GENERAL INFORMATION SECTION

FOREWORD

This portion of the 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 troubleshooting for guidance of both the fully qualified and the less-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.

FUJI HEAVY INDUSTRIES LTD.

1. Important Safety Notice

- Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.
- In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.
- It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if the used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use This Manual

- This Service Manual is divided into four volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

  - GENERAL INFORMATION SECTION
  - REPAIR SECTION
  - TROUBLESHOOTING SECTION
  - WIRING DIAGRAM SECTION

- Each chapter in the manual is basically made of the following four types of areas.

  - S: Specifications and service data
  - C: Component parts
  - W: Service procedure
  - (X: Service procedure)
  - (Y: Service procedure)
  - K: Diagnostics (Mechanical)
  - T: Diagnostics (Electrical)

- The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

• Area title:	W. Service procedure (one of the four types of areas)
• Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
• Medium title (Section):	A. REMOVAL (to denote the type of work in principle)
• Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

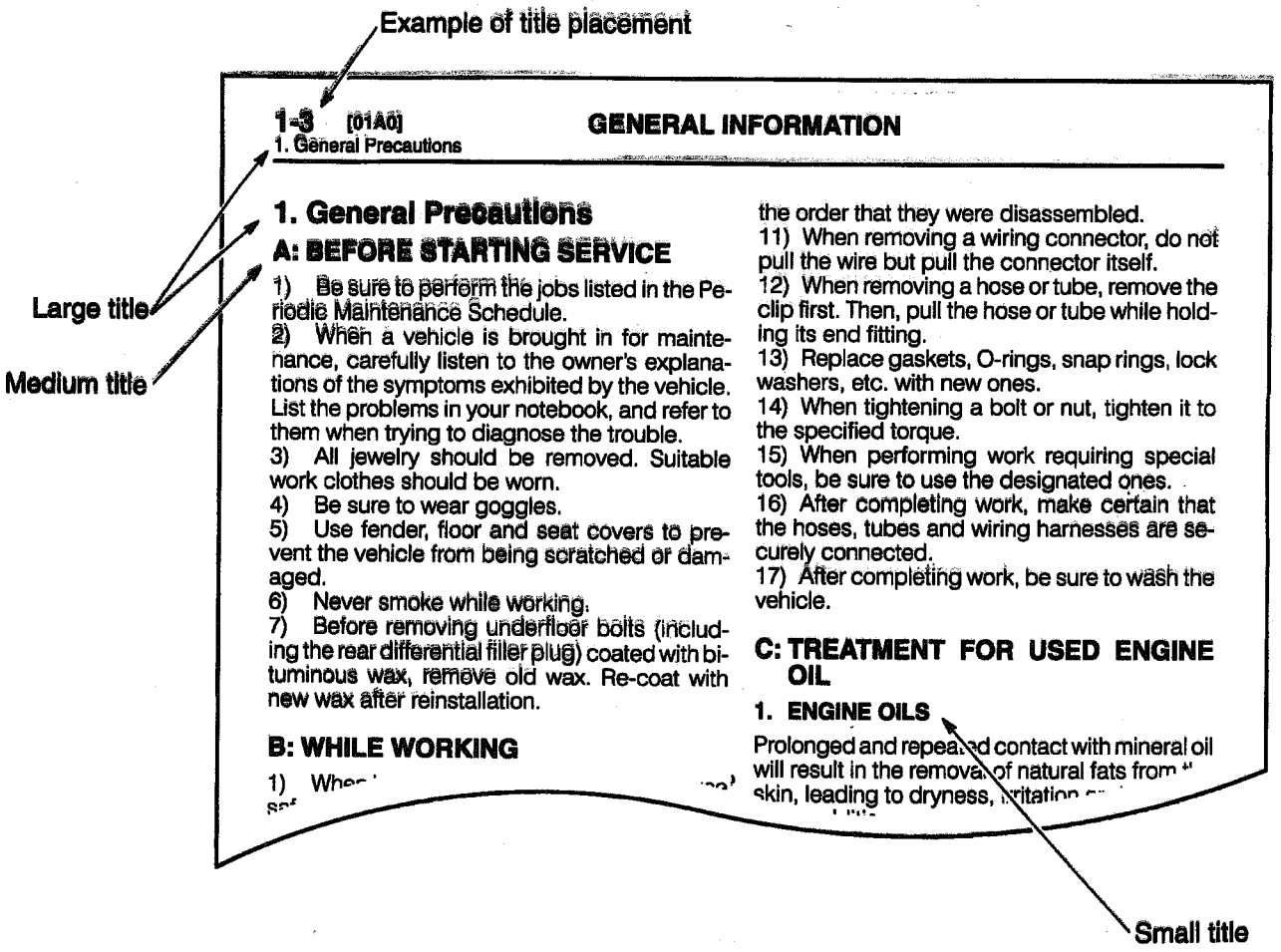
FOREWORD

• The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.

(Example of usage)

Refer to 1 - 3 [0 1 A 0]

- Small title (Sub-section)
- Medium title (Section)
- Large title (Heading)
- Area title
- Chapter No.



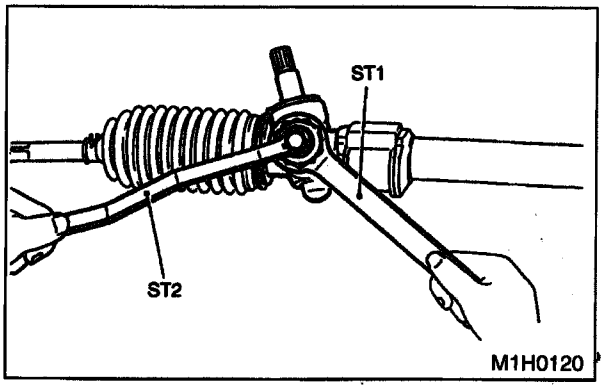
H0H0001

- In this manual, the following symbols are used.

Symbol	Description
* H1H0002	Selective part
★ H0H0003	Replacement part
H0H0004	Should be lubricated with oil.
H0H0005	Should be lubricated with grease.
H0H0006	Sealing point
T H0H0007	Tightening torque

- **WARNING, CAUTION,** NOTE
  - **WARNING:** Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
  - **CAUTION:** Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
  - NOTE: Indicates the hints, knacks, etc. which make the maintenance job easier.

- SPECIAL TOOLS
  When any special tool is required to perform the job, it is identified by "ST" in the applicable illustration and its part number is shown in the manual.



1. Procedures for adjusting backlash

1) Set steering wheel to the straight-ahead position.
2) Remove the exhaust pipe.
3) Loosen the lock nut with ST.

{ ST1 921650000 STEERING GEARBOX WRENCH
{ ST2 921550000 STEERING GEARBOX WRENCH

Description (of job method)

Shows the part name

Shows the part number

Tells that two kinds of special tools are required. When two or more kinds of special tools are required to do a job, they are identified by ST1, ST2, ... respectively.

H0H0008

3. Table of Contents

SPECIFICATIONS 1-1

1. 2-door Coupe

A: DIMENSIONS

Model			1800	2200	
			AWD	AWD	
			Brighton	Brighton	L
Overall length		mm (in)	4,375 (172.2)		
Overall width		mm (in)	1,705 (67.1)		
Overall height		mm (in)	1,410 (55.5)		
Compartment	Leg room	Front Max. mm (in)	1,094 (43.1)		
		Rear Min. mm (in)	825 (32.5)		
	Head room	Front mm (in)	995 (39.2)		
		Rear mm (in)	933 (36.7)		
	Shoulder room	Front mm (in)	1,345(53.1)		
		Rear mm (in)	1,333 (52.5)		
Wheelbase		mm (in)	2,520 (99.2)		
Tread		Front mm (in)	1,470 (57.9)	1,460 (57.5)	
		Rear mm (in)	1,460 (57.5)	1,450 (57.1)	
Minimum road clearance		mm (in)	145 (5.7)		

B: ENGINE

Model	1800	2200
Engine type	Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
Valve arrangement	Overhead camshaft type	
Bore x Stroke mm (in)	87.9 x 75.0 (3.461 x 2.953)	96.9 x 75.0 (3.815 x 2.953)
Displacement cm^3 (cu in)	1,820 (111.06)	2,212 (135.0)
Compression ratio	9.7	
Firing order	1 — 3 — 2 — 4	
Idle speed at Park/Neutral position rpm	700 ± 100	
Maximum output kW (HP)/rpm	86 (115)/5,600	102 (137)/5,400
Maximum torque N.m (kg-m, ft-lb)/rpm	163 (16.6, 120)/4,000	196 (20.0, 145)/4,000

C: ELECTRICAL

Model		1800	2200
Ignition timing at idling speed BTDC/rpm		20°/700	14°/700 (MT), 20°/700 (AT)
Spark plug	Type and manufacturer	NGK: BKR6E-11 Alternate CHAMPION: RC8YC4	CHAMPION: RC10YC4, RC8YC4 Alternate NGK: BKR6E-11 Alternate NIPPONDENSO: K20PR-U11
Generator		12V — 75A	
Battery	Type	MT model: 55D23L, AT model: 75D23L	
	Reserve capacity min.	MT model: 99, AT model: 118	
	Cold cranking amperes amp.	MT model: 356, AT model: 520	

D: TRANSMISSION

Model			AWD	
Transmission type			5MT*	4AT*
Clutch type			DSPD	TCC
Gear ratio		1st	3.545	2.785
		2nd	2.111	1.545
		3rd	1.448	1.000
		4th	1.088	0.694
		5th	0.825 (1800 cc model) 0.780 (2200 cc model)	—
		Reverse	3.416	2.272
Reduction gear (Front drive)	1st reduction	Type of gear	—	Helical
		Gear ratio	—	1.000
	Final reduction	Type of gear	Hypoid	Hypoid
		Gear ratio	3.900	4.111
Reduction gear (Rear drive)	Transfer reduction	Type of gear	Helical	—
		Gear ratio	1.000	—
	Final reduction	Type of gear	Hypoid	Hypoid
		Gear ratio	3.900	4.111

5MT*: 5-forward speeds with synchromesh and 1-reverse – with center differential and viscous coupling
4AT*: Electronically controlled fully-automatic, 4-forward speeds and 1-reverse – with hydraulically controlled transfer clutch
DSPD: Dry Single Plate Diaphragm
TCC: Torque Converter Clutch

E: STEERING

Type	Rack and Pinion
Turns, lock to lock	3.2
Minimum turning circle m (ft)	Curb to curb: 10.2 (33.5), Wall to wall: 11.0 (36.1)

F: SUSPENSION

Front	Macpherson strut type, Independent, Coil spring
Rear	Dual link strut type, Independent, Coil spring

G: BRAKE

Service brake system	Dual circuit hydraulic with vacuum suspended power unit
Front	Ventilated disc brake
Rear	Drum brake
Parking brake	Mechanical on rear brakes

H: TIRE

Model	1800	2200	
	AWD	AWD	
	Brighton	Brighton	L
Size	P175/70R14 84S	P195/60R15 87H	
Type	Steel belted radial, Tubeless		

I: CAPACITY

Model			AWD	
			5MT	4AT
Fuel tank		ℓ (US gal, Imp gal)	1800 cc model: 50 (13.2, 11.0) 2200 cc model: 60 (15.9, 13.2)	
Engine oil	Upper level	ℓ (US qt, Imp qt)	4.0 (4.2, 3.5)	
	Lower level	ℓ (US qt, Imp qt)	3.0 (3.2, 2.6)	
Transmission gear oil		ℓ (US qt, Imp qt)	3.5 (3.7, 3.1)	—
Automatic transmission fluid		ℓ (US qt, Imp qt)	—	7.9 (8.4, 7.0)
AT differential gear oil		ℓ (US qt, Imp qt)	—	1.2 (1.3, 1.1)
AWD rear differential gear oil		ℓ (US qt, Imp qt)	0.8 (0.8, 0.6)	
Power steering fluid .		ℓ (US qt, Imp qt)	0.7 (0.7, 0.6)	
Engine coolant		ℓ (US qt, Imp qt)	1800 cc model: 6.2 (6.6, 5.5) 2200 cc model: 5.8 (6.1, 5.1)	

J: WEIGHT

1. AMERICA SPEC. VEHICLES

Model			1800
			AWD
			Brighton
			5MT
Curb weight (C.W.)	Front	kg (lb)	699 (1,540)
	Rear	kg (lb)	481 (1,060)
	Total	kg (lb)	1,180 (2,600)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	862 (1,900)
	Rear	kg (lb)	816 (1,800)
	Total	kg (lb)	1,678 (3,700)

Model			2200		
			AWD		
			Brighton	L	
			4AT	5MT	4AT
Curb weight (C.W.)	Front	kg (lb)	755 (1,665)	728 (1,605)	760 (1,675)
	Rear	kg (lb)	501 (1,105)	506 (1,115)	508 (1,120)
	Total	kg (lb)	1,256 (2,770)	1,234 (2,720)	1,268 (2,795)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	885 (1,950)		
	Rear	kg (lb)	816 (1,800)		
	Total	kg (lb)	1,701 (3,750)		

2. CANADA SPEC. VEHICLES

Model			1800	2200	
			AWD	AWD	
			Brighton	L	
			5MT	5MT	4AT
Curb weight (C.W.)	Front	kg (lb)	692 (1,525)	728 (1,605)	760 (1,675)
	Rear	kg (lb)	481 (1,060)	506 (1,115)	508 (1,120)
	Total	kg (lb)	1,173 (2,585)	1,234 (2,720)	1,268 (2,795)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	862 (1,900)	885 (1.950)	
	Rear	kg (lb)	816 (1,800)	816 (1,800)	
	Total	kg (lb)	1,678 (3,700)	1,701 (3,750)	

2. 4-door Sedan

A: DIMENSIONS

Model			2200
			AWD
			L
Overall length		mm (in)	4,375 (172.2)
Overall width		mm (in)	1,705 (67.1)
Overall height		mm (in)	1,410 (55.5)
Compartment	Leg room	Front Max. mm (in)	1,094 (43.1)
		Rear Min. mm (in)	825 (32.5)
	Head room	Front mm (in)	995 (39.2)
		Rear mm (in)	933 (36.7)
	Shoulder room	Front mm (in)	1,360 (53.5)
		Rear mm (in)	1,355 (53.3)
Wheelbase		mm (in)	2,520 (99.2)
Tread		Front mm (in)	1,460 (57.5)
		Rear mm (in)	1,450 (57.1)
Minimum road clearance		mm (in)	145 (5.7)

B: ENGINE

Model	2200
Engine type	Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
Valve arrangement	Overhead camshaft type
Bore x Stroke mm (in)	96.9 x 75.0 (3.815 x 2.953)
Displacement cm^3 (cu in)	2,212 (135.0)
Compression ratio	9.7
Firing order	1 — 3 — 2 — 4
Idle speed at Park/Neutral position rpm	700 ± 100
Maximum output kW (HP)/rpm	102 (137)/5,400
Maximum torque N.m (kg-m, ft-lb)/rpm	196 (20.0, 145)/4,000

C: ELECTRICAL

Model		2200
Ignition timing at idling speed BTDC/rpm		14°/700 (MT), 20°/700 (AT)
Spark plug	Type and manufacturer	CHAMPION: RC10YC4, RC8YC4 Alternate NGK: BKR6E-11 Alternate NIPPONDENSO: K20PR-U11
Generator		12V — 75A
Battery	Type	MT model: 55D23L, AT model: 75D23L
	Reserve capacity min.	MT model: 99, AT model: 118
	Cold cranking amperes amp.	MT model: 356, AT model: 520

D: TRANSMISSION

Model			AWD	
Transmission type			5MT*	4AT*
Clutch type			DSPD	TCC
Gear ratio		1st	3.545	2.785
		2nd	2.111	1.545
		3rd	1.448	1.000
		4th	1.088	0.694
		5th	0.780	—
		Reverse	3.416	2.272
Reduction gear (Front drive)	1st reduction	Type of gear	—	Helical
		Gear ratio	—	1.000
	Final reduction	Type of gear	Hypoid	Hypoid
		Gear ratio	3.900	4.111
Reduction gear (Rear drive)	Transfer reduction	Type of gear	Helical	—
		Gear ratio	1.000	—
	Final reduction	Type of gear	Hypoid	Hypoid
		Gear ratio	3.900	4.111

5MT*: 5-forward speeds with synchromesh and 1-reverse – with center differential and viscous coupling
4AT*: Electronically controlled fully-automatic, 4-forward speeds and 1-reverse – with hydraulically controlled transfer clutch
DSPD: Dry Single Plate Diaphragm
TCC: Torque Converter Clutch

E: STEERING

Type	Rack and Pinion
Turns, lock to lock	3.2
Minimum turning circle m (ft)	Curb to curb: 10.2 (33.5), Wall to wall: 11.0 (36.1)

F: SUSPENSION

Front	Macpherson strut type, Independent, Coil spring
Rear	Dual link strut type, Independent, Coil spring

G: BRAKE

Model	L
Service brake system	Dual circuit hydraulic with vacuum suspended power unit
Front	Ventilated disc brake
Rear	Drum brake
Parking brake	Mechanical on rear brakes

H: TIRE

Model	2200
	AWD
	L
Size	P195/60R15 87H
Type	Steel belted radial, Tubeless

SPECIFICATIONS

I: CAPACITY

Model			AWD	
			5MT	4AT
Fuel tank		ℓ (US gal, Imp gal)	60 (15.9, 13.2)	
Engine oil	Upper level	ℓ (US qt, Imp qt)	4.0 (4.2, 3.5)	
	Lower level	ℓ (US qt, Imp qt)	3.0 (3.2, 2.6)	
Transmission gear oil		ℓ (US qt, Imp qt)	3.5 (3.7, 3.1)	—
Automatic transmission fluid		ℓ (US qt, Imp qt)	—	7.9 (8.4, 7.0)
AT differential gear oil		ℓ (US qt, Imp qt)	—	1.2 (1.3, 1.1)
AWD rear differential gear oil		ℓ (US qt, Imp qt)	0.8 (0.8, 0.6)	
Power steering fluid		ℓ (US qt, Imp qt)	0.7 (0.7, 0.6)	
Engine coolant		ℓ (US qt, Imp qt)	5.8 (6.1, 5.1)	

J: WEIGHT

1. AMERICA SPEC. VEHICLES

Model			2200	
			AWD	
			L	
			5MT	4AT
Curb weight (C.W.)	Front	kg (lb)	714 (1,575)	746 (1,645)
	Rear	kg (lb)	506 (1,115)	510 (1,125)
	Total	kg (lb)	1,220 (2,690)	1,256 (2,770)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	885 (1,950)	
	Rear	kg (lb)	816 (1,800)	
	Total	kg (lb)	1,701 (3,750)	

2. CANADA SPEC. VEHICLES

Model			2200	
			AWD	
			L	
			5MT	4AT
Curb weight (C.W.)	Front	kg (lb)	714 (1,575)	746 (1,645)
	Rear	kg (lb)	506 (1,115)	510 (1,125)
	Total	kg (lb)	1,220 (2,690)	1,256 (2,770)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	885 (1,950)	
	Rear	kg (lb)	816 (1,800)	
	Total	kg (lb)	1,701 (3,750)	

3. Sport Wagon

A: DIMENSIONS

Model			1800	2200	
			AWD	AWD	
			Brighton	L	OUTBACK
Overall length mm (in)			4,375 (172.2)		
Overall width mm (in)			1,705 (67.1)		
Overall height mm (in)			1,410 (55.5)		1,430 (56.3)
Compartment	Leg room	Front Max. mm (in)	1,094 (43.1)		
		Rear Min. mm (in)	825 (32.5)		
	Head room	Front mm (in)	995 (39.2)		
		Rear mm (in)	933 (36.7)		
	Shoulder room	Front mm (in)	1,360 (53.5)		
		Rear mm (in)	1,355 (53.3)		
Wheelbase mm (in)			2,520 (99.2)		
Tread		Front mm (in)	1,460 (57.5)		
		Rear mm (in)	1,450 (57.1)		
Minimum road clearance mm (in)			145 (5.7)		165 (6.5)

B: ENGINE

Model	1800	2200
Engine type	Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
Valve arrangement	Overhead camshaft type	
Bore x Stroke mm (in)	87.9 x 75.0 (3.461 x 2.953)	96.9 x 75.0 (3.815 x 2.953)
Displacement cm^3 (cu in)	1,820 (111.06)	2,212 (135.0)
Compression ratio	9.7	
Firing order	1 — 3 — 2 — 4	
Idle speed at Park/Neutral position rpm	700 ± 100	
Maximum output kW (HP)/rpm	86 (115)/5,600	102 (137)/5,400
Maximum torque N.m (kg-m, ft-lb)/rpm	163 (16.6, 120)/4,000	196 (20.0, 145)/4,000

C: ELECTRICAL

Model		1800	2200
Ignition timing at idling speed BTDC/rpm		20°/700	14°/700 (MT), 20°/700 (AT)
Spark plug	Type and manufacturer	NGK: BKR6E-11 Alternate CHAMPION: RC8YC4	CHAMPION: RC10YC4, RC8YC4 Alternate NGK: BKR6E-11 Alternate NIPPONDENSO: K20PR-U11
Generator		12V — 75A	
Battery	Type	MT model: 55D23L, AT model: 75D23L	
	Reserve capacity min.	MT model: 99, AT model: 118	
	Cold cranking amperes amp.	MT model: 356, AT model: 520	

D: TRANSMISSION

Model			AWD	
Transmission type			5MT*	4AT*
Clutch type			DSPD	TCC
Gear ratio		1st	3.545	2.785
		2nd	2.111	1.545
		3rd	1.448	1.000
		4th	1.088	0.694
		5th	0.825 (1800 cc model) 0.780 (2200 cc model)	—
		Reverse	3.416	2.272
Reduction gear (Front drive)	1st reduction	Type of gear	—	Helical
		Gear ratio	—	1.000
	Final reduction	Type of gear	Hypoid	Hypoid
		Gear ratio	3.900	4.111
Reduction gear (Rear drive)	Transfer reduction	Type of gear	Helical	—
		Gear ratio	1.000	—
	Final reduction	Type of gear	Hypoid	Hypoid
		Gear ratio	3.900	4.111

5MT*: 5-forward speeds with synchromesh and 1-reverse – with center differential and viscous coupling
4AT*: Electronically controlled fully-automatic, 4-forward speeds and 1-reverse – with hydraulically controlled transfer clutch
DSPD: Dry Single Plate Diaphragm
TCC: Torque Converter Clutch

E: STEERING

Type	Rack and Pinion
Turns, lock to lock	3.2
Minimum turning circle m (ft)	Curb to curb: 10.2 (33.5), Wall to wall: 11.0 (36.1)

F: SUSPENSION

Front	Macpherson strut type, Independent, Coil spring
Rear	Dual link strut type, Independent, Coil spring

G: BRAKE

Model	1800	2200	
	Brighton	L	OUTBACK
Service brake system	Dual circuit hydraulic with vacuum suspended power unit		
Front	Ventilated disc brake		
Rear	Drum brake		
Parking brake	Mechanical on rear brakes		

H: TIRE

Model	1800	2200	
	AWD	AWD	
	Brighton	L	OUTBACK
Size	P175/70R14 84S	P195/60R15 87H	P205/60R15 90S P205/60R15 90H
Type	Steel belted radial, Tubeless		

I: CAPACITY

Model			AWD	
			5MT	4AT
Fuel tank		ℓ (US gal, Imp gal)	1800 cc model: 50 (13.2, 11.0) 2200 cc model: 60 (15.9, 13.2)	
Engine oil	Upper level	ℓ (US qt, Imp qt)	4.0 (4.2, 3.5)	
	Lower level	ℓ (US qt, Imp qt)	3.0 (3.2, 2.6)	
Transmission gear oil		ℓ (US qt, Imp qt)	3.5 (3.7, 3.1)	—
Automatic transmission fluid		ℓ (US qt, Imp qt)	—	7.9 (8.4, 7.0)
AT differential gear oil		ℓ (US qt, Imp qt)	—	1.2 (1.3, 1.1)
AWD rear differential gear oil		ℓ (US qt, Imp qt)	0.8 (0.8, 0.6)	
Power steering fluid		ℓ (US qt, Imp qt)	0.7 (0.7, 0.6)	
Engine coolant		ℓ (US qt, Imp qt)	1800 cc model: 6.2 (6.6, 5.5) 2200 cc model: 5.8 (6.1, 5.1)	

J: WEIGHT

1. AMERICA SPEC. VEHICLES

Model			2200			
			AWD			
			L		OUTBACK	
			5MT	4AT	5MT	4AT
Curb weight (C.W.)	Front	kg (lb)	721 (1,590)	726 (1,600)	758 (1,670)	753 (1,670)
	Rear	kg (lb)	547 (1,205)	560 (1,215)	565 (1,245)	551 (1,215)
	Total	kg (lb)	1,268 (2,795)	1,286 (2,835)	1,323 (2,915)	1,304 (2,915)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	885 (1,950)			
	Rear	kg (lb)	907 (2,000)			
	Total	kg (lb)	1,792 (3,950)			

2. CANADA SPEC. VEHICLES

Model			1800	2200			
			AWD	AWD			
			Brighton	L		OUTBACK	
			5MT	5MT	4AT	5MT	4AT
Curb weight (C.W.)	Front	kg (lb)	683 (1,505)	721 (1,590)	753 (1,660)	726 (1,600)	758 (1,670)
	Rear	kg (lb)	521 (1,150)	547 (1,205)	551 (1,215)	560 (1,235)	564 (1,245)
	Total	kg (lb)	1,204 (2,655)	1,268 (2,795)	1,304 (2,875)	1,286 (2,835)	1,322 (2,915)
Gross vehicle weight (G.V.W.)	Front	kg (lb)	862 (1,900)	885 (1,950)			
	Rear	kg (lb)	862 (1,900)	907 (2,000)			
	Total	kg (lb)	1,724 (3,800)	1,792 (3,950)			

GENERAL INFORMATION 1-3

1. General Precautions

A: BEFORE STARTING SERVICE

1) Be sure to perform the jobs listed in the Periodic Maintenance Schedule.
2) When a vehicle is brought in for maintenance, carefully listen to the owner's explanations of the symptoms exhibited by the vehicle. List the problems in your notebook, and refer to them when trying to diagnose the trouble.
3) All jewelry should be removed. Suitable work clothes should be worn.
4) Be sure to wear goggles.
5) Use fender, floor and seat covers to prevent the vehicle from being scratched or damaged.
6) Never smoke while working.
7) Before removing underfloor bolts (including the rear differential filler plug) coated with bituminous wax, remove old wax. Re-coat with new wax after reinstallation.

B: WHILE WORKING

1) When jacking up the vehicle, be sure to use safety stands.
2) When jacking up the front or rear end of the car body, be sure to chock the tires remaining in contact with the ground.
3) Keep the parking brake applied when working on the vehicle. Chock the tires remaining in contact with the ground (and set the selector lever to "P" position in AT vehicle), when the parking brake cannot be applied, such as when the brakes are being worked on.
4) Keep the ignition key turned "OFF" if at all possible.
5) Be cautious while working when the ignition key is "ON"; if the engine is hot, the cooling fan may start to operate.
6) While the engine is in operation, properly ventilate the workshop.
7) While the engine is in operation, be aware of any moving parts, such as the cooling fan and the drive belt.
8) Keep your hands off any metal parts such as the radiator, exhaust manifold, exhaust pipe, and muffler to prevent burning yourself.
9) When servicing the electrical system or the fuel system, disconnect the ground cable from the battery.
10) When disassembling, arrange the parts in the order that they were disassembled.
11) When removing a wiring connector, do not pull the wire but pull the connector itself.
12) When removing a hose or tube, remove the clip first. Then, pull the hose or tube while holding its end fitting.
13) Replace gaskets, O-rings, snap rings, lock washers, etc. with new ones.
14) When tightening a bolt or nut, tighten it to the specified torque.
15) When performing work requiring special tools, be sure to use the designated ones.
16) After completing work, make certain that the hoses, tubes and wiring harnesses are securely connected.
17) After completing work, be sure to wash the vehicle.

C: TREATMENT FOR USED ENGINE OIL

1. ENGINE OILS

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.

2. HEALTH PROTECTION PRECAUTIONS

1) Avoid prolonged and repeated contact with oils, particularly used engine oils.
2) Wear protective clothing, including impervious gloves where practicable.
3) Do not put oily rags in pockets.
4) Avoid contaminating clothes, particularly underpants, with oil.
5) Overalls must be cleaned regularly. Discard unwashable clothing and oil impregnated footwear.
6) First aid treatment should be obtained immediately for open cuts and wounds.
7) Use barrier creams, applying them before each work period, to help the removal of oil from the skin.
8) Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.
9) Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for washing skin.

10) If skin disorders develop, obtain medical advice.
11) Where practicable, degrease components prior to handling.
12) Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.

3. ENVIRONMENTAL PROTECTION PRECAUTIONS

It is illegal to pour used oil on to the ground, down sewers or drains, or into water courses. The burning of used engine oil in small space heaters or boilers is not recommended unless emission control equipment is fitted. If in doubt, check with the Local Authority.
Dispose of used oil through authorized waste disposal contractors, licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the Local Authority for advice on disposal facilities.

D: HANDLING AN AT VEHICLE

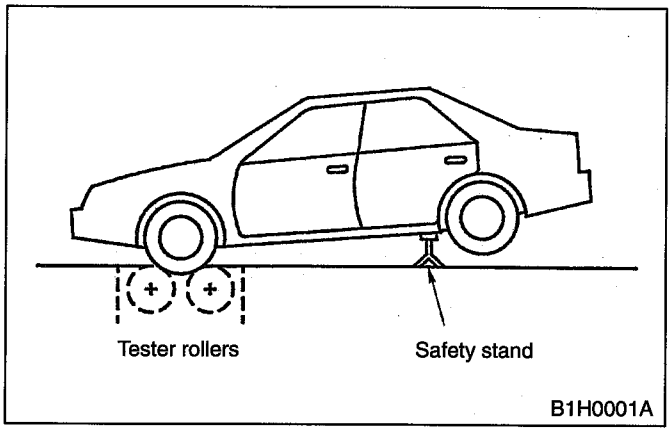
1) The engine cannot be started by pushing the vehicle, and also the vehicle cannot be moved by operating the starter motor.
2) Be sure to release the accelerator pedal before shifting from the "R" to the "N" range and from the "N" to the "D" range, or vise versa even when the vehicle is stopped.
3) Do not maintain the vehicle in a stall operation for more than five seconds as this may overheat the clutch excessively.
4) When the speedometer malfunctions, a vehicle-speed signal will no longer be emitted. Immediately have it repaired.
5) Use only genuine SUBARU AT fluid in the transmission.

E: FULL-TIME AWD MT MODELS

1. SPEEDOMETER TEST (Jack-up method)

1) Position vehicle so that front wheels are placed between rollers of speedometer test machine.
2) Jack up vehicle until rear wheels clear the floor, and support with safety stands.
3) Start engine with shift lever set in 2nd gear (for safety considerations). Perform speedometer tests.

WARNING:
• Secure a rope or wire to the front towing hook to prevent the lateral runout of front wheels.
• Do not abruptly depress/release clutch pedal or accelerator pedal during tests even when engine is operating at low speeds since this may cause vehicle to jump off test machine.
• Avoid abrupt braking after tests.
• In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the safety stands and the vehicle.
• Since the rear wheels will also be rotating, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.

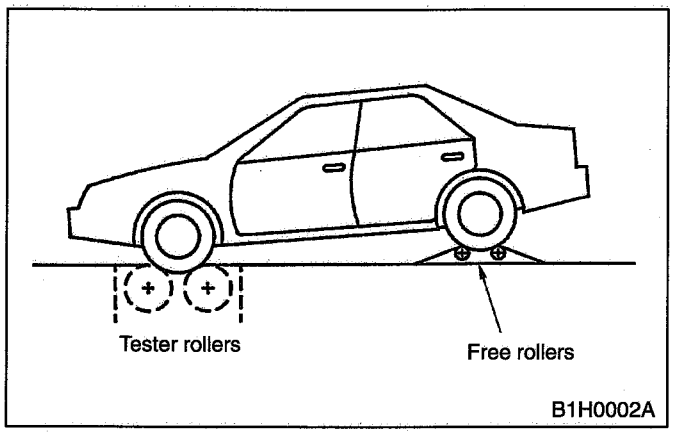


2. SPEEDOMETER TEST (Free roller method)

1) Position vehicle so that front wheels are placed between rollers of test machine.
2) Scribe alignment mark corresponding with centerline of rear wheels on floor.
3) Back up vehicle so that centerline of free rollers are aligned with mark scribed in step 2 above.
4) Drive vehicle onto free rollers.
5) Perform speedometer tests.

WARNING:
• Secure a rope or wire to the front towing hook to prevent the lateral runout of front wheels
• Do not abruptly depress/release clutch pedal or accelerator pedal during tests even when engine is operating at low speeds

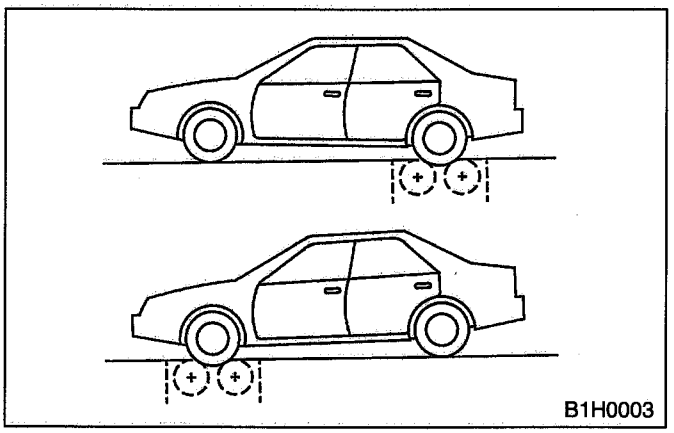
since this may cause vehicle to jump off test machine.
- **Avoid abrupt braking after tests.**



3. BRAKE TEST

1) Drive vehicle for a distance of several kilometers (miles) to stabilize dragging force of viscous coupling.
2) Place vehicle onto brake tester.
3) Perform brake tests.

