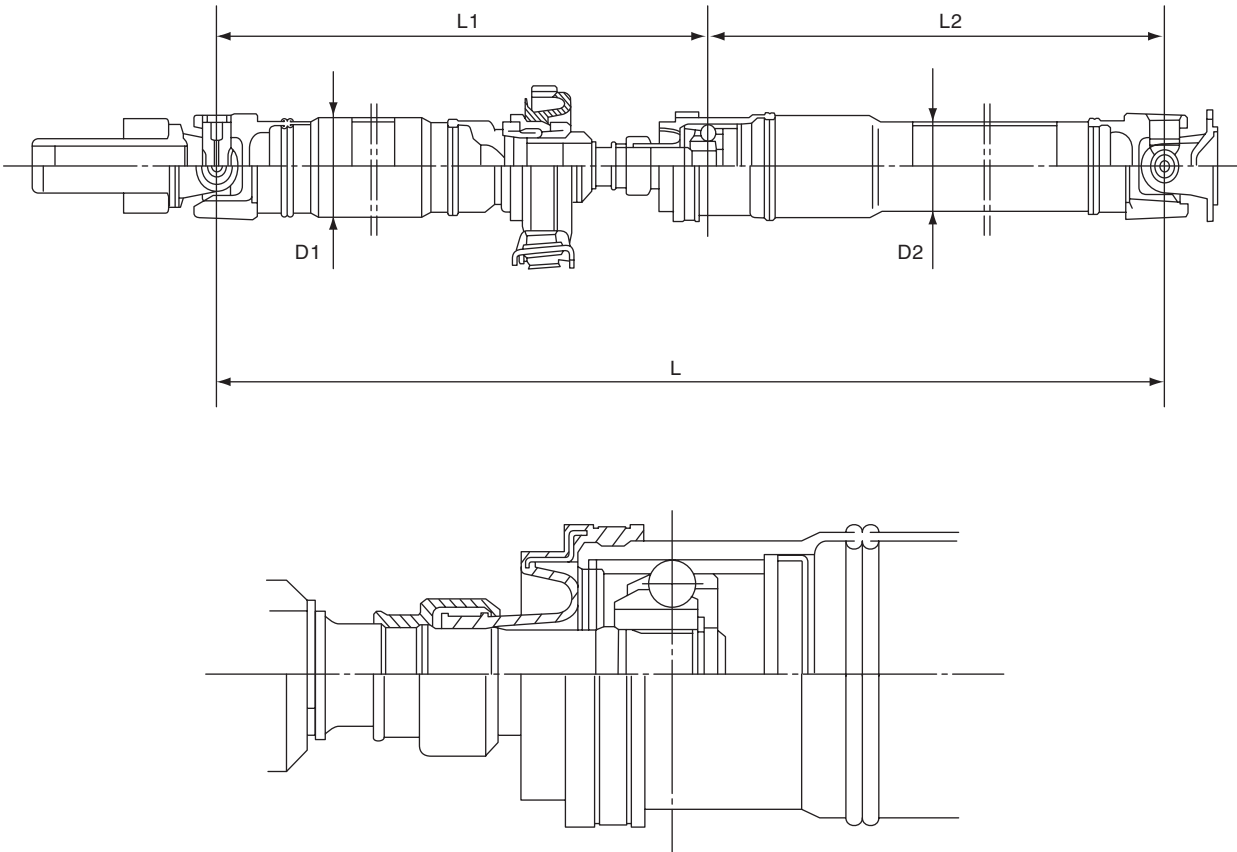
DRIVE SHAFT SYSTEM

1. General Description

A: SPECIFICATION

1. PROPELLER SHAFT

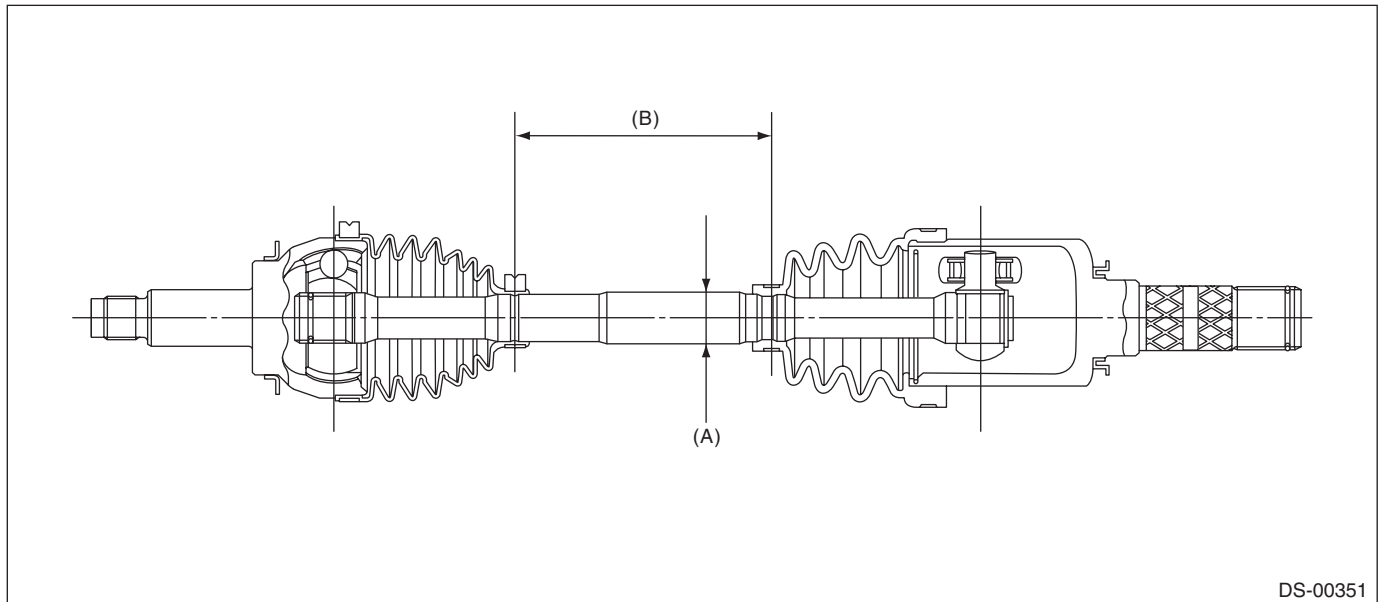
Propeller shaft type		EDJ
Propeller shaft length: L	mm (in)	1,399 (55.08)
Front propeller shaft Joint-to-joint length: L ₁	mm (in)	645 (25.39)
Rear propeller shaft Joint-to-Joint length: L ₂	mm (in)	754 (29.69)
Outer diameter of tube:	D ₁	63.5 (2.50)
	D ₂	57.5 (2.26)



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)

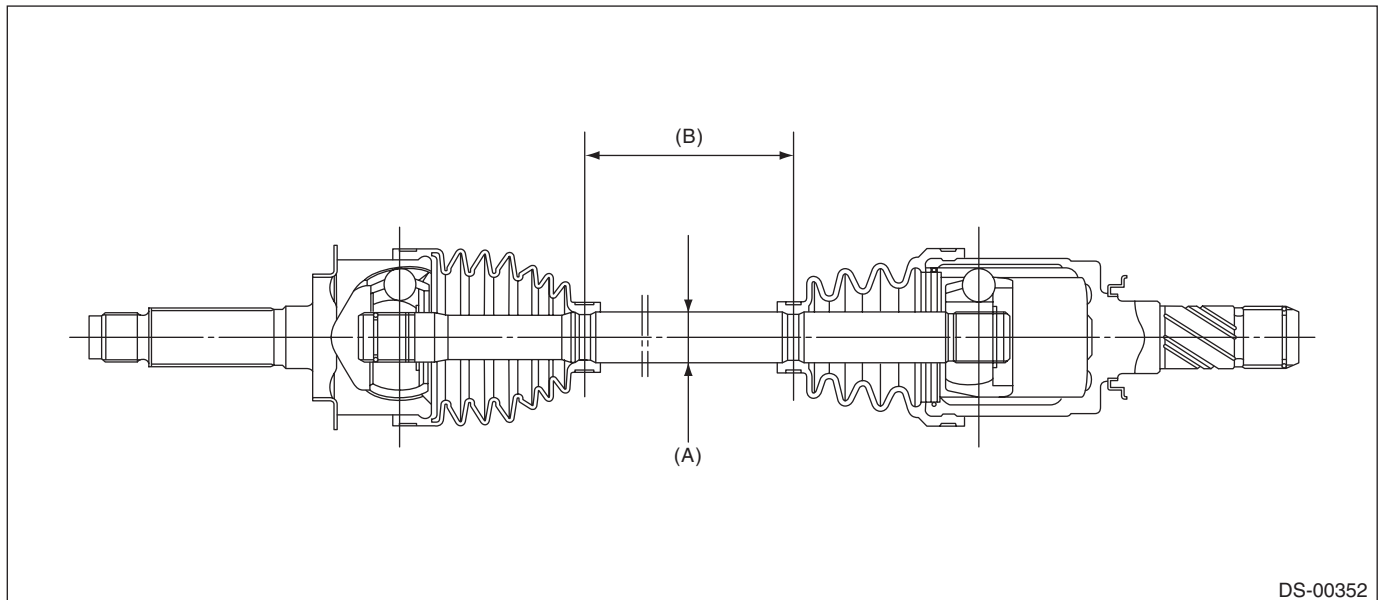


(A) Axle diameter

(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

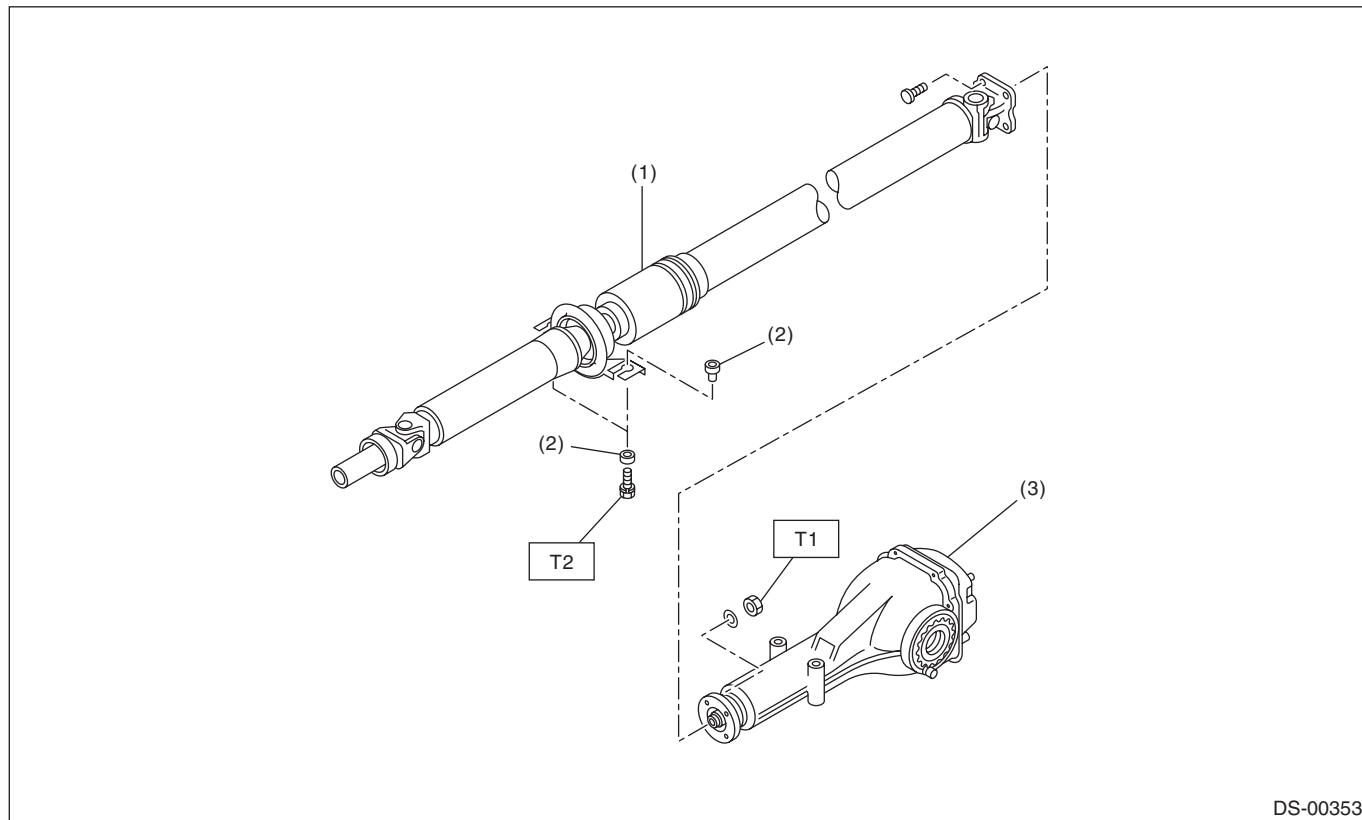
(B) Axle length

General Description

DRIVE SHAFT SYSTEM

B: COMPONENT

1. PROPELLER SHAFT



DS-00353

- (1) Propeller shaft
- (2) Bushing

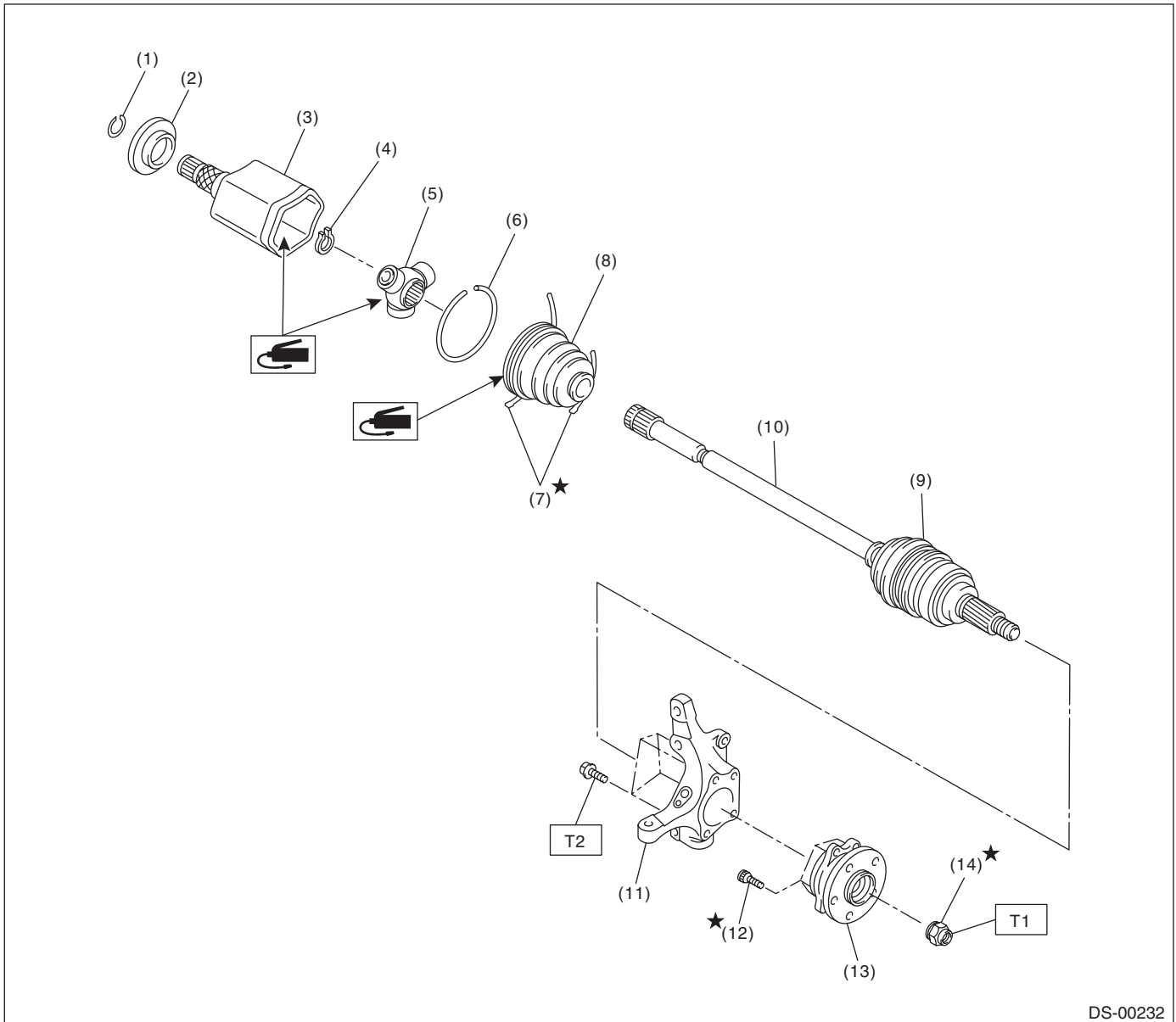
- (3) Rear differential (VA2-type)

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)

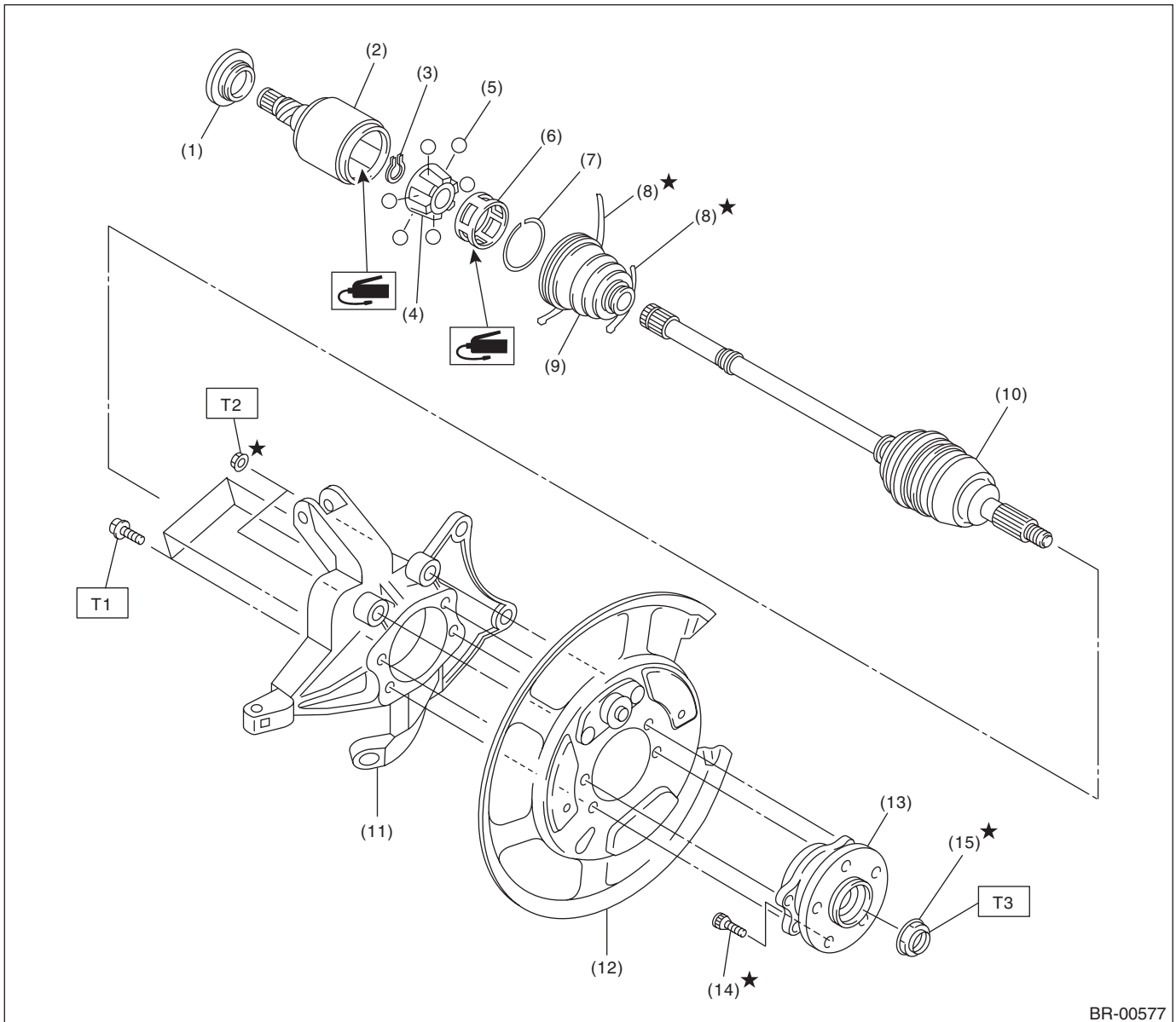
T1: 240 (24.5, 177)

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 (olive color)

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.

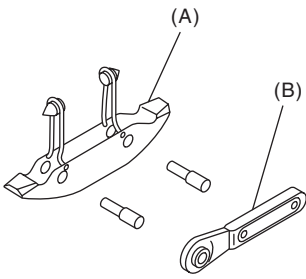
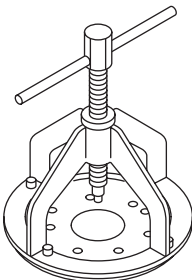
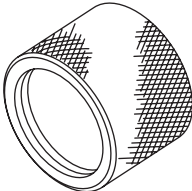
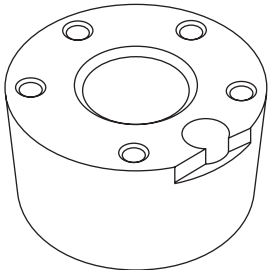
- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

General Description

DRIVE SHAFT SYSTEM

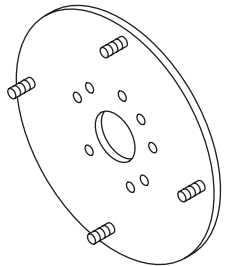
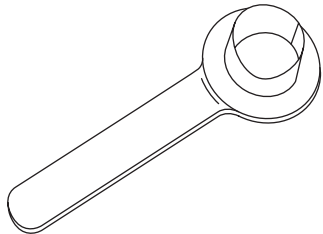
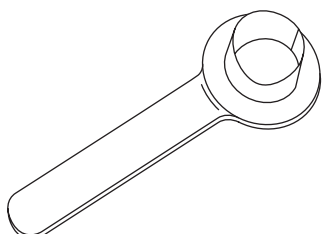
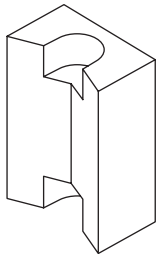
D: PREPARATION TOOL

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 (Newly adopted tool)	HUB STAND	Used for extracting hub bolt.

2. GENERAL TOOL

DESCRIPTION	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

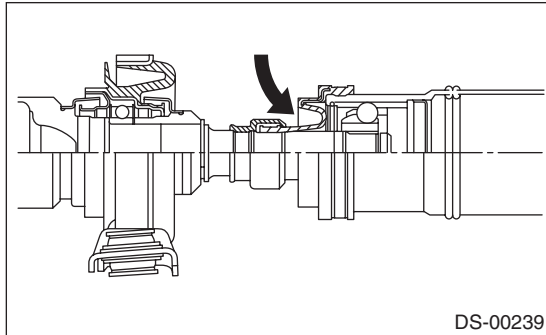
DRIVE SHAFT SYSTEM

2. Propeller Shaft

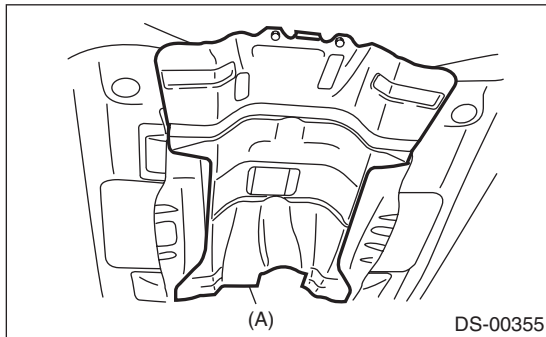
A: REMOVAL

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.

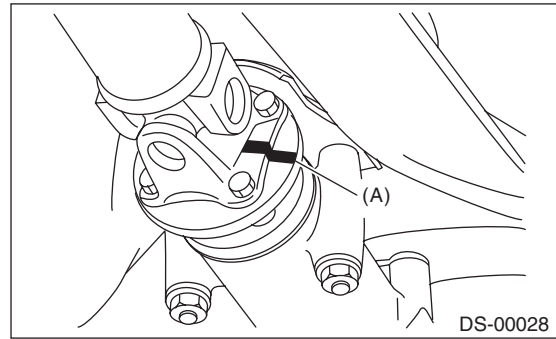


- 1) Disconnect the ground cable from the battery.
- 2) Shift the select lever or gear shift lever to neutral.
- 3) Release the parking brake.
- 4) Lift-up the vehicle.
- 5) Remove the center exhaust pipe.
- 6) Remove the rear exhaust pipe and muffler.
- 7) Remove the heat shield cover.



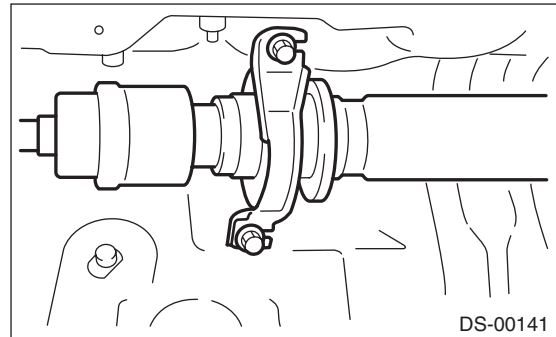
(A) Heat shield cover

- 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.



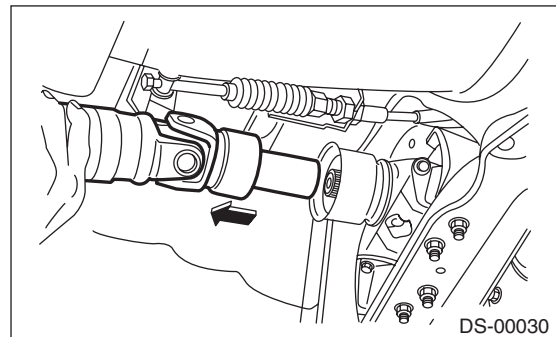
- 12) Remove the propeller shaft from transmission.

CAUTION:

- Be careful not to damage oil seals and contact 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:

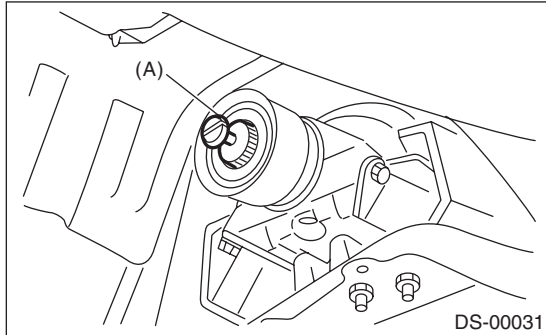
Use a container to catch ATF or oil flowing from propeller shaft.



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.



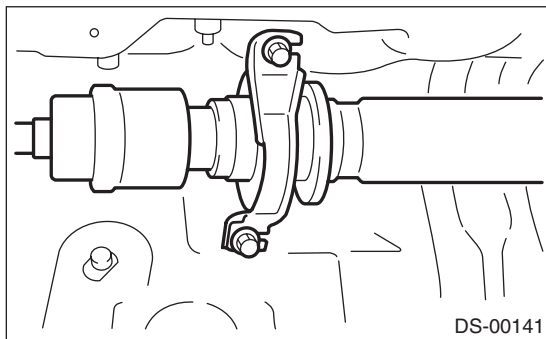
(A) Extension cap

B: INSTALLATION

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

Tightening torque:

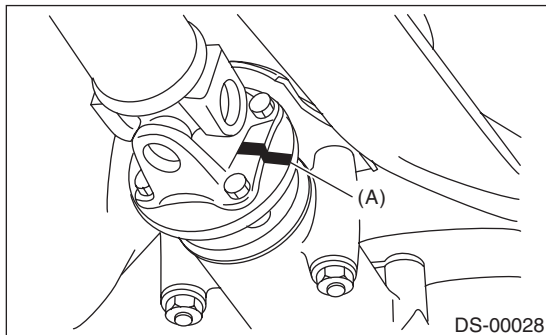
52 N·m (5.3 kgf-m, 38.3 ft-lb)



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

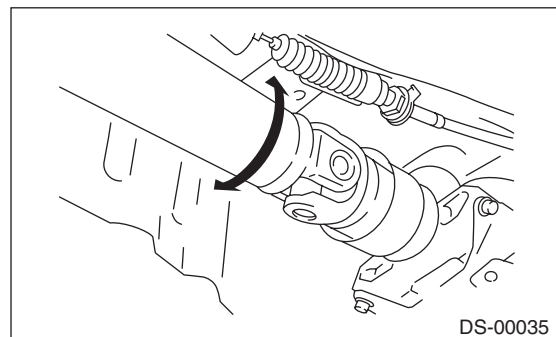
Check the following points with propeller shaft installed in vehicle.

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.

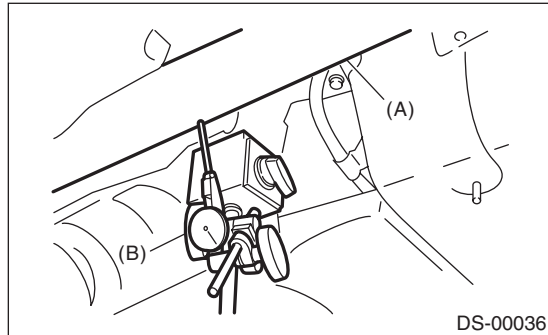


3. RUNOUT OF PROPELLER SHAFT

- 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:

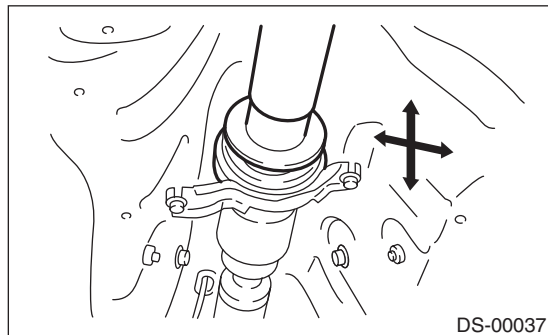
Service limit 0.6 mm (0.024 in)



- (A) Propeller shaft
(B) Dial gauge

4. CENTER BEARING FREE PLAY

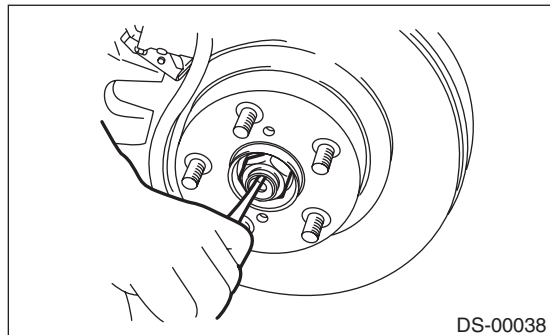
- 1) Remove the front and center exhaust pipes.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the heat shield cover.
- 4) Move the propeller shaft near the center bearing up, down, left, right by hand, to check for any abnormal free play of the bearings.



3. Front Axle

A: REMOVAL

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

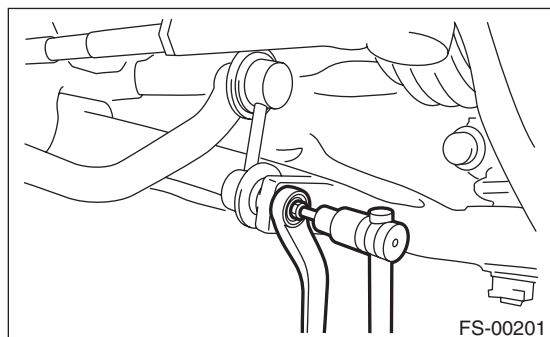


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

CAUTION:

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

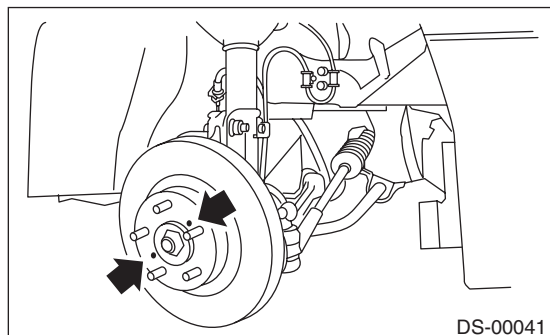
- 5) Remove the stabilizer link.



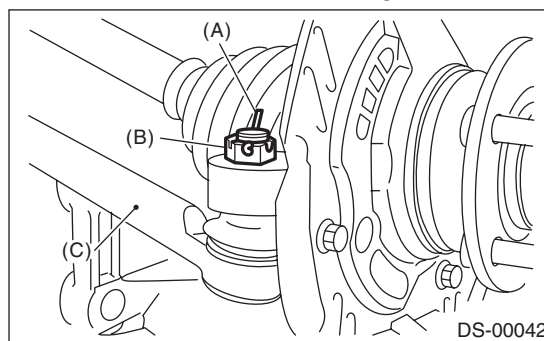
- 6) Remove the disc brake caliper from the front housing, and suspend it from strut using a piece of wire.
- 7) Remove the disc rotor from the hub.

NOTE:

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

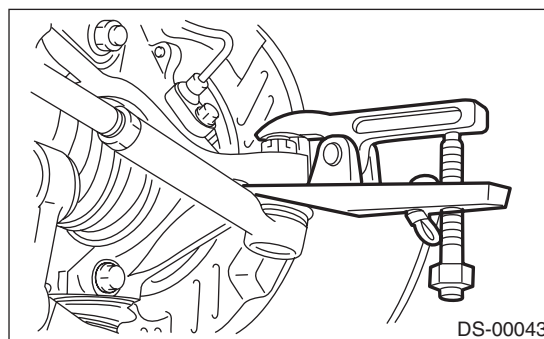


- 8) Remove the cotter pin and castle nut securing the tierod end to the front housing knuckle arm.



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

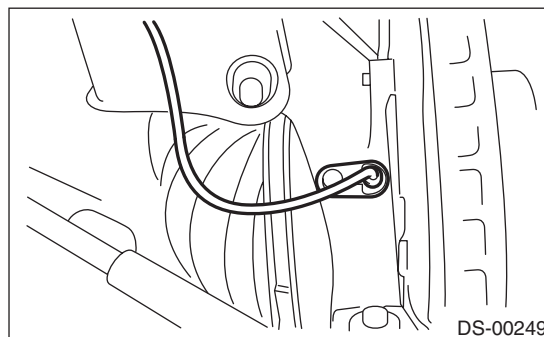
- 9) Using a puller, remove the tie-rod ball joint from knuckle arm.



CAUTION:

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

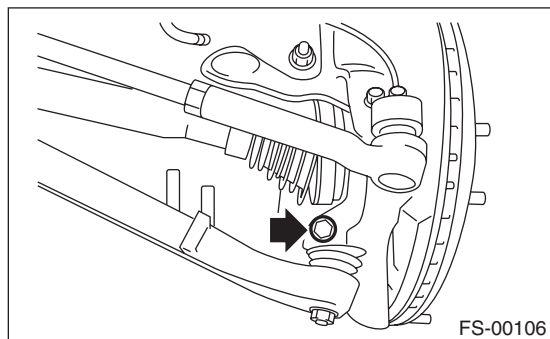
- 10) Remove the ABS wheel speed sensor assembly and harness.



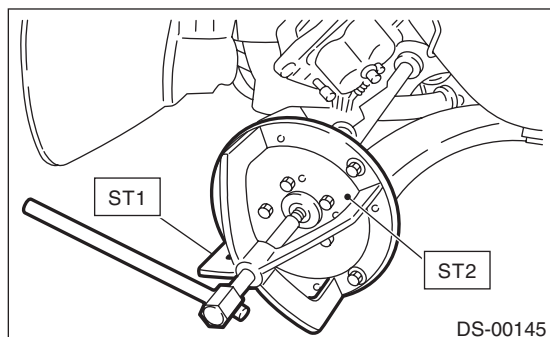
Front Axle

DRIVE SHAFT SYSTEM

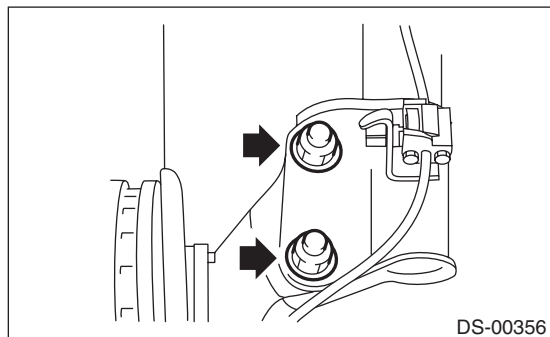
- 11) Remove the front arm ball joint from the front housing.



- 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 selflocking nut.

Tightening torque:

175 N·m (17.9 kgf-m, 129 ft-lb)

- 2) Install the front drive shaft. <Ref. to DS-24, 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.

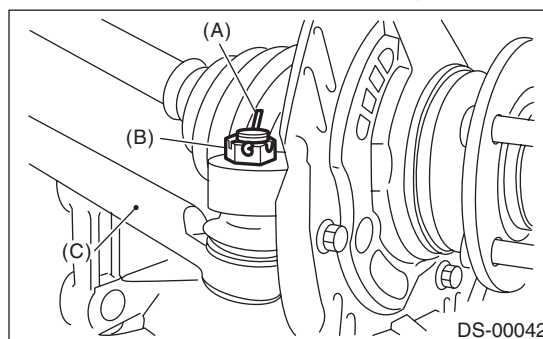
Tightening torque:

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 (olive color) to the specified torque and lock it securely.

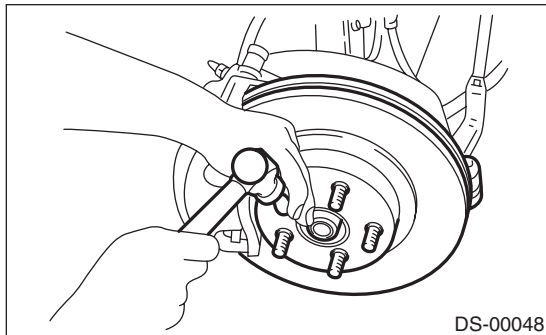
Tightening torque:

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)

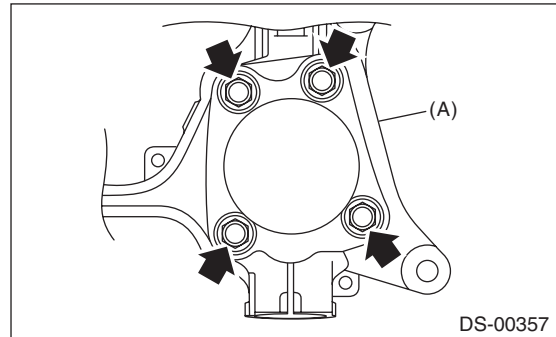
Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

13) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

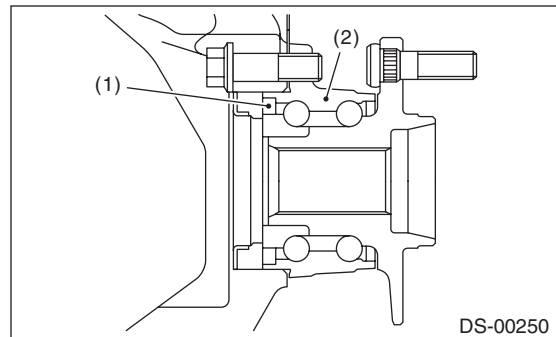
1) Remove the four bolts from the front housing, and remove the front hub unit bearing and disc cover.



(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-20, DISASSEMBLY, Front Hub Unit Bearing.>

Front Axle

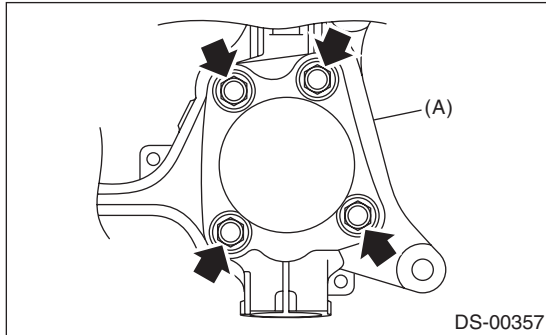
DRIVE SHAFT SYSTEM

D: ASSEMBLY

- 1) Assemble the front hub unit bearing. <Ref. to DS-20, ASSEMBLY, Front Hub Unit Bearing.>
- 2) Place the disc cover between front housing and front hub unit, and tighten the four bolts.

Tightening torque:

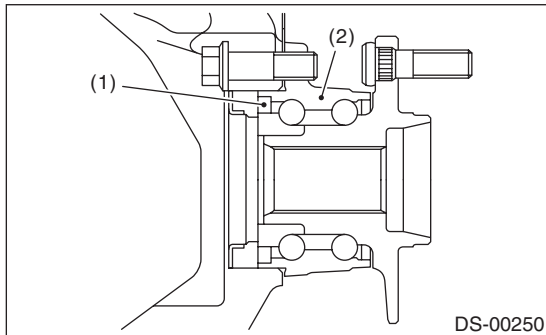
65 N·m (6.6 kgf-m, 47.9 ft-lb)



(A) Front housing

CAUTION:

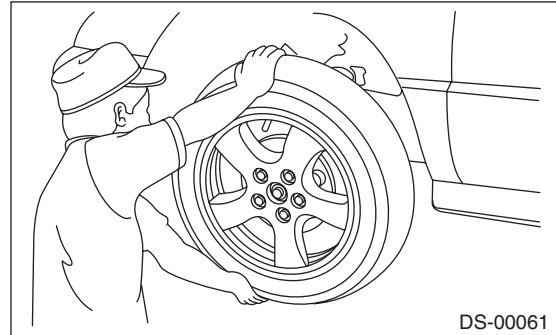
- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



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

E: INSPECTION

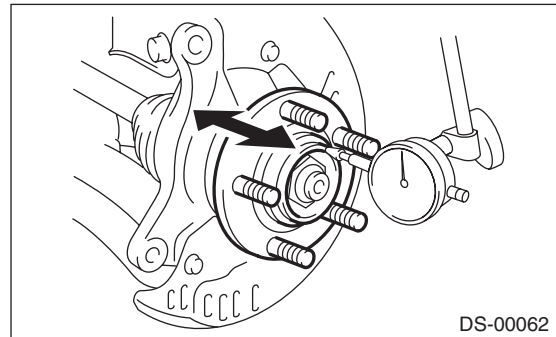
- 1) Moving the front tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



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

Service limit:

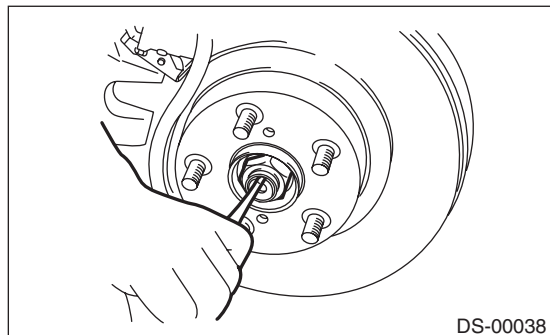
Maximum: 0.05 mm (0.0020 in)



4. Rear Axle

A: REMOVAL

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

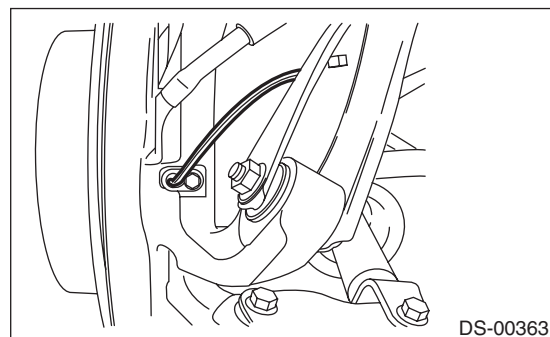


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

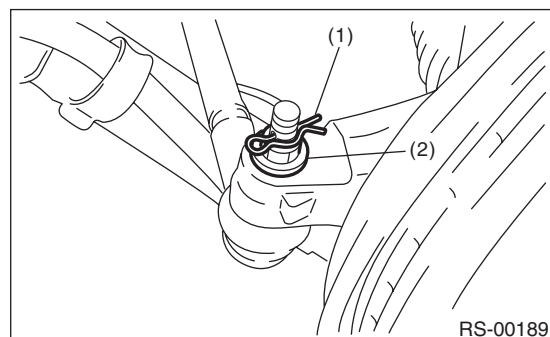
CAUTION:

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

- 5) Remove the parking brake cable from parking brake assembly. <Ref. to PB-8, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>
- 6) Remove the rear ABS wheel speed sensor.

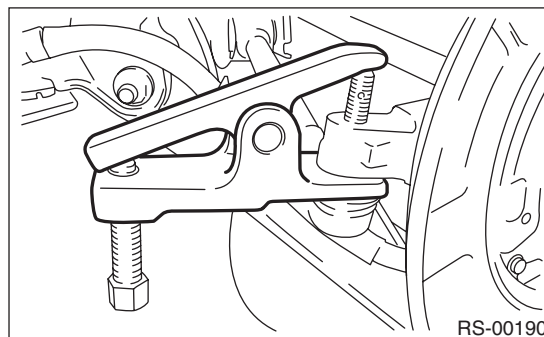


- 7) Remove the snap pin and nut from the front lateral link.

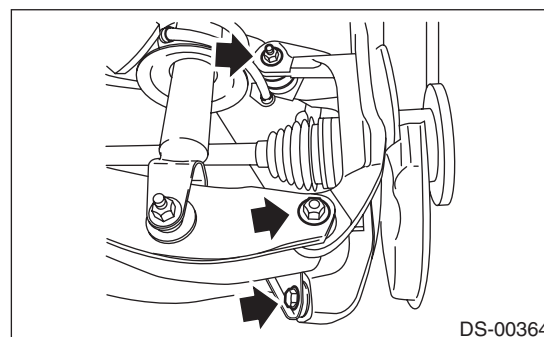


- (1) Snap pin
- (2) Nut

- 8) Using a puller, separate the rear housing and ball joint.



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

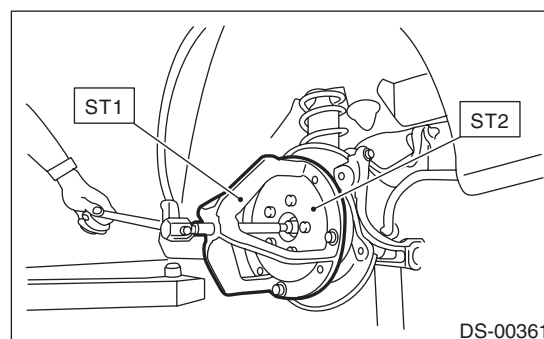


- 10) Remove the rear axle.

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 the stabilizer 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:

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.>

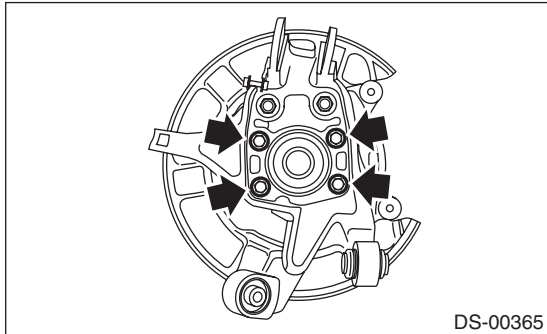
<Ref. to RS-3, COMPONENT, General Description.>

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

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

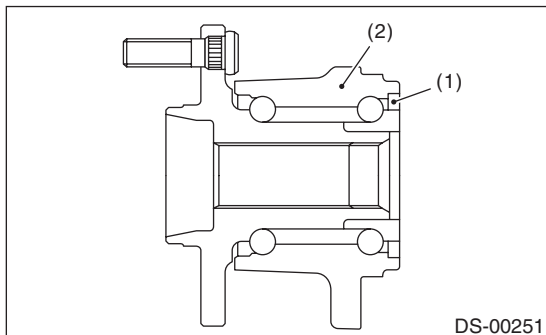
C: DISASSEMBLY

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



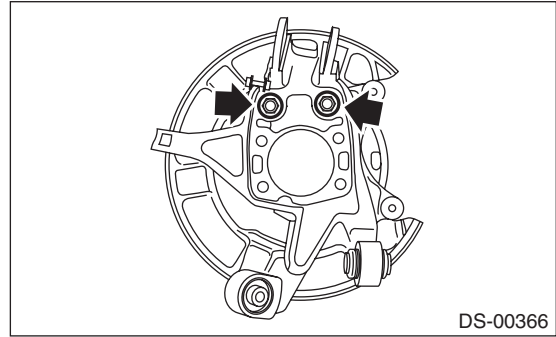
CAUTION:

- 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.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:

Rear hub unit bearing

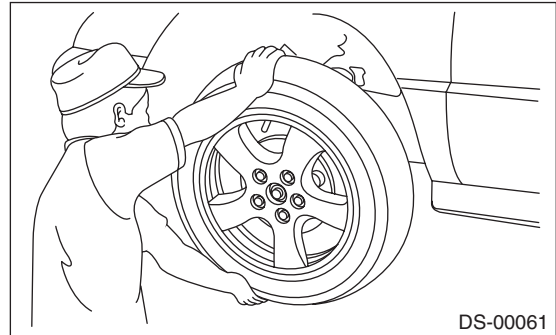
65 N·m (6.6 kgf-m, 47.9 ft-lb)

Back plate

75 N·m (7.6 kgf-m, 55.3 ft-lb)

E: INSPECTION

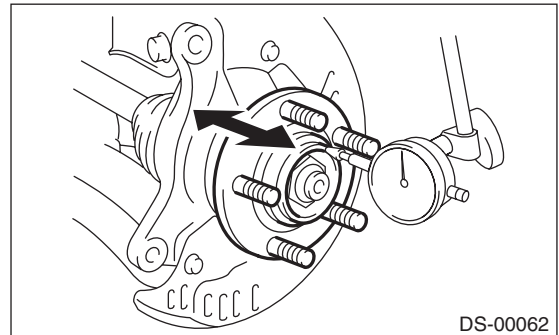
- 1) Moving the rear tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



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

Service limit:

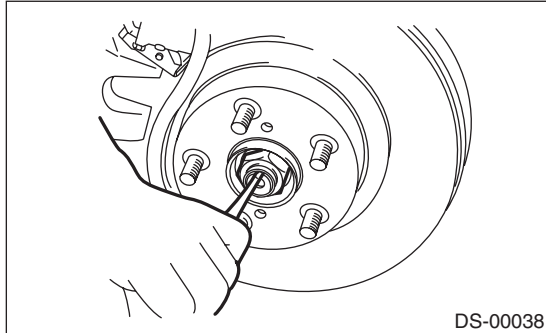
Maximum: 0.05 mm (0.0020 in)



5. Front Hub Unit Bearing

A: REMOVAL

- 1) Disconnect the ground cable from the 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.

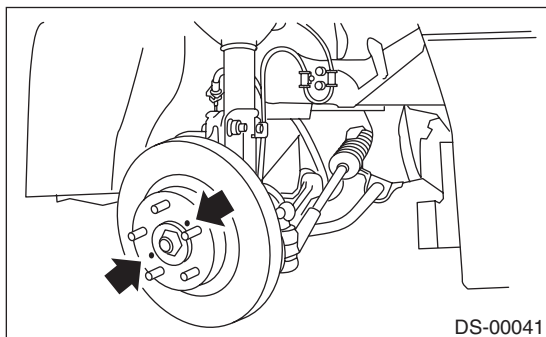
CAUTION:

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

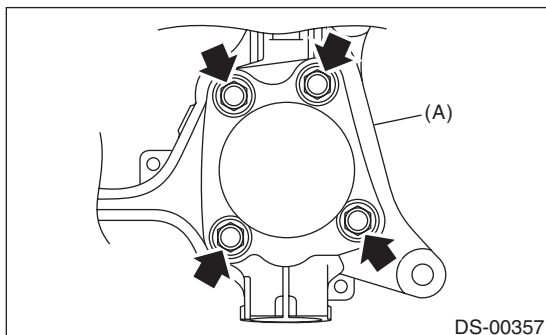
- 5) Remove the disc brake caliper from the front housing, and suspend it from strut using a piece of wire.
- 6) Remove the disc rotor from the hub.

NOTE:

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



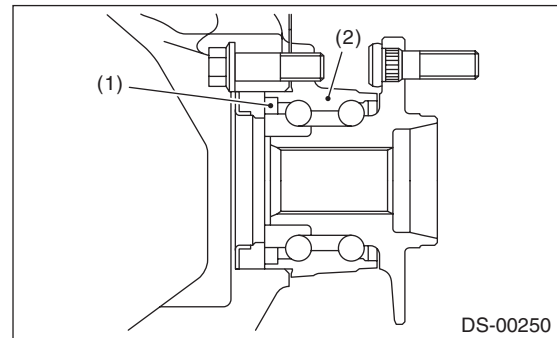
- 7) Remove four bolts from the front housing.



(A) Front housing

CAUTION:

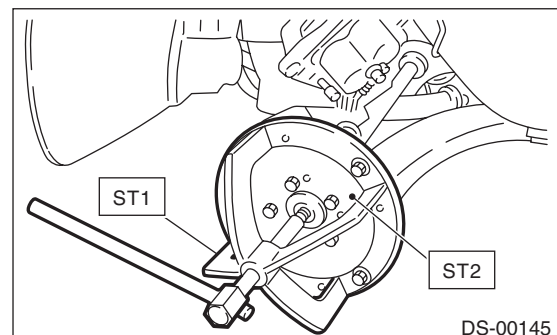
- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



- (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

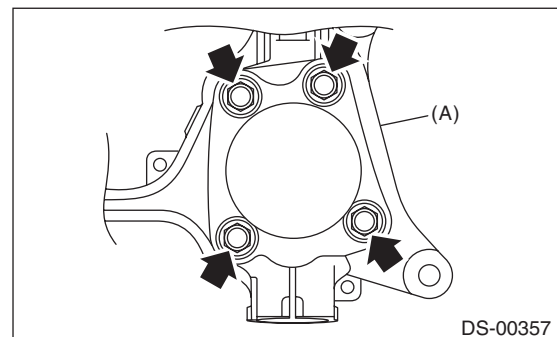


B: INSTALLATION

- 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-24, INSTALLATION, Front Drive Shaft.>

Front Hub Unit Bearing

DRIVE SHAFT SYSTEM

- 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)

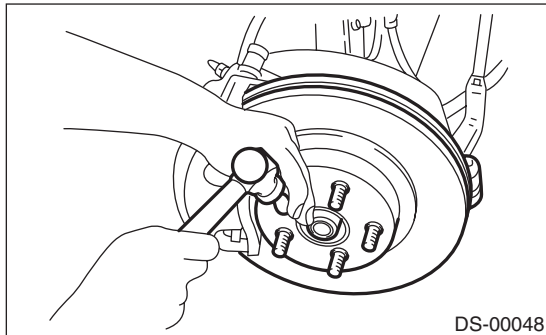
- 6) While depressing the brake pedal, tighten a new axle nut (olive color) to the specified torque and lock it securely.

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.

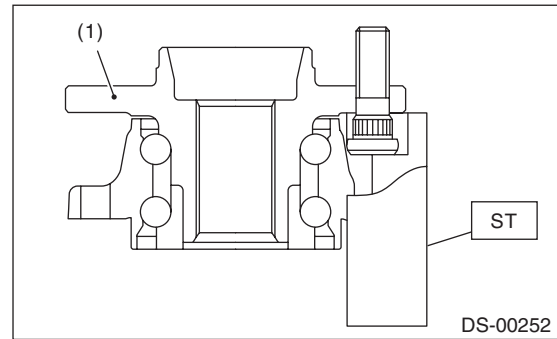
ST 28399AG000 HUB STAND

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.

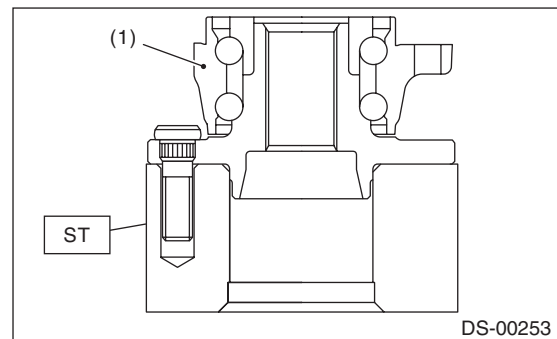


(1) Front hub unit bearing

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.>

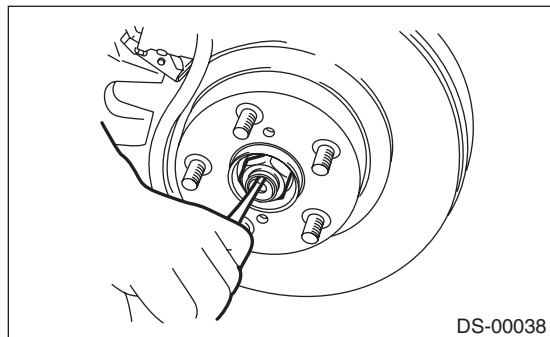
CAUTION:

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

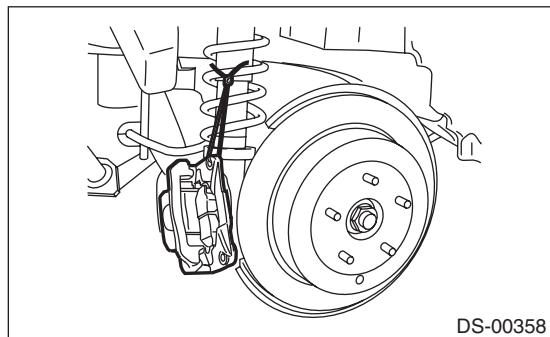


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

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.

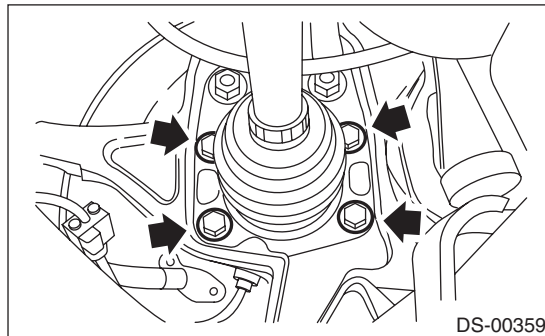


- 7) Remove the disc rotor from the hub.

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 the 8 mm of bolt into the threaded end of rotor, then remove the rotor.

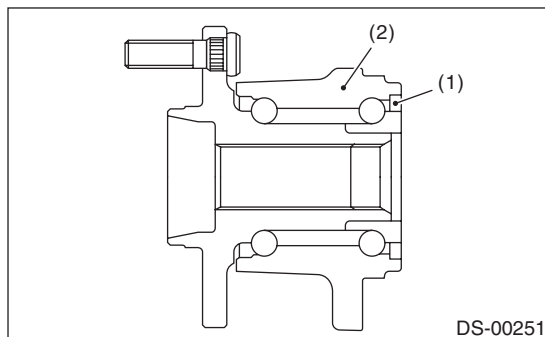
- 8) Remove the four bolts from rear arm.



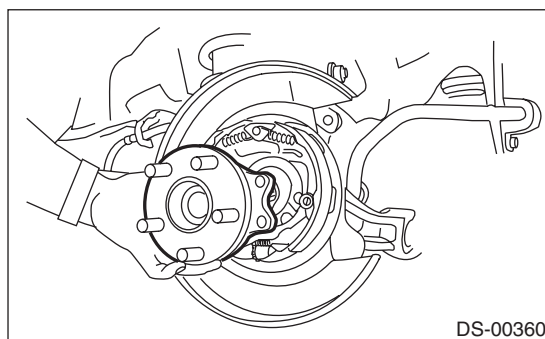
- 9) Remove the hub unit bearing.

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



Rear Hub Unit Bearing

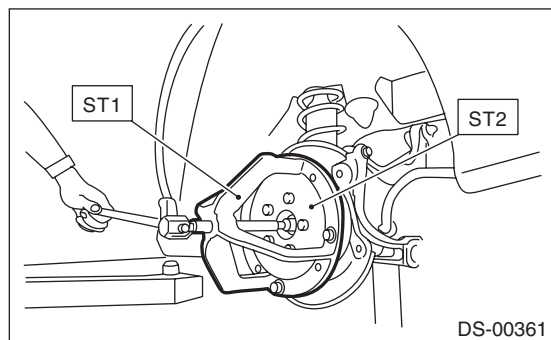
DRIVE SHAFT SYSTEM

NOTE:

If it is hard to remove, use the ST.

ST1 926470000 AXLE SHAFT PULLER

ST2 28099PA110 AXLE SHAFT PULLER
PLATE

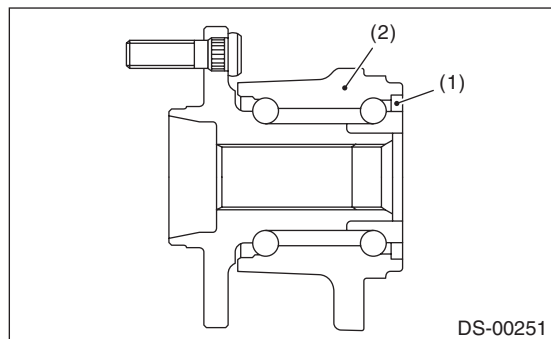


B: INSTALLATION

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.

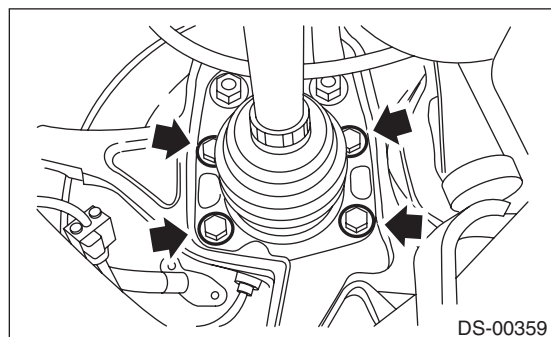


- (1) Magnetic encoder
(2) Rear hub unit bearing

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.

CAUTION:

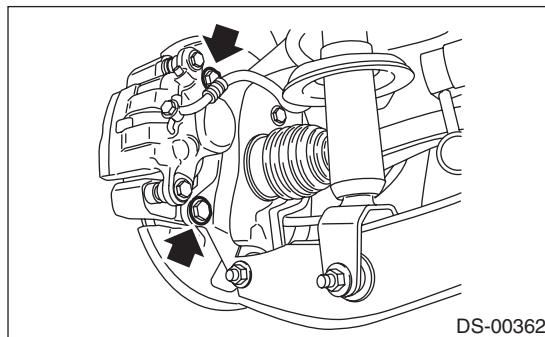
Use a new axle nut (olive color).

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 lever stroke by turning the adjuster. <Ref. to PB-5, ADJUSTMENT, Parking Brake Pedal.>

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

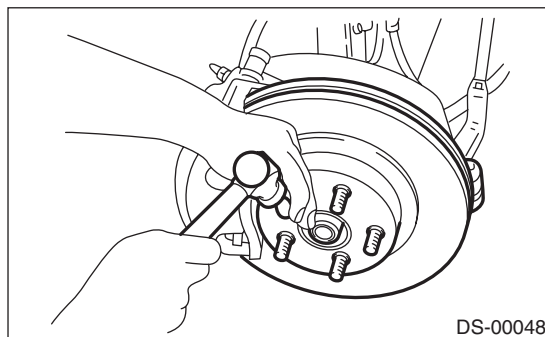
Tightening torque:

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)

C: DISASSEMBLY

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

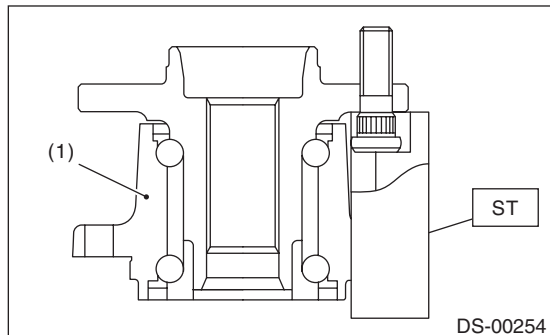
ST 28399AG000 HUB STAND

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.

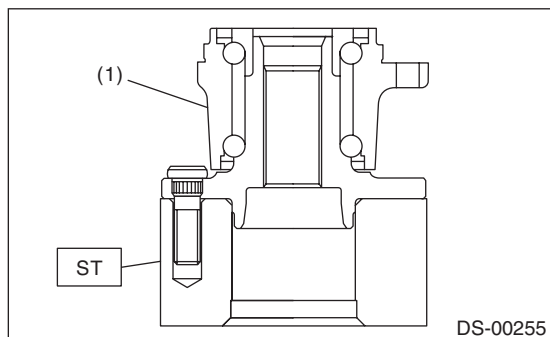


(1) Rear hub unit bearing

D: ASSEMBLY

1) Attach the hub to the ST securely.

ST 28099PA080 HUB STAND



(1) Rear hub unit bearing

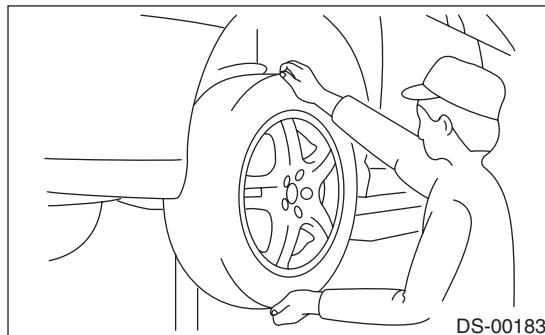
2) Using a press, press the new hub bolts until their seating surfaces contact the hub.

NOTE:

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

E: INSPECTION

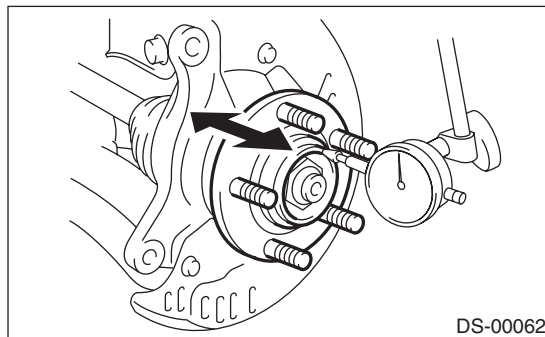
1) Moving the rear tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



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

Service limit:

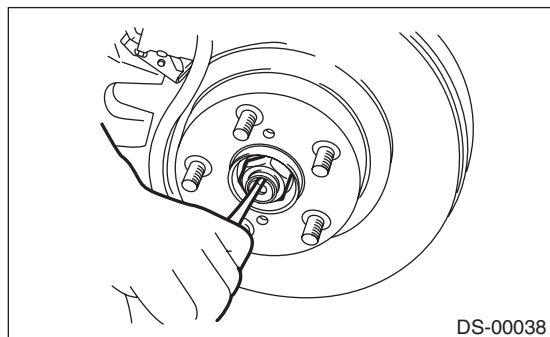
Maximum: 0.05 mm (0.0020 in)



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.

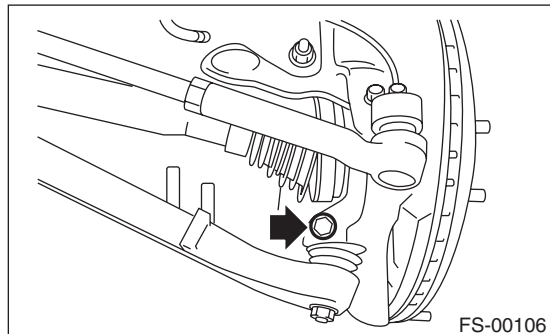


- 5) Remove the axle nut using a socket wrench while depressing the brake pedal.

CAUTION:

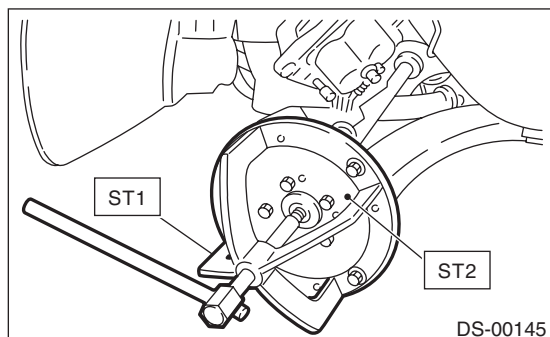
Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

- 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.

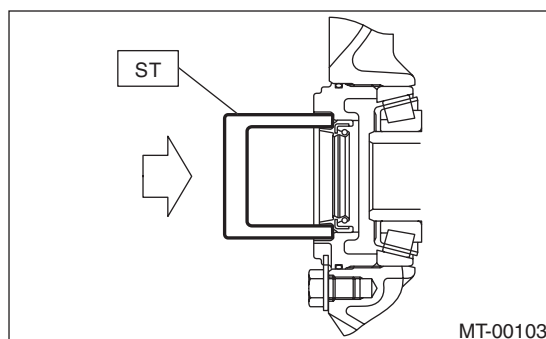
B: INSTALLATION

- 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.



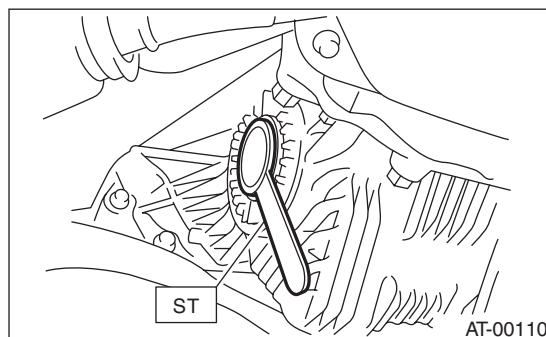
- 2) Insert the EBJ into hub splines.
- 3) Draw the drive shaft into specified position.

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.

8) While depressing the brake pedal, tighten a new axle nut (olive color) 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

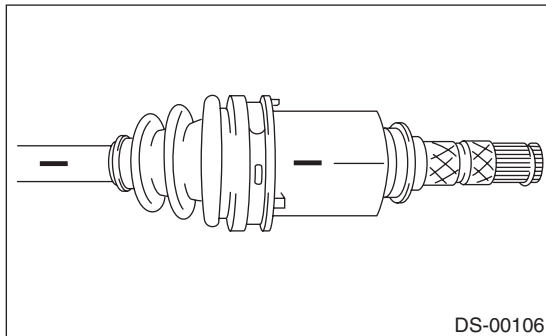
150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

120 N·m (12.2 kgf-m, 88.5 ft-lb)

C: DISASSEMBLY

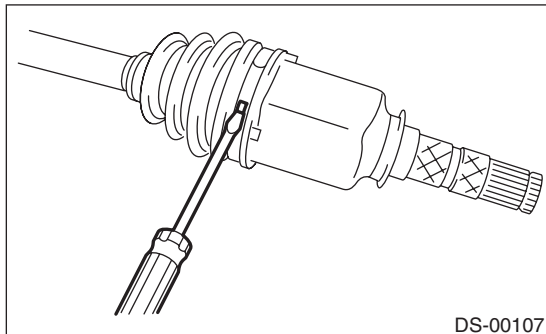
1) Place alignment marks on the shaft and outer race.



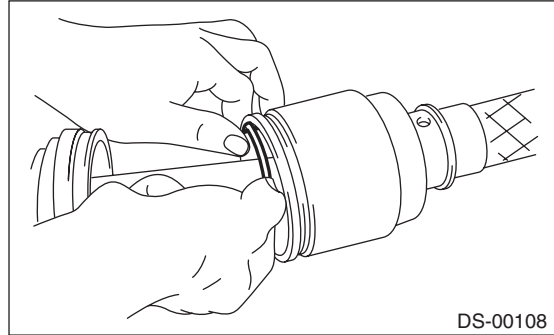
2) Remove the PTJ boot band and boot.

CAUTION:

Be careful not to damage the boot.



3) Remove the snap ring from PTJ outer race.



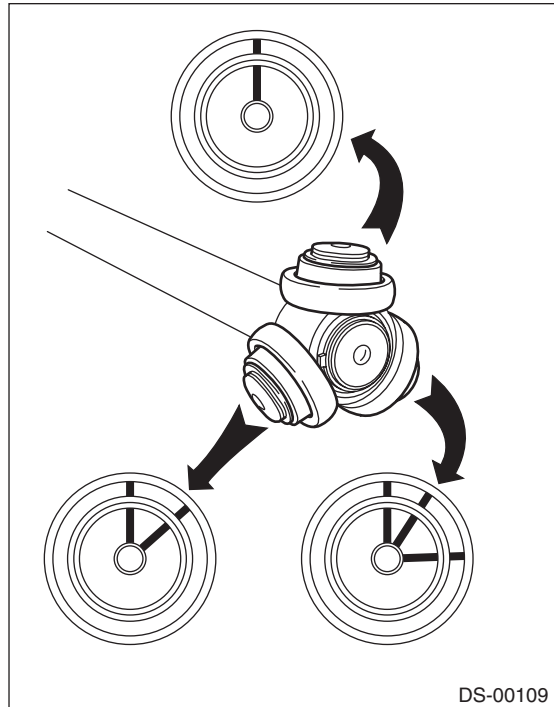
4) Remove the PTJ outer race from shaft assembly.

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.

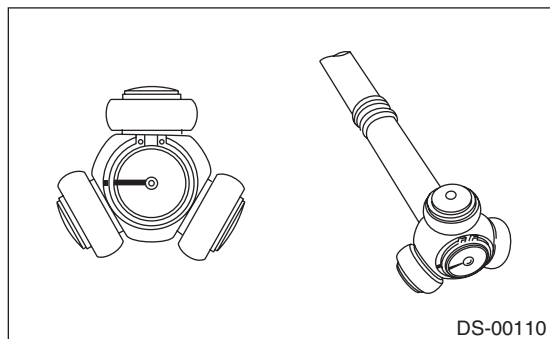
CAUTION:

Be careful with the roller kit position.

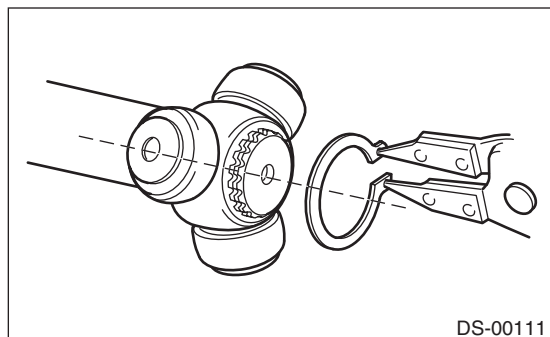
Front Drive Shaft

DRIVE SHAFT SYSTEM

- 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 axle disassembly stops here.

D: ASSEMBLY

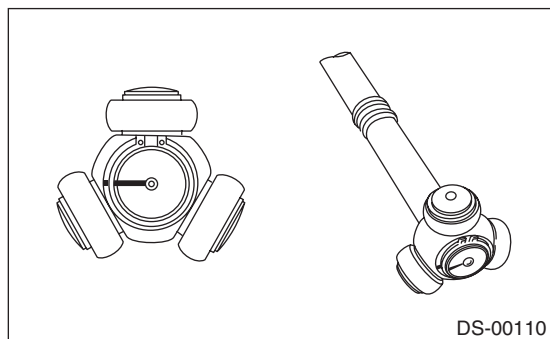
NOTE:

Use specified grease.

PTJ side:

NKG302 (Part No. 28395AG02A)

- 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.

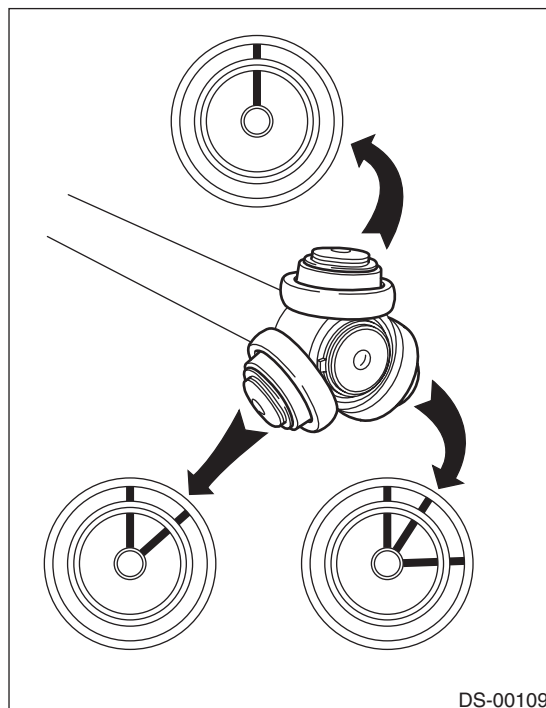
- 4) Fill 100 to 110 g (3.53 to 3.88 oz) of specified grease into the interior of PTJ outer race.