Effect of braking force on viscous coupling torque: Approx. 245 N (25 kg, 55 lb)



NOTE:
If dragging force exceeds specifications, check brake pad or brake shoe for dragging. Abnormalities related to the viscous torque of viscous coupling unit may cause excessive dragging force. At this point, raise vehicle so that two front or rear wheels clear floor, remove cause of abnormality and check wheel rotation.

4. CHASSIS DYNAMOMETER TEST

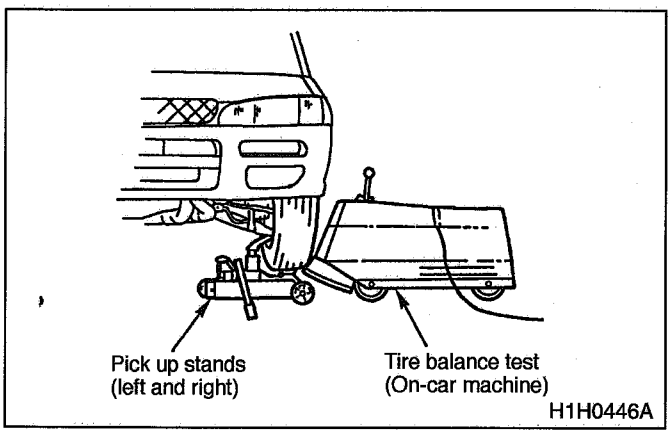
1) Locate vehicle onto chassis dynamometer tester.
2) Locate rear wheels onto free rollers.
3) Perform dynamic performance tests.

WARNING:
- **Do not abruptly depress/release clutch pedal or accelerator pedal during tests.**
- **Avoid abrupt braking tests after tests.**

5. TIRE BALANCE TEST (ON-car machine)

1) Raise vehicle so that left and right wheels to be checked clear the floor. Support wheels using pick-up stands.
2) Raise the other two wheels off the ground and support with a safety stand.
3) Attach on-car machine to wheels to be checked.
4) Drive wheel with engine and perform tire balance tests.

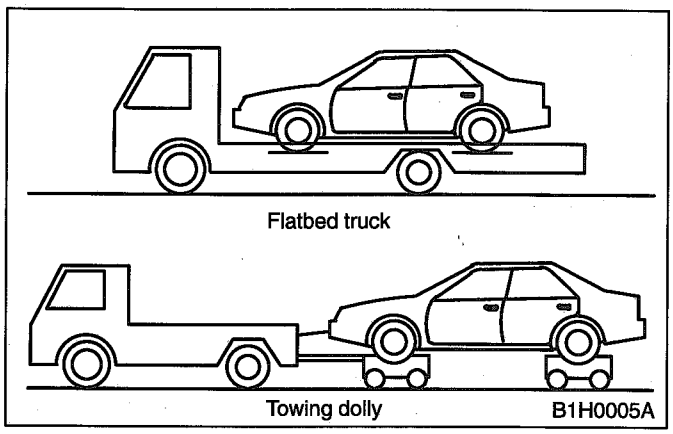
CAUTION:
- **Perform tire balance tests after each tire balance has been measured.**
- **Locate the vehicle so that its front and rear sides are equal in height.**
- **Release parking brake.**
- **Manually rotate each tire and check for drag.**
- **Do not operate clutch and do not accelerate the engine abruptly.**
- **If error occurs due to engine operation, do not operate balance's motor.**



6. TOWING

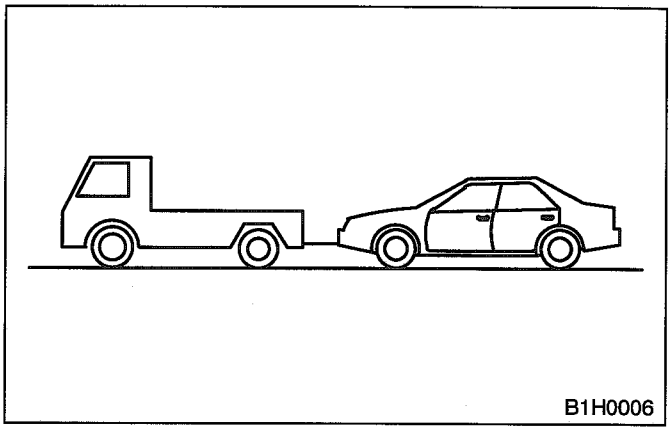
1) Loading vehicle onto dolly or flat-bed truck

CAUTION:
• Transport vehicle using a dolly or flat-bed truck whenever possible.
• Move shift lever to "1st" position and apply parking brake.



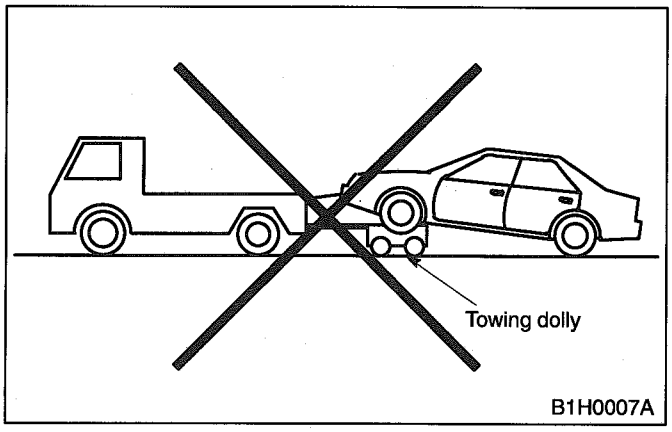
2) Towing with a rope

CAUTION:
• Use a rope only when power train and all wheels are operating properly.
• The ignition switch should be in the "ACC" position. Never have the ignition switch on "LOCK" while the vehicle is being towed because steering will not be possible, since the direction of the wheels will be locked.
• Put the transmission in neutral.
• Never use the tie down hooks for towing.
• Remember that brake booster and power steering will not work when engine is "OFF". You will have to use greater effort for the brake pedal and steering wheel.
• Before towing, check transmission oil and differential oil levels and top up to the specified level if necessary.

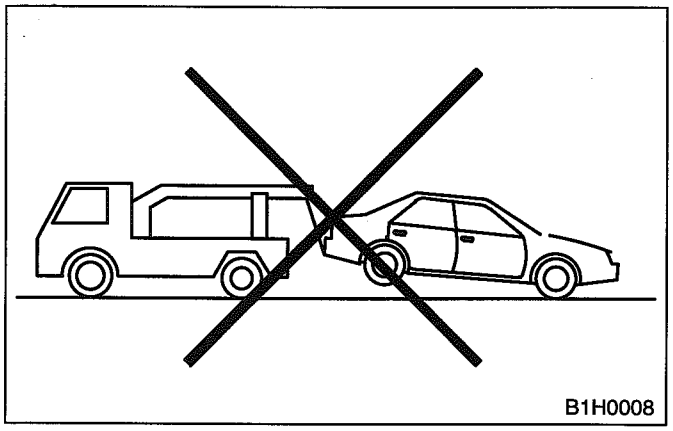


3) Towing with front or rear wheels raised

CAUTION:
• Do not tow vehicle with only front or rear wheels placed on towing dolly or flat-bed truck. This may degrade viscous coupling performance or cause vehicle to jump off dolly or truck.



• Do not tow vehicle with rear wheels raised under any circumstances since this will damage bumper.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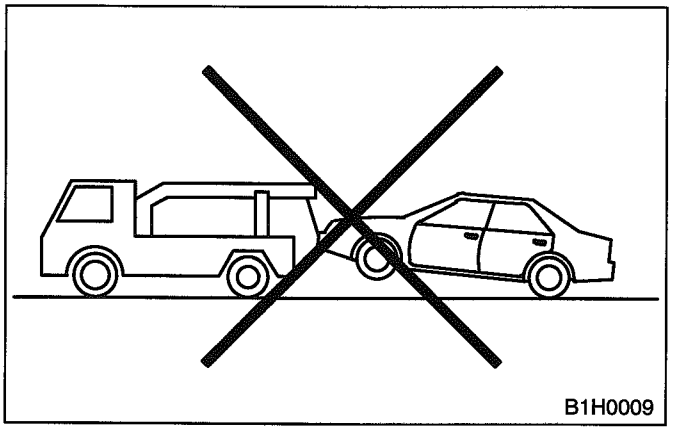
• Do not tow vehicle with front wheels raised under any circumstances since this will damage bumper.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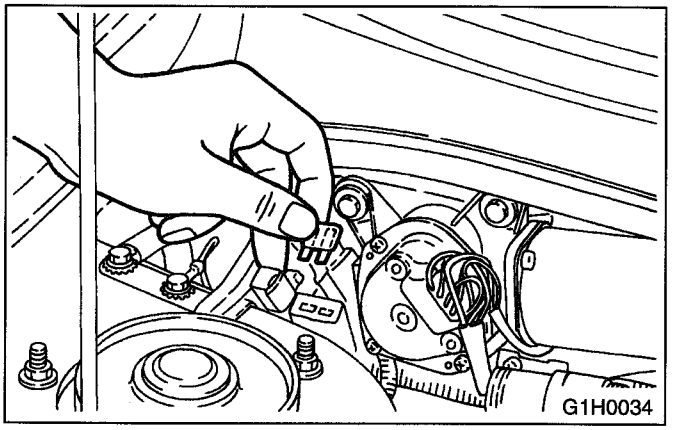
F: FULL TIME AWD AT MODELS

1. BEFORE CHECKING OR SERVICING CARS WITH THE FRONT WHEELS RAISED OR ON ROLLERS (BRAKE TESTER, CHASSIS DYNAMOMETER, ETC.)

Always set the car in the FWD mode.
To set the car in the FWD mode, disconnect the AWD circuit by inserting a fuse in the FWD connector inside the engine compartment. Also chock the rear wheels firmly.

CAUTION:
Ensure that the FWD pilot light is on. If the car is left in the AWD mode, it will surge abruptly when the wheels turn, possibly damaging the transfer clutch.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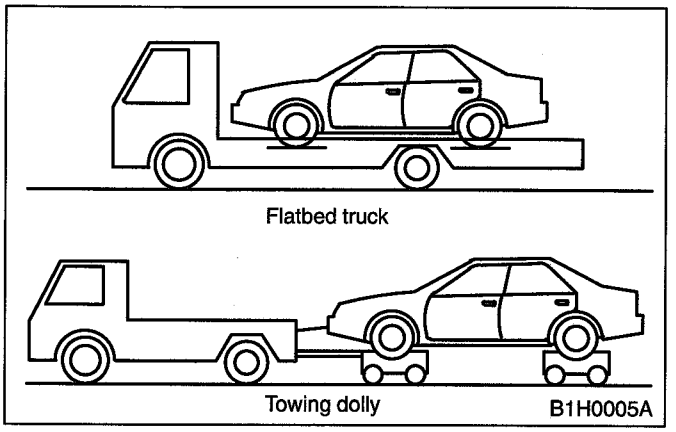
2. TOWING

1) Loading vehicle onto dolly or flat-bed truck

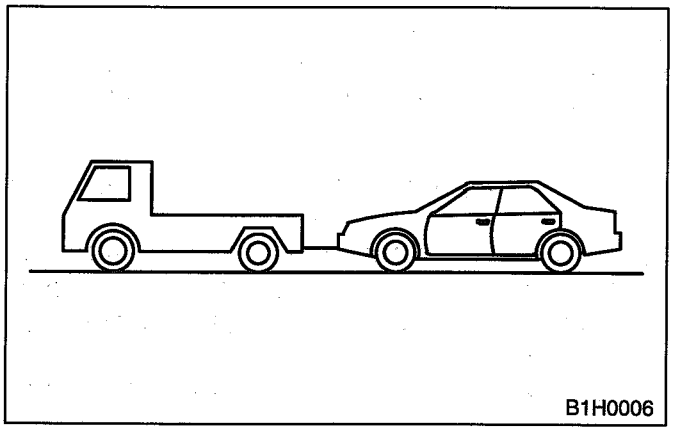
CAUTION:
• Transport vehicle using a dolly or flat-bed truck whenever possible.
• Place the selector lever in "P" position and apply the parking brake.



2) Towing with a rope

CAUTION:
• Tow vehicle with a rope only when power train and all wheels are operating properly.
• Put a spare fuse inside the FWD connector and never exceed 30 km/h (19 MPH). Also, do not tow for more than 50 km (31 miles).
• Place the selector lever in "N" position.
• The ignition switch should be in the "ACC" position while the vehicle is being towed.
• Never use the tie down hooks for towing.
• Remember that brake booster and power steering will not work when the engine is

"OFF". You will have to use greater effort for the brake pedal and steering wheel.
• Before towing, check transmission oil and differential oil levels and top up to the specified level if necessary.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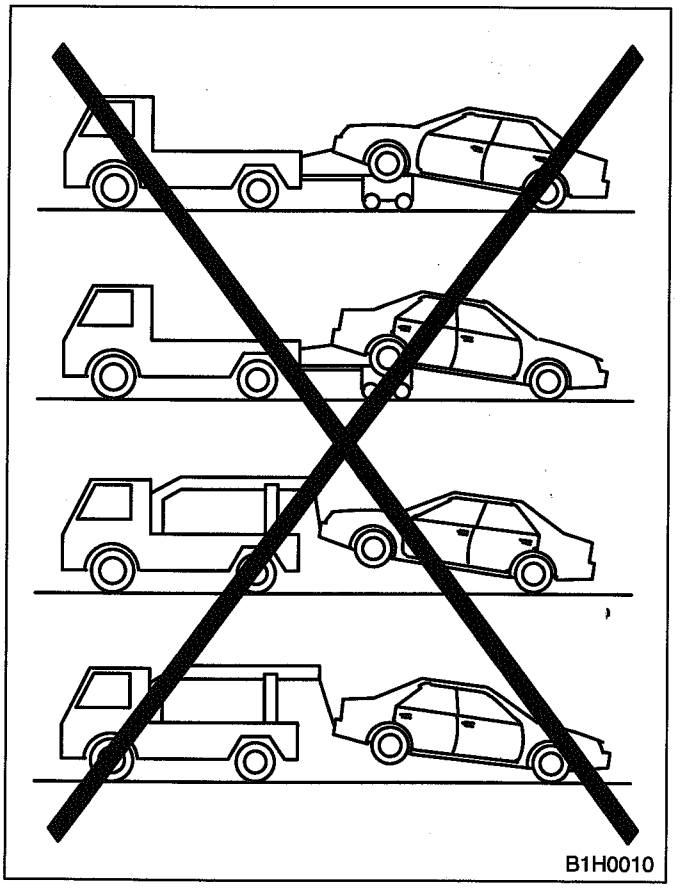
3) Towing with front or rear wheels raised

CAUTION:
Do not tow vehicle with front or rear wheels raised under any circumstances since this will damage bumper.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2. Precaution for Supplemental Restraint System (Airbag)

The Supplemental Restraint System (Airbag) has been implemented in some Subaru vehicles. For proper and safe maintenance of this system, please ensure that you carefully read the precautionary notes given in "5-5 SUPPLEMENTAL RESTRAINT SYSTEM" in the Service Manual before servicing.
It should also be noted that in the SM table of contents, an AIRBAG mark is added to each of the items which do not directly concern the airbag system but need to be considered in their relationship to it. So, during the service work for such items, make sure you refer to "5-5 SUPPLEMENTAL RESTRAINT SYSTEM".

- **Take utmost care to follow faithfully the service procedures specified for the airbag, since otherwise it might deploy unexpectedly.**
- **With the airbag system, failures such as faulty connection of harness connectors or neglect of tightening sensor mounting bolts can lead to failure of deployment in an accident. Recheck each check point after maintenance work and use the on-board self-diagnosis to ensure there is nothing wrong with the system.**
- **All wire harnesses of the airbag system are encased in a yellow cover to make them distinct from those of other systems.**

The following are the parts involved in the airbag installation:
1) Steering wheel
2) Steering column
3) Toe-board (center, left & right ends)
4) Front seat floor and side seal
5) Front pillar (left, lower)
6) Combination meter
7) Installment panel (passenger side, with passenger airbag)

Care should be taken when servicing in areas where the above parts are installed since it can affect the airbag system.

- Examples of service work involving the airbag system:

1) Replacement of steering gear
2) Steering maintenance and repair of the area adjoining toe-board
3) Removal and installation of combination meter
4) Installation of car stereo and other optional extras
5) Replacement and repair of the installment panel (with passenger airbag)

3. Vehicle Identification Numbers (V.I.N.)

A: APPLICABLE V.I.N. IN THIS MANUAL

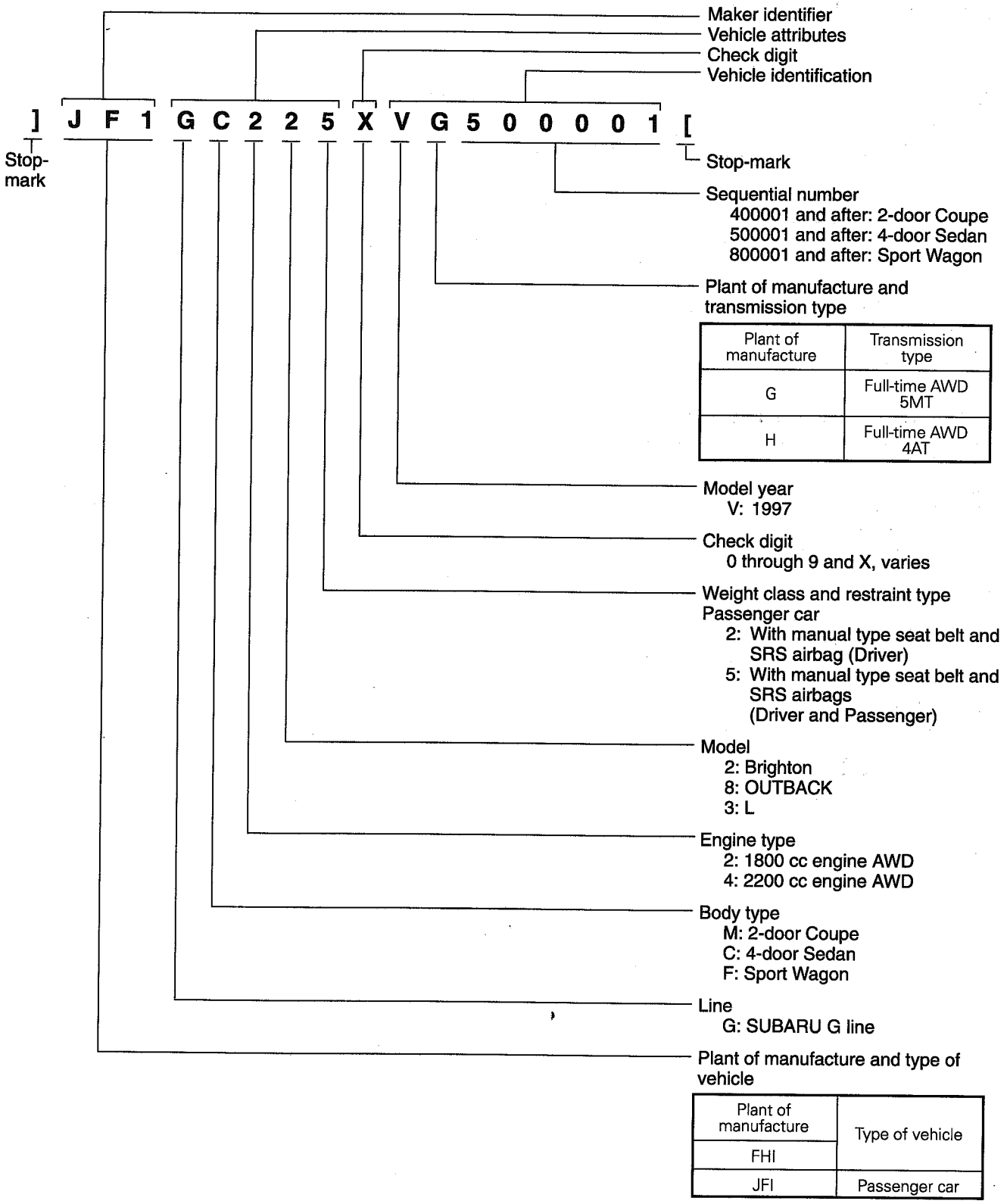
1. AMERICA SPEC. VEHICLES

2-door Coupe	1800 cc engine	AWD Brighton	5MT	J	F	1	G	M	2	2	5	X	V	G	4	0	0	0	0	1	and after
	2200 cc engine	AWD Brighton	5MT	J	F	1	G	M	4	2	5	X	V	G	4	0	0	0	0	1	and after
			4AT	J	F	1	G	M	4	2	5	X	V	H	4	0	0	0	0	1	and after
		AWD L	5MT	J	F	1	G	M	4	3	5	X	V	G	4	0	0	0	0	1	and after
			4AT	J	F	1	G	M	4	3	5	X	V	H	4	0	0	0	0	1	and after
4-door Sedan	2200 cc engine	AWD L	5MT	J	F	1	G	C	4	3	5	X	V	G	5	0	0	0	0	1	and after
			4AT	J	F	1	G	C	4	3	5	X	V	H	5	0	0	0	0	1	and after
Sport Wagon	2200 cc engine	AWD L	5MT	J	F	1	G	F	4	3	5	X	V	G	8	0	0	0	0	1	and after
			4AT	J	F	1	G	F	4	3	5	X	V	H	8	0	0	0	0	1	and after
		AWD OUTBACK	5MT	J	F	1	G	F	4	8	5	X	V	G	8	0	0	0	0	1	and after
			4AT	J	F	1	G	F	4	8	5	X	V	H	8	0	0	0	0	1	and after

2. CANADA SPEC. VEHICLES

2-door Coupe	1800 cc engine	AWD Brighton	5MT	J	F	1	G	M	2	2	2	X	V	G	4	0	0	0	0	1	and after
	2200 cc engine	AWD L	5MT	J	F	1	G	M	4	3	5	X	V	G	4	0	0	0	0	1	and after
			4AT	J	F	1	G	M	4	3	5	X	V	H	4	0	0	0	0	1	and after
4-door Sedan	2200 cc engine	AWD L	5MT	J	F	1	G	C	4	3	5	X	V	G	5	0	0	0	0	1	and after
			4AT	J	F	1	G	C	4	3	5	X	V	H	5	0	0	0	0	1	and after
Sport Wagon	1800 cc engine	AWD Brighton	5MT	J	F	1	G	F	2	2	5	X	V	G	8	0	0	0	0	1	and after
	2200 cc engine	AWD L	5MT	J	F	1	G	F	4	3	5	X	V	G	8	0	0	0	0	1	and after
			4AT	J	F	1	G	F	4	3	5	X	V	H	8	0	0	0	0	1	and after
		AWD OUTBACK	5MT	J	F	1	G	F	4	8	5	X	V	G	8	0	0	0	0	1	and after
			4AT	J	F	1	G	F	4	8	5	X	V	H	8	0	0	0	0	1	and after

B: THE MEANING OF V.I.N.

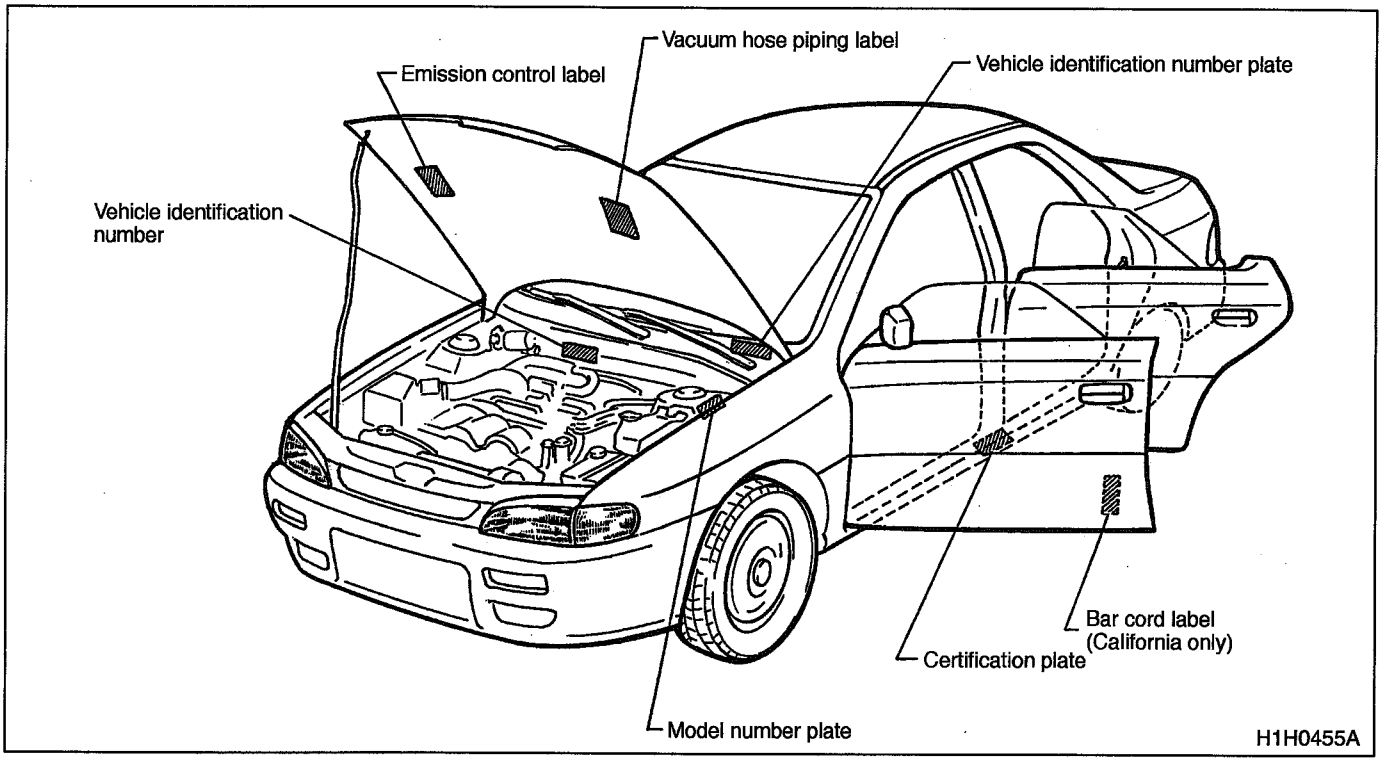


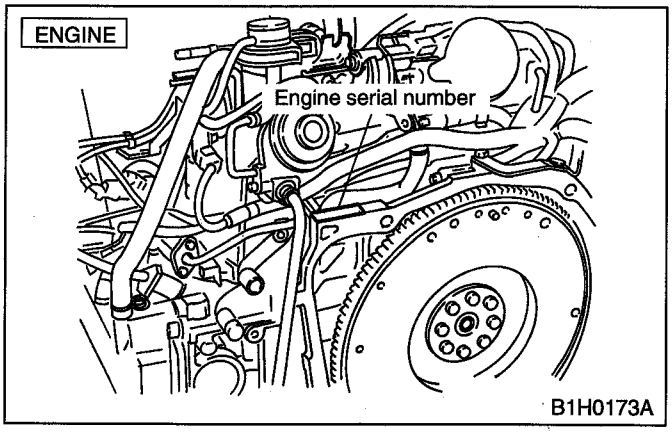
Plant of manufacture	Transmission type
G	Full-time AWD 5MT
H	Full-time AWD 4AT

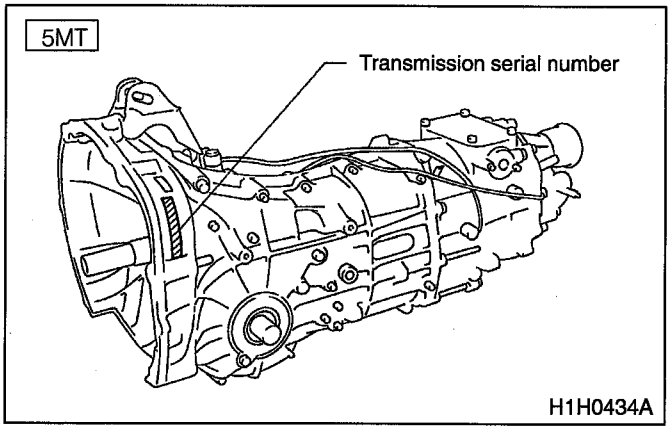
Plant of manufacture	Type of vehicle
FHI	
JFI	Passenger car

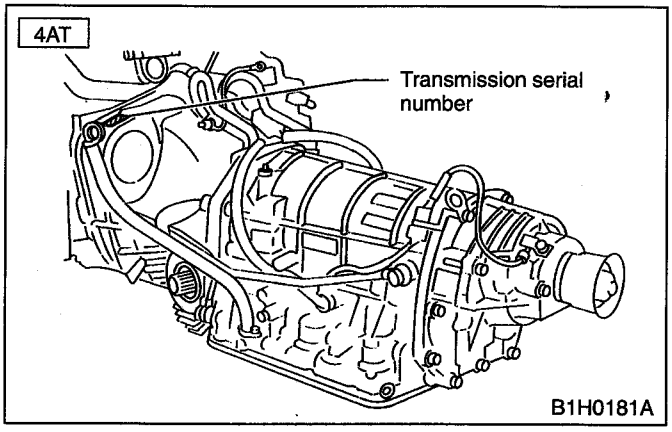
4. Identification Number and Label Locations

Engine, transmission and vehicle identification numbers are used for factory communications such as Technical Information, Service Bulletins and other information.









5. Recommended Fuel, Lubricants, Sealants and Adhesives

A: FUEL

SUBARU Non-TURBO engines are designed to use only unleaded gasoline with an octane rating of 87 AKI or higher. [This octane rating is the average of the Research Octane and Motor Octane numbers and is commonly referred to as the Anti-Knock Index (AKI).] Use of fuels containing proper detergents is recommended for good performance and emission control. The neck of the fuel filler pipe is designed to accept only an unleaded gasoline filler nozzle. Under no circumstances should leaded gasoline be used since it will damage the emission control system and may impair driveability and fuel economy.

B: FUELS CONTAINING ALCOHOL

Some gasoline blends sold at service stations contain alcohol or other oxygenates even though that fact may not be fully disclosed. If you are not sure whether there is alcohol present in the fuel, ask your service station operator. Do not use such fuels unless the gasoline/alcohol blend is suitable for your vehicle as explained at right:

- The fuel should be unleaded and have an octane rating no lower than that recommended below.
- Never use fuel containing more than 10% ethanol (ethyl or grain alcohol).
- Methanol (methyl or wood alcohol) is sometimes mixed with unleaded gasoline. Methanol can be used in your vehicle ONLY if it does not exceed 5% of the fuel mixture AND it is accompanied by sufficient quantities of the proper cosolvents and corrosion inhibitors required to prevent fuel system damage. Otherwise, fuel containing methanol should not be used.
- Unleaded fuel blends which contain no more than 15% MTBE (methyl tertiary butyl ether) or other oxygenates and which are approved by the Environmental Protection Agency may be used.
- You should avoid using fuels mixed with alcohol or other oxygenates on an exclusive basis. If driving problems such as engine stalling or hard starting result when such fuels are used, immediately discontinue their use and switch back to unleaded gasoline that does not contain alcohol or other oxygenates.

CAUTION:
Take care not to spill fuel during refueling. Fuels containing alcohol may cause paint damage.

C: LUBRICANTS

Lubricants	Specifications	Remarks
• Engine oil	• API Classification: SH or SG with the words "Energy Conserving II" • ILSAC Certified • CCMC Specification: G4 or G5 • ACEA Specification: A1 or A2 or A3	• For SAE viscosity number, refer to the following table. • If it is impossible to get SH or SG grade, you may use SF grade.
• Transmission and differential gear oil • AWD rear differential gear oil	• API Classification: GL-5	• For SAE viscosity number, refer to the following table.
• Automatic transmission	• "DEXRON II" or "DEXRON III" type	—
• Power steering fluid	• "DEXRON II" or "DEXRON IIE" or "DEXRON III" type	—
• Coolant	• Genuine SUBARU Coolant (Part No. 000016218) (Anti-freeze, anti-corrosive ethylene glycol base)	• For further coolant specifications, refer to the following table.
• Brake fluid	• DOT3 or DOT4	• FMVSS NO. 116 • Avoid mixing brake fluid of different brands to prevent the fluid performance from degrading. • When brake fluid is added, be careful not to allow any dust into the reservoir.

Lubricants	Recommended	Application	Equivalent
• Spray lubricants	SUBARU CRC (P/N 004301003)	O_2 sensor	
• Grease	SUNLIGHT 2 N: glube R (P/N 003602010)	Steering shaft bearing, bushing for manual transmission gear shift system	—
	Valiant grease M-2 (P/N 003608001)	Steering gearbox	—
	Niglube RX-2 (P/N 003606000 or 725191040)	Piston boot of disc brake and sliding pin	—
	Molykote No. 7439 (P/N 725191460)	Contacting surfaces of drum brake shoes and shoe clearance adjuster	—
	Molylex No.2 (P/N 723223010)	Rear BJ and DOJ (for except front axle of AT vehicle) joints of axle shafts	—
	NTG2218 CP/N 28093AA020	BJ (for front axle) joints of axle shafts	—
	FX clutch grease (P/N 000040901)	Splines of transmission main shaft	—
	Slicolube G-30M (P/N 004404002)	Control cables and throttle linkages subject to cold weather, water-pump impeller, door latch, striker, battery terminals, etc.	—
	SSG-6003 (P/N 28093TA000)	FTJ joints of axle shafts	—

D: FLUID

CAUTION:
• Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands (Except engine oil).
• When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

NOTE:
If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used:
API classification: SH
SAE Viscosity No: 30, 40, 10W-50, 20W-40, 20W-50

* For differential gear oil (AT)

ITEM	API Classification	ILSAC Certification Mark	CCMC Specification	ACEA Specification	SAE Viscosity No. and Applicable Temperature
Engine oil	SH or SG with the words "Energy Conserving II"	AMERICAN PETROLEUM INSTITUTE FOR GASOLINE ENGINES CERTIFIED	G4 or G5	A1 or A2 or A3	10W-30, 10W-40 5W-30 PREFERRED
•Transmission gear oil	GL-5	—	—	—	90 85W 80W 75W-90
•AWD rear differential gear oil •Front differential gear oil for automatic transmission	GL-5	—	—	—	90 85W 80W 80W-90

(°C) -30 -20 -15 0 15 30 40
(°F) -22 -4 5 32 59 86 104
(°F) 15 23 77
(°C) -26 -5 25
B1H0183

E: COOLANT

CAUTION:
• Avoid using any coolant or only water other than this designated type to prevent corrosion.
• SUBARU's engine is aluminum alloy, and so special care is necessary.

Coolant Specifications							
Lowest anticipated atmospheric temperature	SUBARU coolant-to-*water ratio (Volume) %	Specification gravity					Freezing point
		at 10°C (50°F)	at 20°C (68°F)	at 30°C (86°F)	at 40°C (104°F)	at 50°C (122°F)	
Above –30°C (–22°F)	50 — 50	1.084	1.079	1.074	1.068	1.062	–36°C (–33°F)
Above –15°C (5°F)	30 — 70	1.053	1.049	1.044	1.039	1.034	–36°C (33°F)

* It is recommended that distilled water be used.

F: SEALANTS

	Recommended	Application	Equivalent
Sealant	Three Bond 1105 (P/N 004403010)	Rear differential oil drain plug, bearing cap (#5), etc.	Dow Corning's No. 7038
	Three Bond 1215 (P/N 004403007)	Matching surface of oil pump, transmission case, etc. Flywheel and drive plate tightening bolts, etc.	Dow Corning's No. 7038
	Starcalking B-33A (P/N 000018901)	Sealing against water and dust entry through weatherstrips, grommets, etc.	Butyl Rubber Sealant
	Three Bond 1207C (P/N 004403012)	Matching surface of oil pan, oil pressure switch	—
	Three Bond 1102 (P/N 004403006)	Steering gear box adjust screw	—

G: ADHESIVES

Adhesive	Cemedine 5430L	Weatherstrips and other rubber parts, plastics and textiles except soft vinyl parts.	3M's EC-1770 EC-1368
	Cemedine 540	Soft vinyl parts, and other parts subject to gasoline, grease or oil, e.g. trim leather, door inner remote cover, etc.	3M's EC-776 EC-847 EC-1022 (Spray Type)
	Cemedine 3000	Bonding metals, glass, plastic and rubber parts. Repairing slightly torn weatherstrips, etc.	Armstrong's Eastman 910
	Essex Chemical Crop's Urethane E	Windshield to body panel.	Sunstar 580

6. Tightening Torque of Standard Bolts and Nuts

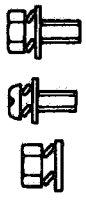
A: ENGINE AND TRANSMISSION

Unit: N.m (kg-m, ft-lb)

Dia. x Pitch (mm)	5T	7T	9T	10T
4 x 0.75	1.0 — 1.5 (0.105 — 0.155, 0.8 — 1.1)	1.5 — 2.0 (0.155 — 0.205, 1.1 — 1.5)	2.5 — 3.0 (0.255 — 0.305, 1.8 — 2.2)	3.0 — 3.5 (0.305 — 0.355, 2.2 — 2.6)
5 x 0.9	2.5 — 3.0 (0.255 — 0.305, 1.8 — 2.2)	2.9 — 3.9 (0.30 — 0.40, 2.2 — 2.9)	4.9 — 5.9 (0.50 — 0.60, 3.6 — 4.3)	5.4 — 6.4 (0.55 — 0.65, 4.0 — 4.7)
6 x 1.0	4.4 — 5.4 (0.45 — 0.55, 3.3 — 4.0)	5.9 — 6.9 (0.60 — 0.70, 4.3 — 5.1)	9.4 — 10.8 (0.955 — 1.105, 6.9 — 8.0)	10 — 12 (1.0 — 1.2, 7 — 9)
8 x 1.25	12 — 14 (1.2 — 1.4, 9 — 10)	14.2 — 17.2 (1.45 — 1.75, 10.5 — 12.7)	23 — 26 (2.3 — 2.7, 17 — 20)	25 — 28 (2.5 — 2.9, 18 — 21)
10 x 1.25	25 — 28 (2.5 — 2.9, 18 — 21)	30 — 36 (3.1 — 3.7, 22 — 27)	46 — 54 (4.7 — 5.5, 34 — 40)	49.5 — 58.4 (5.05 — 5.95, 36.5 — 43.0)
12 x 1.5	41 — 49 (4.2 — 5.0, 30 — 36)	53 — 63 (5.4 — 6.4, 39 — 46)	84 — 98 (8.6 — 10.0, 62 — 72)	88 — 106 (9.0 — 10.8, 65 — 78)
14 x 1.6	71 — 84 (7.2 — 8.6, 52 — 62)	88 — 106 (9.0 — 10.8, 65 — 78)	139 — 165 (14.2 — 16.8, 103 — 122)	147 — 175 (15.0 — 17.8, 108 — 129)

B: BODY

Unit: N.m (kg-m, ft-lb)

	Dia. (mm)	4T	7T	9T
 G1H0041	4	1.7 — 2.6 (0.17 — 0.27, 1.2 — 2.0)	—	—
	5	2.9 — 5.9 (0.30 — 0.60, 2.2 — 4.3)	—	—
	6	5.4 — 9.3 (0.55 — 0.95, 4.0 — 6.9)	—	—
	8	12.7 — 22.6 (1.30 — 2.30, 9.4 — 16.6)	22.6 — 42.2 (2.30 — 4.30, 16.6 — 31.1)	31.4 — 51.0 (3.20 — 5.20, 23.1 — 37.6)
	10	27.5 — 47.1 (2.80 — 4.80, 20.3 — 34.7)	51.0 — 86.3 (5.20 — 8.80, 37.6 — 63.7)	62.8 — 107.9 (6.40 — 11.00, 46.3 — 79.6)
	12	52.0 — 85.3 (5.30 — 8.70, 38.3 — 62.9)	88.3 — 156.9 (9.00 — 16.00, 65.1 — 115.7)	117.7 — 196.1 (12.00 — 20.00, 86.8 — 144.7)
In case bolt or nut with washer or spring washer  G1H0042	4	1.2 — 2.2 (0.12 — 0.22, 0.9 — 1.6)	—	—
	5	2.5 — 4.4 (0.25 — 0.45, 1.8 — 3.3)	—	—
	6	4.4 — 7.4 (0.45 — 0.75, 3.3 — 5.4)	—	—
	8	9.8 — 17.7 (1.10 — 1.80, 7.2 — 13.0)	17.7 — 31.4 (1.80 — 3.20, 13.0 — 23.1)	23.5 — 39.2 (2.40 — 4.00, 17.4 — 28.9)
	10	22.6 — 36.3 (2.30 — 3.70, 16.6 — 26.8)	37.3 — 66.7 (3.80 — 6.80, 27.5 — 49.2)	48.1 — 83.4 (4.90 — 8.50, 35.4 — 61.5)
	12	39.2 — 64.7 (4.00 — 6.60, 28.9 — 47.7)	68.6 — 117.7 (7.00 — 12.00, 50.6 — 86.8)	88.3 — 147.1 (9.00 — 15.00, 65.1 — 108.5)

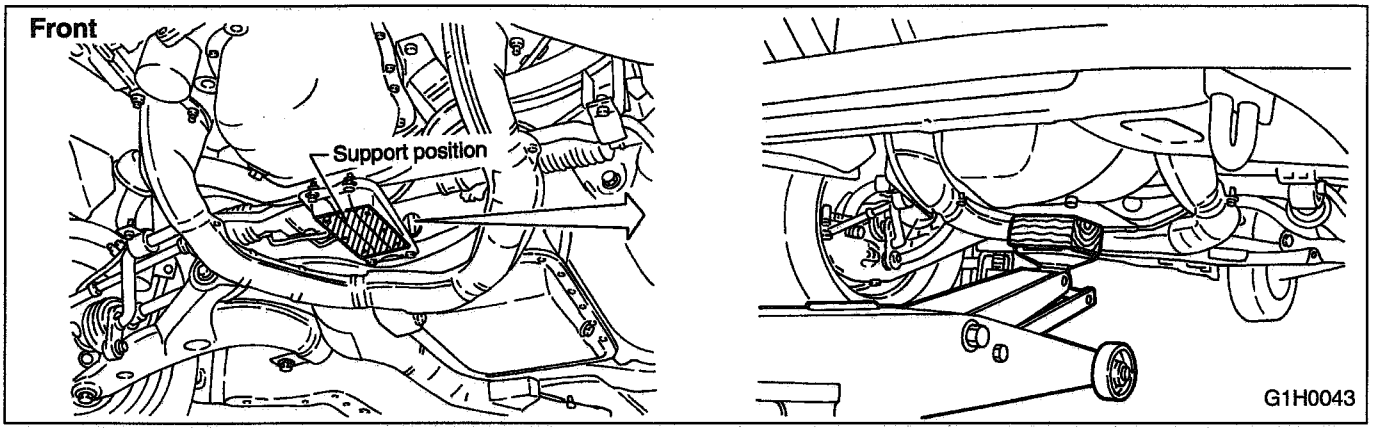
NOTE:
The mark is embossed on the bolt head as follows:
- 4T — 4
- 5T — 5
- 7T — 7
- 9T — 9
- 10T — 10

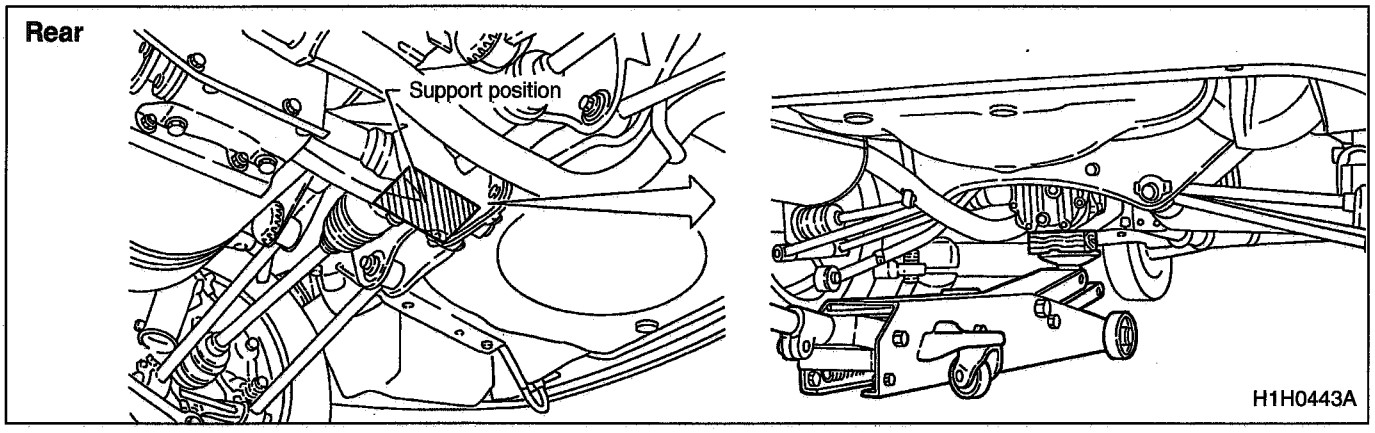
7. Lifting, Towing and Tie-down Points

WARNING:
- **Never get under the vehicle while it is supported by a jack.**
- **When jacking up the vehicle, place chocks to hold wheels.**
- **After jacking up the vehicle with garage jack, be sure to support the vehicle with stands for safety.**
- **Be sure to lift vehicle at the same four positions as those for pantograph jack.**

CAUTION:
Be sure to lift, tow and tie-down the vehicle at the designated positions.

A: GARAGE JACK



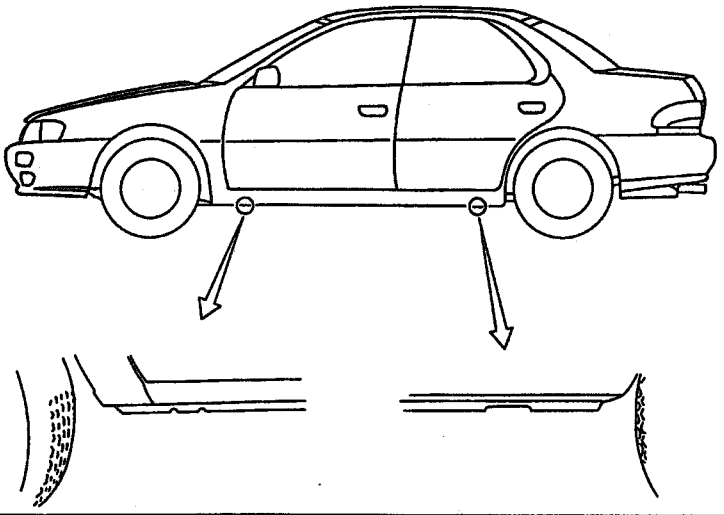


B: PANTOGRAPH JACK, SAFETY STAND AND LIFT

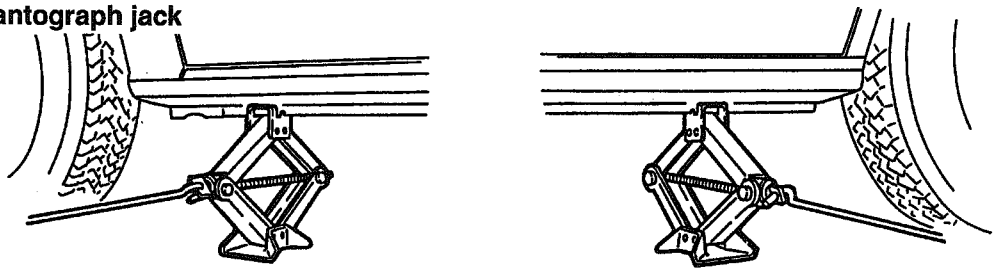
WARNING:
- **Never get under the vehicle while it is supported only by the jack. Always use safety stands to support body when you have to get under the car.**
- **Block the wheels diagonally by wheel chocks.**

CAUTION:
Make sure the jack is set at the correct position on the flange of side sill.

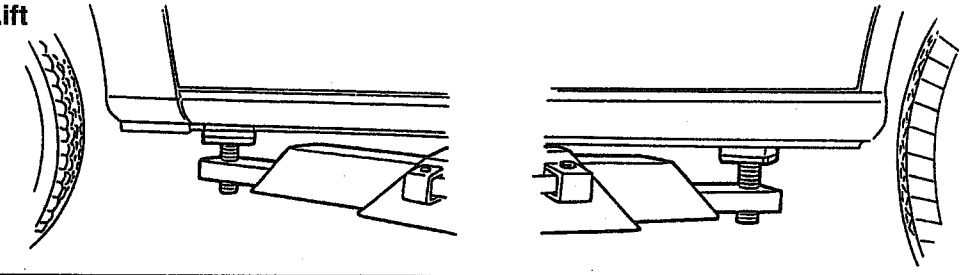
Support locations



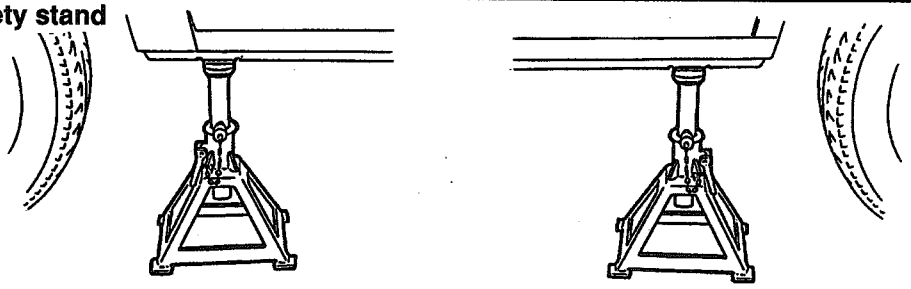
Pantograph jack



Lift



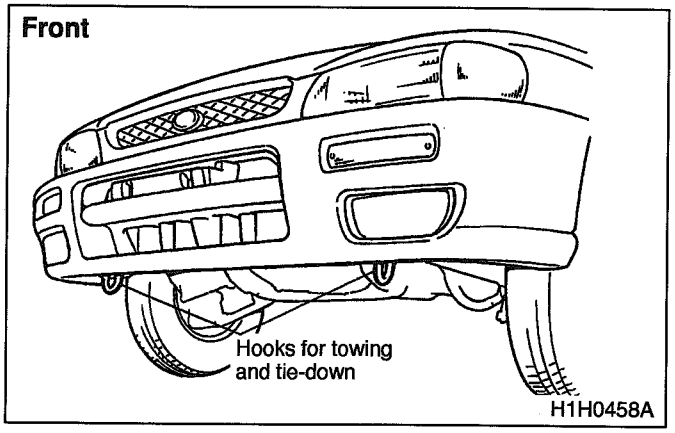
Safety stand

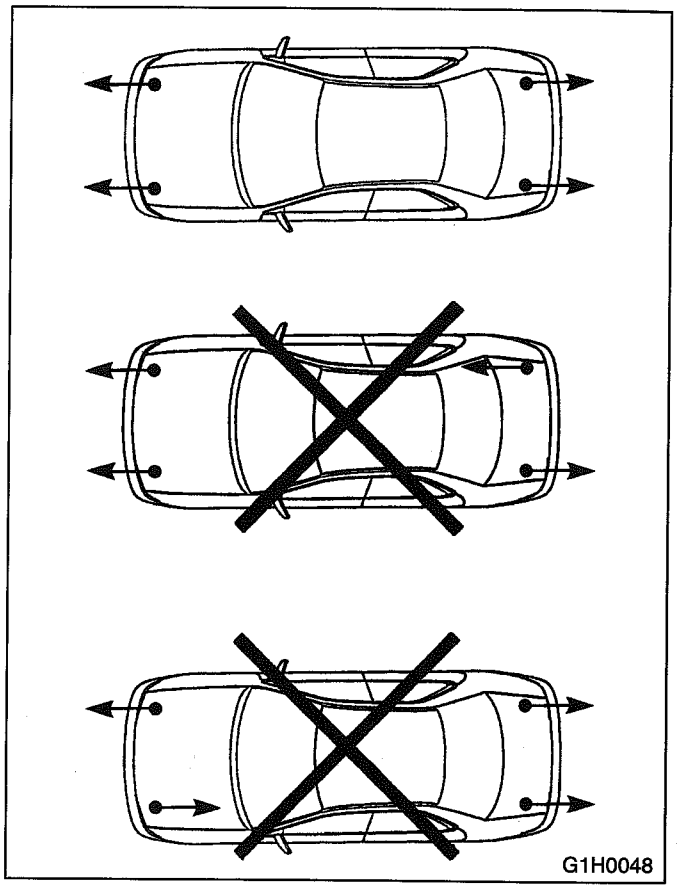


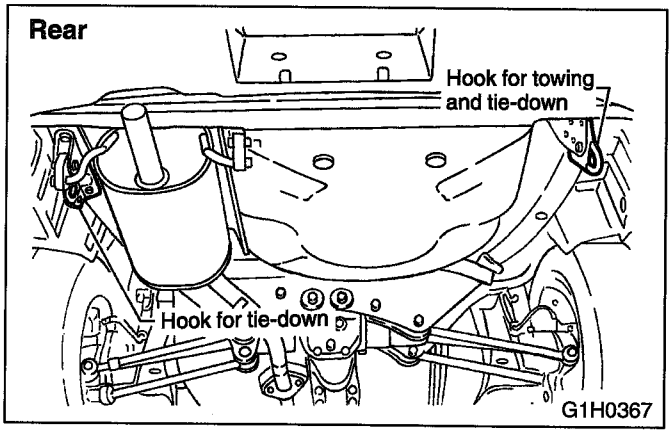
H1H0457A

C: TOWING AND TIE-DOWN HOOKS

CAUTION:
- **Avoid towing another car with front towing hooks.**
- **Do not tow a vehicle which is heavier than towing vehicle.**
- **Do not apply excessive lateral load to towing hook.**
- **Wrap the towing rope with cloth to prevent damaging bumper, etc.**
- **Keep the vehicle level during towing.**
- **Tie the front and rear tie-down hooks in the same direction.**

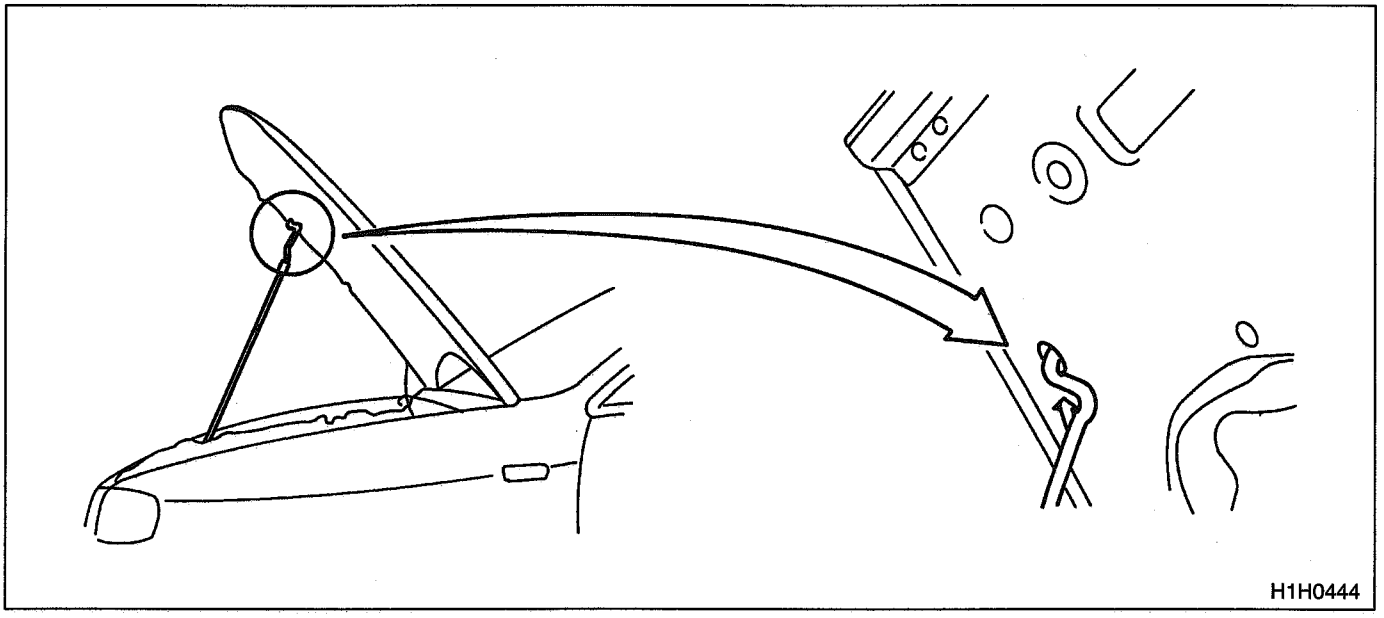






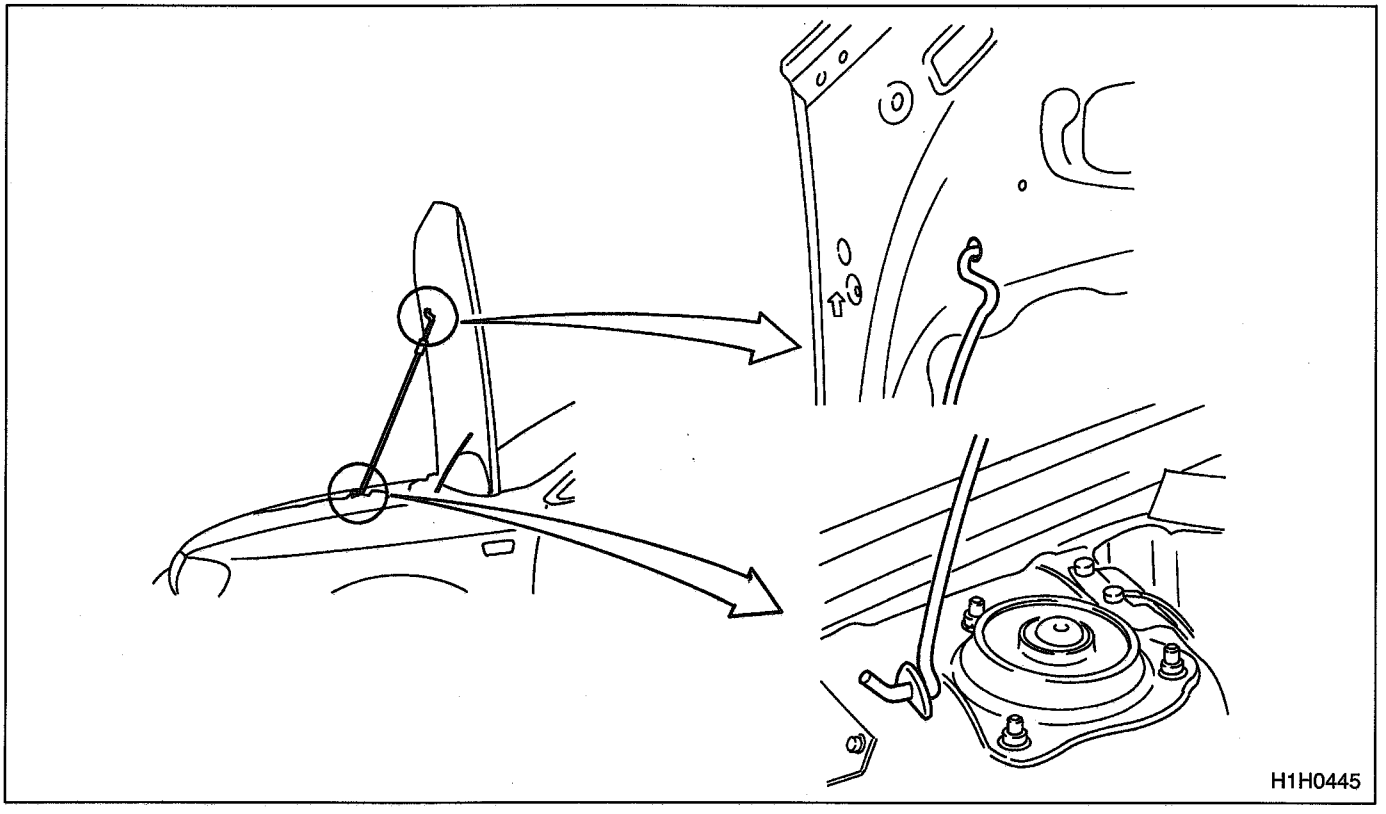
8. Front Hood Stay Installation

A: AT THE CHECK AND GENERAL MAINTENANCE



B: WHEN WIDER HOOD OPENING IS NECESSARY

Set stay into the hole of hood inner as shown in the figure below.



PRE-DELIVERY INSPECTION 1-4

1. List of Pre-delivery Inspection

INSPECTION ITEM		CHECK POINTS
2. Pre-road Test Inspection		
A	HOOD OPERATION	1. Operation of hood release and lock 2. Condition of lock 3. Fitting of hood
B	DOOR OPERATION, DOOR LOCK AND REGULATOR	1. Door "Open-close" operation 2. Operation of door release and lock 3. Loose or damaged parts 4. Regulator handle operation 5. Position of door window glass 6. Operation of power window switches 7. Power door locking operation
C	TRUNK LID, REAR GATE AND FUEL LID OPERATION	1. Trunk lid, rear gate and fuel lid "open-close" operation 2. Operation of trunk lid and rear gate (release and lock) 3. Fitting of trunk lid, rear gate and fuel lid 4. Operation of trunk lid opener cancel lever
D	BRAKE FLUID LEVEL AND BRAKE PIPING INSTALLATION	1. Brake fluid level in reserve tank 2. Wiring of fluid leveller and its operation 3. Brake booster, master cylinder, hill holder and pressure control valve for proper installation; brake pipe, brake hose and connectors for proper fitting 4. Leakage in any of the above
E	BATTERY FLUID LEVEL AND BATTERY INSTALLATION	1. External parts 2. Electrolyte level 3. Specific gravity
F	COOLANT LEVEL AND COOLING FAN INSTALLATION	1. Coolant level 2. Cooling fan motor and wiring 3. Water leakage and hose damage
G	ENGINE OIL LEVEL	1. Engine oil level 2. Engine oil leakage or contamination
H	TRANSMISSION AND DIFFERENTIAL GEAR OIL LEVEL	1. Level of transmission gear oil for manual transmission 2. Level of rear differential gear oil for AWD model 3. Level of differential gear oil for automatic transmission
I	DRIVE BELT TENSION	1. Belt tension 2. Damage to belt
J	AIR CLEANER	1. Contamination of air cleaner element 2. Related parts
K	JACK INSTALLATION	1. Installed condition of jack
L	WINDSHIELD WASHER AND WINDSHIELD WIPERS	1. Installation of windshield washer tank 2. Checking of fluid level 3. Direction and quantity of windshield washer fluid sprayed 4. Operation of windshield wiper and washer
M	REAR WINDOW WASHER AND WIPER	1. Quantity of washer fluid 2. Direction and quantity of washer fluid sprayed 3. Operation of rear window washer and wiper
N	WHEEL NUTS FOR LOOSENESS AND TIRE INFLATION PRESSURE	1. Wheel nut tightening torque 2. Tire inflation pressure and tire specification 3. Damage to tire and rim
O	SEAT ADJUSTER AND SEAT BELTS	1. Front and rear seats, and their facing materials 2. Front seat operation 3. Rear seat folding operation 4. Seat belts and their fit 5. Installing procedure for child anchor
P	FUSES	1. Fuse installation 2. Spare fuse

INSPECTION ITEM		CHECK POINTS
Q	LIGHTS AND SWITCHES	1. Visual inspection of lights (installation, damage, dirty lenses, water inside, etc.) 2. Operation of all lights and switches 3. Horn operation 4. Operation of heater and ventilator 5. Removing the dip for room light switch
R	PREPARATION FOR UNDERSIDE INSPECTION	1. Jacking up and lifting point
S	TEST MODE CONNECTOR	1. Check engine light flashing 2. Test mode connectors disconnection
T	INSTALLATION OF STEERING COMPONENTS	1. Installation of universal joints 2. Steering gear box for looseness, play, or backlash, and boots for damage 3. Tie-rod and tie-rod end for proper installation, or damage
U	EXHAUST PIPE AND MUFFLER	1. Installation of exhaust system 2. Exhaust gas leakage from parts or joints
V	FUEL SYSTEM FOR LEAKAGE	1. Installation of fuel hose and pipe. And condition of clamps 2. Fuel system for leakage
W	PROTECTOR	1. Protector removal
X	AIR CONDITIONING SYSTEM	1. A/C compressor connector connection
3. Road Test Inspection		
A	OPERATION OF INDICATOR LIGHTS AND GAUGES	1. Operation of indicator lights 2. Operation of gauges
B	TACHOMETER, RADIO, ETC.	1. Operation of tachometer, radio, cigarette lighter, etc.
C	STARTING CONDITION OF ENGINE	1. Starting condition of engine
D	DRIVING TEST	1. Operation of foot brake and parking brake 2. Inspect the clutch free play 3. Operation of clutch and gear shift 4. Operation of hill holder (Manual transmission) 5. Operation of selector lever (Automatic transmission) 6. Operation of starter interlock (Manual transmission) 7. Operation of steering and position of steering wheel 8. Operation of turn signal cancel cam 9. Operation of ventilation system and heater 10. Abnormal noises or vibration 11. Operation of cruise control
4. Post-road Test Inspection		
A	AT FLUID LEVEL	1. Level of AT fluid
B	POWER STEERING FLUID LEVEL	1. Level of power steering fluid
C	WHEEL ALIGNMENT	1. Toe of front and rear wheels 2. Camber of front wheels
D	UNDERSIDE	1. Leakage of engine oil, transmission gear oil, differential gear oil, etc. 2. Leakage of coolant 3. Leakage of brake fluid 4. Loose suspension mountings or steering mounting
E	WATER LEAKAGE	1. Water leakage by pouring water
F	EXTERNAL APPEARANCE AND EQUIPMENT	1. Paint 2. Scratches and damage to glass 3. Rust formation 4. Contamination of interior parts 5. Installation of equipment

2. Pre-road Test Inspection

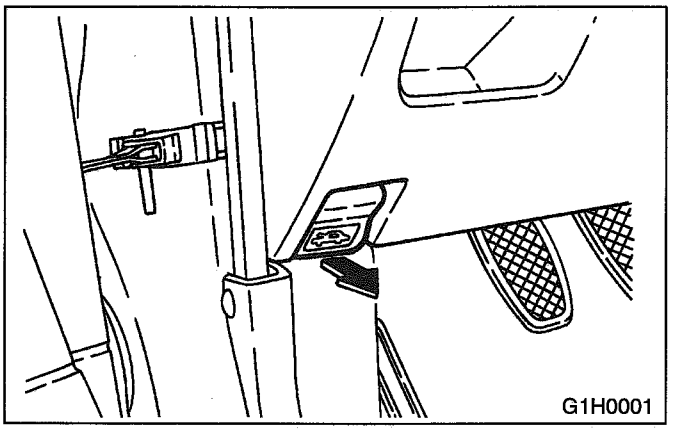
A: HOOD OPERATION

CHECK POINTS

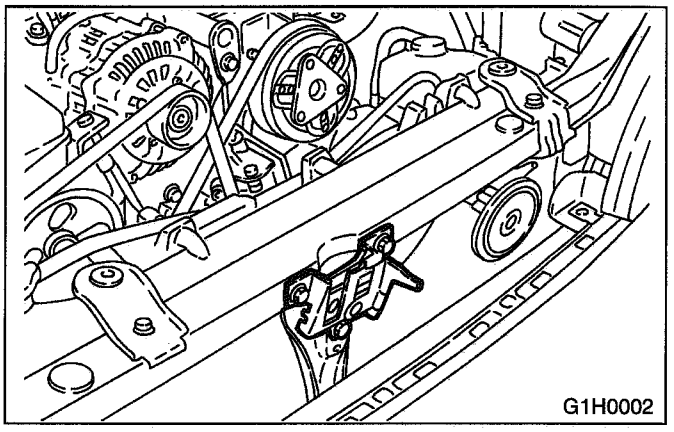
1. **Operation of hood release and lock**
2. **Condition of lock**
3. **Fitting of hood**

1. CHECK THE OPENING, CLOSING AND LOCKING OF HOOD.

1) Make sure the wiper arms are folded down properly. Pull the hood lock release knob under the instrument panel. (The hood will lift a step.) Check if the cable moves easily and lightly without dragging.