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

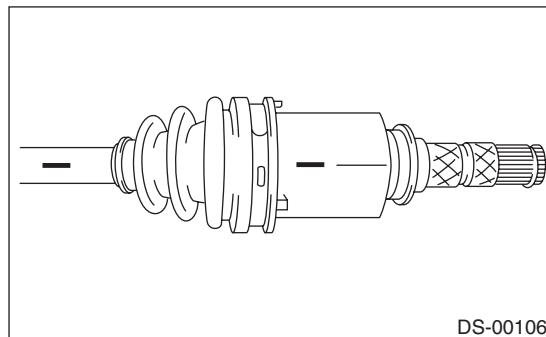
- 6) Align alignment marks on roller kit and trunnion and install the roller kit.

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.

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:

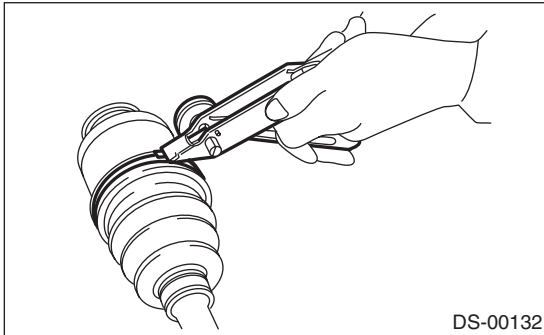
When tightening boot, use care so that the air within the boot is appropriate.

13) Tighten the band using the ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tighten the band until it cannot be moved by hand.

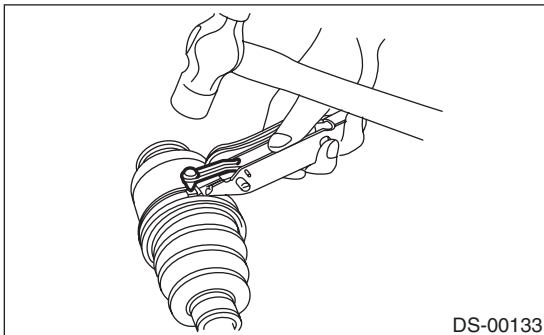


14) Tap the clip with the punch provided at the end of the ST.

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.

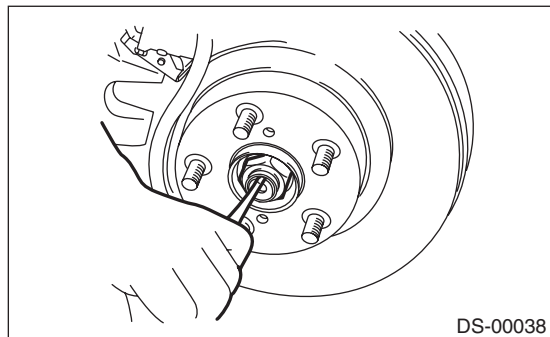
- Grease

Check for discoloration and fluidity.

8. Rear Drive Shaft

A: REMOVAL

- 1) Disconnect the ground cable from the 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-15, REMOVAL, Rear Differential (VA-type).>

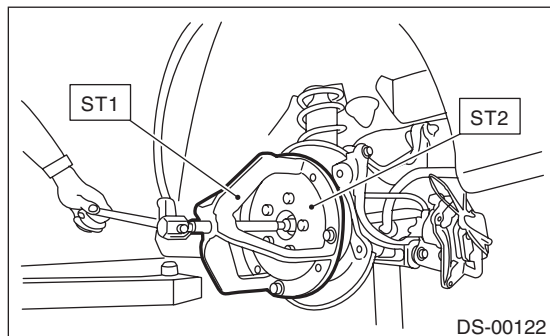
- 6) Remove the axle nut and rear drive shaft. If it is hard to remove, use ST1 and ST2.

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.

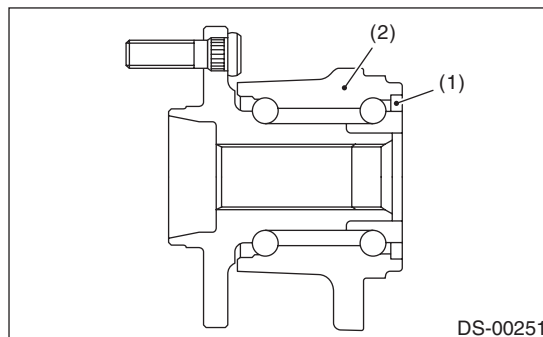


B: INSTALLATION

- 1) Insert the EBJ into 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-16, INSTALLATION, Rear Differential (VA-type).>

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

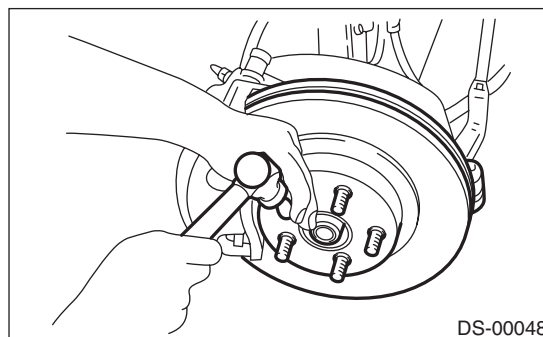
Tightening torque:

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.



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

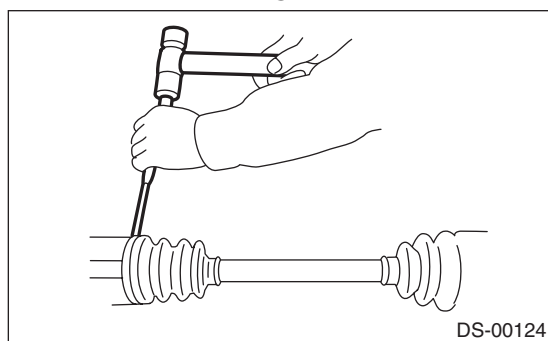
120 N·m (12.2 kgf-m, 88.5 ft-lb)

C: DISASSEMBLY

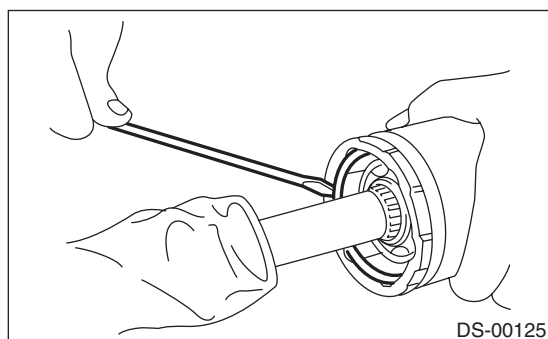
- 1) Straighten the bent claw at the larger end of the DOJ boot.
- 2) Loosen the band by means of screwdriver or pliers.

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.

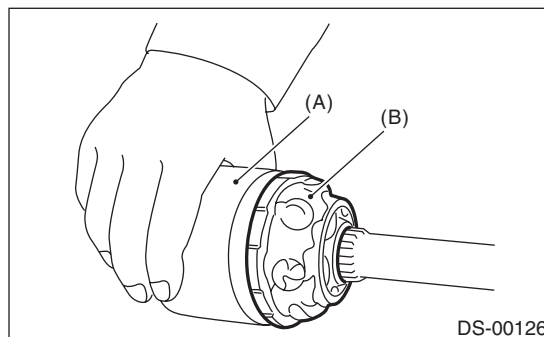
7) Wipe off the grease and take out the ball bearings.

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.

- 12) Remove the EBJ boot using the same procedures as for the DOJ boot.

NOTE:

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

D: ASSEMBLY

NOTE:

Use specified grease.

DOJ side:

NKG205 (Part No. 28495AG00A)

- 1) Install the EBJ boot to the specified position, and fill it with 60 to 70 g (2.12 to 2.47 oz) of specified grease.
- 2) Place the DOJ boot at the center of shaft.

CAUTION:

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

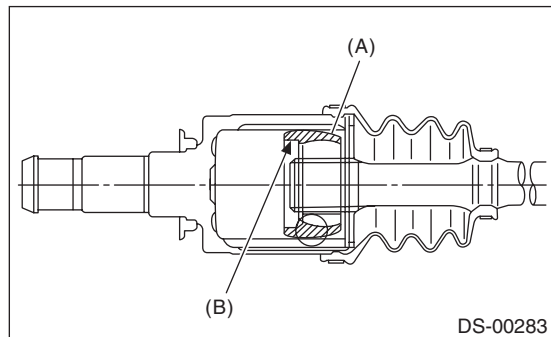
Rear Drive Shaft

DRIVE SHAFT SYSTEM

3) Insert the DOJ cage onto shaft.

NOTE:

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

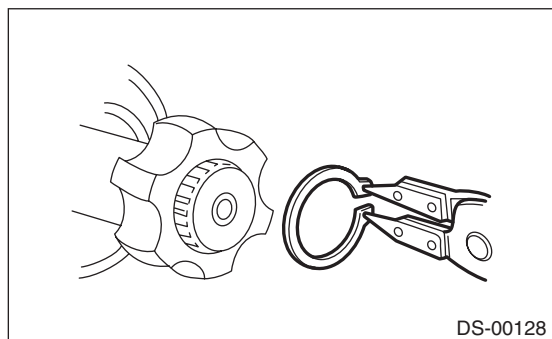


(A) Cage
(B) Cutout portion

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

NOTE:

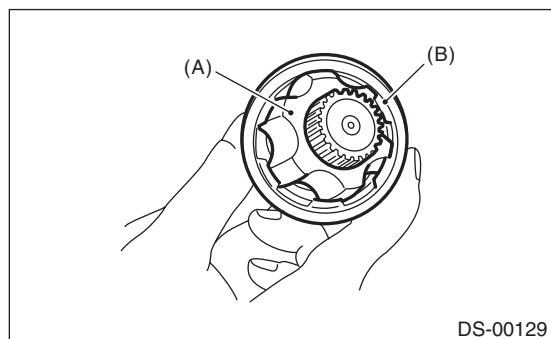
Confirm that the snap ring is completely fitted in the shaft groove.



5) 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.



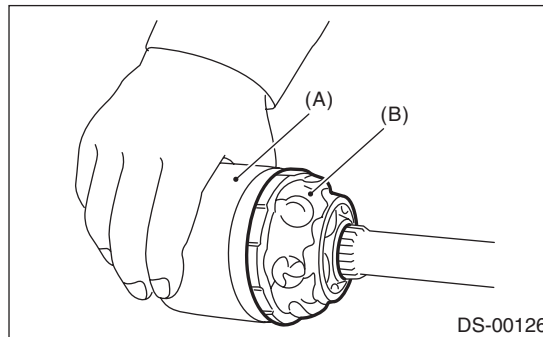
(A) Inner race
(B) Cage

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

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

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

9) 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.

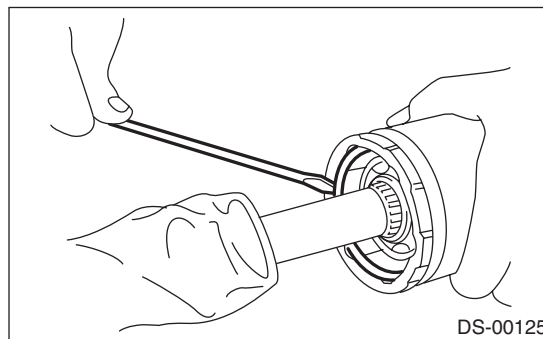


(A) Outer race
(B) Grease

10) 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.



11) Apply an even coat of the specified grease [20 to 30 g (0.71 to 1.06 oz)] to the entire inner surface of boot. Also apply grease to the shaft.

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

NOTE:

- The inside of the larger 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.
- 13) Put a new band through the clip and wind twice in the band groove of the boot.

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

NOTE:

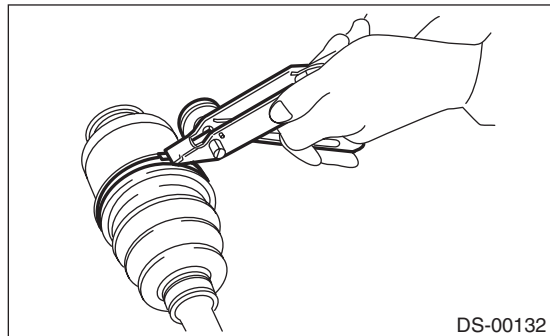
When tightening boot, use care so that the air within the boot is appropriate.

15) Tighten the band using the ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

Tighten the band until it cannot be moved by hand.

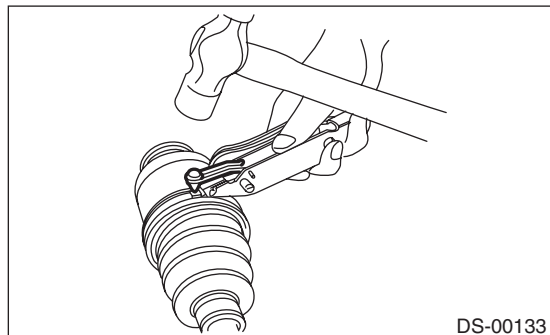


16) Tap the clip with the punch provided at the end of the ST.

ST 925091000 BAND TIGHTENING TOOL

NOTE:

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



17) 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.

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

19) 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.

General Diagnostic Table

DRIVE SHAFT SYSTEM

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.

Symptom	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-9, ADJUSTMENT, Wheel Balancing.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-7, 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-24, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-14, INSPECTION, Rear Shock Absorber.>
	Front drive shaft	Check the front drive shaft. <Ref. to DS-27, INSPECTION, Front Drive Shaft.>
	Rear drive shaft	Check the rear driveshaft. <Ref. to DS-31, INSPECTION, Rear Drive Shaft.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-20, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-23, INSPECTION, Rear Hub Unit Bearing.>
Noise from the underbody	Wheel is out of balance.	Check the wheel balance. <Ref. to WT-9, ADJUSTMENT, Wheel Balancing.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-7, 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-24, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-14, INSPECTION, Rear Shock Absorber.>

VEHICLE DYNAMICS CONTROL (VDC)

VDC

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4. VDC Sequence Control	16
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8. Rear ABS Wheel Speed Sensor	24
9. Front Magnetic Encoder	25
10. Rear Magnetic Encoder	26
11. TCS OFF Switch	27

General Description

FRONT SUSPENSION

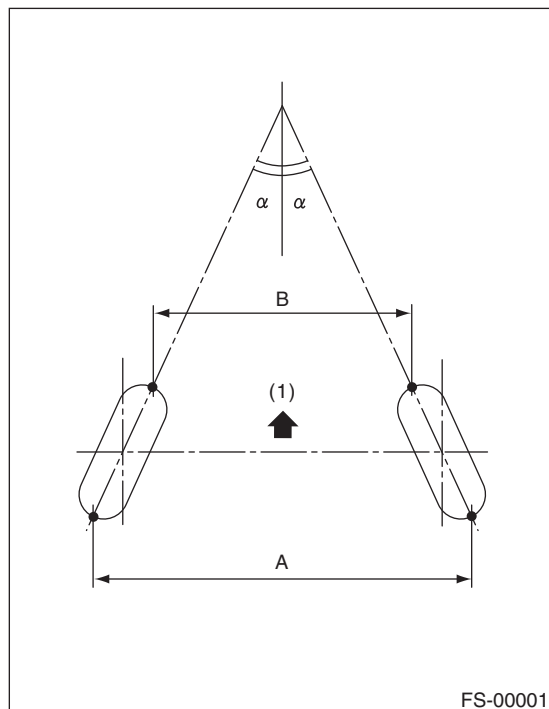
1. General Description

A: SPECIFICATION

Front	Wheel arch height [Tolerance: $+12\text{ mm}$ -24 mm mm (in) ($+0.47\text{ in}$ -0.94 in)]		442 (17.4)
	Camber (Tolerance: $\pm 0^\circ 45'$ Differences between RH and LH: 45' or less)		$0^\circ 00'$
	Caster (Referential Value)		$4^\circ 04'$
	Steering angle (Tolerance: $\pm 1.5^\circ$)	Inner wheel	37.0°
		Outer wheel	32.0°
	Toe-in mm (in)		0 ± 3 (0 ± 0.12) Toe angle (sum of both wheels): $0^\circ \pm 0^\circ 14'$
Rear	Wheel arch height [Tolerance: $+12\text{ mm}$ -24 mm mm (in) ($+0.47\text{ in}$ -0.94 in)]		439 (17.3)
	Camber (Tolerance: $\pm 0^\circ 45'$ Differences between RH and LH: 45' or less)		$-0^\circ 31'$
	Toe-in mm (in)		2 ± 2 (0.08 ± 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.

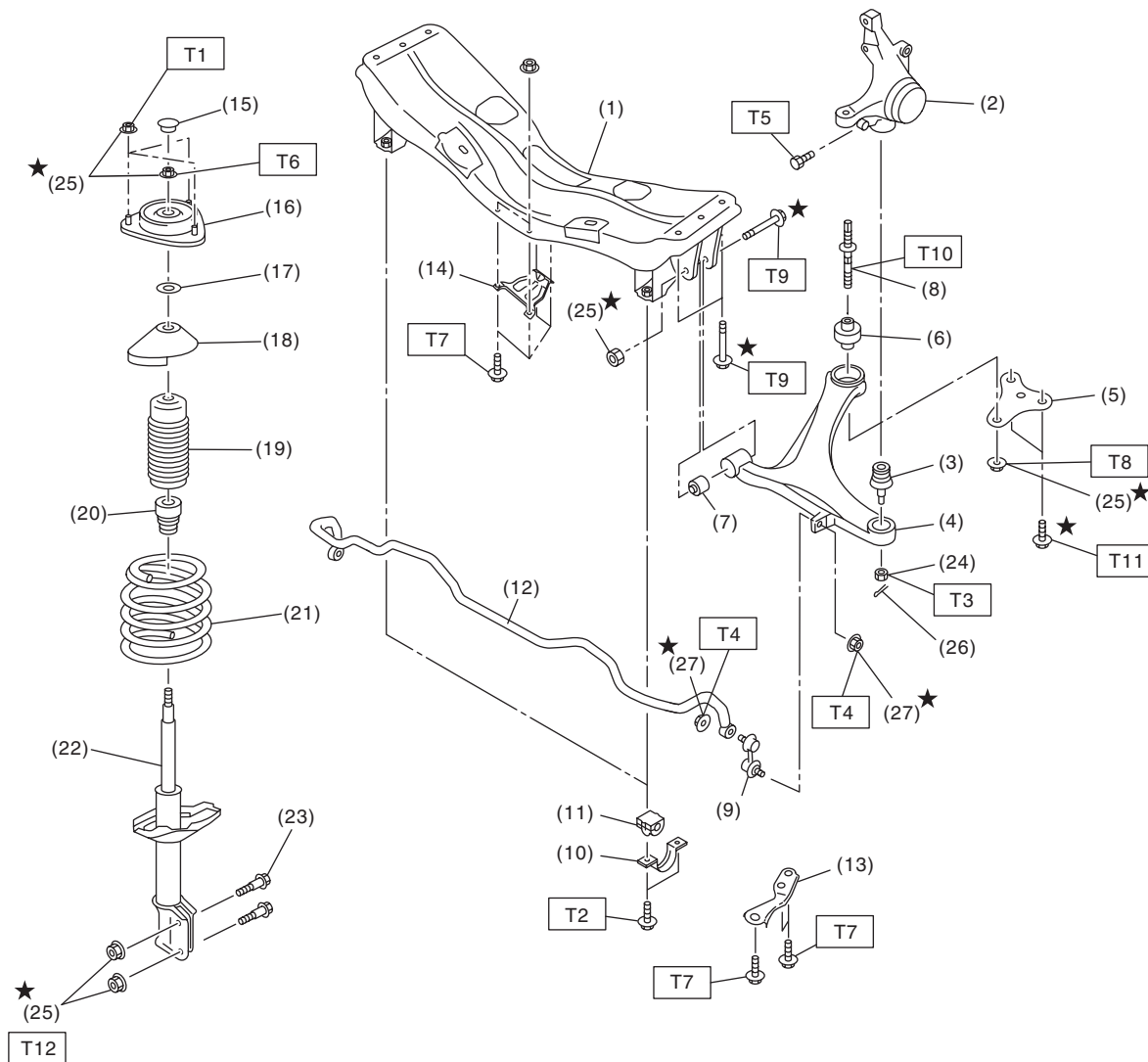


(1) Front

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

α = Individual toe angles

B: COMPONENT



FS-00244

- | | |
|--------------------------------|----------------------------|
| (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 (with WAX) |
| (14) Jack-up plate | |

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: 175 (17.8, 129.1)

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

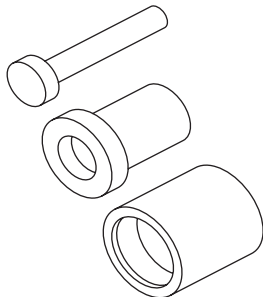
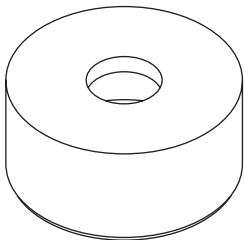
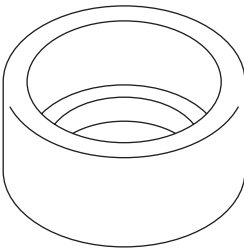
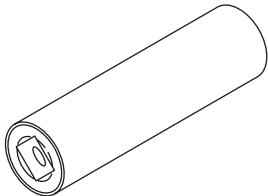
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or 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.

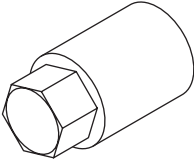
- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

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 (20999AG010).
 ST20299AG010	20299AG010	BASE	Used for replacing front arm rear bushing. used together with REMOVER (20999AG000).
 ST20299AG020	20299AG020	STUD BOLT SOCKET	Used for removing and installing the stud bolt for front arm installing portion.

General Description

FRONT SUSPENSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 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.

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.

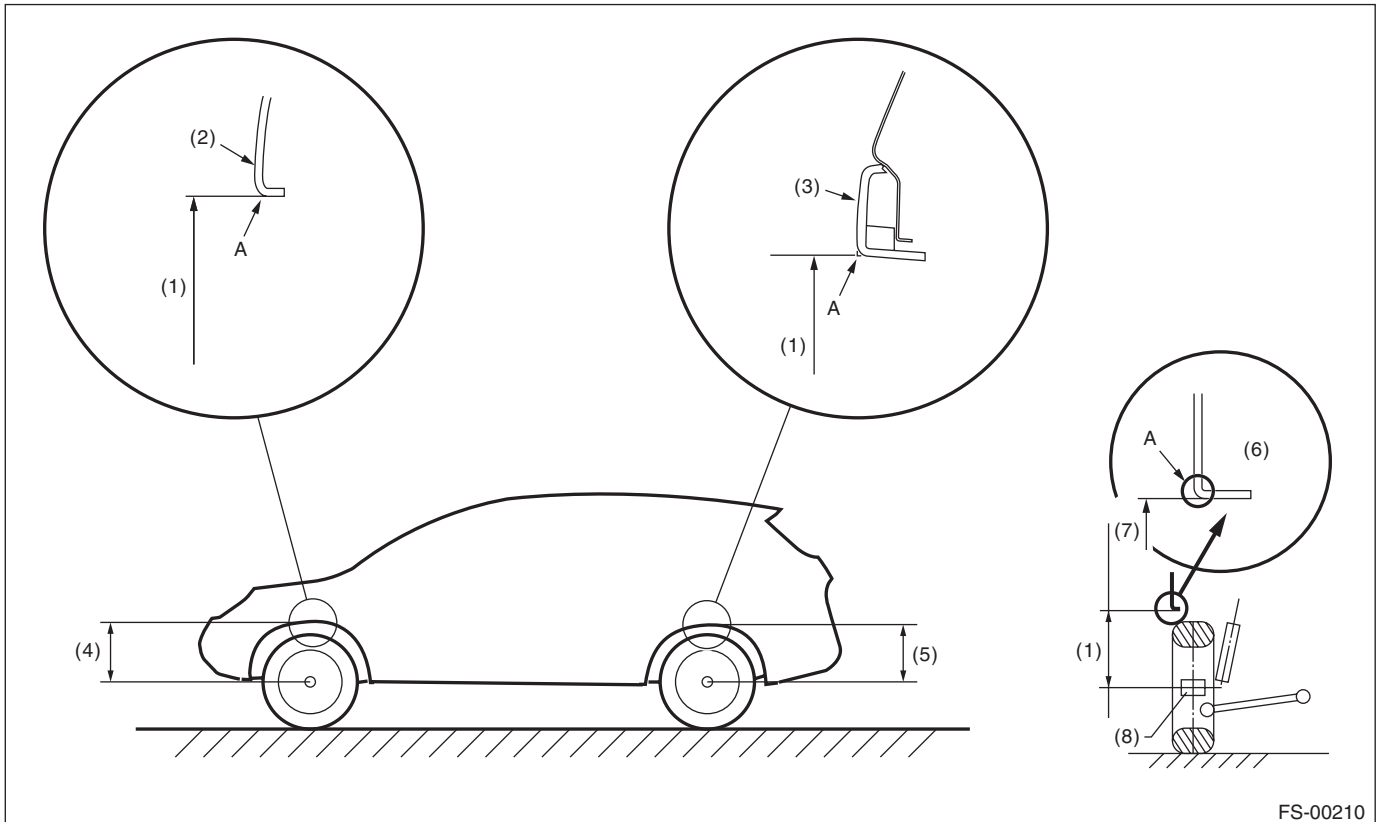
Wheel arch height (front and rear wheels) <Ref. to FS-8, WHEEL ARCH HEIGHT, INSPECTION, Wheel Alignment.>
↓
Camber (front and rear wheels) <Ref. to FS-9, CAMBER, INSPECTION, Wheel Alignment.>
↓
Caster (front wheel) <Ref. to FS-11, CASTER, INSPECTION, Wheel Alignment.>
↓
Steering angle <Ref. to FS-11, STEERING ANGLE, INSPECTION, Wheel Alignment.>
↓
Front wheel toe-in <Ref. to FS-11, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>
↓
Rear wheel toe-in <Ref. to FS-12, REAR WHEEL TOE-IN, INSPECTION, Wheel Alignment.>
↓
Thrust angle <Ref. to FS-14, THRUST ANGLE, INSPECTION, Wheel Alignment.>

Wheel Alignment

FRONT SUSPENSION

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 more than 5 m (16 ft).
- 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.



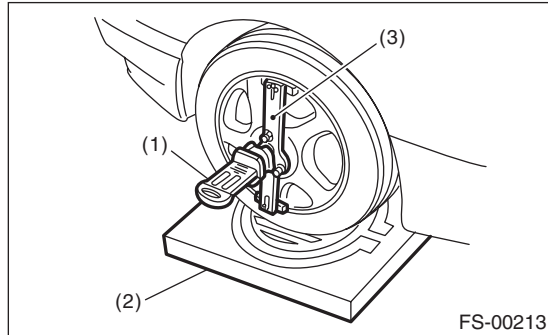
- | | | |
|-----------------------|-----------------------------|--------------------------|
| (1) Wheel arch height | (4) Front wheel arch height | (7) Point of measurement |
| (2) Front fender | (5) Rear wheel arch height | (8) Tip end of spindle |
| (3) Rear quarter | (6) Flange bend line | |

Wheel arch height specification mm (in) (Tolerance: $+12\text{ mm}$ -24 mm ($+0.47\text{ in}$ -0.94 in))	
Front	442 (17.4)
Rear	439 (17.3)

2. CAMBER

• Inspection

- 1) Place the front wheel on the turning radius gauge. Make sure the ground contact surfaces of front and rear wheels are at the same height.
- 2) Set the adapter at the center of wheel, and then attach 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)
$0^{\circ}00' \pm 0^{\circ}45'$

• FRONT CAMBER ADJUSTMENT

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

Camber (Difference between RH and LH 45' or less)
$0^{\circ}00' \pm 0^{\circ}30'$

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

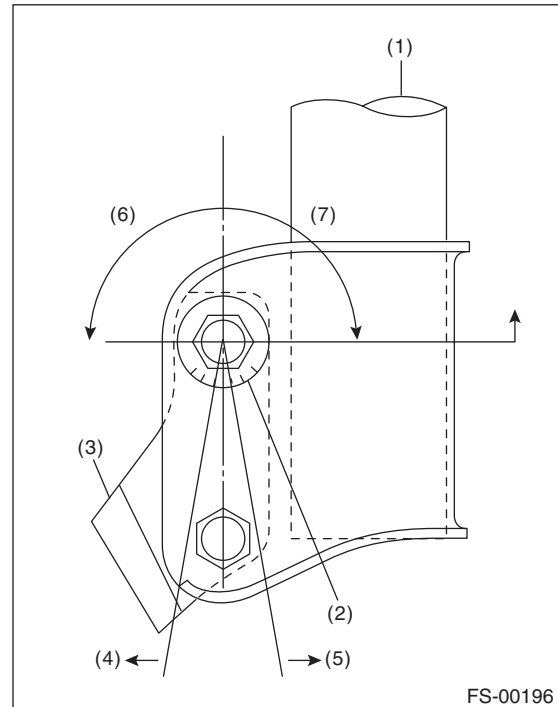
NOTE:

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:

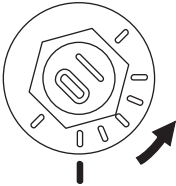
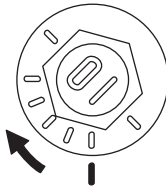
Moving the adjusting bolt by one scale changes the camber by approximately $0^{\circ}10'$.

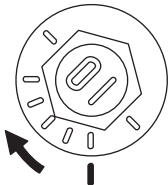
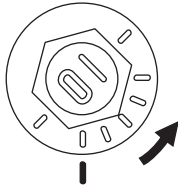


- (1) Strut
- (2) Adjusting bolt
- (3) Housing
- (4) Outer
- (5) Inner
- (6) Camber is increased.
- (7) Camber is decreased.

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

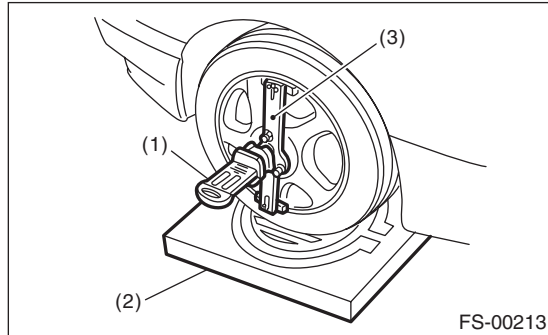
4) Tighten two new self-locking nuts.

Tightening torque:
175 N·m (17.9 kgf-m, 129 ft-lb)

3. CASTER

• INSPECTION

- 1) Place the front wheel on the turning radius gauge. Make sure the ground contact surfaces of front and rear wheels are at the same height.
- 2) Set the adapter at the center of wheel, and then attach 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	
	4°04' (Reference)

4. STEERING ANGLE

• INSPECTION

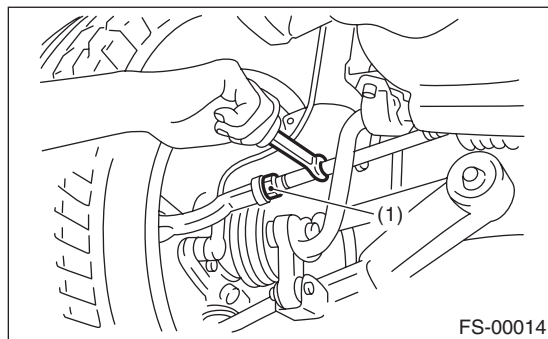
Inner wheel	Outer wheel
37.0°±1.5°	32.0°±1.5°

• 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±3 mm (0±0.12 in)

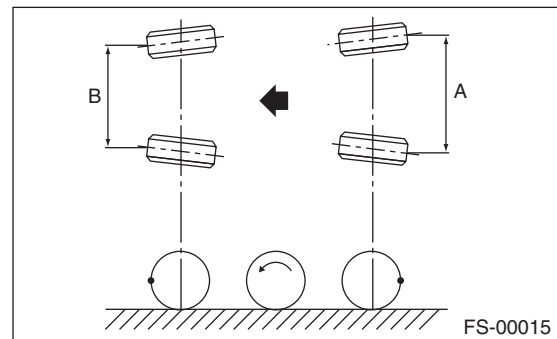
- 1) Set the toe-in gauge in the position at wheel axis center height behind the right and left front tires.
- 2) Place a mark at the center of both left and right tires, and measure distance "A" between the marks.
- 3) Move the vehicle forward to rotate the tires 180°.

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:

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



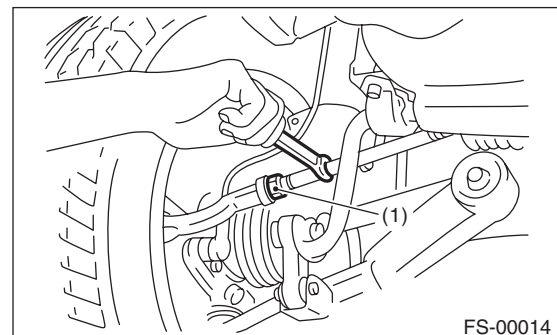
• ADJUSTMENT

When adjusting the toe-in, adjust it to the following value.

Toe-in

0±2 mm (0±0.08 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

Wheel Alignment

FRONT SUSPENSION

4) Tighten the tie-rod lock nut.

Tightening torque:

85 N·m (8.7 kgf-m, 62.7 ft-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-11, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

• ADJUSTMENT

When adjusting, adjust it to the following value.

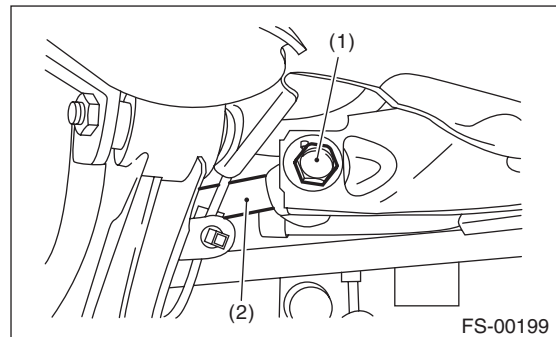
Toe-in

$2 \pm 1.5 \text{ mm (0.08} \pm 0.06 \text{ in)}$

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

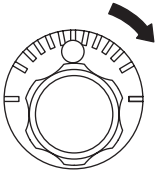
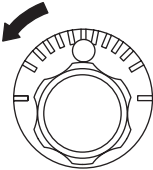
2) Turn the adjusting bolt until toe-in is within the specification.

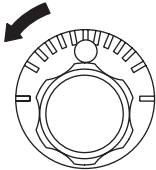
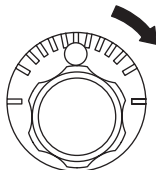
NOTE:

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).

Wheel Alignment

FRONT SUSPENSION

To increase toe-in:	
Rotate the left side clockwise.	Rotate the right side counterclockwise.
	
FS-00018	FS-00019

To decrease toe-in:	
Rotate the left side counterclockwise.	Rotate the right side clockwise.
	
FS-00019	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

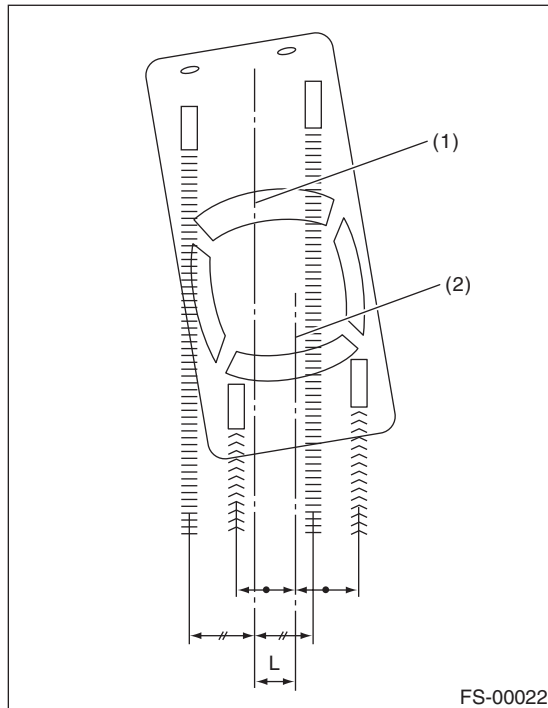
• INSPECTION

- 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

$0^{\circ} \pm 20'$

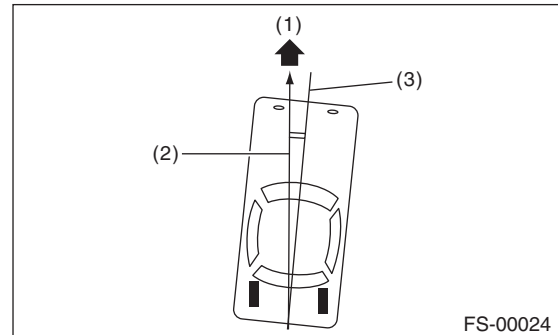
Less than 20' when "L" is 16 mm (0.6 in) or less.

- 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.



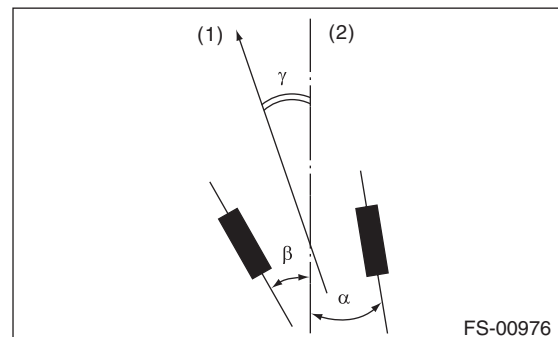
- (1) Front
(2) Thrust angle
(3) Body center line

Thrust angle $r = (\alpha - \beta)/2$

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 equation.

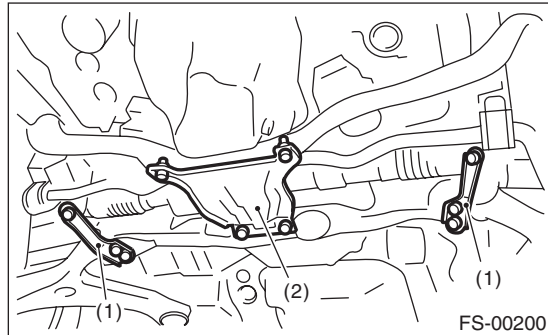


- (1) Front
(2) Body center line

3. Front Crossmember Support Plate

A: REMOVAL

- 1) Lift-up the vehicle.
- 2) Remove the front under cover. <Ref. to EI-17, 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:

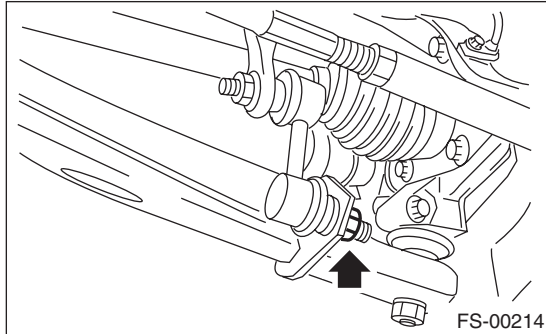
Crossmember support plate
60 N·m (6.1 kgf-m, 44.3 ft-lb)

Jack-up plate
60 N·m (6.1 kgf-m, 44.3 ft-lb)

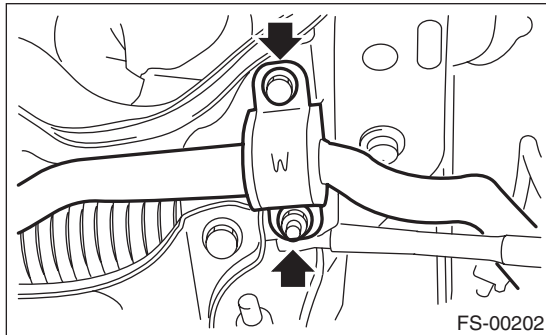
4. Front Stabilizer

A: REMOVAL

- 1) Lift-up the vehicle, and then remove the front wheels.
- 2) Remove the front under cover. <Ref. to EI-17, REMOVAL, Front Under Cover.>
- 3) Remove the front crossmember support plate. <Ref. to FS-15, REMOVAL, Front Crossmember Support Plate.>
- 4) Remove the stabilizer link.



- 5) Remove the stabilizer link.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

- Use a new flange nut (with WAX).
- 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)

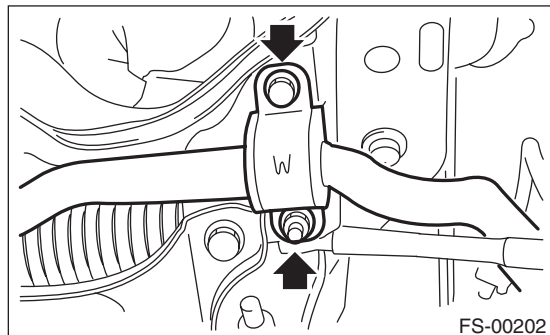
C: INSPECTION

- 1) Check the bushing for cracks, fatigue or damage.
- 2) Check the stabilizer link for damage.

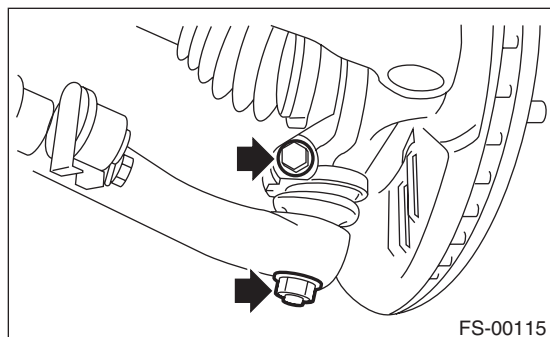
5. Front Ball Joint

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 front arm.
- 4) Remove the bolt installing ball joint to 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:

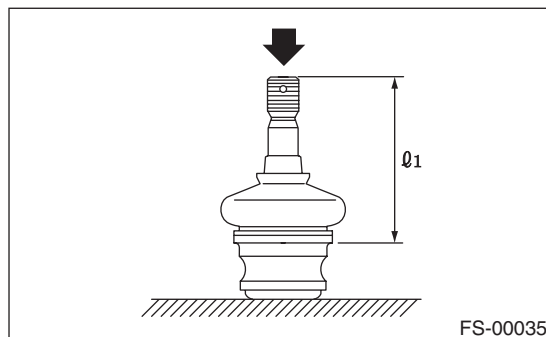
25 N·m (2.5 kgf-m, 18.1 ft-lb)

- 5) Install the front wheels.

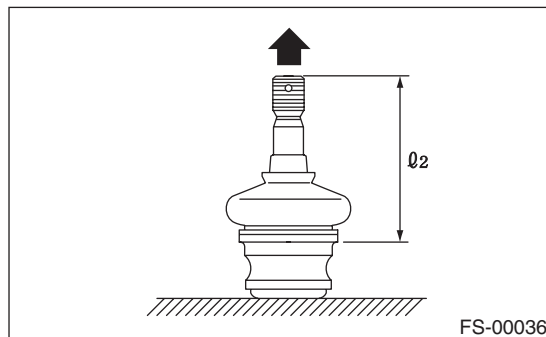
C: INSPECTION

- 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 length Q_1 .



- (2) With 980 N (100 kgf, 220 lb) loaded in direction shown in the figure, measure the length Q_2 .



- (3) Determine free play using the following formula.

$$S = Q_2 - Q_1$$

- (4) Replace with a new part if the play exceeds specification.

FRONT BALL JOINT

Specification for replacement S:

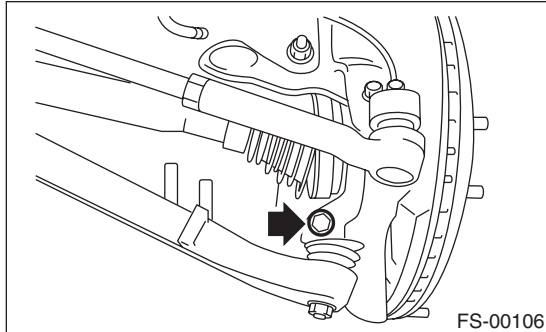
Less than 0.3 mm (0.012 in)

- 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.

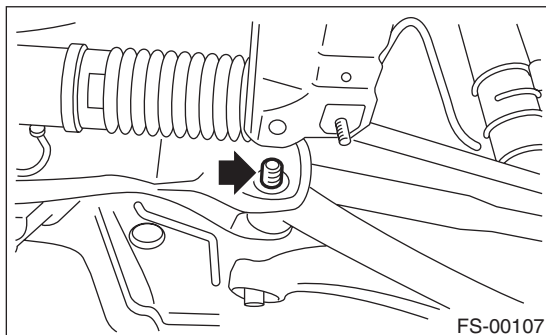
6. Front Arm

A: REMOVAL

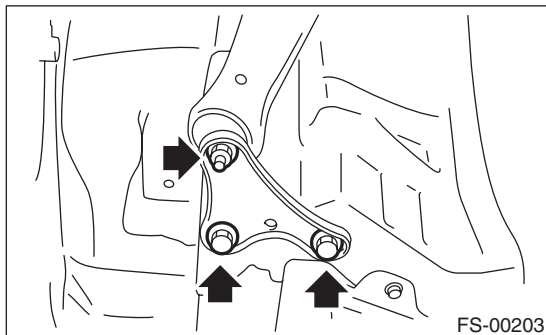
- 1) Lift-up the vehicle, and then remove the front wheels.
- 2) Remove the front crossmember support plate. <Ref. to FS-15, REMOVAL, Front Crossmember Support Plate.>
- 3) Remove the front stabilizer. <Ref. to FS-16, REMOVAL, Front Stabilizer.>
- 4) Remove the ball joint of front arm.



- 5) Remove the nut securing the front arm to crossmember. (Do not remove the bolt.)



- 6) Remove the front arm support plate.

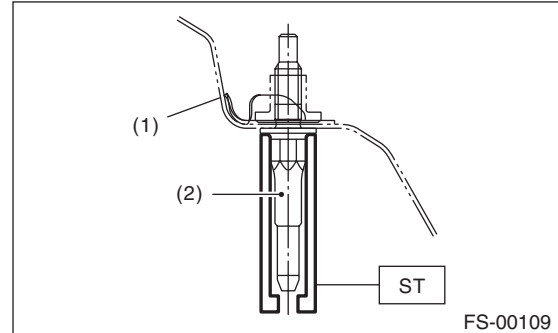


- 7) Remove the bolt securing front arm to crossmember and pull the front arm out of the crossmember.

- 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-16, 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)

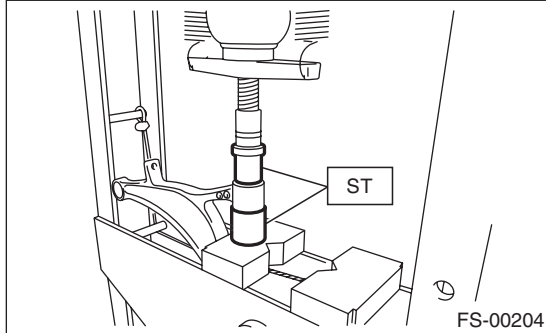
- 7) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

1. FRONT BUSHING

Using the ST and a press, remove the front bushing.

ST 927680000 INSTALLER & REMOVER SET

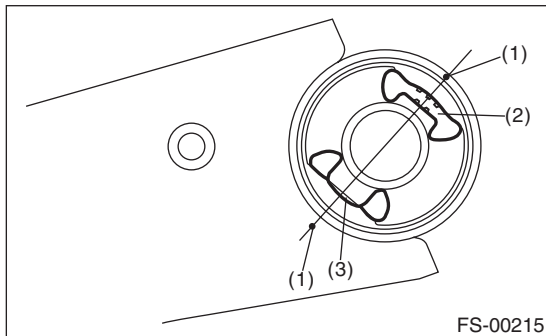


2. REAR BUSHING

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.

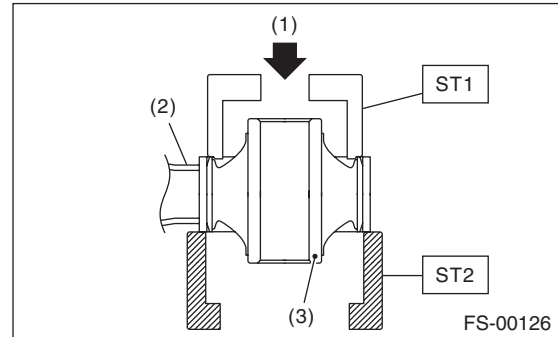


- (1) Put an alignment mark.
- (2) Recess portion (wide spacing)
- (3) Recess portion (narrow spacing)

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

Front Arm

FRONT SUSPENSION

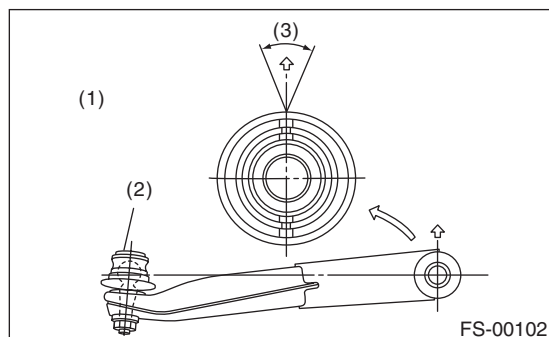
D: ASSEMBLY

1. FRONT BUSHING

Assemble in the reverse order of disassembly.

CAUTION:

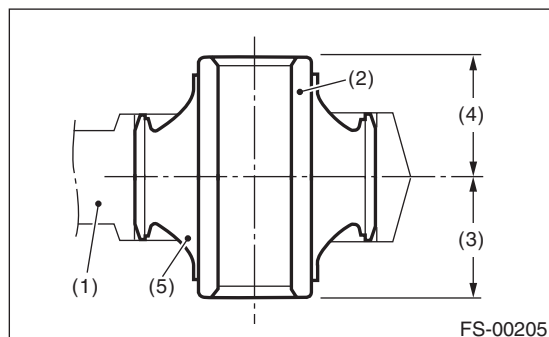
Install the front bushing in proper direction as shown in the figure.



- (1) Face the bushing toward the center of ball joint.
- (2) Ball joint
- (3) $\pm 3^\circ$

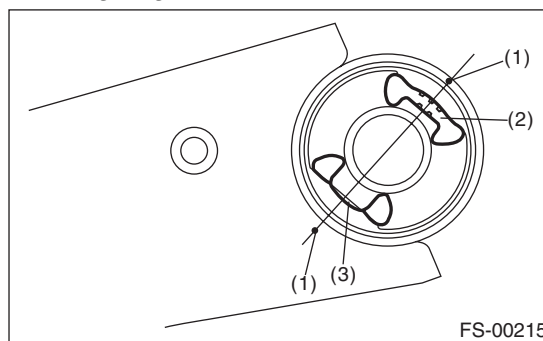
2. REAR BUSHING

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.

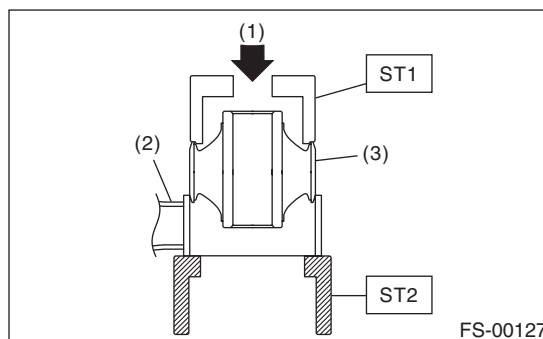


- (1) Alignment mark
- (2) Recess portion (wide spacing)
- (3) Recess portion (narrow spacing)

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

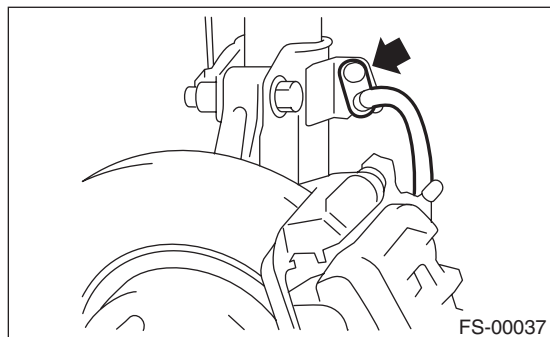
E: INSPECTION

- 1) Check the front arm for wear, damage or cracks, and correct or replace if defective.
- 2) Check the bushing for crack, fatigue or damage.

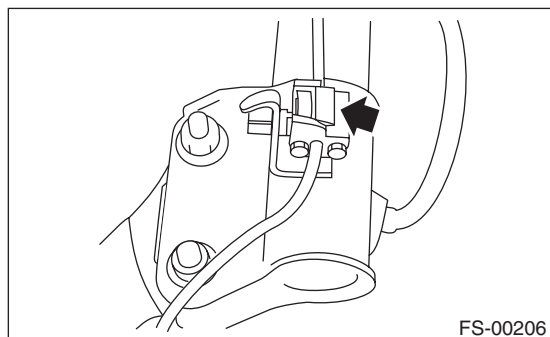
7. Front Strut

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.

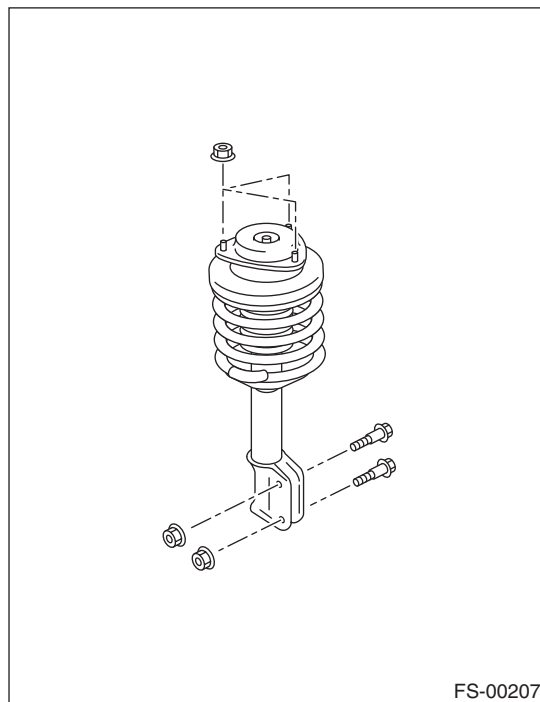


- 5) Remove the two bolts securing the housing to the strut.

NOTE:

While holding the head of the adjusting bolt, loosen the self-locking nut.

- 6) Remove the three nuts securing strut mount to body.



Front Strut

FRONT SUSPENSION

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:

175 N·m (17.9 kgf-m, 129 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:

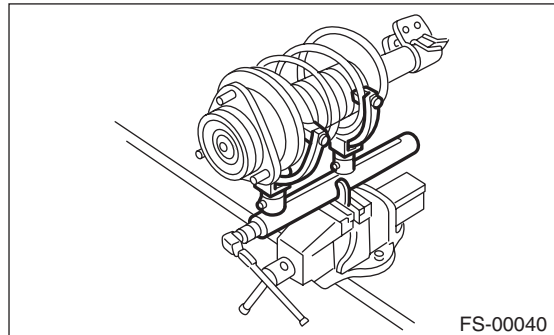
33 N·m (3.4 kgf-m, 24.3 ft-lb)

5) Install the front wheels.

6) Inspect the wheel alignment and adjust if necessary.

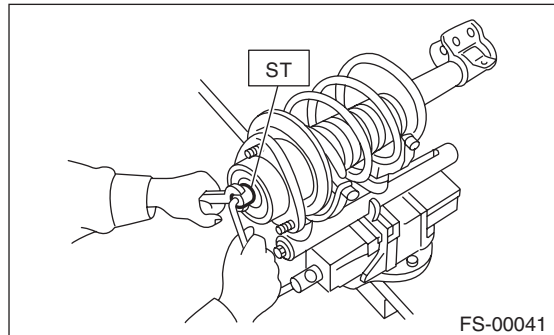
C: DISASSEMBLY

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 more than 10 mm (0.39 in) in the former step, purge air from the strut.

3) Air purging procedure

(1) Place the strut vertically with the piston rod facing up.

(2) Fully extend the piston rod.

(3) With the piston rod fully extended, place the piston rod side down. The strut must stand vertically.

(4) Fully retract the piston rod.

(5) Repeat 3 or 4 times from the step (1).

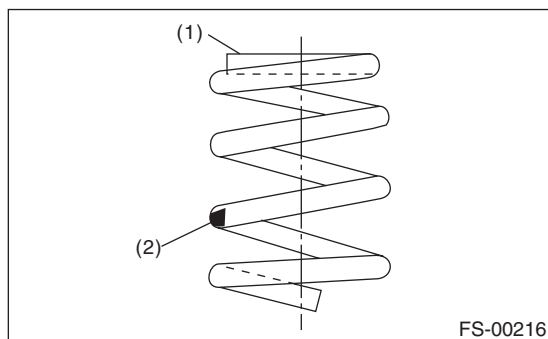
NOTE:

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:

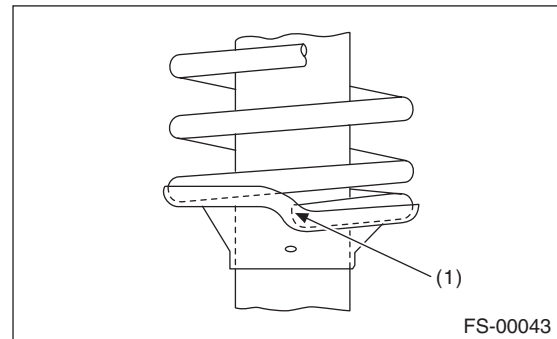
Make sure that the vertical install direction of the coil spring is as shown in the figure.



(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.



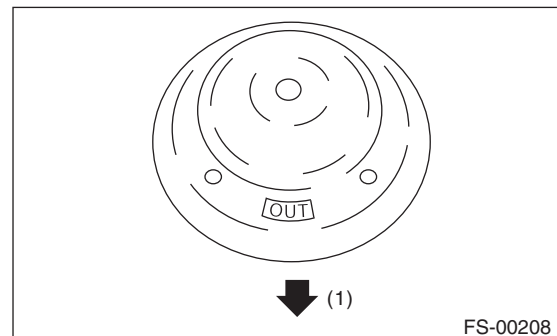
(1) Coil spring end face

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

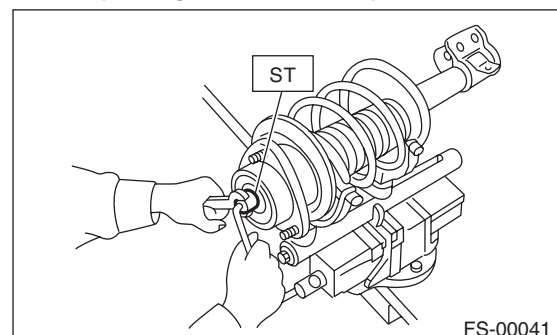
8) Install spacer and the strut mount to piston rod, and tighten a new self-locking nut temporarily.

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

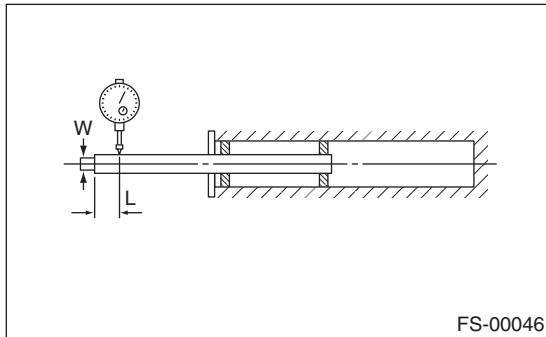
Check the removed part for wear, damage and cracks, and then repair or replace it if defective.

1. DAMPER 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.

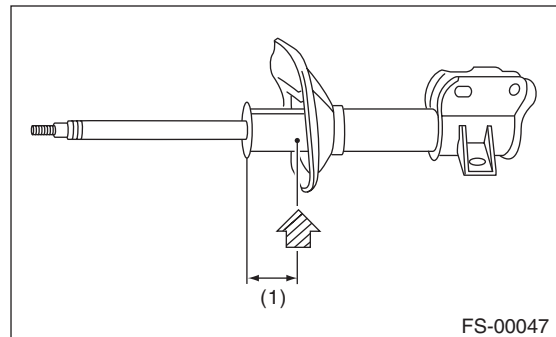
F: DISPOSAL

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.

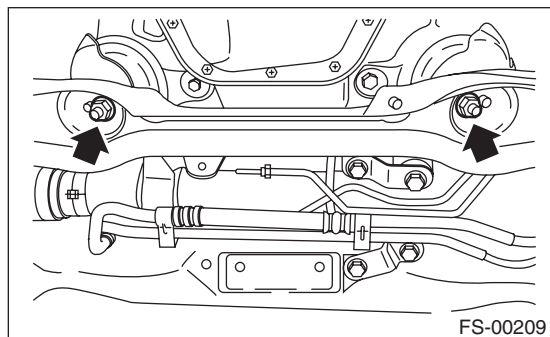


(1) 40 mm (1.57 in)

8. Front Crossmember

A: REMOVAL

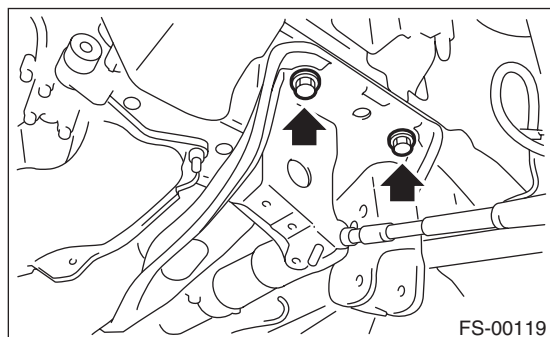
- 1) Lift-up the vehicle, and then remove the front wheels.
- 2) Remove the front exhaust pipe.
- 3) Remove the front crossmember support plate. <Ref. to FS-15, REMOVAL, Front Crossmember Support Plate.>
- 4) Remove the front stabilizer. <Ref. to FS-16, REMOVAL, Front Stabilizer.>
- 5) Disconnect the tie-rod end from housing.
- 6) Remove the front arm. <Ref. to FS-18, 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 the 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.

NOTE:

- 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 stabilizer 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:

85 N·m (8.7 kgf-m, 62.7 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:

27.0 N·m (2.75 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 damper 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	Adjust or replace the coil springs with new parts.
(4) Fault in operation of damper strut or shock absorber	Replace.
(5) Damage or deformation of strut mount or shock absorber mount	Replace.
(6) Unsuitable length (maximum or minimum) of damper 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 damper strut or shock absorber	Replace.

3. NOISE

Possible cause	Corrective action
(1) Wear or damage of damper 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 damper 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

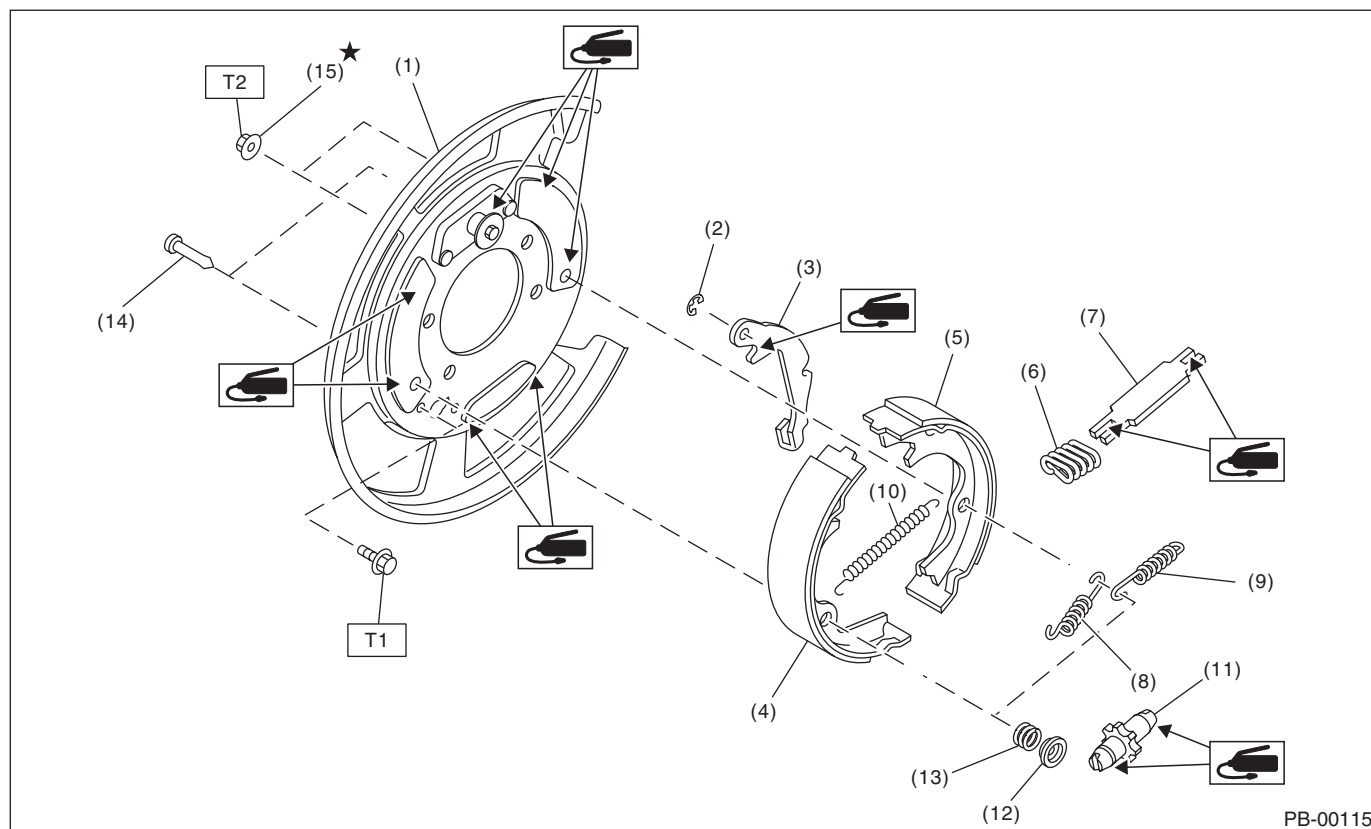
1. General Description

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)



- | | | |
|------------------------------------|-----------------------------|----------------------------------|
| (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, 55.33)

- 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, 13.0) |
| T4: | 33 (3.4, 24.3) |

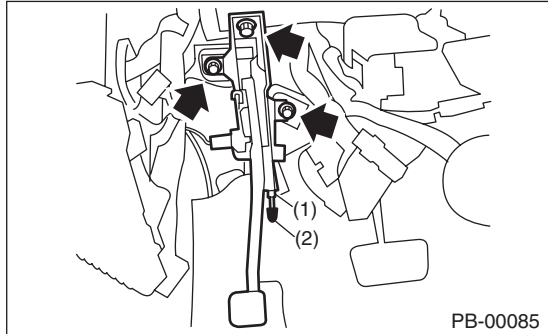
C: CAUTION

- 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

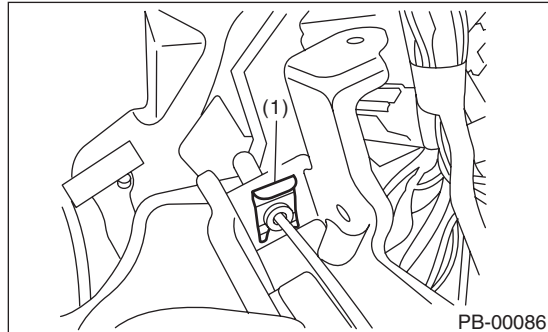
A: REMOVAL

- 1) Set the wheel stoppers to tires.
- 2) Remove the instrument panel lower cover. <Ref. to EI-36, 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, 13.0 ft-lb)

- 2) Install a new adjusting nut (self-locking nut).
- 3) Adjust the pedal stroke. <Ref. to PB-5, 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-10, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

D: ADJUSTMENT

Adjust the parking brake pedal stroke. <Ref. to PB-10, PEDAL STROKE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

Parking Brake Cable

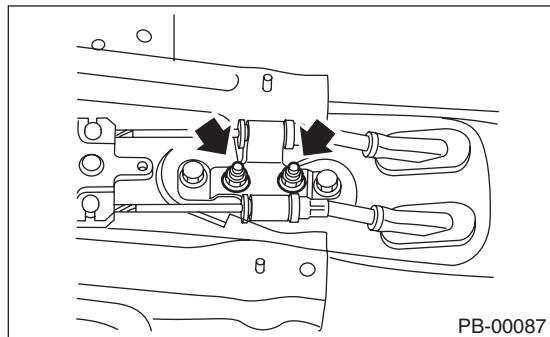
PARKING BRAKE

3. Parking Brake Cable

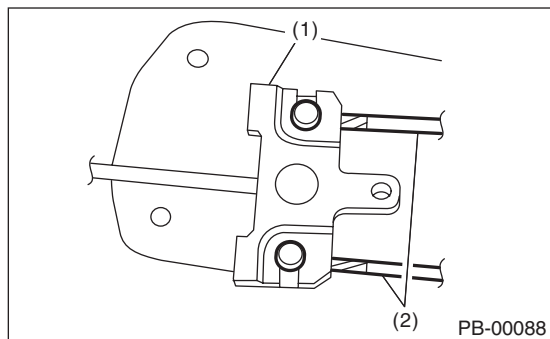
A: REMOVAL

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-5, REMOVAL, Parking Brake Pedal.>
- 5) Roll up the floor mat and remove the clamps.

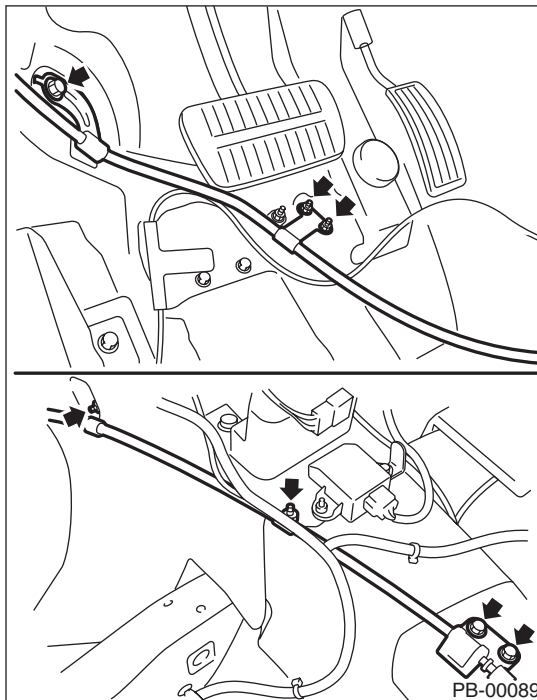


- 6) Remove the cable end from the equalizer.



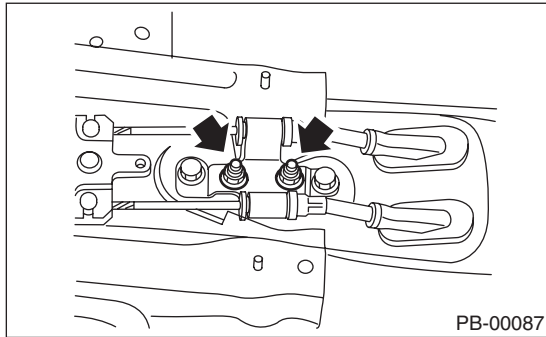
- (1) Equalizer
- (2) Cable end

- 7) Remove the parking brake cable bracket on the driver's side floor, and remove the front parking brake cable.

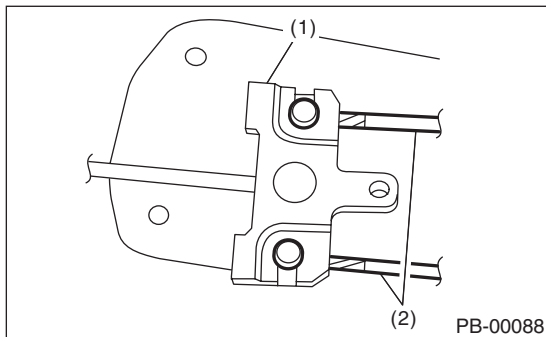


2. REAR PARKING BRAKE CABLE

- 1) Set the vehicle on a lift.
- 2) Remove the console box.
- 3) Roll up the floor mat and remove the clamps.

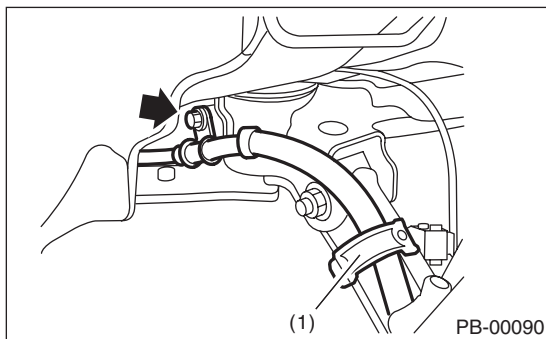


- 4) Remove the cable end from the equalizer.



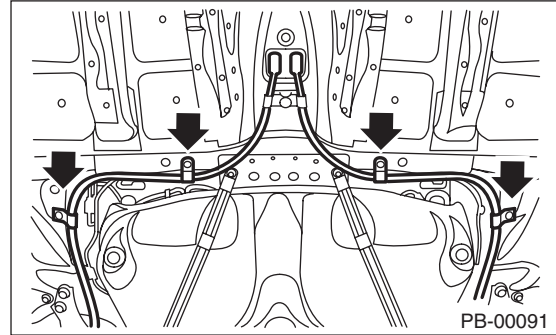
- (1) Equalizer
- (2) Cable end

- 5) Lift-up the vehicle, and then remove the rear wheels.
- 6) Remove the rear parking brake cable from the rear brake. <Ref. to PB-8, 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 cable clamp from rear floor.



- 9) Remove the cable assembly.

B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Adjust the parking brake pedal stroke. <Ref. to PB-5, 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.

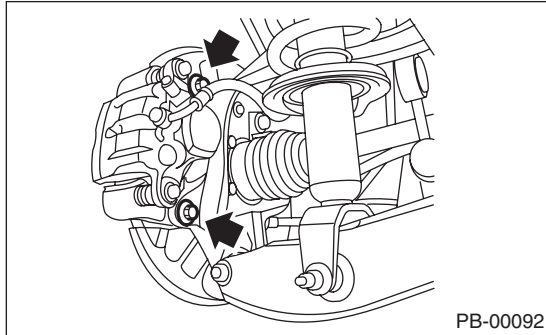
Parking Brake Assembly (Rear Disc Brake)

PARKING BRAKE

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.

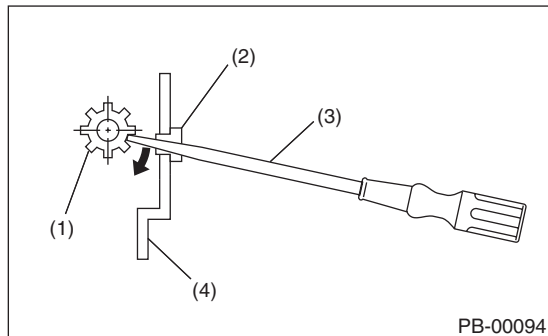


- 4) Suspend the rear disc brake caliper assembly so that the brake hose is not stretched.
- 5) Remove the rear disc brake rotor.

NOTE:

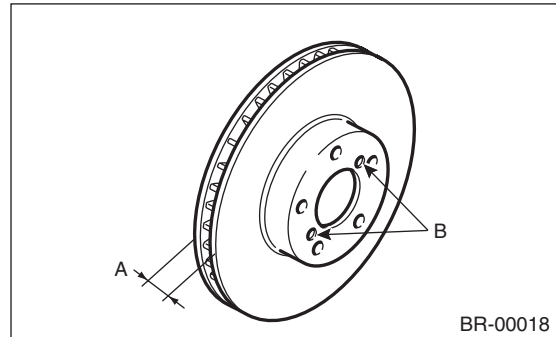
If the disc rotor is difficult to remove, try the following two methods in order.

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

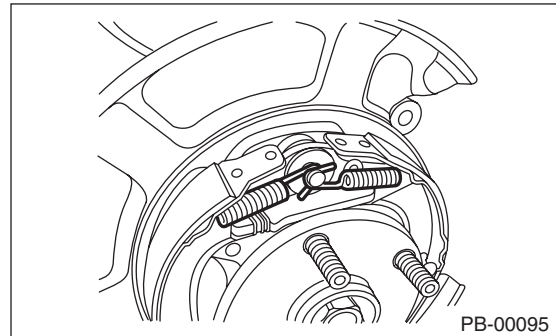


- (1) Adjuster
- (2) Adjusting hole cover (rubber)
- (3) Flat tip screwdriver
- (4) Disc rotor

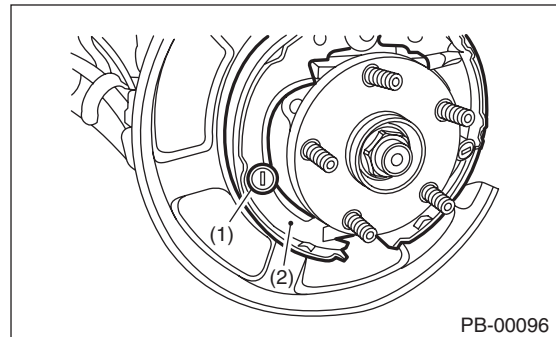
- (2) If disc rotor is seized up on the hub, drive the disc rotor out by pushing two 8-mm bolts in holes B on the rotor.