G1H0001

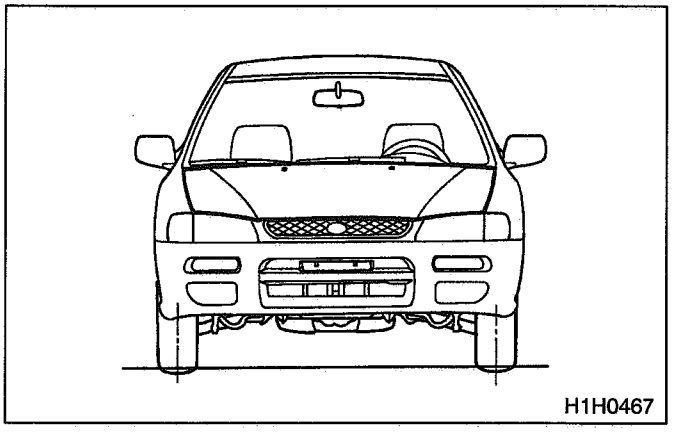
2) Release the lock by pushing the lock lever while pushing the hood down with slight pressure.
Hold the hood open with the stay.
Check the way the safety lock mechanism is released and that the hood opens and closes without any abnormal noise and does not contact the body.


G1H0002

3) Remove the stay and lower the hood slowly. Rest the hood near the body and push down the front end of the hood to see if the lock functions properly.
4) Confirm by repeating the steps 1) to 3) above two or three times.

2. CHECK THE INSTALLATION OF HOOD.

After having closed the hood, ensure the hood fits properly.


H1H0467

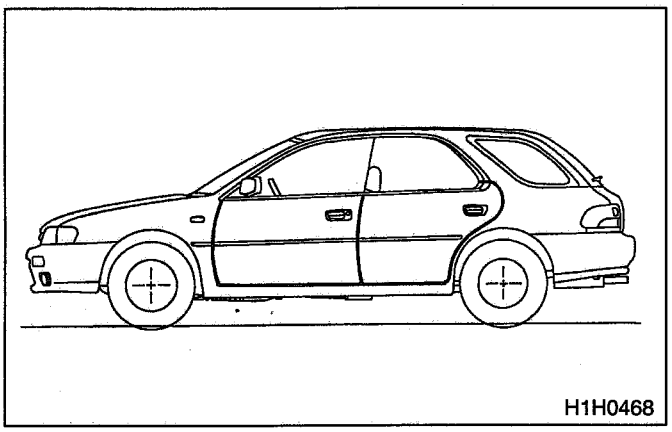
NOTE:
- The clearance between the hood and front fender is uniform.
- The hood's front end is parallel with the front fender.
- The slope of hood is the same as the parts of body surrounding it.
- The hood and weatherstrip stick fast to each other.

B: DOOR OPERATION, DOOR LOCK AND REGULATOR

CHECK POINTS

1. **Door "Open-close" operation**
2. **Operation of door release and lock**
3. **Loose or damaged parts**
4. **Regulator handle operation**
5. **Position of door window glass**
6. **Operation of power window switches**
7. **Power door locking operation**

1. CHECK THE OPENING AND CLOSING OF DOORS AND REAR GATE.


H1H0468

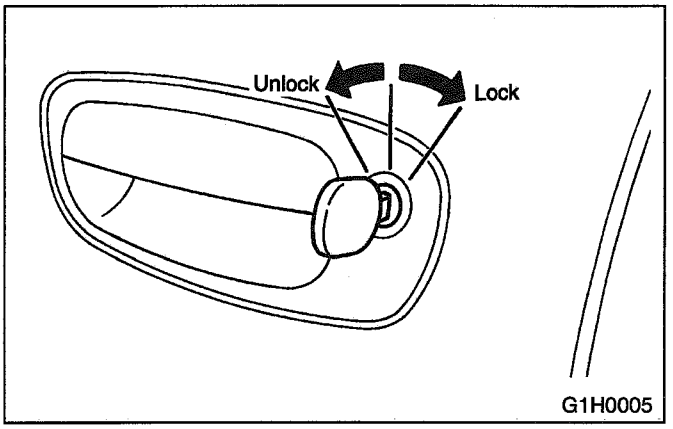
1) First open the door completely and then close it fully by operating the inner handle from the driver's seat.
2) Repeat step 1) two or three times to see how the door opens and closes. Pay attention to the operating effort, any abnormal noise and positive operation.
3) Operate the outer handle from the outside and check how the door opens and closes. Also, check that there is an uniform clearance between the door and car body without any grade difference.

NOTE:
- To examine the closed state and sinking of the door, observe from the front right-hand door.
- If the striker drags during opening when the outer handle is pulled, adjust by relocating the striker.

2. CHECK THE OPERATION OF DOOR LOCKS.

1) Close the door completely, lock it with the key plate and pull the outer handle to ensure the door does not open.

NOTE:
- Do not pull the outer handle with greater force than necessary.
- While inspecting the door and lock, check the lock in the rear part of the door and the door striker attached to the pillar.

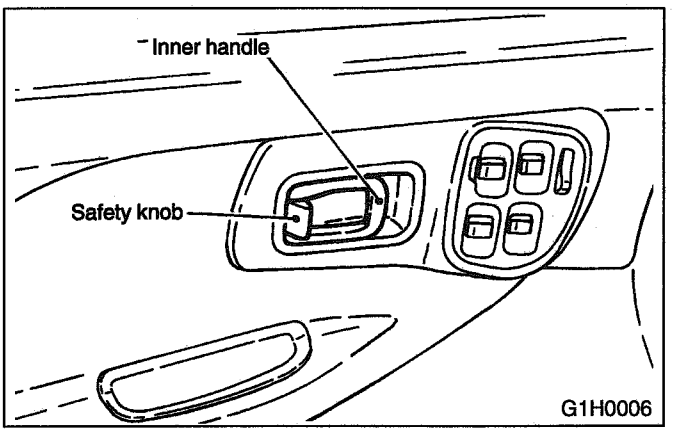


G1H0005

2) Again operate the key plate to ensure the door unlocks.

NOTE:
Replace the lock cylinder if it malfunctions. When the door lock seems to be operating slowly, lubricate the moving parts with grease or oil.

3) Sit in the driver seat, close the door completely, and move the safety knob to lock the door. Then, pull the inner handle to ensure the door will not open.



G1H0006

3. CHECK THE LOOSENESS OF DOORS.

1) Open and close the door two or three times with a somewhat strong force.
2) Check the bolts or screws securing the door hinge, lock and striker for looseness. Retighten loose ones to the specified tightening torque.

4. CHECK THE OPERATION OF REGULATOR HANDLE AND POSITION OF DOOR WINDOW GLASS.

1) Operate the regulator handle to see if the window rises and lowers smoothly.
2) Make sure that the front of the glass stopper is simultaneously in contact with the glass when the glass is completely raised.
3) Also ensure the side windows and locks operate normally.

5. CHECK THE OPERATION OF POWER WINDOW.

1) Depress the power window switches to fully open the windows.
2) Depress the power window switches to fully close the windows.
3) Repeat steps 1) and 2) two or three times to see how the windows open and close.

6. CHECK THE OPERATION OF POWER DOOR LOCK.

1) Close the door completely.
2) Operate the lock lever on the driver's door to lock and check that all the doors are locked.
3) Operate the lock lever on the driver's door to unlock and check that all the doors are unlocked.
4) Repeat the above steps two or three times.

C: TRUNK LID, REAR GATE AND FUEL LID OPERATION

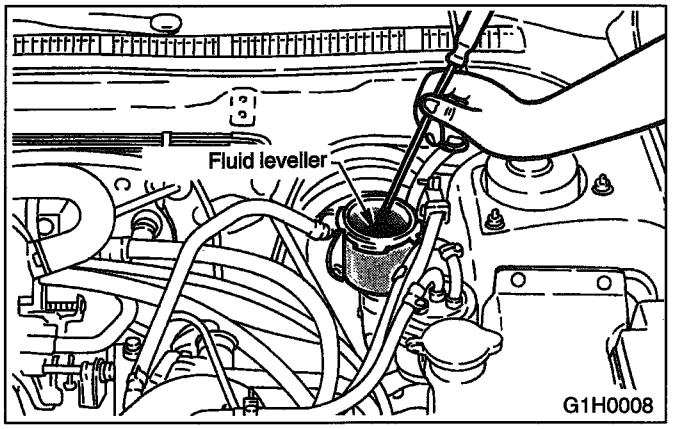
CHECK POINTS
1. Trunk lid, rear gate and fuel lid "open-close" operation
2. Operation of trunk lid and rear gate (release and lock)
3. Fitting of trunk lid, rear gate and fuel lid
4. Operation of trunk lid opener cancel lever

D: BRAKE FLUID LEVEL AND BRAKE PIPING INSTALLATION

CHECK POINTS
1. Fluid level in brake reserve tank
2. Wiring of fluid leveller and its operation
3. Brake booster, master cylinder and pressure control valve for proper installation; brake pipe, brake hose and connectors for proper fitting
4. Leakage in any of the above

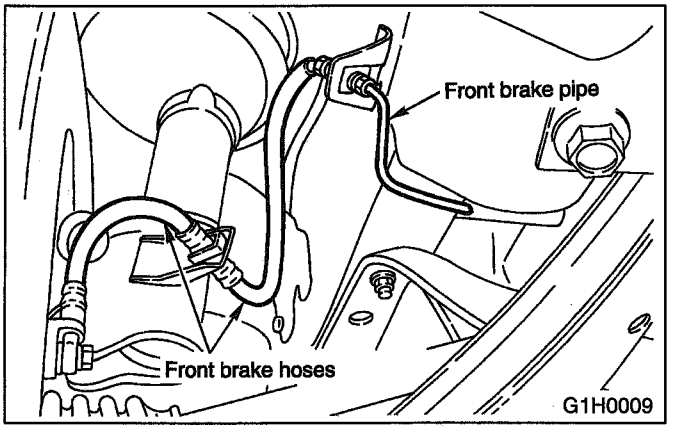
1. CHECK FLUID LEVELLER OPERATION WHILE PUSHING IT DOWN WITH A SCREWDRIVER.

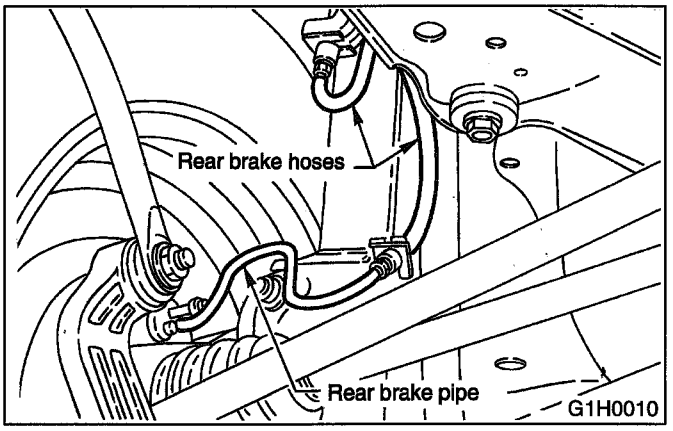
CAUTION:
- **The fluid level must be kept at "MAX" level.**
- **Do not mix different brands of brake fluid.**
- **When adding brake fluid, be careful not to allow any dirt, water, or oil around the fluid tank to enter it.**
- **Use special care not to spill any brake fluid on the vehicle's painted surfaces, because it will quickly erode them. In case of an accident, wipe it off as quickly and as cleanly as possible.**
- **Never use engine oil, gear oil, or any mineral oil.**
- **Use extreme care not to allow any water to get into the fluid; water in the brake fluid will lower the fluid's boiling point and cause vapor-lock.**
- **If too much brake fluid is missing, check the brake line for possible leakage.**
- **After adding brake fluid, any excess must be stored in a tightly sealed container.**
- **When checking the operation of leveller, use clean screwdriver or the like and be careful not to allow dirt or dust to get into the tank.**



Recommended brake fluid
FMVSS No. 116, fresh DOT3 or DOT4 brake fluid

1) Check that the brake pipes, hoses and connectors are in good condition.





(1) Brake fluid is not oozing or leaking from the brake fluid lines.
(2) The connectors and clamps are not loose.
(3) There is no possibility of the pipes and hoses contacting the body or other mechanical parts due to vibration during running.

E: BATTERY FLUID LEVEL AND BATTERY INSTALLATION

CHECK POINTS

1. **External parts**
2. **Electrolyte level**
3. **Specific gravity**

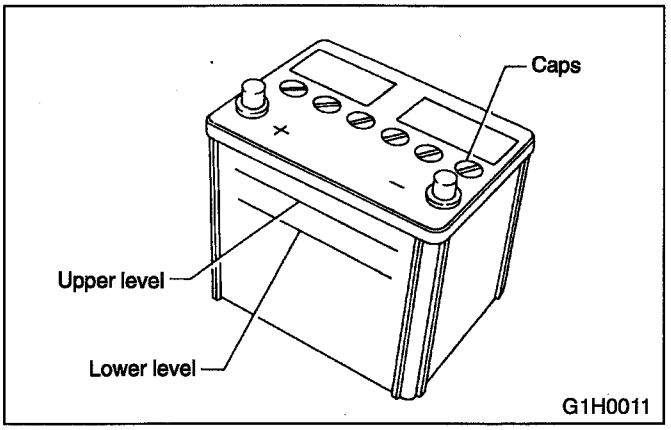
WARNING:
- **Electrolyte has toxicity; be careful about handling the fluid.**
- **Avoid contact with skin, eyes or clothing. Especially in case of contact with eyes, flush with water for 15 minutes and get prompt medical attention.**
- **Batteries produce explosive gases. Keep sparks, flame, cigarettes away.**
- **Ventilate when charging or using in enclosed space.**

1. CHECK THE EXTERNAL PARTS

Check for the existence of dirt or cracks on the battery case, top cover, vent plugs, and terminal posts. If necessary, clean with water and wipe with a dry cloth. Apply a thin coat of grease on the terminal posts to prevent corrosion.

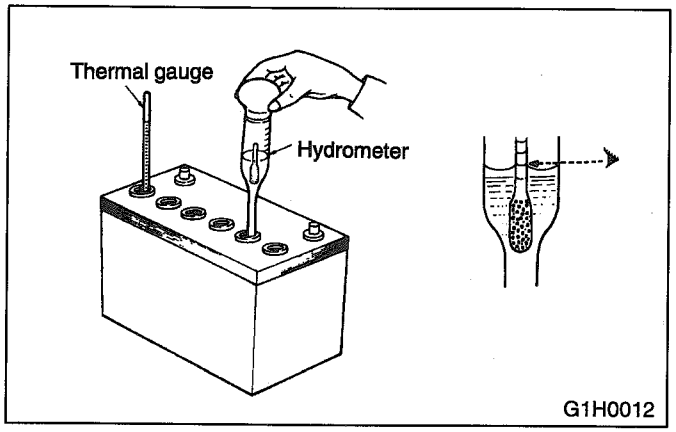
2. CHECK THE ELECTROLYTE LEVEL

Check the electrolyte level in each cell. If the level is below MIN LEVEL, bring the level to MAX LEVEL by pouring distilled water into the battery cell. Do not fill beyond MAX LEVEL.



3. CHECK THE SPECIFIC GRAVITY

The specific gravity of electrolyte can be measured with a hydrometer. Holding the glass tube vertically, slowly draw the liquid into the tube. Take the reading on the float scale at the highest point of the liquid.
When reading, the eye should be level with the surface of the liquid.



Serviceable specific gravity
1.220 — 1.280 at 20°C (68°F)

If the specific gravity reading is below 1.220 at 20°C (68°F), the battery must be recharged and, if necessary, the specific gravity of the electrolyte must be adjusted. The specific gravity changes according to temperature. The standard temperature is considered to be 20°C (68°F).
When measuring the specific gravity, calculate as follows:

S = St + 0.0007 (t – 20)

S = Specific gravity corrected for 20°C (68°F)
St = Measured specific gravity at t°C
t = Electrolyte temperature on centigrade scale (°C)
0.0007 = Temperature coefficient

[EXAMPLE]
A hydrometer reading of 1.273 at 30°C (86°F) is corrected to 1.280 at 20°C (68°F), indicating that the battery is fully charged. On the other hand, a reading of 1.251 at -10°C (14°F) is corrected to 1.230 at 20°C (68°F), indicating that the battery is partially charged.

F: COOLANT LEVEL AND COOLING FAN INSTALLATION

CHECK POINTS

1. **Coolant level**
2. **Cooling fan motor and wiring**
3. **Water leakage and hose damage**

WARNING:
The radiator is a high pressure type. Never attempt to open the radiator cap when the coolant's temperature is high; otherwise boiling water will spurt out. Be sure to wait until the engine cools down before opening the radiator cap.

CAUTION:
- **The level must be kept at "FULL" level.**
- **Use only genuine SUBARU Coolant (P/N 000016218).**
- **Avoid using any coolant or only water other than this designated type to prevent corrosion.**
- **When retightening the hose clamps, be careful not to over-tighten them, as doing so could damage the hose.**

NOTE:
- Always inspect and add at reserve tank when engine is cold.
- If reserve tank is empty, check coolant level in radiator. Add coolant up to filler neck of radiator too, if necessary.

G: ENGINE OIL LEVEL

CHECK POINTS

1. **Engine oil level**
2. **Engine oil leakage or contamination**

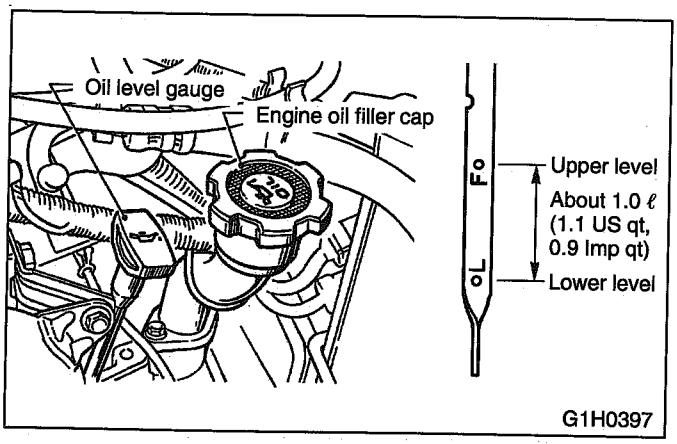
1. CHECK THE ENGINE OIL LEVEL

The level should be within the specified range marked on the gauge.

NOTE:
- Check engine oil level before starting the engine, when engine oil is cold, to obtain correct level reading. After stopping a hot engine, wait

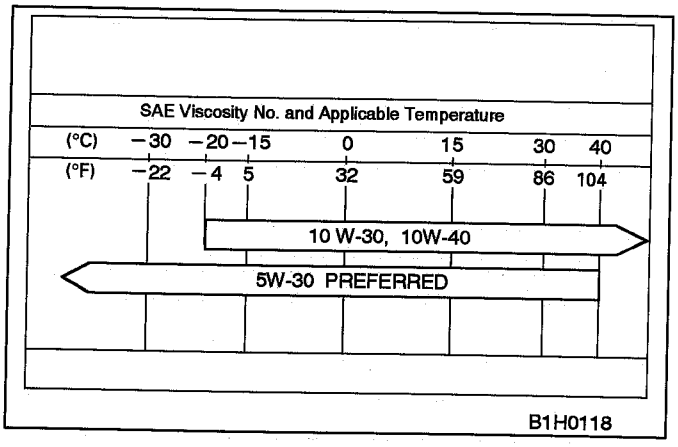
about 5 minutes until oil returns to oil pan before checking oil level. Oil level reading will be slightly higher than when engine is cold due to oil expansion. It is advisable to check oil level each time oil is replenished.

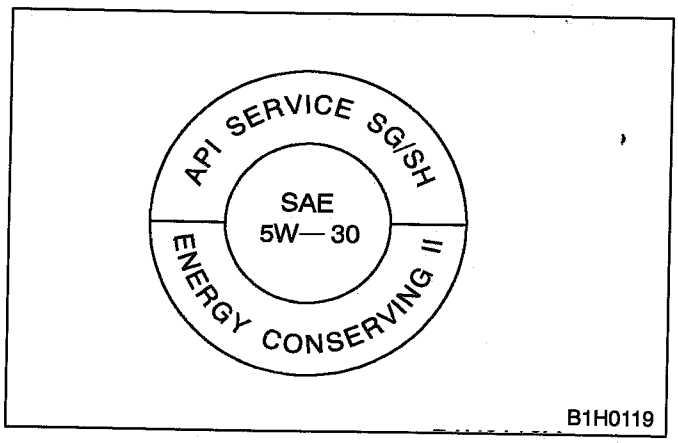
- Insert the oil level gauge into guide hole.

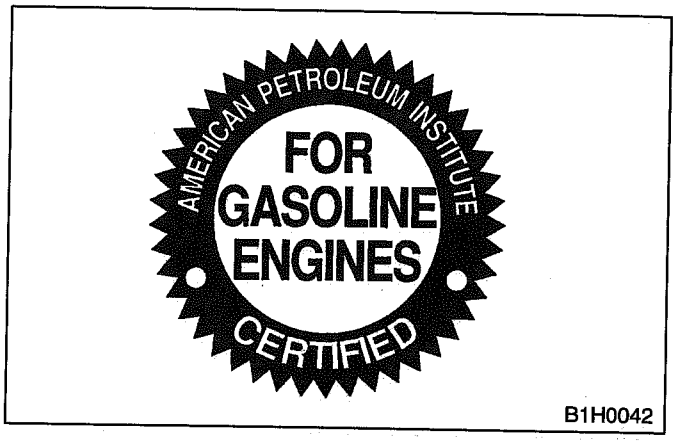


Recommended oil

API classification: SH or SG with the words "Energy Conserving II", or ILSAC certification mark is displayed on the container







CAUTION:
When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

NOTE:

- If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used:

API classification: SH
SAE Viscosity No.: 30, 40, 10 W - 50, 20W - 40, 20 W - 50

H: TRANSMISSION AND DIFFERENTIAL GEAR OIL LEVEL

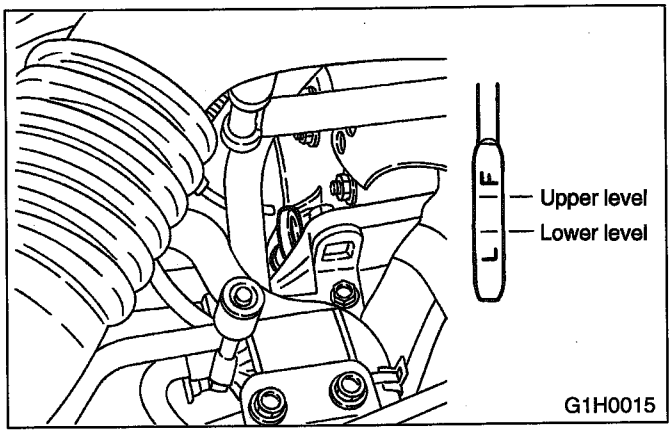
CHECK POINTS

1. **Level of transmission gear oil for manual transmission**
2. **Level of rear differential gear oil for AWD model**
3. **Level of front differential gear oil for automatic transmission**

1. CHECK THE LEVEL OF TRANSMISSION GEAR OIL FOR MANUAL TRANSMISSION

CAUTION:
When inserting the level gauge into transmission, align the protrusion on the side of the top part of the level gauge with the notch in the gauge hole.

NOTE:
The level should be within the specified range marked on the gauge.



- **Recommended oil**

ITEM								
• Transmission gear oil								
API Classification								
GL - 5								
SAE Viscosity No. and Applicable Temperature								
(°C)	-30	-26	-15	-5	0	15	25	30
(°F)	-22	-15	5	23	32	59	77	86
90								
85W								
80W								
75W - 90								

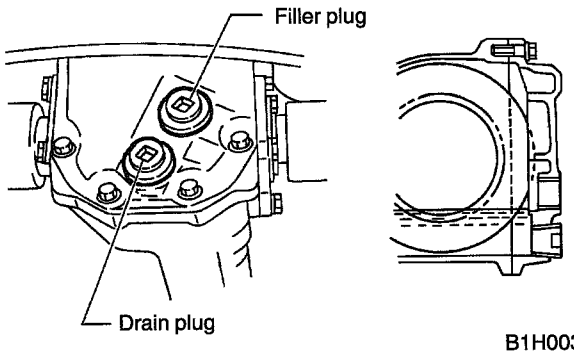
B1H0024

2. CHECK THE LEVEL OF REAR DIFFERENTIAL GEAR OIL

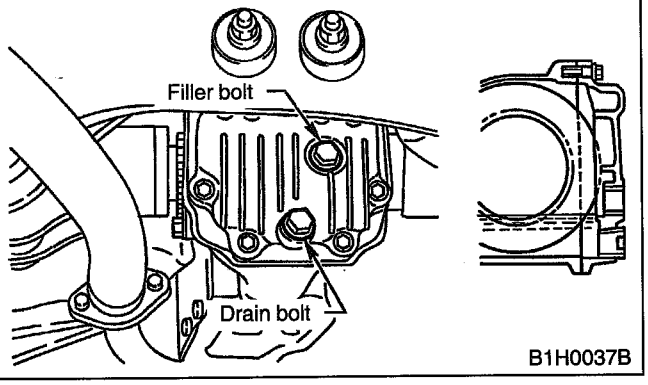
CAUTION:
Each manufacturer uses different base oils and additives. Thus, do not mix brands.

The oil level must be kept above the bottom of the filler bolt. If below that level, add oil up to the bottom line.

2200 cc MT model



Except 2200 MT model



- **Recommended oil**

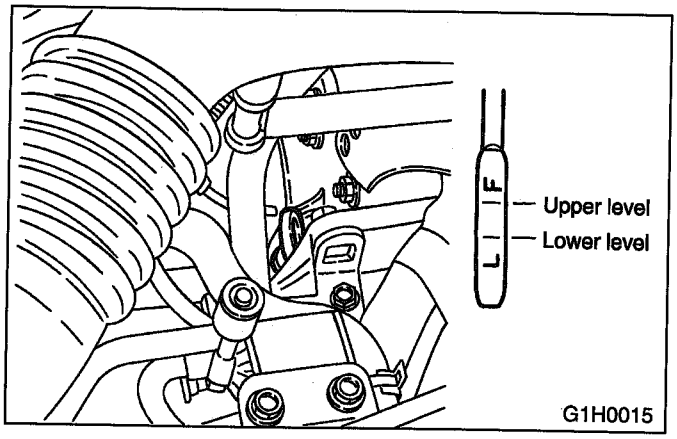
ITEM								
• Rear differential gear oil								
API Classification								
GL - 5								
SAE Viscosity No. and Applicable Temperature								
(°C)	-30	-26	-15	-5	0	15	25	30
(°F)	-22	-15	5	23	32	59	77	86
90								
85W								
80W								
75W - 90								

B1H0038

3. CHECK THE LEVEL OF FRONT DIFFERENTIAL GEAR OIL FOR AUTOMATIC TRANSMISSION

CAUTION:
When inserting the level gauge into differential gear, align the protrusion on the side of the top part of the level gauge with the notch in the gauge hole.

NOTE:
The level should be within the specified range marked on the gauge.



- **Recommended oil**

ITEM									
• Front differential gear oil									
API Classification									
GL - 5									
SAE Viscosity No. and Applicable Temperature									
(°C)	-30	-26	-15	-5	0	15	25	30	
(°F)	-22	-15	5	23	32	59	77	86	
90									
85W									
80W									
80W - 90									

B1H0039

I: DRIVE BELT TENSION

CHECK POINTS

1. **Belt tension**
2. **Damage to belt**

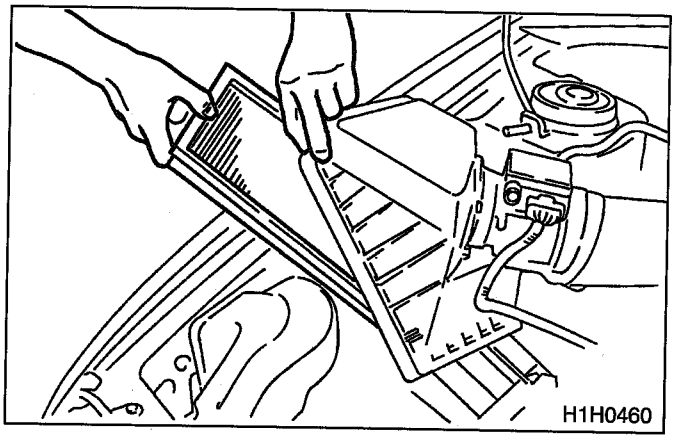
Ref. to 1-5 [01A0].

J: AIR CLEANER

CHECK POINTS

1. **Contamination of air cleaner element**
2. **Related parts**

Check the air cleaner element for contamination or presence of foreign matter.



NOTE:
- The air cleaner element is a viscous type, which should not be washed or cleaned.
- If the air cleaner element is broken or damaged, replace it with a new one.

K: JACK INSTALLATION

CHECK POINT

1. **Installed condition of jack**

L: WASHER AND WIPERS

CHECK POINTS

1. **Installation of washer tank**
2. **Checking of washer fluid level**
3. **Direction and quantity of washer fluid sprayed**
4. **Operation of wiper and washer**

In areas where water freezes in winter, use SUBARU windshield washer fluid (003406401) or equivalent.
The relationship between fluid to water ratio and freezing point is as follows:

Fluid to water ratio (%)	Freezing point °C (°F)
30	–12 (10)
50	–20 (–4)
100	–45 (–49)

CAUTION:
• Do not operate the wipers before clean the window glass.
• In freezing weather, do not use the windshield washer until the windshield is sufficiently warmed by the defroster.
Otherwise the washer fluid can freeze on the windshield, blocking your view.
• Be sure the wiper blades are not frozen to the windshield or rear window before operating the wipers.
If the wiper operated with the wiper blades are frozen to the windshield or rear window, the wiper blades will be worn or damaged prematurely. Be sure to use defroster or rear window defogger.
• Do not operate the washer continuously for more than ten seconds, or when washer fluid tank is empty. This may cause overheating of the washer motor.
Check the washer fluid level.
• Do not operate the wipers when the windshield or rear window is dry.
This may cause overheating of the washer motor, wear of the wiper blades and scratch of the glass. Before operating the wiper on the dry windshield or rear window, always use the windshield washer.
• Do not clean the wiper blades with gasoline or a solvent, such as paint thinner or benzene. This will cause deterioration of the wiper blades.

NOTE:
• Before operating the wipers, be sure to eject washer fluid onto the window. If the window is dry, the wipers' operating speed and angle of operation will be different from when it is wet.
• If the position at which washer fluid is ejected is wrong: Using an eyeleteer or similar tool, adjust the direction of the nozzle, be careful not to damage the nozzle hole.
• Grease, wax, insects or other material on the windshield or the wiper blades results in jerky wiper operation and unclear frontal view. If you can not get clear view after operating the windshield washer or wiper operation is jerky, clean the outer surface of the windshield and wiper blades with a neutral detergent.
Wiper blades, windshield and rear window should be cleaned with sponge, soft cloth or mild-abrasive cleaner.
After cleaning, rinse the windshield and wiper blades with clean water. The windshield is clear if beads do not form when you rinse the windshield with water.

M: REAR WINDOW WASHER AND WIPER

CHECK POINTS

1. **Quantity of washer fluid**
2. **Direction and quantity of washer fluid sprayed**
3. **Operation of rear window washer and wiper**

N: WHEEL NUTS FOR LOOSENESS AND TIRE INFLATION PRESSURE

CHECK POINTS

1. **Wheel nut tightening torque**
2. **Tire inflation pressure and tire specification**
3. **Damage to tire and rim**

1. CHECK THE WHEEL NUT TIGHTENING TORQUE

NOTE:
• When checking the wheel nuts, be sure to use a torque wrench, and tighten the nuts to the specified torque.
• After inspecting and adjusting the tire pressure, be sure to put the valve cap back.

Tightening torque:
88 ± 10 N.m
(9 ± 1 kg-m, 65 ± 7 ft-lb)

2. CHECK THE TIRE INFLATION PRESSURE AND TIRE SPECIFICATION

CAUTION:
Check that all tires are adjusted to the specified tire inflation pressure.

Tire size	Tire inflation pressure kPa (kg/cm^2, psi)	
	Front	Rear
P175/70R14 84S	220 (2.2, 31)	200 (2.0, 29)
P195/60R15 87H	220 (2.2, 31)	200 (2.0, 29)
P205/60R15*	220 (2.2, 31)	186 (1.9, 27)

*: OUTBACK model only

O: SEAT ADJUSTER AND SEAT BELTS

CHECK POINTS

1. **Front and rear seats, and their facing materials**
2. **Front seat operation**
3. **Rear seat folding operation**
4. **Seat belts and their fit**
5. **Installing procedure for child anchor**

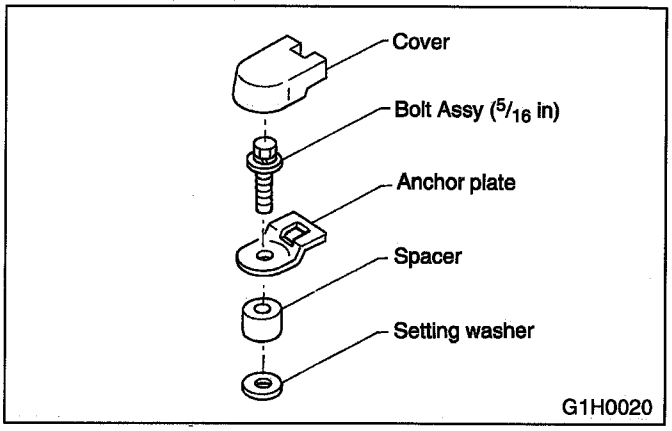
1. MANUAL THREE-POINT TYPE

The seat belt warning light on the instrument panel comes on for approximately six seconds with the ignition switch "ON".
And the warning chime sounds if the driver's seat belt is not fastened.
Make sure that the warning system works normally.

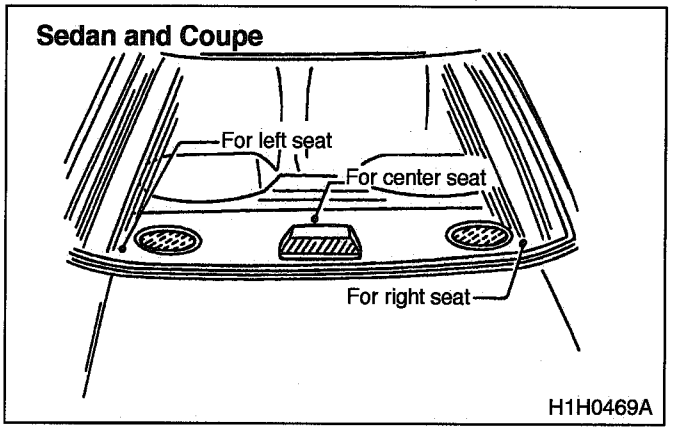
2. INSTALLING PROCEDURE FOR CHILD ANCHOR

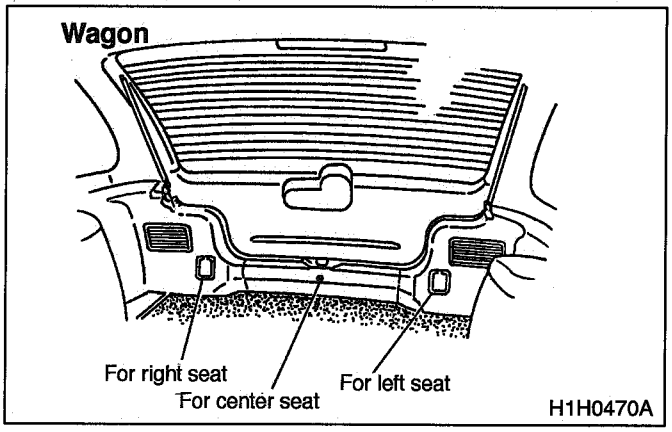
CAUTION:
- **Be sure to install the plate anchor set in the correct direction.**
- **Before tightening the plate anchor set, position the plate in the pawl of the cover. Do not allow the cover base to be caught between the plate anchor and spacer.**
- **Always use a genuine top strap anchor.**

When top strap anchor is used for rear seat:
1) For Canada models, the anchor set is inside the glove box. Take it out and check that its components are assembled as shown in figure.



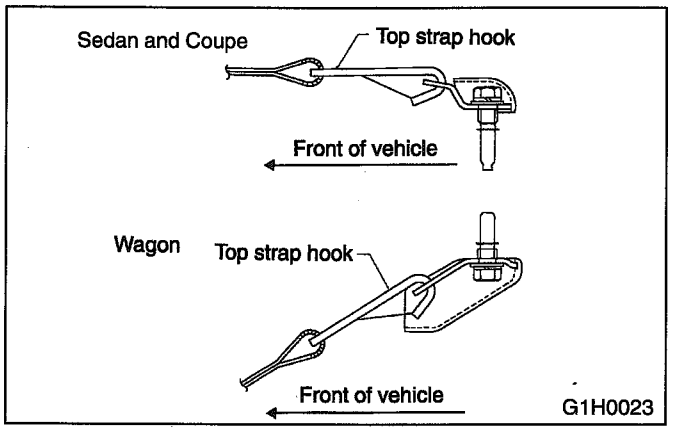
2) The anchor installation points are covered with caps. Remove the cap at the desired anchor installation points.





3) Install the anchor at the installation point. Tighten the bolt so that the anchor is completely secured.

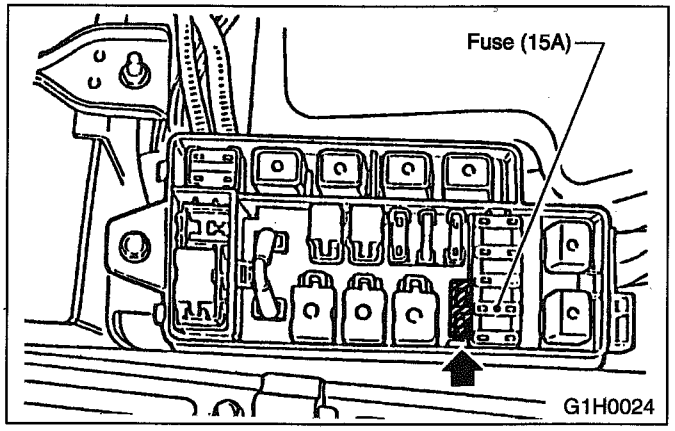
4) Attach the cover to the anchor plate.
5) Attach the hook of the top strap to the anchor.



P: FUSES

CHECK POINTS
1. Fuse installation
2. Spare fuse

Fuse as shown in figure is disconnected to avoid discharging the battery.
Insert fuse (15A) in the main fuse box inside the engine compartment.
Use fuse indicated by arrow in figure.



Q: LIGHTS AND SWITCHES

CHECK POINTS
1. Visual inspection of lights (installation, damage, dirty lenses, water inside, etc.)
2. Operation of all lights and switches
3. Horn operation
4. Operation of heater and ventilator
5. Removing the clip for room light switch

R: PREPARATION FOR UNDERSIDE INSPECTION

CHECK POINT
1. Jacking up and lifting point

Ref. to 1-3 [0700].

S: TEST MODE CONNECTOR

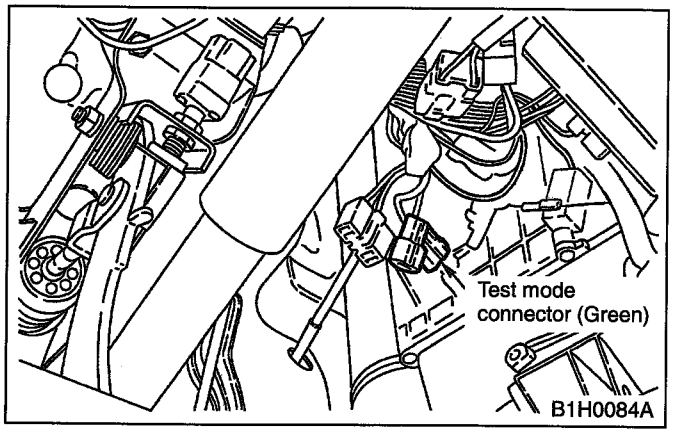
CHECK POINTS
1. Check engine light flashing
2. Test mode connector disconnection

1. CHECK THE ENGINE LIGHT FLASHING

NOTE:
• When ignition switch is turned to ON (engine OFF) or to "START" with the test mode connector connected, the MIL (check engine light) blinks at a cycle of 3 Hz.
• If engine fails to turn over when the ignition switch is set to START, check the spark plugs. <Ref. to 6-1 [W3B0].>

2. CHECK TEST MODE CONNECTOR DISCONNECTION

NOTE:
Disconnect test mode connector. If the MIL (check engine light) illuminates with engine ON, this indicates that a trouble has occurred. Check Troubleshooting. <Ref. to 2-7 [T7A0]>.

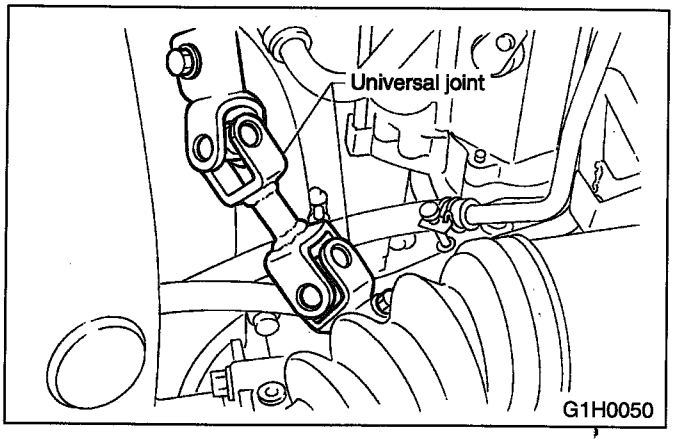


T: INSTALLATION OF STEERING COMPONENTS

CHECK POINTS

1. **Installation of universal joints**
2. **Steering gear box for looseness, play, or backlash, and boots for damage**
3. **Tie-rod and tie-rod end for proper installation, or damage**

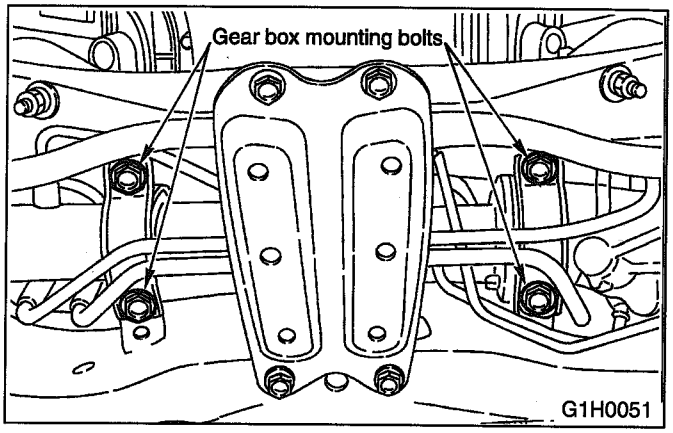
1. CHECK THE UNIVERSAL JOINT FOR LOOSENESS



NOTE:
When checking, turn ignition switch to "ACC" position.

Tightening torque:
24 ± 3 N.m (2.4 ± 0.3 kg-m, 17 ± 2.2 ft-lb)

2. CHECK THE GEAR BOX MOUNTING BOLT FOR LOOSENESS



NOTE:
Carefully check the root portion of the boots, and the condition of the clips.

Tightening torque:
59 ± 12 N.m (6 ± 1.2 kg-m, 43 ± 9 ft-lb)

3. CHECK THE TIE-ROD END LOCK NUT FOR LOOSENESS

Tightening torque:
83 ± 5 N.m (8.5 ± 0.5 kg-m, 61 ± 3.6 ft-lb)

U: EXHAUST PIPE AND MUFFLER

CHECK POINTS

1. **Installation of exhaust system**
2. **Exhaust gas leakage from parts or joints**

Check the exhaust system's installation for looseness, damage and possible interference with other parts. <Ref. to 2-9 [C100].>

WARNING:
When the engine is running, and for a short time after it is stopped, the exhaust system remains very hot; use extreme care and don't get burnt during this evolution.

V: FUEL SYSTEM FOR LEAKAGE

CHECK POINTS
1. Installation of fuel hose and pipe. And condition of clamps
2. Fuel system for leakage

1. CHECK THE INSTALLATION OF FUEL HOSE AND PIPE. AND CONDITION OF CLAMPS

WARNING:
When checking the fuel system, use extreme care to prevent accidental fires.

1) Check the fuel hose's layout, and also search for interference with other parts, twists, or damage, check the condition of the clamps.
2) Check the fuel and air breather pipes visually or by feeling with your fingers from the underside. Retighten the clamps if necessary.

NOTE:
When retightening the clamps, do not tighten them excessively.

2. CHECK THE FUEL SYSTEM FOR LEAKAGE

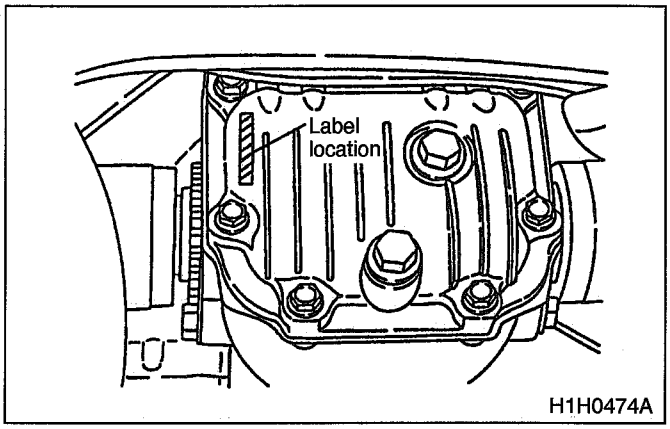
Without starting the engine, turn the ignition switch to the ON position, and operate the fuel pump to pressurize the fuel system. Then check the fuel system for leakage.

W:PROTECTOR

CHECK POINT
1. Protector removal

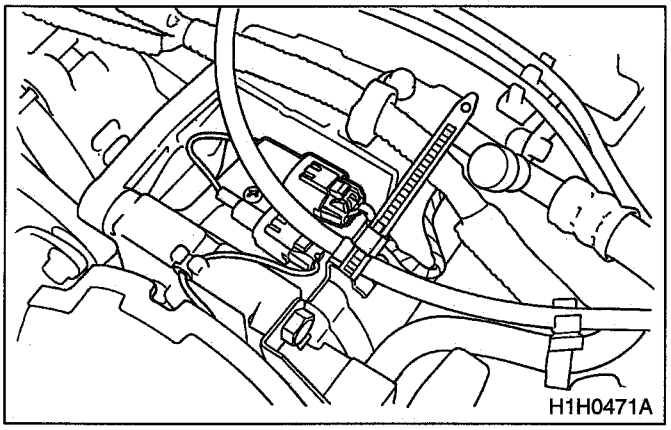
The following parts are covered to prevent splashing of wax. Remove protector.

NOTE:
Label of rear differential is covered by tape. Remove it.



X: AIR CONDITIONING SYSTEM

CHECK POINT
1. A/C compressor connector connection



3. Road Test Inspection

A: OPERATION OF INDICATOR LIGHTS AND GAUGES

CHECK POINTS
1. Operation of indicator lights
2. Operation of gauges

Check the operation according to the "Owner's manual".

NOTE:
- Perform this inspection with the gear shift lever in the neutral position.
(For automatic transmission models: Set the select lever in the "P" position.)
- Set the parking brake.
- Do not race the engine excessively.

B: TACHOMETER, RADIO, ETC.

CHECK POINTS
1. Operation of tachometer, radio, cigarette lighter, etc.

1. TACHOMETER

Race the engine two or three times, and check the tachometer's operation.

CAUTION:
Do not race the engine more than necessary.

2. RADIO

Check the operation according to the "Owner's manual".

3. CIGARETTE LIGHTER

To operate, push in the knob completely and wait for a moment. The lighter will click out of holder automatically when ready to use.

CAUTION:
- **To avoid the possibility of being burned, do not hold the cigarette lighter in by hand. This may also cause damage to the lighter heating element.**
- **When replacing the knob, it is recommended that you use only a genuine part. If you use either non-genuine parts or any combination of parts different from original knob-and-socket combination, it may cause overheating due to a short circuit.**

C: STARTING CONDITION OF ENGINE

CHECK POINT
1. Starting condition of engine

1) Check that the engine starts quickly and runs smoothly without any abnormal noise.

WARNING:
- **Before starting the engine, make sure that there is nothing which will burn easily behind the car and that there is no dry grass near the exhaust pipe.**
- **Do not leave the engine running in a closed garage as there is the danger of poisoning from the exhaust gases.**

2) From how it starts, judge if the spark plugs, distributor and auxiliary equipment (throttle body or air cleaner, etc.) are in good condition.

WARNING:
- **The engine has already been operated for transportation purposes.**
- **For safety's sake, never touch the following parts while the engine is operating.**
  - **(1) Revolving parts such as the belt, fan, etc.**
  - **(2) High-temperature parts such as the exhaust pipe, radiator, etc.**
  - **(3) Electric system such as the plugs, cords, etc.**
- **Be careful not to leave inflammable paper or clothes in the engine compartment.**
- **Never try to disconnect hoses or wirings.**

D: DRIVING TEST

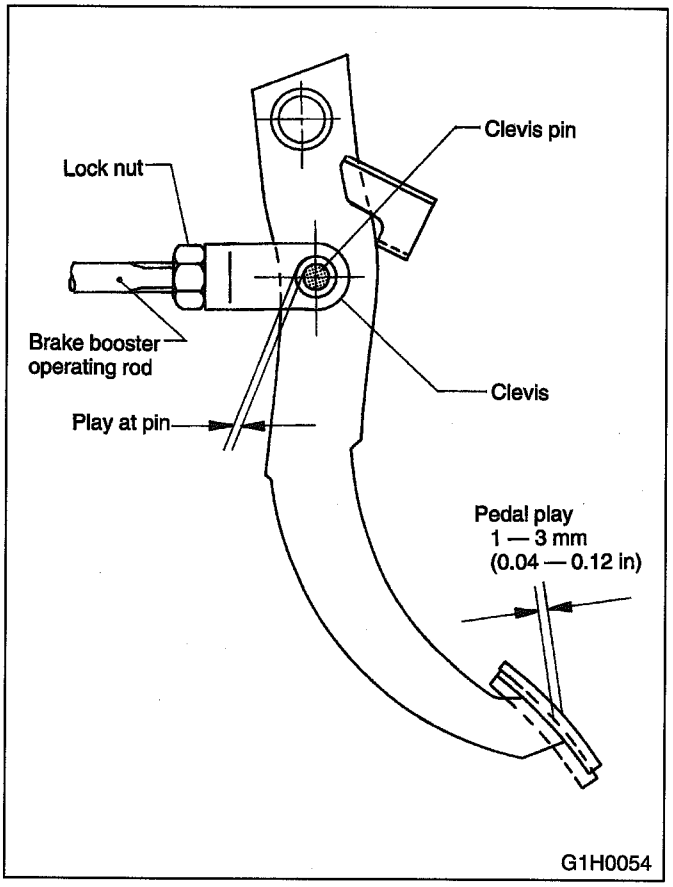
CHECK POINTS

1. **Operation of foot brake and parking brake**
2. **Inspect the clutch pedal free play**
3. **Operation of clutch and gear shift**
4. **Operation of select lever (Automatic transmission)**
5. **Operation of starter interlock (Manual transmission)**
6. **Operation of steering and position of steering wheel**
7. **Operation of turn signal cancel cam**
8. **Operation of ventilation system and heater**
9. **Abnormal noises or vibration**
10. **Operation of cruise control**

1. CHECK THE FOOT AND PARKING BRAKES' OPERATION

CAUTION:
Be sure to perform this test in a safe area.

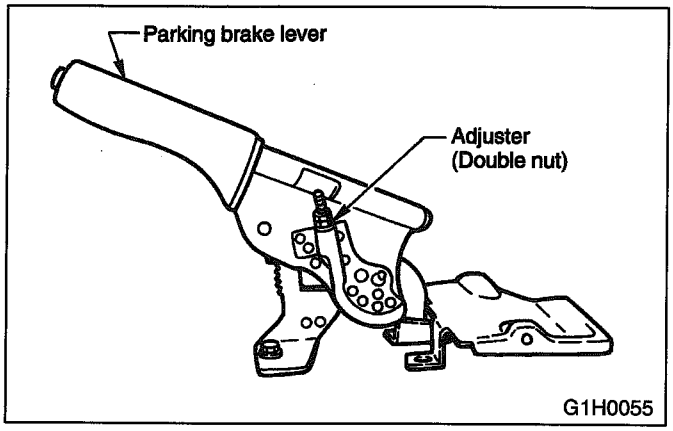
1) Drive on a dry, level, paved road, and apply normal braking. Look for uneven or improper operation, or pulling to one side.
2) Press the brake pedal in two or three times, and keep it fully depressed. Make sure that the brake can be kept that way for at least five seconds. Also check for air in the brake system, or brake fluid leakage.
3) Perform the adjustment of operating rod assembly as follows:
(1) Be sure engine is off. (No vacuum is applied to brake booster).
(2) There should be play between brake booster clevis and pin at brake pedal installing portion.
[Depress brake pedal pad with a force of less than 10 N (1 kg, 2 lb) to a stroke of 1 to 3 mm (0.04 to 0.12 in).]



(3) Depress the surface of brake pad by hand.
(4) If there is no free play between clevis pin and clevis, loosen lock nut for operating rod and adjust operating rod by turning in the direction that it is shortened.
(5) After adjustment, make sure there is no brake dragging.

4) Pull the parking brake lever completely out, and check its operation. Also check the ratchet for normal functioning.
Check the parking brake lever stroke. If it is out of specification, adjust it by turning adjusting nut at parking brake lever.

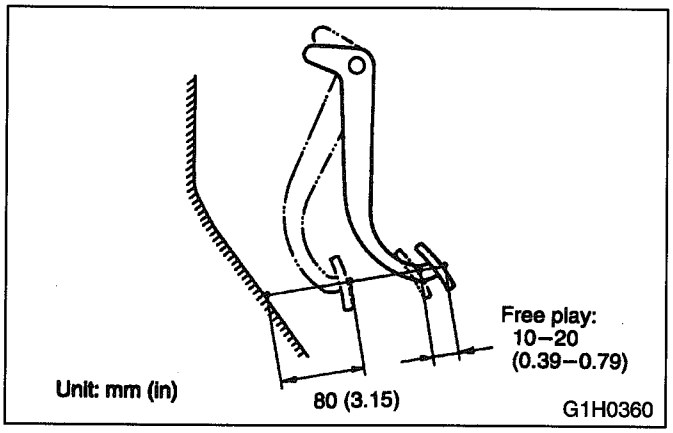
Parking brake lever stroke:
Standard:
7 — 8 notches/196 N (20 kg, 44 lb)



2. INSPECT THE CLUTCH PEDAL FREE PLAY

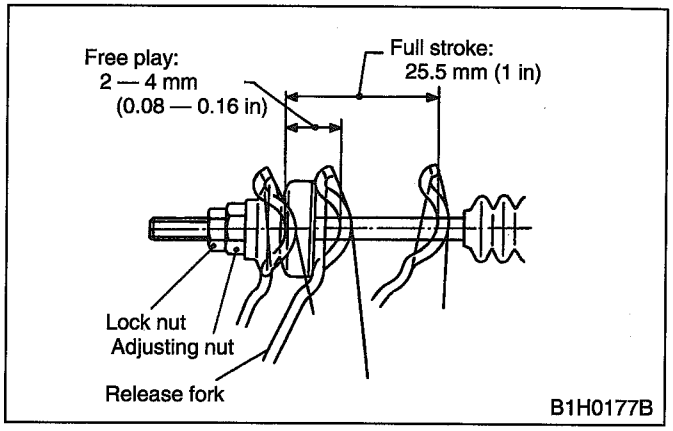
1) Mechanical application type
(1) Lightly press the clutch pedal down with a finger to check the free play.

Standard free play at clutch pedal:
10 — 20 mm (0.39 — 0.79 in)



(2) If it is out of specification, adjust it by turning adjusting nut on engine side end of clutch cable at release fork.

Fork lever free play allowance:
2 — 4 mm (0.08 — 0.16 in)



Tightening torque:
5.4 — 9.3 N.m
(0.55 — 0.95 kg-m, 4.0 — 6.9 ft-lb)

3. CHECK THE OPERATION OF CLUTCH AND GEAR SHIFTING

CAUTION:
- **Be sure to perform this test in a safe area.**
- **Do not repeat this test.**

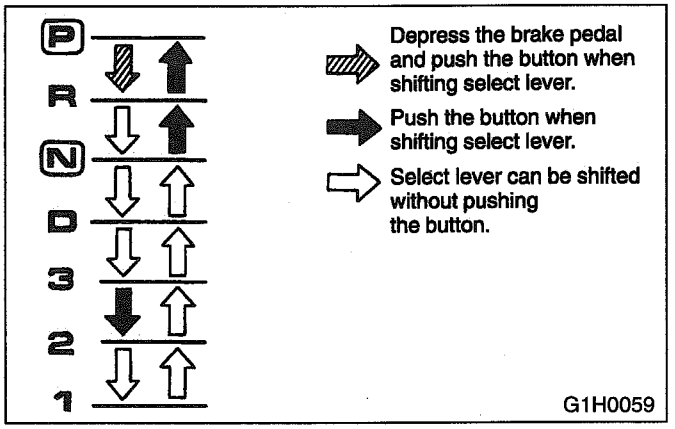
1) With the engine idling and the shift lever in neutral, gradually depress the clutch pedal, to see if it generates any abnormal noise.

NOTE:
Carefully compare a normal clutch's operating sounds to the clutch being tested.

2) Pull the parking brake lever completely out, and place wheel chocks under the tires. Then depress the clutch pedal completely, and place the shift lever in 5th speed.
Raise engine rpm a little, gradually engage the clutch, and see if the engine stalls.
If the engine stalls, it means that the clutch is not slipping.
3) Remove the wheel chocks, and return the shift lever to neutral, then check the gear shifting mechanism for excessive play.
4) Drive the car at various speeds. While depressing the clutch pedal completely, move the gear shift lever into each position, and check for any unusual play or unusual resistance.

4. OPERATION OF SELECTOR LEVER (AUTOMATIC TRANSMISSION MODELS)

1) Check the operation of shift lock system and key interlock.
Ensure that select lever is shifted from "P" to any other position only after brake pedal is depressed.
Also ensure that ignition key is removed from key cylinder only when select lever is set to "P" position.
2) Place the selector lever in each position, and make sure that the pointer indicates the position of each range correctly.



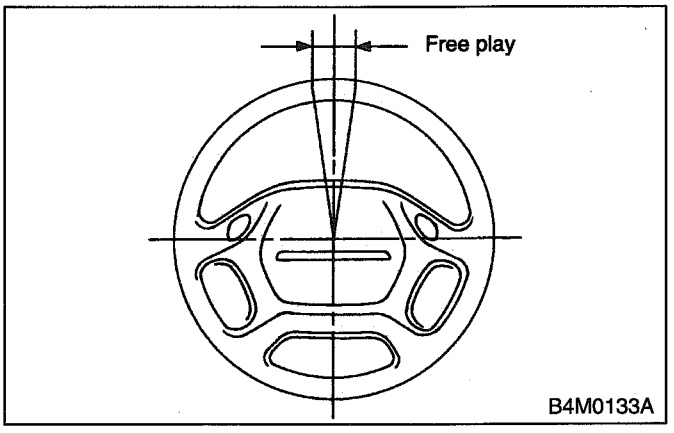
5. OPERATION OF STARTER INTERLOCK (MANUAL TRANSMISSION MODELS)

Ensure that engine starts only when after clutch pedal is depressed.

6. OPERATION OF STEERING AND POSITION OF STEERING WHEEL

1) Check the steering wheel for free play.

Steering wheel free play:
0 — 17 mm (0 — 0.67 in)



2) With the car moving straight ahead, check for hard steering, shimmy, or other abnormalities.
3) Make a turn, and check for hard or heavy steering wheel operation, or poor stability.

7. OPERATION OF TURN SIGNAL CANCEL CAM

Make a right or left turn with the turn signal on, and make sure that the turn signal switch returns automatically to the OFF position when the steering wheel is returned to the straight ahead position.

8. OPERATION OF VENTILATION SYSTEM AND HEATER

1) While driving, move the control lever and dial into each position, and check the ventilation system's operation. Also check for unusual vibration or noises.
2) Move the temperature control lever and fan switch, and make sure that warm air is discharged into the compartment.

9. ABNORMAL NOISES OR VIBRATION

1) When starting the engine, and while driving the vehicle, check the engine, transmission, body, suspension, and steering system for any unusual noises or vibration.
Do this when idling the engine, accelerating, decelerating, and running at low, middle and high speeds.
2) Depress the accelerator pedal, and make sure that the engine rpm increase smoothly and that the vehicle accelerates smoothly.
3) While driving, turn the steering wheel right and left to test the vehicle's stability and response.

CAUTION:
Be sure to perform this test in a safe area.

10. CHECK THE OPERATION OF THE CRUISE CONTROL ACCORDING TO "OWNER'S MANUAL"

CAUTION:
Be sure to conduct driving tests using a chassis dynamometer with front wheels set in operation, or tests on an authorized race course or similar place.

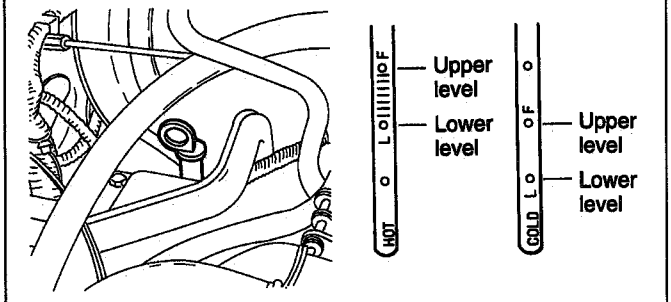
4. Post-road Test Inspection

A: AUTOMATIC TRANSMISSION FLUID (ATF) LEVEL

CHECK POINT
1. Level of ATF

CAUTION:
Do not fill above the high mark level.

NOTE:
If the fluid level is at the lower mark or below on the "HOT" side, add the recommended ATF to bring the level to the high mark. ATF is added through the level gauge hole. When the fluid level has to be checked without time to warm up the AT, check to see that the fluid level is within the marks on the "COLD" side. If it is below the marks, add fluid.



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The ATF should be maintained at the proper level as follows:
1) Drive the car several miles to bring the transmission to the normal operating temperature. 60 to 80°C (140 to 176°F) is normal.
2) Park the car on a level surface.
3) While idling the engine, move selector lever to all ranges. Then return to the P range.
4) Remove the level gauge and wipe it clean.
5) Reinsert the level gauge completely.
6) Remove it again and note its reading.

B: POWER STEERING FLUID LEVEL

CHECK POINT
1. Level of power steering fluid

The power steering fluid shoud be maintained at a proper level.

CAUTION:
The available power steering fluid is ATF DEXRON II.
Be sure to use the recommended fluid.
When power steering fluid is added, be careful not to allow any dust into the tank.

Check level as follows:
1) Drive the car several miles or kilometers to bring power steering system up to the normal operating temperature of about 60°C (140°F).
2) Park the car on a level surface and stop the engine.
3) Remove the level gauge and wipe it clean.
4) Reinstall the level gauge firmly.
5) Remove it again and read the level on the "HOT" side.
If the fluid level is at lower level or below it, add recommended power steering fluid up to the high level. When the fluid level is to be checked without warming up the power steering system [at approximately 21°C (70°F)], read the fluid level at the "COLD" position of the level gauge.

C: WHEEL ALIGNMENT

CHECK POINTS
1. Toe of front and rear wheels
2. Camber of front wheels

Before check the toe and camber, make sure that the spare tire, floor mats and service tool are in place. No other weight should be present.

D: UNDERSIDE

CHECK POINTS
1. Leakage of engine oil, transmission gear oil, differential gear oil, etc.
2. Leakage of coolant
3. Leakage of brake fluid
4. Loose suspension mountings or steering mounting

Raise the vehicle body and perform these checks from the underside.
1) Visually check for any signs of leakage of engine oil, transmission gear oil, differential gear oil, etc.
2) Visually check for any sign of coolant leakage.
3) Visually check for any sign of brake fluid leakage.
4) Check the suspension mounting and steering mounting for any loose or unconnected parts.

E: WATER LEAKAGE

CHECK POINT
1. Water leakage by pouring water

1) Before performing the water leakage test, remove anything that may obstruct the operation or which must be kept dry.
2) Close all of the windows completely, and then close all of the doors tightly. Close the hood and trunk lid before starting the test.
3) Connect a hose to a tap, and spray water on the vehicle. The rate of water discharge must be approx. 20 to 25 liters (5.3 to 6.6 US gal, 4.4 to 5.5 Imp gal) per minute. When spraying water on areas adjacent to the floor and wheel house, increase the pressure.
When directing water on areas other than the floor portion and wheel house, decrease the pressure. But the force of water must be made strong occasionally by pressing the end of the hose.

NOTE:
Be sure to keep the hose at least 10 cm (3.9 in) from the vehicle.

4) Check the following areas:
(1) Front window and body framework mating portion
(2) Door mating portions
(3) Glass mating portions
(4) Rear quarter window mating portions
(5) Rear window and body framework mating portion
(6) Trunk lid mating portion
(7) Around roof drips

NOTE:
If any dampness in the compartments is discovered after the water has been applied, carefully check all areas that may have possibly contributed to the leak.