- 6) Remove the shoe return spring.



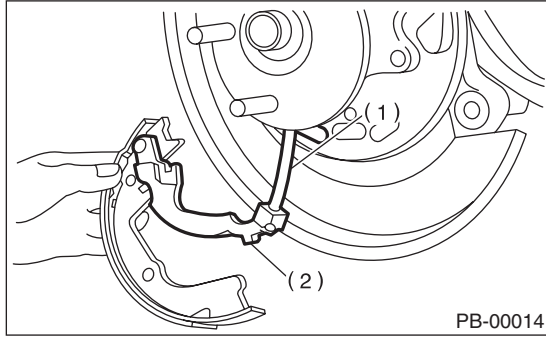
- 7) Remove the brake shoe cup and brake shoe spring, then remove the primary brake shoe.



- (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.

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

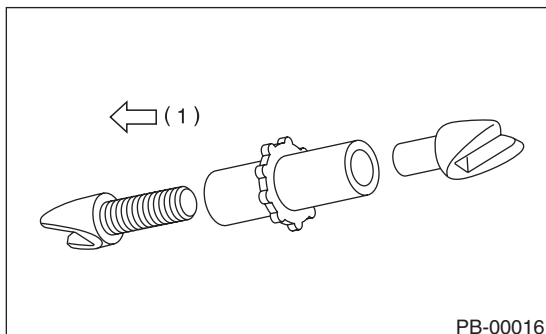
2) Install the parking lever to the secondary side brake shoe, then clamp and lock the retainer securely.

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) LH

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-10, 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, re-adjust 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.

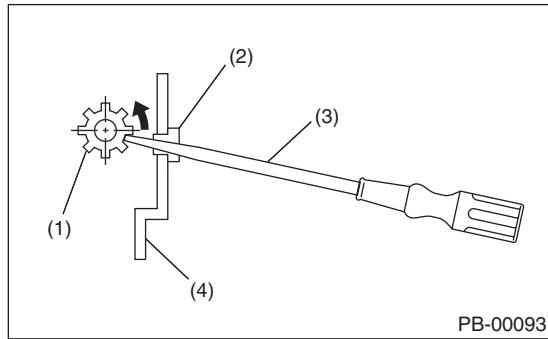
Parking Brake Assembly (Rear Disc Brake)

PARKING BRAKE

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.

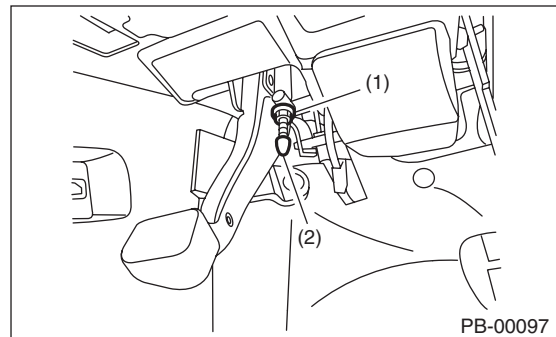
- 5) Install the adjusting hole cover to the disc rotor.
- 6) Adjust the parking brake pedal stroke. <Ref. to PB-10, PEDAL STROKE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

2. PEDAL STROKE

- 1) Adjust the shoe clearance before adjusting pedal stroke. <Ref. to PB-10, 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.

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

General Diagnostic Table

PARKING BRAKE

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)	Description			ATF DEXRON III or equivalent
	Capacity ℓ (US qt, Imp qt)	Oil tank		0.2 (0.2, 0.2)
		Whole system		0.9 (1.0, 0.8)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

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)	400 (41, 90) or less Difference between right and left sliding resistance: Less than 20%
	Rack shaft play in the radial direction	Right-turn steering	mm (in)	0.19 (0.0075) or less
		Left-turn steering	mm (in)	Horizontal movement: 0.6 (0.024) or less Vertical movement: 0.4 (0.016) or less
	Input shaft play	In radial direction	mm (in)	0.18 (0.0071) or less
		In axial direction	mm (in)	0.5 (0.0197) or less
	Rotation resistance		N (kgf, lb)	Maximum allowable value: 10.5 (1.07, 2.36) or less Difference between right and left sliding resistance: Less than 20%
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
		Rotation 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

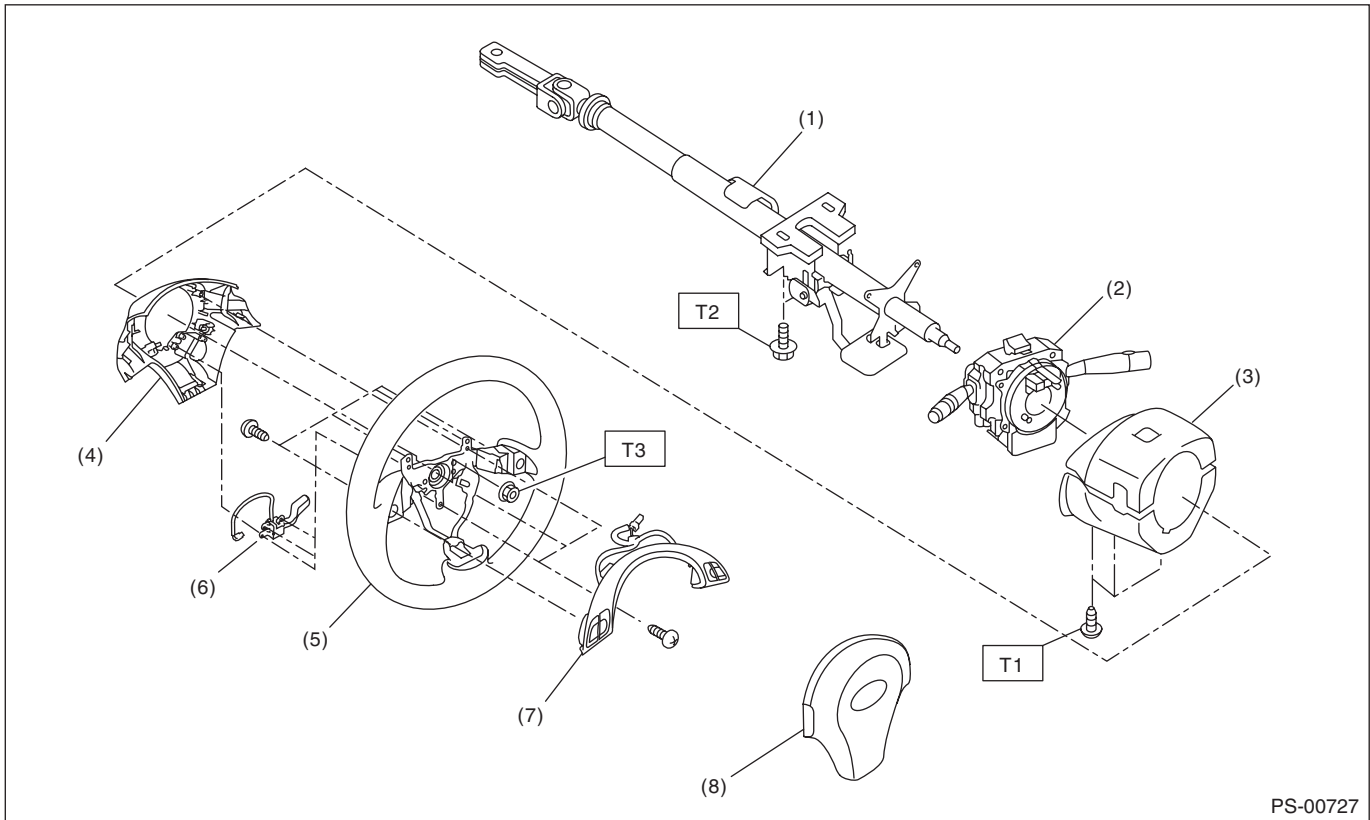
Recommended power steering fluid	Manufacturer
ATF DEXRON III or equivalent	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

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, 0.9)

T2: 25 (2.5, 18.1)

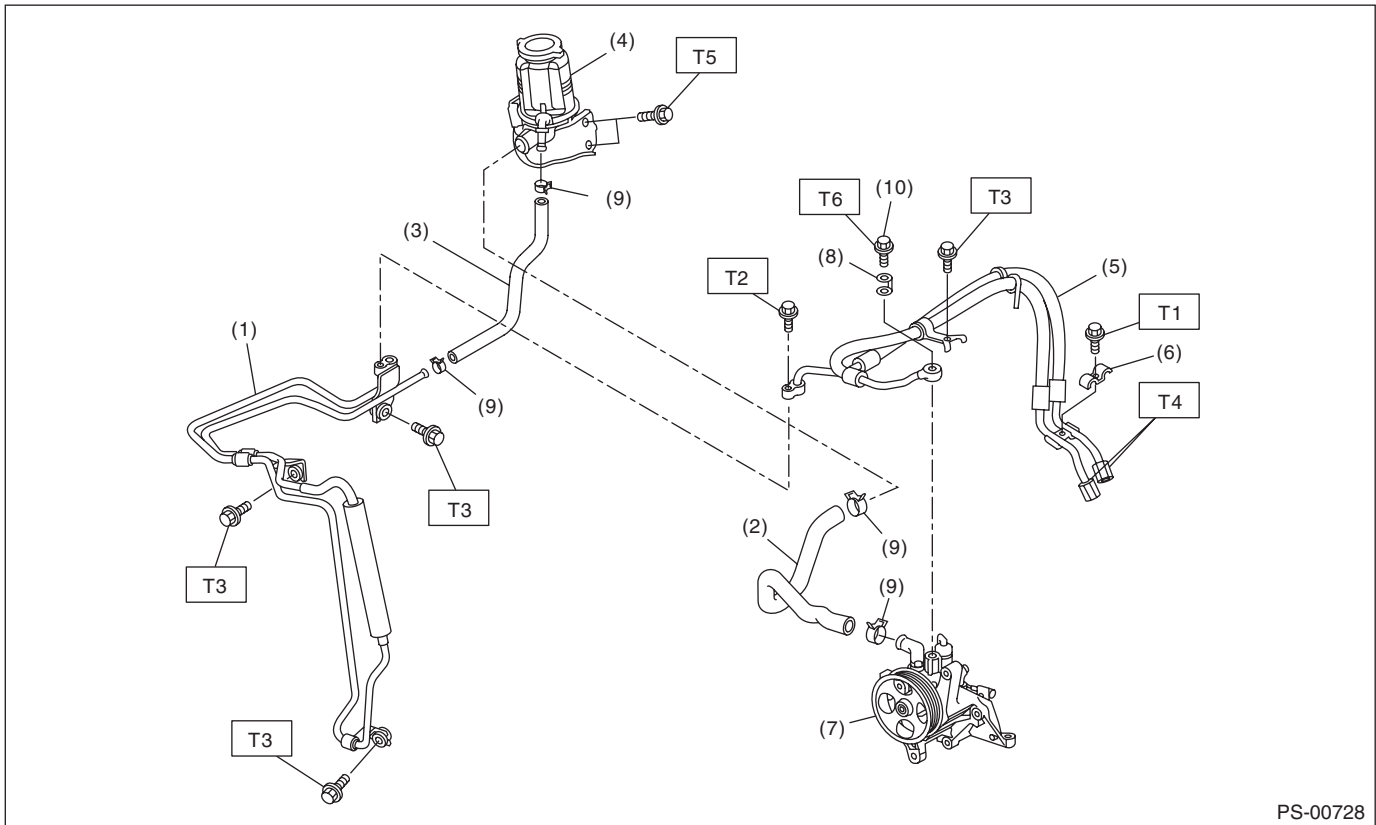
T3: 45 (4.6, 33.2)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

2. POWER ASSISTED SYSTEM

- Hose and tank



PS-00728

- | | |
|---------------------|---------------------|
| (1) Oil cooler pipe | (8) Eye bolt gasket |
| (2) Suction hose | (9) Clip |
| (3) Return hose | (10) Eye bolt |
| (4) Reservoir tank | |
| (5) Hose | |
| (6) Clamp E | |
| (7) Oil pump | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 8 (0.82, 5.9)

T2: 10 (1.02, 7.4)

T3: 13 (1.32, 9.6)

T4: 15 (1.5, 10.8)

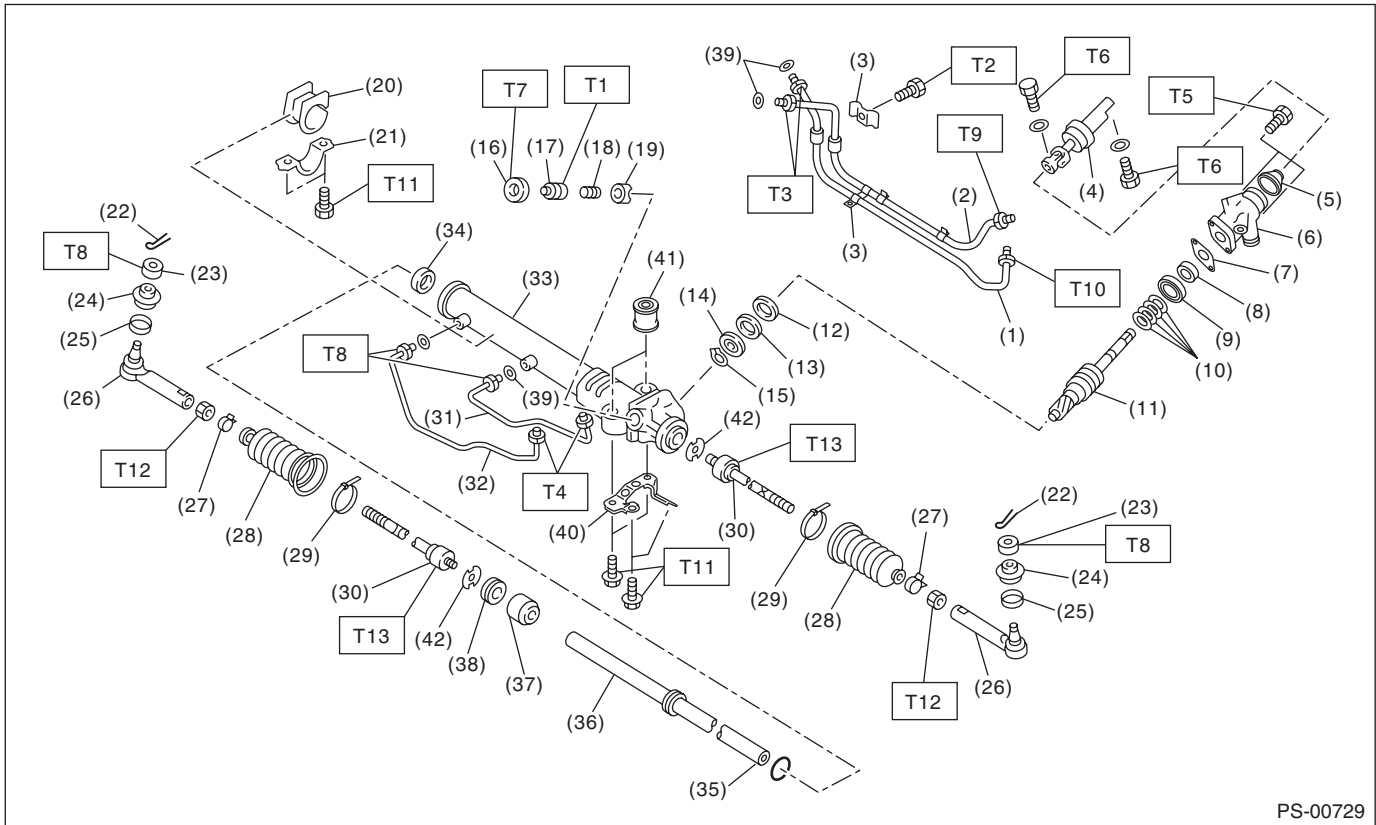
T5: 33 (3.37, 24.3)

T6: 40 (4.08, 29.5)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

• Gearbox



PS-00729

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

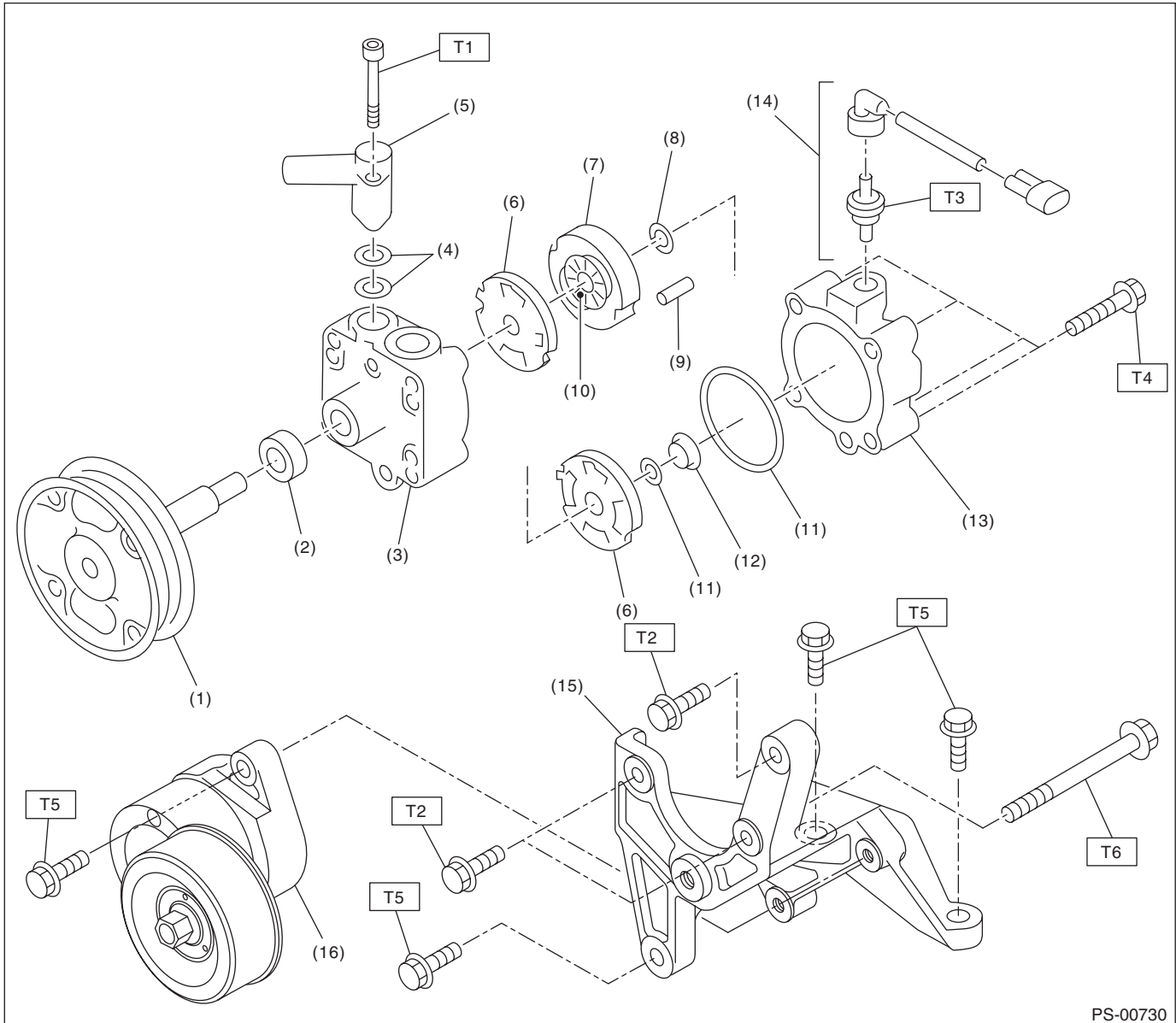
Tightening torque: N·m (kgf-m, ft-lb)

T1:	3.9 (0.4, 2.9)
T2:	9 (0.9, 6.6)
T3:	15 (1.5, 10.8)
T4:	17 (1.7, 12.5)
T5:	20 (2.0, 14.8)
T6:	24 (2.4, 17.4)
T7:	25 (2.5, 18.1)
T8:	27 (2.75, 19.9)
T9:	29 (3.0, 21.4)
T10:	37 (3.8, 27.3)
T11:	60 (6.1, 44.1)
T12:	85 (8.7, 62.7)
T13:	128 (13.1, 94.4)

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

3. OIL PUMP



PS-00730

- | | |
|--------------------|---------------------|
| (1) Pulley | (9) Straight pin |
| (2) Oil seal | (10) Rotor |
| (3) Front casing | (11) O-ring |
| (4) O-ring | (12) Seal ring |
| (5) Socket | (13) Rear body |
| (6) Pressure plate | (14) Connector |
| (7) Cam ring | (15) Bracket |
| (8) Snap ring | (16) Belt tensioner |

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 (3.37, 24.3)

T6: 36.8 (3.75, 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.

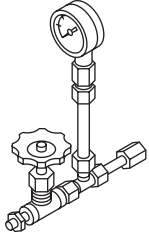
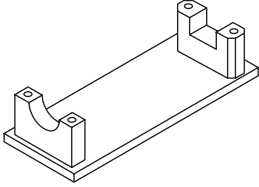
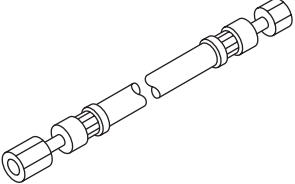
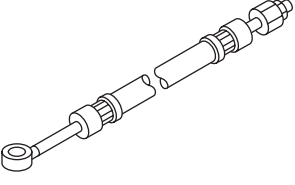
- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government and local regulations concerning waste disposal.

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

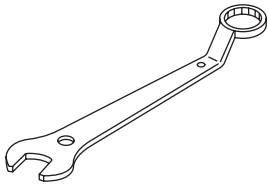
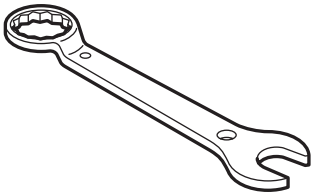
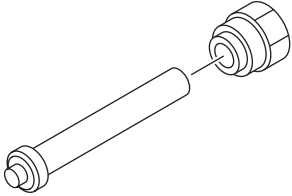
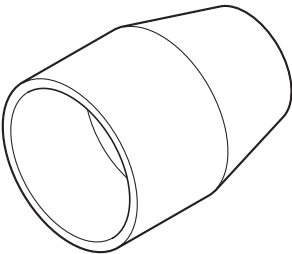
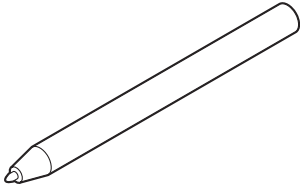
D: PREPARATION TOOL

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).
 ST34099AC010	34099AC010	ADAPTER HOSE A	Used together with PRESSURE GAUGE (925711000).
 ST34099AC020	34099AC020	ADAPTER HOSE B	Used together with PRESSURE GAUGE (925711000).

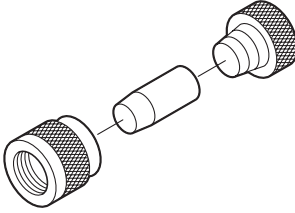
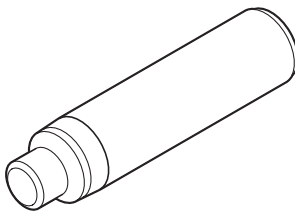
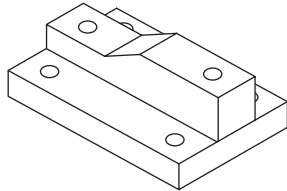
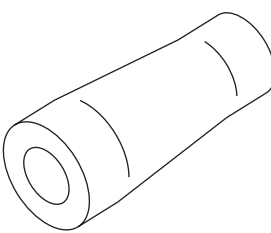
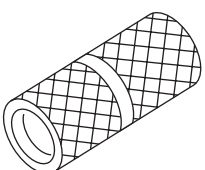
General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-926230000	926230000	SPANNER	For the lock nut when adjusting backlash of gearbox.
 ST34099PA100	34099PA100	SPANNER	Used when measuring the rotating 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.
 ST-926250000	926250000	GUIDE	Used for installing the holder assembly into the rack housing.
 ST34099FA060	34099FA060	PUNCH HOLDER	Used for crimping.

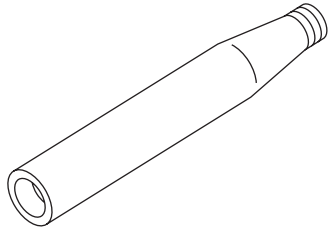
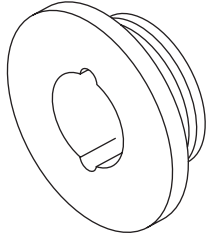
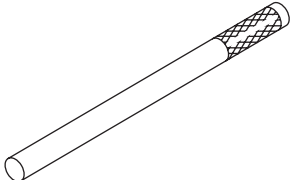
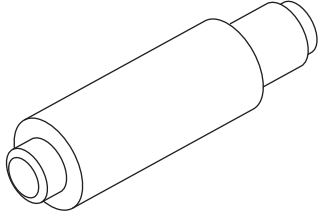
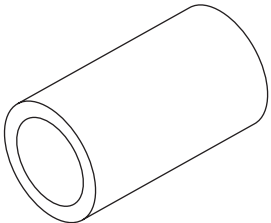
General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 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 & 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.
 ST34199AG070	34199AG070	FORMER	Used for forming seal ring of pinion.

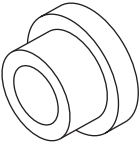
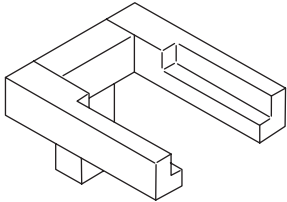
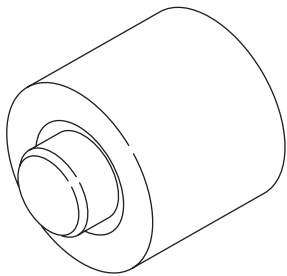
General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199AG020	34199AG020	GUIDE	Used for installing seal ring of pinion.
 ST34199AG060	34199AG060	GUIDE G (26)	• Used for forming seal ring of rack. • Used together with FORMER PISTON (34199XA020).
 ST34199AE050	34199AE050	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.
 ST34199XA020	34199XA020	FORMER PISTON 44	• Used for forming seal ring of rack. • Used together with GUIDE G (26) (34199AG060).

General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST34199XA000	34199XA000	INSTALLER 44	Used for pressing-fit oil seal of gearbox cylinder.
 ST34199AE020	34199AE020	MOUNT	Used for removing oil pump.
 ST34199AE030	34199AE030	INSTALLER	Used for installing the oil seal to the oil pump.

Steering Wheel

POWER ASSISTED SYSTEM (POWER STEERING)

2. Steering Wheel

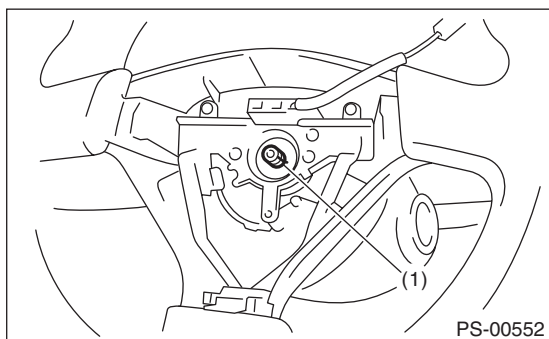
A: REMOVAL

- 1) Disconnect the ground cable from the 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-22, 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:

45 N·m (4.6 kgf-m, 33.2 ft-lb)

Column cover-to-steering wheel clearance:

2 — 4 mm (0.08 — 0.16 in)

CAUTION:

Insert the roll connector guide pin into the guide hole on the lower end of the steering wheel surface. Avoid damaging the pin.

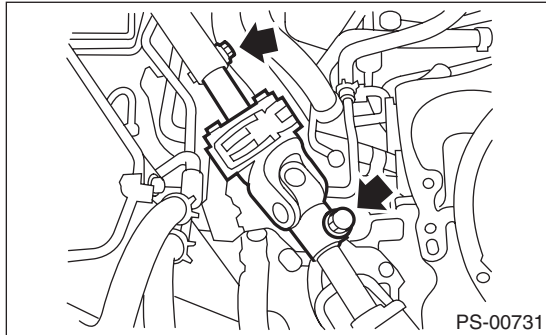
C: INSPECTION

- 1) Check the steering wheel for deformation. If the deformation is excessive, replace the steering wheel.
- 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-14, REMOVAL, Steering Wheel.>
- 2) Place alignment marks on universal joint.
- 3) Remove the universal joint bolt, and then 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 bolt.

Tightening torque:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

CAUTION:

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

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-22, ADJUSTMENT, Roll Connector.>
- 5) Install the steering wheel. <Ref. to PS-14, INSTALLATION, Steering Wheel.>

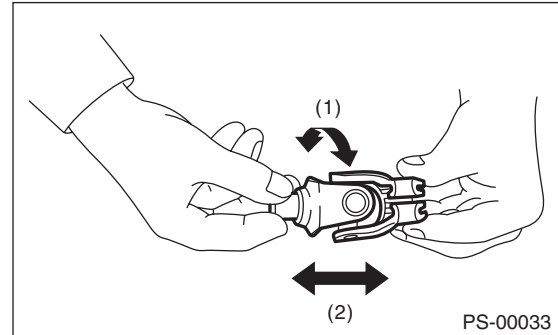
C: INSPECTION

Check for wear, damage or any other faults. Replace as necessary.

Service limit:

Universal joint play: 0 mm (0 in)

Maximum swing torque: 0.3 N (0.03 kgf, 0.07 lb)



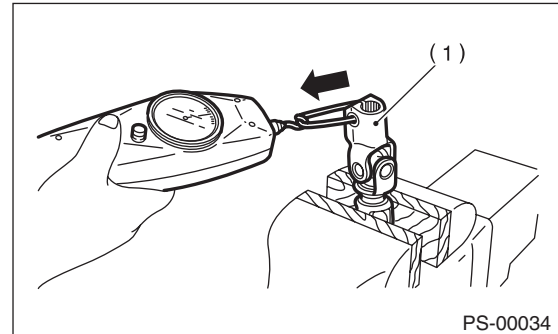
(1) Swing torque

(2) Play

Measure the swing torque of universal joint.

Service limit:

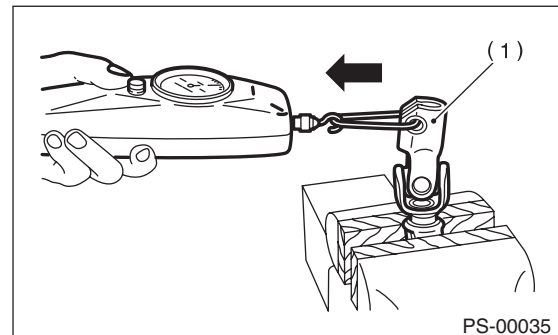
Maximum load: 3.8 N (0.39 kgf, 0.86 lb) or less



(1) Yoke (Gearbox side)

Service limit:

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



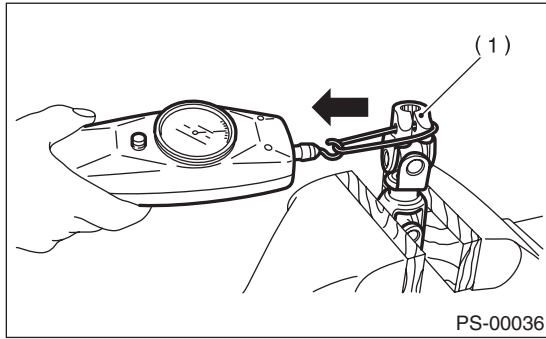
(1) Yoke (Gearbox side)

Universal Joint

POWER ASSISTED SYSTEM (POWER STEERING)

Service limit:

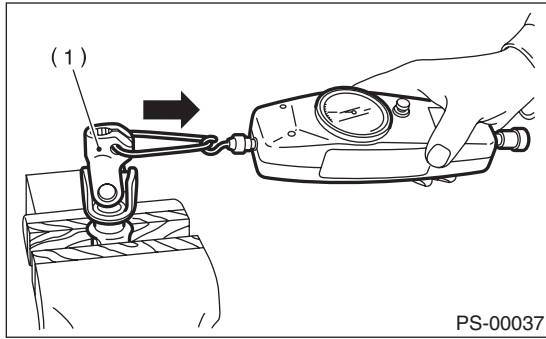
Maximum load: 7.3 N (0.74 kgf, 1.64 lb) or less



(1) Yoke (Steering column side)

Service limit:

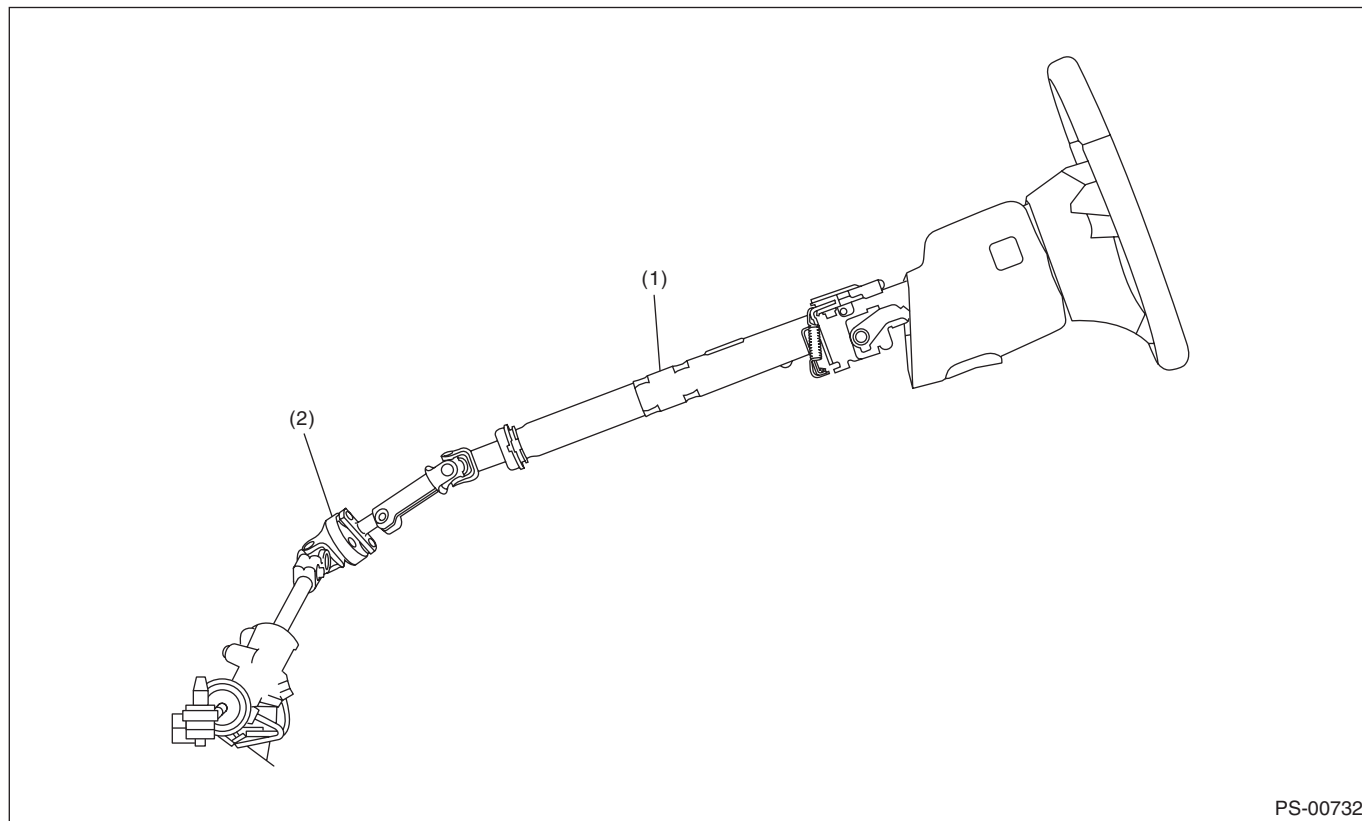
Maximum load: 7.3 N (0.74 kgf, 1.64 lb) or less



(1) Yoke (Steering column side)

4. Tilt Steering Column

A: REMOVAL



PS-00732

(1) Tilt steering column

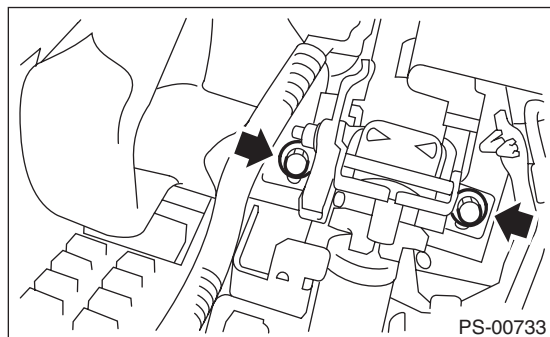
(2) Universal joint

- 1) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 2) Remove the universal joint. <Ref. to PS-15, REMOVAL, Universal Joint.>
- 3) Remove the instrument panel lower cover under.
- 4) Remove the instrument panel lower cover upper.
- 5) Remove all connectors from the steering column.
- 6) Remove the two bolts under instrument panel securing the steering column.

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

CAUTION:

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



PS-00733

Tilt Steering Column

POWER ASSISTED SYSTEM (POWER STEERING)

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:

25 N·m (2.5 kgf-m, 18.1 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-15, INSTALLATION, Universal Joint.>
- 7) Align the center position of the roll connector. <Ref. to AB-22, ADJUSTMENT, Roll Connector.>
- 8) Install the steering wheel. <Ref. to PS-14, 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 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, 0.9 ft-lb)

CAUTION:

Do not overtorque the screw.

E: INSPECTION

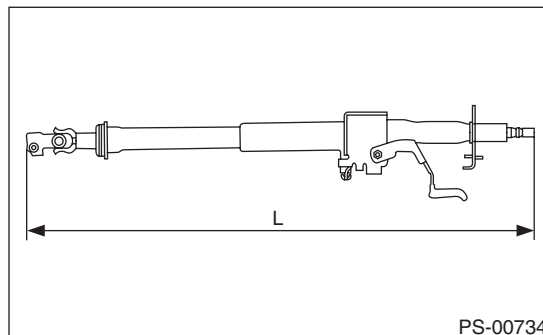
1. BASIC INSPECTION

Measure the overall length of steering column. If not within specification, replace it.

Overall length L:

Specification

917.5 ^{+1.3}mm _{-0.3}mm (36.12 ^{+0.051}in _{-0.020}in)



2. INSPECTION OF AIRBAG SYSTEM

WARNING:

Refer to “Airbag System” for airbag inspection procedure. <Ref. to AB-4, CAUTION, General Description.>

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5. Steering Gearbox

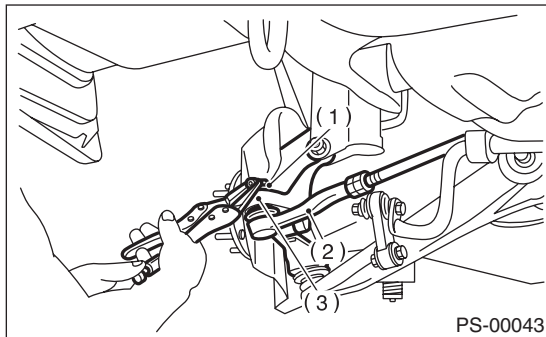
A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Lift-up the vehicle, and remove the front wheels.
- 4) Remove the under cover. <Ref. to EI-17, REMOVAL, Front Under Cover.>
- 5) Remove the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.>

WARNING:

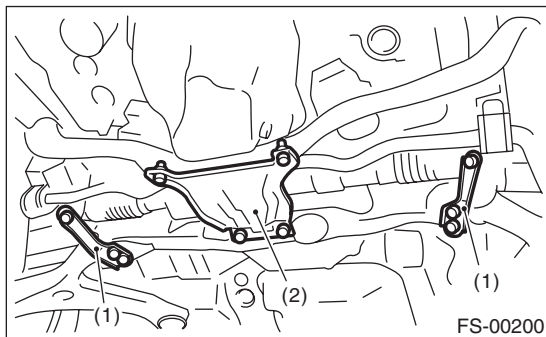
Be careful not to burn yourself because the exhaust pipe is hot.

- 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.



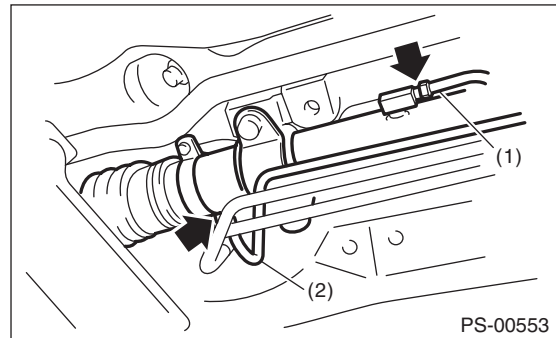
- (1) Castle nut
- (2) Tie-rod end
- (3) Knuckle arm

- 7) Remove the front crossmember support plate, jack-up plate and front stabilizer. <Ref. to FS-16, REMOVAL, Front Stabilizer.>



- (1) Crossmember support plate
- (2) Jack-up plate

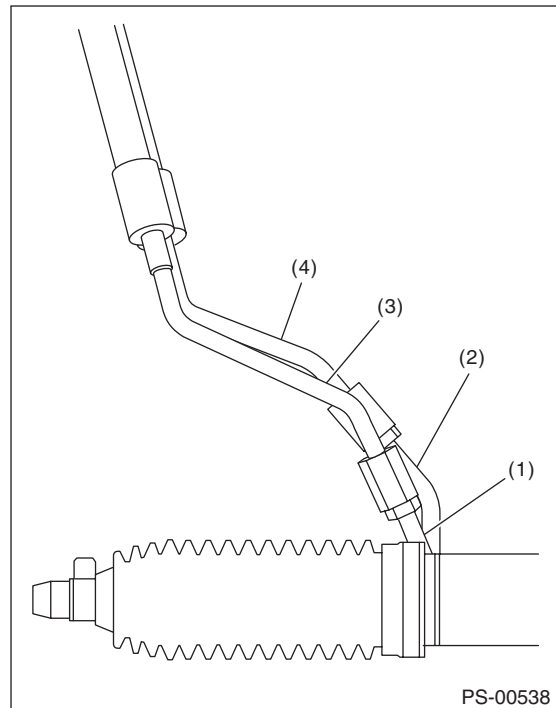
- 8) Remove the one pipe joint at the center of the gearbox, and connect the vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



- (1) Pipe A
- (2) Pipe B

- 9) Remove the universal joint. <Ref. to PS-15, REMOVAL, Universal Joint.>

- 10) Disconnect the pipe C from pressure hose first, then disconnect pipe D from the return hose.

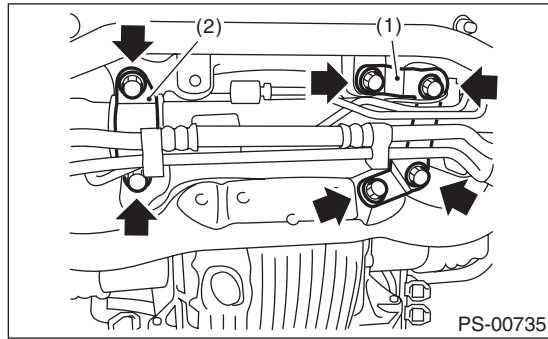


- (1) Pipe C
- (2) Pipe D
- (3) Pressure hose
- (4) Return hose

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

11) Remove the gear box bracket and clamp, and remove the gearbox.



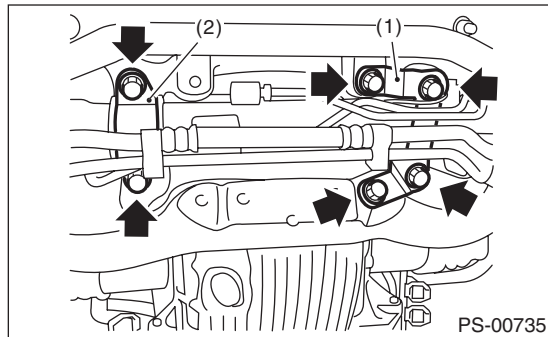
- (1) Bracket
- (2) Clamp

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, 44.1 ft-lb)

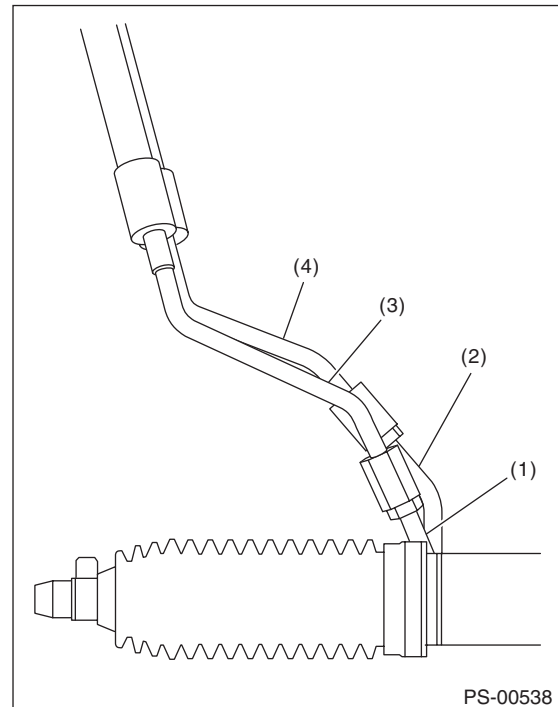


- (1) Bracket
- (2) Clamp

3) Connect the pipe D to return hose first, and the pipe C to pressure hose second.

Tightening torque:

15 N·m (1.5 kgf-m, 10.8 ft-lb)



- (1) Pipe C
- (2) Pipe D
- (3) Pressure hose
- (4) Return hose

4) Install the universal joint. <Ref. to PS-15, INSTALLATION, Universal Joint.>

5) Connect the tie-rod end and knuckle arm, and tighten with castle nut.

Castle nut tightening torque:

27 N·m (2.75 kgf-m, 19.9 ft-lb)

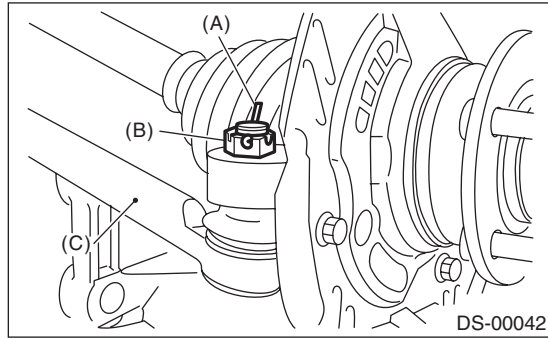
CAUTION:

When connecting, do not hit the cap at 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-16, INSTALLATION, Front Stabilizer.>

8) Install the front crossmember support plate and jack-up plate.

9) Install the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.>

10) Install the under cover. <Ref. to EI-17, INSTALLATION, Front Under Cover.>

11) Install the front wheels.

12) Tighten the wheel nuts to the 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) Lower the vehicle.

14) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>

15) Align the center position of the roll connector. <Ref. to AB-22, ADJUSTMENT, Roll Connector.>

16) Install the steering wheel. <Ref. to PS-14, INSTALLATION, Steering Wheel.>

17) Connect the battery ground cable to the battery.

18) Pour fluid into the oil tank, and bleed air. <Ref. to PS-49, Power Steering Fluid.>

19) Check for fluid leaks.

20) Check the fluid level in oil tank.

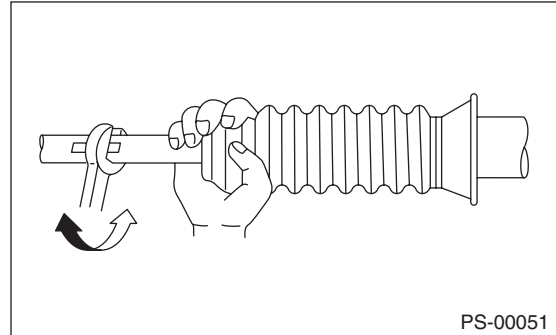
21) After adjusting toe-in and steering angle, tighten the lock nut on tie-rod end.

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.

NOTE:

Remove the pipes C and D, which are fixed to clamp plate, as a unit.

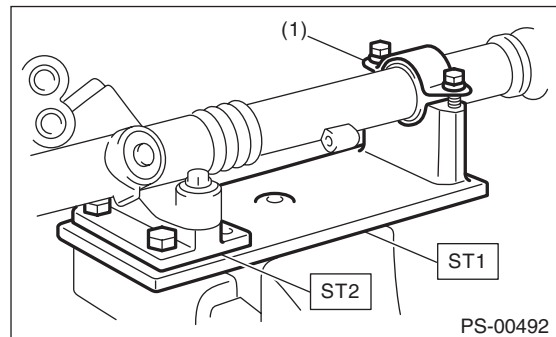
2) Secure the gearbox removed from vehicle in a vise using ST.

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.



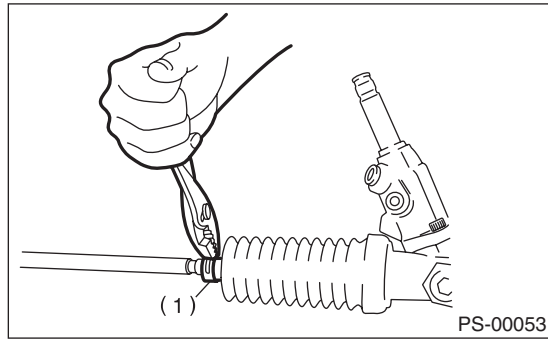
- (1) Clamp

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.

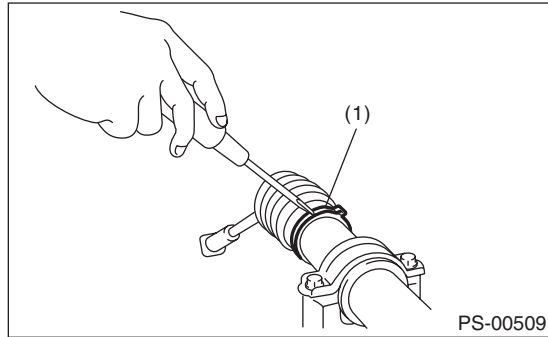


(1) Clip

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

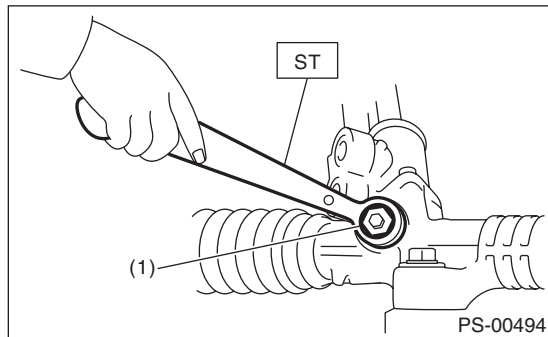
NOTE:

Replace the boot if there is damage, cracks or deterioration.



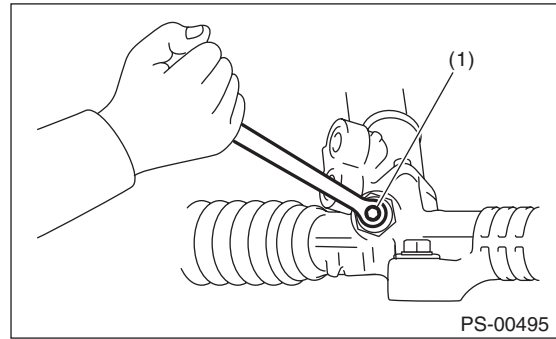
(1) Band

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



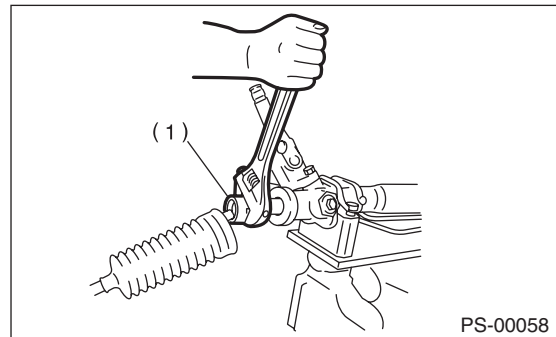
(1) Lock nut

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



(1) Adjusting screw

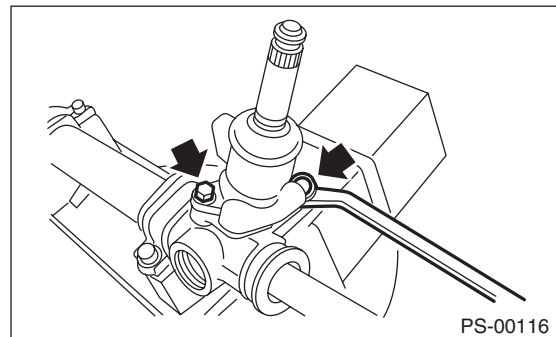
8) While securing the rack with a 22 mm (0.87 in) wrench, remove the tie-rod using 32 mm (1.26 in) wrench or adjustable wrench.



(1) Holder

9) Loosen the adjusting screw, and remove the spring and sleeve.

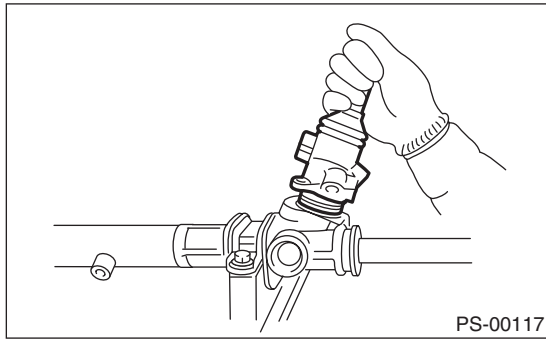
10) Remove the two bolts securing valve assembly.



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

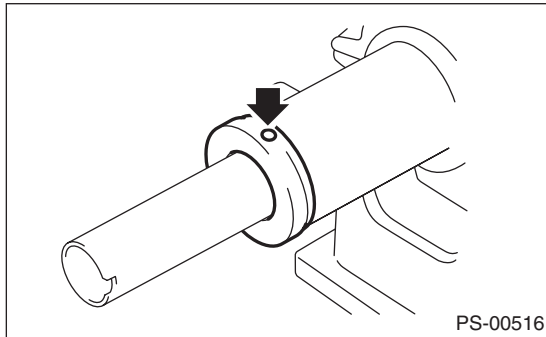
11) Carefully draw out the input shaft and remove the valve assembly.



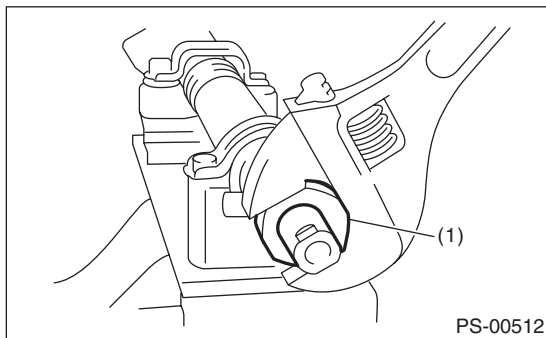
12) Using a drill, release the crimping of holder.

CAUTION:

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



13) Remove the holder using a 36 mm (1.42 in) wrench or adjustable wrench.



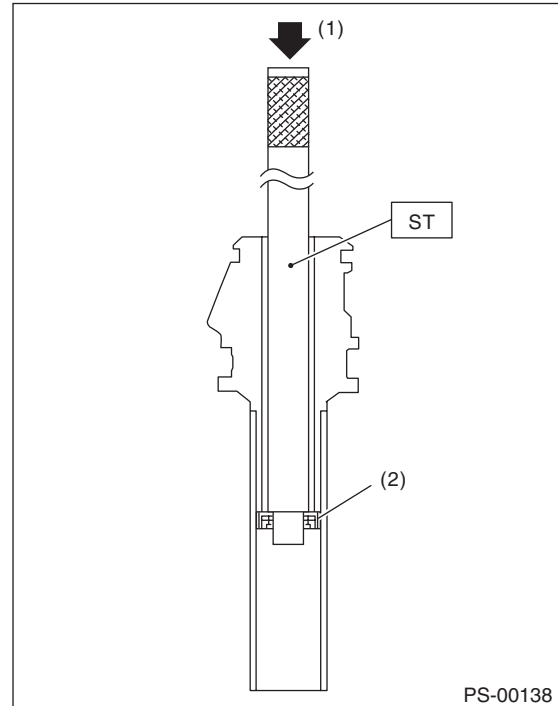
(1) Holder

14) Remove the rack bushing and rack stopper from rack assembly.

15) Remove the oil seal from rack.

16) Insert the ST from pinion housing side and remove the oil seal using a press.

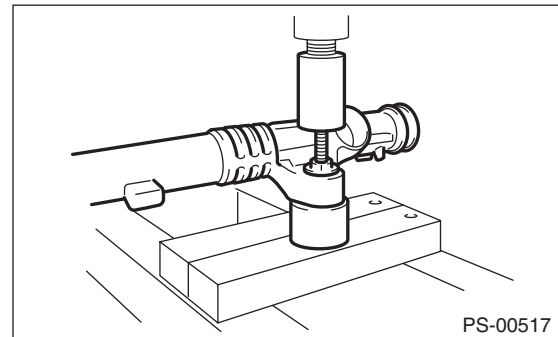
ST 34199AE050 OIL SEAL REMOVER



(1) Press

(2) Oil seal

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



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

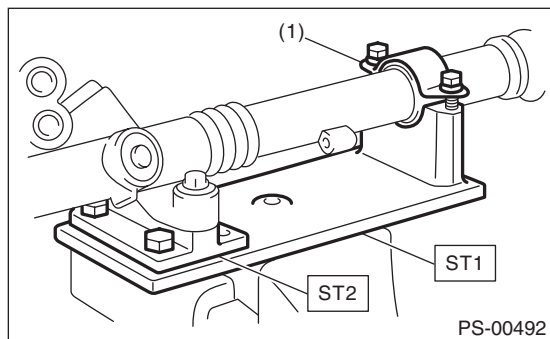
2. CONTROL VALVE

- 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

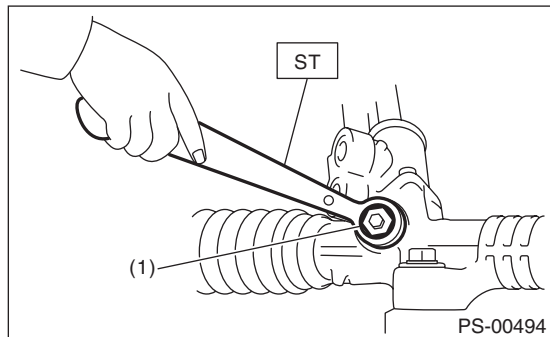
CAUTION:

Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.



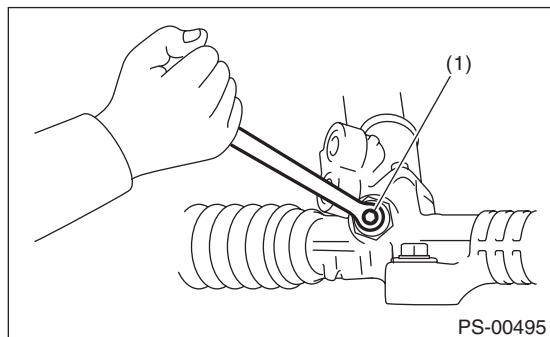
(1) Clamp

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



(1) Lock nut

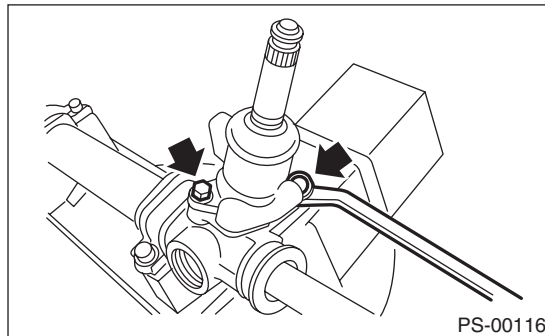
- 4) Tighten the adjusting screw until it can no longer be tightened.



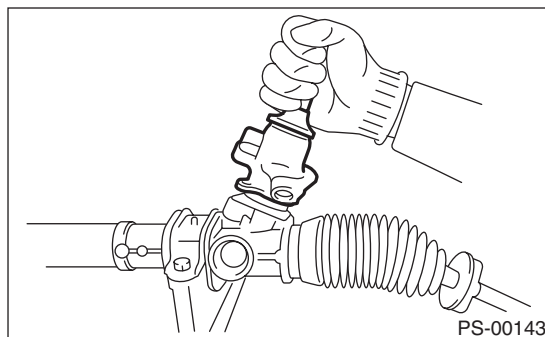
(1) Adjusting screw

- 5) Loosen the adjusting screw, and remove the spring and sleeve.

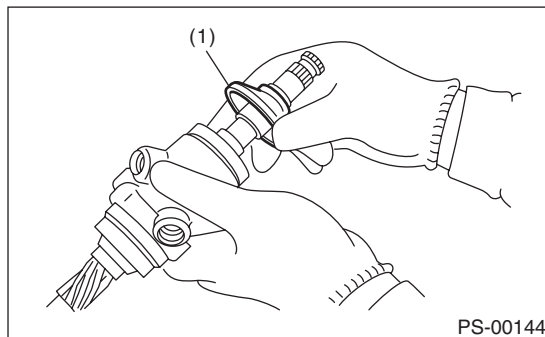
- 6) Remove the two bolts securing valve assembly.



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

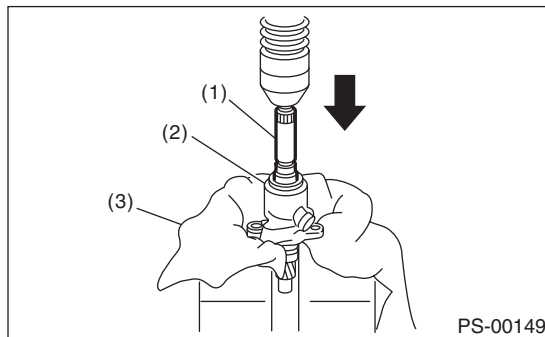


- 8) Put a vinyl tape around the spline portion, and slide the dust cover to remove.



(1) Dust cover

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



- (1) Pinion and valve ASSY
(2) Valve housing
(3) Cloth

Steering Gearbox

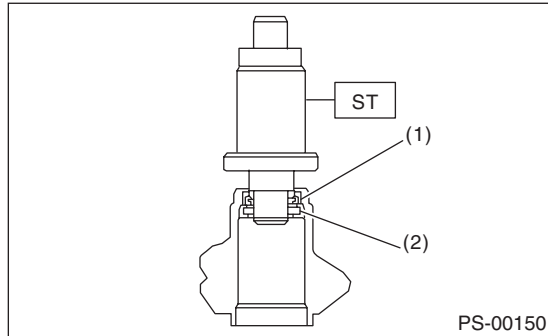
POWER ASSISTED SYSTEM (POWER STEERING)

10) 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.

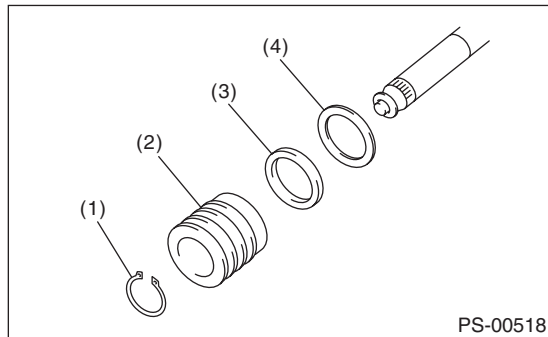


- (1) Oil seal
(2) Bushing

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

CAUTION:

Be careful not to scratch the pinion and valve assembly.

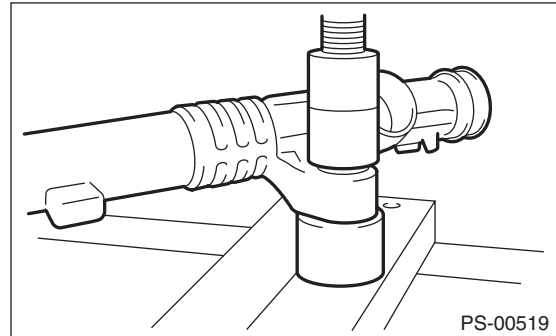


- (1) Snap ring
(2) Valve
(3) Oil seal
(4) Back-up ring

D: ASSEMBLY

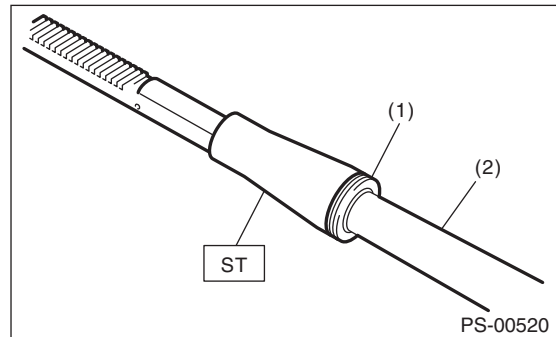
1. RACK HOUSING ASSEMBLY

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



2) Insert the ST to rack.

ST 34199XA010 GUIDE 44



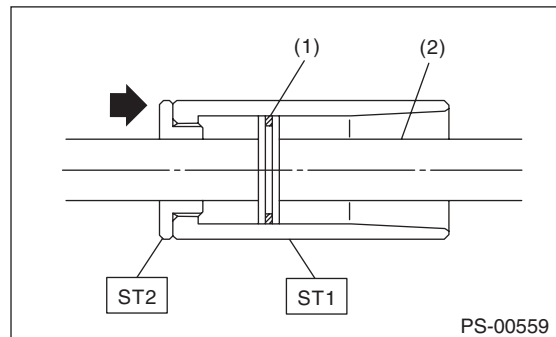
- (1) Seal ring
(2) Rack

3) Install the seal ring to piston portion of rack.

(1) Using the ST, form the seal ring properly.

ST1 34199XA020 FORMER PISTON 44

ST2 34199AG060 GUIDE G (26)



- (1) Seal ring
(2) Rack

Steering Gearbox

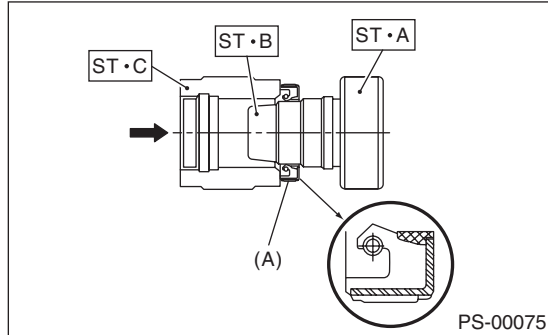
POWER ASSISTED SYSTEM (POWER STEERING)

(2) Using the ST B and ST C, attach the oil seal to ST A.

ST 34199FE040 INSTALLER A, B, C

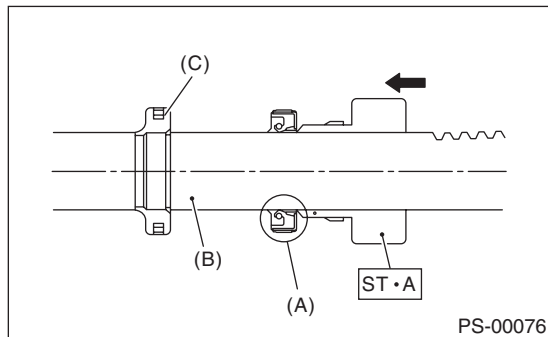
NOTE:

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



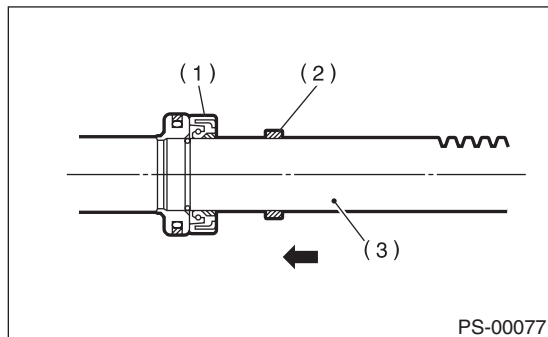
(A) Oil seal

(3) 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

4) Install the back-up washer from the gear side of rack.



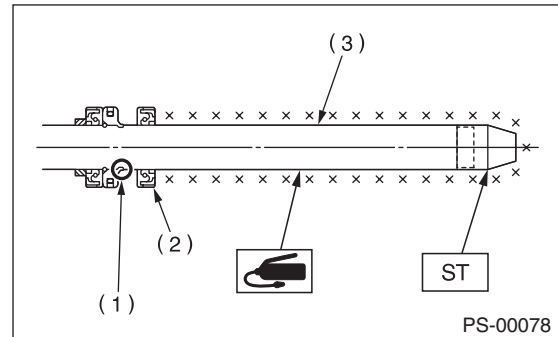
(1) Oil seal
(2) Back-up washer
(3) Rack

5) Attach the ST on rack, equally apply a thin coat of grease to the rack and ST, and then install the oil seal.

ST 926250000 GUIDE

CAUTION:

Be careful not to scratch the oil seal lips with the inner ring section of piston.



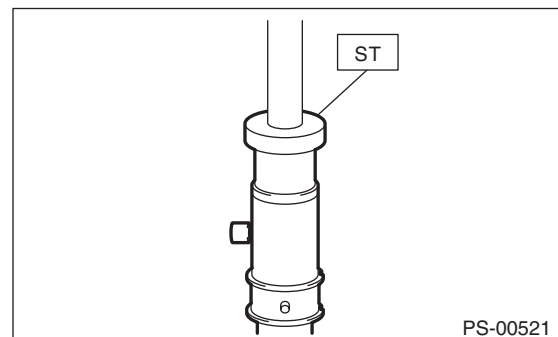
(1) Rack piston inner ring
(2) Outer side oil seal
(3) Rack

6) 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.

7) Check the threaded end of holder and gearbox cylinder end for burrs, damage, etc. Correct if faulty.

8) Insert the ST into gearbox cylinder, and then press-fit the oil seal.

ST 34199XA000 INSTALLER 44



9) Temporarily tighten the holder to gearbox cylinder.

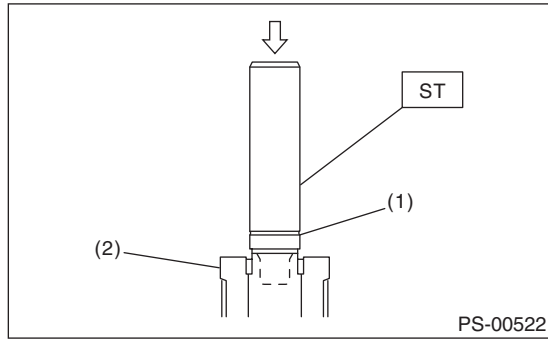
10) Set the ST to the end of rack.

ST 34199XA030 INSTALLER & REMOVER 44

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

11) Using a press, press-fit until the groove of ST are aligned to the end surface of holder.

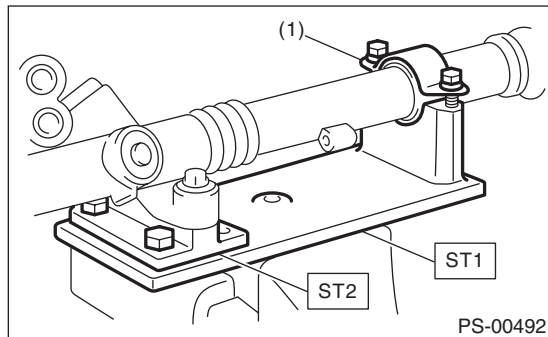


- (1) Groove
- (2) Holder

12) Secure the gearbox in a vise using ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

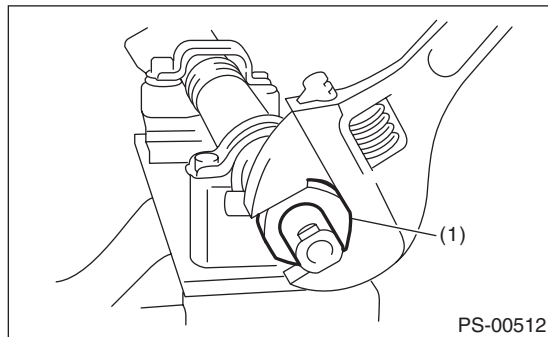


- (1) Clamp

13) Tighten the holder.

Tightening torque:

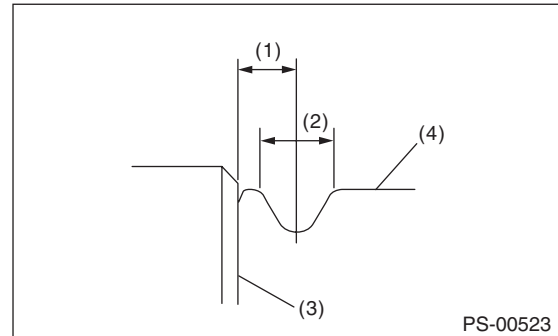
85 N·m (8.7 kgf-m, 62.7 ft-lb)



- (1) Holder

14) 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.

ST 34099FA060 PUNCH HOLDER

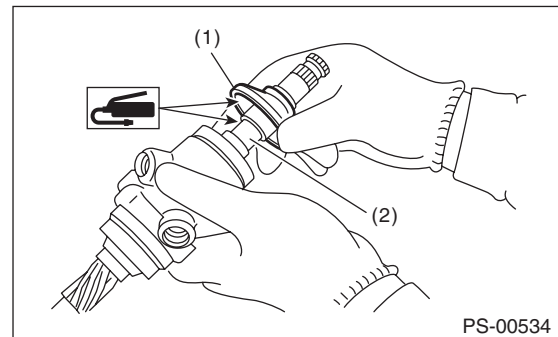


- (1) 2 mm (0.08 in)
- (2) Diameter: 2 — 2.5 mm (0.08 — 0.10 in)
- (3) End of cylinder
- (4) Holder

15) Put a vinyl tape around the spline portion and apply genuine grease to the dust cover and install to valve assembly.

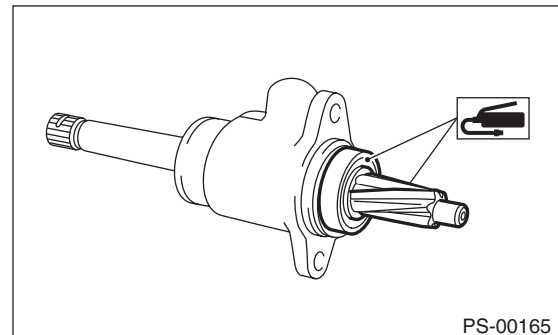
CAUTION:

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



- (1) Dust cover
- (2) Groove

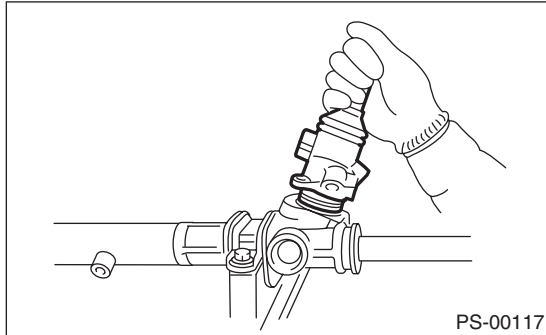
16) Apply the genuine grease to the pinion gear and bearing of valve assembly.



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

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



18) 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.

19) Temporarily install the tie-rod to rack end, and then operate the rack from lock to lock for two or three times to make it fit in. Remove any grease blocking the air vent hole.

CAUTION:

Operating the rack from lock to lock without installing tierods may damage the oil seal. Always install the LEFT AND RIGHT tierods.

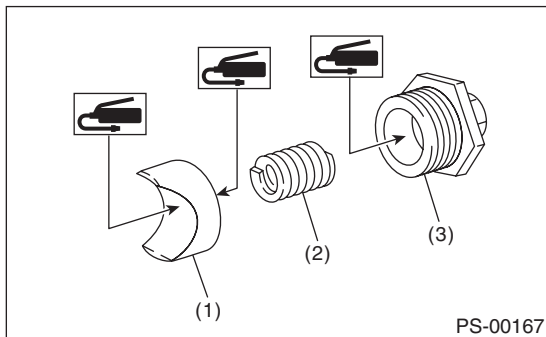
20) Apply liquid gasket to more than 1/3 of entire perimeter of adjusting screw thread.

Liquid gasket:

THREE BOND 1141

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:

3.9 N-m (0.4 kgf-m, 2.9 ft-lb)

23) Tighten the adjusting screw to the specified torque, then loosen it 20°.

24) Remove the tie-rod.

25) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-36, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>

26) Apply liquid gasket to lock nut and install it into adjusting screw. While holding the adjusting screw with wrench, tighten the lock nut using ST.