F: EXTERNAL APPEARANCE AND EQUIPMENT

CHECK POINTS
1. Paint
2. Scratches or damage to glass
3. Rust formation
4. Contamination of interior parts
5. Installation of equipment

1) Check the paint after removing the paint protective agent and washing the vehicle.

NOTE:
Before removing the protective agent, be sure to wash the vehicle, because the painted surface may be scratched if the surface is rubbed with sand or other hard particles which may be attached to the protective agent.

- Check the whole vehicle body for stains, flaking, damage caused by transportation, rust, dirt, cracks, or blistering.

NOTE:
- It is better to determine an inspection pattern in order to avoid missing an area, since the total area is not small.
- It is desirable not to make corrections to the body paint unless absolutely needed. However, if any corrections are required to remove scratches or rust, the area to be corrected must be limited as much as possible. Re-painting and spray painting must be avoided whenever

possible.

2) Carefully check each window glass for scratches. Slight damage may be removed by polishing with cerium oxide. (Half-fill a cup with cerium oxide, and add warm water to it. Then agitate the content until it turns to wax. Apply this wax to a soft cloth, and polish the glass.)
3) Check each portion of the vehicle body and underside components for the formation of rust. If rust is discovered, remove it with #80 — #180 emery paper, and treat the surface with rust preventive. After this treatment is completed, flush the portion thoroughly, and prepare the surface for repair painting.

• Check each portion of the body and all of the chrome parts for deformation or distortion. Also check each lamp lens for cracks.

4) Check the following interior parts for contamination.
(1) Instrument panel and meter glass
(2) Glove box
(3) Sun visor
(4) Room mirror
(5) Assist rail
(6) Roof trim
(7) Door trim
(8) Inner trim
(9) Front and rear seats
(10) Luggage shelf
(11) Floor mat
(12) Others

NOTE:
• If the meter glass is contaminated, wipe it gently with a clean soft cloth that has been dampened with water.
• Do not rub the meter glass hard; otherwise, the transparent resin plate on it may become clouded due to the formation of scratches.

5) Check the interior and exterior equipment to make sure that they are installed securely. Also make sure that the equipment conforms to the vehicle's specifications.

Make sure that the spare tire, jack, spare key, tools, owner's manual, warranty & service booklet, etc. are all present.

PERIODIC MAINTENANCE SERVICES 1-5

1. Schedule of Inspection and Maintenance Services

A: Federal spec. vehicles

Continue periodic maintenance beyond 192,000 km (120,000 miles) or 120 months by returning to the first column of the maintenance schedule and adding 192,000 km (120,000 miles) or 120 months to the column headings.

Symbols used:
R: Replace
I: Inspect, correct or replace if necessary.
P: Perform
(I) or (P): Recommended service for safe vehicle operation

	MAINTENANCE ITEM	MAINTENANCE INTERVAL (Number of months or km (miles), whichever occurs first)																	REMARKS
		Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
		x 1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	
		x 1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
1	Drive belt(s) [Except camshaft]						I				R				I				R	
2	Camshaft drive belt						I				R				I				R	
3	Engine oil	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	See NOTE 1)
4	Engine oil filter	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	See NOTE 1)
5	Replace engine coolant and inspect cooling system, hoses and connections					P				P				P				P	
6	Replace fuel filter and inspect fuel system, hoses and connections					(P)				P				(P)				P	See NOTE 2), 6) & 7)
7	Air cleaner					R				R				R				R	
8	Spark plugs					R				R				R				R	
9	Transmission/Differential (Front & Rear) lubricants (Gear oil)					I				I				I				I	See NOTE 3)
10	Automatic transmission fluid					I				I				I				I	See NOTE 4)
11	Brake fluid					R				R				R				R	See NOTE 5)
12	Disc brake pads and discs, Front and rear axle boots and axle shaft joint portions			I		I		I		I		I		I		I		I	See NOTE 6)
13	Brake linings and drums					I				I				I				I	See NOTE 6)
14	Inspect brake line and check operation of parking and service brake system			P		P		P		P		P		P		P		P	See NOTE 6)
15	Clutch operation			I		I		I		I		I		I		I		I	
16	Steering and suspension			I		I		I		I		I		I		I		I	See NOTE 6)
17	Front and rear wheel bearing lubricant									(I)								(I)	
18	Supplemental restraint system	Inspect every 10 years																	
19	Valve clearance	Inspect every 160,000 km (100,000 miles)																	

NOTE:

1) **When the vehicle is used under severe driving conditions such as those mentioned below*, the engine oil should be changed more often.**
2) **When the vehicle is used in extremely cold or hot weather areas, contamination of the filter may occur and filter replacement should be performed more often.**
3) **When the vehicle is frequently operated under severe driving conditions, replacement should be performed every 48,000 km (30,000 miles).**
4) **When the vehicle is frequently operated under severe driving conditions, such as mountain driving replacement should be performed every 24,000 km (15,000 miles).**
5) **When the vehicle is used in high humidity areas or in mountainous areas, change the brake fluid every 24,000 km (15,000 miles) or 15 months, whichever occurs first.**
6) **When the vehicle is used under severe driving conditions such as those mentioned below*, inspection should be performed every 12,000 km (7,500 miles) or 7.5 months, whichever occurs first.**
7) **This inspection is not required to maintain emission warranty eligibility and it does not affect the manufacturer's obligations under EPA's in-use compliance program.**

- * Examples of severe driving conditions:
  - Repeated short distance driving. (Items 3, 12 and 13 only)
  - Driving on rough and/or muddy roads. (Items 12, 13 and 16 only)
  - Driving in dusty conditions.
  - Driving in extremely cold weather. (Items 3 and 16 only)
  - Driving in areas where roads salts or other corrosive materials are used. (Items 6, 12, 13, 14 and 16 only)
  - Living in coastal areas. (Items 6, 12, 13, 14 and 16 only)

B: California spec. vehicles

Continue periodic maintenance beyond 192,000 km (120,000 miles) or 120 months by returning to the first column of the maintenance schedule and adding 192,000 km (120,000 miles) or 120 months to the column headings.

Symbols used:
R: Replace
I: Inspect, correct or replace if necessary.
P: Perform
(I) or (P): Recommended service for safe vehicle operation
*: This maintenance operation is required for federal spec. vehicles.
However, we do recommend that this operation be performed on California spec. vehicles as well.

	MAINTENANCE ITEM	MAINTENANCE INTERVAL (Number of months or km (miles), whichever occurs first)																	REMARKS
		Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
		x 1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	
		x 1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
1	Drive belt(s) [Except camshaft]						I				I				I		R			
2	Camshaft drive belt						I*				I*				I*		R			
3	Engine oil	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	See NOTE 1)
4	Engine oil filter	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	See NOTE 1)
5	Replace engine coolant and inspect cooling system, hoses and connections					P				P				P				P	
6	Replace fuel filter and inspect fuel system, hoses and connections					(P)				(P)				(P)				P	See NOTE 2), 6) & 7)
7	Air cleaner					R				R				R				R	
8	Spark plugs					R				R				R				R	
9	Transmission/Differential (Front & Rear) lubricants (Gear oil)					I				I				I				I	See NOTE 3)
10	Automatic transmission fluid					I				I				I				I	See NOTE 4)
11	Brake fluid					R				R				R				R	See NOTE 5)
12	Disc brake pads and discs, Front and rear axle boots and axle shaft joint portions			I		I		I		I		I		I		I		I	See NOTE 6)
13	Brake linings and drums					I				I				I				I	See NOTE 6)
14	Inspect brake line and check operation of parking and service brake system			P		P		P		P		P		P		P		P	See NOTE 6)
15	Clutch operation			I		I		I		I		I		I		I		I	
16	Steering and suspension			I		I		I		I		I		I		I		I	See NOTE 6)
17	Front and rear wheel bearing lubricant									(I)								(I)	
18	Supplemental restraint system	Inspect every 10 years																	
19	Valve clearance	Inspect every 160,000 km (100,000 miles)																	

NOTE:

1) **When the vehicle is used under severe driving conditions such as those mentioned below*, the engine oil should be changed more often.**
2) **When the vehicle is used in extremely cold or hot weather areas, contamination of the filter may occur and filter replacement should be performed more often.**
3) **When the vehicle is frequently operated under severe driving conditions, replacement should be performed every 48,000 km (30,000 miles).**
4) **When the vehicle is frequently operated under severe driving conditions, such as mountain driving replacement should be performed every 24,000 km (15,000 miles).**
5) **When the vehicle is used in high humidity areas or in mountainous areas, change the brake fluid every 24,000 km (15,000 miles) or 15 months, whichever occurs first.**
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- * Examples of severe driving conditions:
  - Repeated short distance driving. (Items 3, 12 and 13 only)
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  - Driving in dusty conditions.
  - Driving in extremely cold weather. (Items 3 and 16 only)
  - Driving in areas where roads salts or other corrosive materials are used. (Items 6, 12, 13, 14 and 16 only)
  - Living in coastal areas. (Items 6, 12, 13, 14 and 16 only)

2. Drive Belt(s) [Except Camshaft] (Inspect drive belt tension)

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					I				I				I		R		
All states except California					I				R				I				R

A: INSPECTION

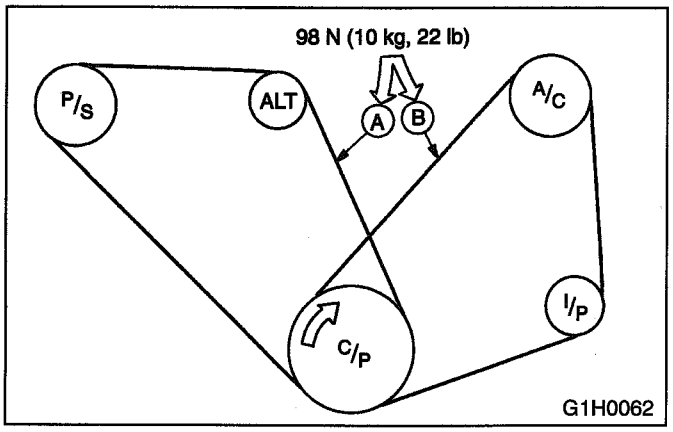
1) Replace belts, if cracks, fraying or wear is found.
2) Check drive belt tension and adjust it if necessary by changing alternator installing position and/or idler pulley installing position.

Belt tension

Ⓐ
- ***replaced: 7 — 9 mm (0.276 — 0.354 in)***
- ***reused: 9 — 11 mm (0.354 — 0.433 in)***

*Ⓑ
- ***replaced: 7.5 — 8.5 mm (0.295 — 0.335 in)***
- ***reused: 9.0 — 10.0 mm (0.354 — 0.394 in)***

* There is no belt [B] on models without an air conditioner.

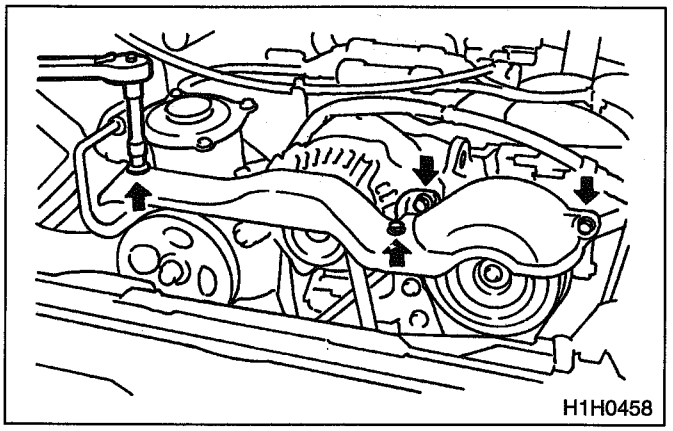


C/P: Crankshaft pulley
ALT: Alternator pulley
P/S: Power steering oil pump pulley
A/C: Air conditioner compressor pulley
I/P: Idler pulley

B: REPLACEMENT

1. V-BELT COVER

1) Remove V-belt cover.

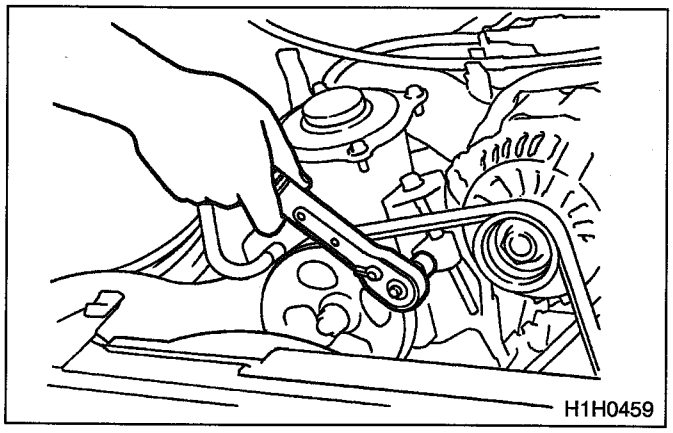


2. FRONT SIDE BELT (Driving Power Steering Oil Pump and Alternator)

CAUTION:
Wipe off any oil or water on the belt and pulley.

1) Loosen the lock bolt on the slider bolt.
2) Loosen the slider bolt.
3) Remove the front side belt.
4) , Install a new belt, and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to 1-5 [02A0].>
5) Tighten the lock bolt.
6) Tighten the slider bolt.

Tightening torque:
Lock bolt, through bolt: 25 ± 2 N.m (2.5 ± 0.2 kg-m, 18 ± 1.5 ft-lb)
Slider bolt: 8 ± 2 N.m (0.8 ± 0.2 kg-m, 5.5 ± 1.5 ft-lb)



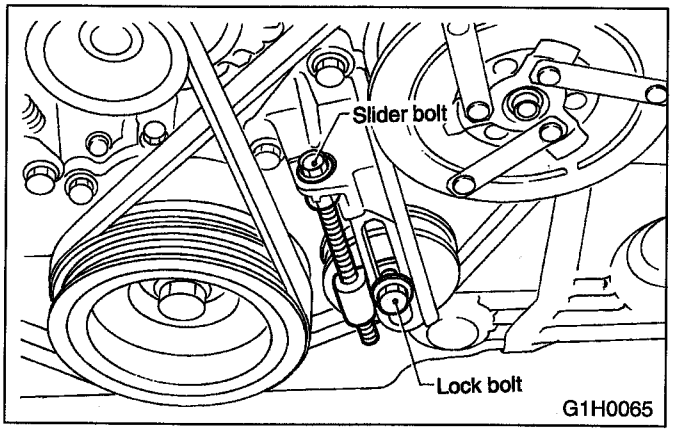
3. REAR SIDE BELT (Driving Air Conditioner)

CAUTION:
Wipe off any oil or water on the belt and pulley.

NOTE:
Before removing the rear side belt, remove the front side belt.

1) Loosen the lock bolt on the slider bolt.
2) Loosen the slider bolt.
3) Remove the rear side belt.
4) Install a new belt, and tighten the slider bolt so as to obtain the specified belt tension <Ref. to 1-5 [01A0].>
5) Tighten the lock bolt.
6) Tighten the slider bolt.

Tightening torque (Lock bolt):
22.6 ± 2.9 N.m
(2.3 ± 0.3 kg-m, 16.6 ± 2.2 ft-lb)



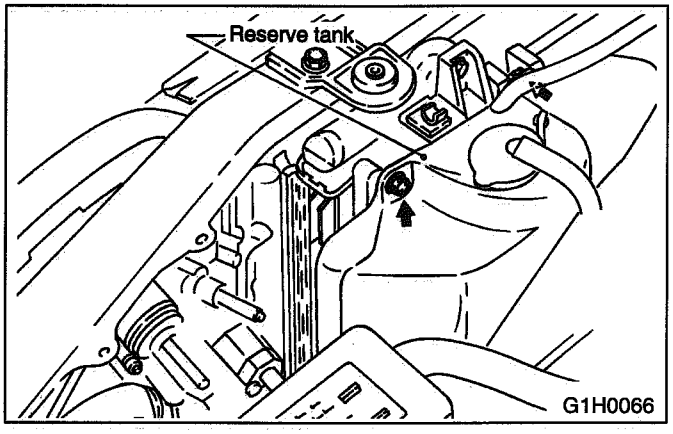
3. Camshaft Drive Belt (Timing Belt)

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					I*				I*				I*		R		
All states except California					I				R				I				R

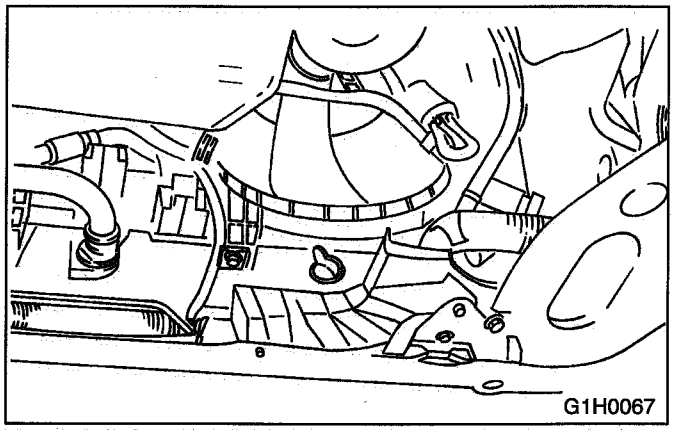
*: This maintenance operation is required for all state except California. However, we do recommend that this operation be performed on California vehicles as well.

A: REPLACEMENT

1) Disconnect ground cable (-) from battery.
2) Remove reserve tank.

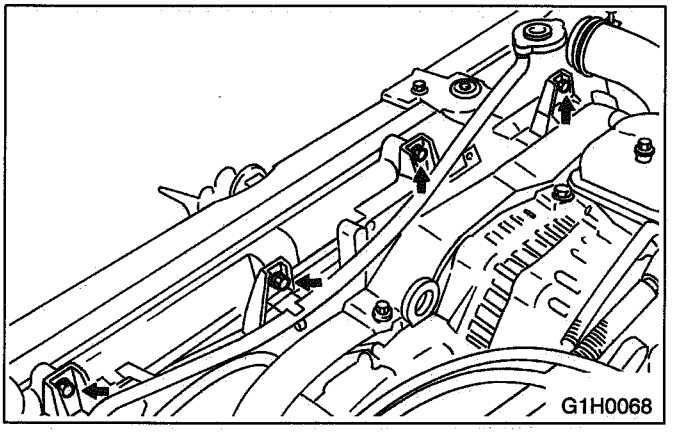


3) Remove radiator fan motor connector and air conditioner fan motor connector.

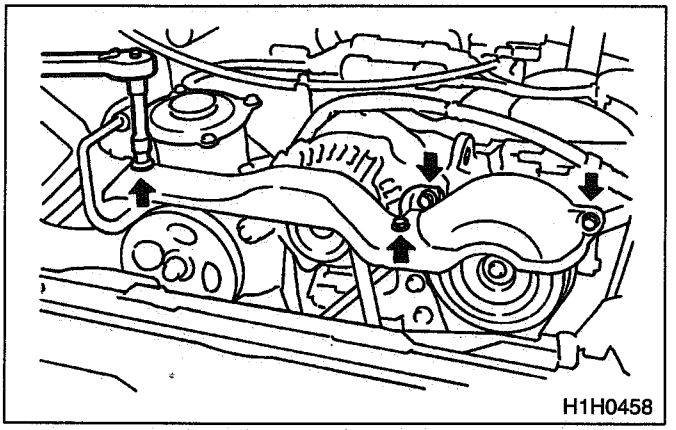


4) Remove radiator fan.
   (1) Remove the two bolts from the upper side of the shroud.
   (2) Remove radiator fan.

CAUTION:
Remove air conditioner fan in same steps described in the removal of radiator.



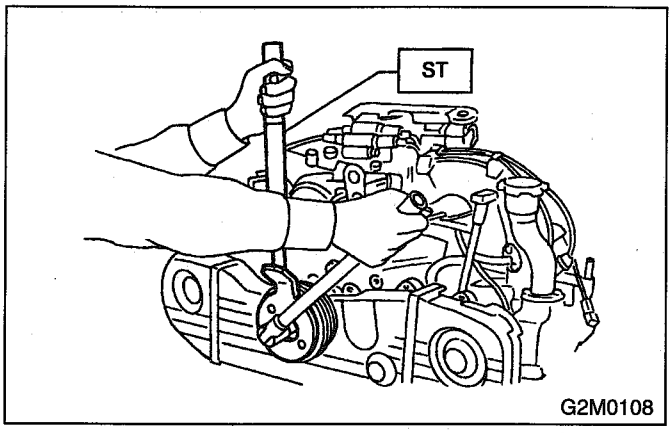
5) Remove V-belt cover.



6) Remove V-belts.
[Refer to "Drive Belt(s)".]
7) Remove air conditioner compressor drive belt tensioner.

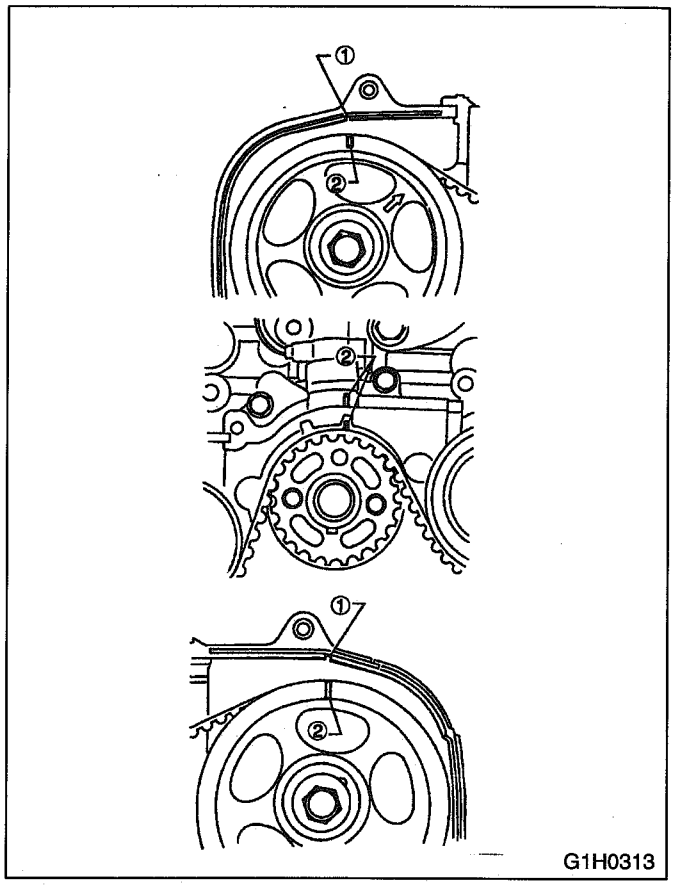
8) Remove pulley bolt. To lock crankshaft use ST.

ST 499977000 CRANKSHAFT PULLEY WRENCH



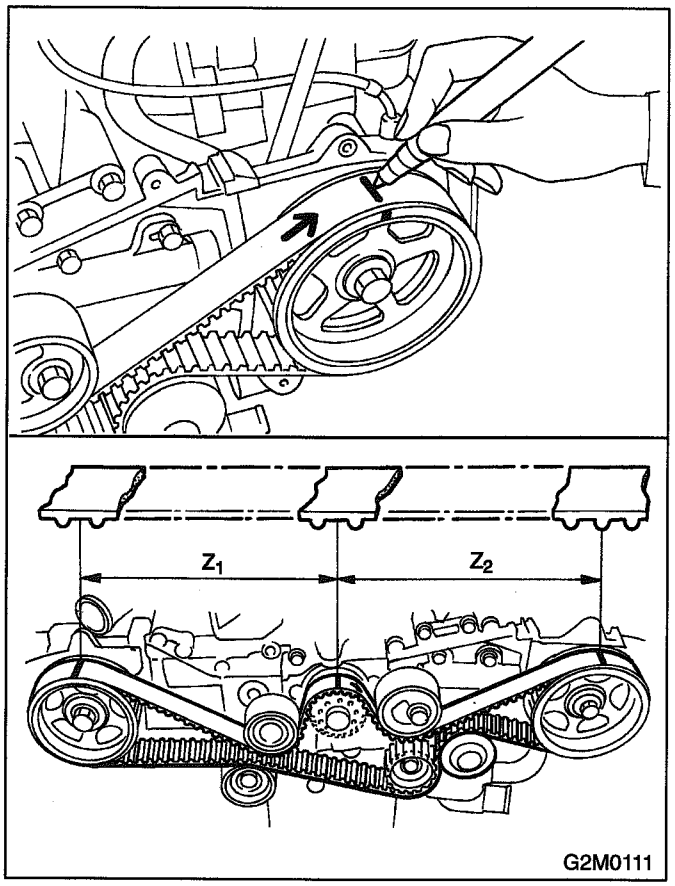
9) Remove crankshaft pulley.
10) Remove left side belt cover.
11) Remove right side belt cover.
12) Remove front belt cover.
13) If alignment mark and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing timing belt as follows:
(1) Turn crankshaft and align alignment marks on crankshaft, and left and right camshaft sprockets with notches of belt cover and cylinder block.

ST 499987500 CRANKSHAFT SOCKET



① Notch
② Alignment mark

(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the sprockets.



Z_1, 44 tooth length
Z_2, 40.5 tooth length

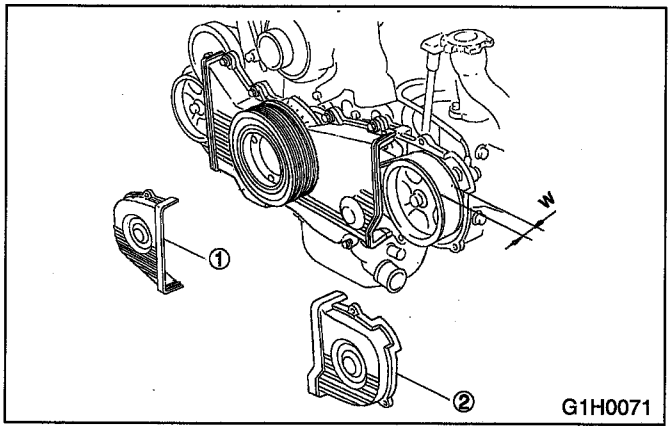
14) Loosen tensioner adjuster mounting bolts.
15) Remove belt idler.
16) Remove belt idler No. 2.
17) Remove timing belt.

B: INSTALLATION

To install, reverse order of removal procedures.
<Ref. to 2-3 [W3C2], [W3C3], [W3C4].>

C: INSPECTION

1) Remove left and right timing belt covers ① and ②.
2) While cranking engine at least four rotations, check timing belt back surface for cracks or damage. Replace faulty timing belt as needed.
3) Measure timing belt width W. If it is less than 27 mm (1.06 in), check idlers, tensioner, water pump pulley and cam sprocket to determine idler alignment (squareness). Replace worn timing belt.
4) Install left and right timing belt covers ① and ②.

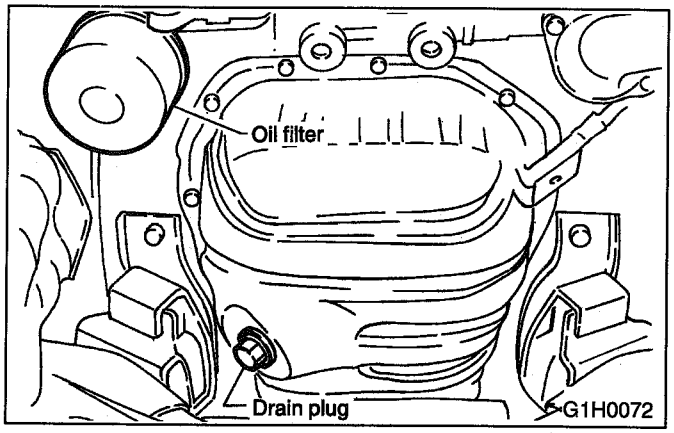


4. Engine Oil

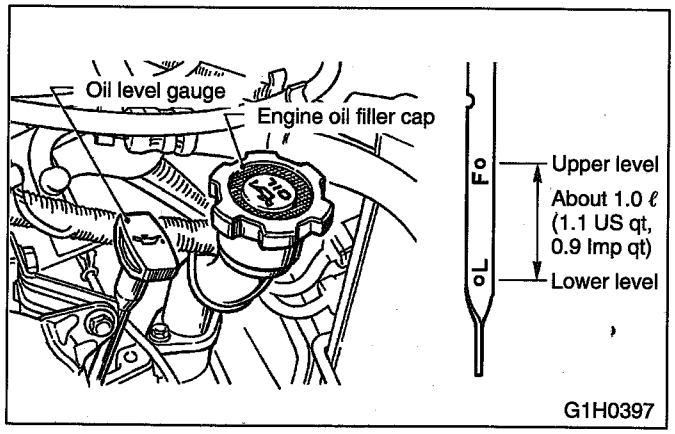
MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
All states except California and Canada	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

A: REPLACEMENT

1) Drain engine oil by loosening engine oil drain plug.



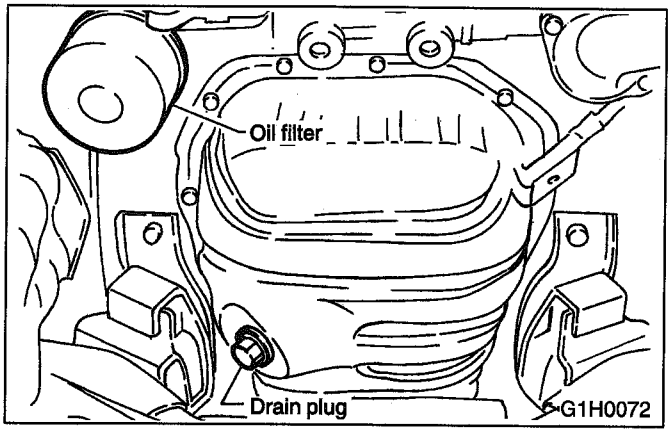
2) Open engine oil filler cap for quick draining of the engine oil.



3) Tighten engine oil drain plug after drainingengine oil.

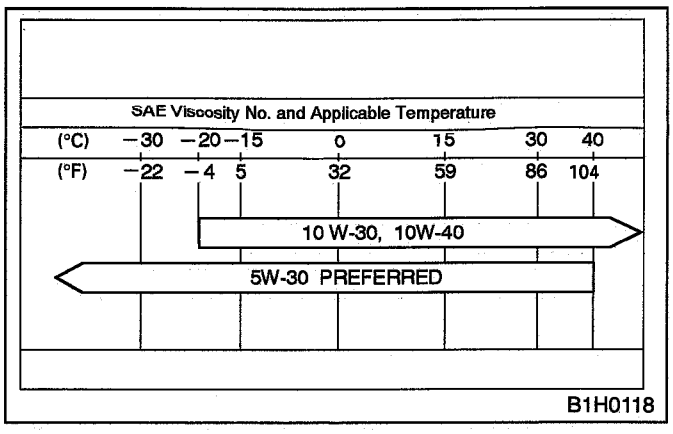
Tightening torque:
$44^{+4.8}_{0}$ N.m ($4.5^{+0.5}_{0}$ kg-m, $33^{+3.6}_{0}$ ft-lb)

NOTE:
Replace drain plug gasket.



4) Fill engine oil through filler pipe up to upper point on level gauge. Make sure that vehicle is placed level when checking oil level. Use engine oil of proper quality and viscosity, selected in accordance with the table in figure.

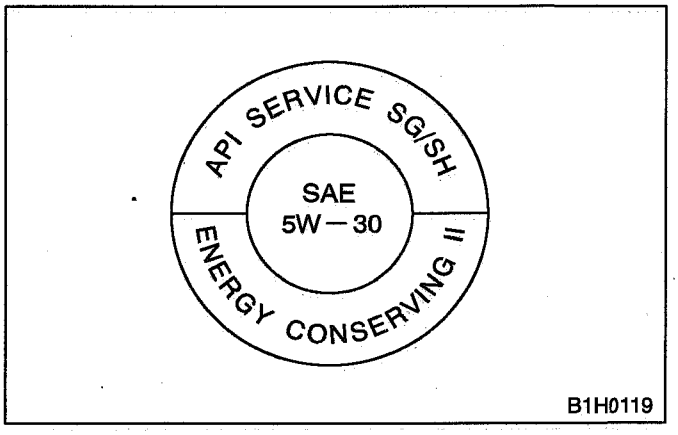
Recommended oil
API classification: SH or SG with the words "Energy Conserving II", or ILSAC certification mark is displayed on the container

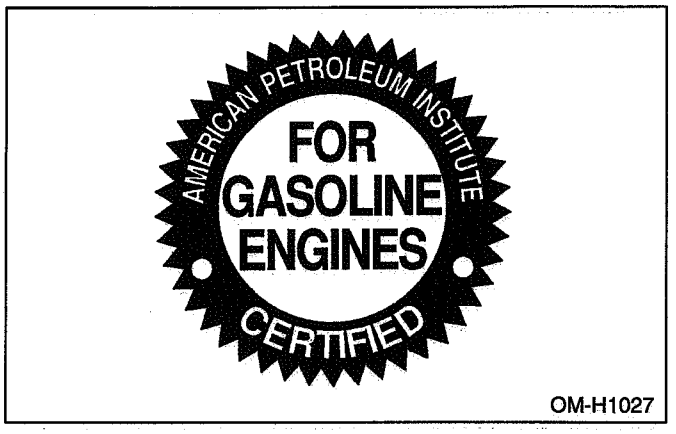


The proper viscosity helps car get good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

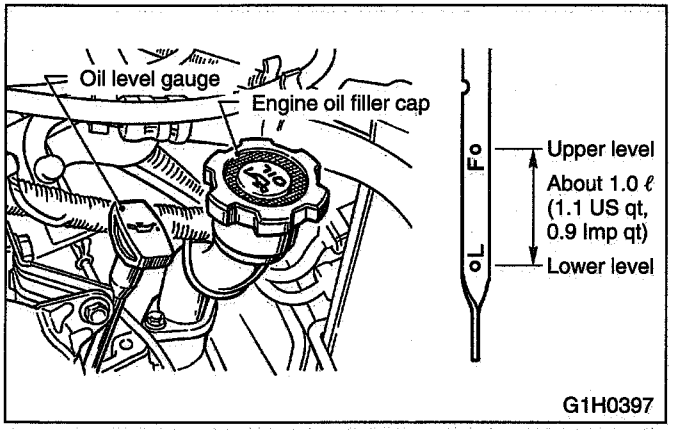
CAUTION:
When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

NOTE:
If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used:
API classification: SH
SAE Viscosity No.: 30, 40, 10 W - 50, 20W - 40, 20 W - 50





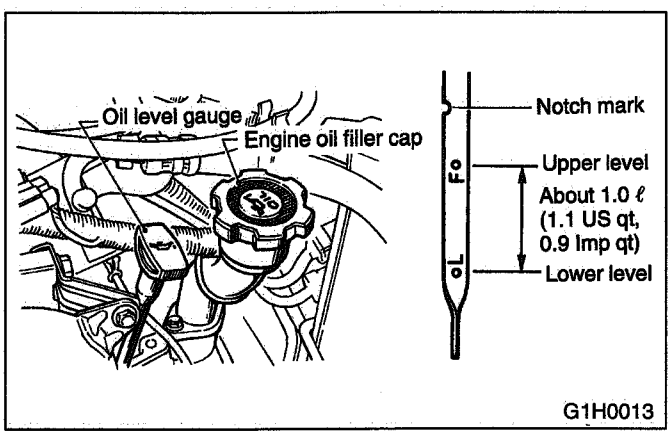
5) Close engine oil filler cap.
6) Start engine and warm it up for a time.
7) After engine stops, recheck the oil level.
If necessary, add engine oil up to upper level on level gauge.