Liquid gasket:

THREE BOND 1141

ST 926230000 SPANNER

Tightening torque (lock nut):

25 N-m (2.5 kgf-m, 18.1 ft-lb)

NOTE:

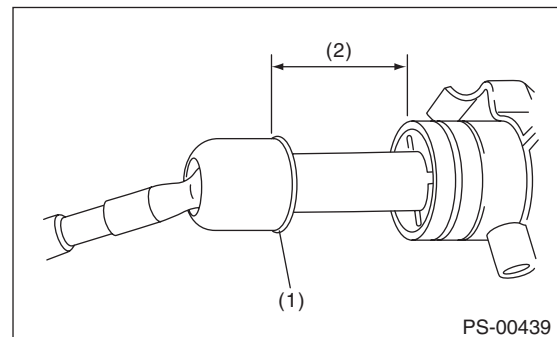
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

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

28) 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)

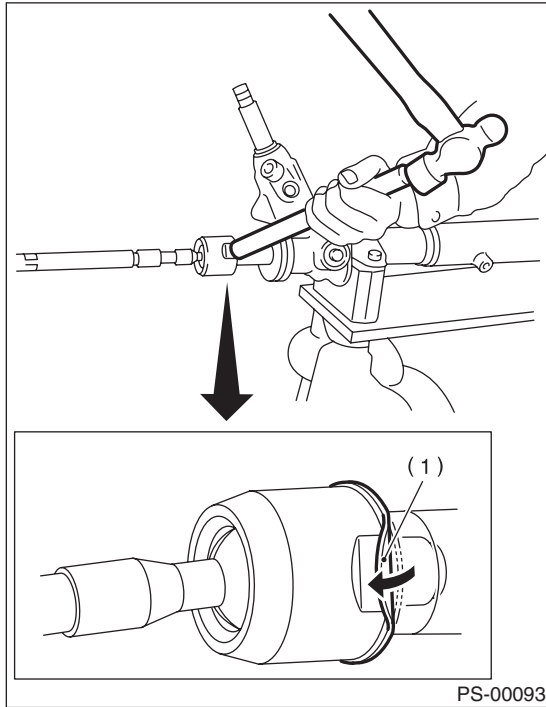
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

29) Bend the lock washer and crimp it.

CAUTION:

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

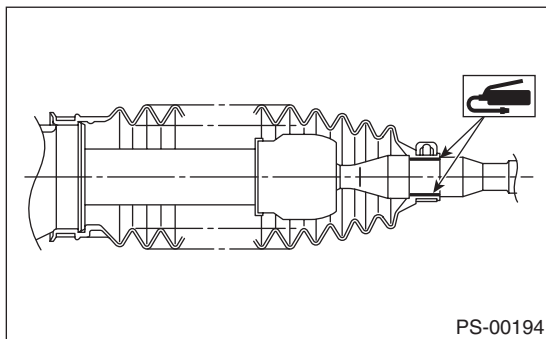


(1) Lock washer

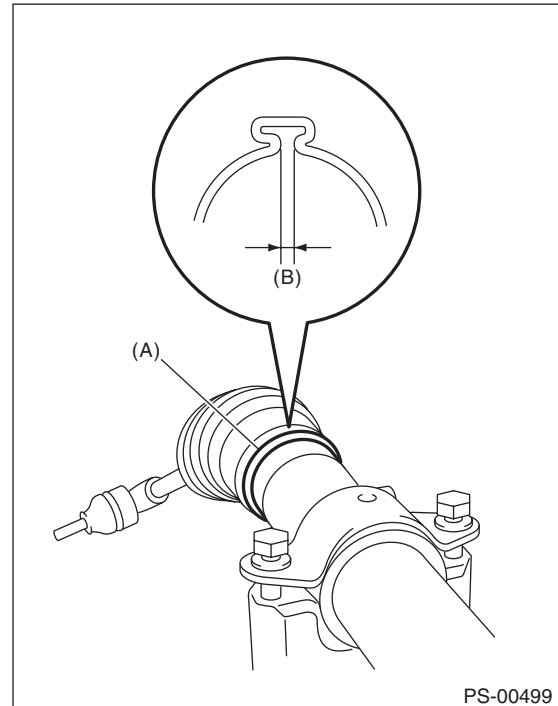
30) Apply a coat of grease to the tie-rod groove, and then install the boot to the housing.

NOTE:

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



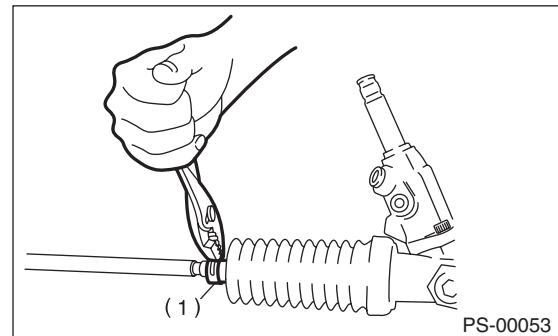
31) Install a new boot band. Using band clamp pliers, crimp it so that the clearance of crimping portion becomes 2 mm (0.079 in) or less.



(A) Boot band

(B) 2 mm (0.079 in) or less

32) Fix the boot end with small clip.



(1) Clip

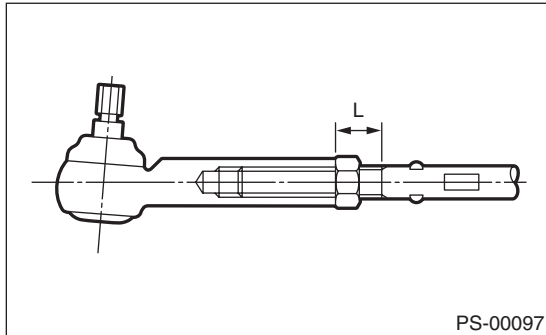
33) After installing, check that the boot end is installed to the groove of the tie-rod.

Steering Gearbox

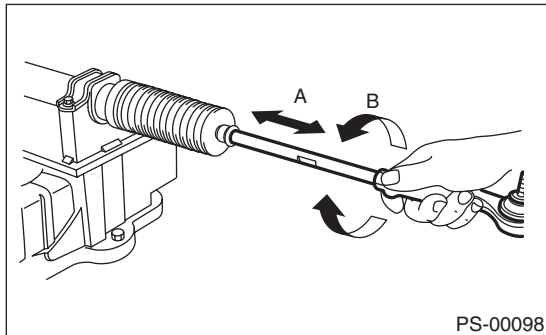
POWER ASSISTED SYSTEM (POWER STEERING)

34) 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)



35) Inspect the gearbox as follows:
Holding the “A” tie-rod end, repeat movement from lock to lock two or three times as quickly as possible.
Holding the “B” tie-rod end, turn a few times as slowly as possible.
Finally, make sure that the boot is installed in the specified position without inflating.



36) Remove the gearbox from ST.
ST1 926200000 STAND
ST2 34199AG000 BOSS D

37) Install the four pipes on gearbox.

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

Tightening torque:

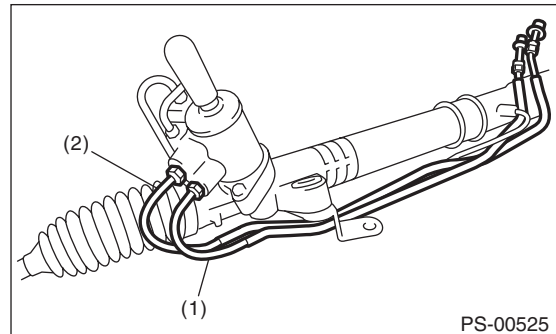
Refer to the component parts. <Ref. to PS-5, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

(2) Connect the pipes C and D to gearbox.

Tightening torque:

Pipe C: 37 N·m (3.8 kgf-m, 27.3 ft-lb)

Pipe D: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(1) Pipe C

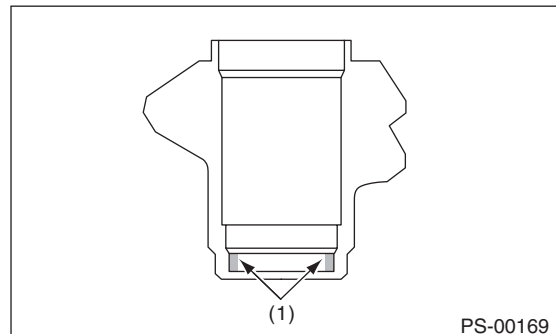
(2) Pipe D

2. CONTROL VALVE ASSEMBLY

Specified steering grease:

VALIANT GREASE M2 (Part No. 003608001)

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



(1) Apply fluid.

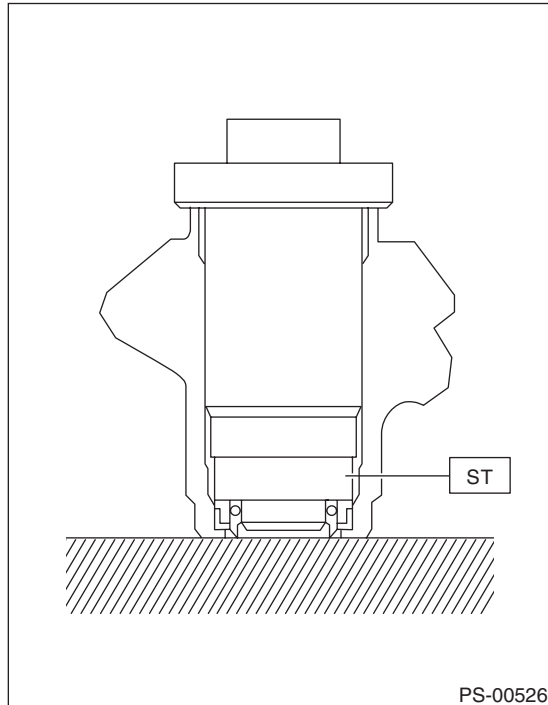
3) To avoid scratching the oil seal, apply a coat of grease to the contact surface of installer and oil seal.

4) Verify the direction of oil seal. Install the oil seal to installer and position it to valve housing.

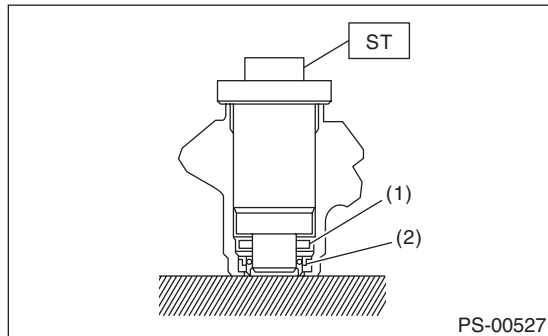
Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

- 5) Press the oil seal into position using press.
ST 34199AG090 INSTALLER & REMOVER



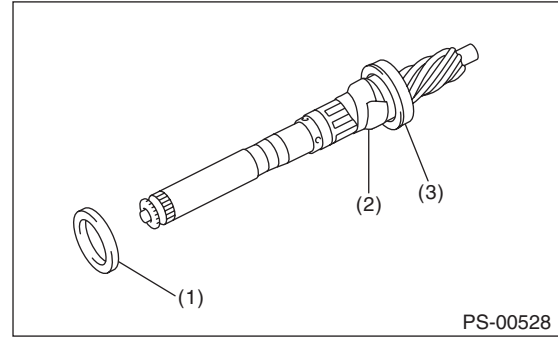
- 6) Install the bearing to ST and position it to housing. Using the ST and a press, install the special bearing in valve housing.
ST 34199AG090 INSTALLER & REMOVER



- (1) Special bearing
(2) Oil seal

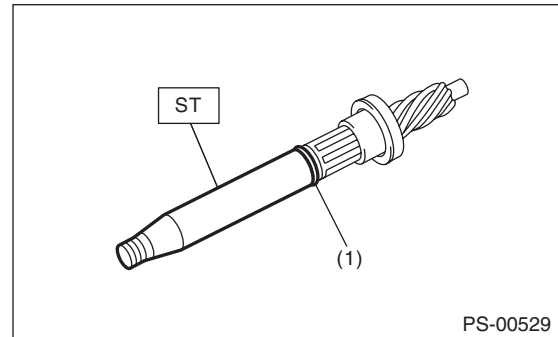
- 7) Apply vinyl tape to the groove of pinion.

- 8) Install the back-up ring and oil seal to pinion, and then remove the vinyl tape.



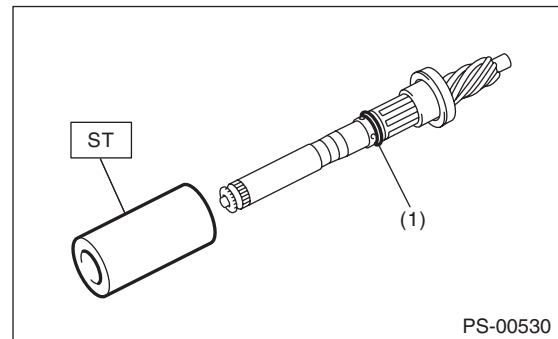
- (1) Oil seal
(2) Vinyl tape
(3) Back-up ring

- 9) Attach the ST to pinion, and install the seal ring.
ST 34199AG020 GUIDE



- (1) Seal ring

- 10) Remove the ST GUIDE, and form the seal ring properly using ST FORMER.
ST 34199AG070 FORMER



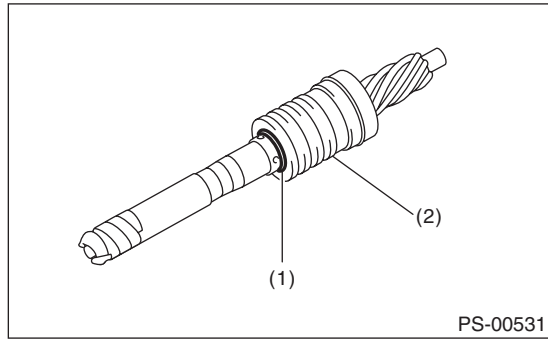
- (1) Seal ring

- 11) Put vinyl tape around pinion shaft spline to protect oil seal from damage.

Steering Gearbox

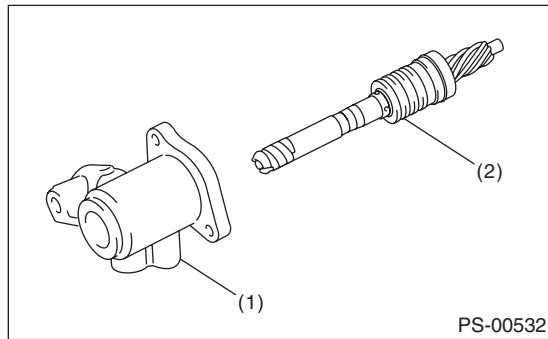
POWER ASSISTED SYSTEM (POWER STEERING)

12) Install the valve to pinion, and install the snap ring.



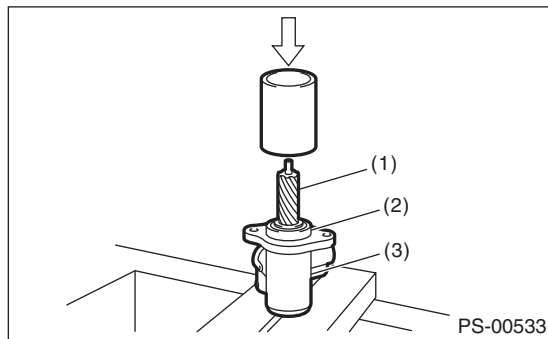
- (1) Snap ring
- (2) Valve

13) Attach the pinion and valve assembly into the valve housing.



- (1) Valve housing
- (2) Pinion and valve ASSY

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



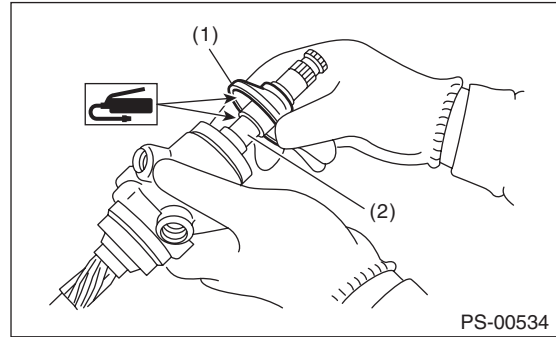
- (1) Pinion and valve ASSY
- (2) Bearing
- (3) Housing

15) Apply the specified grease to dust cover.

16) Install the dust cover on valve assembly.

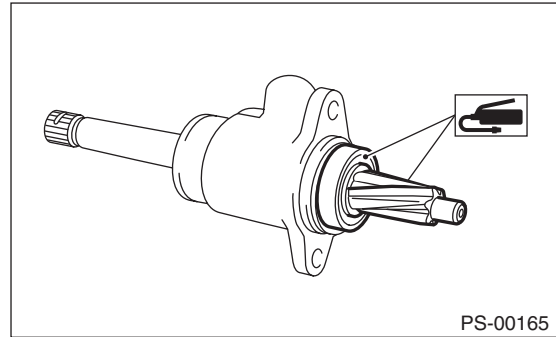
CAUTION:

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

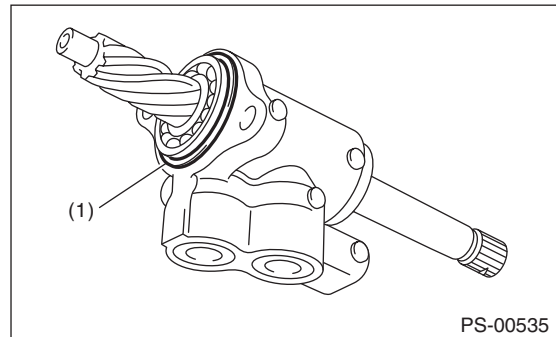


- (1) Dust cover
- (2) Groove

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



18) Install new O-ring to valve assembly.

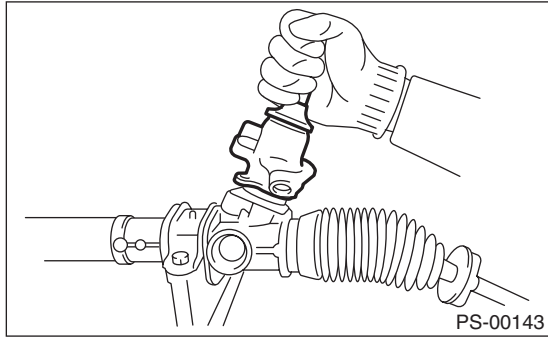


- (1) O-ring

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

19) Insert the valve assembly into place while facing the rack teeth toward pinion.



20) 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.

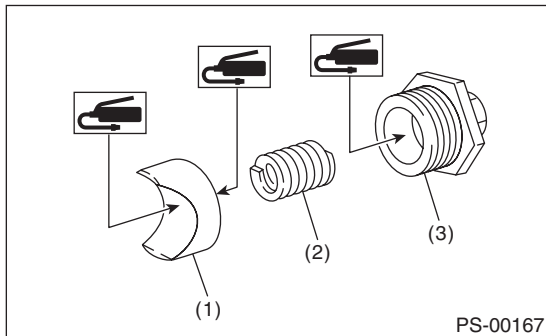
21) Apply liquid gasket to more than 1/3 of entire perimeter of adjusting screw thread.

Liquid gasket:

THREE BOND 1141 (Part No. 004403006)

22) 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

23) Tighten the adjusting screw to the specified torque.

Tightening torque:

3.9 N·m (0.4 kgf-m, 2.9 ft-lb)

24) Tighten the adjusting screw to the specified torque, then loosen it 20°.

25) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-36, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>

26) Apply liquid gasket to lock nut and install it into adjusting screw. While holding the adjusting screw with wrench, tighten the lock nut using ST.

Liquid gasket:

THREE BOND 1141 (Part No. 004403006)

ST 926230000 SPANNER

Tightening torque (lock nut):

25 N·m (2.5 kgf-m, 18.1 ft-lb)

NOTE:

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

27) Remove the gearbox from ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

28) Install the four pipes on gearbox.

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

Tightening torque:

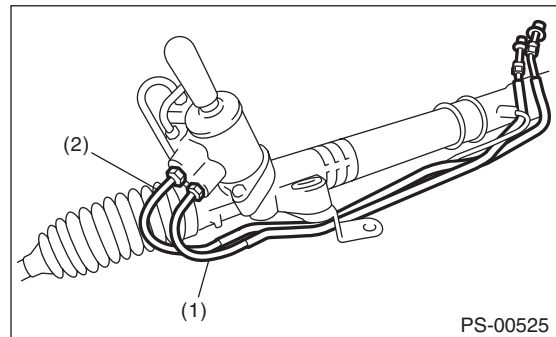
Refer to the component parts. <Ref. to PS-5, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

(2) Connect the pipes C and D to gearbox.

Tightening torque:

Pipe C: 37 N·m (3.8 kgf-m, 27.3 ft-lb)

Pipe D: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



- (1) Pipe C
- (2) Pipe D

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 and 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 cast iron 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.

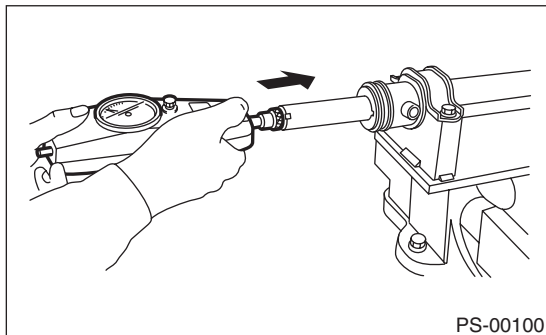
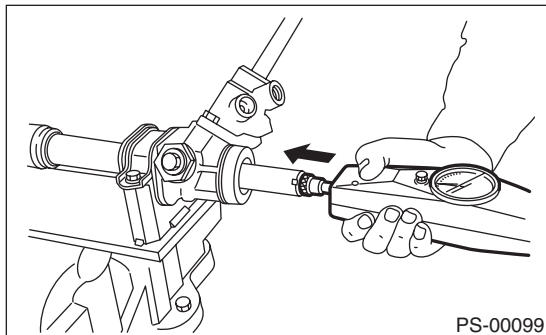
ST1 926200000 STAND

ST2 34199AG000 BOSS D

Sliding resistance of rack shaft:

Limit

Less than 400 N (41 kgf, 90 lb)



3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

Right-turn steering:

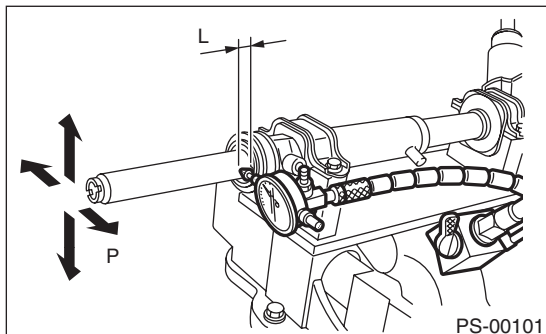
Limit

0.19 mm (0.0075 in) or less

Condition

L: 5 mm (0.20 in)

P: 122.6 N (12.5 kgf, 27.6 lb)



Left-turn steering:

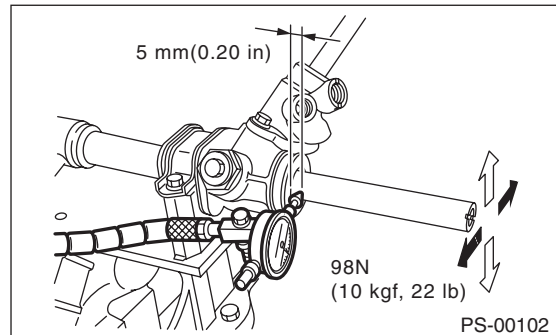
Limit

Direction ⇄

0.6 mm (0.024 in) or less

Direction ⇄

0.4 mm (0.016 in) or less



4. INPUT SHAFT PLAY

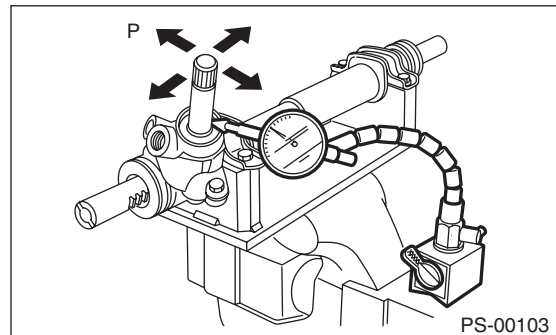
In radial direction:

Limit

0.18 mm (0.0071 in) or less

Condition

P: 98 N (10 kgf, 22 lb)



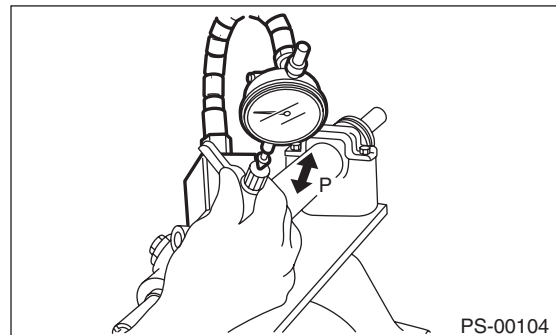
In axial direction:

SERVICE LIMIT

0.5 mm (0.0197 in) or less

Condition

P: 20 — 49 N (2 — 5 kgf, 4 — 11 lb)



Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the gearbox turning resistance.

ST 34099PA100 SPANNER

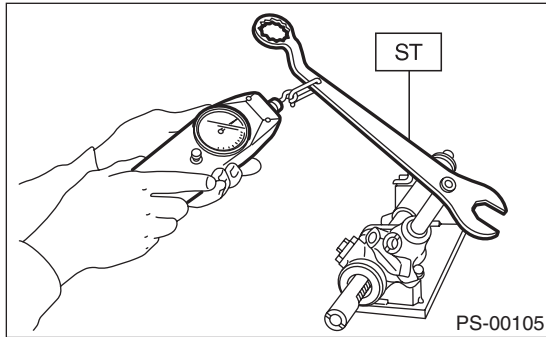
Service limit:

Maximum allowable resistance:

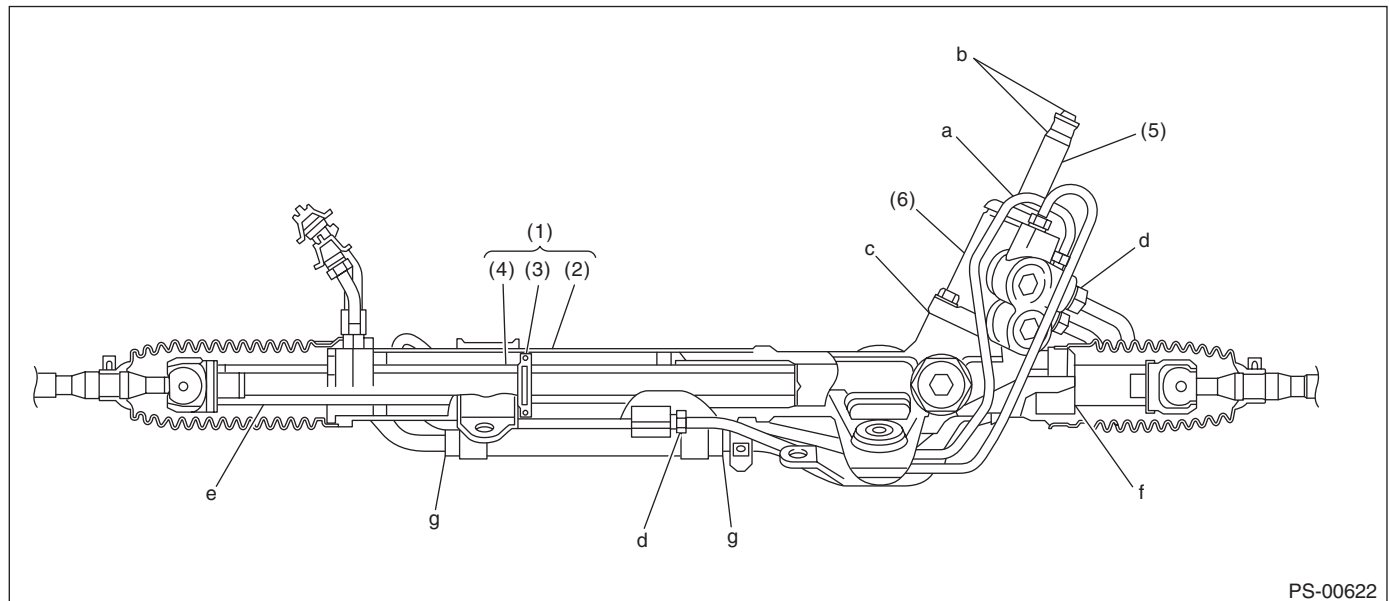
10.5 N (1.1 kgf, 2.4 lb) or less

Difference between right and left turning resistance:

20% or less



6. OIL LEAKAGE



- (1) Power cylinder
- (2) Cylinder

- (3) Rack piston
- (4) Rack axle

- (5) Input shaft
- (6) Valve housing

Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

- 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 approx. 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 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 thirty to forty times with the engine running, and make comparison of the leaked portion immediately after and several hours after this operation.

(1) Leakage from "e"

The cylinder seal is damaged. Replace the rack 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 and 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.

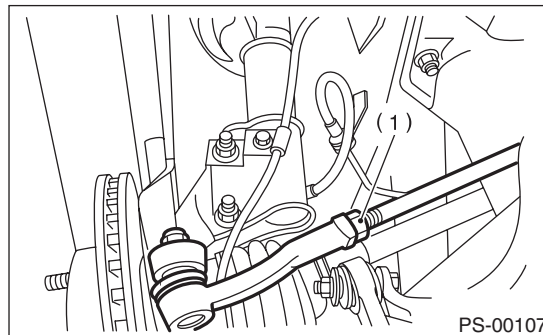
F: ADJUSTMENT

- 1) Adjust the front toe.

<Ref. to FS-11, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

Standard of front toe:

IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)



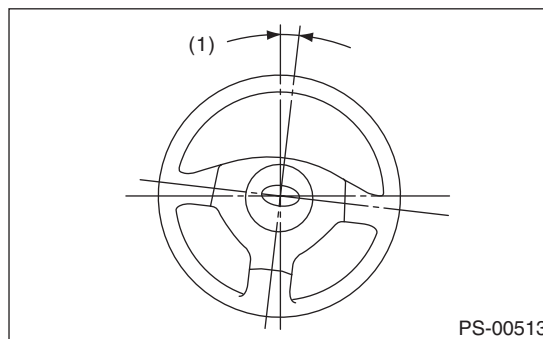
(1) Lock nut

- 2) Adjust the steering angle of the wheels.

Specification of steering angle:

Inner wheel	37.0°±1.5°
Outer wheel	32.0°±1.5°

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



(1) 5° or less

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

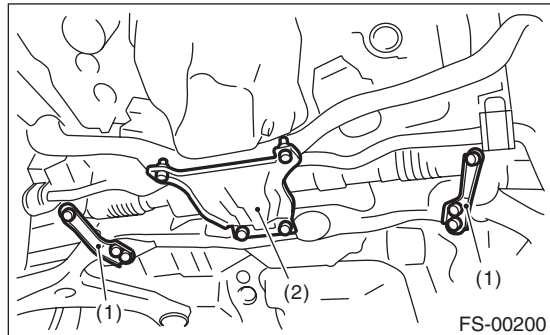
Pipe Assembly

POWER ASSISTED SYSTEM (POWER STEERING)

6. Pipe Assembly

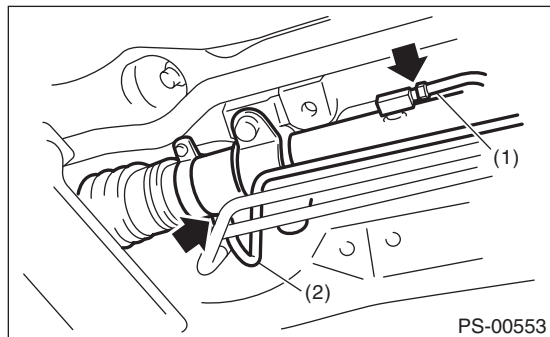
A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift-up the vehicle, and then remove the front crossmember support plate and jack-up plate.



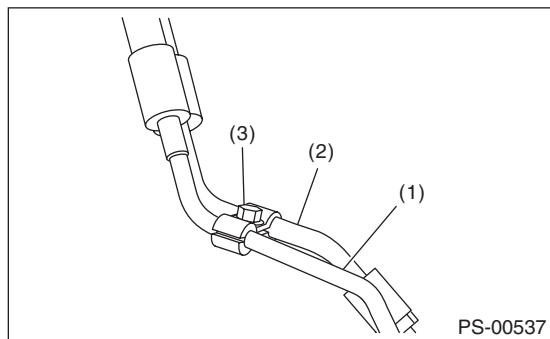
- (1) Front crossmember support plate
- (2) Jack-up plate

- 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.



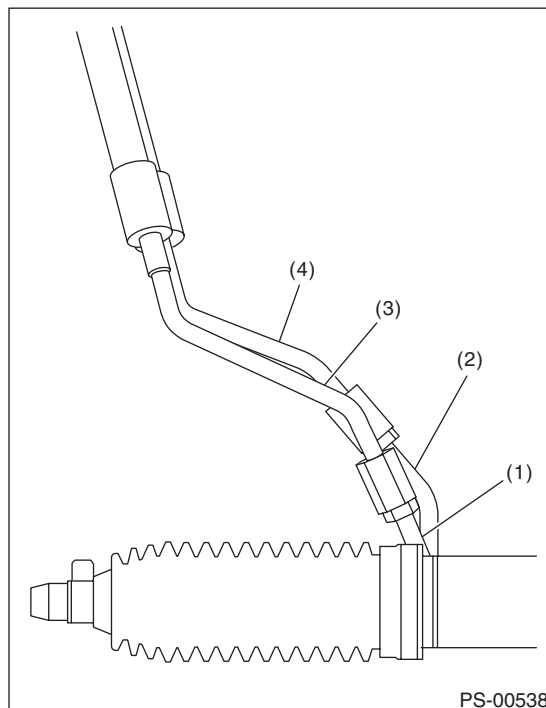
- (1) Pipe A
- (2) Pipe B

- 4) Remove the clamp E from return hose and pressure hose.



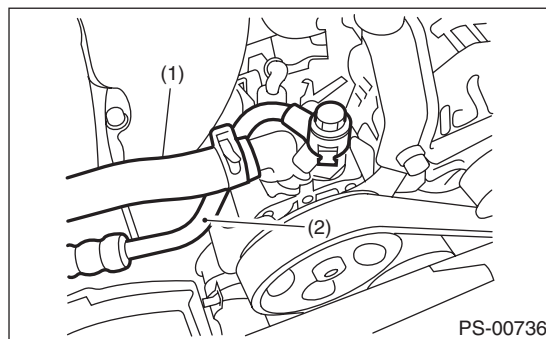
- (1) Return hose
- (2) Pressure hose
- (3) Clamp E

- 5) Disconnect the pipe D from return hose and pipe C from pressure hose.



- (1) Pipe C
- (2) Pipe D
- (3) Pressure hose
- (4) Return hose

- 6) Remove the air intake duct. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Duct.>
- 7) Disconnect the suction hose and pressure hose from oil pump.

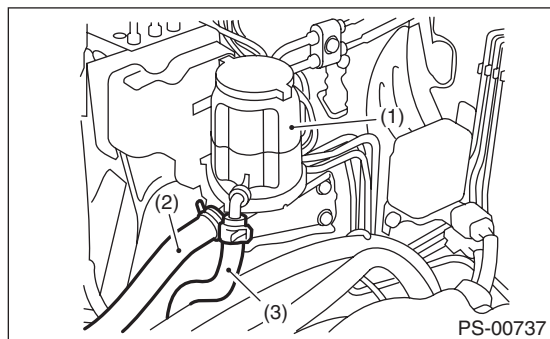


- (1) Suction hose
- (2) Pressure hose

Pipe Assembly

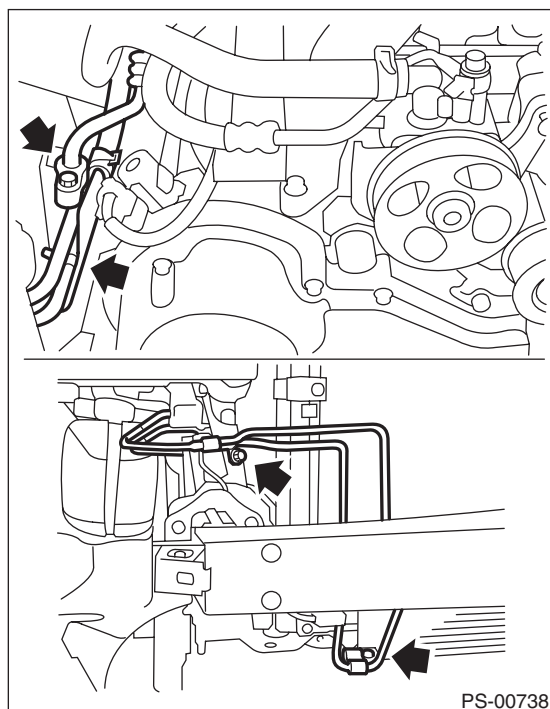
POWER ASSISTED SYSTEM (POWER STEERING)

8) Disconnect the suction hose and return hose from the reservoir tank.

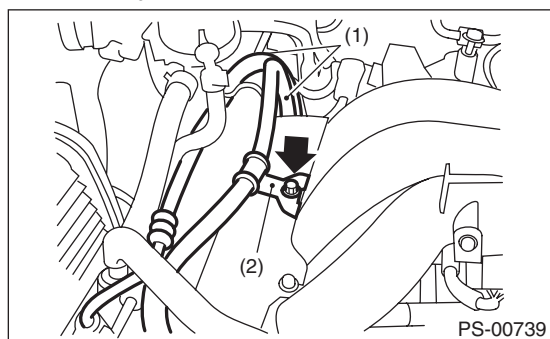


- (1) Reservoir tank
- (2) Suction hose
- (3) Return hose

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-5, POWER ASSISTED SYSTEM, COMPONENT, General Description.>

2) Fill with the specified fluid.

CAUTION:

Never start the engine before feeding the fluid otherwise the vane pump might be seized.

3) Finally, check the clearance between pipes or hoses as shown in the figure indicated in "General Diagnostic Table". <Ref. to PS-54, 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.
Clamp	Loose clamps	Replace with a new part.
Hose	- Flare surface damage - Flare nut damage - Outer surface cracks - Outer surface wear - Clip damage - End coupling or adapter for 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.

Particularly continuous work of relief valve over 5 seconds causes to reduce service lives of the hoses, the oil pump, the fluid, etc. due to over heat.

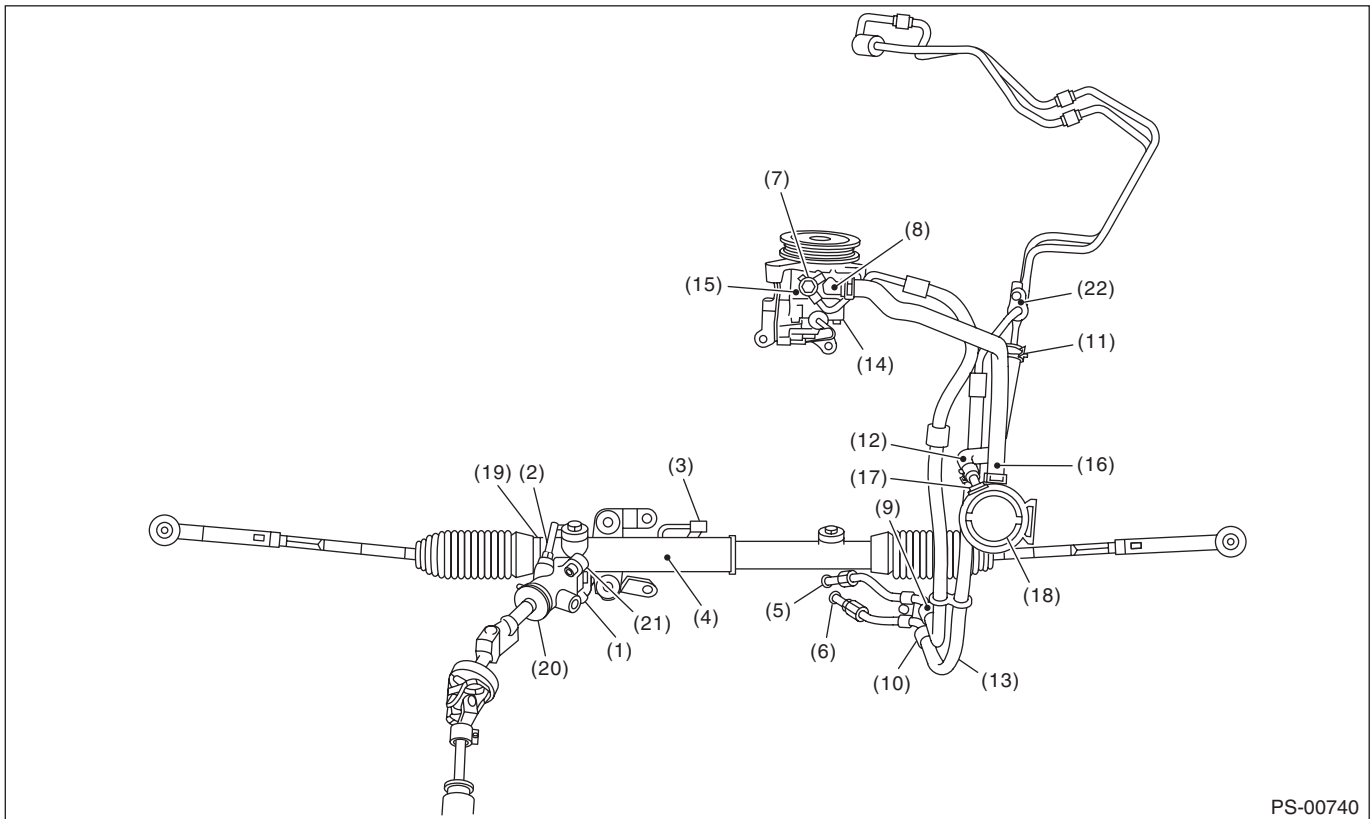
Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct customers.
	Malfunction of the relief valve	Replace the oil pump.
	Poor cold characteristic of fluid	Replace fluid.
Disconnection of the return hose	Improper connection	Repair.
	Loosening of the clip	Retighten.
	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.
	Excessive tightening torque for return hose clip	Replace.
	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 pipe and hose connections numbered with (1) through (8) in the figure	Insufficient tightening of flare nut, adhesion of dirt, damage to flare or flare nut or eye bolt	Loosen and retighten. Replace if ineffective.
	Improper installation of hose or clamp	Retighten or replace the clamp.
	Damaged O-ring or gasket	Replace the O-ring, gasket pipe or hose with new part, if still no improvement, replace the gearbox 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 cast iron 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 gear-box 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 problem 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)

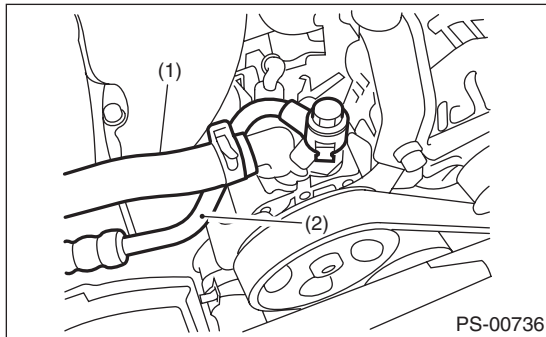
7. Oil Pump

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the air intake duct. <Ref. to IN(H6DO)-7, 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.

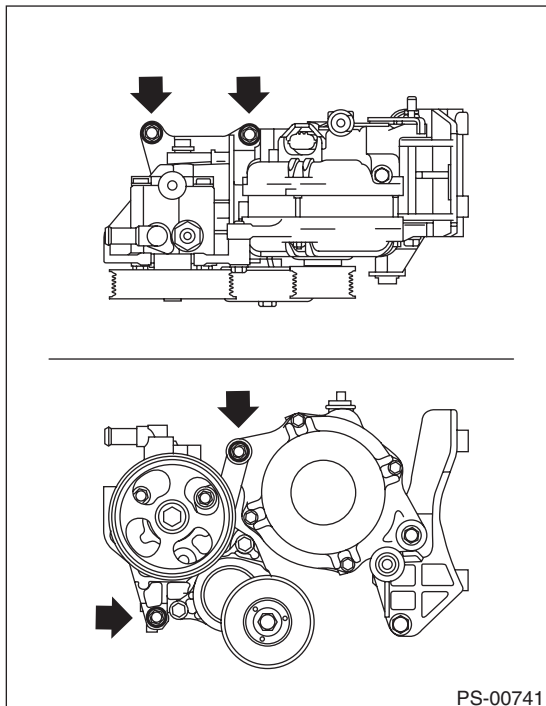
CAUTION:

- 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

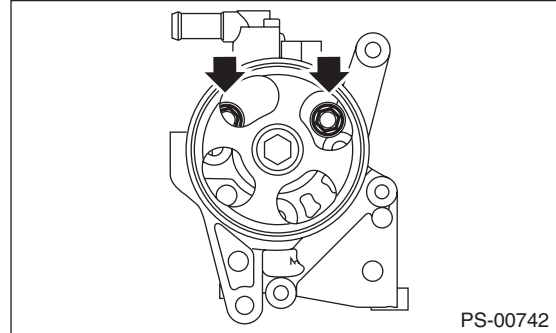
- 7) Remove the installation bolt of the power steering pump bracket.



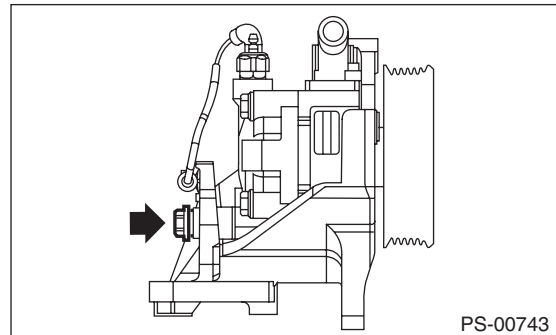
- 8) Place the oil pump bracket in a vise, and remove the two bolts from the front side of the oil pump.

CAUTION:

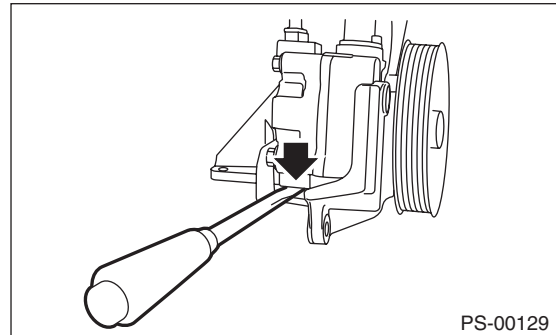
When securing the oil pump bracket in a vise, hold the oil pump bracket with the least possible force between two pieces of wood.



- 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.



B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Replace the fluid and perform air purge.

Tightening torque:

<Ref. to PS-7, OIL PUMP, COMPONENT, General Description.>

CAUTION:

Never start the engine before filling with fluid, as doing so may cause the vane pump to seize.

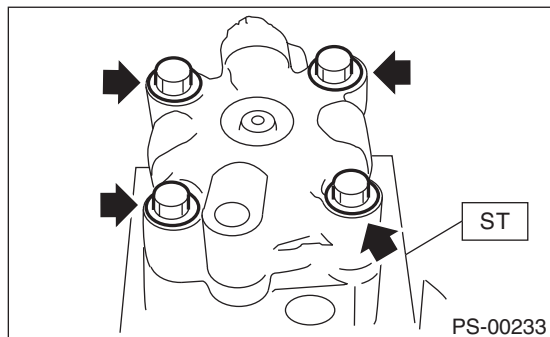
Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

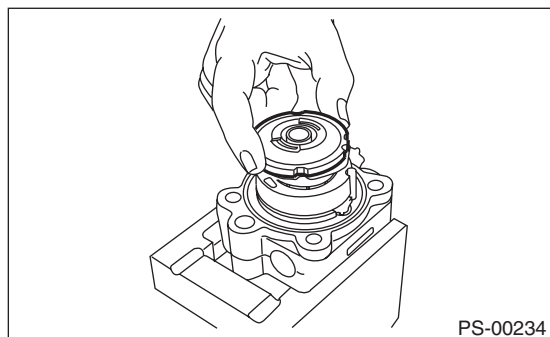
C: DISASSEMBLY

1) Using the ST, place the oil pump in the vise, and remove the 4 bolts holding the rear cover.

ST 34199AE020 MOUNT



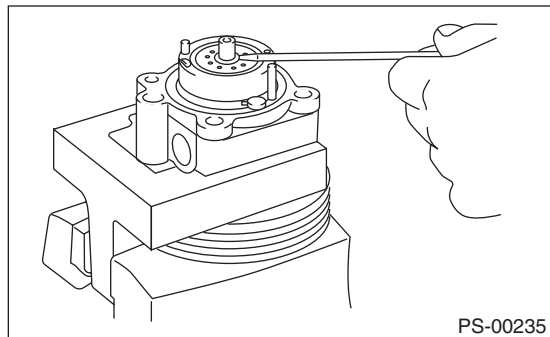
2) Remove the pressure plate.



3) Use a screw driver to pry the retaining ring.

CAUTION:

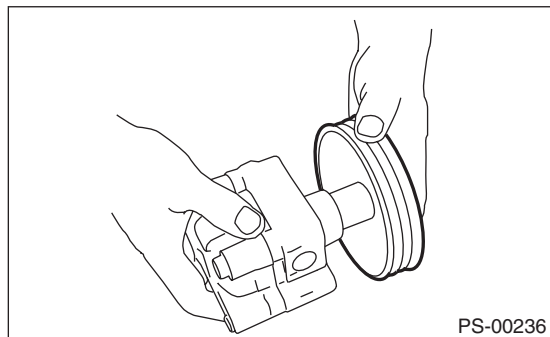
Do not remove the cam rings and rotors.



4) Install the pressure plate.

5) Temporarily tighten the rear cover to the front casing.

6) Remove the oil pump pulley.



7) Place the oil pump in the vise.

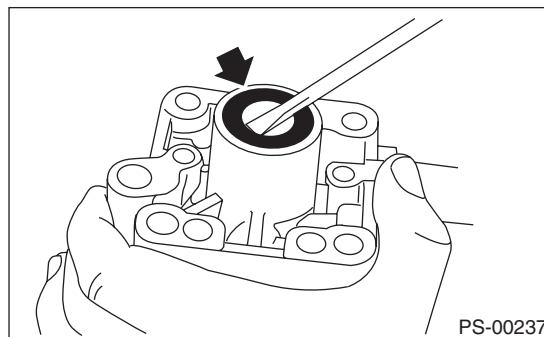
CAUTION:

Do not place the oil pump in the vise directly. Support the oil pump lightly using soft pads to protect it.

8) Use a screw driver 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.

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 body is not damaged.

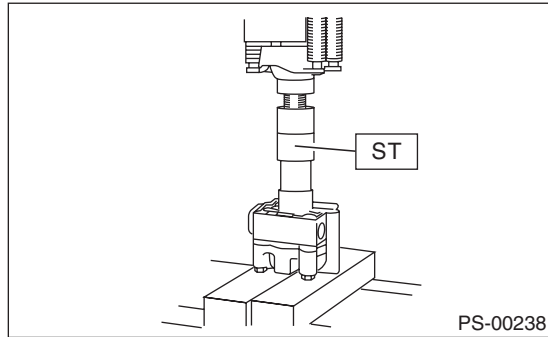
3) Temporarily tighten the rear cover to the front body.

Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

4) Attach ST to the front body. Using the press, install the oil seal.

ST 34199AE030 INSTALLER



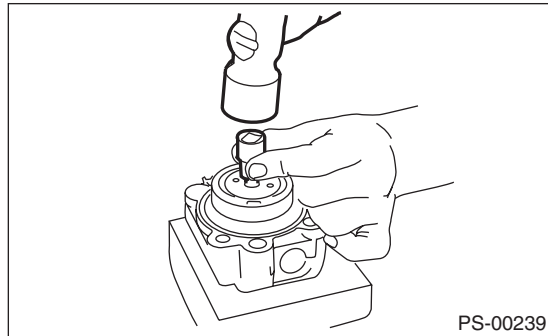
5) Install the pump pulley to front body.

6) Using the ST, place the oil pump in a vise.

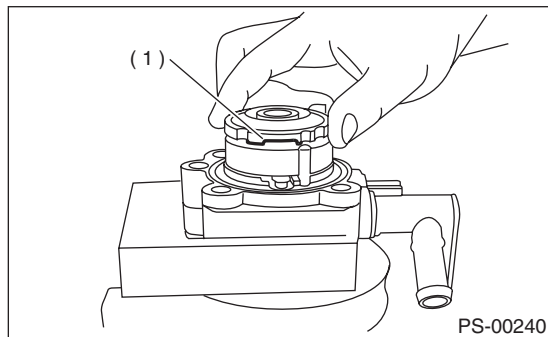
ST 34199AE020 MOUNT

7) Remove the rear cover.

8) Using a 10 mm box wrench, tap the retaining ring into the shaft groove.



9) Install the pressure plate as shown in the figure.



(1) Groove

10) Apply the specified hydraulic oil to the O-rings, and attach to the front casing and pressure plate.

11) Install the seal ring to the pressure plate.

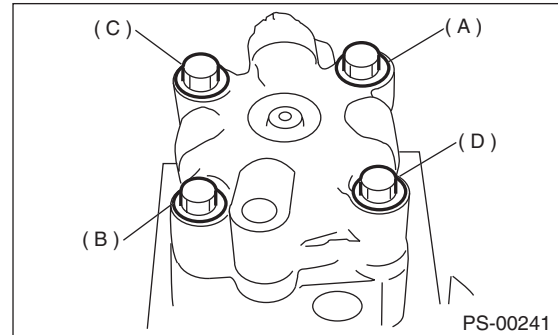
12) With knock pin positions aligned, install the rear cover.

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.

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 pulley 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	Cracking	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.

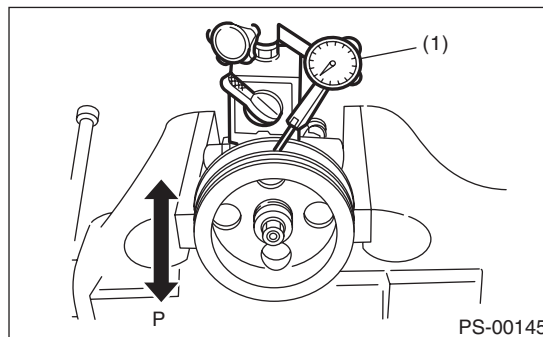
1) Play of the pulley shaft

Condition:

P: When applying the force of 9.8 N (1.0 kgf, 2.2 lb)

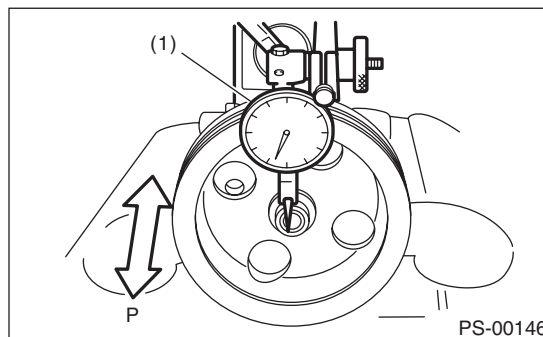
Service limit:

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

2) Deflection of the pulley groove

Oil Pump

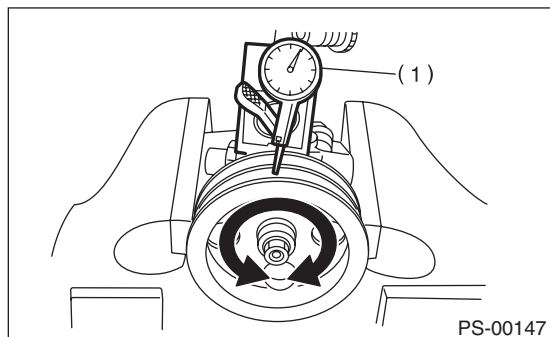
POWER ASSISTED SYSTEM (POWER STEERING)

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

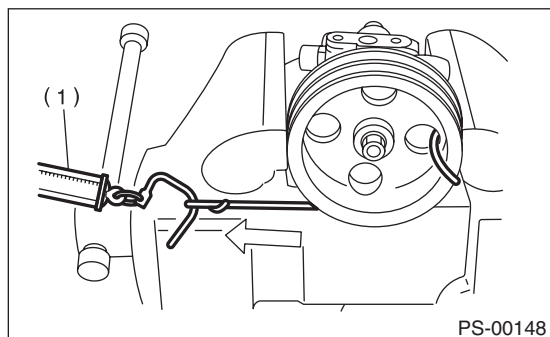
3) Rotating resistance of pulley

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-50, 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 a wastecloth at locations where fluid can be 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

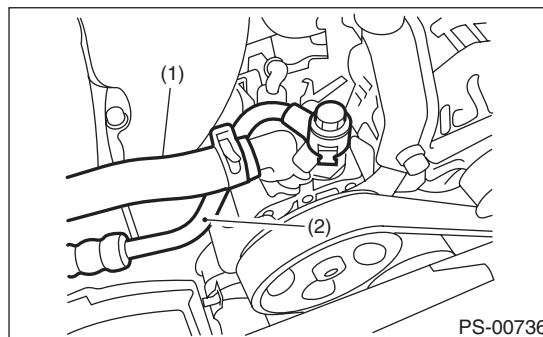
ST2 34099AC020 ADAPTER HOSE B

ST3 34099AC010 ADAPTER HOSE A

(2) Remove the air intake duct.

(3) Disconnect the pipe C from pump.

(4) Using the gasket (Part No. 34621AC021) 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

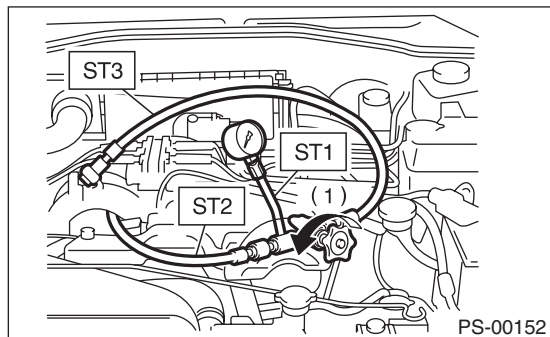
POWER ASSISTED SYSTEM (POWER STEERING)

(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 problem 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 STs, measure the relief pressure.

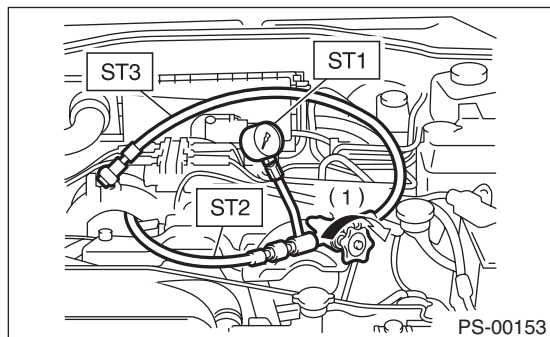
(2) Close the valve.

(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 it is not within the specification, 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.

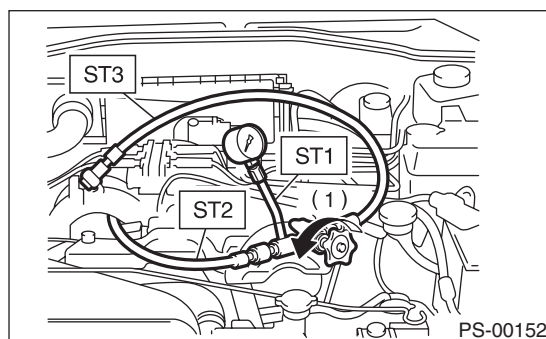
NOTE:

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-53, 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.

Reservoir Tank

POWER ASSISTED SYSTEM (POWER STEERING)

8. Reservoir Tank

A: REMOVAL

- 1) Drain fluid from the reservoir tank.
- 2) Disconnect the hose from reservoir tank.

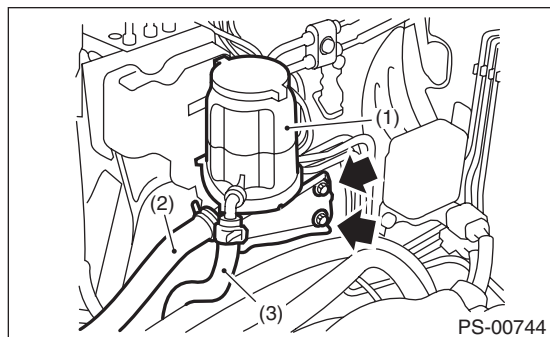
CAUTION:

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-49, Power Steering Fluid.>

Tightening torque:

33 N·m (3.37 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.

9. Power Steering Fluid

A: SPECIFICATION

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

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.

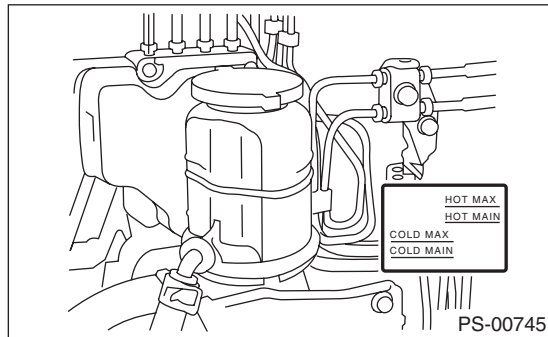
2) Check the joints and units for oil leakage. If any oil leaks are found, repair or replace the applicable part.

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.
	2. Tire and wheel - Improper tire out of specifications^{*1} - Improper wheel out of specifications^{*1} - Tires not properly inflated	Replace or reinflate.
	3. Fluid - Low fluid level - Air entry in fluid - Entry of dust in the fluid - Fluid deterioration - Inadequate warm-up of fluid ^{*2}	Refill, 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 or instruct customer.
	5. Measure the hydraulic pressure. <Ref. to PS-46, HYDRAULIC PRESSURE, INSPECTION, Oil Pump.>	Replace the problem parts.
	6. Measure the steering wheel effort. <Ref. to PS-53, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>	Adjust or replace.
- Vehicle leads to one side or the other. - Returning force of steering wheel to center is poor. - Steering wheel vibrates when turning.	1. Fluid line - Folded hose - Flattened pipe	Correct or replace.
	2. 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, fix or replace.
	3. Front alignment - Improper or unequal caster - Improper or unequal toe-in - Loose suspension connections	Adjust or retighten.
	4. Others - Damaged joint assembly - Unbalanced height - Unbalanced weight	Replace, adjust or instruct customer.
	5. Measure the steering wheel effort. <Ref. to PS-53, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>	Adjust or replace.

^{*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 over five seconds 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 over five seconds.)	Normal
	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 gear-box 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 over 2,000 rpm, 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)?	Go to step 2.	Adjust the back-lash.
2 CHECK STEERING EFFORT. 1) Stop the engine. 2) Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.	Is the steering effort less than 294.2 N (30 kgf, 66.2 lb)?	Go to step 3.	Perform the adjustment.
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.	Check, adjust and replace if necessary.
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.	Check, adjust and replace if necessary.
5 CHECK UNIVERSAL JOINT. Measure the swing torque of the joint (yoke of steering column side). <Ref. to PS-15, INSPECTION, Universal Joint.>	Is the swing torque of the universal joint less than 7.3 N (0.74 kgf, 1.64 lb)?	Go to step 6.	Replace with a new part.
6 CHECK UNIVERSAL JOINT. Measure the swing torque of the joint (yoke of gearbox side). <Ref. to PS-15, INSPECTION, Universal Joint.>	Is the swing torque of the universal joint less than 3.8 N (0.39 kgf, 0.86 lb)?	Go to step 7.	Replace with a new part.
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.	If the tie-rod ends of suspension have unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 9.
9 BALL JOINT CHECK. Remove the ball joint.	If the ball joints of suspension have unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 10.
10 CHECK GEARBOX. Measure the rotating of gearbox. <Ref. to PS-36, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>	Is the rotating resistance of steering gearbox less than 10.5 N (1.1 kgf, 2.4 lb)? Is the difference between right and left sides less than 20%?	Go to step 11.	Readjust the back-lash, and if ineffective, replace the faulty parts.
11 CHECK GEARBOX. Measure the sliding of gearbox. <Ref. to PS-35, LIMIT, INSPECTION, Steering Gearbox.>	Is the sliding resistance of steering gearbox less than 400 N (41 kgf, 90 lb)? Is the difference between the right and left sliding resistance 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)

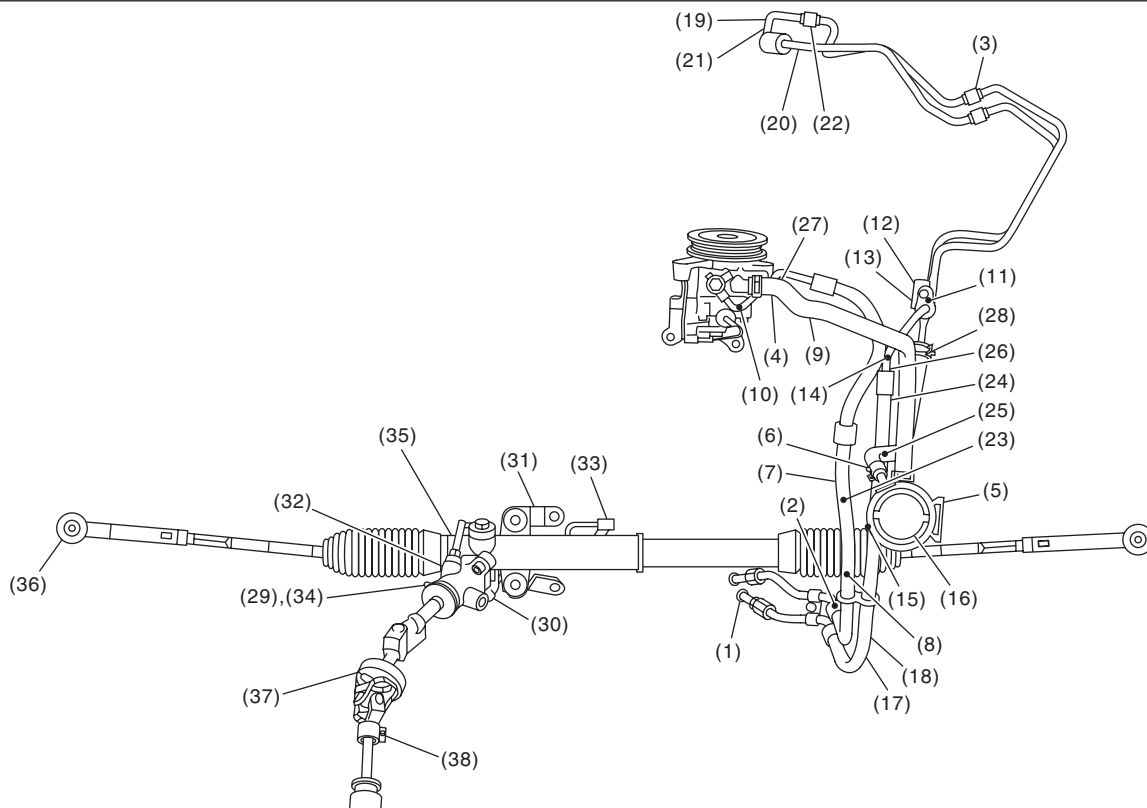
3. INSPECTION OF CLEARANCE

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) Air cleaner case-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)



PS-00746

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

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(DIAGNOSTICS)****CC(diag)****IMMOBILIZER (DIAGNOSTICS)****IM(diag)****LAN SYSTEM (DIAGNOSTICS)****LAN(diag)**

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

AC

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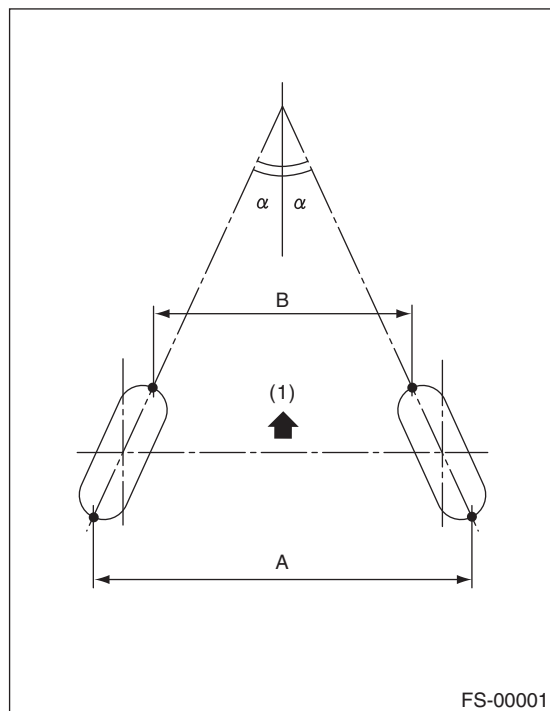
1. General Description

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.



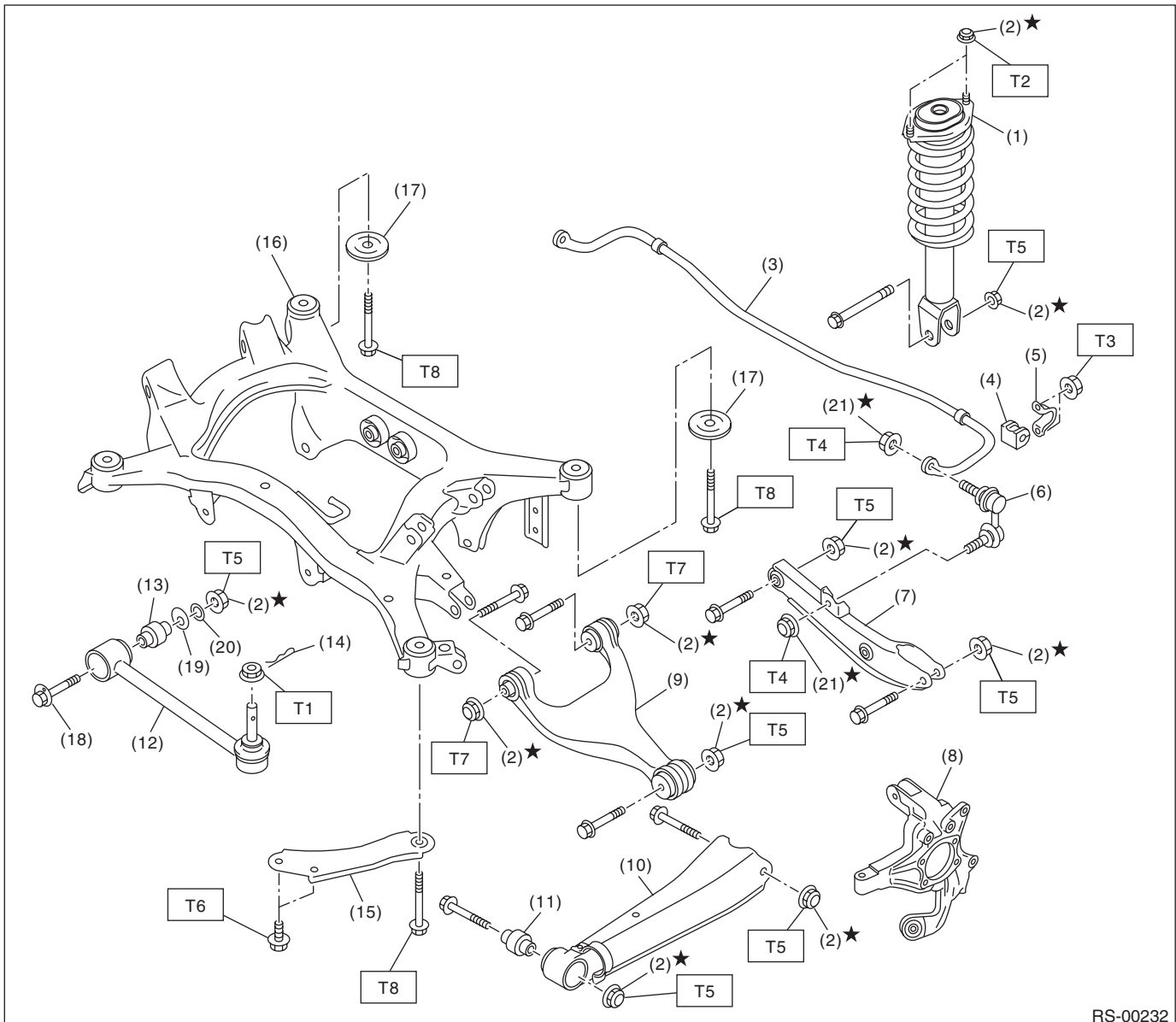
(1) Front

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

α = Individual toe angles

B: COMPONENT

1. REAR SUSPENSION



RS-00232

- | | |
|----------------------------|------------------------------------|
| (1) Shock absorber | (12) Front lateral link |
| (2) Self-locking nut | (13) Front lateral link bushing |
| (3) Rear Stabilizer | (14) Snap pin |
| (4) Stabilizer bushing | (15) Front sub frame support plate |
| (5) Stabilizer clamp | (16) Rear sub frame |
| (6) Stabilizer link | (17) Rear sub frame stopper plate |
| (7) Rear lateral link | (18) Adjusting bolt |
| (8) Rear housing | (19) Adjusting washer |
| (9) Upper arm | (20) Washer |
| (10) Trailing link | (21) Flange nut |
| (11) Trailing link bushing | |

Tightening torque:N·m (kgf·m, ft·lb)

T1: 27 (2.8, 19.9)

T2: 30 (3.1, 22.4)

T3: 35 (3.6, 25.8)

T4: 60 (6.1, 44)

T5: 120 (12.2, 89)

T6: 125 (12.7, 92)

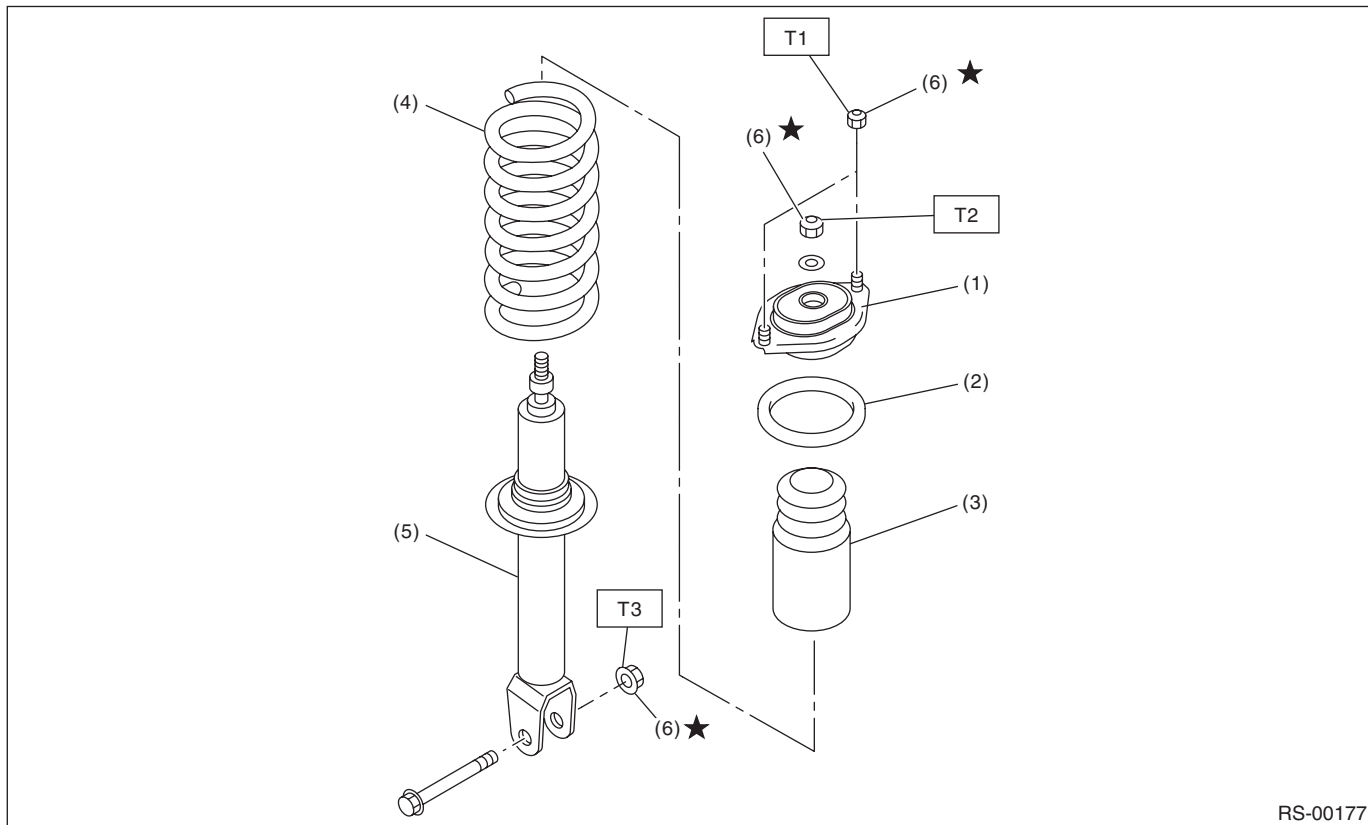
T7: 150 (15.3, 111)

T8: 200 (20.4, 148)

General Description

REAR SUSPENSION

2. SHOCK ABSORBER



- | | |
|------------------------|----------------------|
| (1) Mount | (5) Shock absorber |
| (2) Upper rubber sheet | (6) Self-locking nut |
| (3) Dust cover | |
| (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 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 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, carefully observe the following to prevent unexpected accidents.

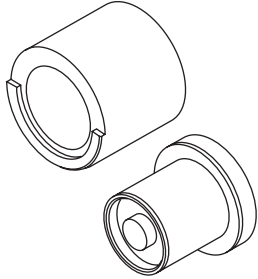
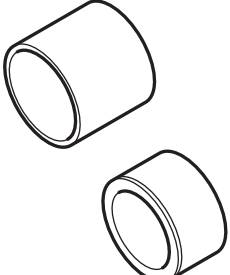
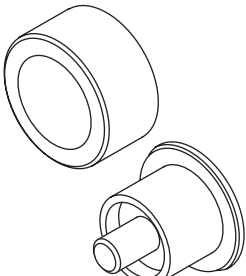
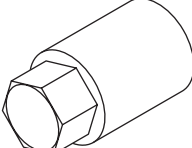
- Prepare a container and cloth when performing work which oil possibly spills. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out, to protect the environmental.
- Follow all government regulations concerning disposal of refuse when disposing.

General Description

REAR SUSPENSION

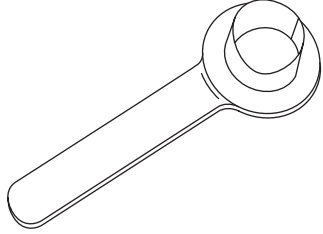
D: PREPARATION TOOL

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

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

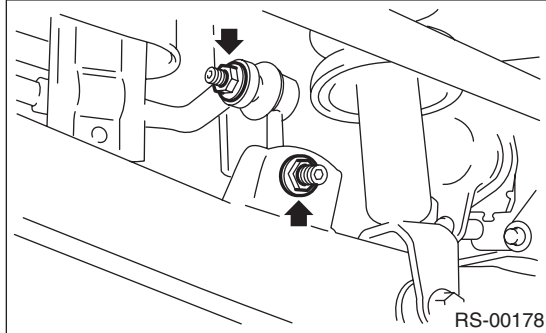
NOTE:

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-7, INSPECTION, Wheel Alignment.>

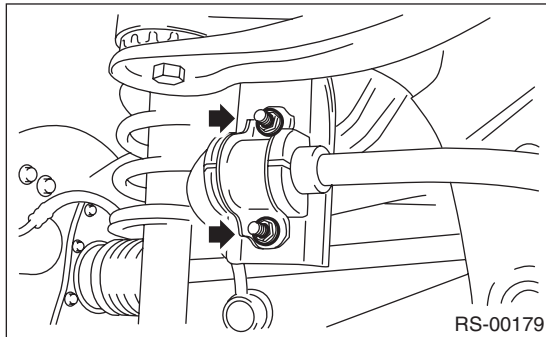
3. Rear Stabilizer

A: REMOVAL

- 1) Lift-up the vehicle, and then remove the rear wheels.
- 2) Remove the stabilizer link.



- 3) Remove the stabilizer link.



B: INSTALLATION

NOTE:

- To install the bushing, align the bushing end to the stabilizer stopper or the end of the paint mark.
- Be sure to use a new flange nut.
- Always tighten the stabilizer bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

Install in the reverse order of removal.

Tightening torque:

Stabilizer link

60 N·m (6.1 kgf-m, 44 ft-lb)

Stabilizer clamp

35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

- 1) Check the bushing for cracks, fatigue or damage.
- 2) Check the stabilizer link for damage.

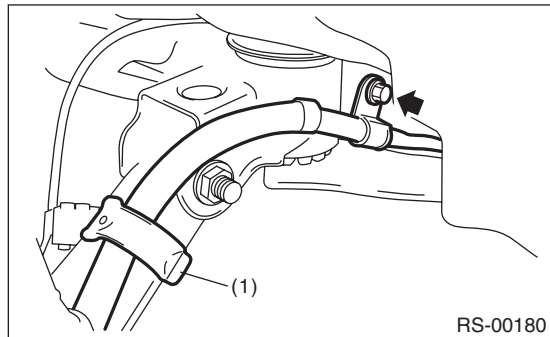
Rear Trailing Link

REAR SUSPENSION

4. Rear Trailing Link

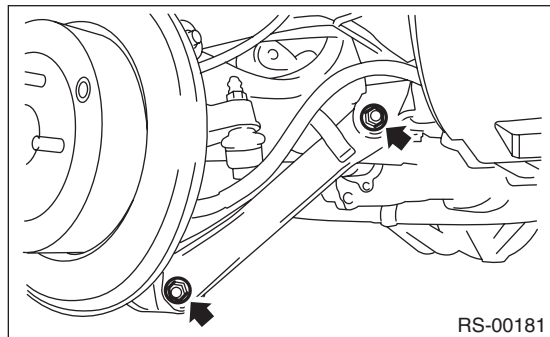
A: REMOVAL

- 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

NOTE:

- Be sure to use a new self-locking nut.
 - Always tighten the stabilizer bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.
- Install in the reverse order of removal.

Tightening torque:

Trailing link

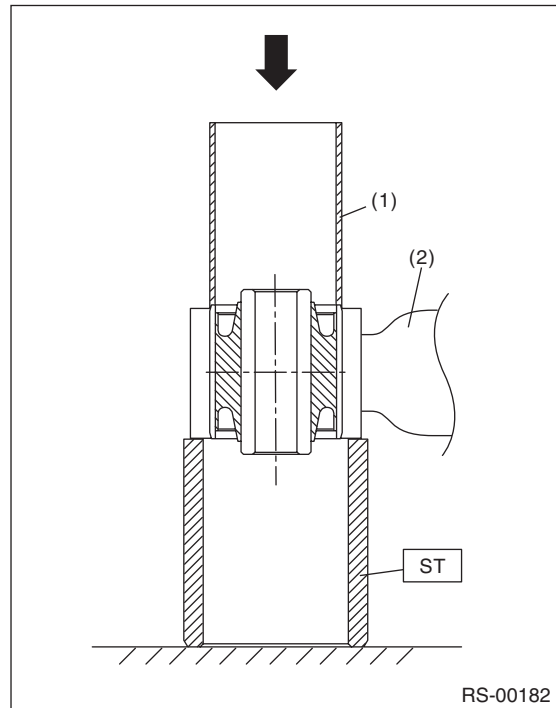
120 N·m (12.2 kgf-m, 89 ft-lb)

Parking Brake Cable bracket

33 N·m (3.4 kgf-m, 24 ft-lb)

C: DISASSEMBLY

Using the ST and a pipe, press the bushing out.
ST 20099PA010 INSTALLER & REMOVER



- (1) 39 mm dia., 50 mm long pipe
- (2) Trailing link

D: ASSEMBLY

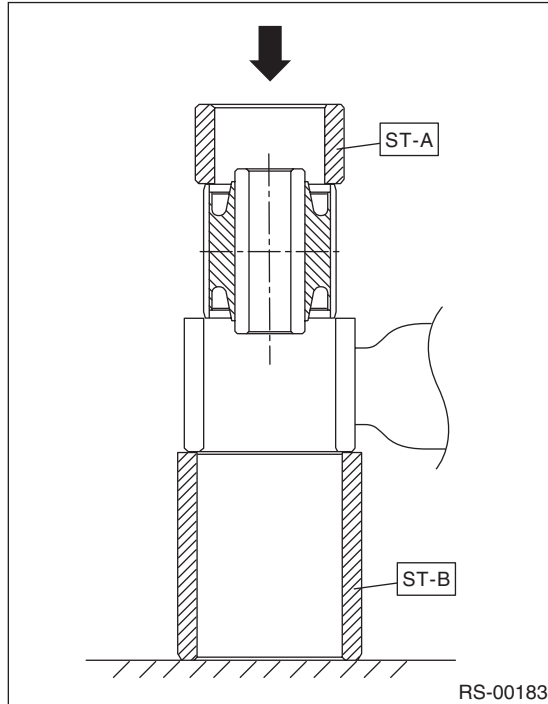
Using the ST A and ST B, press-fit the bushing.

STA 20099AE040 INSTALLER & REMOVER

STB 20099PA010 INSTALLER & REMOVER

CAUTION:

Press the bushing straight in.



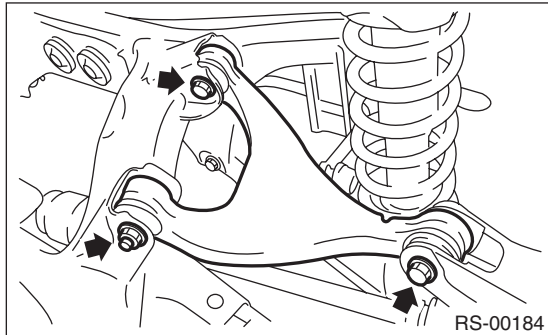
E: INSPECTION

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

NOTE:

- Use a new self-locking nut.
 - Always tighten the stabilizer 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 it if necessary.

Tightening torque:

Upper arm to Rear sub frame
150 N·m (15.3 kgf-m, 111 ft-lb)

Upper arm to Rear housing
120 N·m (12.2 kgf-m, 89 ft-lb)

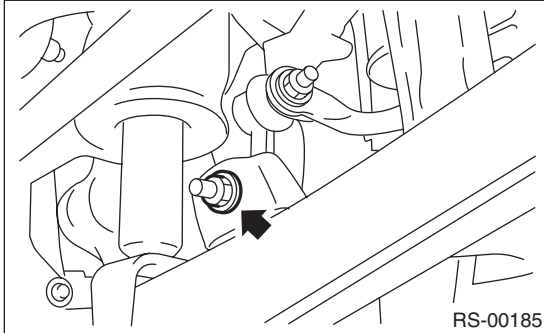
C: INSPECTION

- 1) Visually check the upper arm for damage and deformation.
- 2) Visually check the bushing for crack, damage and fatigue.

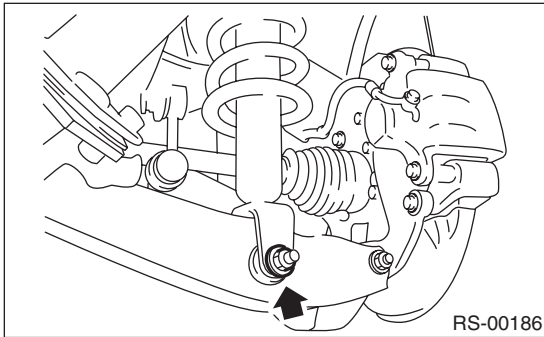
6. Rear Shock Absorber

A: REMOVAL

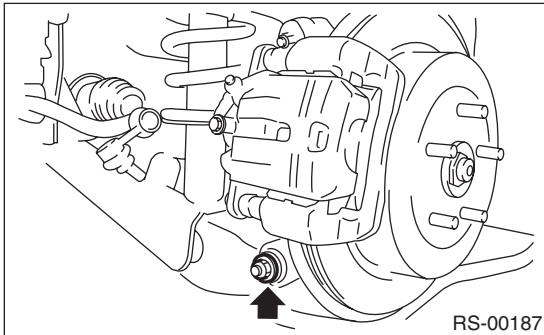
- 1) Remove the strut cap of quarter trim.
- 2) Lift-up the vehicle, and then remove the rear wheels.
- 3) Remove the nut and detach the rear stabilizer link.



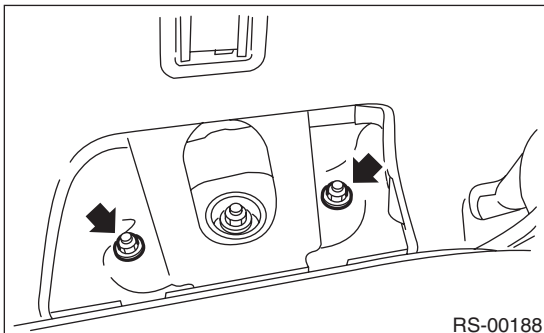
- 4) Remove the bolts on the bottom side of the shock absorber.



- 5) Detach the rear lateral link.



- 6) Remove the nuts of the shock absorber mount.



- 7) Remove the shock absorber.

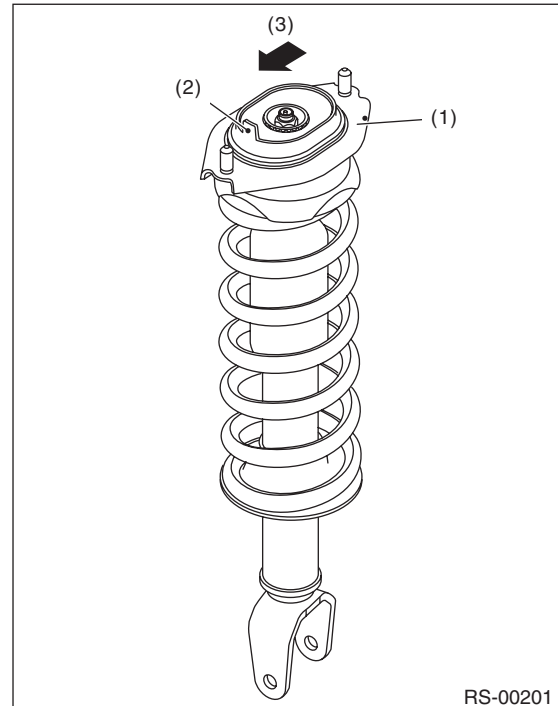
B: INSTALLATION

NOTE:

- Be sure to use a new self-locking nut.
 - Always tighten the stabilizer 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.

Rear Shock Absorber

REAR SUSPENSION

C: DISASSEMBLY

Refer to “Front Strut” for disassembly procedure.
<Ref. to FS-22, DISASSEMBLY, Front Strut.>

D: ASSEMBLY

Refer to “Front Strut” for installation procedures.
<Ref. to FS-23, ASSEMBLY, Front Strut.>

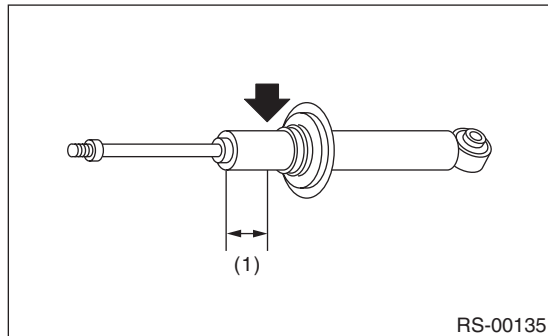
E: INSPECTION

Refer to “Front Strut” for inspection procedures.
<Ref. to FS-24, 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.

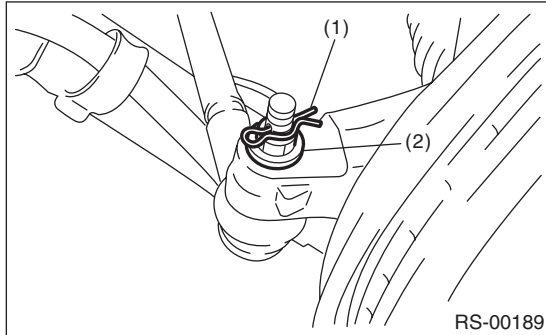


(1) 40 mm (1.57 in)

7. Front Lateral Link

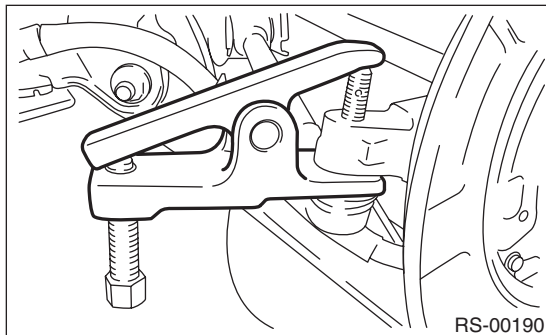
A: REMOVAL

- 1) Lift-up the vehicle, and then remove the rear wheels.
- 2) Remove the snap pin and nut.



- (1) Snap pin
- (2) Nut

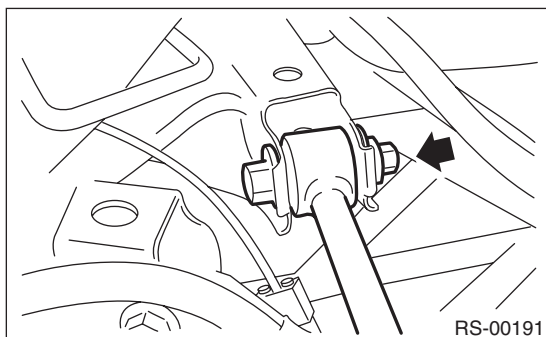
- 3) Use a puller to detach the ball joint.



- 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

NOTE:

- Be sure to use a new self-locking nut.
 - Always tighten the stabilizer 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 to Sub frame
120 N·m (12.2 kgf-m, 89 ft-lb)

Front lateral link to Rear axle housing.
27 N·m (2.8 kgf-m, 20 ft-lb)

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

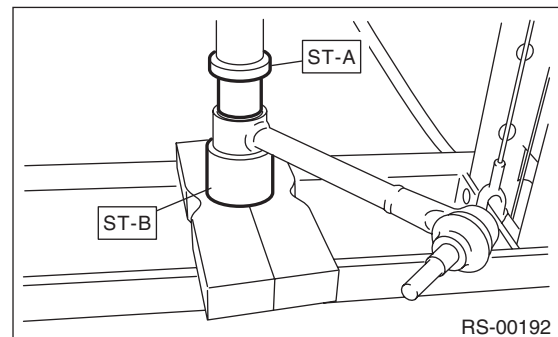
C: INSPECTION

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

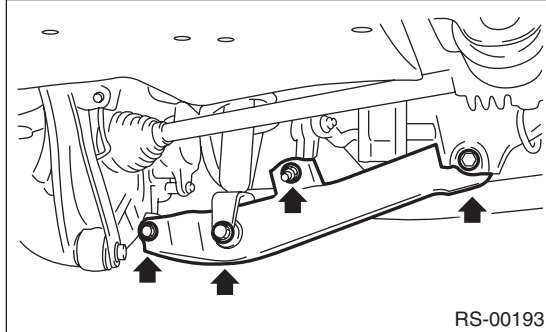
CAUTION:

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

NOTE:

- Be sure to use a new self-locking nut.
- Always tighten the stabilizer 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:

Rear lateral link

120 N·m (12.2 kgf-m, 89 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.

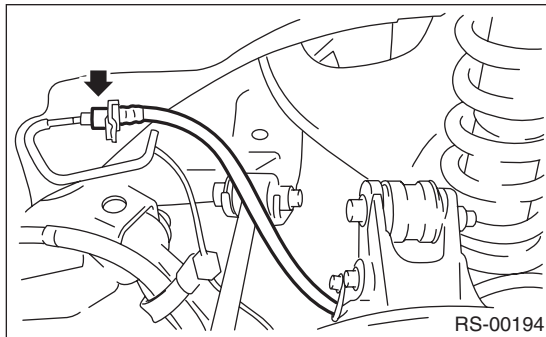
C: INSPECTION

Visually check the rear lateral link for damage and deformation.

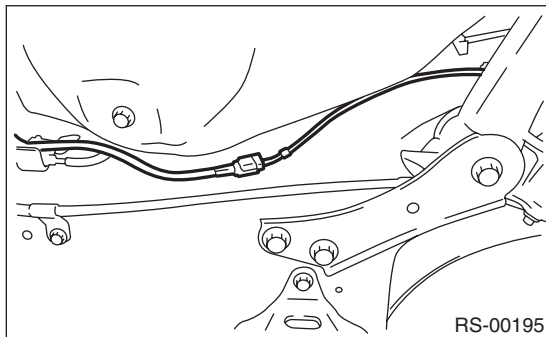
9. Rear Sub Frame

A: REMOVAL

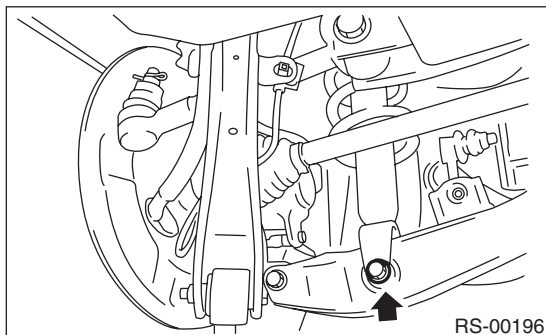
- 1) Separate the front exhaust pipe and rear exhaust pipe.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the propeller shaft.
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 4) Remove the spare tire hoist. <Ref. to WT-14, REMOVAL, Spare Tire Hoist.>
- 5) Remove the rear parking brake cable from the parking brake assembly. <Ref. to PB-8, 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.

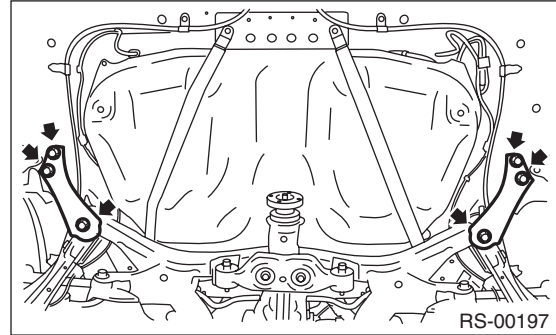


- 8) Remove the bolts on the bottom side of the shock absorber.

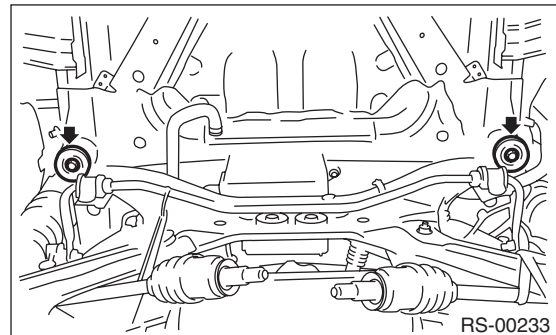


- 9) Support the sub frame using a jack.

- 10) Remove the front sub frame.



- 11) Remove the rear sub frame.



B: INSTALLATION

NOTE:

- Be sure to use a new self-locking nut.
 - Always tighten the stabilizer 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:

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.

General Diagnostic Table

REAR SUSPENSION

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 damper 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	Adjust or replace the coil springs with new parts.
(4) Fault in operation of damper strut or shock absorber	Replace.
(5) Damage or deformation of strut mount or shock absorber mount	Replace.
(6) Unsuitable length (maximum or minimum) of damper 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 damper strut or shock absorber	Replace.

3. NOISE

Possible cause	Corrective action
(1) Wear or damage of damper 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 damper 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.

WHEEL AND TIRE SYSTEM

WT

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6. Tire Pressure Monitoring System	12
7. Spare Tire Hoist	14
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Basic Diagnostic Procedure

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

CAUTION:

Remove foreign matter (dust, water, oil etc.) from the tire pressure monitoring control module connector when removing or installing.

NOTE:

To check harness for broken wires or short circuits, shake 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 the components which might mal-affect 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)-11, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.> 4) Read the DTC. <Ref. to TPM(diag)-16, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Go to step 4.	Go to step 3.
3 PERFORM GENERAL DIAGNOSTICS. 1) Inspect using "General Diagnostic Table". <Ref. to TPM(diag)-42, General Diagnostic Table.> 2) Perform the Clear Memory Mode. <Ref. to TPM(diag)-9, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 3) Perform the Inspection Mode. <Ref. to TPM(diag)-17, Inspection Mode.> 4) Read the DTC. <Ref. to TPM(diag)-8, 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 using "Diagnostic Procedure for TPM" <Ref. to TPM(diag)-14, WITHOUT DTC, INSPECTION, Subaru Select Monitor.>
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)-9, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 4) Perform the drive test. Drive the vehicle at a speed more than 40 km/h (25 MPH) for at least 10 minutes. 5) Read the DTC. <Ref. to TPM(diag)-8, 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.

General Description

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

2. General Description

A: CAUTION

1. SRS AIRBAG SYSTEM

Airbag system wiring harness is routed near the TPM control module.

CAUTION:

- **Wiring harnesses of all airbag system are yellow. Do not use the electrical test equipment on these circuits.**
- **Be careful not to damage the airbag system wiring harness when servicing the tire pressure monitoring control module.**

2. TIRE PRESSURE MONITORING CONTROL MODULE

- If the alteration of tire rotation, the installation position or the replacement of transmitter is performed, 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 air pressure in the tires will drop, causing the tire pressure warning light to come on, even if the pressure in the tires 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	15.5 (60)		
	Ambient temperature	-1 (30)	-12 (10)	-23 (-10)
Reference for adjusting tire pressure kPa (psi)	Front	250 (36)	265 (38)	280 (40)
	Rear	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

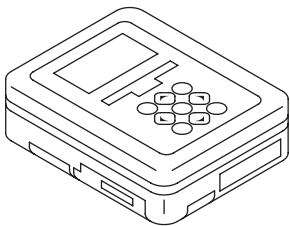
Specific gravity: Above 1.260

General Description

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

C: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B020XU0	1B020XU0	SUBARU SELECT MONITOR KIT	Used for troubleshooting for the electrical system.

2. GENERAL TOOL

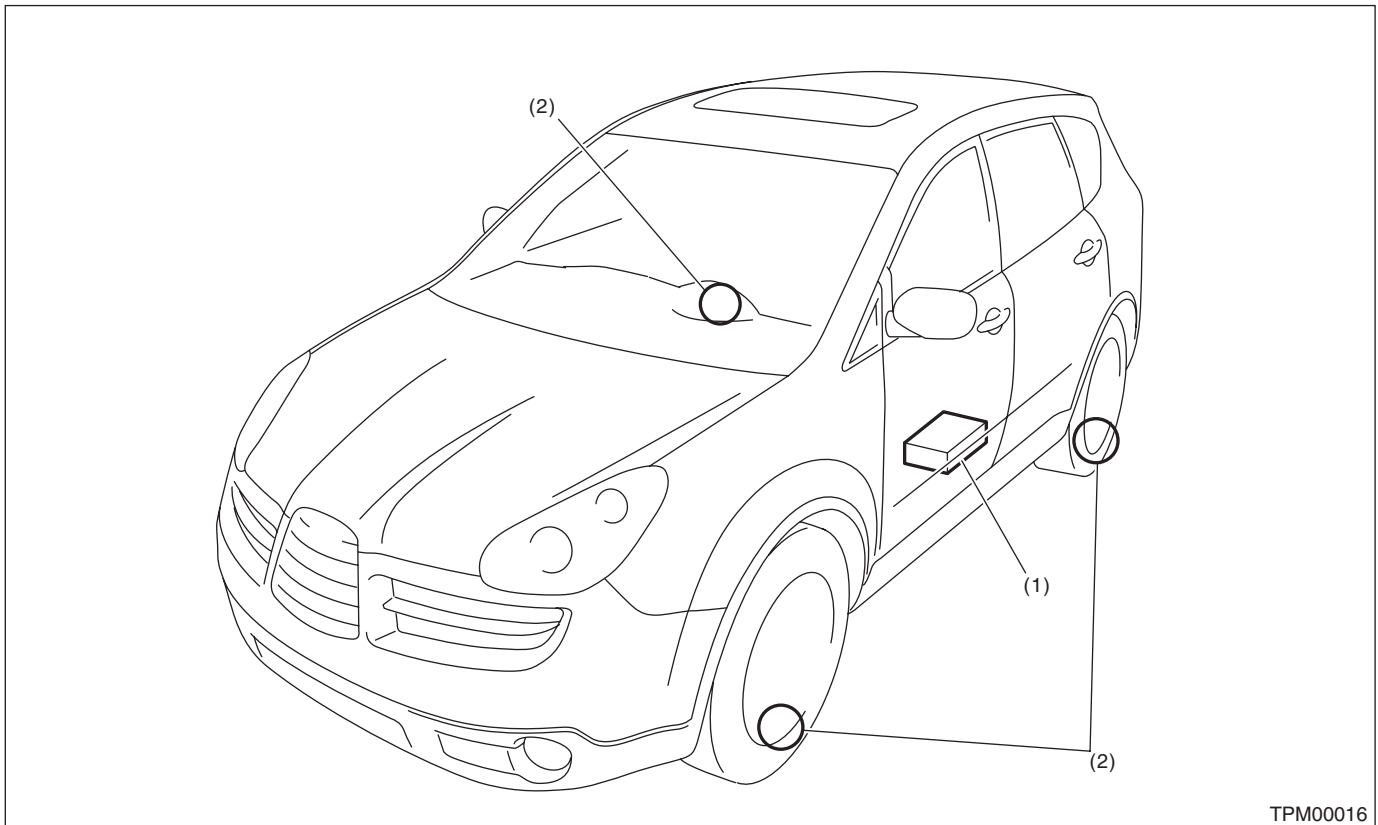
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Transmitter registration tool	Used to register the transmitter ID. Manufacturer: Kent-Moore Item number: J45295

Electrical Component Location

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

3. Electrical Component Location

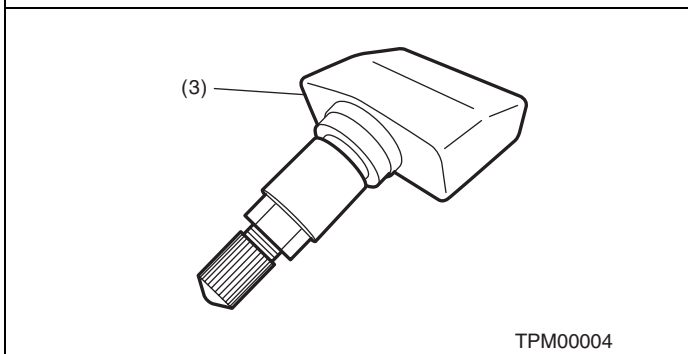
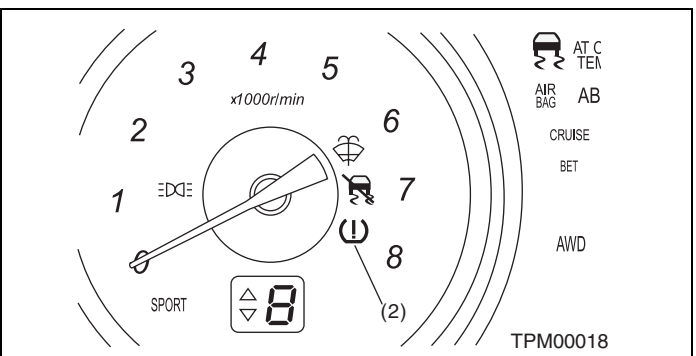
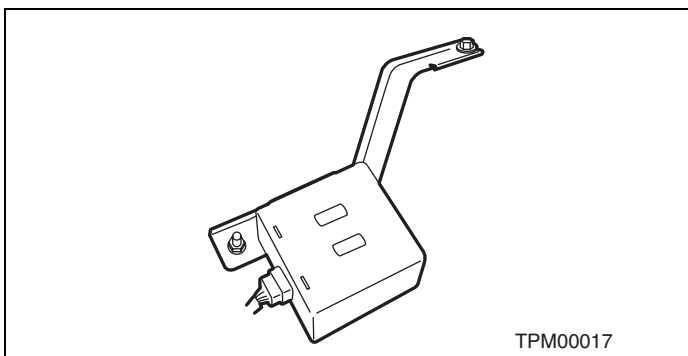
A: LOCATION



(1) Tire pressure monitoring control module

(2) Tire pressure warning light

(3) Transmitter 1 — 4



SUBARU

Control Module I/O Signal

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

4. Control Module I/O Signal

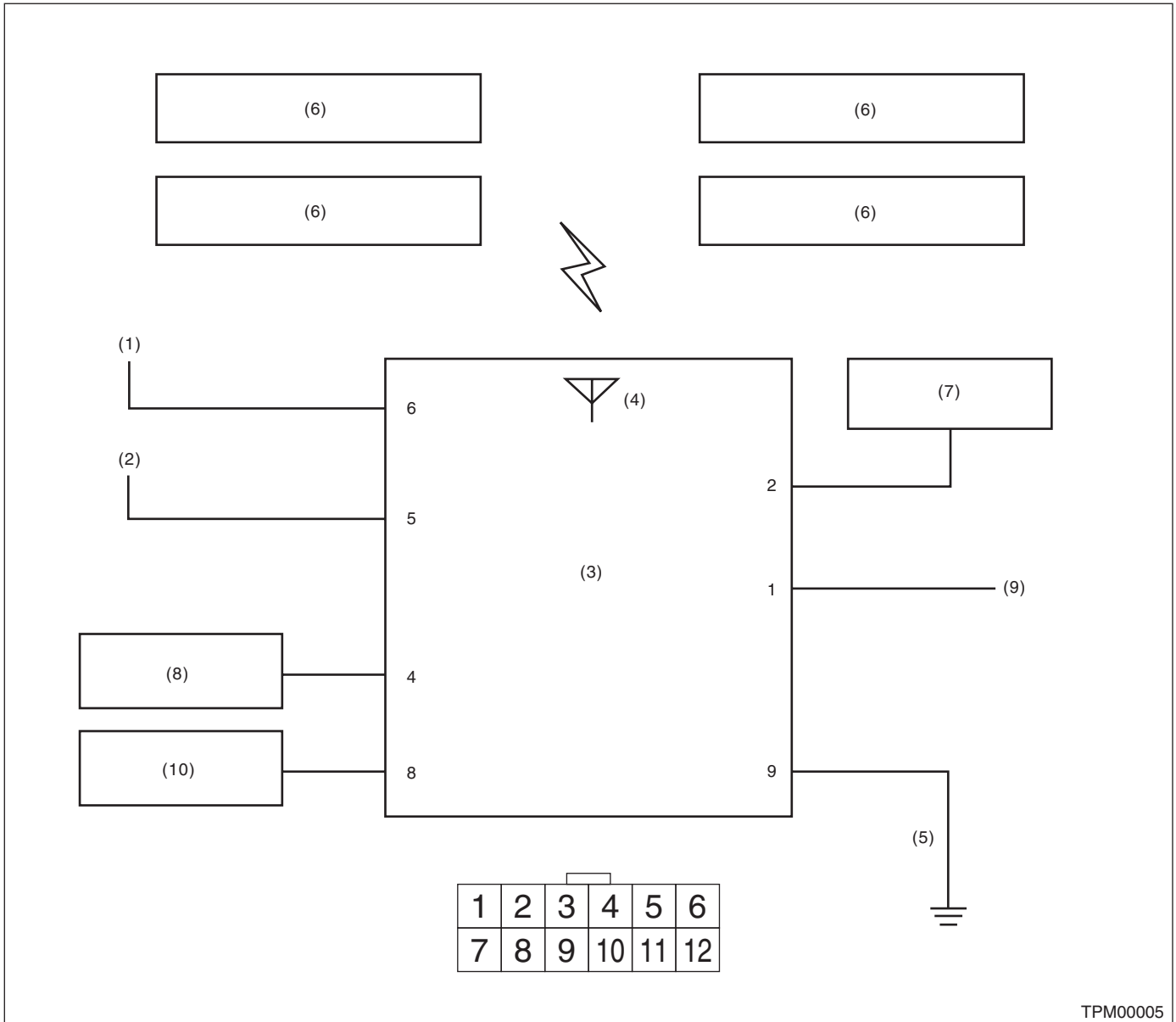
A: ELECTRICAL SPECIFICATION

Terminal No.	Measured value	Measuring condition	Remarks
1	Select monitor communication	Serial communication	—
2	Tire pressure warning light output	When malfunction occurs, or tire pressure decreases	System failure: blinks Tire pressure decreases: turns on
4	Speed sensor signal	While driving (Pulse signal)	Change according to vehicle speed
5	Ignition power supply	IG switch ON (Battery voltage)	—
6	Battery power supply	Battery voltage	Always
8	Body integrated unit (Hazard output signal).	—	When hazard turns on.
9	GND	0 V (Always)	Always

Control Module I/O Signal

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

B: WIRING DIAGRAM



Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

5. Subaru Select Monitor

A: OPERATION

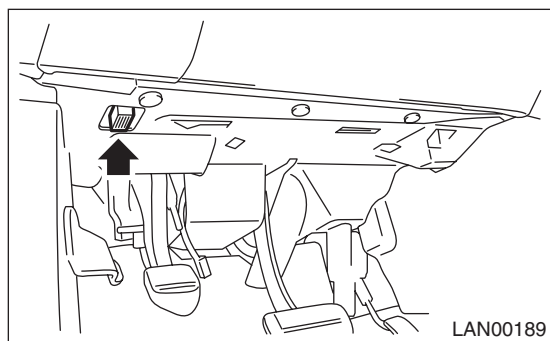
1. READ DIAGNOSTIC TROUBLE CODE (DTC)

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).



(1) Data link connector

(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect the scan tools except for Subaru Select Monitor.

4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.

5) On the «Main Menu» display screen, select the {Each System Check}.

6) On the «System Selection Menu» display screen, select the {Tire Pressure Monitor}.

7) Select the [OK] after the {Model Year} is displayed.

8) On the «Tire Pressure Monitor Diagnosis» screen, select the {DTC Display}.

NOTE:

- For details concerning operation procedure, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".

- For details concerning DTCs, refer to List of Diagnostic Trouble Code (DTC). <Ref. to TPM(diag)-27, List of Diagnostic Trouble Code (DTC).>

- Display all the DTCs detected.

- If a particular DTC is not properly stored in memory (due to a drop in occupant detection control module power supply, etc.) when a problem occurs, the DTC which is suffixed with a question mark appears on the Subaru Select Monitor display. This shows it may be an unreliable reading.

9) If communication is not possible between the tire pressure monitoring control module and the Subaru Select Monitor, check the communication circuit. <Ref. to TPM(diag)-11, 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)-14, WITHOUT DTC, INSPECTION, Subaru Select Monitor.>

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

2. DATA DISPLAY

- 1) On the «Main Menu» display screen, select the {Each System Check}.
 - 2) On the «System Selection Menu» display screen, select the {Tire Pressure Monitor}.
 - 3) Select the [OK] after the {Tire Pressure Monitor} is displayed.
 - 4) On the «Tire pressure monitor diagnosis» display screen, select the {Data Display}, then necessary data will be displayed.
- A list of the support data is shown in the following table.

Display	Contents to be monitored	Unit of measure
FR 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: Started transmitting data from a stopped state NORMAL: Conditions other than above
FL FN Code		
RR FN Code		
RL FN Code		
FR tire pressure	Value converted to tire pressure from data delivered from transmitter is displayed. (It may be different from values measured by the direct contact meter.)	kPa, psig, mmHg, inHg
FL tire pressure		kPa, psig, mmHg, inHg
RR tire pressure		kPa, psig, mmHg, inHg
RL tire 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 lights	kPa, psig, mmHg, inHg
Return pressure	Threshold where tire pressure warning light goes out	kPa, psig, mmHg, inHg

3. CLEAR MEMORY

- 1) On the «Main Menu», select the {2. Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Tire Pressure Monitor}.
- 3) Select the [OK] after the {Tire Pressure Monitor} is displayed.
- 4) On the «Tire Pressure Monitor Diagnosis» display screen, select the {Clear Memory}.
- 5) When «Done» and «Turn ignition switch OFF» are shown on the display screen, turn the ignition switch to OFF and close the Subaru Select Monitor.

NOTE:

For details concerning operation procedure, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

4. REGISTER TRANSMITTER ID

Perform the procedures below to register the transmitter.

- Transmitter replaced.
- Switched the position of the transmitter (rotated tires).
- Replaced the tire pressure monitoring control module.

NOTE:

- If registration of the transmitter ID is not possible after 2 attempts, replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING 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 registration is not possible for more than 5 minutes, 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.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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 the Subaru Select Monitor, on the «Main Menu» display screen, select the {2. Each System Check}.

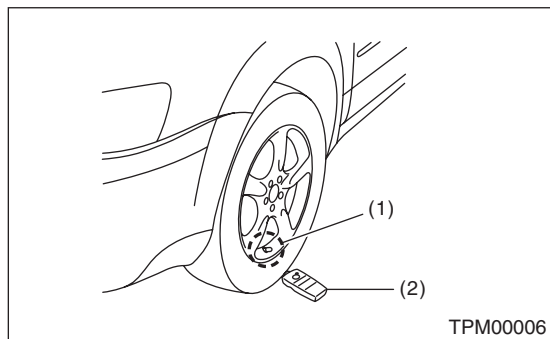
3) On the «System Selection Menu» display screen, select the {Tire Pressure Monitor}.

4) Select the [OK] after the {Tire Pressure Monitor} is displayed.

5) On the «Tire Pressure Monitor Diagnosis» display screen, select the {Transmitter ID regist confirm}.

6) {When ID registration mode execute, Registered ID is deleted Proceed?} is displayed then select the [OK].

7) Touch the transmitter registration tool to the side wall area near the air valve on the front left tire, and press the switch. The transmitter ID is sent to the tire pressure monitoring control module. (At that time, the tire pressure warning light blinks to confirm that the registration has started.)



(1) Air valve (transmitter)

(2) Transmitter registration tool

NOTE:

- Register the transmitter ID in the order of Left Front → Right Front → Right Rear → Left Rear.
- The transmitter registration tool is used by touching the side wall area near the transmitter.
- When registration of each tire is completed, the hazard light will blink and {ID registration completed} is displayed on the Select Monitor screen.
- 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)-10, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.>

9) Check the transmitter ID that was registered, then perform a driving test. <Ref. to TPM(diag)-17, PROCEDURE, Inspection Mode.>

5. DISPLAY TRANSMITTER (ID)

1) On the «Main Menu» display screen, select the {Each System Check}.

2) On the «System Selection Menu» display screen, select the {Tire Pressure Monitor}.

3) Select the [OK] after the {Tire Pressure Monitor} is displayed.

4) On the «Tire Pressure Monitor Diagnosis» display screen, select the {Transmitter ID regist confirm}.

5) Select {Transmitter ID Data Monitor} to display the transmitter ID.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

B: INSPECTION

1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

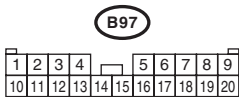
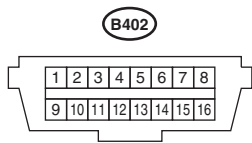
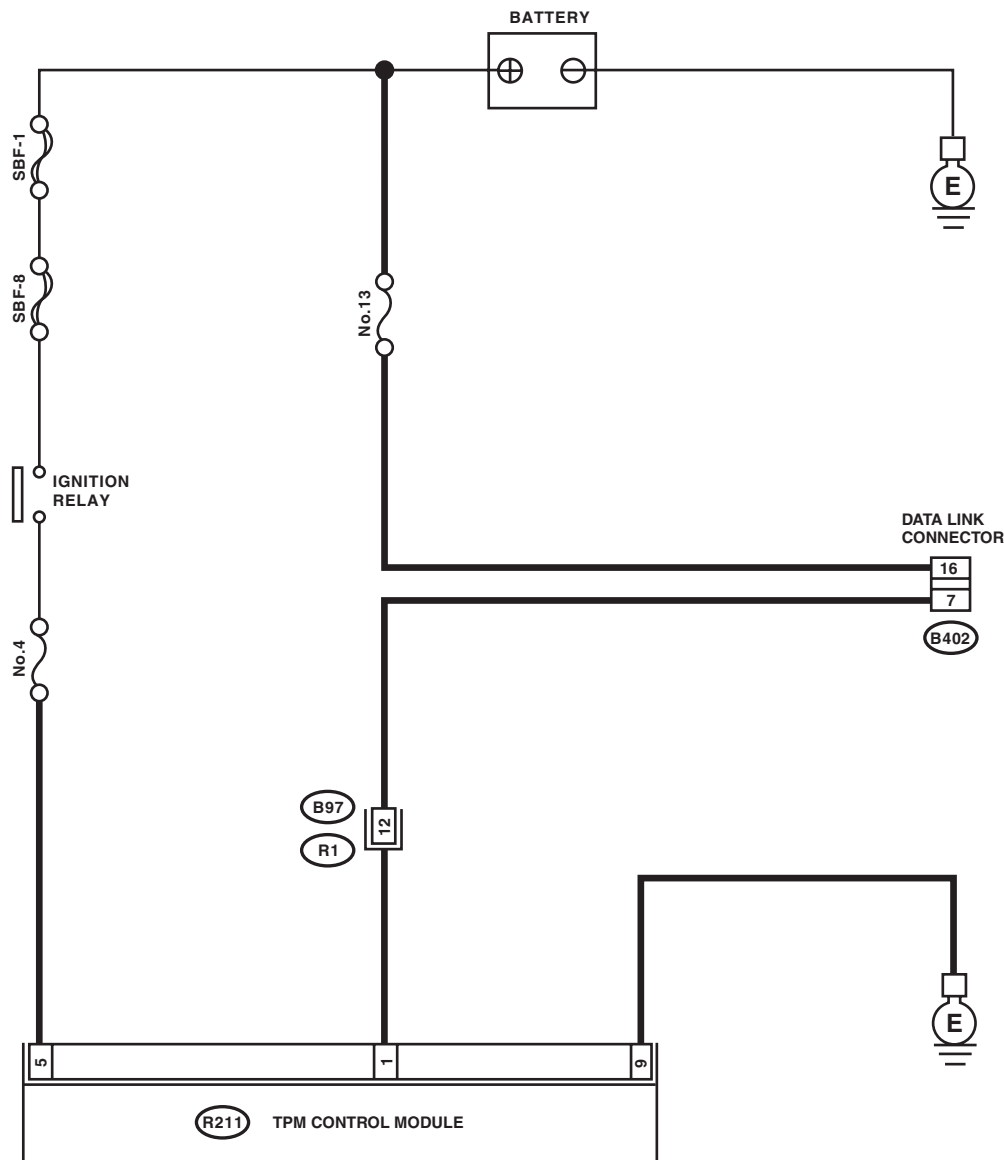
DETECTING CONDITION:

Defective harness connector

TROUBLE SYMPTOM:

Communication is impossible between the tire pressure monitoring control module and the Subaru Select Monitor.

WIRING DIAGRAM:



Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (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 TPM mode using Subaru Select Monitor.
2	CHECK BATTERY.	Is the voltage more than 11 V?	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 system can be executed normally.	Are the system name and model year 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 tire pressure monitoring control module connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Are the system name and model year displayed on Subaru Select Monitor?	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	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 tire pressure monitoring control module. 3) Measure the resistance between data link connector and chassis ground. Connector & terminal (B402) No. 10 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
7	CHECK THE TIRE PRESSURE MONITORING CONTROL MODULE OUTPUT SIGNAL. 1) Turn the ignition switch to ON. 2) Measure the voltage between tire pressure monitoring control module and chassis ground. Connector & terminal (B40) No. 10 (+) — 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 TIRE PRESSURE MONITORING CONTROL MODULE AND DATA LINK CONNECTOR. Measure the resistance between tire pressure monitoring control module and data link connector. Connector & terminal (R211) No. 1 — (B402) No. 10:	Is the resistance less than 0.5 Ω?	Go to step 9.	Repair the harness and connector between tire pressure monitoring control module and data link connector.
9	CHECK TIRE PRESSURE MONITORING CONTROL MODULE CONNECTOR. Turn the ignition switch to OFF.	Is the tire pressure monitoring control module connector inserted in the tire pressure monitoring control module until it locks?	Go to step 10.	Insert the tire pressure monitoring control module connector into the tire pressure monitoring control module.

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK POWER SUPPLY CIRCUIT. 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the ignition power voltage between tire pressure monitoring control module connector and chassis ground. Connector & terminal (R211) No. 5 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 11.	Repair open circuit of the harness between the tire pressure monitoring control module and battery.
11 CHECK HARNESS CONNECTOR BETWEEN TIRE PRESSURE MONITORING CONTROL MODULE AND CHASSIS GROUND. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the tire pressure monitoring control module. 3) Measure the resistance of harness between tire pressure monitoring control module and chassis ground. Connector & terminal (R211) No. 9 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 12.	Repair open circuit of the harness of the tire pressure monitoring control module.
12 CHECK POOR CONTACT OF CONNECTOR.	Is there poor contact in tire pressure monitoring control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

2. WITHOUT DTC

DETECTING CONDITION:

- Defective combination meter
- Defective harness

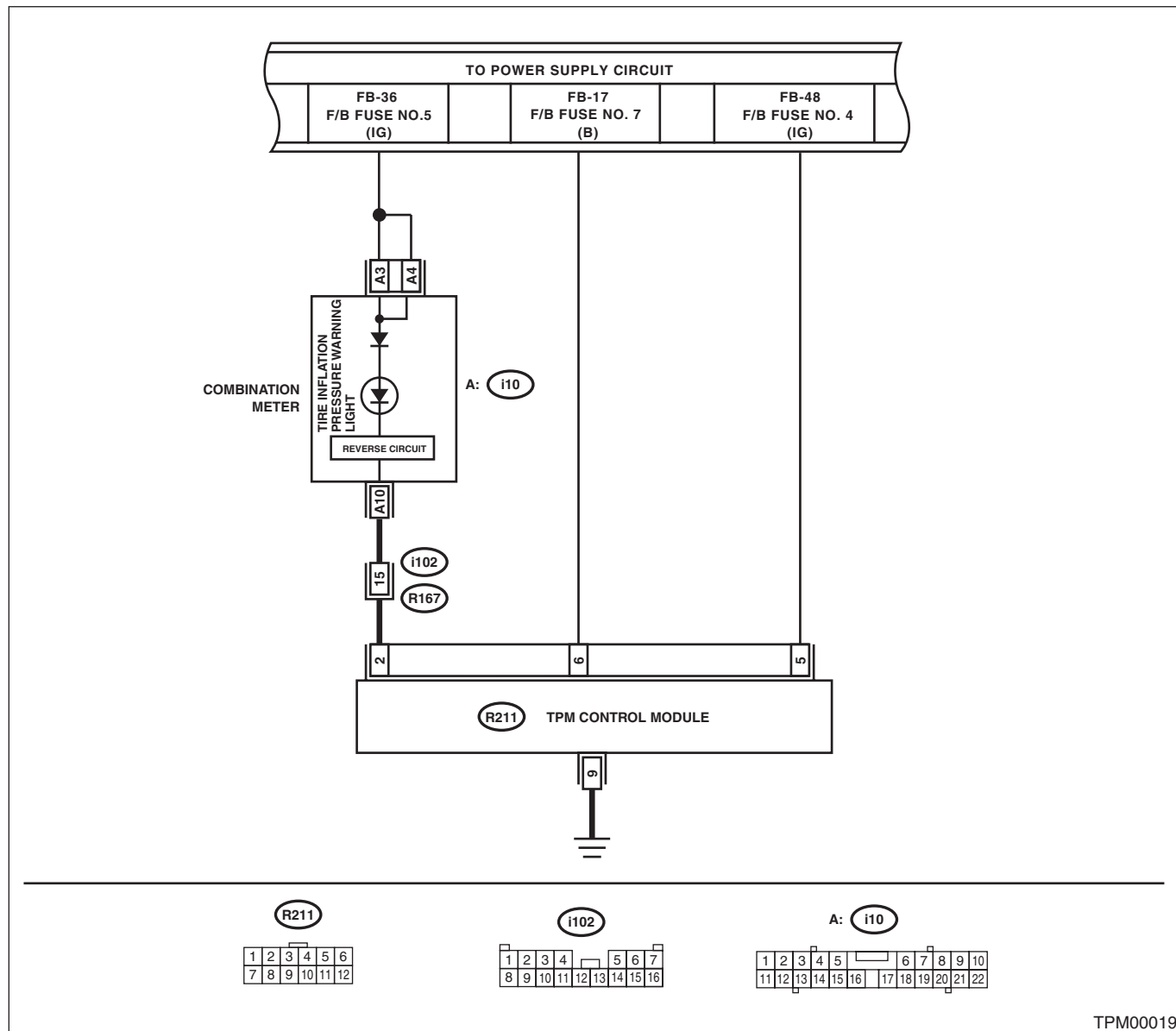
TROUBLE SYMPTOM:

- Tire pressure warning light does not go off.
- “NO TROUBLE CODE” will be displayed on the Subaru Select Monitor.

NOTE:

When the tire pressure warning light is OFF and “NO TROUBLE CODE” is displayed on Subaru Select Monitor, the system is in a normal condition.

WIRING DIAGRAM:



TPM00019

Subaru Select Monitor

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
1 DATA CHECK SUBARU SELECT MONITOR. 1) Select {Current Data Display & Save} in Subaru Select Monitor. 2) Read the data of the "Tire pressure warning light".	Is "ON" displayed?	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Go to step 2.
2 CHECK WIRING HARNESS. Measure the resistance between tire pressure monitoring control module and combination meter connector. Connector & terminal (i10) No. 10 — (R211) No. 2:	Is the resistance less than 0.5 Ω ?	Go to step 3.	Repair the harness and connector between tire pressure monitoring control module and combination meter.
3 CHECK POOR CONTACT OF CONNECTOR.	Is there poor contact in the tire pressure monitoring control module connector and combination meter connector?	Repair the connector.	Check the combination meter.

Read Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

6. Read Diagnostic Trouble Code (DTC)

A: OPERATION

For details about reading of DTCs, refer to “Subaru Select Monitor”. <Ref. to TPM(diag)-8, Subaru Select Monitor.>

7. Inspection Mode

A: PROCEDURE

Reproduce the malfunction occurrence condition as possible. Drive the vehicle at a speed more than 40 km/h (25 MPH) for at least ten minutes.

Clear Memory Mode

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

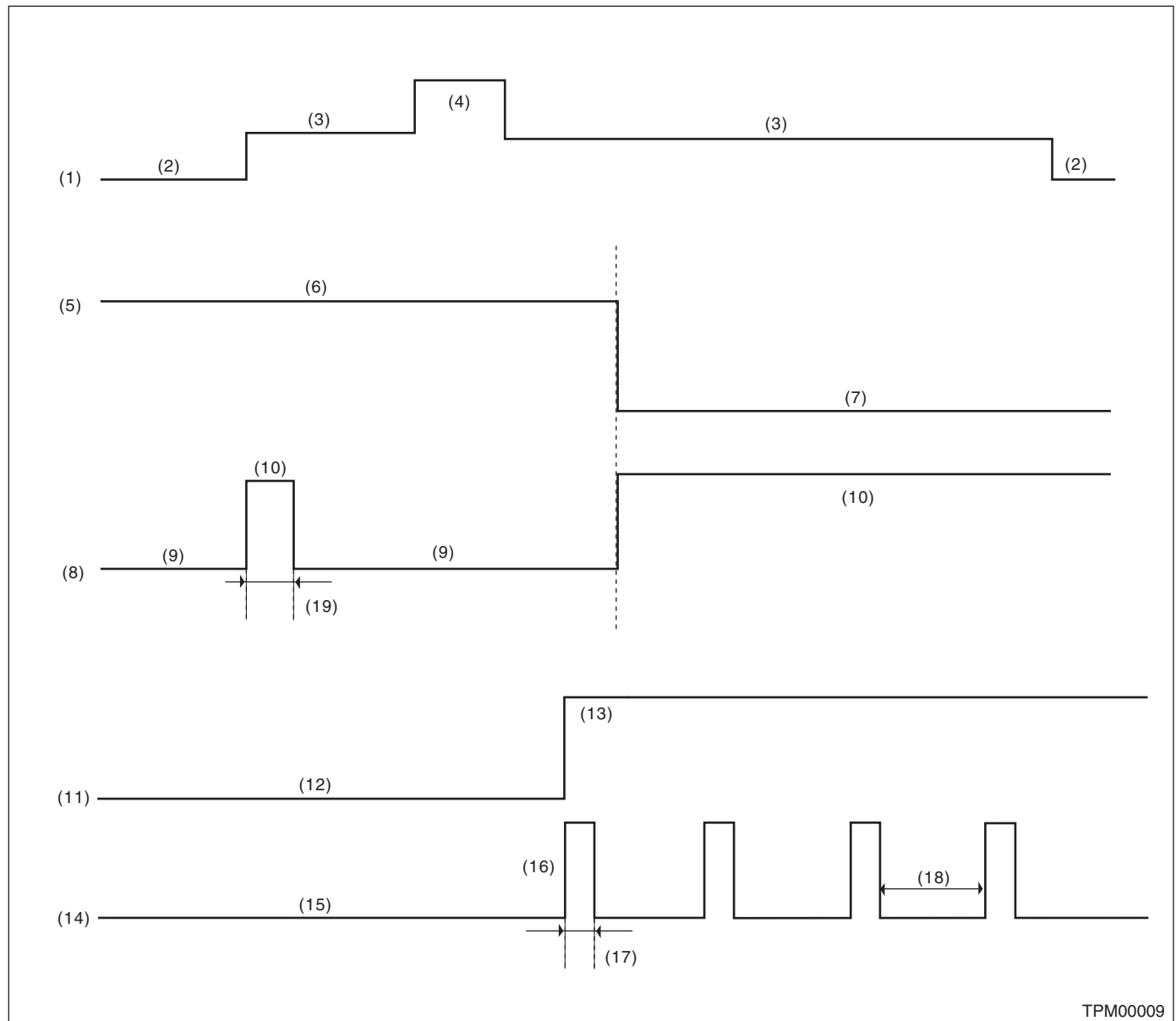
8. Clear Memory Mode

A: OPERATION

For details concerning DTC clear operation, refer to
“Subaru Select Monitor”. <Ref. to TPM(diag)-8,
Subaru Select Monitor.>

9. Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

A: INSPECTION



TPM00009

- | | | |
|--|---------------------------------|----------------------------------|
| (1) Ignition switch | (8) Tire pressure warning light | (14) Tire pressure warning light |
| (2) OFF | (9) Light OFF | (15) Light OFF |
| (3) ON | (10) Light ON | (16) Blink |
| (4) Start | (11) System status | (17) 1 second |
| (5) Tire pressure | (12) Normal | (18) 3 seconds |
| (6) Meet the specification | (13) Defective | (19) 2 seconds |
| (7) 188 kPa (1.9 kgf/cm ² , 27 psi) or less | | |

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) When tire pressure warning light does not go off, check the tire pressure monitoring control module/warning light circuit and the combination meter circuit. <Ref. to TPM(diag)-23, 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 malfunction of the system, the past malfunctions are displayed.)

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

B: TIRE PRESSURE WARNING LIGHT DOES NOT COME ON

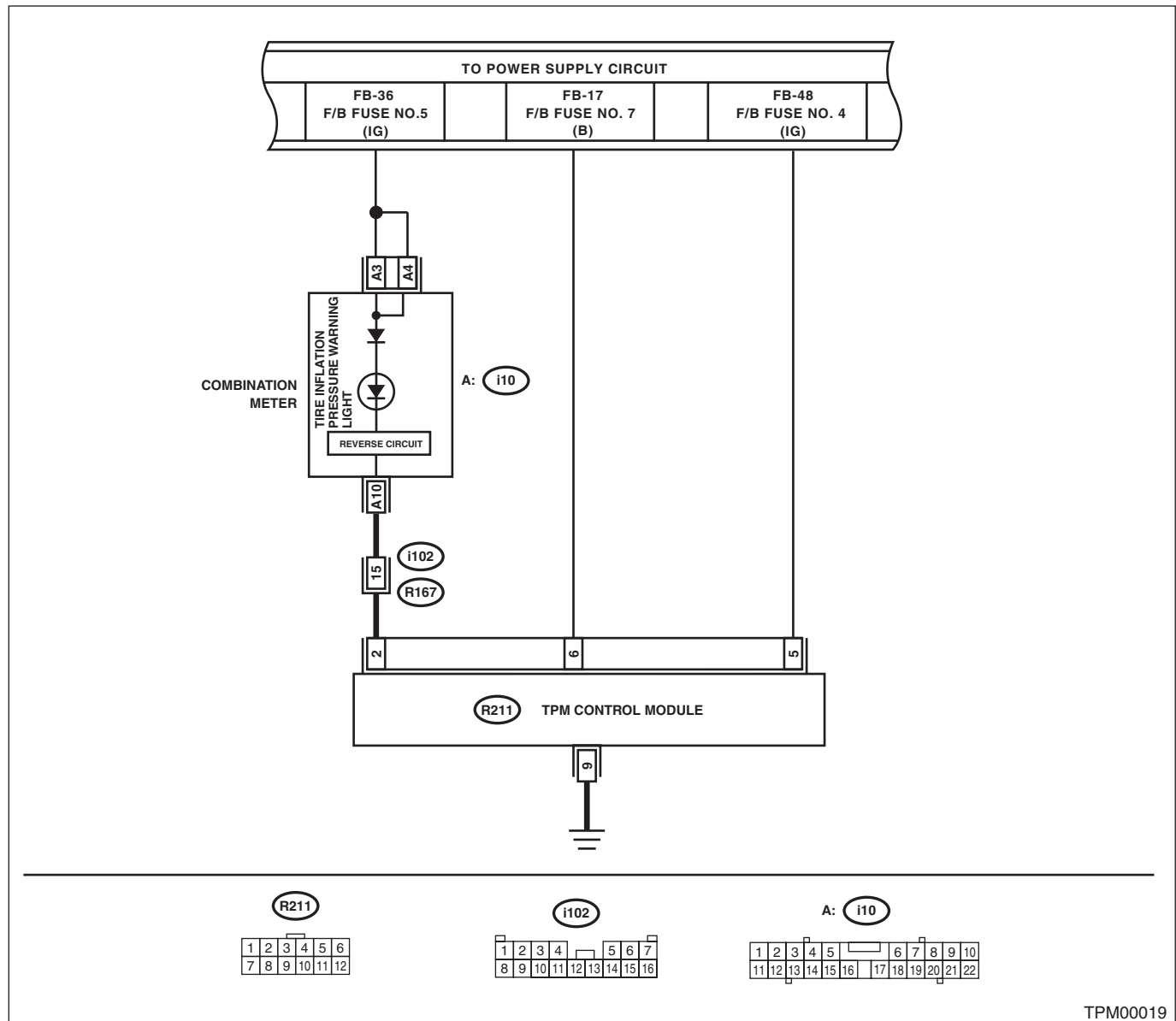
DETECTING CONDITION:

- Defective combination meter
- Defective harness

TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), the tire pressure warning light does not come on (for approximately 2 seconds).

WIRING DIAGRAM:



Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK DIAGNOSTIC TROUBLE CODE (DTC). Connect Subaru Select Monitor, read Diagnostic Trouble Code. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is diagnostics code (DTC) displayed?	Perform the diagnosis according to DTC. <Ref. to TPM(diag)-27, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK DATA OUTPUT. 1) Select data display of the tire pressure monitoring. 2) Check that the warning light output is ON for approximately 2 seconds immediately after turning the ignition switch to ON.	Is the warning light output ON for approximately 2 seconds?	Go to step 3.	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>
3	CHECK HARNESS. 1) Disconnect the tire pressure monitoring control module connector. 2) Use a lead wire to short the terminal No. 2 of the tire pressure monitoring control module harness connector (R211) with the chassis ground, and turn the ignition switch to ON.	Is the tire pressure warning light lit?	Go to step 4.	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>
4	CHECK HARNESS. 1) Connect the tester to the terminal No. 2 of the tire pressure monitoring control module connector (R211). 2) Turn the ignition switch to ON and measure the voltage between the tire pressure monitoring control module connector and chassis ground. Connector & terminal (R211) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 5.	Replace the combination meter. <Ref. to IDI-12, REMOVAL, Combination Meter.>
5	CHECK COMBINATION METER. 1) Short between the combination meter connector (i10) No. 10 and the chassis ground. 2) Turn the ignition switch to ON.	Is the tire pressure warning light lit?	Go to step 6.	Repair or replace the harness that is open between the combination meter connector and the tire pressure monitoring control module harness.
6	CHECK HARNESS. 1) Disconnect the combination meter connector (i10). 2) Measure the resistance between tire pressure monitoring control module connector (i10) and chassis ground. Connector & terminal (i10) No. 10 — Chassis ground:	Is the resistance less than 1 Ω ?	Replace the combination meter. <Ref. to IDI-12, REMOVAL, Combination Meter.>	Repair or replace the harness that is open between the combination meter and the chassis ground.

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

C: TIRE PRESSURE WARNING LIGHT DOES NOT COME OFF

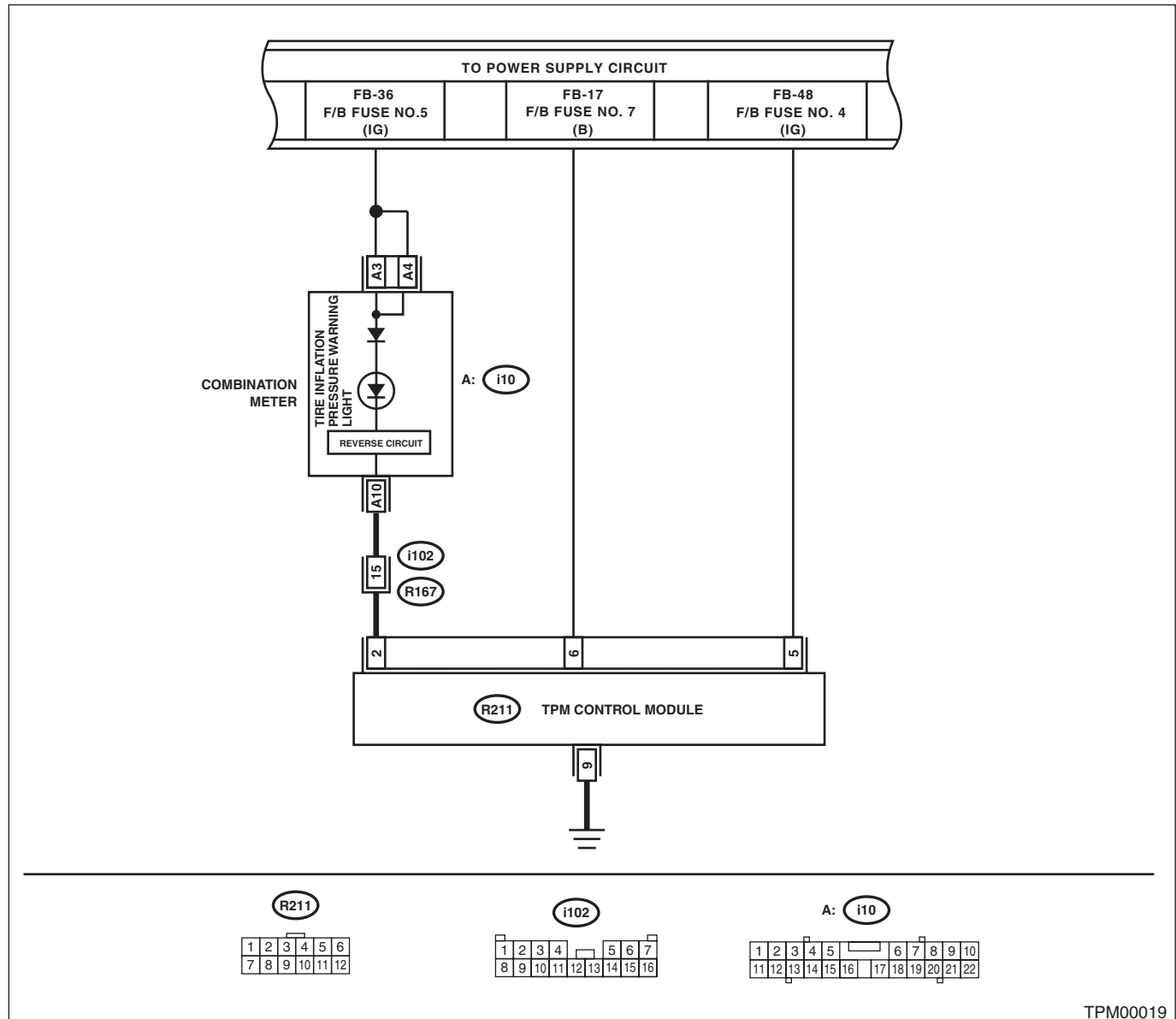
DETECTING CONDITION:

- Defective combination meter
- Defective harness
- Tires pressure drop
- Transmitter ID not registered

TROUBLE SYMPTOM:

Tire pressure warning light does not go off after engine starts.

WIRING DIAGRAM:



Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK DIAGNOSTIC TROUBLE CODE (DTC). Connect Subaru Select Monitor, read Diagnostic Trouble Code. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Perform the diagnosis according to DTC. <Ref. to TPM(diag)-27, 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)-10, 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 tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Go to step 4.
4	CHECK HARNESS. 1) Disconnect the tire pressure monitoring control module connector. 2) Connect the tester to the terminal No. 2 of the tire pressure monitoring control module connector (R211). 3) Turn the ignition switch to ON, and measure the voltage. Connector & terminal (R211) No. 2 (+) — Chassis ground (–):	Is the voltage more than 10 V?	Go to step 5.	Replace the combination meter. <Ref. to IDI-12, REMOVAL, Combination Meter.>
5	CHECK COMBINATION METER. 1) Short between the combination meter connector (i10) No. 10 and the chassis ground. 2) Turn the ignition switch to ON.	Is the tire pressure warning light lit?	Go to step 6.	Repair or replace the harness that is open between the combination meter connector and the tire pressure monitoring control module harness.
6	CHECK HARNESS. 1) Disconnect the combination meter connector (i10). 2) Measure the resistance between the terminal No. 2 of the tire pressure monitoring control module connector (R211) and chassis ground. Connector & terminal (R211) No. 2 — Chassis ground:	Is the resistance more than 1 MΩ?	Replace the combination meter. <Ref. to IDI-12, REMOVAL, Combination Meter.>	Repair or replace the harness connector short circuit between the combination meter connector and the tire pressure monitoring control module connector.

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

D: TIRE PRESSURE WARNING LIGHT IS BLINKING

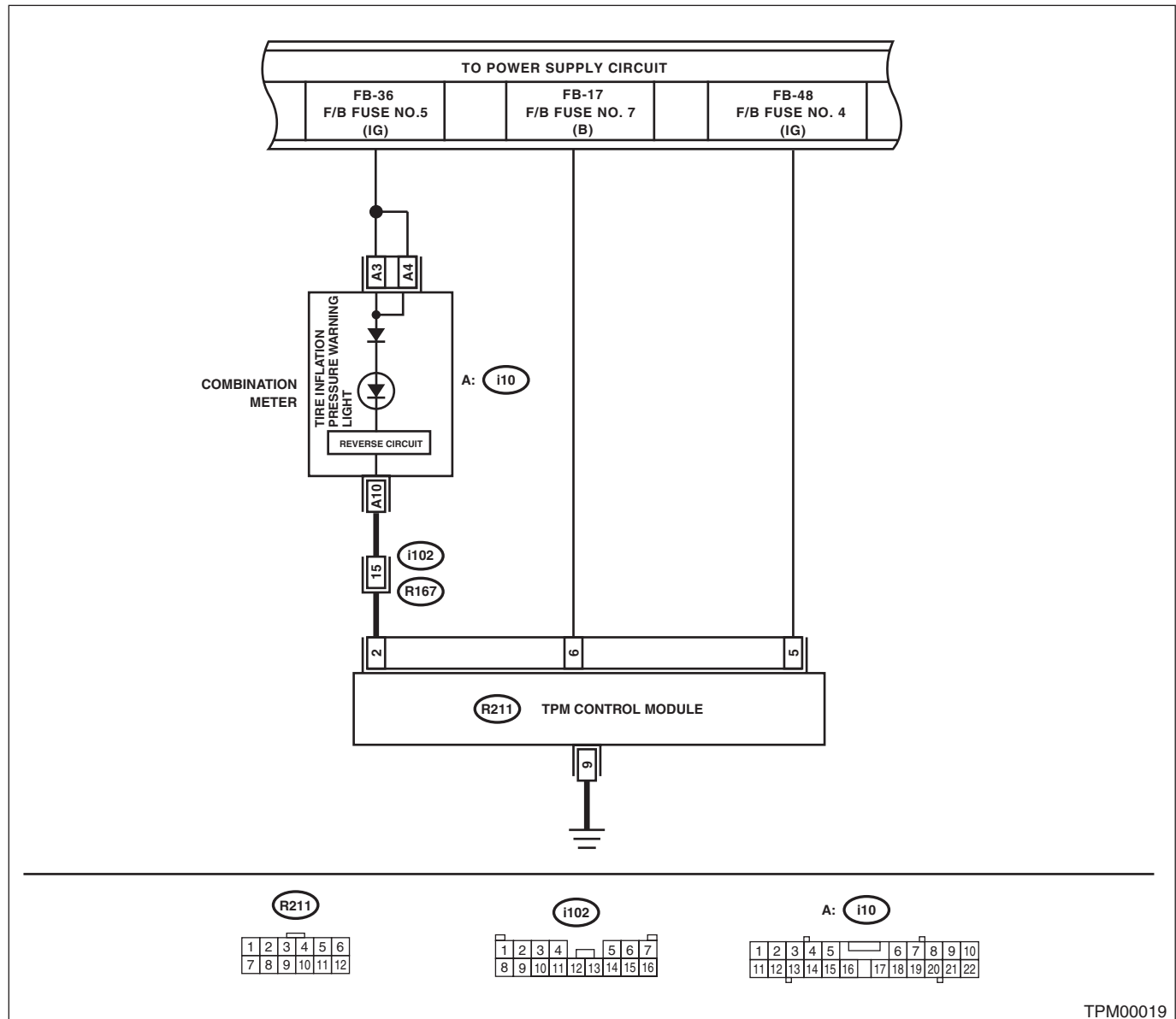
DETECTING CONDITION:

- Tire pressure monitoring control module is faulty.
- Defective harness
- Transmitter is faulty.

TROUBLE SYMPTOM:

Tire pressure warning light blinks continuously after engine starting.

WIRING DIAGRAM:



TPM00019

Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK DIAGNOSTIC TROUBLE CODE (DTC). Connect Subaru Select Monitor, read Diagnostic Trouble Code. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is diagnostics code (DTC) displayed?	Perform the diagnosis according to DTC. <Ref. to TPM(diag)-27, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK HARNESS. 1) Disconnect the tire pressure monitoring control module connector. 2) Short the terminal No. 2 of the tire pressure monitoring control module harness connector (R211) with the chassis ground, and turn the ignition switch to ON.	Is the tire pressure warning light lit?	Go to step 3.	Replace the tire pressure monitoring control module.
3	CHECK HARNESS. 1) Connect the tester to the terminal No. 2 of the tire pressure monitoring control module connector (R211). 2) Turn the ignition switch to ON, and measure the voltage. Connector & terminal (R211) No. 2 (+) — Chassis ground (–):	Is the voltage more than 10 V?	Go to step 4.	Replace the combination meter. <Ref. to IDI-12, REMOVAL, Combination Meter.>
4	CHECK COMBINATION METER. 1) Short between the combination meter connector (i10) No. 10 and the chassis ground. 2) Turn the ignition switch to ON.	Is the tire pressure warning light lit?	Go to step 5.	There is an open circuit between the combination meter connector and the tire pressure monitoring control module harness. Repair or replace the harness.
5	CHECK HARNESS. 1) Disconnect the combination meter connector (i10). 2) Measure the resistance between tire pressure monitoring control module connector (i10) and chassis ground. Connector & terminal (i10) No. 10 — Chassis ground:	Is the resistance more than 1 MΩ?	Replace the combination meter. <Ref. to IDI-12, REMOVAL, Combination Meter.>	Repair or replace the harness connector short circuit between the combination meter connector and the tire pressure monitoring control module connector.