B: INSPECTION

1) Park vehicle on a level surface.
2) Remove oil level gauge and wipe it clean.
3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
4) Remove it again and note the reading. If the engine oil level is below the "L" line, add oil to bring the level up to the "F" line.
5), After turning off the engine, wait a few minutes for the oil to drain back into the oil pan before checking the level.
6) Just after driving or while the engine is warm, engine oil level may show in the range between the "F" line and the notch mark. This is caused by thermal expansion of the engine oil.
7) To prevent overfilling the engine oil, do not add oil above the "F" line when the engine is cold.

Engine oil capacity:
Upper level
4.0 ℓ (4.2 US qt, 3.5 Imp qt)
Lower level
3.0 ℓ (3.2 US qt, 2.6 Imp qt)



5. Engine Oil Filter

	MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
All states except California	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

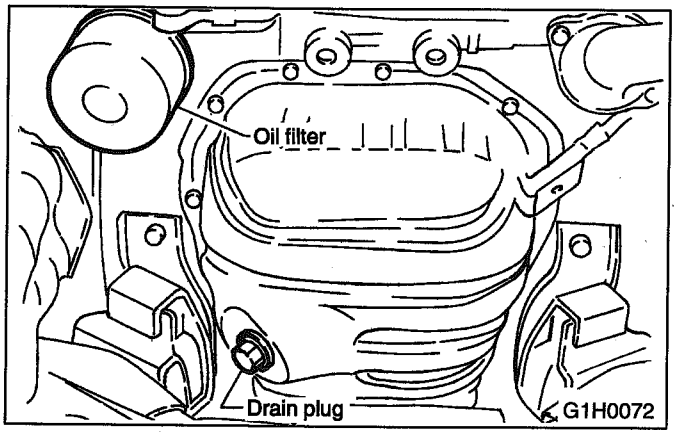
A: REPLACEMENT

1) Remove oil filter with ST.

ST 498547000 OIL FILTER WRENCH

2) Get a new oil filter and apply a thin coat of engine oil to the seal rubber.
3) Install oil filter by turning it by hand, being careful not to damage seal rubber.
4) Tighten more (approximately 2/3 to 3/4 turn) after the seal rubber contacts the oil pump case. Do not tighten excessively, or oil may leak.
5) After installing oil filter, run engine and make sure that no oil is leaking around seal rubber.

NOTE:
The filter element and filter case are permanently joined; therefore, interior cleaning is not necessary.



6. Replace Engine Coolant and Inspect Cooling and Heating System, Hoses and Connections

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					P				P				P				P
All states except California					P				P				P				P

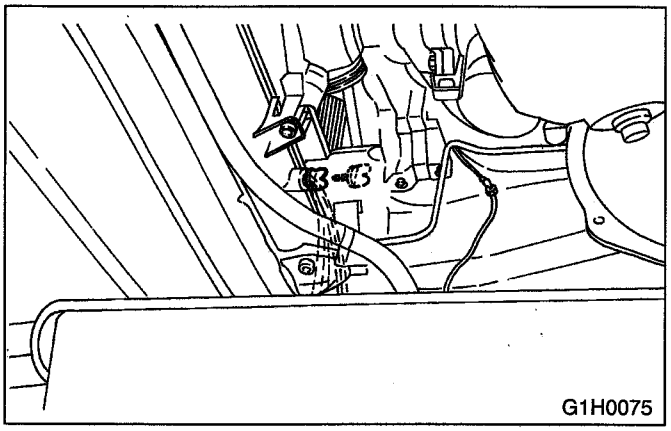
A: REPLACEMENT

1. REPLACEMENT OF COOLANT

WARNING:
The radiator is of the pressurized type. Do not attempt to open the radiator cap immediately after the engine has been stopped.

1) Place a container under drain tube, and loosen drain plug.
2) Loosen radiator cap to drain coolant.

CAUTION:
Be careful not to spill coolant on the floor.


G1H0075

3) Drain coolant from reserve tank.
4) Tighten radiator drain plug securely after draining coolant. (Drain tube may face downward.)
5) Install reserve tank to original position.
6) Slowly pour prepared coolant from radiator filler port to neck of filler, then pour into reserve tank up to "FULL" level.

Coolant capacity (fill up to "FULL" level)
MT:
Approx. 6.3 ℓ (6.7 US qt, 5.5 Imp qt)
AT:
Approx. 6.2 ℓ (6.6 US qt, 5.5 Imp qt)

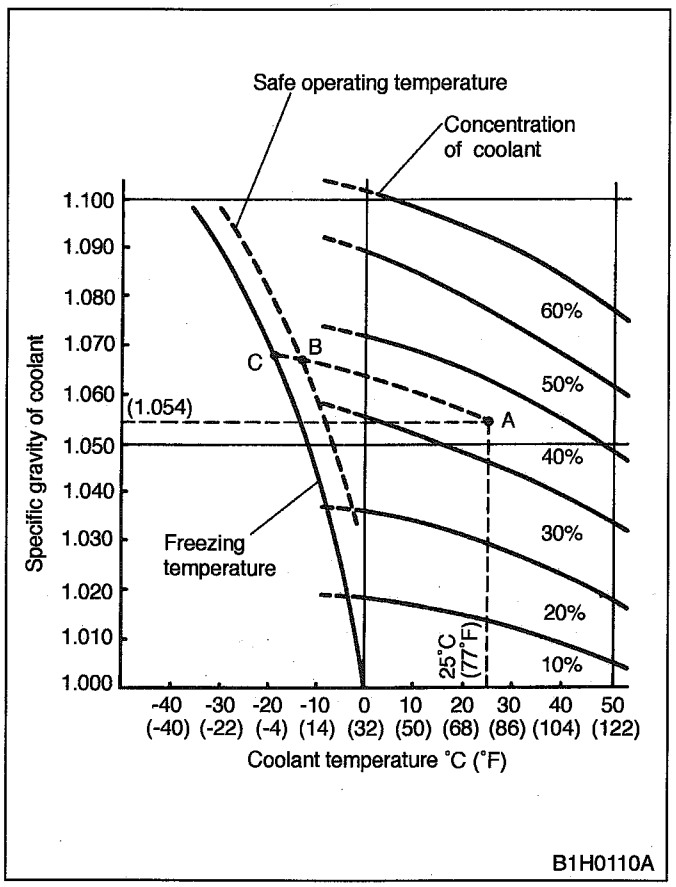
CAUTION:
The SUBARU Genuine Coolant containing anti-freeze and anti-rust agents is especially made for SUBARU engine, which has an aluminum crankcase. Always use SUBARU Genuine Coolant, since other coolant may cause corrosion.

7) Securely install radiator cap.
8) Run engine for more than five minutes at 2,000 to 3,000 rpm. (Run engine until radiator becomes hot in order to purge air trapped in cooling system.)
9) Stop engine and wait until coolant temperature lowers. Then open radiator cap to check coolant level and add coolant up to radiator filler neck. Next, add coolant into reserve tank up to "FULL" level.
10) After adding coolant, securely install radiator and reserve tank caps.

2. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of the SUBARU coolant is shown in the diagram. Measuring the temperature and specific gravity of the coolant will provide this information.

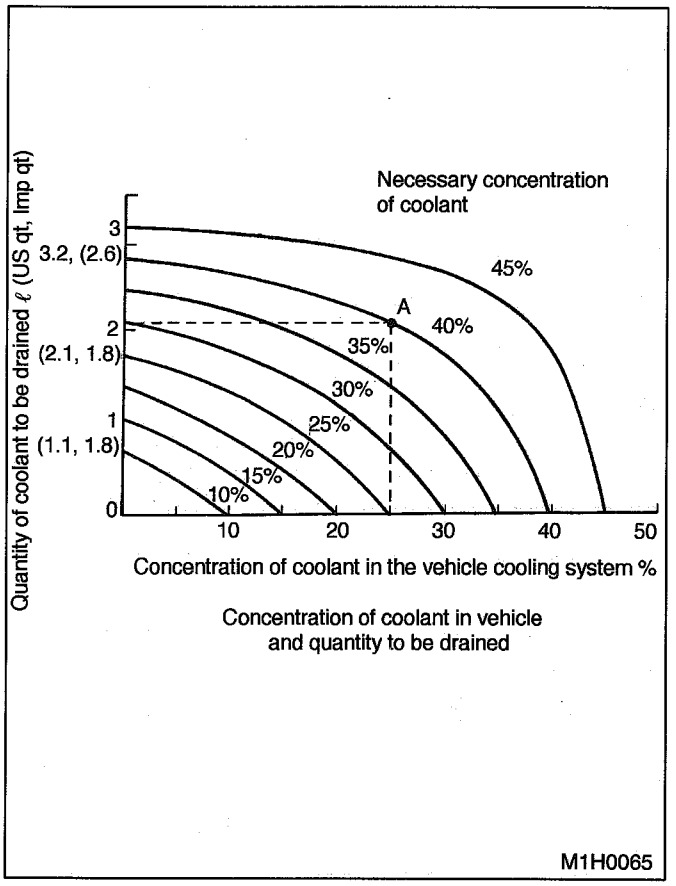
[Example]
If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).



3. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of the coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50).
The amount of coolant that should be replaced can be determined using the diagram.

[Example]
Assume that the coolant concentration must be increased from 30% to 40%. Find point A, where the 30% line of coolant concentration intersects with the 40% curve of the necessary coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 3.0 liters (3.2 US qt, 2.6 Imp qt). Drain 3.0 liters (3.2 US qt, 2.6 Imp qt) of coolant from the cooling system and add 3.0 liters (3.2 US qt, 2.6 Imp qt) of the undiluted solution of SUBARU coolant.
If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.



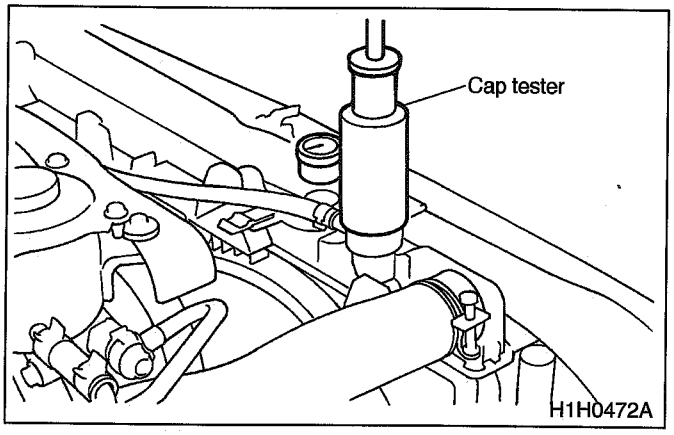
B: INSPECTION

1) Check radiator for leakage, filling it with coolant and attach radiator cap tester to the filler neck. Then apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) and check the following points:
- Each portion of radiator for leakage
- Hose joints and other connections for leakage

CAUTION:
When attaching or detaching tester and when operating tester, use special care not to deform radiator filler neck.

NOTE:
- When performing this check, be sure to keep the engine stationary and fill radiator with coolant.

• Wipe off check points before applying pressure.
• Use care not to spill coolant when detaching tester from radiator.

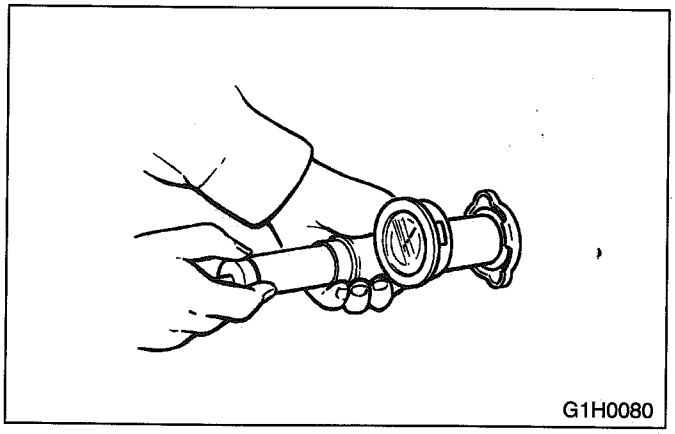


2) Check the radiator cap valve open pressure using radiator cap tester.

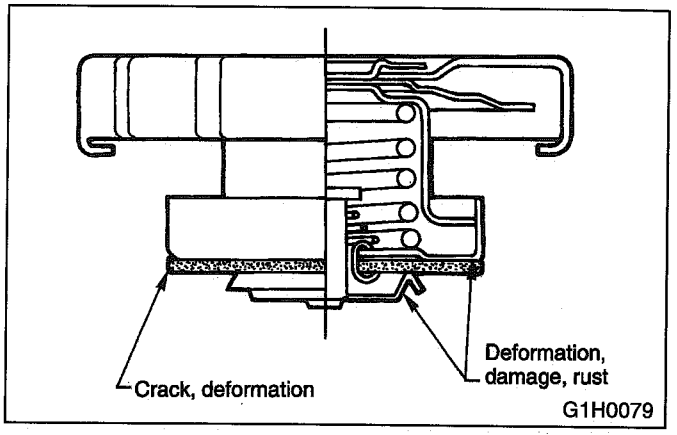
CAUTION:
Rust or dirt on cap may prevent valve from functioning normally: be sure to clean cap before testing.

Raise the pressure until the needle of gauge stops and see if the pressure can be retained for five to six seconds. The radiator cap is normal if a pressure above the service limit value has been maintained for this period.

Radiator cap valve open pressure
Standard value:
78 — 98 kPa
(0.8 — 1.0 kg/cm², 11 — 14 psi)
Service limit: 69 kPa (0.7 kg/cm², 10 psi)



3) If the coolant temperature exceeds 76.0 to 80.0°C (169 to 176°F) while radiator is not so hot, check thermostat. If thermostat does not open at 76.0 to 80.0°C (169 to 176°F), replace it with a new one.
4) If electric fan does not operate when coolant temperature exceeds 90 to 94°C (194 to 201°F), check thermoswitch or fan motor.



7. Replace Fuel Filter and Inspect Fuel System, Lines and Connections

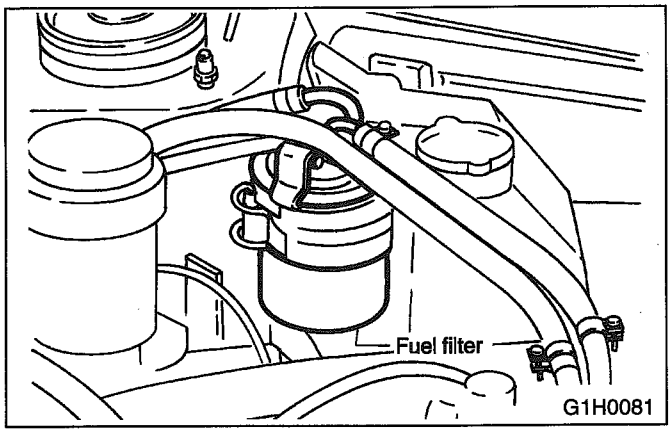
MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					(P)				(P)				(P)				P
All states except California					(P)				P				(P)				P

A: REPLACEMENT

WARNING:
• Place "No fire" signs near the working area.
• Disconnect ground cable from battery.

CAUTION:
Be careful not to spill fuel on the floor.

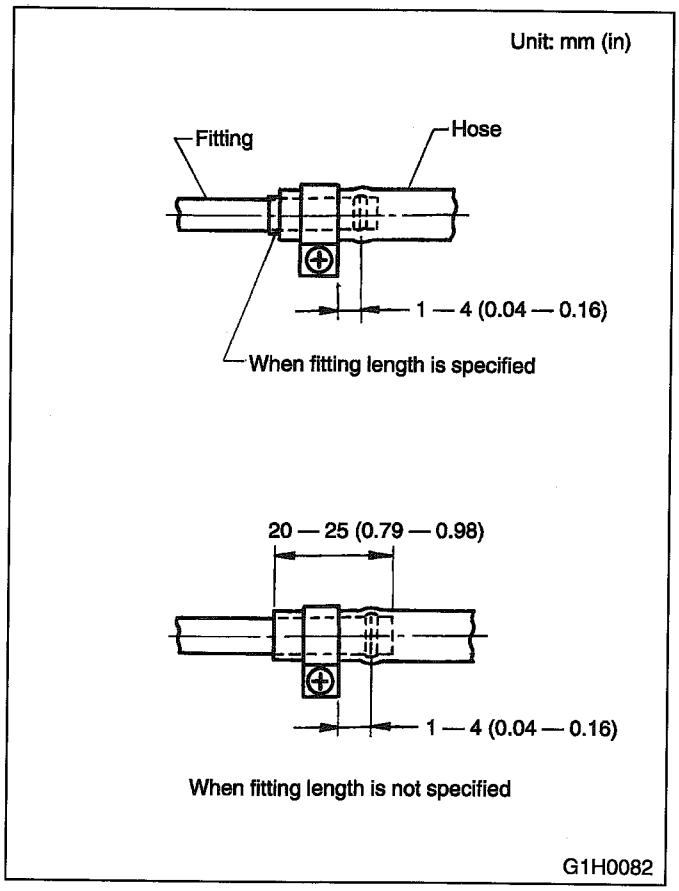
1) Before removing the hose, filter, pump, etc., be sure to release the fuel pressure, as follows:
• Disconnect the wiring connector of the fuel pump.
• Crank the engine for more than five seconds. If the engine starts, let the engine run until it stops.
• After turning IG switch OFF, connect the wiring connector of the fuel pump.
2) Loosen the screw of the hose clamp and pull off the hose from the filter.
3) Remove the filter from the holder.



4) Replace fuel filter with a new one.
5) Install the hoses as shown in the figure.

Tightening torque:
1.0 — 1.5 N.m
(0.1 — 0.15 kg-m, 0.7 — 1.1 ft-lb)

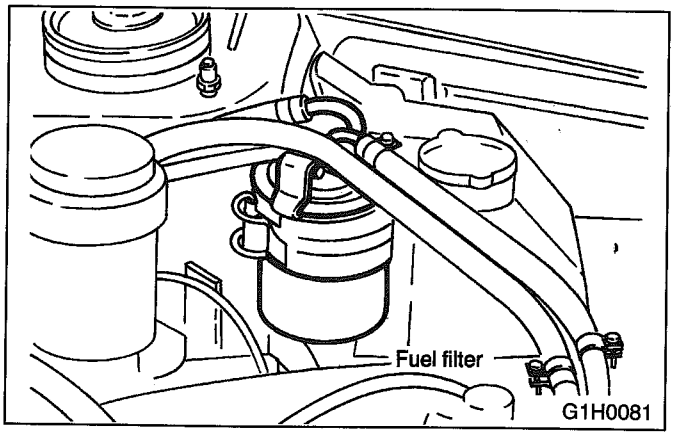
CAUTION:
• If the hose is damaged at the clamping portion, replace the hose with a new one.
• If the hose clamp is deformed too much, replace with a new one.
• Correct the hose position by removing any twist so that it will not interfere with the filter body or washer tank, before tightening the screw of the hose clamp.



6) Install the fuel filter bracket to the vehicle body. And tighten the bolts to the specified torque.

Tightening torque:
5.4 — 9.3 N.m
(0.55 — 0.95 kg-m, 4.0 — 6.9 ft-lb)

CAUTION:
Make sure that the clamp screw is not loose.



B: INSPECTION

1. FUEL PIPING AND CONNECTIONS

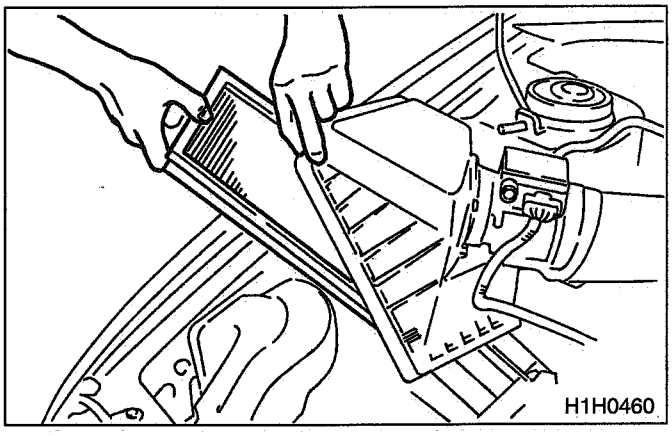
Check fuel piping and connections for leakage, scratches, swelling and corrosion.

8. Air Cleaner

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					R				R				R				R
All states except California					R				R				R				R

A: REPLACEMENT

Do not attempt to clean the air cleaner element. The filter paper of the element is wetted with a special non-inflammable slow-evaporating viscous liquid. It is resistant to cold weather and has a long service life. Dirt adhering to this filter paper forms porous laminations with the viscous liquid, which function as a filtration layer to reduce dust penetration into the filter paper. If this filter paper is cleaned, the filtration layer thus formed will be lost along with the viscous liquid.

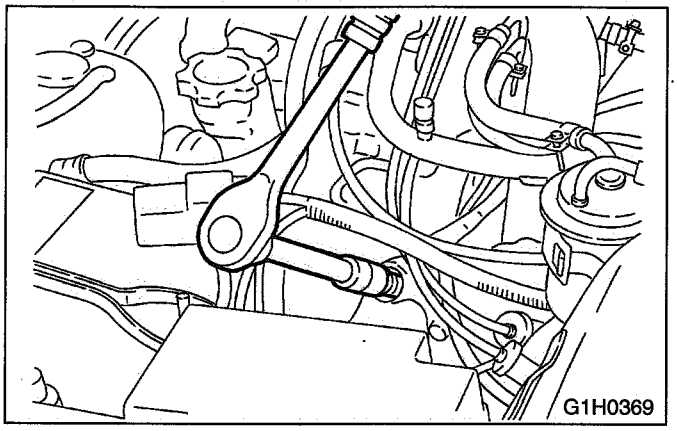


9. Spark Plugs

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					R				R				R				R
All states except California					R				R				R				R

A: REPLACEMENT

1) Remove spark plug with a plug-wrench.



2) Set new spark plug.
3) Tighten spark plug lightly with hand, and then secure with a plug-wrench to the specified torque.

Tightening torque:
18 — 24 N.m (1.8 — 2.4 kg-m, 13 — 17 ft-lb)

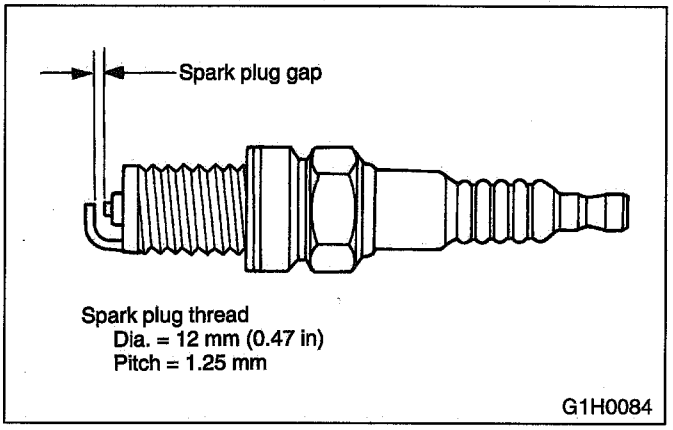
CAUTION:
Be sure to place the gasket between the cylinder head and spark plug.

NOTE:
If torque wrench is not available, tighten spark plug until gasket contacts cylinder head; then tighten further 1/4 to 1/2 turns.

Recommended spark plug:
- ***1800 cc model***
  CHAMPION RC8YC4
  NGK BKR6E-11
- ***2200 cc model***
  CHAMPION RC10YC4, RC8YC4
  NGK BKR6E-11
  NIPPONDENSO K20PR-U11

Spark plug gap
1.0 — 1.1 mm (0.039 — 0.043 in)

NOTE:
<Ref. to 6-1 [W3A0].>



10. Transmission/Differential (Front and rear) Lubricants (Gear oil)

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					I								I				
All states except California					I								I				

A: REPLACEMENT

1. MANUAL TRANSMISSION

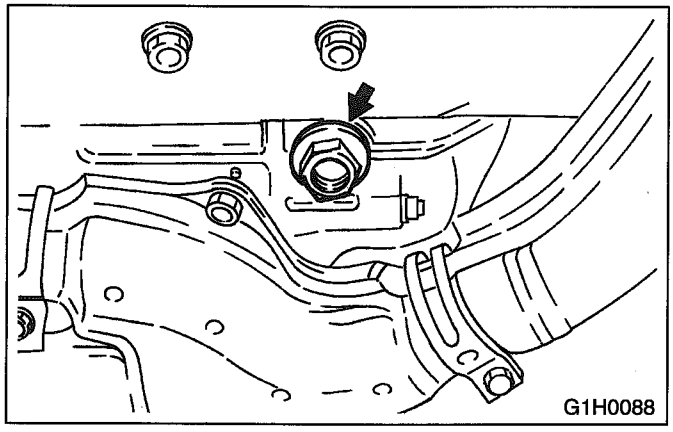
1) Drain gear oil by removing drain plug after allowing the engine to cool for 3 to 4 hours.

CAUTION:
Before starting work, cool off the engine well.

2) Reinstall drain plug after draining gear oil and tighten it to the specified torque.

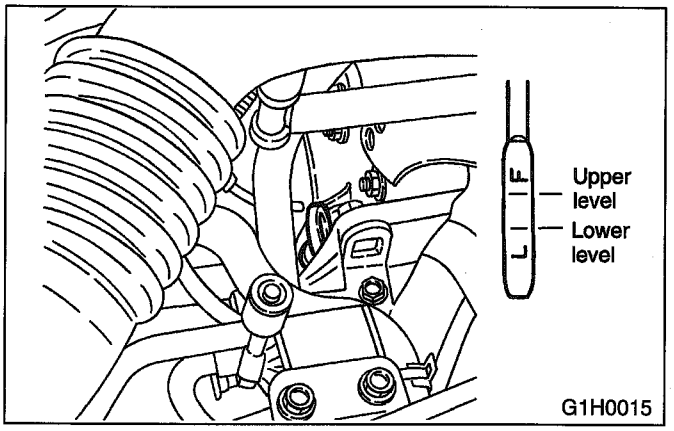
Tightening torque:
41 — 47 N.m (4.2 — 4.8 kg-m, 30 — 35 ft-lb)

CAUTION:
• Be sure to place a gasket between the transmission case and drain plug.
• Replace the gasket with a new one.



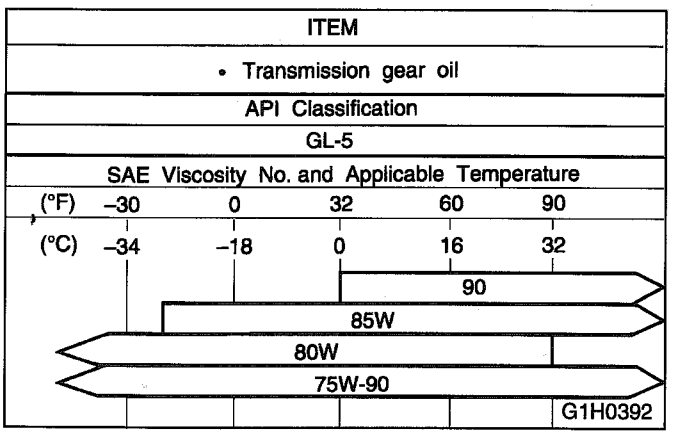
NOTE:
Inspect the transmission gear oil level. If the oil level is at the lower point or below, add some oil through the oil level gauge hole up to the upper point of gauge.

Gear oil capacity: 3.5 ℓ (3.7 US qt, 3.1 Imp qt)



• Recommended transmission gear oil

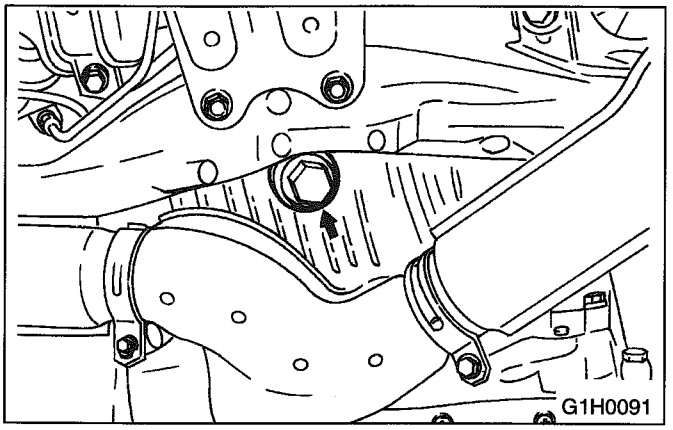
CAUTION
Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.



2. FRONT DIFFERENTIAL (AUTOMATIC TRANSMISSION)

1) Drain differential gear oil by removing drain plug after allowing the engine to cool for 3 to 4 hours.

CAUTION:
Before starting work, cool off the engine well.



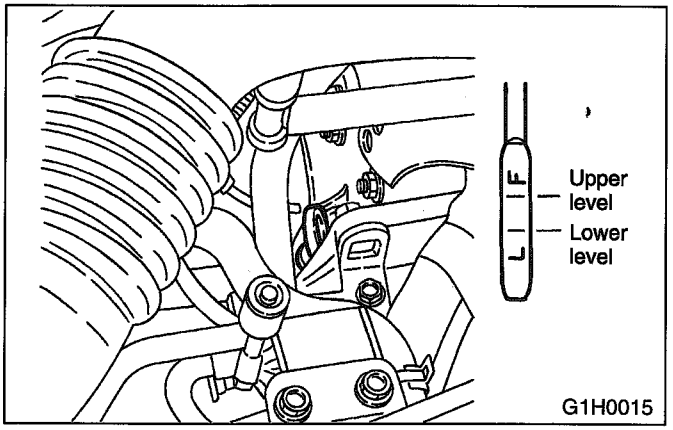
2) Reinstall drain plug after draining differential gear oil and tighten in to the specified torque.

Tightening torque:
41.2 — 47.1 N.m
(4.2 — 4.8 kg-m, 30.4 — 34.7 ft-lb)

CAUTION:
- **Be sure to place a gasket between the transmission case and drain plug.**
- **Replace the gasket with a new one.**

3) Fill differential gear oil through the oil level gauge hole up to upper point level gauge.

Differential gear oil capacity:
1.1 — 1.3 ℓ
(1.2 — 1.4 US qt, 1.0 — 1.1 Imp qt)



- **Recommended front differential gear oil**

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

ITEM									
• Front differential gear oil									
API Classification									
GL - 5									
SAE Viscosity No. and Applicable Temperature									
(°C)	-30	-26	-15	-5	0	15	25	30	
(°F)	-22	-15	5	23	32	59	77	86	
90									
85W									
80W									
80W - 90									

B1H0039

3. REAR DIFFERENTIAL

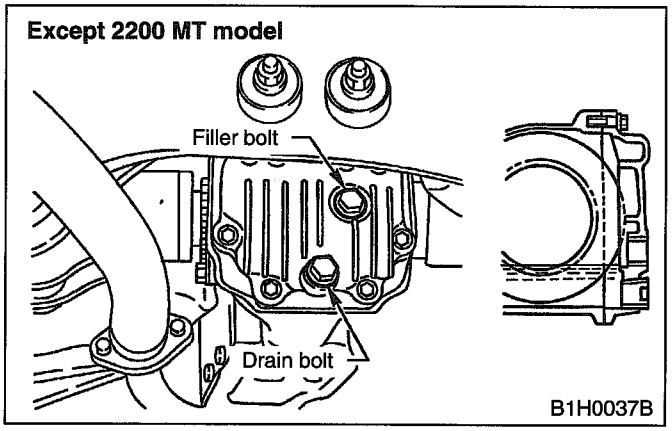
1) Drain oil by removing drain bolt.
2) Remove filler bolt for quick draining oil.
3) Tighten drain bolt after draining oil.