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	FL Air Pressure Decrease	FL tire pressure is reduced.	<Ref. to TPM(diag)-29, DTC 11 FL AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
12	FR Air Pressure Decrease	FR tire pressure is reduced.	<Ref. to TPM(diag)-29, DTC 12 FR AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
13	RR Air Pressure Decrease	RR tire pressure is reduced.	<Ref. to TPM(diag)-29, DTC 13 RR AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
14	RL Air Pressure Decrease	RL tire pressure is reduced.	<Ref. to TPM(diag)-29, DTC 14 RL AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	No FL Transmitter Data	Data cannot be received from FL sensor.	<Ref. to TPM(diag)-29, DTC 21 NO FL TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	No FR Transmitter Data	Data cannot be received from FR sensor.	<Ref. to TPM(diag)-30, DTC 22 NO FR TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	No RR Transmitter Data	Data cannot be received from RR sensor.	<Ref. to TPM(diag)-30, DTC 23 NO RR TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	No RL Transmitter Data	Data cannot be received from RL sensor.	<Ref. to TPM(diag)-31, DTC 24 NO RL TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
31	FL Transmit Pres Data Abnormal	FL sensor data contents are abnormal.	<Ref. to TPM(diag)-33, DTC 31 FL TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
32	FR Transmit Pres Data Abnormal	FR sensor data contents are abnormal.	<Ref. to TPM(diag)-33, DTC 32 FR TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
33	RR Transmit Pres Data Abnormal	RR sensor data contents are abnormal.	<Ref. to TPM(diag)-33, DTC 33 RR TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
34	RL Transmit Pres Data Abnormal	RL sensor data contents are abnormal.	<Ref. to TPM(diag)-34, DTC 34 RL TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
41	FL Trans Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-36, DTC 41 FL TRANS 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	FR Trans Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-36, DTC 42 FR TRANS FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
43	RR Trans Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-36, DTC 43 RR TRANS FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
44	RL Trans Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-37, DTC 44 RL TRANS FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
51	FL Transmit Battery Low Voltage	Transmitter battery voltage is low.	<Ref. to TPM(diag)-39, DTC 51 FL TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
52	FR Transmit Battery Low Voltage	Transmitter battery voltage is low.	<Ref. to TPM(diag)-39, DTC 52 FR TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
53	RR Transmit Battery Low Voltage	Transmitter battery voltage is low.	<Ref. to TPM(diag)-39, DTC 53 RR TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
54	RL Transmit Battery Low Voltage	Transmitter battery voltage is low.	<Ref. to TPM(diag)-39, DTC 54 RL TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
61	Vehicle Speed Is Abnormal	Vehicle speed signal is not input to the control module with the vehicle speed more than 25 km/h.	<Ref. to TPM(diag)-40, 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 FL AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for diagnostic procedure. <Ref. to TPM(diag)-29, DTC 14 RL AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

B: DTC 12 FR AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for diagnostic procedure. <Ref. to TPM(diag)-29, DTC 14 RL AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

C: DTC 13 RR AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for diagnostic procedure. <Ref. to TPM(diag)-29, DTC 14 RL AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

D: DTC 14 RL AIR PRESSURE DECREASE

DTC DETECTING CONDITION:

Inflation pressure of each tire reduces under specifications (188 kPa (1.9 kgf/cm², 27.3 psi) or less).

TROUBLE SYMPTOM:

Tire pressure warning light illuminates.

Step	Check	Yes	No
1 CHECK THE 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-6, Tire.>	Go to step 2.
2 CHECK THE TIRES. Check the tire air pressure.	Is the tire pressure in the specifications?	Go to step 3.	Adjust the air pressure.
3 CHECK THE TRANSMITTER. Drive the vehicle at a speed more than 40 km/h (25 MPH) 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-12, Tire Pressure Monitoring System.>	Go to step 4.
4 PERFORM DRIVING TEST. 1) Perform the Clear Memory Mode. <Ref. to TPM(diag)-9, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 2) Perform the driving test. <Ref. to TPM(diag)-17, PROCEDURE, Inspection Mode.> 3) Read the DTC. <Ref. to TPM(diag)-8, 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)-27, 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 NO FL TRANSMITTER DATA

NOTE:

Refer to DTC 24 for diagnostic procedure. <Ref. to TPM(diag)-31, DTC 24 NO RL TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

F: DTC 22 NO FR TRANSMITTER DATA

NOTE:

Refer to DTC 24 for diagnostic procedure. <Ref. to TPM(diag)-31, DTC 24 NO RL TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

G: DTC 23 NO RR TRANSMITTER DATA

NOTE:

Refer to DTC 24 for diagnostic procedure. <Ref. to TPM(diag)-31, DTC 24 NO RL TRANSMITTER DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

H: DTC 24 NO RL TRANSMITTER DATA

DTC DETECTING CONDITION:

Data from each transmitter is not received for 10 minutes.

TROUBLE SYMPTOM:

Tire pressure warning light blinks.

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". <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 2.	Replace the FL transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
2 CHECK FL TRANSMITTER ID. Check the ID displayed in the updated ID display and the FL 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 Received ID".	Is "Latest Received ID" updated?	Go to step 4.	Replace the FR transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK FR TRANSMITTER ID. Check the ID displayed in the updated ID display and the FR 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 Received ID".	Is "Latest Received ID" updated?	Go to step 6.	Replace the RR transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
6 CHECK RR TRANSMITTER ID. Check the ID displayed in the updated ID display and the RR 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 Received ID".	Is "Latest Received ID" updated?	Go to step 8.	Replace the RL transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
8 CHECK RL TRANSMITTER ID. Check the ID displayed in the updated ID display and the RL 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.	Replace the transmitter indicated by DTC. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

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-12, REMOVAL, Tire Pressure Monitoring System.>	Replace the transmitter indicated by DTC. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

CAUTION:

When driving vehicle to perform driving test, there should be always 2 persons (driver and checker) to check.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

I: DTC 31 FL TRANSMIT PRES DATA ABNORMAL

NOTE:

Refer to DTC 34 for diagnostic procedure. <Ref. to TPM(diag)-34, DTC 34 RL TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

J: DTC 32 FR TRANSMIT PRES DATA ABNORMAL

NOTE:

Refer to DTC 34 for diagnostic procedure. <Ref. to TPM(diag)-34, DTC 34 RL TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

K: DTC 33 RR TRANSMIT PRES DATA ABNORMAL

NOTE:

Refer to DTC 34 for diagnostic procedure. <Ref. to TPM(diag)-34, DTC 34 RL TRANSMIT PRES DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

L: DTC 34 RL TRANSMIT PRES 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.

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". <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 2.	Replace the FL transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
2 CHECK FL TRANSMITTER ID. Check the ID displayed in the updated ID display and the FL 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 Received ID".	Is "Latest Received ID" updated?	Go to step 4.	Replace the FR transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK FR TRANSMITTER ID. Check the ID displayed in the updated ID display and the FR 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 Received ID".	Is "Latest Received ID" updated?	Go to step 6.	Replace the RR transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
6 CHECK RR TRANSMITTER ID. Check the ID displayed in the updated ID display and the RR 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 Received ID".	Is "Latest Received ID" updated?	Go to step 8.	Replace the RL transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
8 CHECK RL TRANSMITTER ID. Check the ID displayed in the updated ID display and the RL 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.	Replace the transmitter indicated by DTC.

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-12, REMOVAL, Tire Pressure Monitoring System.>	Replace the transmitter indicated by DTC. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

M: DTC 41 FL TRANS FUNCTION CODE ABNORMAL

NOTE:

Refer to DTC 44 for diagnostic procedure. <Ref. to TPM(diag)-37, DTC 44 RL TRANS FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

N: DTC 42 FR TRANS FUNCTION CODE ABNORMAL

NOTE:

Refer to DTC 44 for diagnostic procedure. <Ref. to TPM(diag)-37, DTC 44 RL TRANS FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

O: DTC 43 RR TRANS FUNCTION CODE ABNORMAL

NOTE:

Refer to DTC 44 for diagnostic procedure. <Ref. to TPM(diag)-37, DTC 44 RL TRANS 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 RL TRANS FUNCTION CODE ABNORMAL

DTC DETECTING CONDITION:

Unexpected function codes received from each transmitter.

TROUBLE SYMPTOM:

Tire pressure warning light blinks.

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". <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID), OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 2.	Replace the FL transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
2 CHECK FL TRANSMITTER ID. Check the ID displayed in the updated ID display and the FL 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 Received ID".	Is "Latest Received ID" updated?	Go to step 4.	Replace the FR transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
4 CHECK FR TRANSMITTER ID. Check the ID displayed in the updated ID display and the FR 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 Received ID".	Is "Latest Received ID" updated?	Go to step 6.	Replace the RR transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
6 CHECK RR TRANSMITTER ID. Check the ID displayed in the updated ID display and the RR 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 Received ID".	Is "Latest Received ID" updated?	Go to step 8.	Replace the RL transmitter. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
8 CHECK RL TRANSMITTER ID. Check the ID displayed in the updated ID display and the RL 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.	Replace the transmitter indicated by DTC. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

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-12, REMOVAL, Tire Pressure Monitoring System.>	Replace the transmitter indicated by DTC. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Q: DTC 51 FL TRANSMIT BATTERY LOW VOLTAGE

NOTE:

Refer to DTC 54 for diagnostic procedure. <Ref. to TPM(diag)-39, DTC 54 RL TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

R: DTC 52 FR TRANSMIT BATTERY LOW VOLTAGE

NOTE:

Refer to DTC 54 for diagnostic procedure. <Ref. to TPM(diag)-39, DTC 54 RL TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

S: DTC 53 RR TRANSMIT BATTERY LOW VOLTAGE

NOTE:

Refer to DTC 54 for diagnostic procedure. <Ref. to TPM(diag)-39, DTC 54 RL TRANSMIT BATTERY LOW VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

T: DTC 54 RL TRANSMIT BATTERY LOW VOLTAGE

DTC DETECTING CONDITION:

Low battery signals received 20 times from each transmitter.

TROUBLE SYMPTOM:

Tire pressure warning light blinks.

Step		Check	Yes	No
1	CHECK THE TRANSMITTER. 1) Replace all transmitters with new parts and register their IDs. <Ref. to WT-12, 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?	Transmitter embedded battery has worn out. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>	Replace the tire pressure monitoring control module. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

U: DTC 61 VEHICLE SPEED IS ABNORMAL

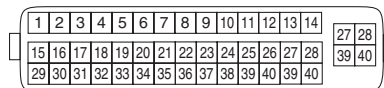
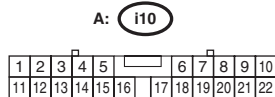
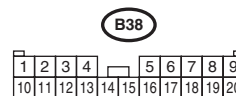
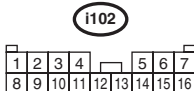
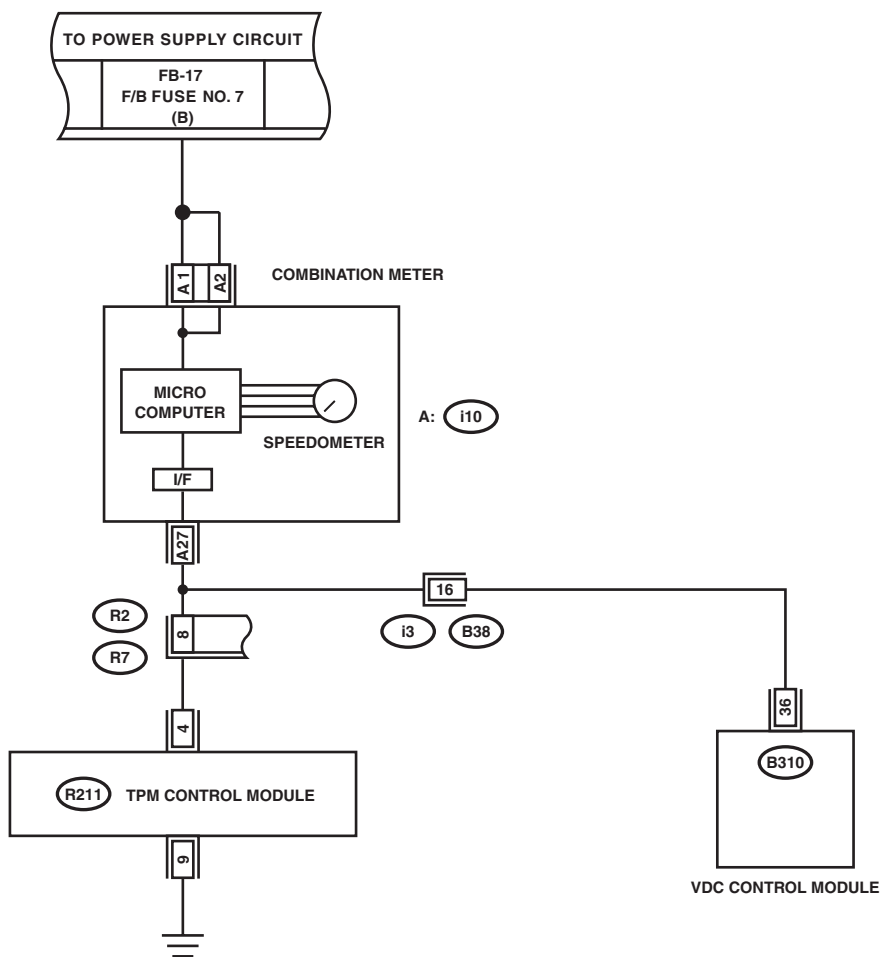
DTC DETECTING CONDITION:

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:



TPM00020

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK TIRE PRESSURE MONITORING CONTROL MODULE. 1) Connect an oscilloscope to the terminal No. 4 of the tire pressure monitoring control module connector (R211). 2) Drive the vehicle at 40 km/h (25 MPH) and check the vehicle speed signal at that time.	Is the vehicle speed being input?	Replace the tire pressure monitoring control module. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>	Go to step 2.
2	CHECK HARNESS. 1) Disconnect the combination meter connector (i10). 2) Connect the tire pressure monitoring control module connector (R211) and combination meter connector (i10) and measure the resistance.	Is the resistance less than 0.5 Ω ?	Check the combination meter. <Ref. to IDI-12, 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

Symptom		Problem parts
Tire pressure warning light illuminates.	Tire pressure is reduced.	• Improper tire pressure adjustment. • Punctured tire
Tire pressure warning light blinks.	Tire pressure monitoring system has malfunction.	• Air pressure sensor is faulty. • Air pressure sensor is out of battery • Tire pressure monitoring control module is faulty. • 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. • Tire pressure monitoring control module is faulty. • Defective vehicle harness

DIFFERENTIALS

DI

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1. General Description

A: NOTE

For inspection, 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-67, Transfer Clutch.>

3. Extension Case

A: NOTE

For removal, installation and inspection, refer to
“5AT” section. <Ref. to 5AT-65, Extension Case.>

4. Oil Seal

A: NOTE

For inspection, refer to the “5AT” section.

<Ref. to 5AT-45, Extension Case Oil Seal.> <Ref.
to 5AT-47, Differential Side Retainer Oil Seal.>

5. Center Differential Carrier

A: NOTE

For removal, installation and inspection, refer to
“5AT” section.

<Ref. to 5AT-74, Center Differential Carrier.>

6. Reduction Driven Gear

A: NOTE

For removal, installation and inspection, refer to
"5AT" section.

<Ref. to 5AT-71, 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-35, 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 broken wires 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 checklist. <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)-8, 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)-21, OPERATION, Read Diagnostic Trouble Code (DTC).> NOTE: If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. <Ref. to VDC(diag)-18, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.> 5) Record all DTCs and freeze frame data.	Is DTC displayed?	Go to step 4.	Go to step 3.
3 PERFORM GENERAL DIAGNOSTICS. 1) Inspect using "General Diagnostic Table". <Ref. to VDC(diag)-84, INSPECTION, General Diagnostic Table.> 2) Perform the Clear Memory Mode. <Ref. to VDC(diag)-23, OPERATION, Clear Memory Mode.> 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC. <Ref. to VDC(diag)-21, 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)-28, ABS WARNING LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-25, VDC WARNING LIGHT, TCS OFF INDICATOR LIGHT AND VDC INDICATOR LIGHT DO NOT COME ON, Warning Light Illumination Pattern.>

Basic Diagnostic Procedure

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
4 PERFORM THE 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)-33, LIST, List of Diagnostic Trouble Code (DTC).> 2) Correct the cause of trouble. 3) Perform the Clear Memory Mode. <Ref. to VDC(diag)-23, OPERATION, Clear Memory Mode.> 4) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 5) Read the DTC. <Ref. to VDC(diag)-21, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Repeat step 4 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 come on • 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
	☐ Reducing speed	—	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

VDC warning light and TCS OFF indicator light come on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not come on • When/How long does it come on?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, 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
	☐ Reducing speed	— 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:			

3. STATE OF VDC INDICATOR LIGHT

VDC indicator light comes on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not come on • When/How long does it come on?		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ ON (after starting engine, 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
	☐ Reducing speed	— 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)

4. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Others:
	b) Ambient temperature	°C (°F)
	c) Road	☐ Inner city ☐ Suburbs ☐ Highway ☐ General road ☐ 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 ☐ New-fallen snow ☐ Compressed 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 ☐ Accelerating ☐ Reducing speed ☐ Low speed ☐ Turning ☐ Others:	
	d) Tire inflation pressure	Front RH tire:	kPa
		Front LH tire:	kPa
		Rear RH tire:	kPa
		Rear LH tire:	kPa
	e) Degree of wear	Front RH tire:	
		Front LH tire:	
		Rear RH tire:	
		Rear LH tire:	
	f) 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 chains are fitted: ☐ Yes / ☐ No		
	j) T-type tire is used: ☐ Yes / ☐ No		
	k) Condition of suspension alignment:		
l) Loading state:			
m) Repair parts are used: ☐ Yes / ☐ No			
• Contents:			
n) Others:			

General Description

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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:

- 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 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-12, CHECK HYDRAULIC UNIT VDC OPERATION WITH BRAKE TESTER, INSPECTION, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
- Without brake tester <Ref. to VDC-11, 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-19, INSPECTION, Rear Brake Pad.> <Ref. to BR-21, INSPECTION, Rear Disc Rotor.>

7. TIRE

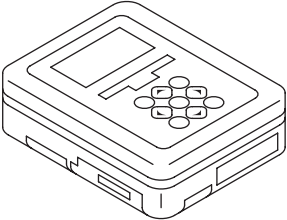
Check the tire specifications, tire wear and air pressure. <Ref. to WT-2, SPECIFICATION, General Description.>

General Description

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

C: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B020XU0	1B020XU0	SUBARU SELECT MONITOR KIT	Used for troubleshooting for the electrical system.

2. GENERAL TOOL

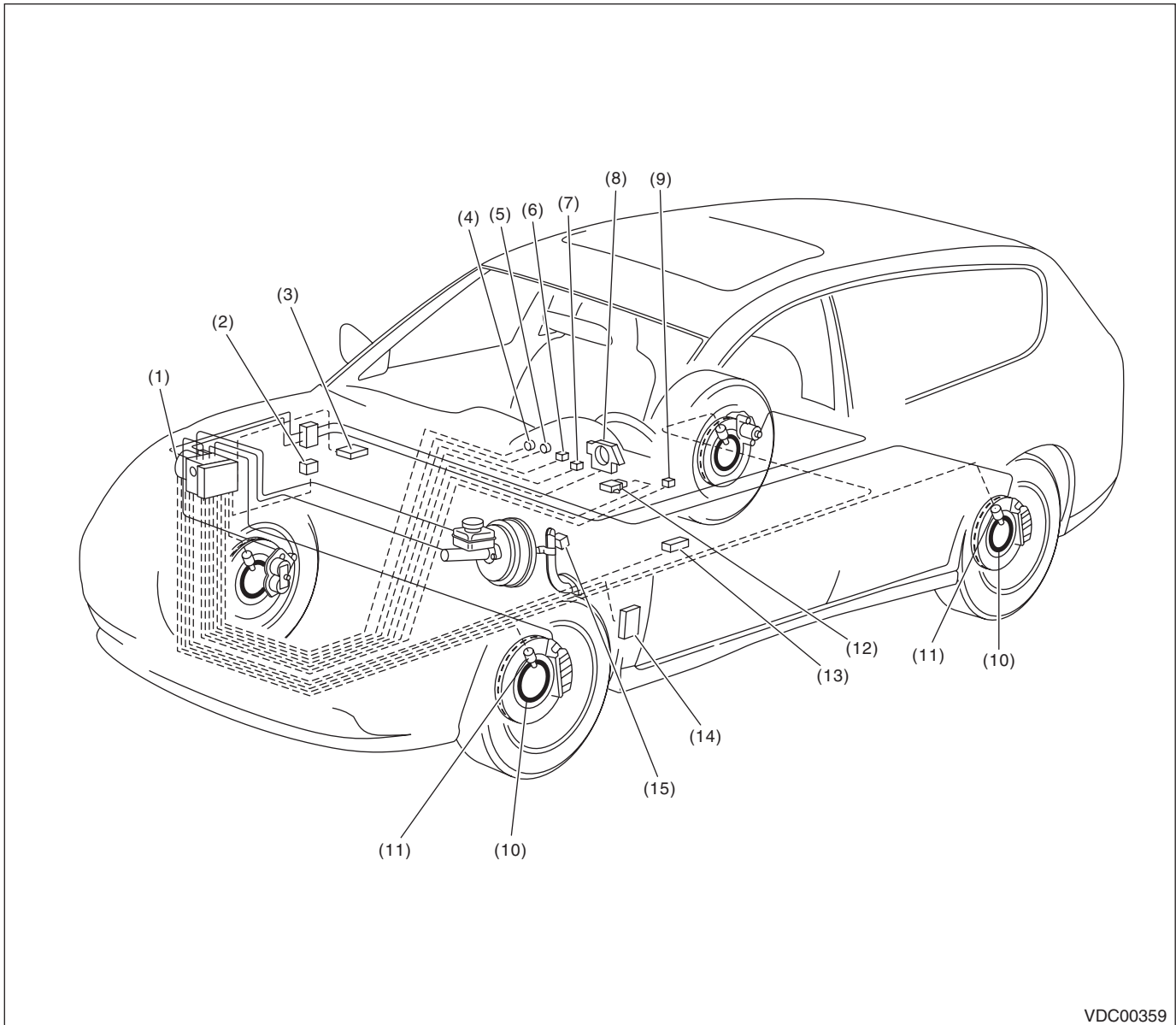
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

Electrical Component Location

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

4. Electrical Component Location

A: LOCATION

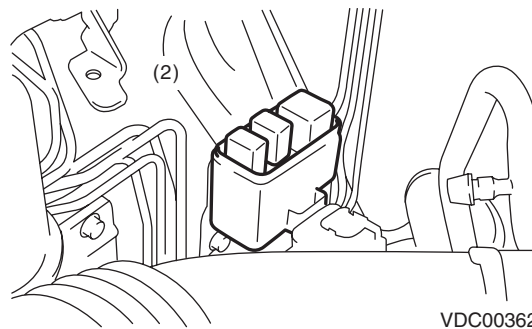
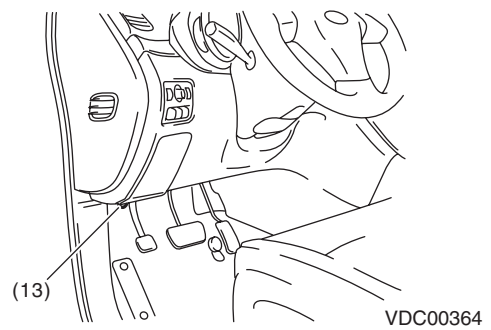
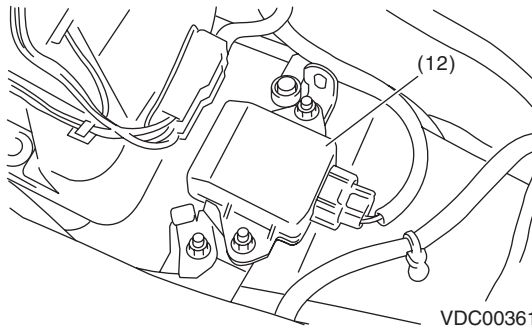
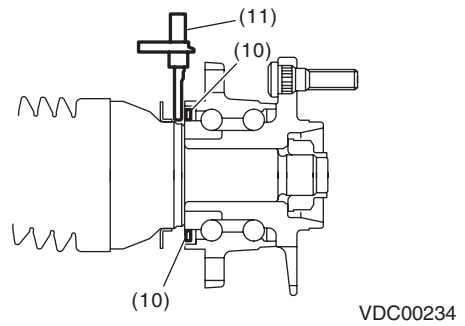
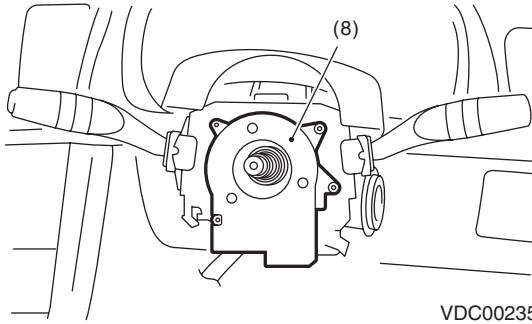
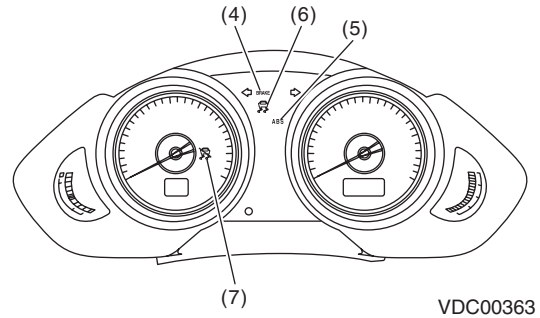
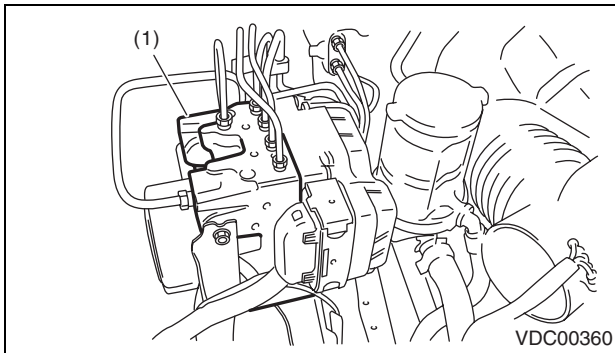


VDC00359

- | | | |
|---|---|--|
| (1) VDC control module & hydraulic control unit (VDCCM&H/U) | (6) VDC indicator light | (11) ABS wheel speed sensor |
| (2) Relay box | (7) VDC warning light and TCS OFF indicator light | (12) Yaw rate & lateral 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 | (15) Stop light switch |

Electrical Component Location

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)



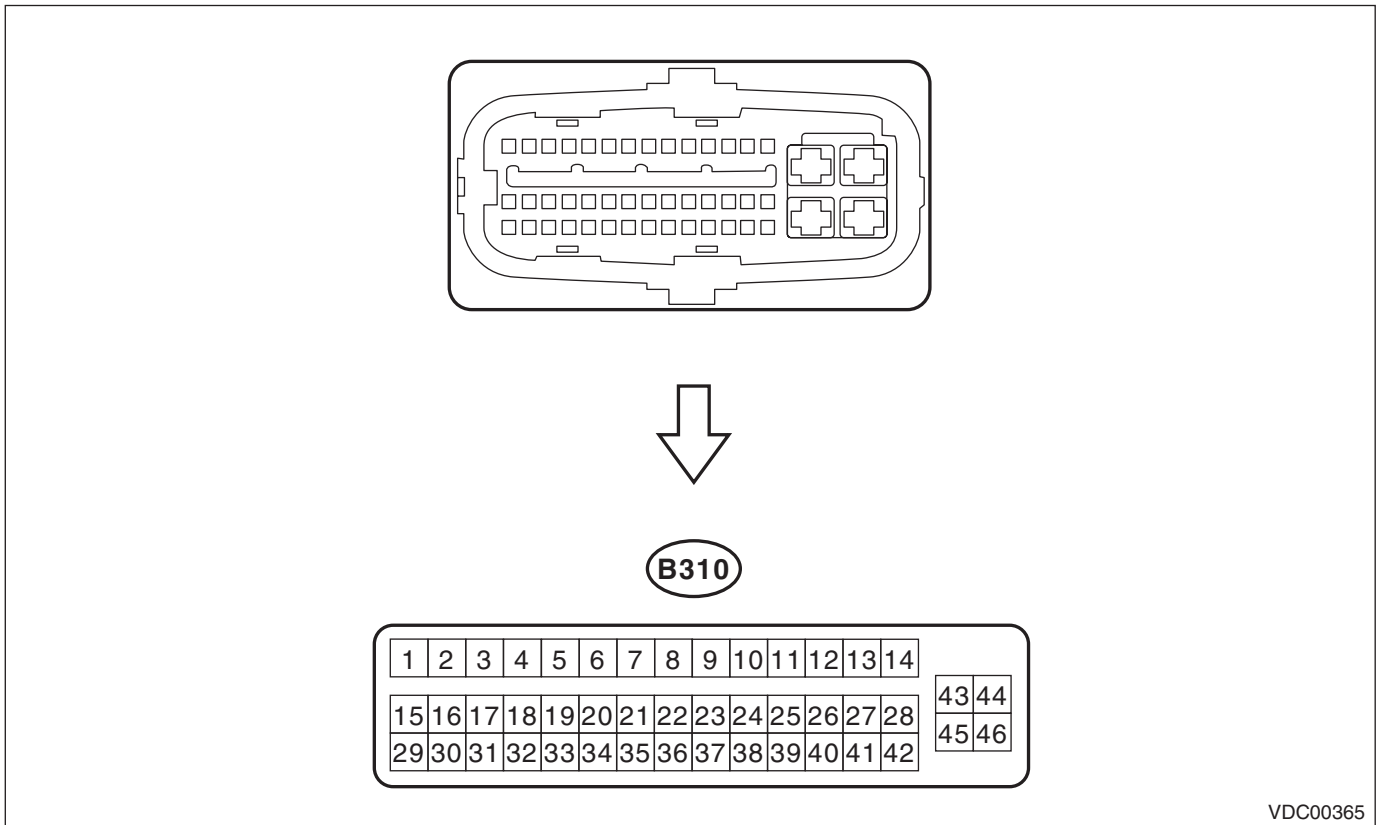
SUBARU

Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

5. Control Module I/O Signal

A: ELECTRICAL SPECIFICATION



VDC00365

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 and TCS OFF indicator light illuminate.

Control Module I/O Signal

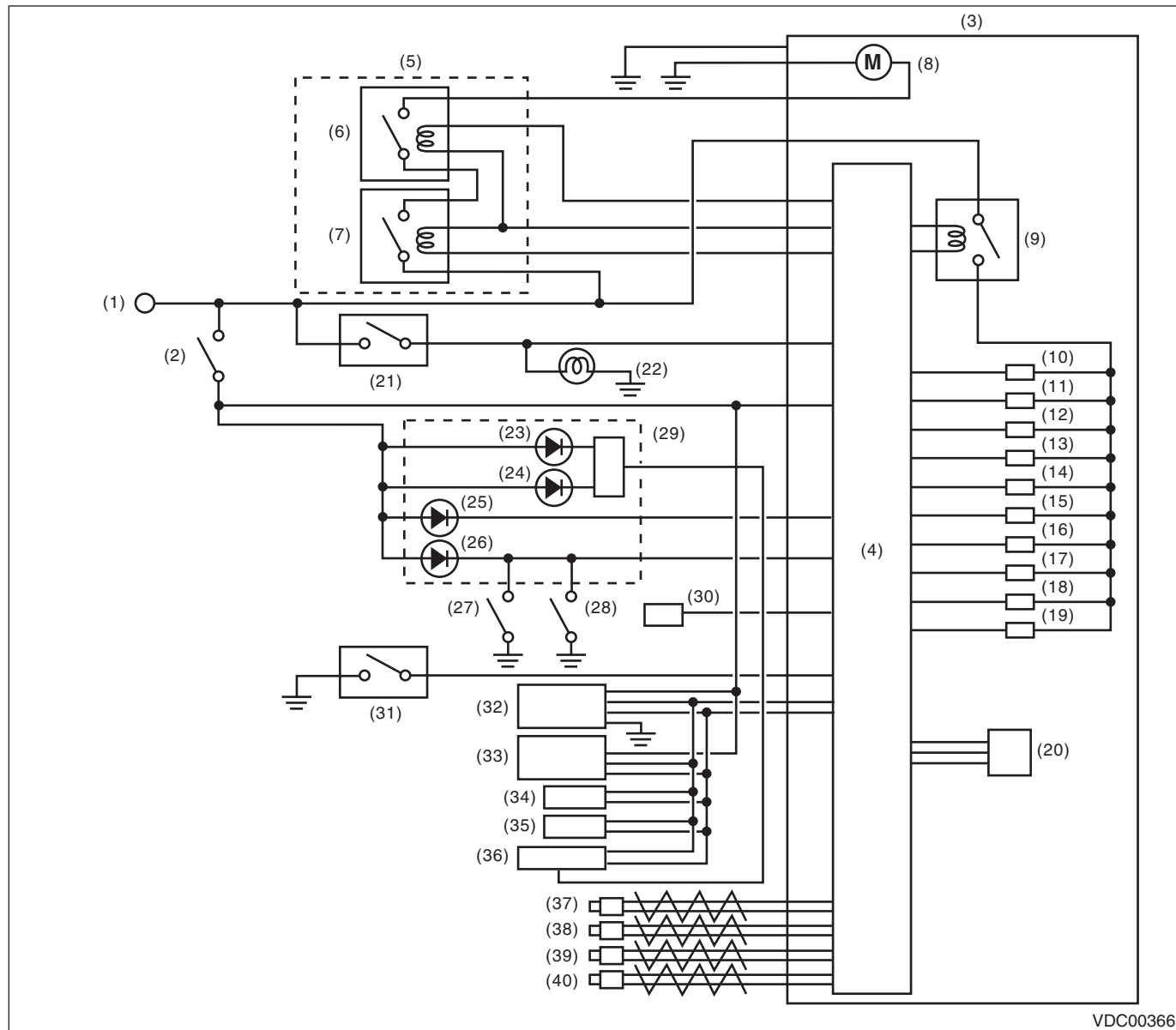
VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Description			Terminal No. (+) — (–)	Input/Output signal
				Measured value and measuring conditions
Power supply			1 — 43	10 — 15 V when the ignition switch is ON.
ABS wheel speed sensor	Front LH wheel	Power supply	27 — 43	8 — 15 V
		Signal	41	5 — 17 mA: Rectangle waveform
	Front RH wheel	Power supply	42 — 43	8 — 15 V
		Signal	28	5 — 17 mA: Rectangle waveform
	Rear LH wheel	Power supply	25 — 43	8 — 15 V
		Signal	39	5 — 17 mA: Rectangle waveform
	Rear RH wheel	Power supply	26 — 43	8 — 15 V
		Signal	40	5 — 17 mA: Rectangle waveform
Yaw rate & lateral G sensor			34 — 20	Serial communication
Steering angle sensor				
CAN communication line (+)			34	Serial communication
CAN communication line (–)			20	Serial communication
Valve relay power supply			44 — 43	10 — 15 V always.
Motor power supply			45 — 46	10 — 15 V when the motor is ON.
ABS warning light			16 — 43	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds and less than 1.5 V after 1.5 seconds passed.
Brake warning light (EBD warning light)			3 — 43	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds and less than 1.5 V after 1.5 seconds passed.
Stop light switch			18 — 43	Less than 1.5 V when the stop light is OFF; otherwise, 10 — 15 V when the stop light is ON.
Subaru Select Monitor			32 — 43	0 ↔ 12 V pulse (in communication)
Vehicle speed output signal			33	Model without vehicle speed dependent wiper: 0 ↔ 5 V pulse Model with vehicle speed dependent wiper: 0 ↔ 12 V pulse
Ground			43	—
Relay box	Relay power supply		2 — 43	10 — 15 V when the ignition switch is ON.
	Motor relay drive		30 — 43	After turning the ignition switch to ON: 10 — 15 V, during the motor is operating: 1.5 V.
	Fail safe relay drive		31 — 43	When the ignition switch is ON, less than 1.5 V.

Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

B: WIRING DIAGRAM



VDC00366

- | | | |
|---|--|--|
| (1) Battery | (14) Rear inlet solenoid valve LH | (27) Parking brake switch |
| (2) Ignition switch | (15) Rear outlet solenoid valve LH | (28) Brake fluid level switch |
| (3) VDC control module & hydraulic control unit (VDCCM&H/U) | (16) Rear inlet solenoid valve RH | (29) Combination meter |
| (4) VDC control module | (17) Rear outlet solenoid valve RH | (30) Data link connector |
| (5) Relay box | (18) Linear valve 1 | (31) TCS OFF switch |
| (6) Motor relay | (19) Linear valve 2 | (32) Steering angle sensor |
| (7) Fail safe relay | (20) Pressure sensor | (33) Yaw rate & lateral G sensor |
| (8) Motor | (21) Stop light switch | (34) Transmission control module (TCM) |
| (9) Valve relay | (22) Stop light | (35) Engine control module (ECM) |
| (10) Front inlet solenoid valve LH | (23) VDC indicator light | (36) Body integrated unit |
| (11) Front outlet solenoid valve LH | (24) VDC warning light and TCS OFF indicator light | (37) Front ABS wheel speed sensor LH |
| (12) Front inlet solenoid valve RH | (25) ABS warning light | (38) Front ABS wheel speed sensor RH |
| (13) Front outlet solenoid valve RH | (26) Brake warning light | (39) Rear ABS wheel speed sensor LH |
| | | (40) Rear ABS wheel speed sensor RH |

6. Subaru Select Monitor

A: OPERATION

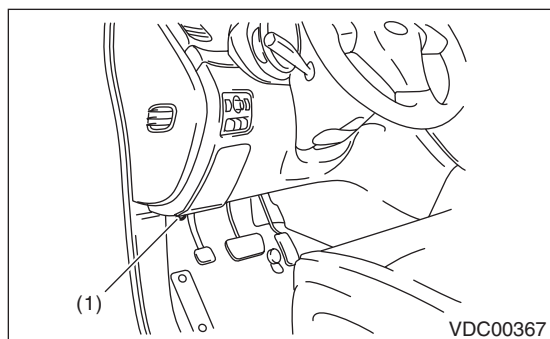
1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare the Subaru Select Monitor kit. <Ref. to VDC(diag)-9, 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).



(1) Data link connector

(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect the scan tools except for Subaru Select Monitor.

4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.

5) On the «Main Menu» display screen, select the {Each System Check}.

6) On the «System Selection Menu» display screen, select the {Brake Control}.

7) Select the [OK] after the {VDC AWD AT} is displayed.

8) On the «VDC Diagnosis» screen, select the {Diagnostic Code(s) Display}.

NOTE:

- For details concerning operation procedure, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".

- For details concerning DTCs, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to VDC(diag)-33, List of Diagnostic Trouble Code (DTC).>

- DTCs are displayed up to three in detected order.

9) If VDC and Subaru Select Monitor cannot communicate, check the communication circuit. <Ref. to VDC(diag)-18, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

Display	Contents to be monitored
Current	Indicate the latest malfunction DTC on the Subaru Select Monitor display.
Old	The latest DTC in previous troubles is displayed on Subaru Select Monitor display screen.
Older	The second latest DTC in previous troubles is displayed on Subaru Select Monitor display screen.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

2. READ CURRENT DATA

- 1) On the «Main Menu» display screen, select the {Each System Check}.
 - 2) On the «System Selection Menu» display screen, select the {Brake Control}.
 - 3) Select the [OK] after {VDC AWD AT} is displayed.
 - 4) On the «Brake Control Diagnosis» display screen, select the {Current Data Display/Save}.
 - 5) On the «Display Menu» screen, select the data display method.
 - 6) Using a 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 monitored	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
Front/Rear G Sensor	Vehicle front/rear 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 Light	ON/OFF condition of TCS OFF indicator light is displayed.	ON or OFF
E/G Control Prohibited Flag	Engine control command signal is displayed.	1 or 0
OFF Switch Signal	Operation condition of TCS OFF switch is displayed.	ON or OFF
Motor Fail Safe Relay Drive Signal	Motor fail safe relay drive signal is displayed.	ON or OFF

NOTE:

For details concerning operation procedure, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

3. CLEAR MEMORY MODE

- 1) On the «Main Menu», select the {2. Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Brake Control}.
- 3) Select the [OK] after {VDC AWD AT} is displayed.
- 4) On the «Brake Control Diagnosis» display screen, select the {Clear Memory}.

Display	Contents to be monitored
Clear memory?	DTC deleting function

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

NOTE:

For details concerning operation procedure, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

4. SEQUENCE CONTROL

Display	Contents to be monitored	Reference target
ABS sequence control	Operate the valve and pump motor continuously to perform the ABS sequence control.	<Ref. to VDC-13, ABS Sequence Control.>
VDC sequence control	Operate the valve and pump motor continuously to perform the VDC sequence control.	<Ref. to VDC-16, VDC Sequence Control.>

5. FREEZE FRAME DATA

NOTE:

- Data stored at the time of trouble occurrence is shown on display.
- Each time trouble occurs, the latest information is stored in the freeze frame data in memory.

Display	Contents to be monitored
IG Counter	Number of times ignition switch turned to ON is displayed.
DTC	The recorded failure 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 Shaft	The sensor value for a 45° angle crossed 2 axis G sensor is displayed.
G Sensor Second Shaft	
Yaw Rate Sensor	Vehicle angular speed detected by yaw rate sensor is displayed.
IG power supply voltage	Voltage supplied to VDC control module is displayed.
Steering Angle Sensor	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.
Acceleration Opening Angle	Acceleration opening is displayed.
Gear position	Gear position on malfunction occurrence is displayed.
Steering Angle Sensor Malfunction Code	The recorded steering angle sensor failure code 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 Flag	Engine control command signal is displayed.
Absolute angle recognition flag	Whether the absolute angle was determined is displayed.
OFF Switch Signal	Operation condition of TCS OFF switch is displayed.

Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

B: INSPECTION

1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

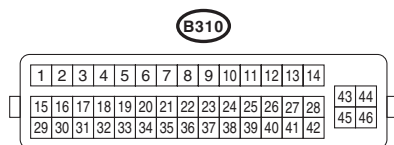
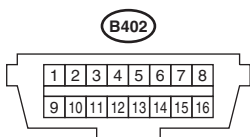
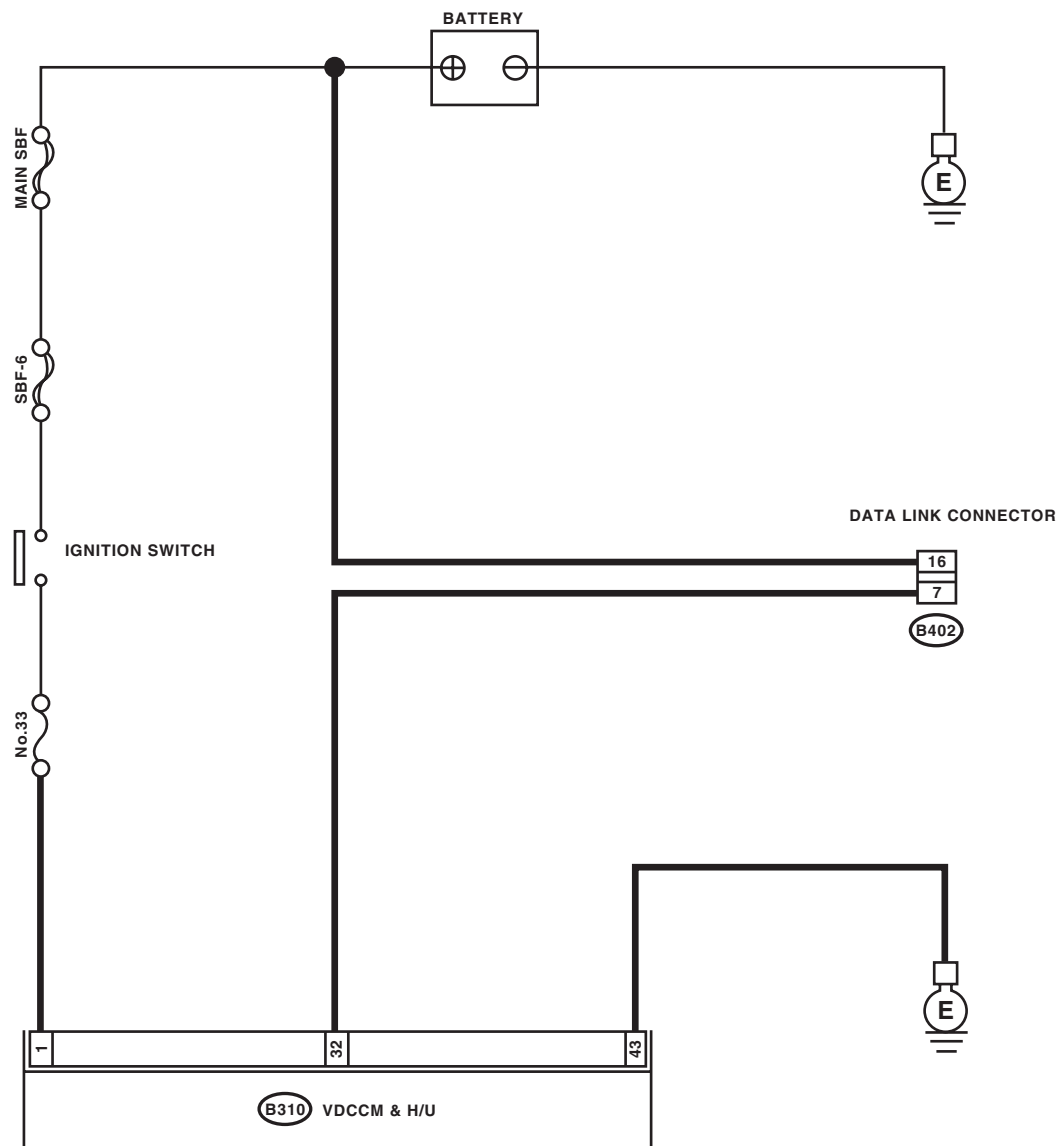
DETECTING CONDITION:

Defective harness connector

TROUBLE SYMPTOM:

Communication is impossible between VDC and Subaru Select Monitor.

WIRING DIAGRAM:



VDC00446

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 more than 11 V?	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 system can be executed normally.	Are the system name and model year 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.	Are the system name and model year displayed on Subaru Select Monitor?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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 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 more than 1 MΩ?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
7 CHECK THE VDCCM&H/U OUTPUT SIGNALS. 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 THE 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. 32 — (B402) No. 7:	Is the resistance less than 0.5 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. 1 (+) — 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 THE 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. 43 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 12.	Repair the open circuit in harness between VDCCM&H/U and inhibitor side connector, and poor contact of coupling connector.
12 CHECK POOR CONTACT IN CONNECTOR.	Is there poor contact in control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

Read Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

7. Read Diagnostic Trouble Code (DTC)

A: OPERATION

For details concerning DTC reading procedure, refer to "Subaru Select Monitor". <Ref. to VDC(diag)-15, Subaru Select Monitor.>

8. Inspection Mode

A: PROCEDURE

Reproduce the malfunction occurrence condition 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

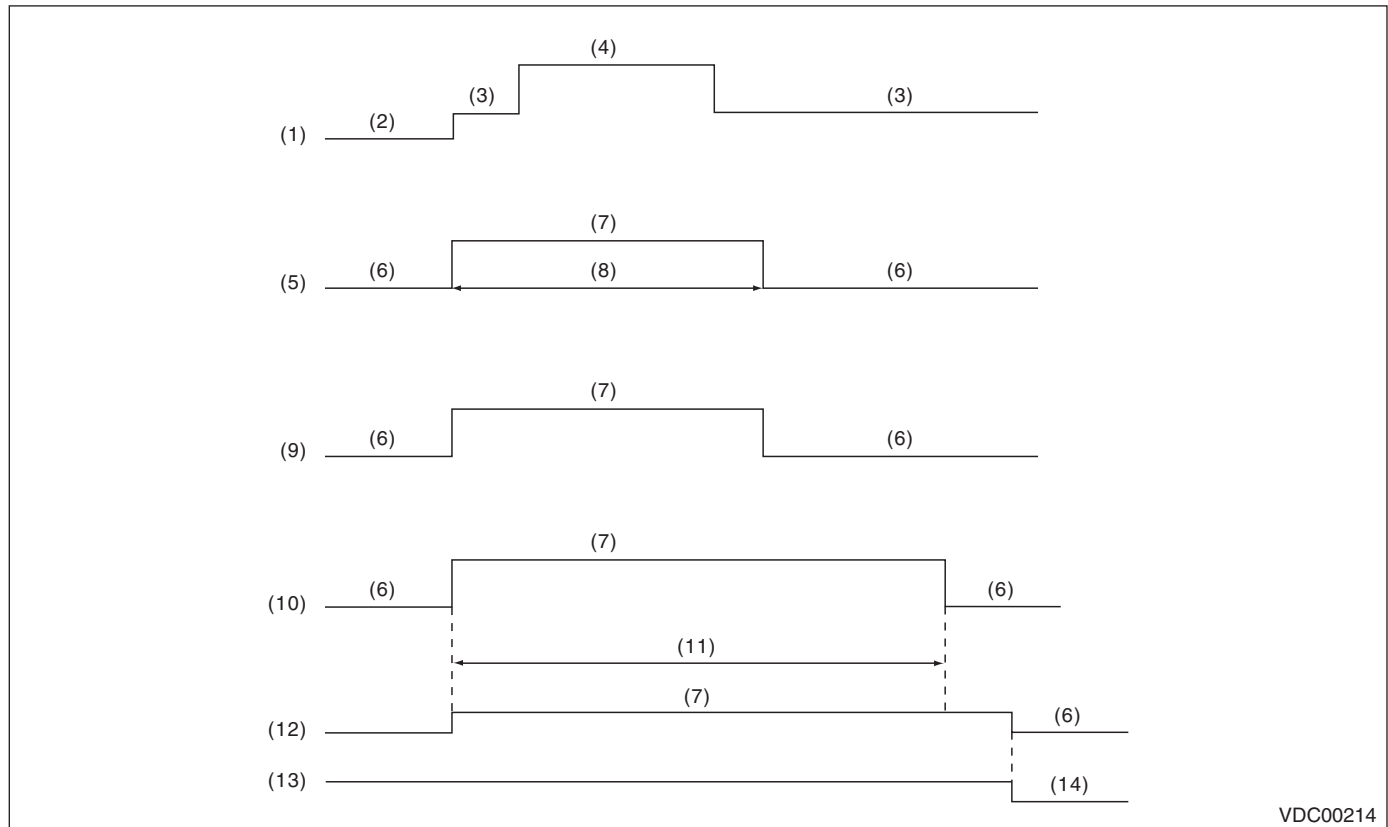
For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to VDC(diag)-15, Subaru Select Monitor.>

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

10.Warning Light Illumination Pattern

A: INSPECTION



VDC00214

- | | | |
|-----------------------|--|--|
| (1) Ignition switch | (8) 1.5 seconds | (12) Brake warning light (EBD warning light) |
| (2) OFF | (9) VDC indicator light | (13) Parking brake |
| (3) ON | (10) VDC warning light and TCS OFF indicator light | (14) Released |
| (4) Engine start | (11) Several seconds (depending on engine coolant temperature) | |
| (5) ABS warning light | | |
| (6) Light OFF | | |
| (7) Light ON | | |

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)-25, VDC WARNING LIGHT, TCS OFF INDICATOR LIGHT AND VDC 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)-28, ABS WARNING LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.>

4) When the VDC indicator light, VDC warning light and TCS OFF indicator light do not go off, check the combination meter circuit or CAN communication circuit. <Ref. to VDC(diag)-29, VDC INDICATOR LIGHT DOES 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.

- It may take several minutes before VDC warning light and TCS OFF indicator light goes off if the vehicle is parked under low temperature for a specified time. This is not defective because it is resulted from low engine coolant temperature.

- With the vehicle jack-up/lift-up or set on free rollers, when the wheels lock or spin after starting the engine, ABS warning light, VDC warning light and TCS OFF indicator light may illuminate because VDCCM&H/U detects the abnormal conditions from 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

DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication

TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), VDC indicator light, VDC warning light and TCS OFF indicator light do not come on.

NOTE:

When pressing the TCS OFF switch for more than 10 seconds, the TCS OFF indicator light goes off and cannot operate any more. 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.
2 CHECK VDCCM. When the engine does not start, display the current data of VDCCM using Subaru Select Monitor.	Is "VDC warning light" output set to "ON"?	Go to step 3.	Replace the VDCCM&H/U.
3 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 4.
4 CHECK COMBINATION METER. Check the combination meter.	Is combination meter OK?	Replace the VDCCM&H/U.	Repair the combination meter assembly.

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

C: ABS WARNING LIGHT DOES NOT COME ON

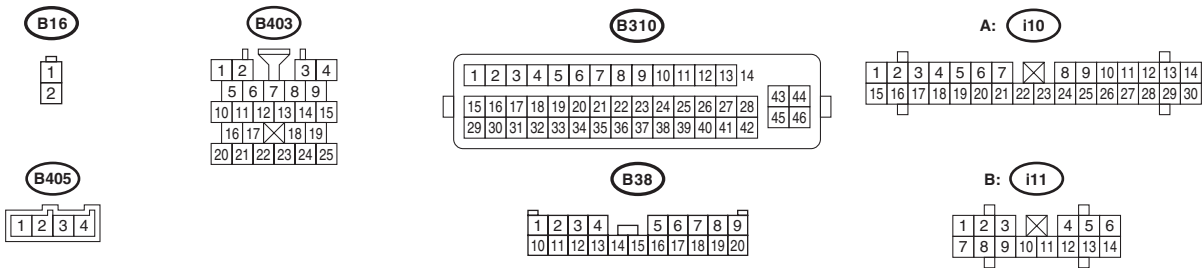
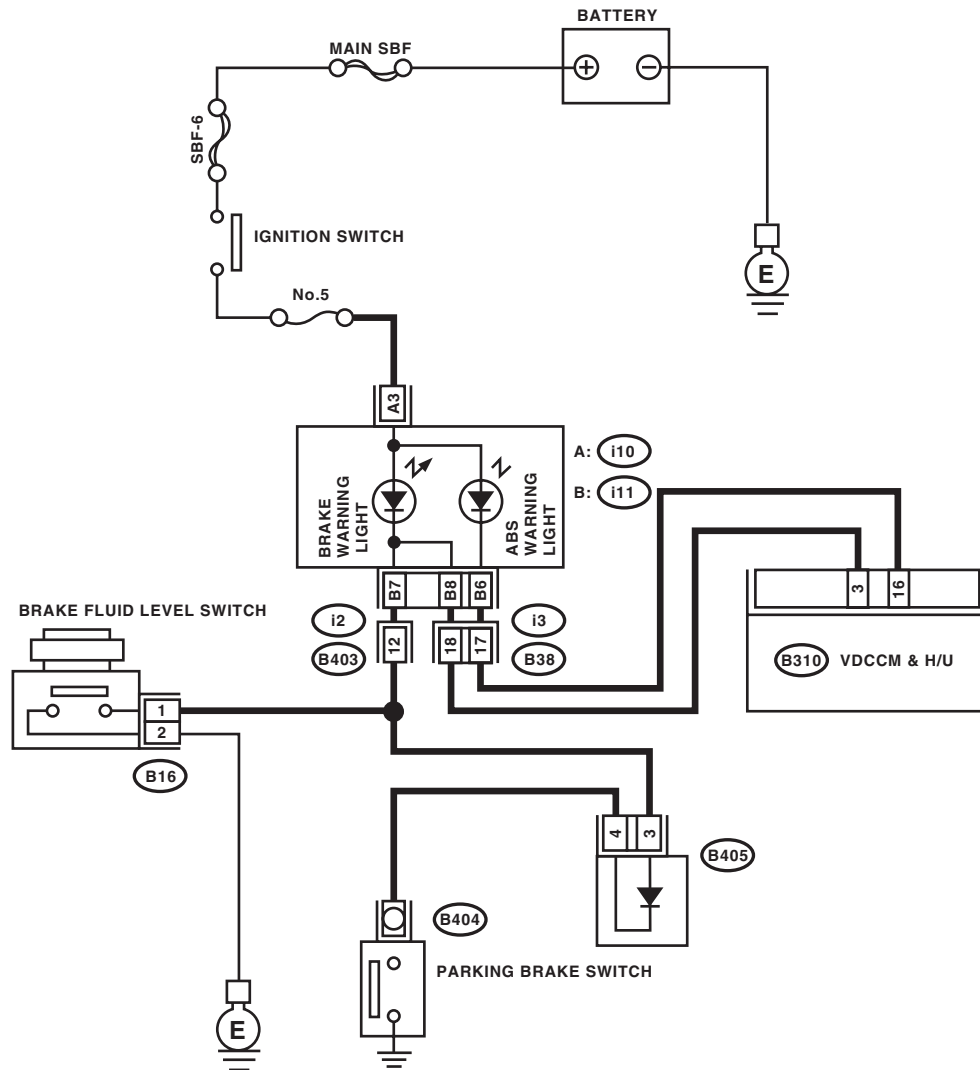
DETECTING CONDITION:

- Defective combination meter
- Defective harness

TROUBLE SYMPTOM:

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

WIRING DIAGRAM:



VDC00430

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.	Check the combination meter.
2	READ DTC. Read the DTC. <Ref. to VDC(diag)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to 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. 16 — Chassis ground:	Is the resistance more than 1 MΩ?	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. B6 — Chassis ground:	Is the resistance more than 1 MΩ?	Check the combination meter.	Replace the VDCCM&H/U.

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

D: ABS WARNING LIGHT DOES NOT GO OFF

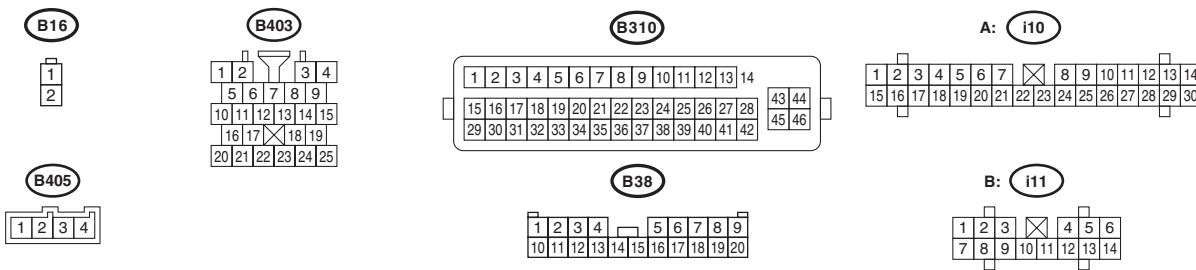
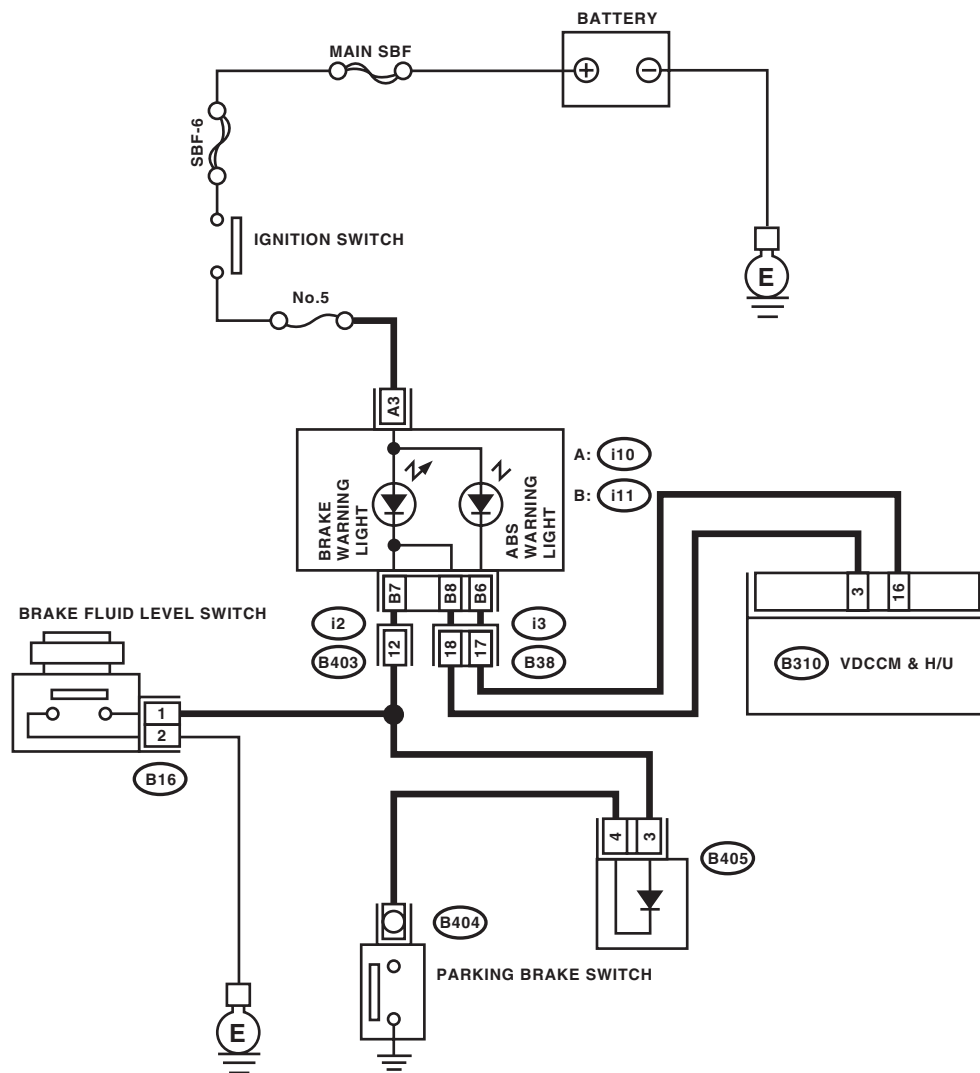
DETECTING CONDITION:

- Defective combination meter
- Open circuit in harness

TROUBLE SYMPTOM:

When starting the engine, the ABS warning light is kept ON.

WIRING DIAGRAM:



VDC00430

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)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to 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. 16 — (i11) No. B6:	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the harness connector between VDCCM&H/U and combination meter.
4	CHECK POOR CONTACT OF CONNECTOR. Check poor contact in all connectors.	Is there poor contact?	Repair the 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) Measure the voltage between the combination meter connector and chassis ground 1.5 or more seconds after the ignition switch is turned to ON. Connector & terminal (i11) No. B6 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Check the combination meter.	Replace the VDCCM&H/U.

E: VDC INDICATOR LIGHT DOES NOT GO OFF

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)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	CHECK THE VDCCM&H/U. 1) Connect the Subaru Select Monitor to the vehicle. 2) Start the engine, and select {Current Data Display & Save} in Subaru Select Monitor.	Is the ABS warning light output indicated as OFF on the display?	Go to step 3.	Replace the VDCCM&H/U.
3	CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 4.
4	CHECK COMBINATION METER. Check the combination meter.	Is combination meter OK?	Replace the VDCCM&H/U.	Repair the combination meter.

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

F: VDC WARNING LIGHT AND TCS OFF INDICATOR LIGHT DO NOT GO OFF

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 pressing the TCS OFF switch for more than 10 seconds, the TCS OFF indicator light goes off and cannot operate any more. 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)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2 CHECK ENGINE.	Does the malfunction indicator light illuminate?	Repair the engine.	Go to step 3.
3 CHECK ENGINE COOLANT TEMPERATURE. Warm up the engine and check if VDC warning light and TCS OFF indicator light illumination condition changes.	When the engine coolant temperature is too low, VDC warning light and TCS OFF indicator light illuminate. 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.	Is TCS OFF switch normal?	Go to step 5.	Replace the TCS OFF switch.
5 CHECK THE VDCCM&H/U. 1) Connect the Subaru Select Monitor to the vehicle. 2) Start the engine, and select {Current Data Display & Save} in Subaru Select Monitor.	Are the VDC warning light and TCS OFF indicator light output indicated as OFF on the display?	Go to step 6.	Replace the VDCCM&H/U.
6 CHECK LAN SYSTEM. Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 7.
7 CHECK COMBINATION METER. Check the combination meter.	Is combination meter OK?	Temporary poor contact occurs.	Repair the combination meter.

Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

G: BRAKE WARNING LIGHT DOES NOT GO OFF

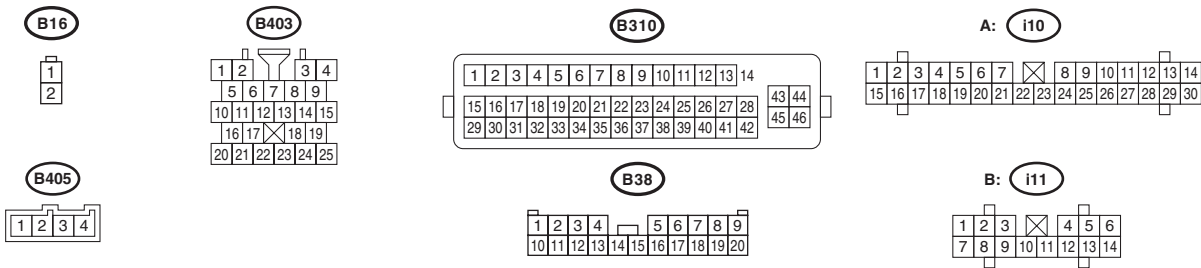
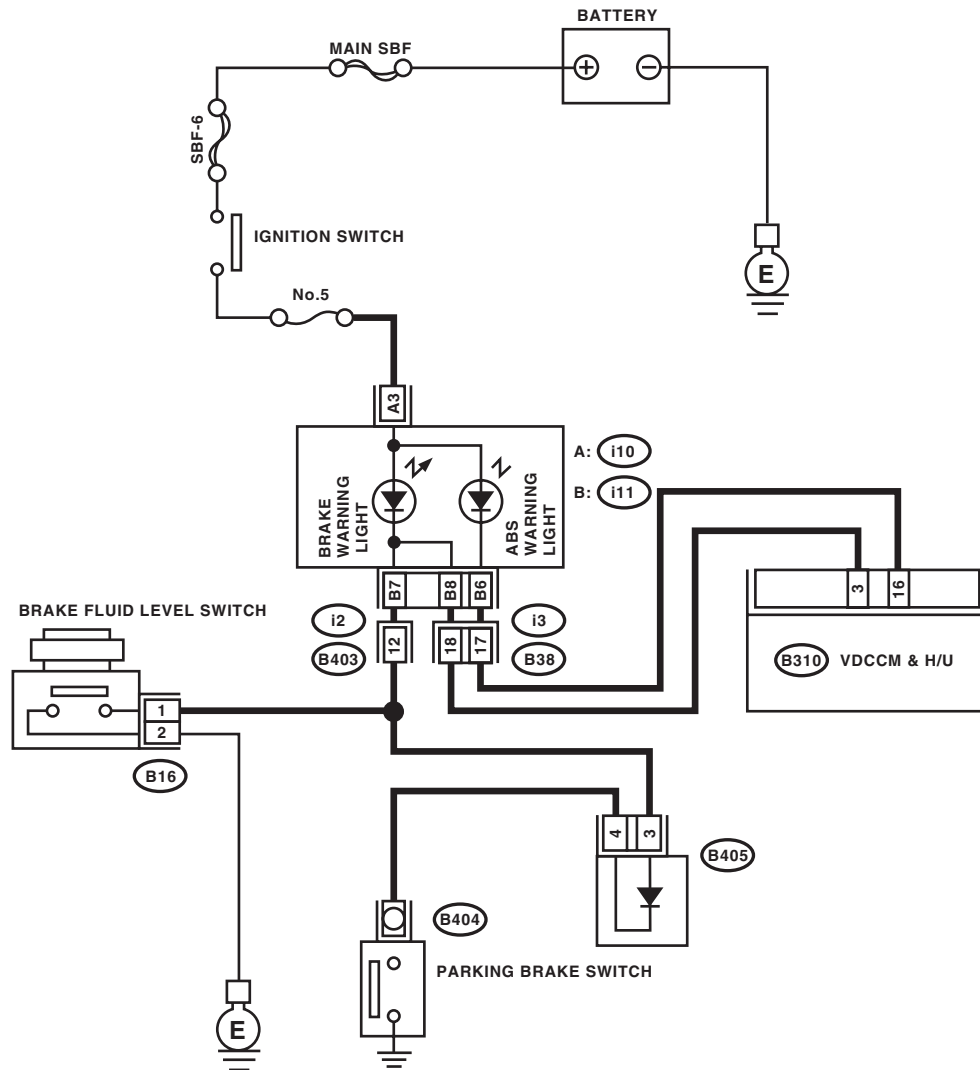
DETECTING CONDITION:

- Brake warning light circuit is shorted.
- Defective sensor/connector

TROUBLE SYMPTOM:

After starting the engine, the brake warning light is kept on though the parking lever is released.

WIRING DIAGRAM:



VDC00430

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)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 3.
3	CHECK BRAKE FLUID AMOUNT. Check the amount of brake fluid in the reservoir tank of master cylinder.	Is the amount of brake fluid 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 of master cylinder terminals. Terminals No. 1 — No. 2:	Is the resistance more than 1 MΩ?	Go to step 5.	Replace the 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 more than 1 MΩ?	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. B8 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 7.	Repair the harness connector between combination meter brake fluid level switch and 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. 3 — (i11) No. B8:	Is the resistance less than 0.5 Ω?	Go to step 8.	Repair the harness connector between VDCCM&H/U and combination meter.
8	CHECK POOR CONTACT OF CONNECTOR. Check poor contact in 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) Measure the voltage between the combination meter connector and chassis ground 1.5 or more seconds after the ignition switch is turned to ON. Connector & terminal (i11) No. B8 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Check the combination meter.	Replace the 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	Display	Content of diagnosis	Reference target
C0021	4211	FR wheel speed sensor open line	Front Right ABS Sensor Open Circuit	<Ref. to VDC(diag)-36, DTC C0021 FRONT RIGHT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0022	4221	FR wheel speed sensor system	Front ABS Wheel Speed Sensor RH Signal Malfunction	<Ref. to VDC(diag)-40, DTC C0022 FRONT ABS WHEEL SPEED SENSOR RH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4222	FR wheel sensor noise	Front Right ABS Sensor Noise	<Ref. to VDC(diag)-40, DTC C0022 FRONT RIGHT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0023	4231	FL wheel speed sensor open line	Front Left ABS Sensor Open Circuit	<Ref. to VDC(diag)-36, DTC C0023 FRONT LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0024	4241	FL wheel speed sensor signal system	Front ABS Wheel Speed Sensor LH Signal Malfunction	<Ref. to VDC(diag)-40, DTC C0024 FRONT ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4242	FL wheel sensor noise	Front Left ABS Sensor Noise	<Ref. to VDC(diag)-40, DTC C0024 FRONT LEFT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0025	4251	RR wheel sensor open line	Rear Right ABS Sensor Open Circuit	<Ref. to VDC(diag)-36, DTC C0025 REAR RIGHT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0026	4261	RR wheel speed sensor signal system	Rear ABS Wheel Speed Sensor RH Signal Malfunction	<Ref. to VDC(diag)-40, DTC C0026 REAR ABS WHEEL SPEED SENSOR RH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4262	RR wheel sensor noise	Rear Right ABS Sensor Noise	<Ref. to VDC(diag)-40, DTC C0026 REAR RIGHT ABS SENSOR NOISE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0027	4271	RL wheel speed sensor open line	Rear Left ABS Sensor Open Circuit	<Ref. to VDC(diag)-37, DTC C0027 REAR LEFT ABS SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0028	4281	RL wheel speed sensor signal system	Rear ABS Wheel Speed Sensor LH Signal Malfunction	<Ref. to VDC(diag)-41, DTC C0028 REAR ABS WHEEL SPEED SENSOR LH SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4282	RL wheel sensor noise	Rear Left ABS Sensor Noise	<Ref. to VDC(diag)-40, 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)-43, 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)-43, DTC C0032 FRONT OUTLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0033	4331	FL hold valve malfunction	Front Inlet Solenoid Valve LH Malfunction In VDCCM&H/U	<Ref. to VDC(diag)-43, DTC C0033 FRONT INLET SOLENOID VALVE LH 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	Display	Content of diagnosis	Reference target
C0034	4341	FL pressure reducing valve malfunction	Front Outlet Solenoid Valve LH Malfunction In VDCCM&H/U	<Ref. to VDC(diag)-44, 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)-44, 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)-44, 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)-44, 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)-44, DTC C0038 REAR OUTLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0061	4611	VDC switching valve (P) system	VDC Switchover Valve (P)	<Ref. to VDC(diag)-44, DTC C0061 VDC SWITCHOVER VALVE (P), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0062	4621	VDC switching valve (S) system	VDC Switchover Valve (S)	<Ref. to VDC(diag)-44, DTC C0062 VDC SWITCHOVER VALVE (S), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0063	4631	VDC switching valve	VDC Switchover Valve	<Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0042	4421	Power supply voltage failure	Power Voltage Malfunction	<Ref. to VDC(diag)-47, DTC C0042 POWER VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0047	C471	CAN communication system	Improper CAN Communication	<Ref. to VDC(diag)-50, DTC C0047 IMPROPER CAN COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0051	4511	Valve relay system open line	Valve Relay Open Circuit	<Ref. to VDC(diag)-51, DTC C0051 VALVE RELAY OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4512	Valve relay system short	Valve Relay Short Circuit	<Ref. to VDC(diag)-53, DTC C0051 VALVE RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0052	4521	Motor relay system open line	Motor And Motor Relay Open Circuit	<Ref. to VDC(diag)-54, DTC C0052 MOTOR AND MOTOR RELAY OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4522	Motor relay system short	Motor And Motor Relay Short Circuit	<Ref. to VDC(diag)-57, DTC C0052 MOTOR AND MOTOR RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4523	Motor system not running	Motor Do Not Work	<Ref. to VDC(diag)-61, DTC C0052 MOTOR DO NOT WORK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4524	Motor system	Motor Malfunction	<Ref. to VDC(diag)-55, DTC C0052 MOTOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4525	Motor fail safe system short	Motor Fail Safe Relay Short Circuit	<Ref. to VDC(diag)-58, DTC C0052 MOTOR FAIL SAFE RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0054	4541	Brake light switch open line	Brake Lamp Switch Open Circuit	<Ref. to VDC(diag)-63, DTC C0054 BRAKE LAMP SWITCH OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0056	4561	G Sensor Output Seizure	G Sensor Output Freeze	<Ref. to VDC(diag)-65, DTC C0056 G SENSOR OUTPUT FREEZE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4562	G sensor signal	G Sensor Signal Malfunction	<Ref. to VDC(diag)-65, DTC C0056 G SENSOR SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4563	Yaw G sensor power voltage	Yaw Rate G Sensor Power Supply Voltage Malfunction	<Ref. to VDC(diag)-66, DTC C0056 YAW RATE G SENSOR POWER SUPPLY VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4564	G sensor output	G Sensor Output Malfunction	<Ref. to VDC(diag)-67, DTC C0056 G SENSOR OUTPUT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	C565	G sensor communication	G Sensor Communication Malfunction	<Ref. to VDC(diag)-76, DTC C0056 G SENSOR COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4566	G sensor inside	G Sensor Internal Problem Malfunction	<Ref. to VDC(diag)-76, DTC C0056 G SENSOR INTERNAL PROBLEM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0057	C571	ECM communication circuit	ECM Communication	<Ref. to VDC(diag)-68, DTC C0057 ECM COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	C573	TCM communication circuit	AT Communication	<Ref. to VDC(diag)-68, DTC C0057 AT COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4574	Transmission system	Transmission System Failure	<Ref. to VDC(diag)-69, DTC C0057 TRANSMISSION SYSTEM FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0071	4711	Steering angle sensor counter	Steering Angle Sensor Internal Problem Malfunction	<Ref. to VDC(diag)-70, 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)-72, DTC C0071 STEERING ANGLE SENSOR COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4713	Steering angle sensor signal seizure	Steering Angle Sensor Signal Freeze	<Ref. to VDC(diag)-74, DTC C0071 STEERING ANGLE SENSOR SIGNAL FREEZE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4714	Steering angle sensor calibration incomplete	Steering Angle Sensor Calibration Non Completion	<Ref. to VDC(diag)-74, DTC C0071 STEERING ANGLE SENSOR CALIBRATION NON COMPLETION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0072	4721	Yaw rate sensor signal	Yaw Rate Sensor Signal Malfunction	<Ref. to VDC(diag)-75, DTC C0072 YAW RATE SENSOR SIGNAL MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4722	Inside yaw rate sensor	Yaw Rate Sensor Internal Problem Malfunction	<Ref. to VDC(diag)-76, 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)-77, 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)-74, DTC C0072 YAW RATE SENSOR OSCILLATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0074	4741	Pressure sensor open line	Pressure Sensor Open Circuit	<Ref. to VDC(diag)-79, DTC C0074 PRESSURE SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4742	Pressure sensor signal seizure	Pressure Sensor Signal Freeze	<Ref. to VDC(diag)-78, 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)-81, DTC C0074 PRESSURE SENSOR 0 POINT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	4744	Pressure sensor noise	Pressure Sensor Noise	<Ref. to VDC(diag)-82, 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)-78, 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)-37, 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)-37, 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)-37, 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

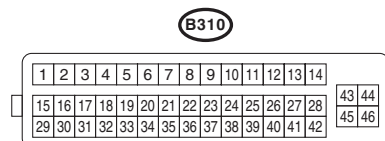
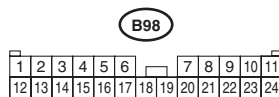
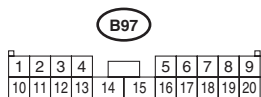
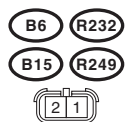
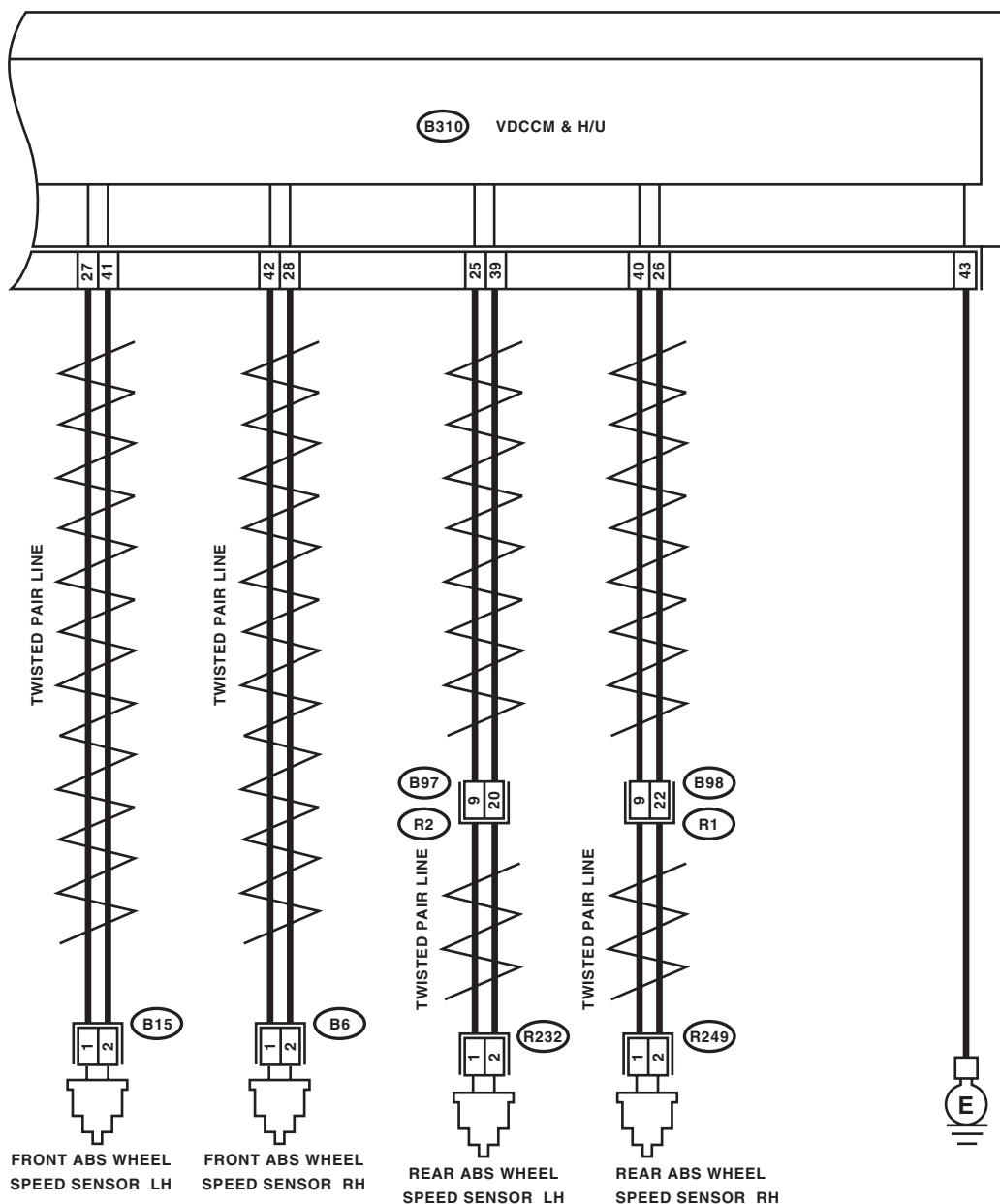
DTC DETECTING CONDITION:

- Faulty ABS wheel speed sensor (harness open line)
- Defective harness connector

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00370

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	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.
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. 42 — (B6) No. 1: (B310) No. 28 — (B6) No. 2: DTC C0023 (B310) No. 27 — (B15) No. 1: (B310) No. 41 — (B15) No. 2: DTC C0025 (B310) No. 40 — (R249) No. 1: (B310) No. 26 — (R249) No. 2: DTC C0027 (B310) No. 25 — (R232) No. 1: (B310) No. 39 — (R232) No. 2:	Is the resistance less than 0.5 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. 28 — Chassis ground: DTC C0023 (B310) No. 41 — Chassis ground: DTC C0025 (B310) No. 26 — Chassis ground: DTC C0027 (B310) No. 39 — Chassis ground:	Is the resistance more than 1 M Ω ?	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.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK THE 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. 1 (+) — (B310) No. 43 (-):	Is the voltage 10 — 15 V?	Go to step 7.	Check the generator, battery and VDCCM&H/U power supply circuit.
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-23, 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.
7 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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)-41, 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)-41, 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)-41, 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)-41, 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)-41, 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)-41, 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)-41, 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

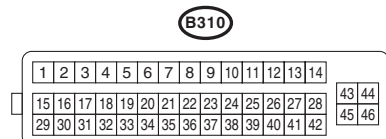
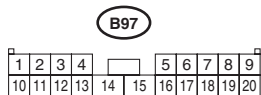
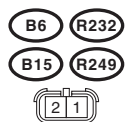
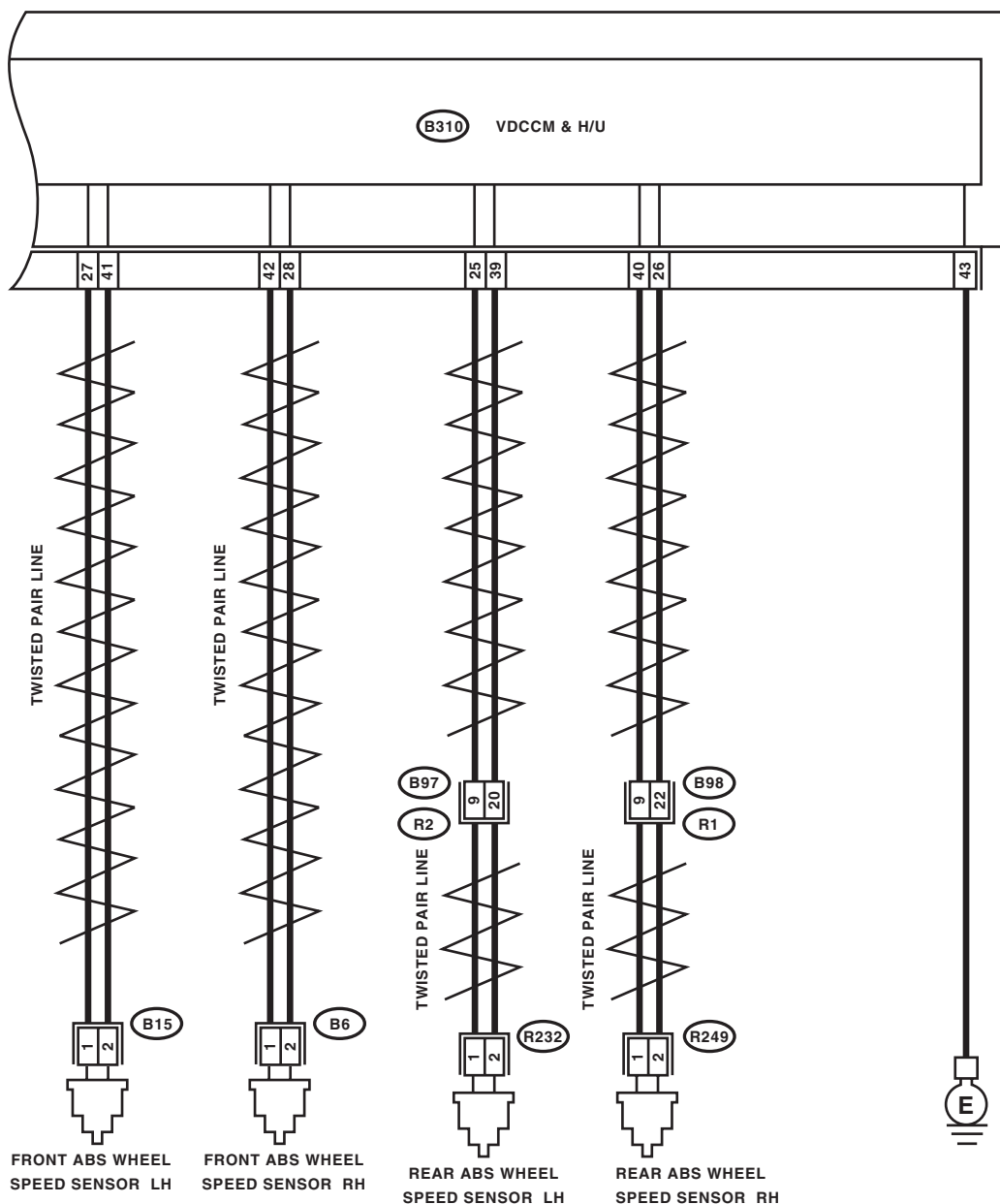
DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor signal (noise, irregular signal, etc.)
- Defective harness connector

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00370

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK THE 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. 1 (+) — (B310) No. 43 (-):	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} in Subaru Select Monitor. 2) Read the ABS wheel speed sensor output corresponding to the faulty wheel in Subaru Select Monitor data display mode.	Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?	Go to step 3.	Go to step 8.
3 CHECK POOR CONTACT OF CONNECTOR. Turn the ignition switch to OFF.	Is there poor contact in 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 electric components are installed correctly.	Are the radio wave devices and electric components installed correctly?	Go to step 5.	Install the radio wave devices and electric 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 THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	It results from a temporary noise interference.
8 CHECK INSTALLATION OF ABS WHEEL SPEED SENSOR.	Is the ABS wheel speed sensor installation bolt tightened 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-23, 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 more one rotation?	Go to step 11.	Go to step 10.
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.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
11 CHECK CAUSE OF SIGNAL NOISE. Make sure the radio wave devices and electric components are installed correctly.	Are the radio wave devices and electric components installed correctly?	Go to step 12.	Install the radio wave devices and electric components properly.
12 CHECK CAUSE OF SIGNAL NOISE. Check if the noise sources (such as an antenna) are installed near the sensor harness.	Is the noise sources installed?	Go to step 13.	Install the noise sources apart from sensor harness.
13 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	It results from a temporary noise interference. NOTE: Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at more than 12 km/h (7 MPH) in order to turn ABS warning light off. Be sure to drive the vehicle and check the warning light goes off.

M: DTC C0031 FRONT INLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

N: DTC C0032 FRONT OUTLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

O: DTC C0033 FRONT INLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

P: DTC C0034 FRONT OUTLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Q: DTC C0035 REAR INLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

R: DTC C0036 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

S: DTC C0037 REAR INLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

T: DTC C0038 REAR OUTLET SOLENOID VALVE LH MALFUNCTION IN VDCCM&H/U

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, 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)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

V: DTC C0062 VDC SWITCHOVER VALVE (S)

NOTE:

For the diagnostic procedure, refer to DTC C0063 "VDC SWITCHOVER VALVE". <Ref. to VDC(diag)-45, DTC C0063 VDC SWITCHOVER VALVE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

W: DTC C0063 VDC SWITCHOVER VALVE

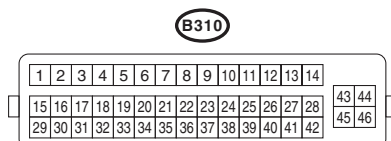
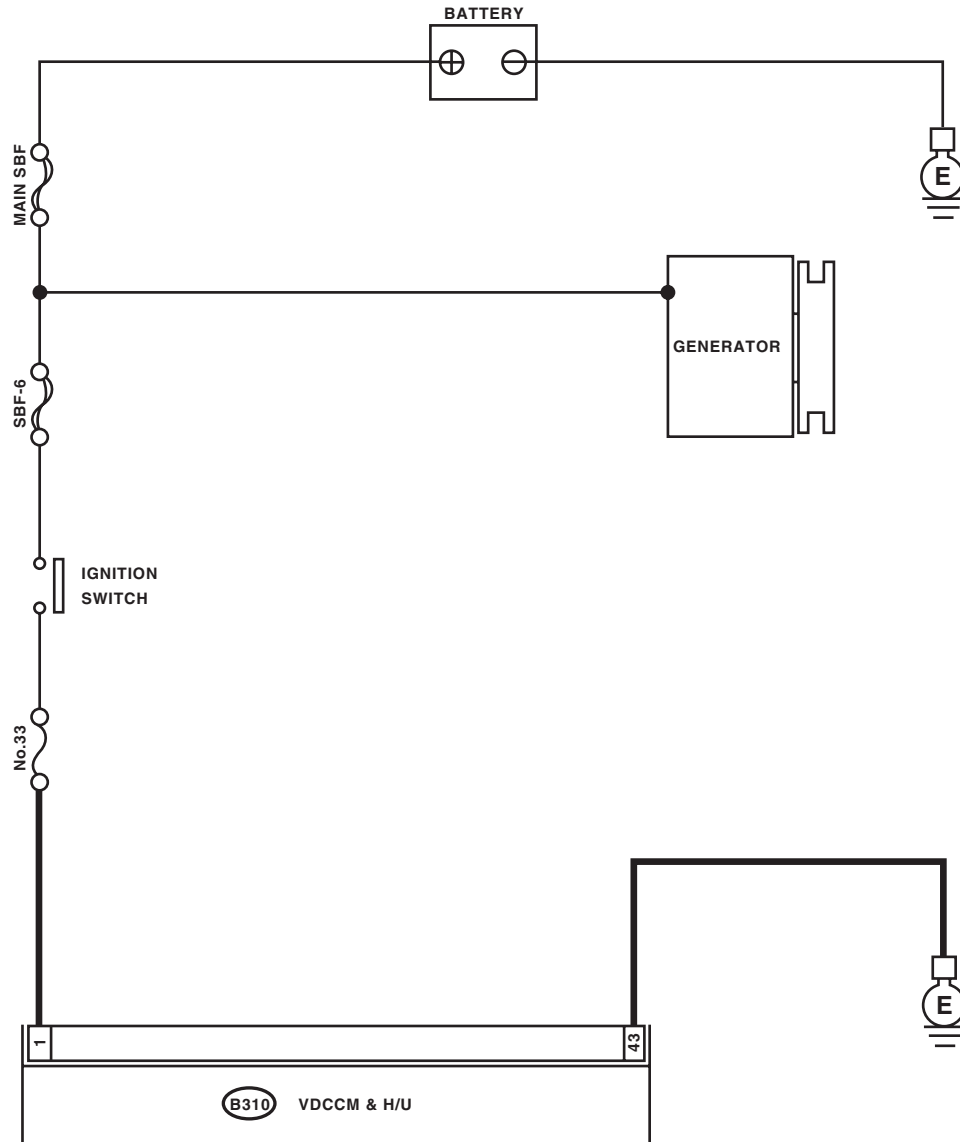
DTC DETECTING CONDITION:

- Defective harness connector
- Defective VDCH/U solenoid valve

TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00371

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK THE 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. 1 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
2	CHECK THE 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. 43 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 4.
4	CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

X: DTC C0042 POWER VOLTAGE MALFUNCTION

DTC DETECTING CONDITION:

CHECK THE VDCCM&H/U power supply voltage.

TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

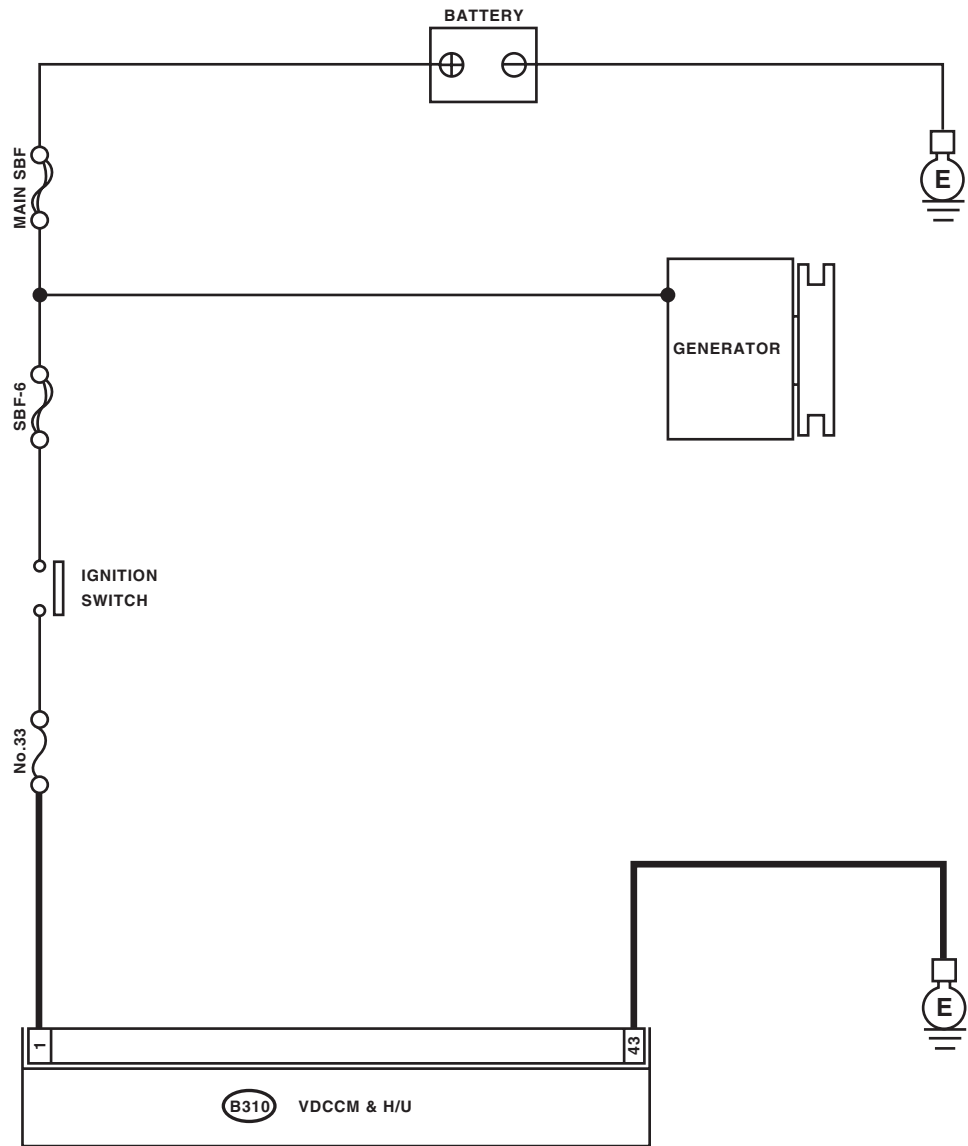
NOTE:

Warning lights go off if voltage returns.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:



(B310)

1	2	3	4	5	6	7	8	9	10	11	12	13	14		
15	16	17	18	19	20	21	22	23	24	25	26	27	28	43	44
29	30	31	32	33	34	35	36	37	38	39	40	41	42	45	46

VDC00371

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 B terminal (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the generator. <Ref. to SC(H6DO)-19, 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 terminal.
3 CHECK THE VDCCM&H/U INPUT VOLTAGE. 1) Disconnect the connector from the VDCCM&H/U. 2) Run the engine at idle. 3) Operate the devices such as headlights, air conditioner, defogger, etc. which produce much electrical loading. 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 4.	Repair the power supply circuit.
4 CHECK THE 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. 43 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 5.	Repair the VDCCM&H/U ground harness.
5 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 6.
6 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Y: 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)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in VDCCM&H/U connector?	Repair the connector.	Go to step 3.
3 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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)

Z: DTC C0051 VALVE RELAY OPEN CIRCUIT

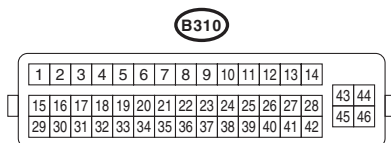
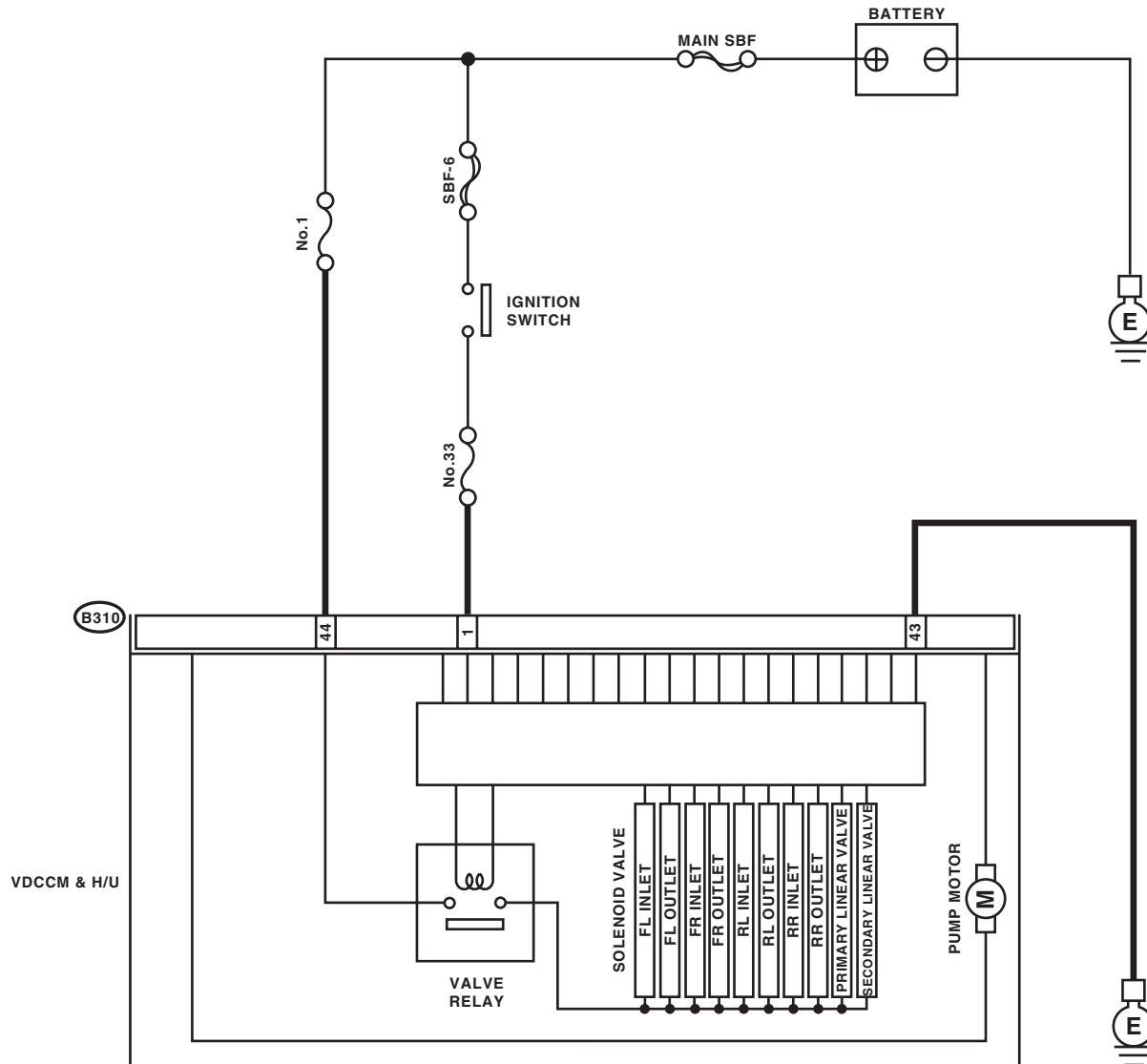
DTC DETECTING CONDITION:

Defective valve relay

TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00372

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK THE 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. 44 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the harness connector between battery and VDCCM&H/U.
2	CHECK THE 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. 43 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 4.
4	CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AA:DTC C0051 VALVE RELAY SHORT CIRCUIT

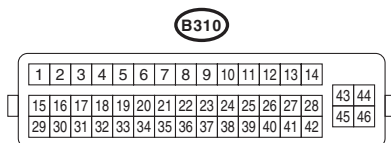
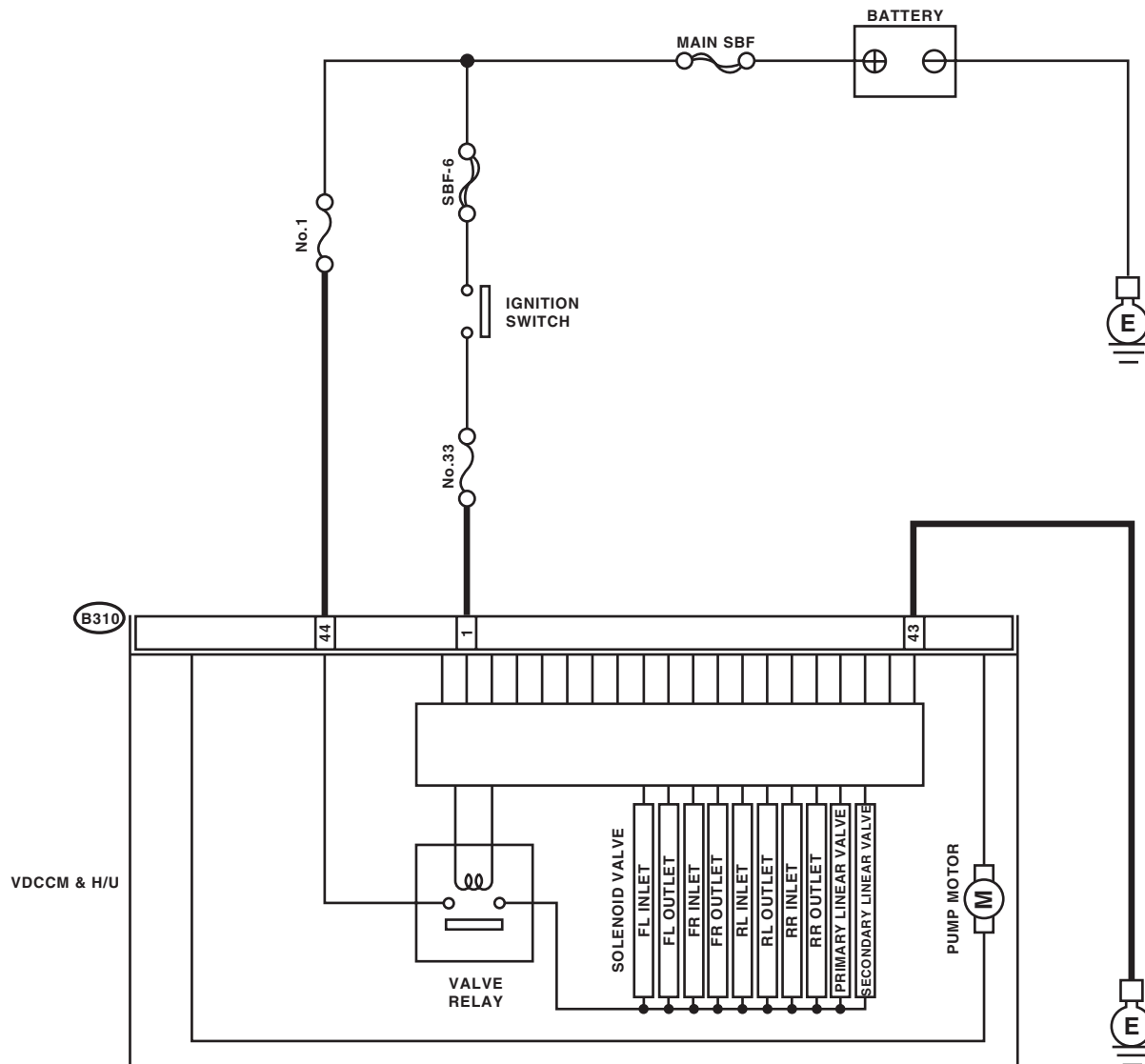
DTC DETECTING CONDITION:

Defective valve relay

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD does not operate.

WIRING DIAGRAM:



VDC00372

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK THE VDCCM&H/U VALVE RELAY. 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U connector terminals. Terminals No. 44 — No. 43:	Is the resistance more than 1 MΩ?	Go to step 2.	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
2 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 3.
3 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

AB:DTC C0052 MOTOR AND MOTOR RELAY OPEN CIRCUIT

NOTE:

For the diagnostic procedure, refer to DTC C0052 "MOTOR MALFUNCTION". <Ref. to VDC(diag)-55, DTC C0052 MOTOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AC:DTC C0052 MOTOR MALFUNCTION

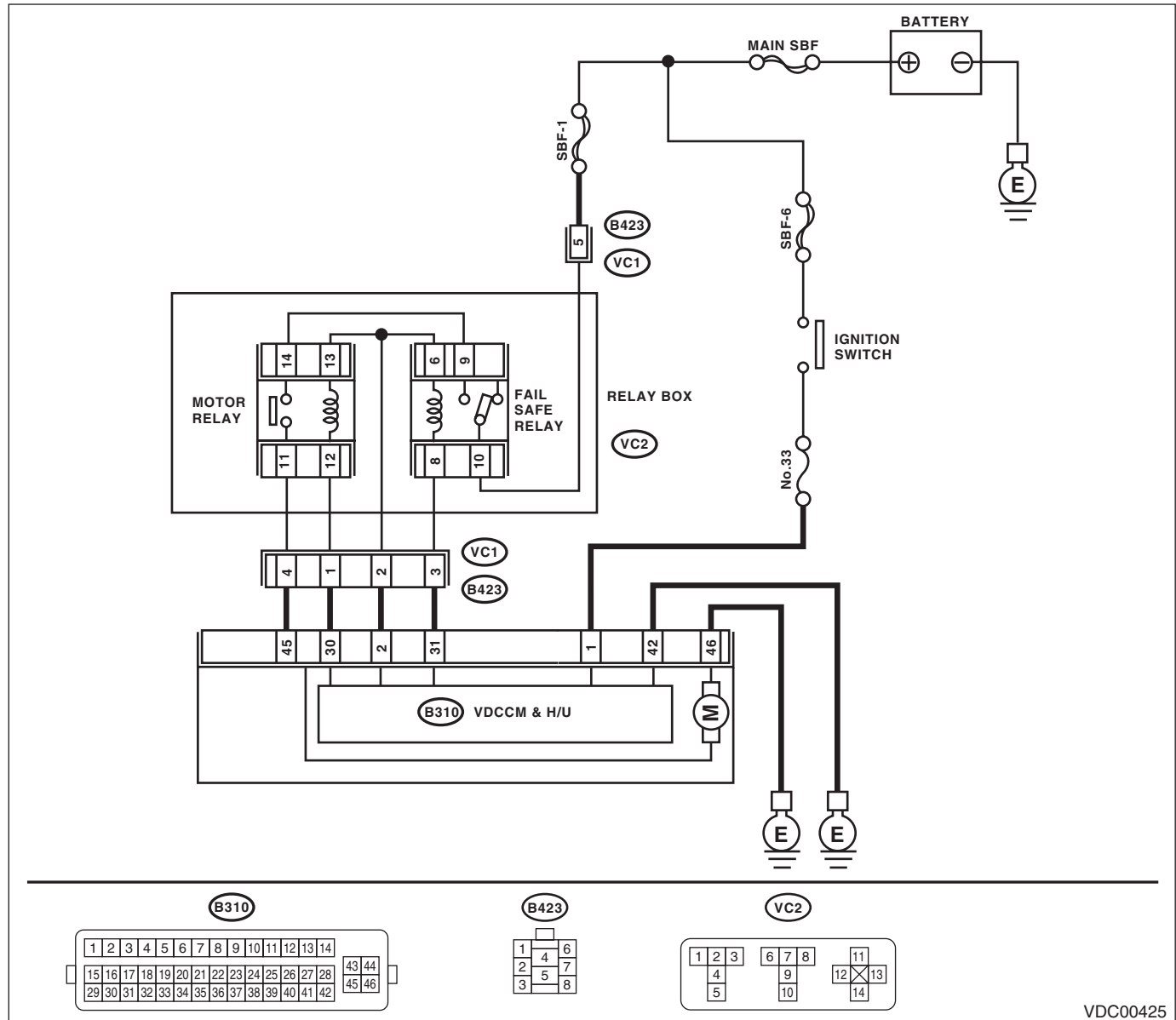
DTC DETECTING CONDITION:

- Defective motor and motor relay
- Defective harness connector

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD does not operate.

WIRING DIAGRAM:



VDC00425

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK MOTOR RELAY RESISTANCE. 1) Turn the ignition switch to OFF. 2) Remove the motor relay from the relay box. 3) Measure the resistance between motor relay terminals. Terminals No. 12 — No. 13:	Is the resistance between 70 — 100 Ω ?	Go to step 2.	Replace the motor relay.
2	CHECK MOTOR RELAY CONTACT POINT. 1) Connect the battery to motor relay terminals No. 13 (+) and No. 12(–). 2) Measure the resistance between motor relay terminals. Terminals No. 11 — No. 14:	Is the resistance less than 0.5 Ω ?	Go to step 3.	Replace the motor relay.
3	CHECK MOTOR RELAY SHORT. Measure the resistance between motor relay terminals. Terminals No. 12 — No. 11: No. 12 — No. 14:	Is the resistance more than 1 M Ω ?	Go to step 4.	Replace the motor relay.
4	CHECK FAIL SAFE RELAY RESISTANCE. 1) Turn the ignition switch to OFF. 2) Remove the fail safe relay from the relay box. 3) Measure the resistance between fail safe relay terminals. Terminals No. 6 — No. 8:	Is the resistance between 80 — 130 Ω ?	Go to step 5.	Replace the fail safe relay.
5	CHECK THE FAIL SAFE RELAY CONTACT POINT. 1) Connect the battery to motor relay terminals No. 6 (+) and No. 8(–). 2) Measure the resistance between motor relay terminals. Terminals No. 9 — No. 10:	Is the resistance less than 0.5 Ω ?	Go to step 6.	Replace the fail safe relay.
6	CHECK FAIL SAFE RELAY SHORT. Measure the resistance between motor relay terminals. Terminals No. 6 — No. 9: No. 6 — No. 10:	Is the resistance more than 1 M Ω ?	Go to step 7.	Replace the fail safe relay.
7	CHECK MOTOR RELAY POWER SUPPLY VOLTAGE. 1) Disconnect the connectors (B423) and (VC1). 2) Turn the ignition switch to ON. 3) Measure the voltage between connector (B423) and chassis ground. Connector & terminal (B423) No. 5 (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Go to step 8.	Repair the power supply circuit.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK RELAY BOX. Measure the resistance between each terminal. Terminals (VC1) No. 5 — (VC2) No. 10: (VC1) No. 2 — (VC2) No. 6: (VC1) No. 2 — (VC2) No. 13: (VC1) No. 3 — (VC2) No. 8: (VC1) No. 1 — (VC2) No. 12: (VC1) No. 4 — (VC2) No. 11: (VC2) No. 9 — (VC2) No. 14:	Is the resistance less than 0.5 Ω ?	Go to step 9.	Replace the relay box.
9 CHECK HARNESS. 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U and relay box. Connector & terminal (B423) No. 3 — (B310) No. 31: (B423) No. 2 — (B310) No. 2: (B423) No. 1 — (B310) No. 30: (B423) No. 4 — (B310) No. 45:	Is the resistance less than 0.5 Ω ?	Go to step 10.	Repair the harness.
10 CHECK GROUND SHORT CIRCUIT OF HARNESS. Measure the resistance between harness and chassis ground. Connector & terminal (B423) No. 3 — Chassis ground: (B423) No. 2 — Chassis ground: (B423) No. 1 — Chassis ground: (B423) No. 4 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 11.	Repair the harness.
11 CHECK GROUND CIRCUIT FOR MOTOR. Measure the resistance between VDCCM&H/U and chassis ground. Connector & terminal (B310) No. 46 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 12.	Repair the harness.
12 CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector?	Repair the connector.	Go to step 13.
13 CHECK THE VDCCM&H/U. 1) Connect all the connectors and relays. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

AD:DTC C0052 MOTOR AND MOTOR RELAY SHORT CIRCUIT

NOTE:

For the diagnostic procedure, refer to DTC C0052 "MOTOR FAIL SAFE RELAY SHORT CIRCUIT". <Ref. to VDC(diag)-58, DTC C0052 MOTOR FAIL SAFE RELAY SHORT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK MOTOR RELAY RESISTANCE. 1) Turn the ignition switch to OFF. 2) Remove the motor relay from the relay box. 3) Measure the resistance between motor relay terminals. Terminals No. 12 — No. 13:	Is the resistance between 70 — 100 Ω ?	Go to step 2.	Replace the motor relay.
2	CHECK MOTOR RELAY CONTACT POINT. 1) Connect the battery to motor relay terminals No. 13 (+) and No. 12(–). 2) Measure the resistance between motor relay terminals. Terminals No. 11 — No. 14:	Is the resistance less than 0.5 Ω ?	Go to step 3.	Replace the motor relay.
3	CHECK MOTOR RELAY SHORT. Measure the resistance between motor relay terminals. Terminals No. 12 — No. 11: No. 12 — No. 14:	Is the resistance more than 1 M Ω ?	Go to step 4.	Replace the motor relay.
4	CHECK FAIL SAFE RELAY RESISTANCE. 1) Turn the ignition switch to OFF. 2) Remove the fail safe relay from the relay box. 3) Measure the resistance between fail safe relay terminals. Terminals No. 6 — No. 8:	Is the resistance between 80 — 130 Ω ?	Go to step 5.	Replace the fail safe relay.
5	CHECK THE FAIL SAFE RELAY CONTACT POINT. 1) Connect the battery to motor relay terminals No. 6 (+) and No. 8(–). 2) Measure the resistance between motor relay terminals. Terminals No. 9 — No. 10:	Is the resistance less than 0.5 Ω ?	Go to step 6.	Replace the fail safe relay.
6	CHECK FAIL SAFE RELAY SHORT. Measure the resistance between motor relay terminals. Terminals No. 6 — No. 9: No. 6 — No. 10: No. 9 — No. 10:	Is the resistance more than 1 M Ω ?	Go to step 7.	Replace the fail safe relay.
7	CHECK RELAY BOX. 1) Disconnect the connectors (B423) and (VC1). 2) Turn the ignition switch to ON. 3) Measure the voltage between connector (VC2) and chassis ground. Connector & terminal (VC2) No. 11 (+) — Chassis ground (–): (VC2) No. 12 (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Replace the relay box.	Go to step 8.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK HARNESS. 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the voltage between connector (B423) and chassis ground. Connector & terminal (B423) No. 4 (+) — Chassis ground (–): (B423) No. 1 (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Repair the harness.	Go to step 9.
9 CHECK THE MOTOR. 1) Connect all the connectors and relays. 2) Turn the ignition switch to ON.	Is the motor continuing to rotate?	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 10.
10 CHECK THE VDCCM&H/U. 1) Connect all the connectors and relays. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 11.
11 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AF:DTC C0052 MOTOR DO NOT WORK

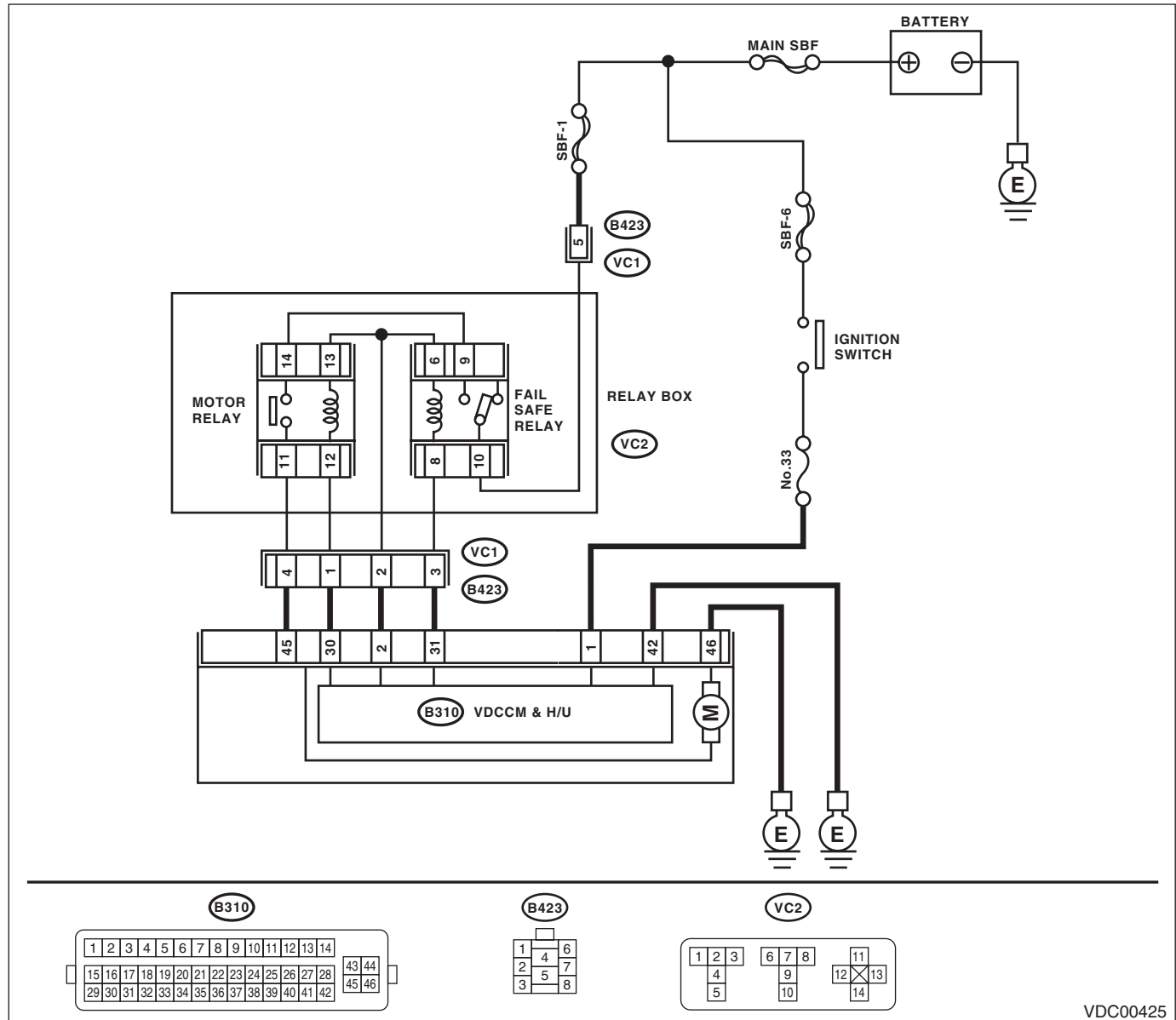
DTC DETECTING CONDITION:

- Defective motor
- Defective harness connector

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD does not operate.

WIRING DIAGRAM:



VDC00425

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK THE 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. 1 (+) — 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 THE 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. 46 (+) — Chassis ground (-):	Is the resistance less than 0.5 Ω ?	Go to step 4.	Repair the VDCCM&H/U ground harness.
4	CHECK THE VDCCM&H/U. 1) Connect all the connectors and relays. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AG:DTC C0054 BRAKE LAMP SWITCH OPEN CIRCUIT

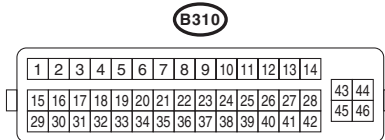
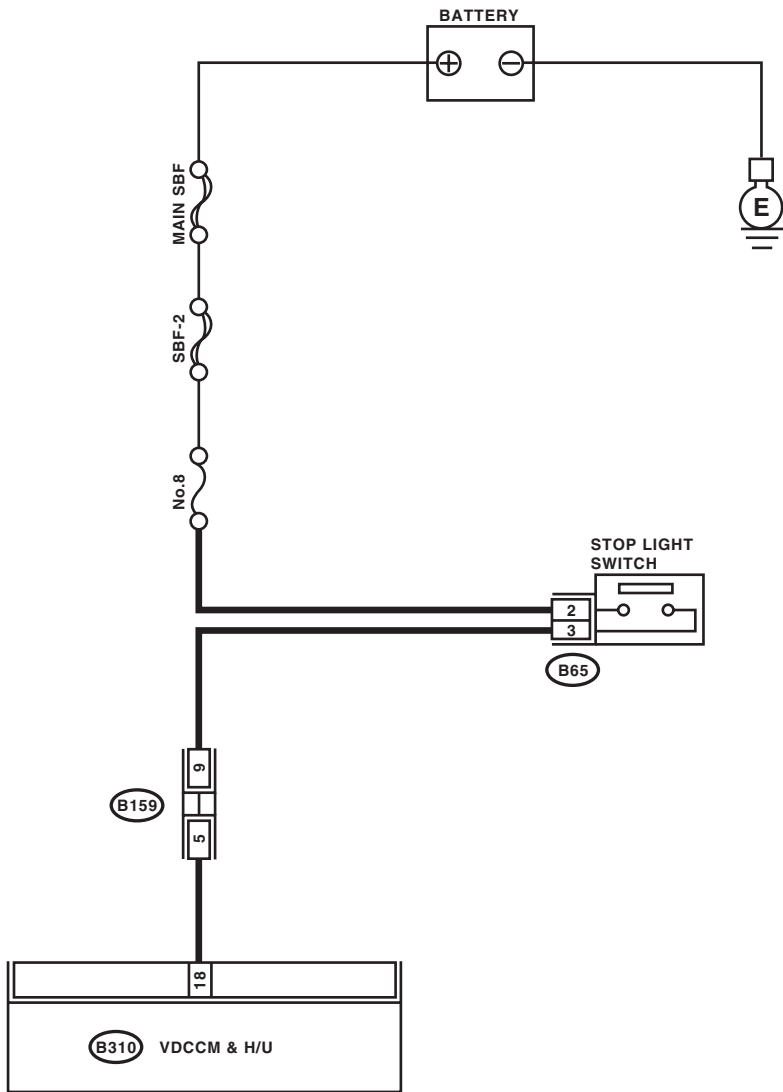
DTC DETECTING CONDITION:

Defective stop light switch

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



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} in 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 COME ON. 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. 18 (+) — 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 in connector between stop light switch and VDCCM&H/U?	Go to step 6.	Repair the connector.
6 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AH: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. 3) Read the G sensor output when braking.	Do the values on the monitor display change?	Go to step 2.	Replace the yaw rate & lateral G sensor.
2 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Go to step 3.
3 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

AI: 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 & LATERAL G SENSOR INSTALLATION. Check the yaw rate & lateral G sensor installation.	Are the yaw rate & lateral G sensor and bracket tightened to a torque of 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. 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 & lateral G sensor.
3 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Go to step 4.
4 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AJ:DTC C0056 YAW RATE G SENSOR POWER SUPPLY VOLTAGE MALFUNCTION

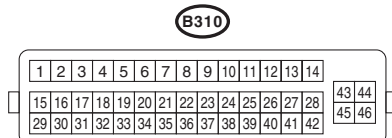
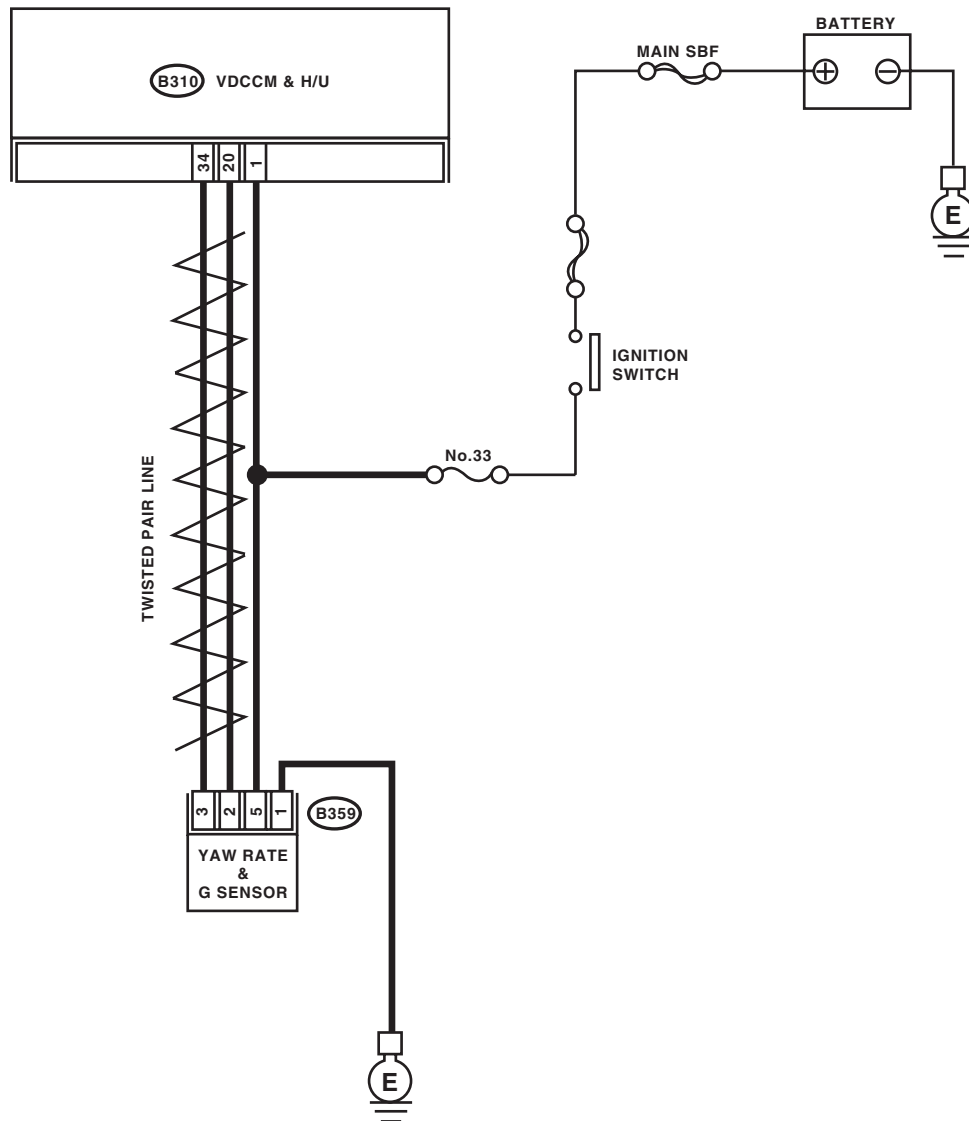
DTC DETECTING CONDITION:

Defective G sensor

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00375

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK THE YAW RATE & LATERAL G SENSOR POWER SUPPLY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the yaw rate & lateral G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & lateral G sensor and chassis ground. Connector & terminal (B359) No. 5 (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Go to step 2.	Replace the yaw rate & lateral G sensor power supply circuit.
2 CHECK GROUND CIRCUIT OF YAW RATE & LATERAL G SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between the yaw rate & lateral G sensor connector and chassis ground. Connector & terminal (B359) No. 1 (+) — Chassis ground (–):	Is the resistance less than 0.5 Ω ?	Go to step 3.	Replace the yaw rate & lateral G sensor power supply circuit.
3 CHECK YAW RATE & LATERAL G SENSOR. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Go to step 4.
4 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

AK: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 & LATERAL G SENSOR INSTALLATION. Check the yaw rate & lateral G sensor installation.	Are the yaw rate & lateral G sensor and bracket tightened to a torque of 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. 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 $-1.5 — 1.5 \text{ m/s}^2$?	Go to step 3.	Replace the yaw rate & lateral G sensor.
3 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Go to step 4.
4 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AL: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)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in ECM connector?	Repair the connector.	Go to step 3.
3	CHECK ECM.	Is ECM normal?	Go to step 4.	Replace the ECM.
4	CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

AM: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)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in TCM connector?	Repair the connector.	Go to step 3.
3	CHECK TCM.	Is the TCM normal?	Go to step 4.	Replace the TCM. <Ref. to 5AT-58, Transmission Control Module (TCM).>
4	CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Go to step 5.
5	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AN:DTC C0057 TRANSMISSION SYSTEM FAILURE

DTC DETECTING CONDITION:

Transmission System Defect

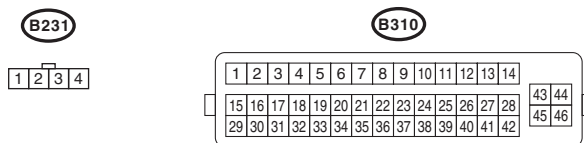
TROUBLE SYMPTOM:

- 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.	Is DTC of AT system displayed?	Repair the AT system.	Go to step 2.
2 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Go to step 3.
3 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

WIRING DIAGRAM:



VDC(diag)-70

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK THE POWER SUPPLY OF THE 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 power supply circuit in the steering angle sensor.
2	CHECK GROUND CIRCUIT OF STEERING ANGLE SENSOR. Measure the voltage between steering angle sensor and chassis ground. Connector & terminal (B231) No. 3 (+) — Chassis ground (-):	Is the resistance less than 0.5 Ω ?	Go to step 3.	Repair ground circuit in the steering angle sensor.
3	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector?	Correct or replace the connector.	Go to step 4.
4	CHECK STEERING ANGLE SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the steering angle sensor.	Go to step 5.
5	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AP:DTC C0071 STEERING ANGLE SENSOR COMMUNICATION MALFUNCTION

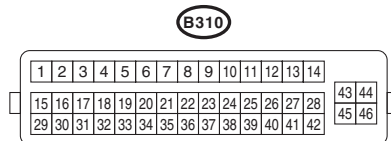
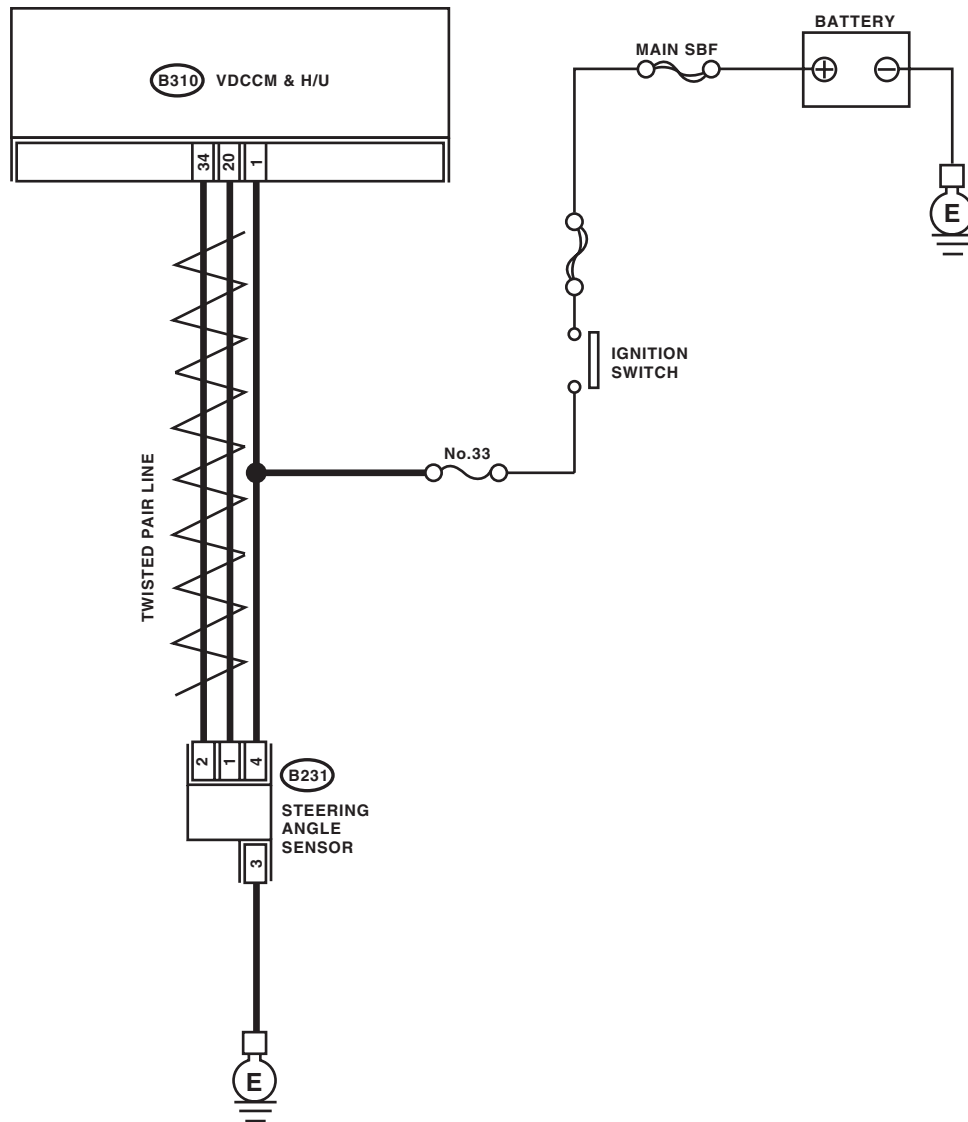
DTC DETECTING CONDITION:

Signal does not come from steering angle sensor.

TROUBLE SYMPTOM:

VDC does not operate.

WIRING DIAGRAM:



VDC00376

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)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2 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 3.	Repair the power supply circuit.
3 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 0.5 Ω ?	Go to step 4.	Repair ground circuit in the steering angle sensor.
4 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. 20: (B231) No. 2 — (B310) No. 34:	Is the resistance less than 0.5 Ω ?	Go to step 5.	Repair the harness between the steering angle sensor and VDCCM&H/U.
5 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 more than 1 M Ω ?	Go to step 6.	Repair the harness between the steering angle sensor and VDCCM&H/U.
6 CHECK STEERING ANGLE SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 7.	Go to step 8.
7 CHECK THE VDCCM&H/U. 1) Turn the ignition switch to OFF. 2) Replace the steering angle sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 9.
8 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
9 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Original steering angle sensor malfunction

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AQ: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. 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.
4 CHECK THE VDCCM&H/U. 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

AR: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-12, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

AS: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)-75, 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)

AT: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 & LATERAL G SENSOR INSTALLATION.	Is the yaw rate & lateral 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 & lateral G sensor installation bolt.
3 CHECK OUTPUT OF YAW RATE & LATERAL 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. 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 & lateral 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. 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.
5 CHECK YAW RATE & LATERAL G SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 6.	Go to step 7.
6 CHECK THE VDCCM&H/U. 1) Turn the ignition switch to OFF. 2) Replace the yaw rate & lateral G sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.
8 CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Malfunction is found in original yaw rate & lateral G sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

AU: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)-76, DTC C0072 YAW RATE SENSOR INTERNAL PROBLEM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AV:DTC C0072 YAW RATE SENSOR INTERNAL PROBLEM MALFUNCTION

DTC DETECTING CONDITION:

Yaw rate & lateral G sensor malfunction

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

	Step	Check	Yes	No
1	CHECK YAW RATE & LATERAL G SENSOR. 1) Erase the memory. 2) Perform the Inspection Mode. 3) Read the DTC.	Is the same DTC displayed?	Replace the yaw rate & lateral G sensor.	Go to step 2.
2	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

AW:DTC C0056 G SENSOR COMMUNICATION MALFUNCTION

NOTE:

For the diagnostic procedure, refer to DTC C0072 “YAW RATE SENSOR COMMUNICATION MALFUNCTION”. <Ref. to VDC(diag)-77, DTC C0072 YAW RATE SENSOR COMMUNICATION 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 COMMUNICATION MALFUNCTION

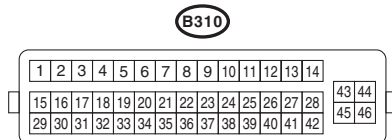
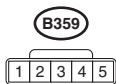
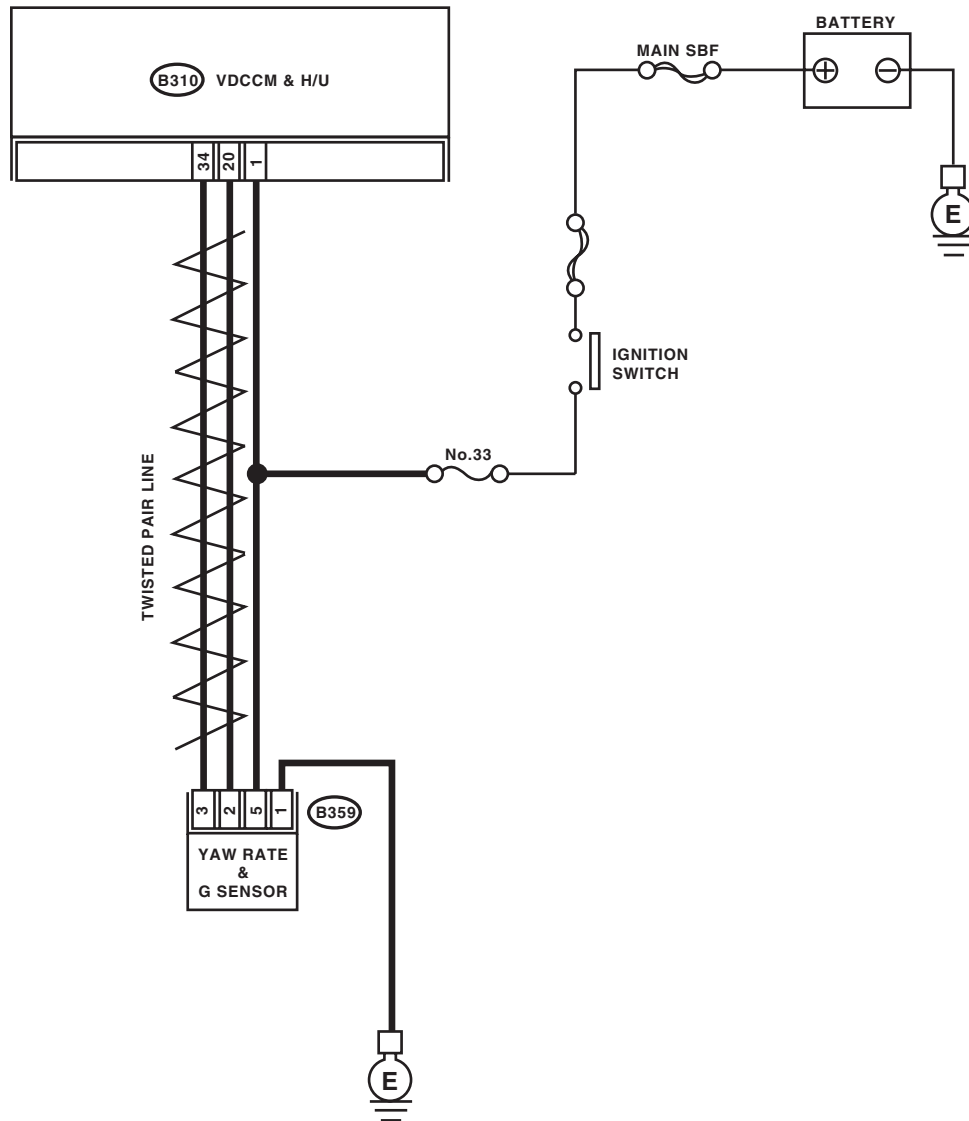
DTC DETECTING CONDITION:

Yaw rate & lateral G sensor malfunction

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00375

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK LAN SYSTEM. 1) Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2	CHECK THE YAW RATE & LATERAL G SENSOR POWER SUPPLY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the yaw rate & lateral G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & lateral G sensor and chassis ground. Connector & terminal (B359) No. 5 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 3.	Replace the yaw rate & lateral G sensor power supply circuit.
3	CHECK GROUND CIRCUIT OF YAW RATE & LATERAL G SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between the yaw rate & lateral G sensor and chassis ground. Connector & terminal (B359) No. 1 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 4.	Repair the yaw rate & lateral G sensor ground circuit.
4	CHECK POOR CONTACT OF CONNECTORS.	Is there poor contact in connector?	Correct or replace the connector.	Go to step 5.
5	CHECK YAW RATE & LATERAL G SENSOR. 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the yaw rate & lateral G sensor.	Go to step 6.
6	CHECK OTHER DTC DETECTION.	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

AY:DTC C0074 PRESSURE SENSOR SIGNAL FREEZE

NOTE:

For the diagnostic procedure, refer to DTC C0074 "PRESSURE SENSOR OPEN CIRCUIT". <Ref. to VDC(diag)-79, DTC C0074 PRESSURE SENSOR OPEN CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AZ:DTC C0074 PRESSURE SENSOR OUTPUT RISE

NOTE:

For the diagnostic procedure, refer to DTC C0074 "PRESSURE SENSOR OPEN CIRCUIT". <Ref. to VDC(diag)-79, 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)

BA:DTC C0074 PRESSURE SENSOR OPEN CIRCUIT

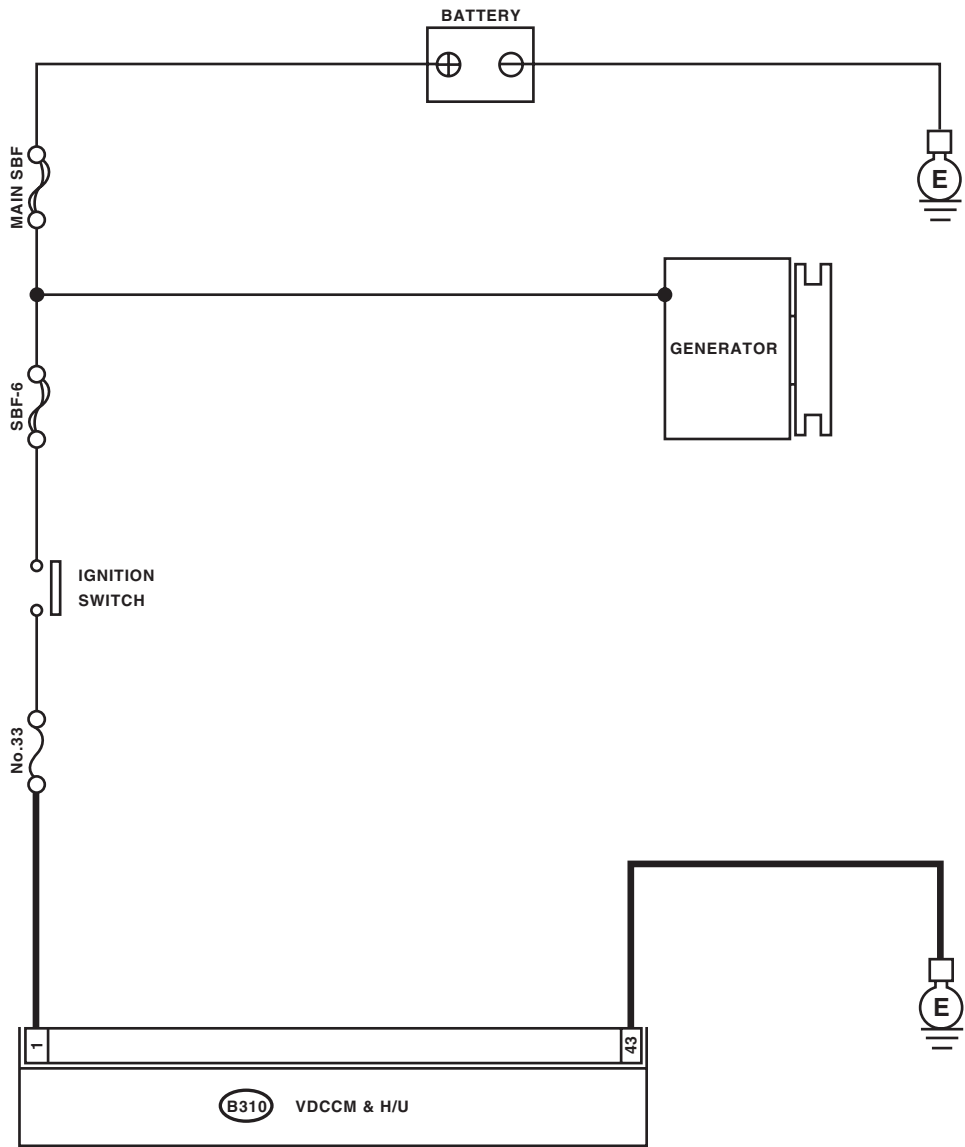
DTC DETECTING CONDITION:

Defective pressure sensor

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



B310

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
												43	44
												45	46

VDC00371

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK THE 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. 1 (+) — Chassis ground (–):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
2	CHECK THE 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. 43 — Chassis ground:	Is the resistance less than 0.5 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 Subaru Select Monitor. 3) Depress the brake pedal. 4) Read the pressure switch output in 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-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
4	CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

BB: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 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 COME ON. 1) 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 using the Subaru Select Monitor.	Do the output values on the monitor display change when the pedal is depressed?	Go to step 5.	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
5 CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

BC:DTC C0074 PRESSURE SENSOR NOISE

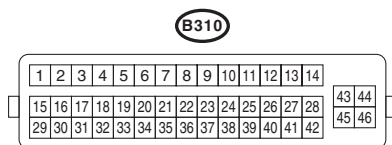
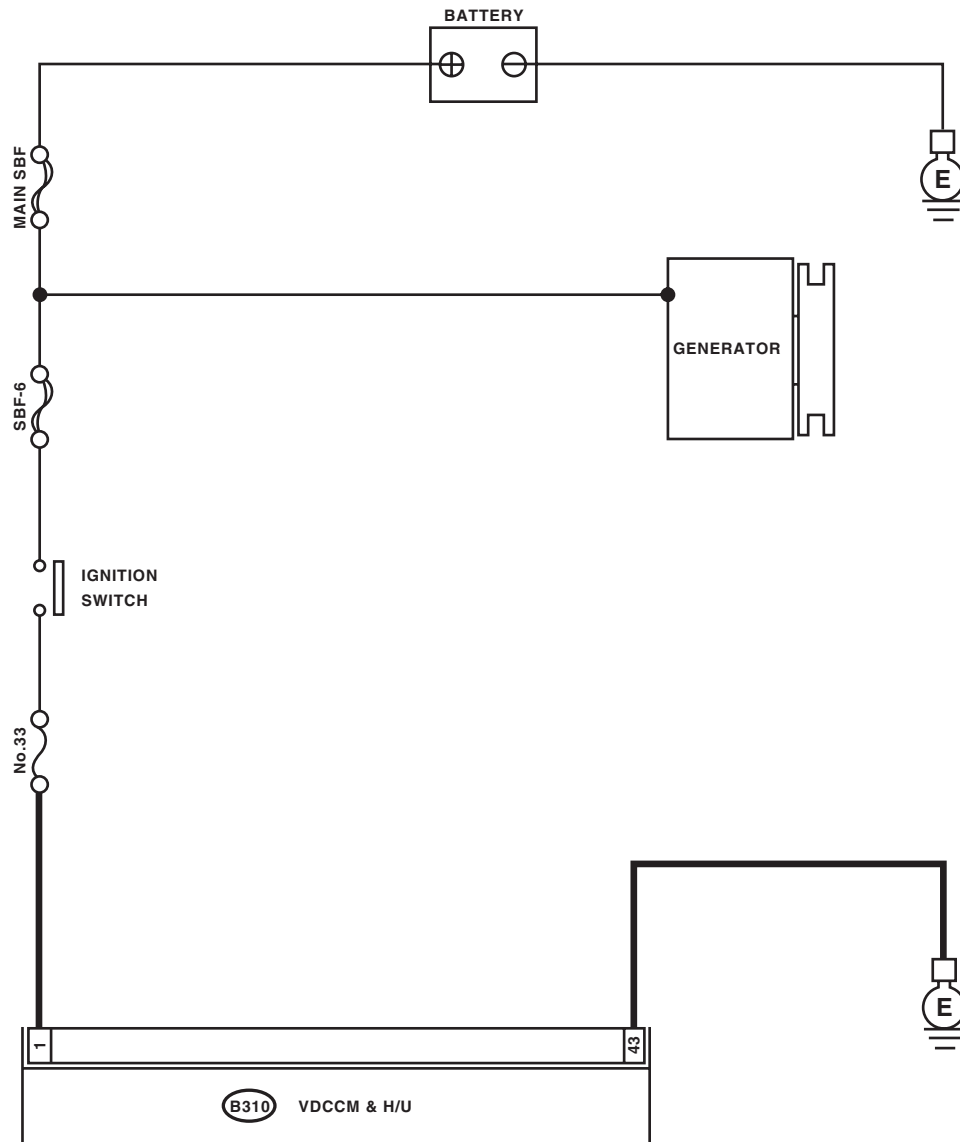
DTC DETECTING CONDITION:

Defective pressure sensor

TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

WIRING DIAGRAM:



VDC00371

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK THE 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. 1 (+) — Chassis ground (-):	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
2	CHECK THE 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. 43 — Chassis ground:	Is the resistance less than 0.5 Ω ?	Go to step 3.	Repair the VDCCM&H/U ground harness.
3	CHECK CAUSE OF SIGNAL NOISE. Check if the noise sources (such as an antenna) are installed near the VDCCM&H/U.	Are noise sources installed?	Install the noise sources apart from the VDCCM&H/U.	Go to step 4.
4	CHECK PRESSURE SENSOR. 1) Depress the brake pedal. 2) Read the pressure switch output in Subaru Select Monitor.	Do the output values on the monitor display change when the pedal is depressed?	Go to step 5.	Replace the VDCCM&H/U. <Ref. to VDC-8, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
5	CHECK THE VDCCM&H/U. 1) Connect all the connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-8, 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.	Temporary poor contact occurs.

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

13.General Diagnostic Table

A: INSPECTION

Symptom		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 & lateral 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 & lateral 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 & lateral 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 & lateral 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 & lateral G sensor or improper installation • Master cylinder • Disc rotor • Brake pipe • Axle and wheels • Road with crowns or banks • Suspension play or fatigue (poor damping)

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptom		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 (poor 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 & lateral 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 (poor 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 & lateral 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 (poor 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 & lateral G sensor or improper installation - Brake pad - Brake pipe

General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptom		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 & lateral 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 (poor 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 & lateral 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 & lateral 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 (poor 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 & lateral G sensor or improper installation • Wheel alignment • Road surface (uneven) • Road with crowns or banks • Suspension play or fatigue (poor damping) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections • Power steering system	
TCS OFF indicator light does not come on when the TCS OFF switch is depressed. NOTE: When pressing TCS OFF switch for more than 10 seconds, TCS OFF indicator light goes off and cannot operate any more. When turning the ignition switch from OFF to ON, the previous status is restored.		• Harness • Indicator light bulb • TCS OFF switch	

BRAKE

BR

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General Description

VEHICLE DYNAMICS CONTROL (VDC)

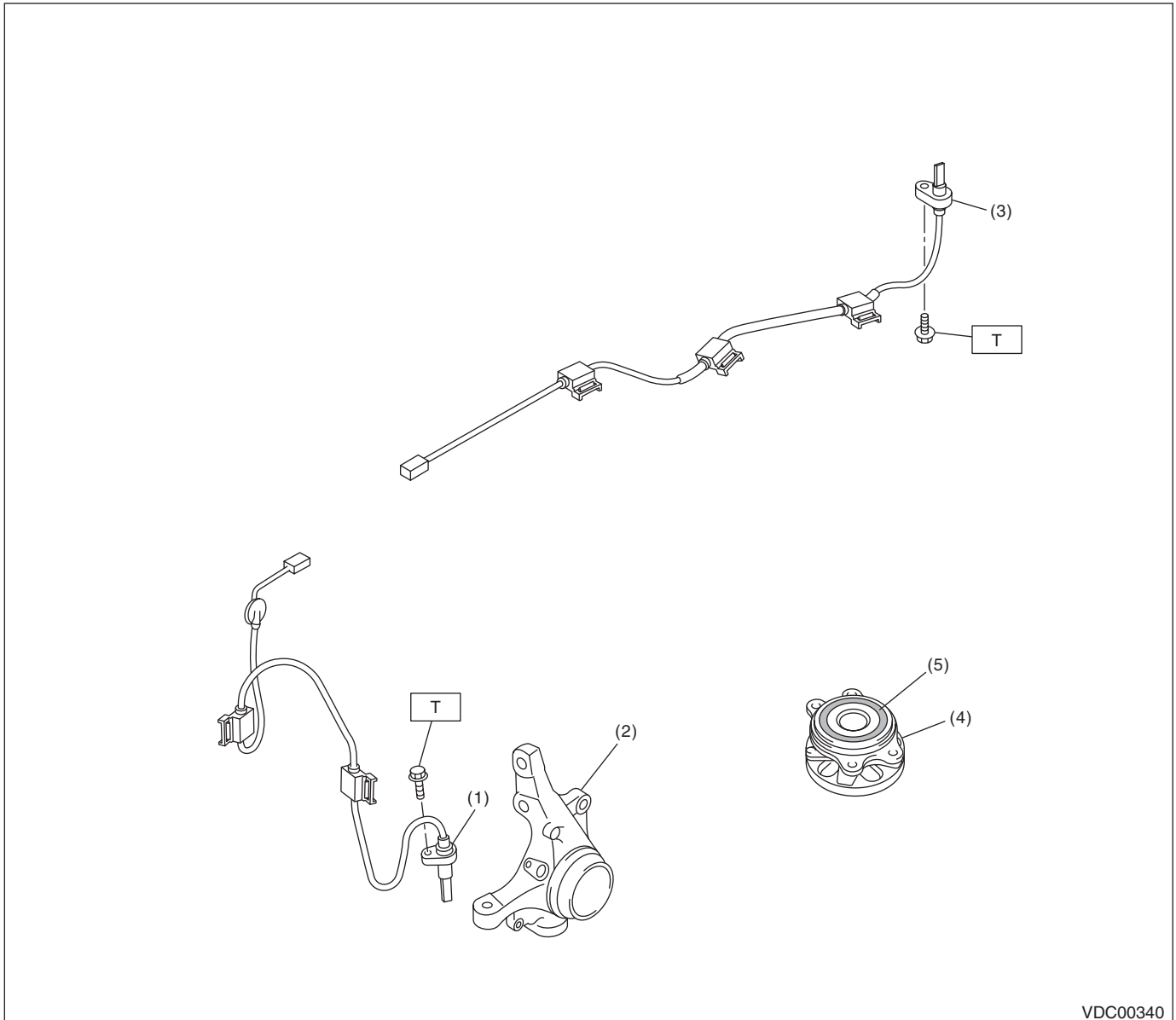
1. General Description

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			W2

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 | |

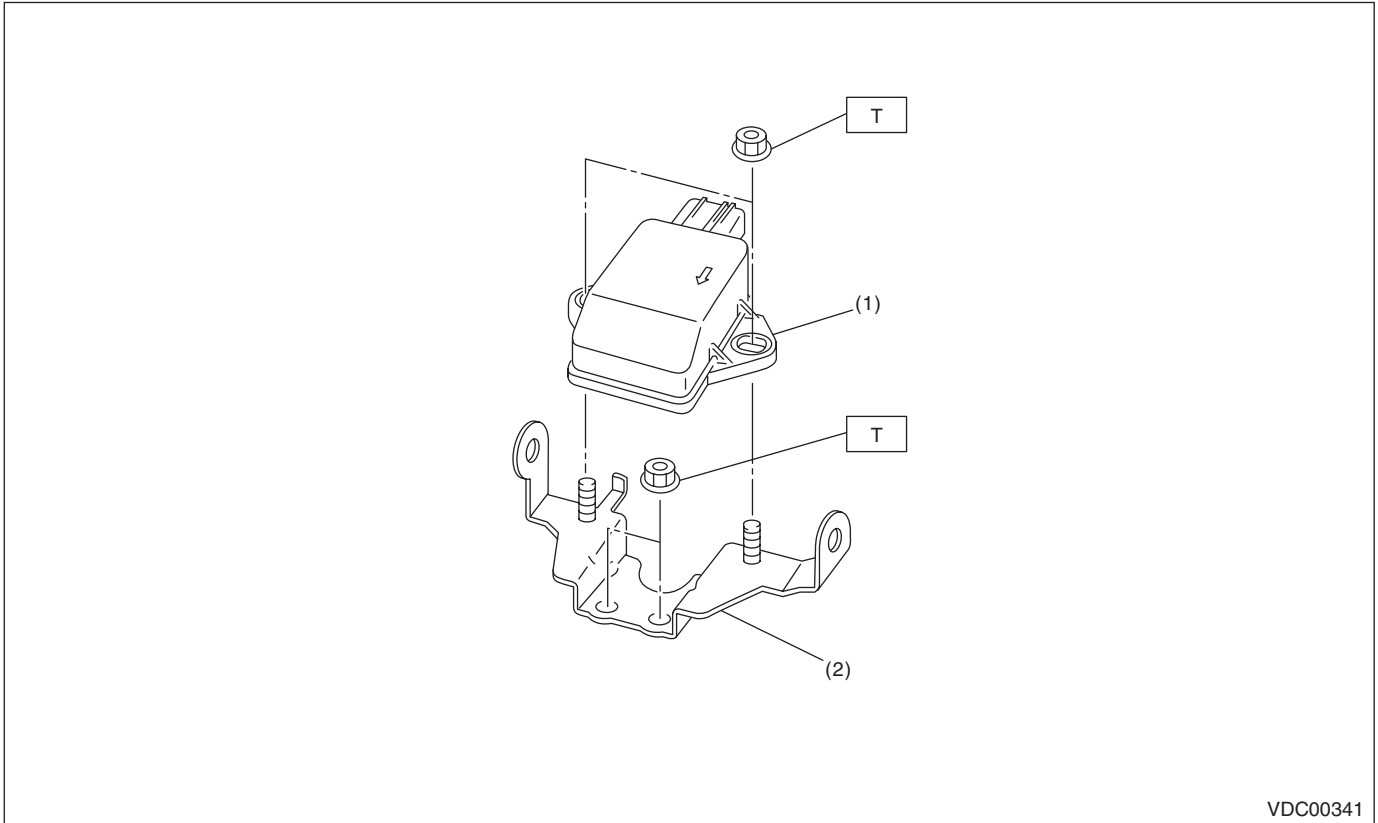
Tightening torque: N·m (kgf-m, ft-lb)

T: 7.5 (0.76, 5.5)

General Description

VEHICLE DYNAMICS CONTROL (VDC)

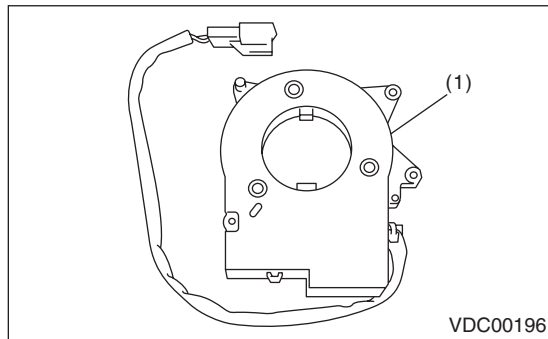
2. YAW RATE & LATERAL G SENSOR



- (1) Yaw rate & lateral G sensor
- (2) Bracket

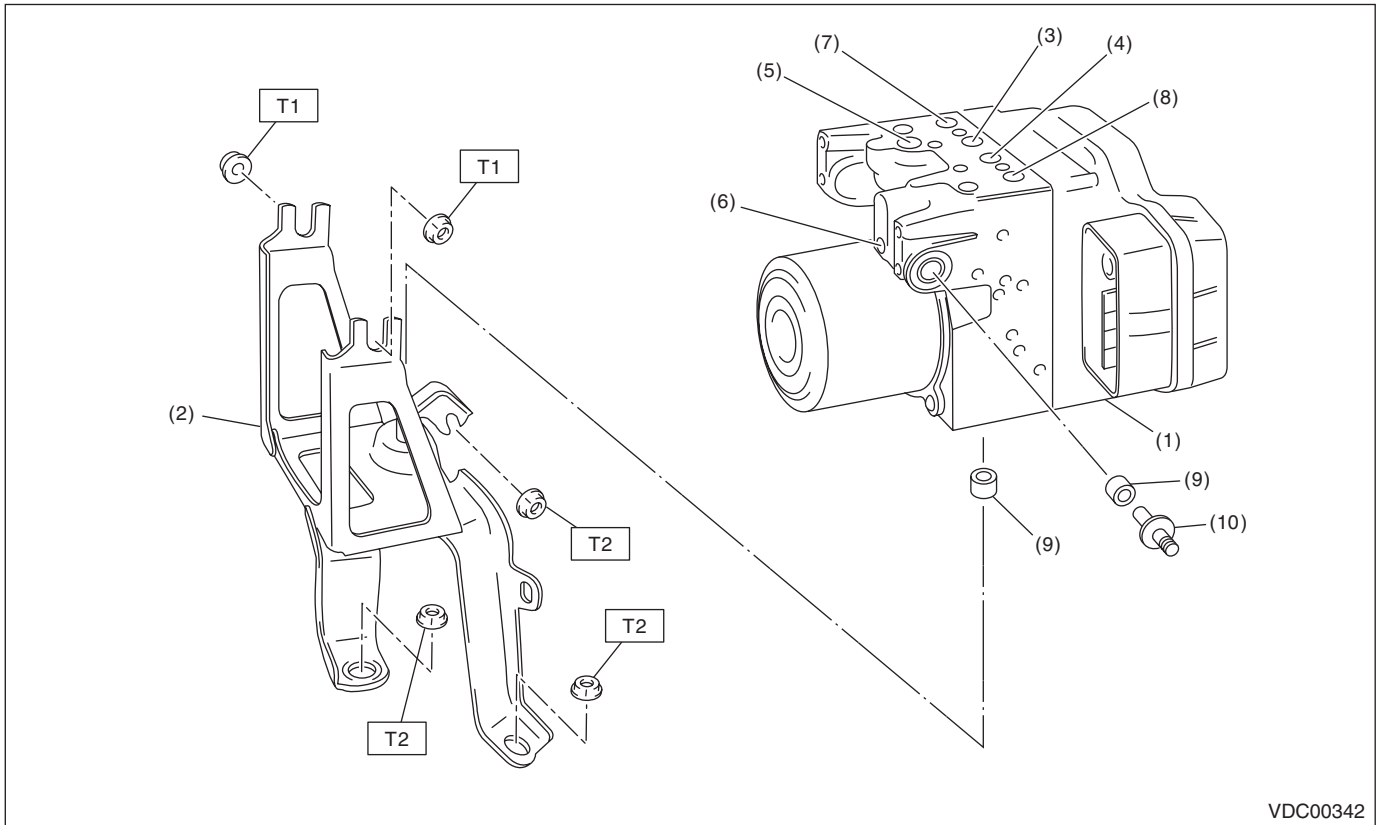
Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.76, 5.5)

3. STEERING ANGLE SENSOR



- (1) Steering angle sensor

4. VDC CONTROL MODULE AND HYDRAULIC CONTROL UNIT (VDCCM&H/U)



VDC00342

- (1) VDC control module and hydraulic control unit (VDCCM&H/U)
- (2) Bracket
- (3) Rear RH outlet
- (4) Rear LH outlet

- (5) Secondary inlet
- (6) Primary inlet
- (7) Front LH outlet
- (8) Front RH outlet
- (9) Damper

- (10) Stud bolt

Tightening torque: N·m (kgf-m, ft-lb)

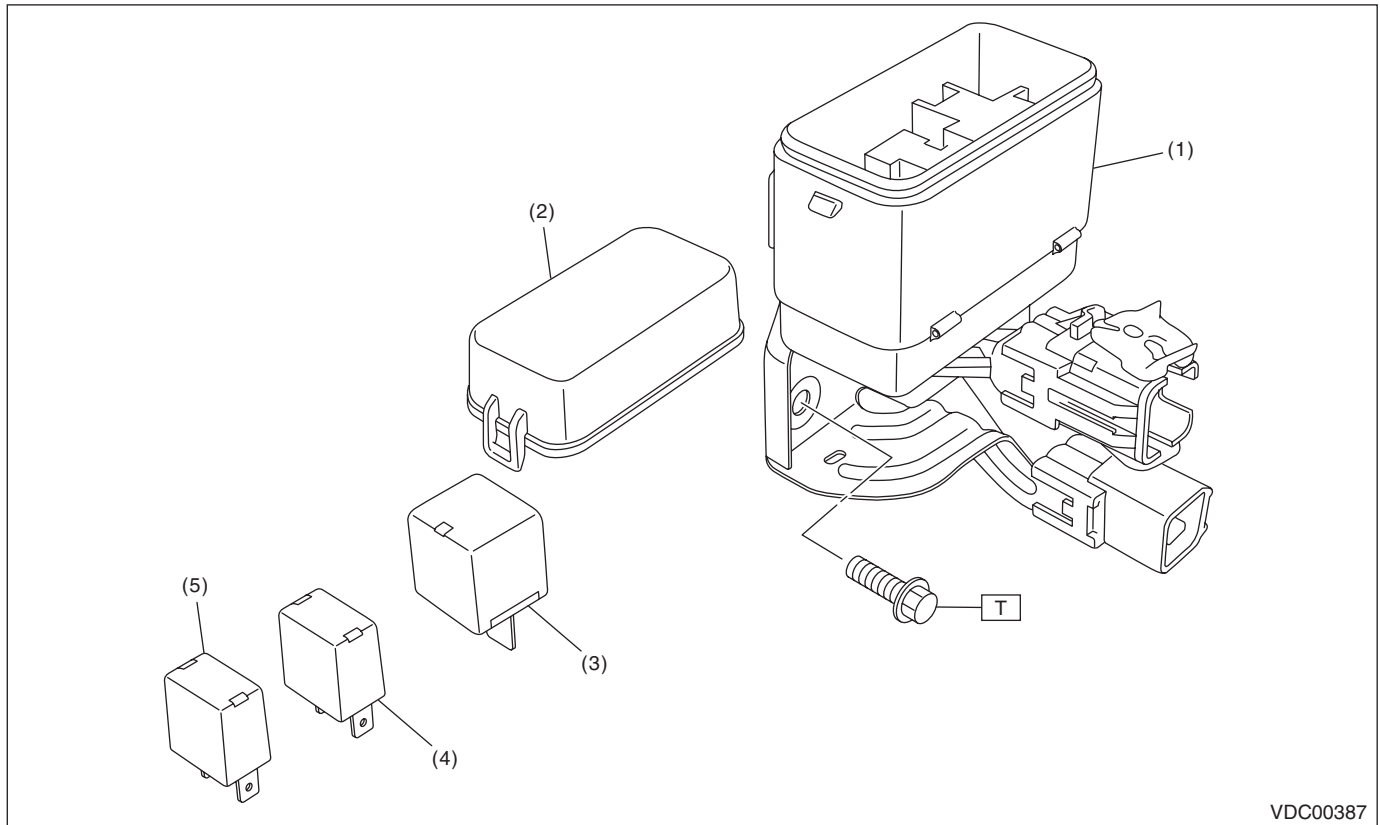
T1: 7.5 (0.76, 5.5)

T2: 33 (3.4, 24)

General Description

VEHICLE DYNAMICS CONTROL (VDC)

5. RELAY BOX



- | | |
|------------------------|-------------------------------|
| (1) Relay box | (4) Fuel safe relay (green) |
| (2) Cover | (5) Vacuum pump relay (black) |
| (3) Motor relay (blue) | |

Tightening torque: N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.0)

C: CAUTION

Please 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 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, carefully observe the following to prevent unexpected accidents.

- Prepare a container and cloth when performing work which oil possibly spills. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out, to protect the environmental.
- Follow all government regulations concerning disposal of refuse when disposing.

3. BRAKE FLUID

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

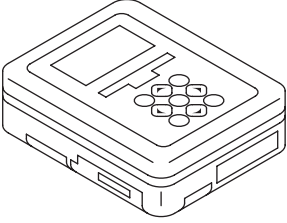
- Wash out your eyes and seek immediate medical attention.
- Wash your skin with soap and then rinse thoroughly with water.
- Follow all government regulations concerning disposal of refuse when disposing.

General Description

VEHICLE DYNAMICS CONTROL (VDC)

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B020XU0	1B020XU0	SUBARU SELECT MONITOR KIT	Used for troubleshooting for 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 (VDCCM&H/U)

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Use compressed air to remove moisture and dust around the VDCCM&H/U.

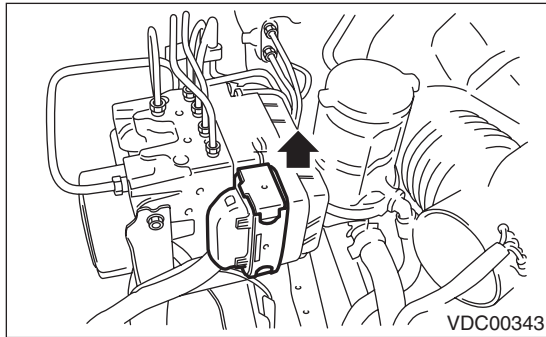
NOTE:

If the terminals become dirty, it may cause improper contact.

- 3) Lift the lock lever and Disconnect the VDC-CM&H/U connector.

CAUTION:

Do not pull on the harness when disconnecting the connector.

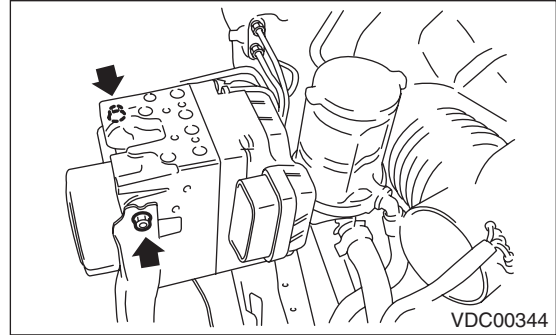


- 4) Disconnect the brake pipes from the VDC-CM&H/U.
- 5) Wrap the brake pipe with a vinyl bag so as not to spill the brake fluid on the vehicle body.

CAUTION:

If brake fluid is spilled on the vehicle body, wash it off immediately with water and wipe clean.

- 6) Remove the nuts 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 during storage.
- Be careful not to let foreign matter enter the VDCCM&H/U.
- Be careful that no water enters the connectors.

- 7) Remove the VDCCM&H/U bracket.

B: INSTALLATION

1) Install the VDCCM&H/U bracket.

Tightening torque:

33 N·m (3.3 kgf-m, 24 ft-lb)

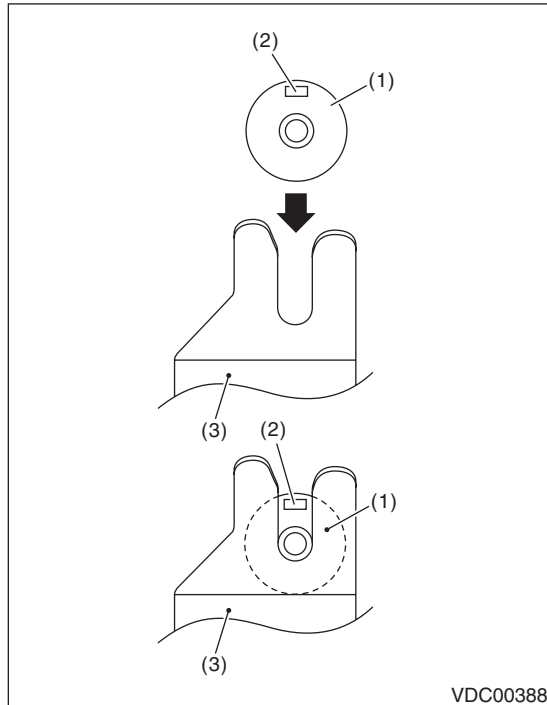
2) Install the VDCCM&H/U to the bracket.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

CAUTION:

Attach so that the protrusion of the stud bolt is at the position shown in the figure.



- (1) Stud bolt
- (2) Protrusion portion
- (3) Bracket

3) Connect the brake pipes to their correct VDC-CM&H/U positions.

Tightening torque:

<Ref. to BR-7, FRONT BRAKE PIPES AND HOSE, COMPONENT, General Description.>

4) Connect the VDCCM&H/U connector.

NOTE:

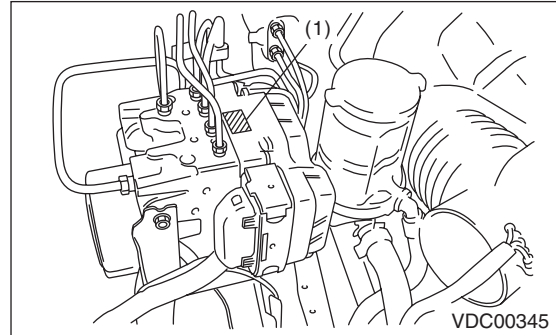
- Be sure to remove all foreign matter from inside the connector before connecting.
 - Make sure the VDCCM&H/U connector is securely locked.
- 5) Bleed air from the brake system.

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.

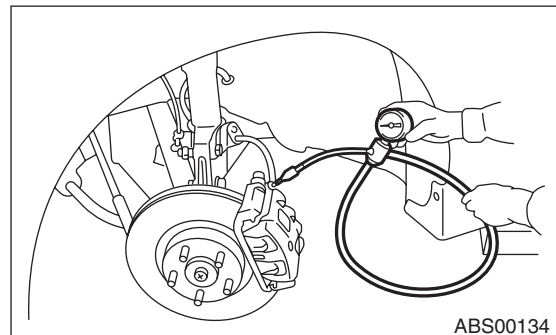
3) Connect two pressure gauges to FL and FR caliper bodies.

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-13, 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.

VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

VEHICLE DYNAMICS CONTROL (VDC)

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-13, 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.

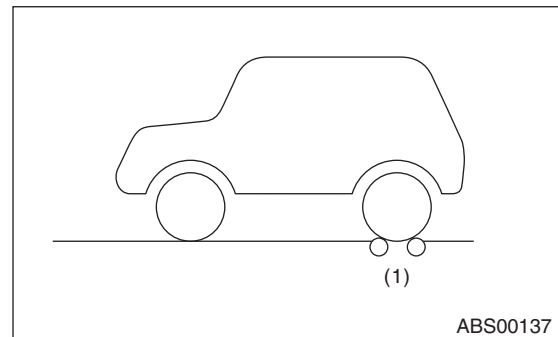
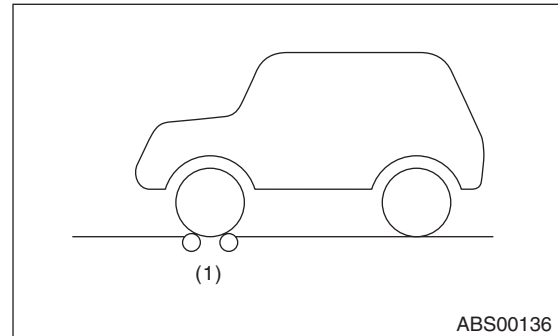
19) Bleed air from the brake system.

2. CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER

1) Set wheels other than the one to measure free rollers.

2) Prepare for the ABS sequence control operation.
<Ref. to VDC-13, 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-13, 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

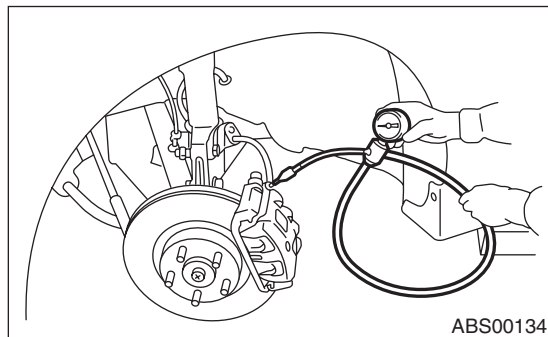
- 1) Lift-up the vehicle and remove the wheel.
- 2) Remove the air bleeder screws from FL and FR caliper bodies.
- 3) Connect two pressure gauges to FL and FR caliper bodies.

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-16, 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-16, 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.

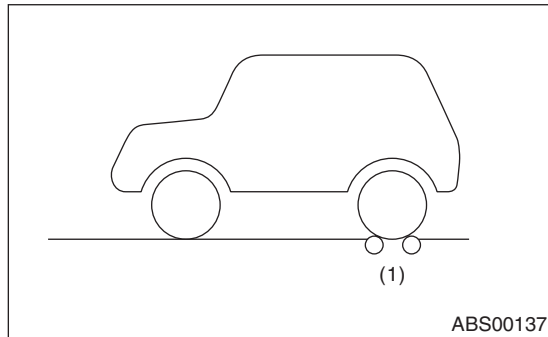
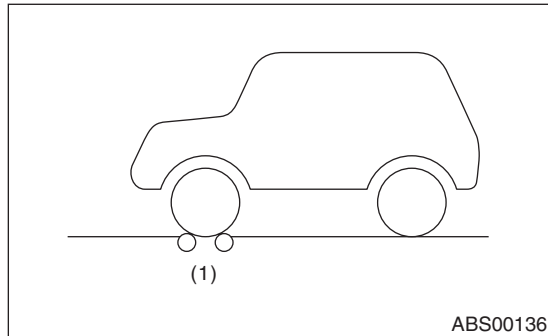
18) Bleed air from the brake line.

VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

VEHICLE DYNAMICS CONTROL (VDC)

4. CHECK HYDRAULIC UNIT VDC OPERATION WITH BRAKE TESTER

- 1) Set wheels other than the one to measure free rollers.
- 2) Prepare to operate the VDC sequence control.
<Ref. to VDC-16, 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.



(1) Brake tester

- 4) Operate the brake tester.
- 5) Perform VDC sequence control.
<Ref. to VDC-16, 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 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 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 procedures shown in 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 Subaru Select Monitor.

4) Set the Subaru Select Monitor to "Brake Control" mode.

5) When the "Function check sequence" is selected, the "ABS sequence control" will start.

6) Execute the following operations when the message "Press the brake pedal so that the brake pedal force is between 100 and 150 kgf" 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).

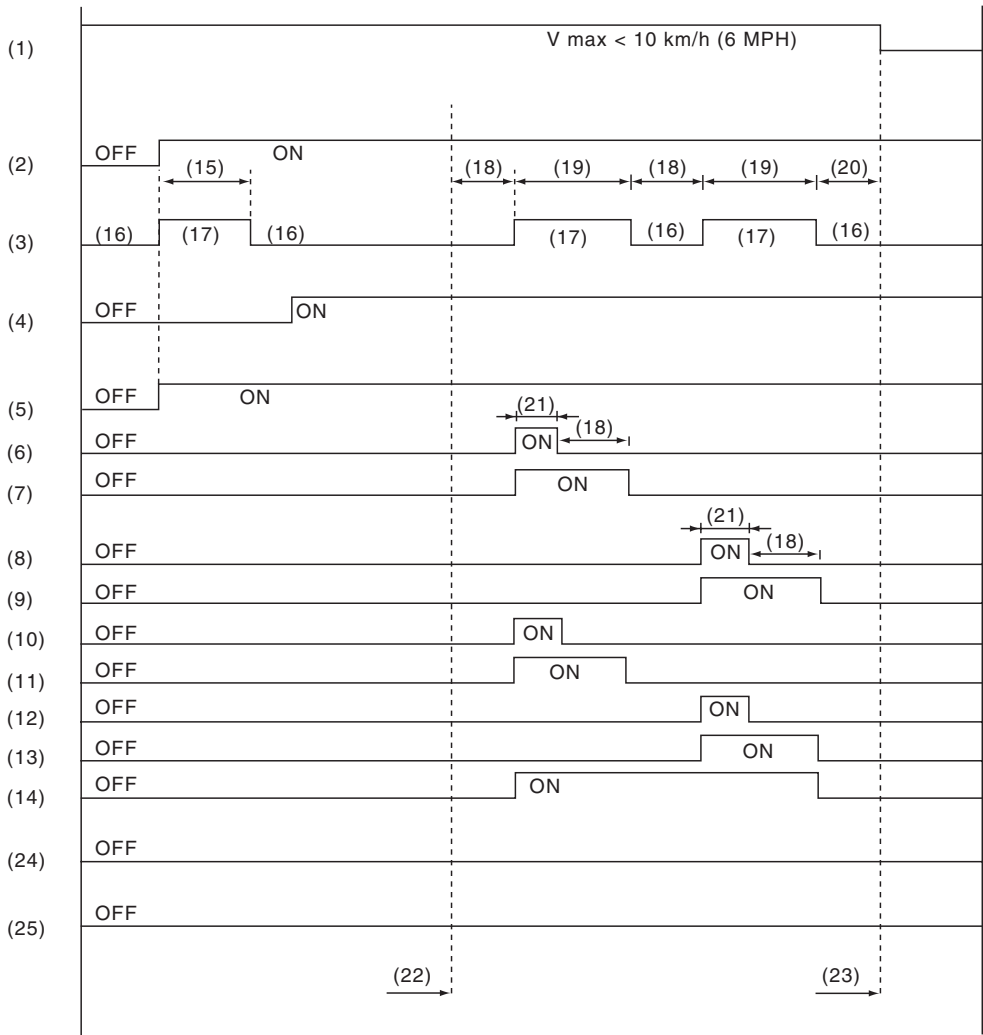
7) "OK" will be displayed. Select the [OK].

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.

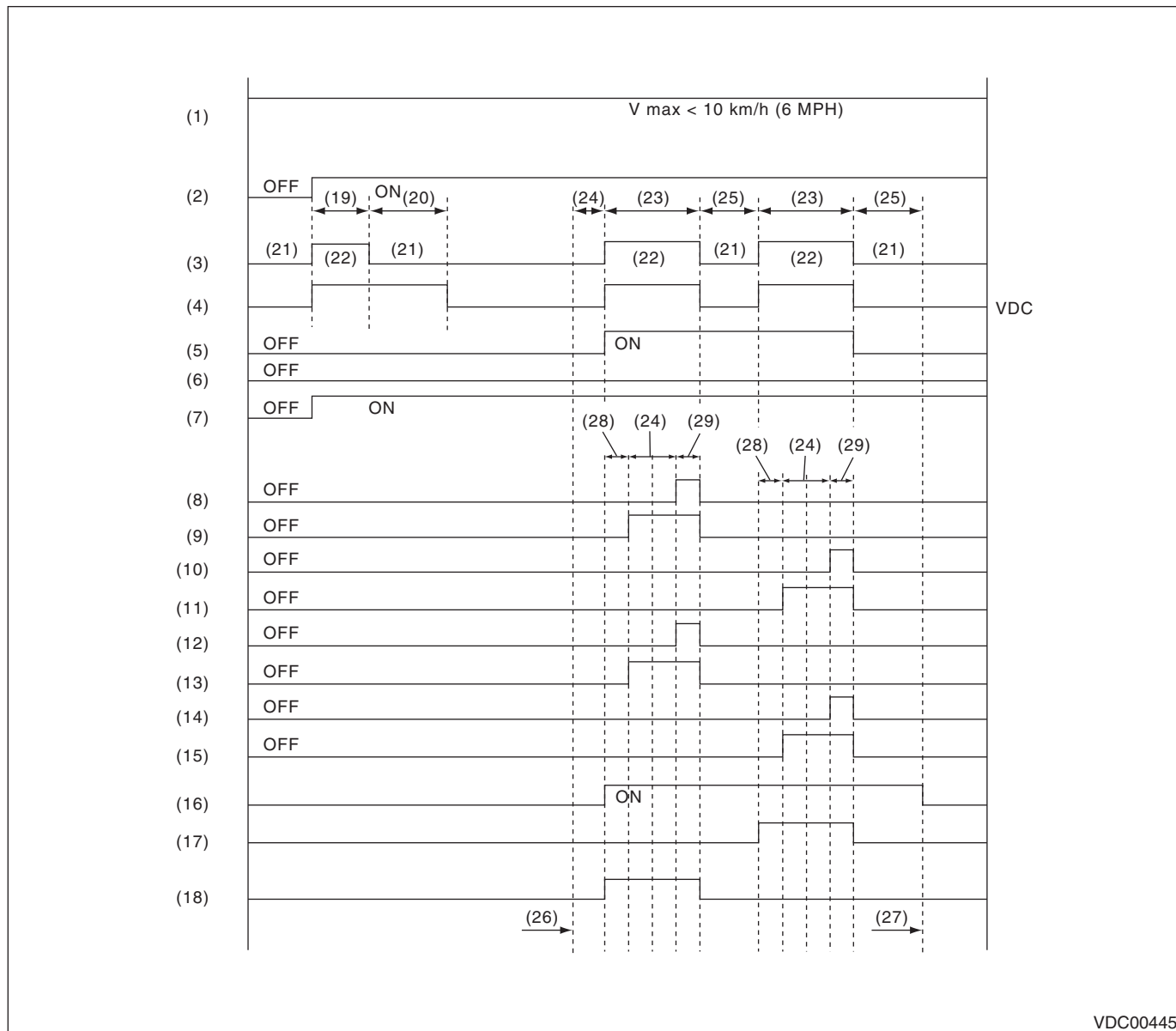
1. VDC SEQUENCE CONTROL WITH SUBARU SELECT MONITOR

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 Subaru Select Monitor.
- 4) Set the Subaru Select Monitor to "Brake Control" mode.
- 5) When the "VDC Inspection Mode" is selected from the "Function check sequence" menu, the "VDC sequence control" will start.
- 6) "OK" will be displayed. Select the [OK].
- 7) Operation points will be displayed on Subaru Select Monitor.

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 sec.	

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.

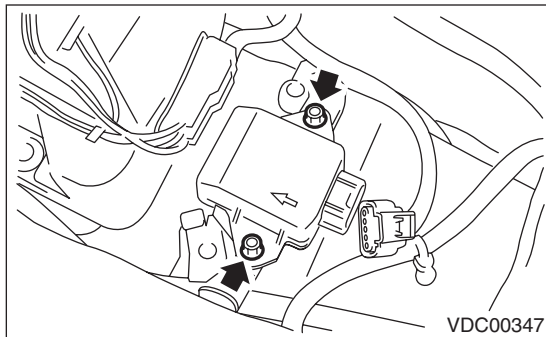
5. Yaw Rate and Lateral G Sensor

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box.
<Ref. to EI-38, 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.

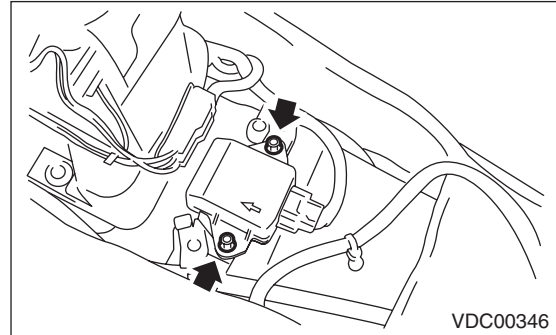


B: INSTALLATION

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, 5.5 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 & Hydraulic Control Unit (VDCCM&H/U)”. <Ref. to VDC-12, 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 more than three times, replace the combination switch as assembly to protect the threads.

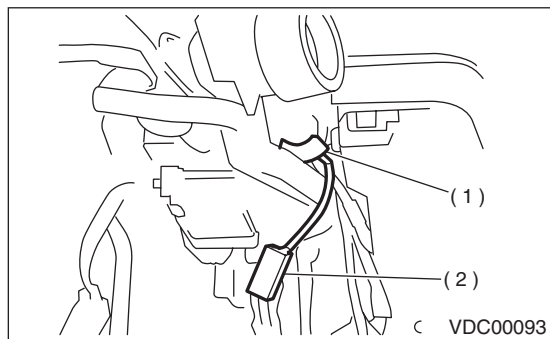
- 1) Set the steering wheel in a straight-ahead position.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the airbag module.
<Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

WARNING:

Always refer to "Airbag System" when performing the airbag module repair service.

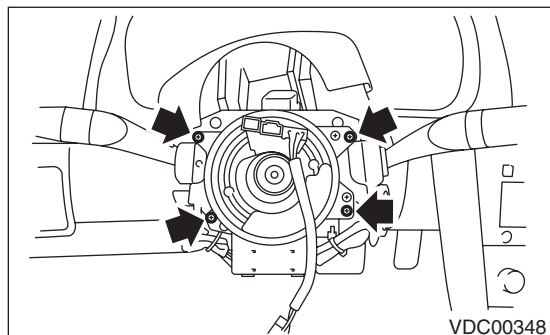
<Ref. to AB-4, CAUTION, General Description.>

- 4) Remove the steering wheel.
<Ref. to PS-14, 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.

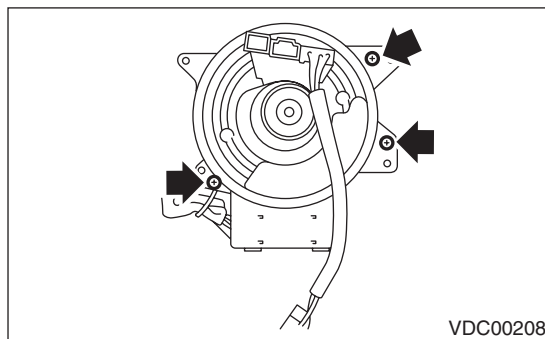


- (1) Harness band
- (2) Connector

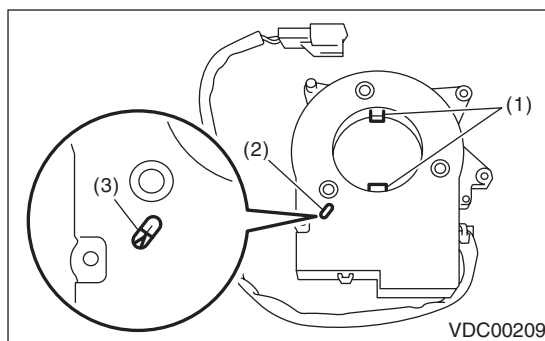
- 8) Remove the screws which secure the roll connector to steering column.



- 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.

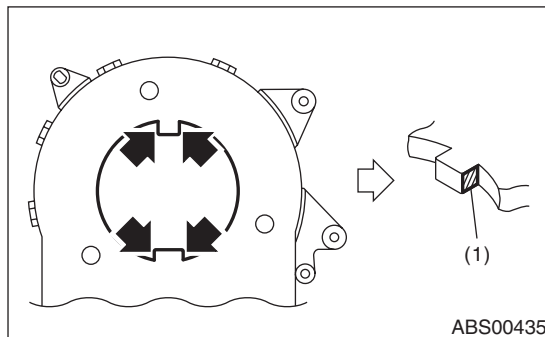


- (1) Protrusion portion
- (2) Inspection hole
- (3) Alignment mark

CAUTION:

Be careful not to allow foreign matter to enter into inspection hole.

- 11) Align the center of roll connector.
<Ref. to AB-22, 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.

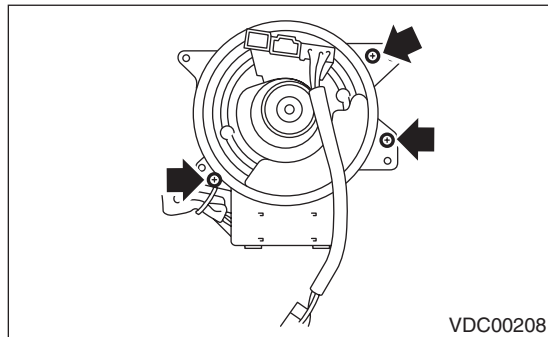


- (1) Apply grease.

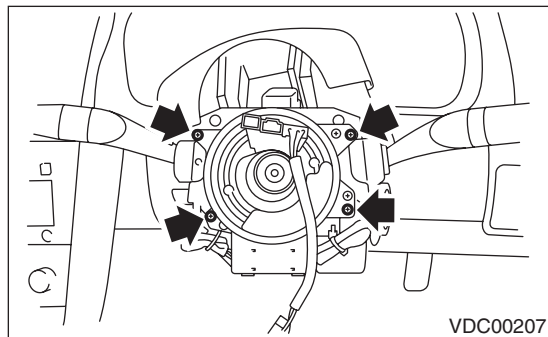
13) Align the position of the protrusion and install roll connector to steering angle sensor.

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-14, 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 the battery.

CAUTION:

After completion of installation, adjust 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 for the VDC-CM to identify vehicle position afterward. For the setting procedures of the 2 steps above, refer to "VDC Control Module & Hydraulic Control Unit (VDCCM&H/U)". <Ref. to VDC-12, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

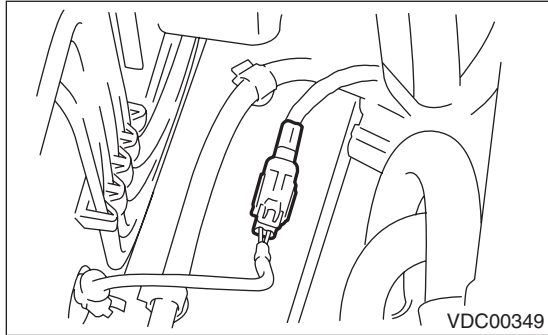
Front ABS Wheel Speed Sensor

VEHICLE DYNAMICS CONTROL (VDC)

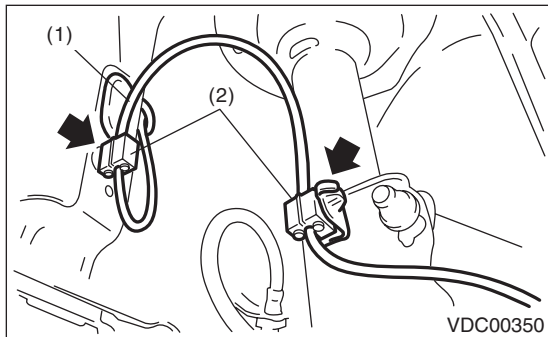
7. Front ABS Wheel Speed Sensor

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.

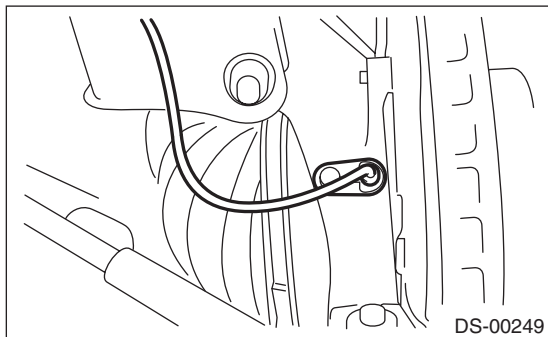


- (1) To the front ABS wheel speed sensor connector
- (2) Clip

- 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, 5.5 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

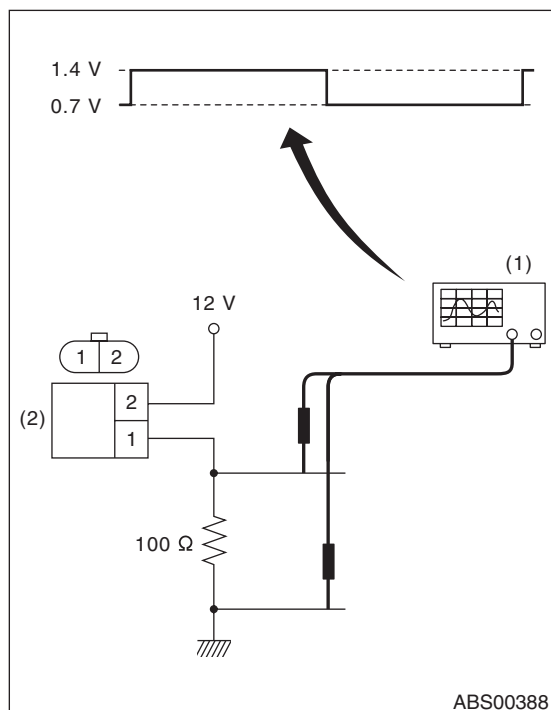
- 1) Connect the Subaru Select Monitor to the data link connector.
- 2) Select {Current Data Display & Save}. Check if the speed indicated on the display changes in the same manner as the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position.
- 3) If the speed indicated on the display does not change, check the ABS wheel speed sensor. <Ref. to VDC-23, 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

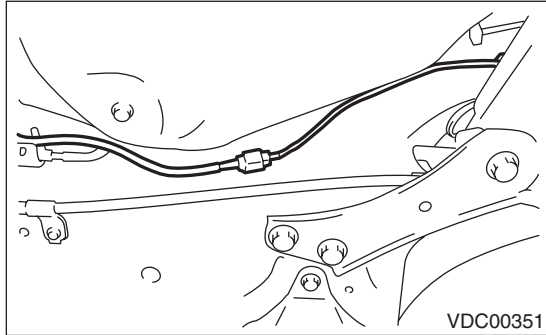
Rear ABS Wheel Speed Sensor

VEHICLE DYNAMICS CONTROL (VDC)

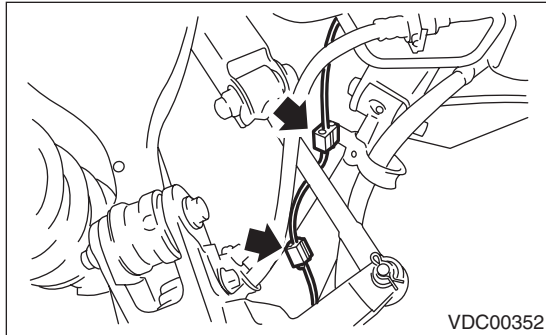
8. Rear ABS Wheel Speed Sensor

A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the connector from the rear ABS wheel speed sensor.



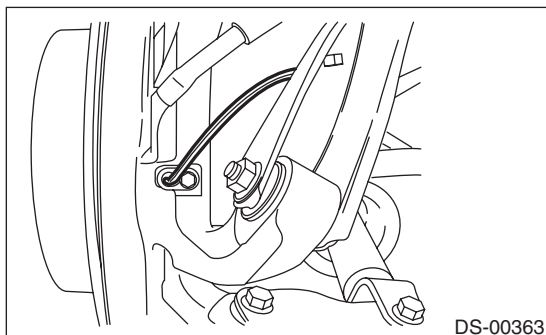
- 3) Remove the sensor harness from the rear arm clip.



- 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, 5.5 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-23, 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-19, 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-19, 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-21, 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-22, 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.

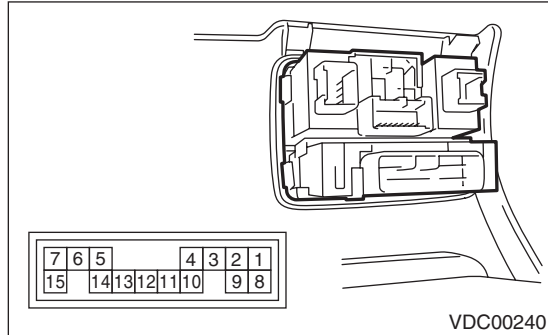
NOTE:

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
ON	2 — 15	Less than 1 Ω
OFF	2 — 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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6. Subaru Select Monitor	15
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8. Inspection Mode	22
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10. Warning Light Illumination Pattern	24
11. List of Diagnostic Trouble Code (DTC)	33
12. Diagnostic Procedure with Diagnostic Trouble Code (DTC)	36
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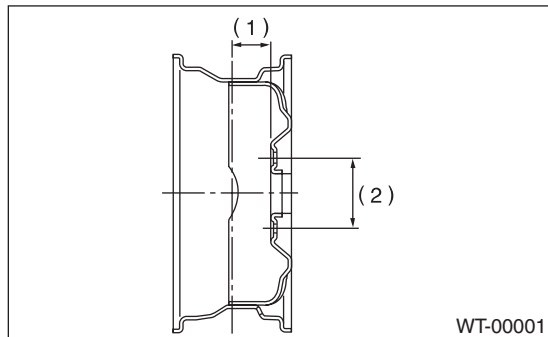
General Description

WHEEL AND TIRE SYSTEM

1. General Description

A: SPECIFICATION

1. WHEEL AND TIRE SIZE



(1) Offset

(2) P.C.D.

Specification	Tire size	Wheel size	Offset mm (in)	P.C.D. mm (in)	Tire inflation pressure kPa (kgf/cm ² , psi)	
					Front wheel	Rear wheel
Standard type	P255/55R18 104H	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)	

General Description

WHEEL AND TIRE SYSTEM

3. ADJUSTING PARTS

Wheel balancing	Standard:	Service limit
Dynamic unbalance	10 g (0.35 oz) or less	

Balance weight part number (Knock-on type weight for aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
23141GA562	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

Balance weight part number (Adhesive type weight for aluminum wheel)	Weight
28101AE00B	5 g (0.18 oz)
28101AE01B	7.5 g (0.26 oz)
28101AE02B	10 g (0.35 oz)
28101AE03B	12.5 g (0.44 oz)
28101AE04B	15 g (0.53 oz)
28101AE05B	17.5 g (0.62 oz)
28101AE06B	20 g (0.71 oz)
28101AE07B	22.5 g (0.79 oz)
28101AE08B	25 g (0.88 oz)
28101AE09B	27.5 g (0.97 oz)
28101AE10B	30 g (1.06 oz)
28101AE11B	32.5 g (1.15 oz)
28101AE12B	35 g (1.23 oz)
28101AE13B	37.5 g (1.32 oz)
28101AE14B	40 g (1.41 oz)
28101AE15B	42.5 g (1.50 oz)
28101AE16B	45 g (1.59 oz)
28101AE17B	47.5 g (1.68 oz)
28101AE18B	50 g (1.76 oz)
28101AE19B	52.5 g (1.85 oz)
28101AE20B	55 g (1.94 oz)
28101AE21B	57.5 g (2.03 oz)
28101AE22B	60 g (2.12 oz)
28101AE23B	62.5 g (2.20 oz)
28101AE24B	65 g (2.29 oz)
28101AE25B	67.5 g (2.38 oz)
28101AE26B	70 g (2.47 oz)
28101AE27B	72.5 g (2.56 oz)

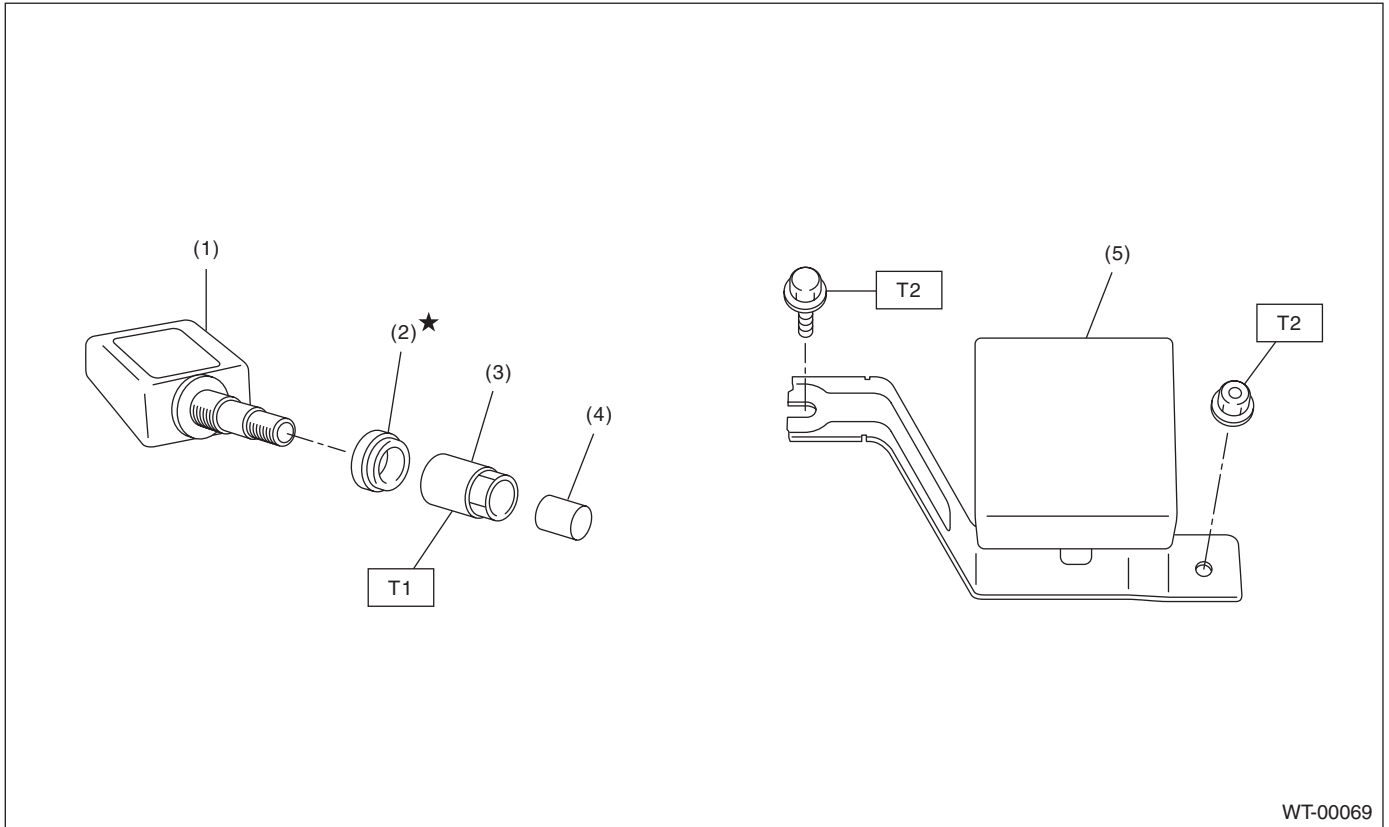
Balance weight part number (Adhesive type weight for aluminum wheel)	Weight
28101AE28B	75 g (2.65 oz)
28101AE29B	77.5 g (2.73 oz)
28101AE30B	80 g (2.82 oz)
28101AE31B	82.5 g (2.91 oz)
28101AE32B	85 g (3.00 oz)
28101AE33B	87.5 g (3.09 oz)
28101AE34B	90 g (3.17 oz)
28101AE35B	92.5 g (3.26 oz)
28101AE36B	95 g (3.35 oz)
28101AE37B	97.5 g (3.44 oz)
28101AE38B	100 g (3.53 oz)
28101AG50B	102.5 g (3.62 oz)
28101AG51B	105 g (3.70 oz)
28101AG52B	107.5 g (3.79 oz)
28101AG53B	110 g (3.88 oz)
28101AG54B	112.5 g (3.97 oz)
28101AG55B	115 g (4.06 oz)
28101AG56B	117.5 g (4.14 oz)
28101AG57B	120 g (4.23 oz)

General Description

WHEEL AND TIRE SYSTEM

B: COMPONENT

1. TIRE PRESSURE MONITORING SYSTEM



WT-00069

- (1) Transmitter
- (2) Grommet
- (3) Nut

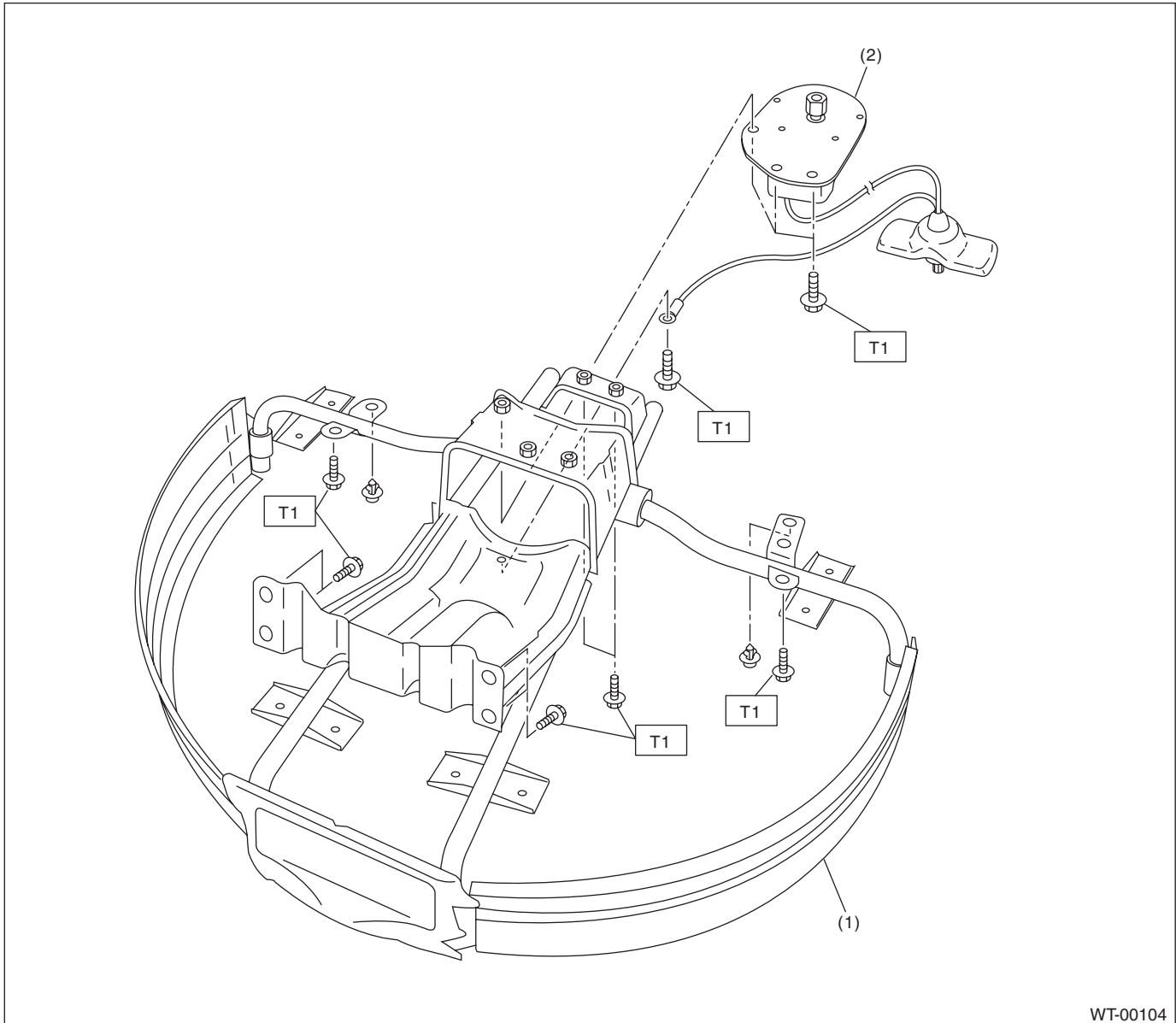
- (4) Cap
- (5) Tire pressure monitoring control module

Tightening torque: N·m (kgf-m, ft-lb)

T1: 7.5 (0.76, 5.53)

T2: 8 (0.8, 5.8)

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

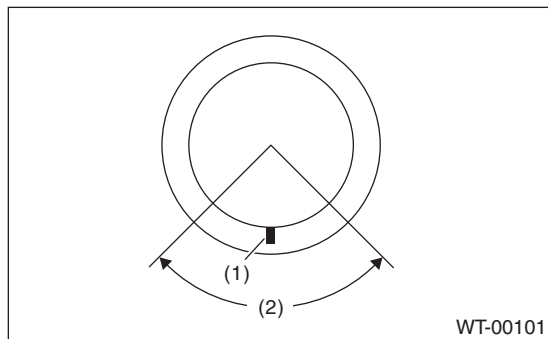
A: INSPECTION

1) Take stones, glass, nails etc. out of the tread groove.

2) Replace tires in the following cases.

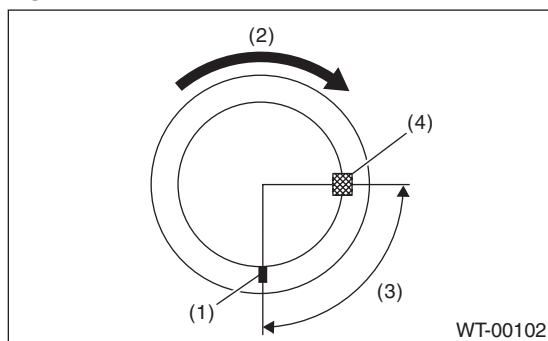
CAUTION:

- 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.)

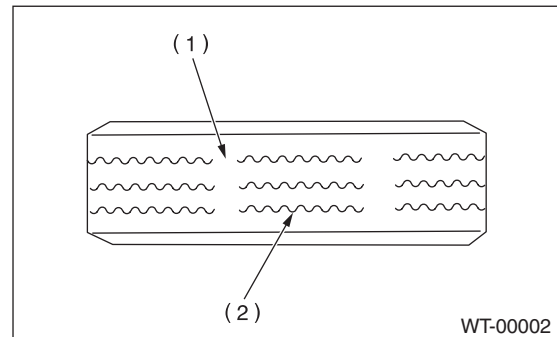
- To prevent damaging the transmitter, set the tire changer boom in the position as shown in the figure.



- (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.



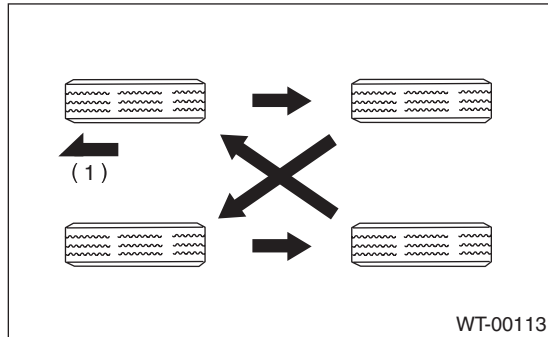
- (1) Tread wear indicator
(2) Tire tread

3) When a crack on tire valve is found, replace the tire valve.

1. TIRE ROTATION

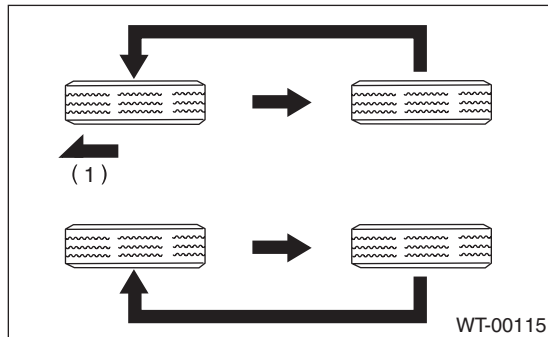
Rotate tires periodically (12,500 km/7,500 miles) as shown in the figure, in order to prevent them from uneven wear and to prolong their life.

- Without instruction for the direction of tire rotation



(1) Front

- With instruction for the direction of tire rotation



(1) Front

NOTE:

Vehicles equipped with tire pressure monitoring systems will require re-registration of transmitter ID. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

3. Aluminum Wheel

A: REMOVAL

- 1) Apply the parking brake, and position select lever to "P" or "LOW".
- 2) Set the shop jacks or a lift to the specified points, and support the vehicle with its wheels slightly contacting the floor.
- 3) Loosen the wheel nuts.
- 4) Raise the vehicle until its wheels are off the ground using the jack or a lift.
- 5) Remove the wheel nuts and wheels.

NOTE:

- When removing the wheels, be careful not to damage the hub bolts.
- Place the wheels with their outer sides facing upward to prevent wheels from being damaged.

B: INSTALLATION

- 1) Remove dirt from the mating surface of the wheel and brake rotor.
- 2) Attach the wheel to the hub by aligning the wheel bolt holes with the hub bolts.
- 3) Temporarily attach the wheel nuts to the hub bolts. (In the case of aluminum wheels, use SUBARU genuine wheel nuts for aluminum wheels.)
- 4) Tighten the nuts by hand, making sure the wheel hub hole is aligned correctly to the guide portion of hub.
- 5) Tighten the wheel nuts in a diagonal selection to the specified torque. Use a wheel nut wrench.

Tightening torque:

Chromed wheel

150 N·m (15.3 kgf-m, 110.6 ft-lb)

Other than above

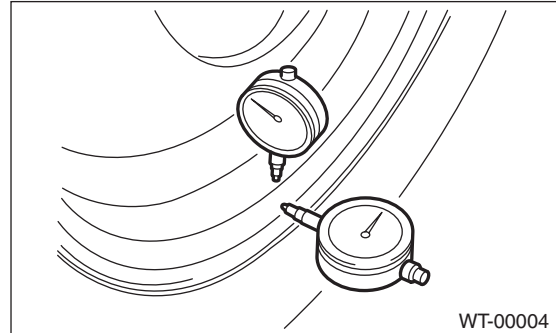
120 N·m (12.2 kgf-m, 88.5 ft-lb)

CAUTION:

- Tighten the wheel nuts in two or three steps by gradually increasing the torque on opposing nuts, until they reach the specified torque.
 - Do not push the wrench by foot. Always use both hands when tightening the nuts.
 - Make sure the bolt, nut and the nut seating surface of the wheel are free from oil.
- 6) If a wheel is removed for replacement or for repair of a puncture, retighten the wheel nuts to the specified torque after driving 1,000 km (600 miles).

C: INSPECTION

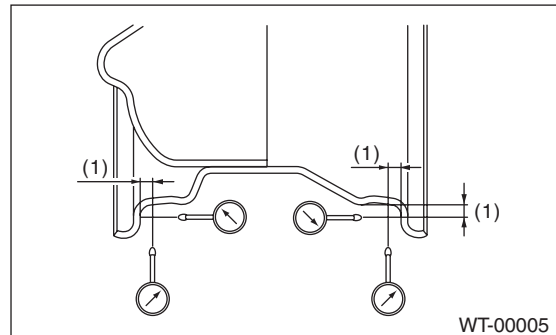
- 1) Deformation or damage to the rim may cause air leakage. Check the rim flange for deformation, cracks or damage, and repair or replace as necessary.
- 2) Jack-up the vehicle until wheels clear the floor.
- 3) Slowly rotate the wheel to check rim "runout" using a dial gauge.



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.

D: CAUTION

Aluminum wheels are easily scratched. To maintain their appearance and safety, be careful of the following:

- 1) Do not damage the aluminum wheels during removal, installation, wheel balancing, etc. After removing aluminum wheels, place them on a rubber mat etc.
- 2) When washing the aluminum wheel, use neutral synthetic detergent and water. Avoid using the cleanser including abrasive, hard brushes or an automatic car washer.

4. Wheel Balancing

A: ADJUSTMENT

NOTE:

The balance weight for the outside of the wheel uses an adhesive type weight. Change the setting of the wheel balancer to an adhesive type weight.

1) Remove the balance weights.

CAUTION:

- Be careful not to damage the wheel.
- Completely remove the double-sided tape of the adhesive type weight from the wheel.

2) Using the wheel balancer, measure wheel balance.

3) Select a weight close to the value measured by wheel balancer.

CAUTION:

Use SUBARU genuine balance weights.

Balance weight part number (Knock-on type weight for aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
23141GA562	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

Balance weight part number (Adhesive type weight for aluminum wheel)	Weight
28101AE00B	5 g (0.18 oz)
28101AE01B	7.5 g (0.26 oz)
28101AE02B	10 g (0.35 oz)
28101AE03B	12.5 g (0.44 oz)
28101AE04B	15 g (0.53 oz)
28101AE05B	17.5 g (0.62 oz)
28101AE06B	20 g (0.71 oz)
28101AE07B	22.5 g (0.79 oz)
28101AE08B	25 g (0.88 oz)
28101AE09B	27.5 g (0.97 oz)
28101AE10B	30 g (1.06 oz)
28101AE11B	32.5 g (1.15 oz)
28101AE12B	35 g (1.23 oz)
28101AE13B	37.5 g (1.32 oz)
28101AE14B	40 g (1.41 oz)
28101AE15B	42.5 g (1.50 oz)
28101AE16B	45 g (1.59 oz)
28101AE17B	47.5 g (1.68 oz)
28101AE18B	50 g (1.76 oz)
28101AE19B	52.5 g (1.85 oz)
28101AE20B	55 g (1.94 oz)
28101AE21B	57.5 g (2.03 oz)
28101AE22B	60 g (2.12 oz)
28101AE23B	62.5 g (2.20 oz)
28101AE24B	65 g (2.29 oz)
28101AE25B	67.5 g (2.38 oz)
28101AE26B	70 g (2.47 oz)
28101AE27B	72.5 g (2.56 oz)
28101AE28B	75 g (2.65 oz)
28101AE29B	77.5 g (2.73 oz)
28101AE30B	80 g (2.82 oz)
28101AE31B	82.5 g (2.91 oz)
28101AE32B	85 g (3.00 oz)
28101AE33B	87.5 g (3.09 oz)
28101AE34B	90 g (3.17 oz)
28101AE35B	92.5 g (3.26 oz)
28101AE36B	95 g (3.35 oz)
28101AE37B	97.5 g (3.44 oz)
28101AE38B	100 g (3.53 oz)
28101AG50B	102.5 g (3.62 oz)
28101AG51B	105 g (3.70 oz)
28101AG52B	107.5 g (3.79 oz)
28101AG53B	110 g (3.88 oz)
28101AG54B	112.5 g (3.97 oz)
28101AG55B	115 g (4.06 oz)
28101AG56B	117.5 g (4.14 oz)
28101AG57B	120 g (4.23 oz)

Wheel Balancing

WHEEL AND TIRE SYSTEM

4) Install the selected weight to the point designated by the wheel balancer.

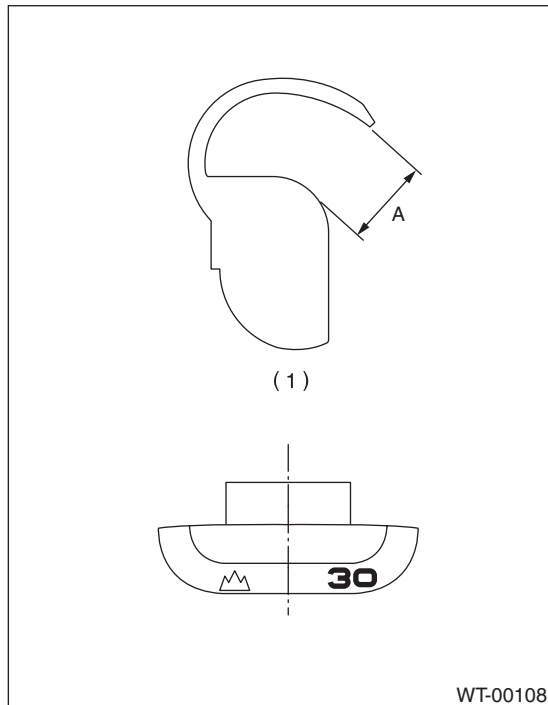
CAUTION:

- Remove grease from adhesive type weight applying surface of wheel.
- Press the adhesive type weight by 25 N (2.5 kgf, 5.6 lb) or more per 5 g (0.18 oz) for more than 2 seconds and attain full adhesion.
- The total weight of all adhesive weight on models with transmitters (tire pressure sensor) is to be 120 g (4.23 oz) or less.

5) Using the wheel balancer, measure the wheel balance again. Check that wheel balance is correctly adjusted.

NOTE:

Knock-on type balance weights for aluminum wheels are available for use with any 15 to 18 inch wheels.



(1) Knock-on type weight for aluminum wheels

Service limit:

Knock-on type weight for aluminum wheels:

5 — 25 g (0.18 — 0.88 oz) 5.0 mm (0.20 in)

30 g (1.06 oz) or more 4.5 mm (0.177 in)

5. “T-type” Tire

A: NOTE

“T-type” tire for temporary use is equipped as a spare tire.

CAUTION:

- 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 blink when running with the “T-type” tire.

B: REPLACEMENT

Refer to “Aluminum Wheels” for removal and installation procedures of the “T-type”. <Ref. to WT-8, REMOVAL, Aluminum Wheel.>

CAUTION:

The “T-type” tire is only for temporary use. Replace with a conventional tire as soon as possible.

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.

Tire Pressure Monitoring System

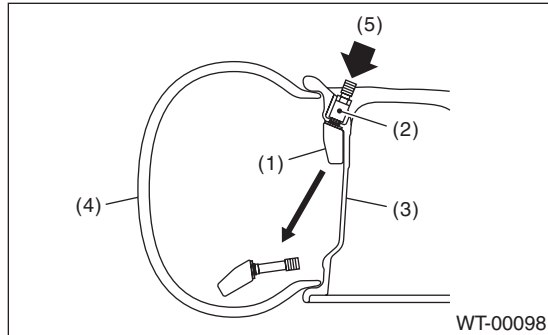
WHEEL AND TIRE SYSTEM

6. Tire Pressure Monitoring System

A: REMOVAL

1. TRANSMITTER (TIRE PRESSURE SENSOR)

- 1) Remove the wheels from the vehicle. <Ref. to WT-8, REMOVAL, Aluminum Wheel.>
- 2) Bleed air from tire valve.
- 3) Remove the nut, and drop the transmitter in the tire.



- (1) Transmitter
- (2) Nut
- (3) Wheel
- (4) Tire
- (5) Push

- 4) Remove the tires from wheels.

CAUTION:

Use a tire changer when removing the tire from the wheel.

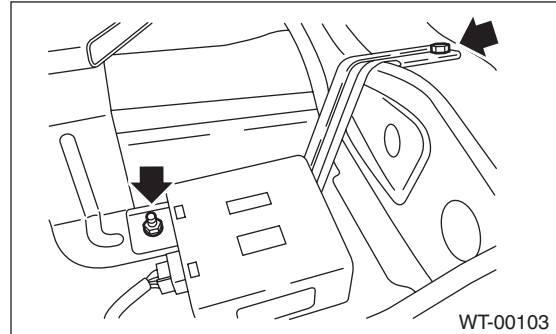
- 5) Remove the nut to take out transmitter.

NOTE:

Replace the grommet with a new part when reusing transmitter.

2. TIRE PRESSURE MONITORING CONTROL MODULE

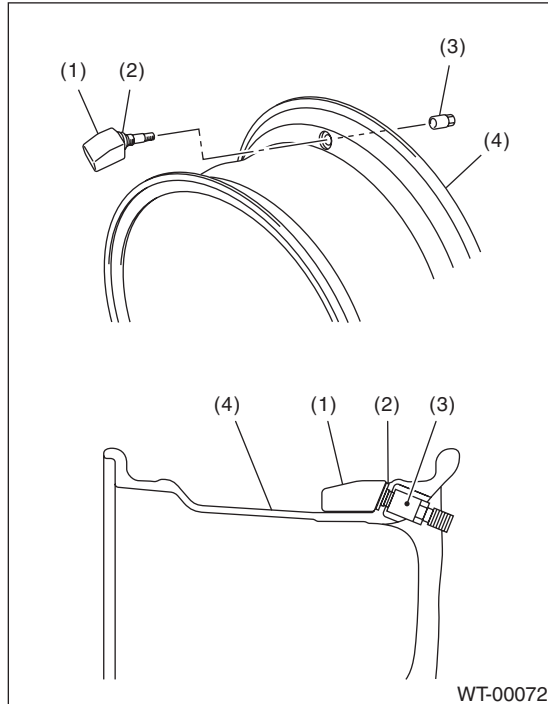
- 1) Remove the driver's seat. <Ref. to SE-7, REMOVAL, Front Seat.>
- 2) Turn up the floor mat in the driver's seat area.
- 3) Remove the connector to remove tire pressure monitoring control module.



B: INSTALLATION

1. TRANSMITTER (TIRE PRESSURE SENSOR)

1) Install the transmitter to the wheel by aligning it with valve hole, and then tighten with nuts.



- (1) Transmitter
- (2) Grommet
- (3) Nut
- (4) Wheel

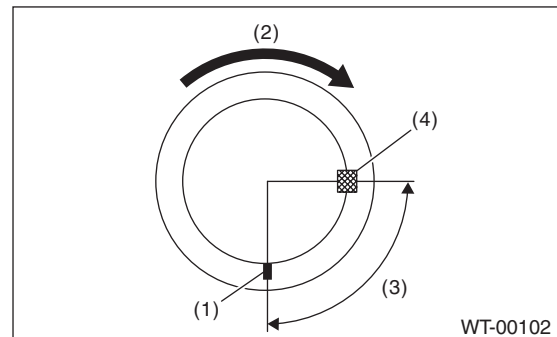
Tightening torque:

7.5 N·m (0.76 kgf-m, 5.53 ft-lb)

2) 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

3) Install the wheels to vehicle. <Ref. to WT-8, INSTALLATION, Aluminum Wheel.>

4) Register the transmitter ID to the tire pressure monitoring control module. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

2. TIRE PRESSURE MONITORING CONTROL MODULE

Install in the reverse order of removal.

Tightening torque:

8 N·m (0.8 kgf-m, 5.8 ft-lb)

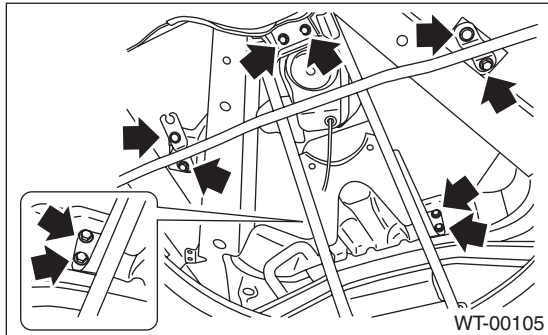
C: ADJUSTMENT

Re-register the transmitter ID when transmitter has been replaced or tires have been rotated. <Ref. to TPM(diag)-9, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

7. 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

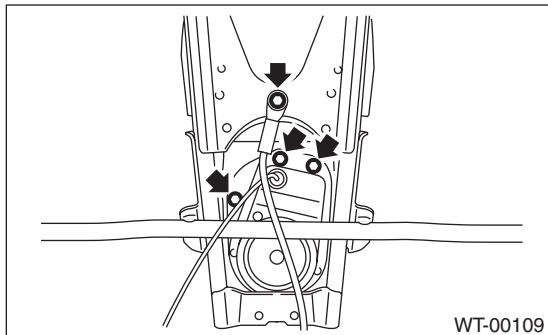
Install in the reverse order of removal.

Tightening torque:

33 N·m (3.7 kgf-m, 24.3 ft-lb)

C: DISASSEMBLY

Remove the spare tire hoist.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:

33 N·m (3.7 kgf-m, 24.3 ft-lb)

8. General Diagnostic Table

A: INSPECTION

Symptom	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-7, 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-24, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-14, 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-20, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-23, 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-16, INSPECTION, Front Stabilizer.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-7, 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-9, ADJUSTMENT, Wheel Balancing.>
	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-20, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-23, INSPECTION, Rear Hub Unit Bearing.>

General Diagnostic Table

WHEEL AND TIRE SYSTEM

Symptom	Possible cause	Corrective action
Abnormal tire wear	Improperly inflated tire.	Adjust the tire pressure.
	Improper wheel balancing	Check the wheel balance. <Ref. to WT-9, ADJUSTMENT, Wheel Balancing.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-7, 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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