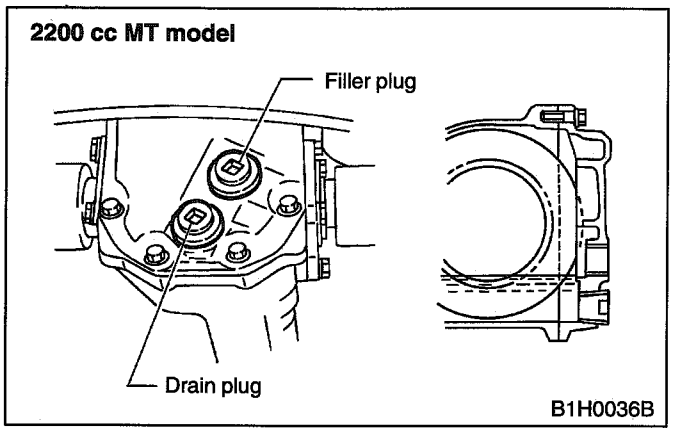
CAUTION:
Always use a new aluminum gasket.

Tightening torque:
Except 2200 cc MT model: 30 — 38 N.m
(3.1 — 3.9 kg-m, 22.4 — 28.2 ft-lb)
2200 cc MT model: 40 — 48 N.m
(4.1 — 4.9 kg-m, 31.1 — 35.9 ft-lb)

4) After installing drain bolt onto rear differential gear case firmly, fill oil up fully to the mouth of filler bolt.

Oil capacity:
0.8 ℓ (0.8 US qt, 0.7 Imp qt)





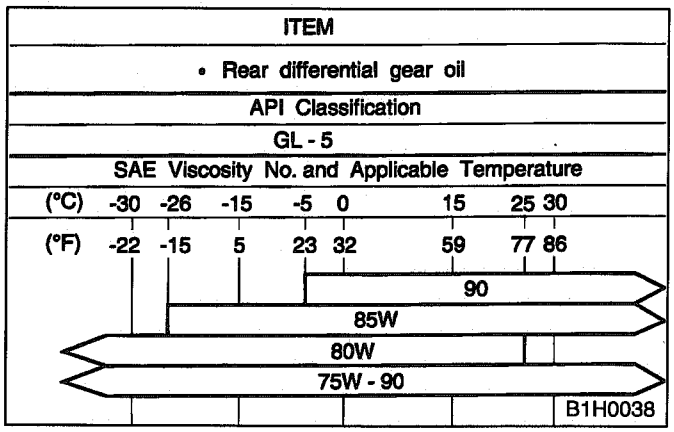
5) Instal filler bolt onto rear differential gear case firmly.

CAUTION:
Always use a new aluminum gasket.

Tightening torque:
Except 2200 cc MT model: 30 — 38 N.m (3.1 — 3.9 kg-m, 22.4 — 28.2 ft-lb)
2200 cc MT model: 40 — 48 N.m (4.1 — 4.9 kg-m, 31.1 — 35.9 ft-lb)

- **Recommended rear differential gear oil**

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



11. Automatic Transmission Fluid

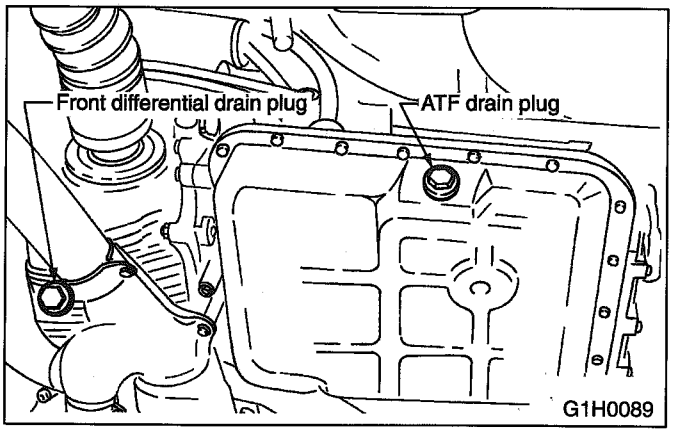
MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					I				I				I				I
All states except California					I				I				I				I

A: REPLACEMENT

CAUTION:
Before starting work, cool off the engine well.

1) Drain ATF (Automatic Transmission Fluid) by removing drain plug after allowing the engine to cool for 3 to 4 hours.
2) Reinstall drain plug after draining ATF, and tighten it to the specified torque.

Tightening torque:
25 N.m (2.5 kg-m, 18 ft-lb)

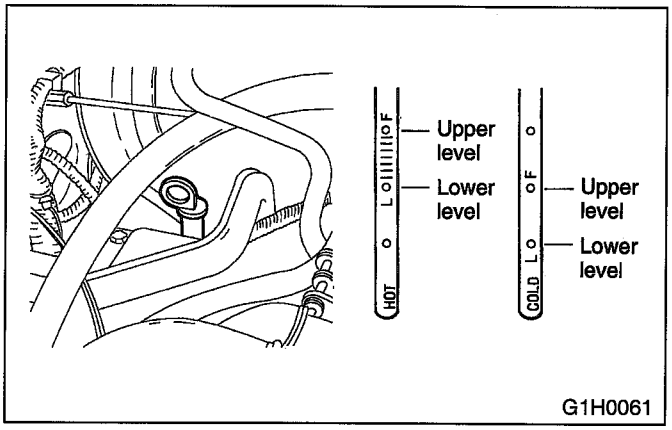


3) Fill ATF up to the middle of the "COOL" side on level gauge by using the gauge hole.

Fluid capacity:
7.6 — 8.2 ℓ
(8.0 — 8.7 US qt, 6.7 — 7.2 Imp qt)

4) Run the vehicle until the ATF temperature rises to 60 to 80°C (140 to 176°F) and check the ATF level of the "HOT" side on level gauge.

Recommended automatic transmission fluid: ATF Dexron II or Dexron III



12. Brake Fluid

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					R				R				R				R
All states except California					R				R				R				R

A: REPLACEMENT

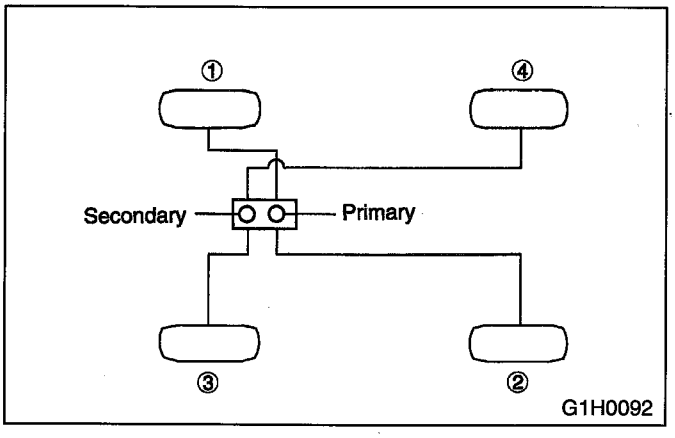
1) Either jack up vehicle and place a safety stand under it, or lift up vehicle.
2) Remove both front and rear wheels.
3) Draw out the brake fluid from master cylinder with syringe.
4) Refill reservoir tank with recommended brake fluid.

Recommended brake fluid:
FMVSS No. 116, fresh DOT3 or 4 brake fluid

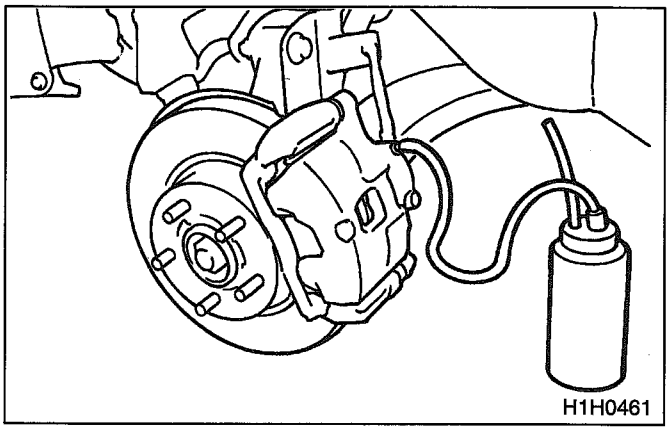
CAUTION:
• Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
• Be careful not to allow dirt or dust to get into the reservoir tank.

Bleeding sequence ① → ② → ③ → ④

① Front right
② Rear left
③ Front left
④ Rear right



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



NOTE:
• Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
• During bleeding operation, keep the brake reserve tank filled with brake fluid to eliminate entry of air.
• Brake pedal operation must be very slow.
• For convenience and safety, it is advisable to have two men working.
• The amount of brake fluid required is approximately 330 mℓ (10.1 US fl oz, 10.6 Imp fl oz) for total brake system.

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

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

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

Tightening torque:
7 — 9 N.m (0.7 — 0.9 kg-m, 5.1 — 6.5 ft-lb)

10) Bleed air from each wheel cylinder using the same procedures as described in steps 5) through 9) above.
11) Depress brake pedal with a force of approximately 294 N (30 kg, 66 lb) and hold it there for approximately 20 seconds. At this time check pedal to see if it makes any unusual movement.
Visually inspect bleeder screws and brake pipe joints to make sure that there is no fluid leakage.
12) Install wheels, and drive car for a short distance between 2 to 3 km (1 to 2 miles) to make sure that brakes are operating properly.

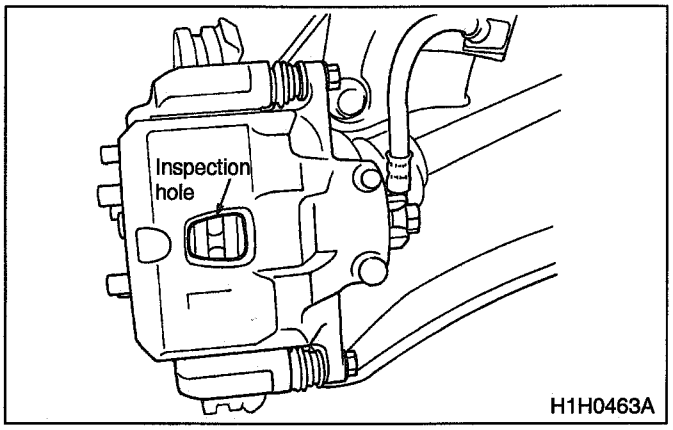
13. Disc Brake Pads and Discs/ Front and Rear Axle Boots and Axle Shaft Joint Portions

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California			I		I		I		I		I		I		I		I
All states except California			I		I		I		I		I		I		I		I

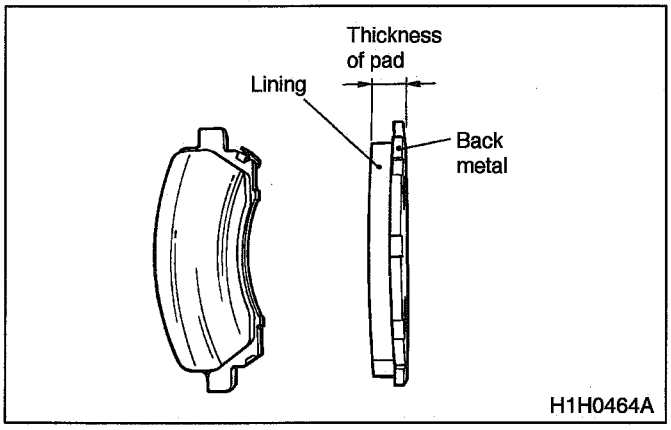
A: INSPECTION

1. DISC BRAKE PAD AND DISC

1) Jack up vehicle and support with rigid racks. Then remove wheels.
2) Visually check pad thickness through inspection hole of disc brake assembly. Replace pad if necessary.



Pad thickness including back metal mm (in)	
Front	
Standard	17 (0.67)
Service limit	7.5 (0.295)
Service limit (exclude back metal)	1.5 (0.059)



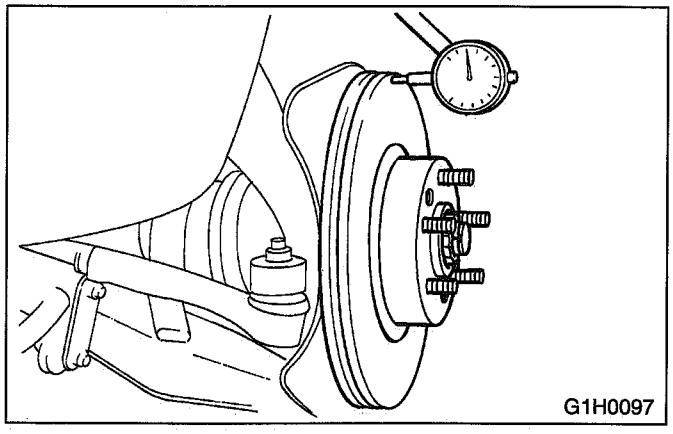
3) Check the disc rotor, and correct or replace if it is damaged or worn.

Brake disc thickness mm (in)	
Front	
14"	
Standard	24 (0.94)
Wear limit	22 (0.87)

Measure the disc rotor runout at a point less than 5 mm (0.20 in) from the outer periphery of the rotor.

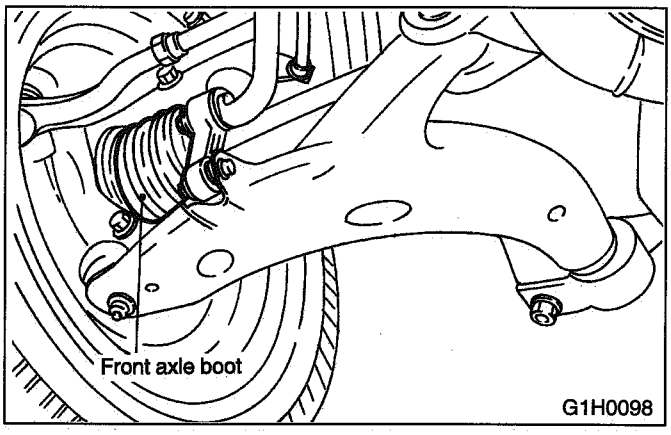
Disc rotor runout limit: 0.075 mm (0.00295 in)

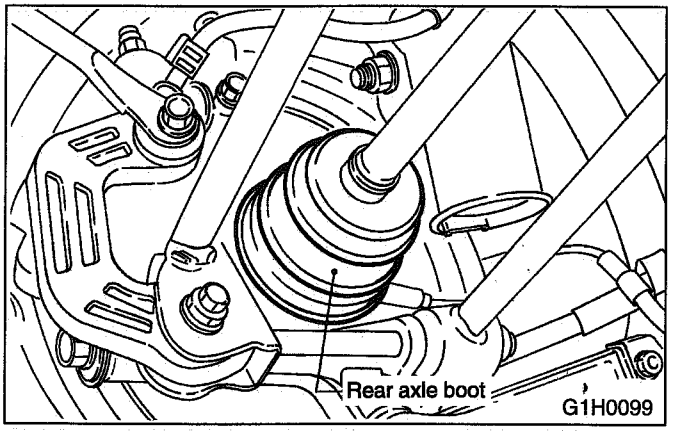
CAUTION:
When replacing a pad, always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.



2. FRONT AND REAR AXLE BOOTS

Inspect front and rear axle boots for deformation, damage or failure. If faulty, replace them with new ones.





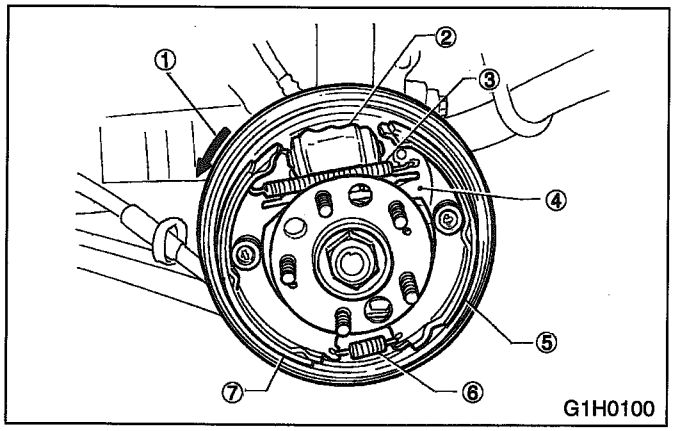
14. Brake Linings and Drums

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California					I				I				I				I
All states except California					I				I				I				I

A: INSPECTION

1. REAR DRUM BRAKE

1) Remove brake drum, and check that there is no fluid leakage from wheel cylinder.
If there is fluid leakage from wheel cylinder, replace it.
2) Inspect brake shoes for damage or deformities and check brake linings for wear.



G1H0100

① Rotational direction of drum (Forward)
② Wheel cylinder
③ Upper shoe return spring
④ Adjusting lever
⑤ Trailing shoe
⑥ Lower shoe return spring
⑦ Leading shoe

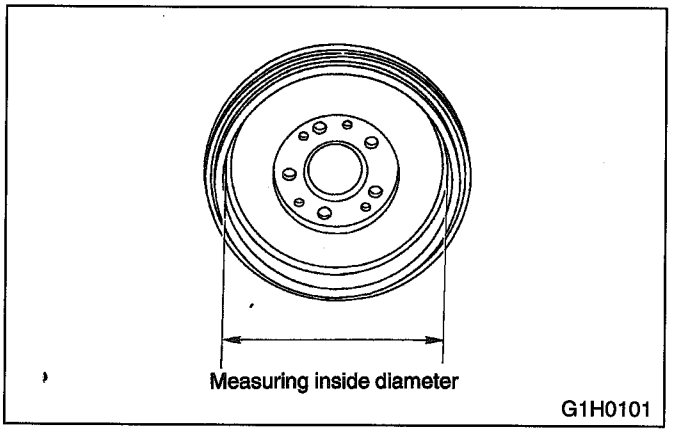
CAUTION:
• Always replace both leading and trailing brake shoes for the left and right wheels at the same time.
• When either the left or the right brake assembly is replaced, always replace the leading shoe and trailing shoe of the other.
• The cotter pin, once removed, cannot be reused.

Thickness of lining (except back metal)
Standard value: 4.1 mm (0.161 in)
Service limit: 1.5 mm (0.059 in)

To replace trailing shoe, remove cotter pin. Clevis pin should also be replaced if worn.
3) Check brake drum for wear, dents or other damage.
If the inside surface of brake drum is streaked, correct the surface with emery cloth (#200 or more). If it is unevenly worn, tapered, or the outside surface of brake drum is damaged, correct or replace it.

Brake drum inner diameter
Standard value: 228.6 mm (9.000 in)
Service limit: 230.6 mm (9.079 in)

If deformation or wear of back plate, shoe, etc. is noticeable, replace the affected parts.



G1H0101

B: ADJUSTMENT

1. REAR DRUM BRAKE

The main brake is adjusted automatically, and so there is no need to adjust it.

15. Inspect Brake Lines and Check Operation of Parking and Service Brake System

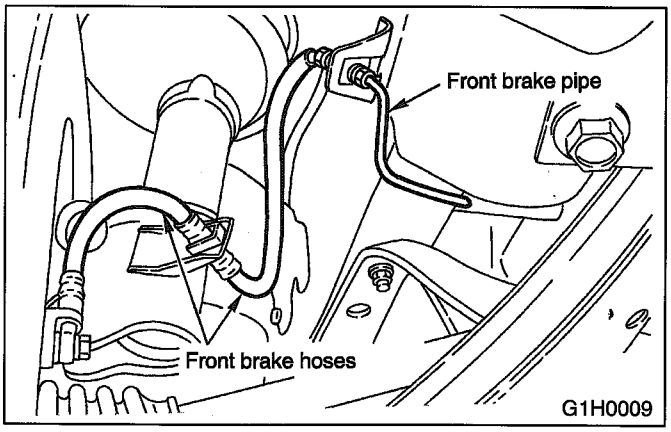
MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California			P		P		P		P		P		P		P		P
All states except California			P		P		P		P		P		P		P		P

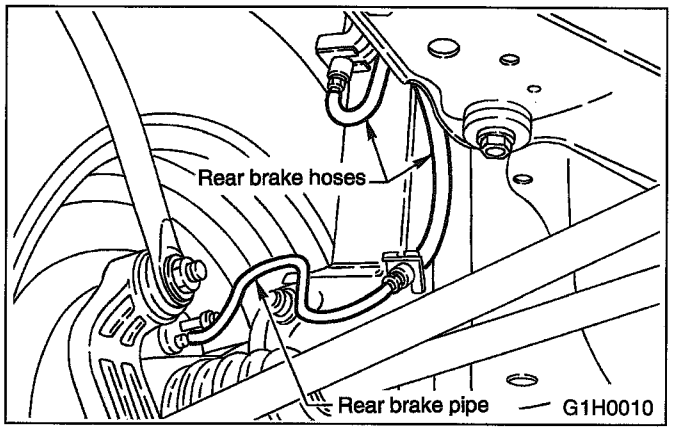
A: INSPECTION

1. BRAKE LINE

1) Check scratches, swelling, corrosion and/or traces of fluid leakage on brake hoses or pipe joints.
2) Check the possibility of adjacent parts interfering with brake pipes/hoses during driving, and loose connections/clamps.
3) Check any trace of fluid leakage, scratches, etc. on master cylinder, wheel cylinder, pressure control valve and hill-holder.

NOTE:
When the brake fluid level in the reservoir tank is lower than the specified limit, the brake fluid warning light on the combination meter will come on.





B: CHECKING

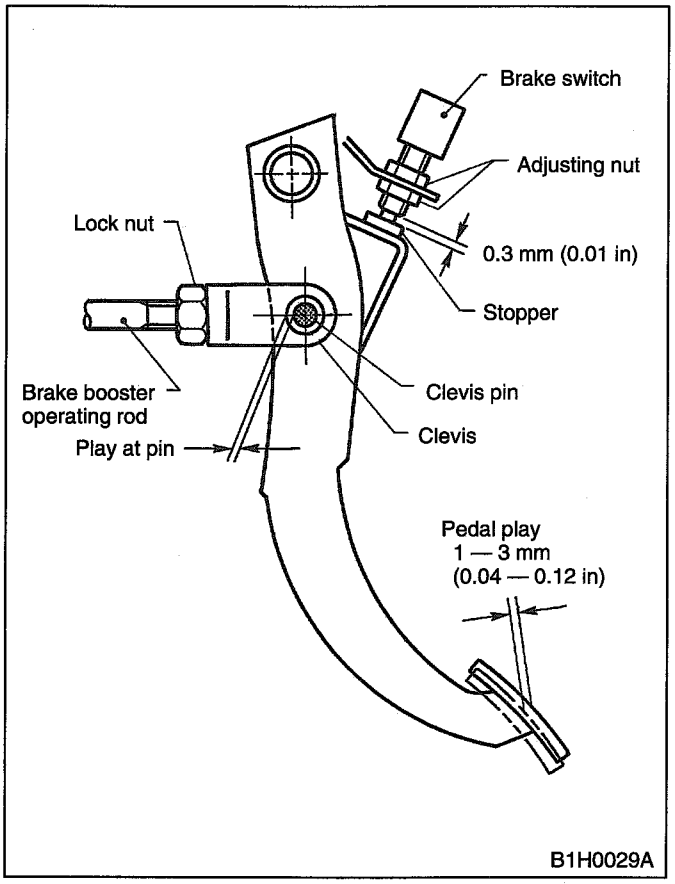
1. SERVICE BRAKE

1) Check the free play of brake pedal with a force of less than 10 N (1 kg, 2 lb).

Brake pedal free play:
1 — 3 mm (0.04 — 0.12 in)

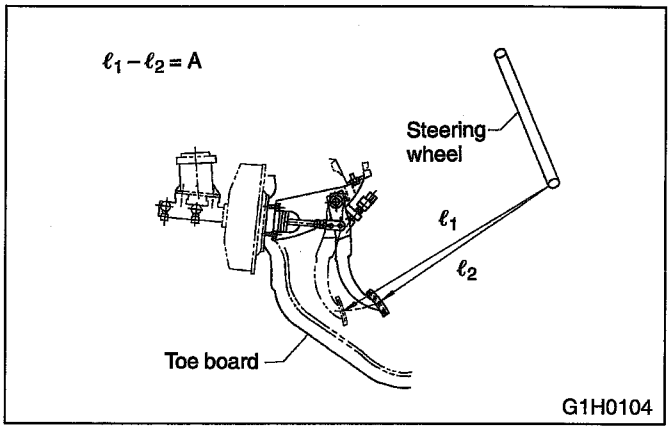
If the free play is out of specifications above, adjust the brake pedal as follows:
(1) Be sure engine is off. (No vacuum is applied to brake booster.)
(2) There should be play between brake booster clevis and pin at brake pedal installing portion.
[Depress brake pedal pad with a force of less than 10 N (1 kg, 2 lb) to a stroke of 1 to 3 mm (0.04 to 0.12 in).]
(3) Depress the surface of brake pad by hand.

(4) If there is no free play between clevis pin and clevis, turn brake switch adjusting nut until the clearance between stopper and screw of brake switch becomes 0.3 mm (0.01 in).



2) Check the pedal stroke.
While the engine is idling, depress the brake pedal with a 490 N (50 kg, 110 lb) load and measure the distance between the brake pedal and steering wheel. With the brake pedal released, measure the distance between the pedal and steering wheel again. The difference between the two measurements must be less than 90 mm (3.54 in) [with ABS, 95 mm (3.74 in)]. If the distance is more than specified, there is a possibility air is in the inside of the hydraulic unit.

Specified pedal stroke: A
With ABS
less than 95 mm (3.74 in)/ 490 N (50 kg, 110 lb)
Without ABS
less than 90 mm (3.54 in)/ 490 N (50 kg, 110 lb)

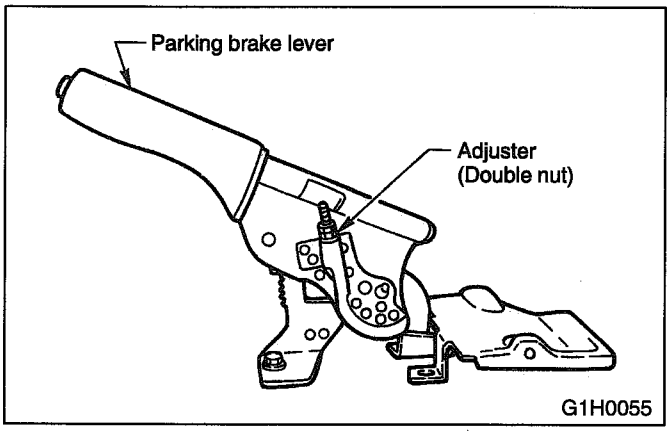


3) Check to see if air is in the hydraulic brake line by the feel of pedal operation. If air appears to exist in the line, bleed it from the system.
4) Check for even operation of all brakes, using a brake tester or by driving the vehicle for a short distance on a straight road.

2. PARKING BRAKE SYSTEM

1) Operation of parking brake is normal if is applied at sixth notch of ratchet when brake lever is pulled by force of about 196 N (20 kg, 44 lb). Total number of the notches is 17.

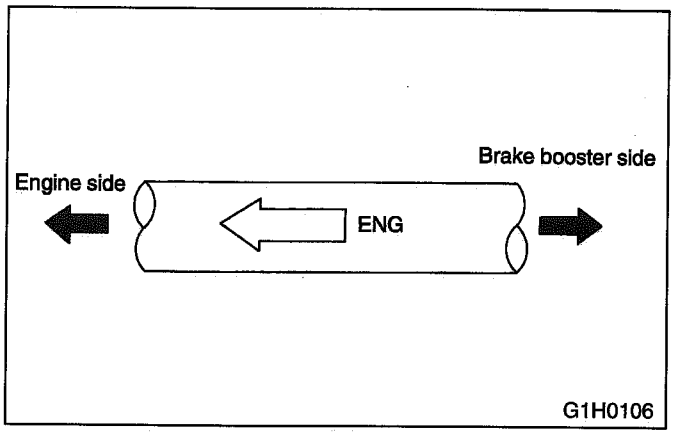
Parking brake lever stroke:
7 to 8th notch/196 N (20 kg, 44 lb)



2) Parking brake should be adjusted after adjusting the shoe clearance of rear brakes.
3) Remove rear console cover.
4) Adjust parking brake lever by turning adjuster (double nut) until parking brake lever stroke is set at 7 to 8 notches with operating force of 196 N (20 kg, 44 lb).

3. BRAKE SERVO SYSTEM

1) With the engine off, depress the brake pedal several times applying the same pedal force: Make sure the travel distance should not change.
2) With the brake pedal depressed, start the engine: Make sure the pedal should move slightly toward the floor.
3) With the brake pedal depressed, stop the engine and keep the pedal depressed for 30 seconds: Make sure the pedal height should not change.
4) Check valve is built into vacuum hose. Disconnect vacuum hose to inspect function of check valve.
Blow air into vacuum hose from its brake booster side end: Air must flow out of engine side end of hose. Next blow air into hose from engine side: Air should not flow out of hose.
Replace both check valve and vacuum hose if check valve is faulty. Engine side of vacuum hose is indicated by marking "ENGINE" as shown.



5) Check vacuum hose for cracks or other damage.

NOTE:
When installing the vacuum hose on the engine and brake booster, do not use soapy water or lubricating oil on their connections.

6) Check vacuum hose to make sure it is tight and secure.

16. Clutch Operation

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California			I		I		I		I		I		I		I		I
All states except California			I		I		I		I		I		I		I		I

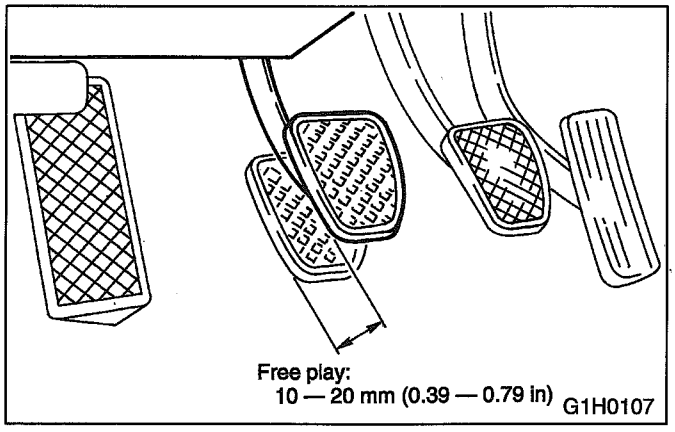
A: INSPECTION AND ADJUSTMENT

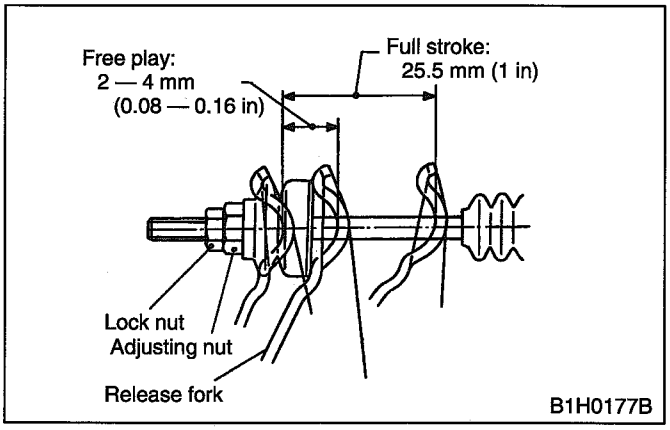
1) Inspect free play of clutch pedal by operating pedal by hand.
If it is out of the specified value, adjust it by turning wing nut on engine side of clutch cable at release fork.

Tightening torque
(Adjusting nut on release fork):
4.4 — 7.4 N.m
(0.45 — 0.75 kg-m, 3.3 — 5.4 ft-lb)

Standard free play:
At clutch pedal
10 — 20 mm (0.39 — 0.79 in)

Fork lever free play allowance:
2 — 4 mm (0.08 — 0.16 in)





2) Pedal-to-floor plate gap in disengaged position
(1) With the engine idling, pull parking brake lever completely.
(2) Slowly depress clutch pedal while moving shift lever into reverse.
(3) Stop depressing clutch pedal when gearshifting is complete. With clutch pedal in this position, measure the distance between the upper side of pedal pad and the lower end of front panel (intersection of front panel with floor). Check that the measured value is within the specified standard.

Standard:
80 mm (3.15 in) or more

3) Pedal height
Check that the clutch pedal pad surface is level with or higher than brake pedal pad surface.

17. Steering and Suspension System

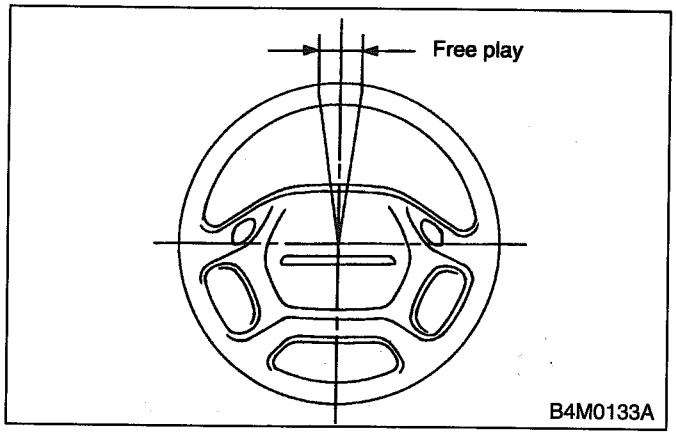
MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California			I		I		I		I		I		I		I		I
All states except California			I		I		I		I		I		I		I		I

A: INSPECTION

1. STEERING WHEEL

1) Set steering wheel in a straight-ahead position, and check wheel spokes to make sure they are correctly set in their specified positions.
2) Lightly turn steering wheel to the left and right to determine the point where front wheels start to move.
Measure the distance of the movement of steering wheel at the outer periphery of wheel.

Steering wheel free play:
0 — 17 mm (0 — 0.67 in)



Move steering wheel vertically toward the shaft to ascertain if there is play in the direction.

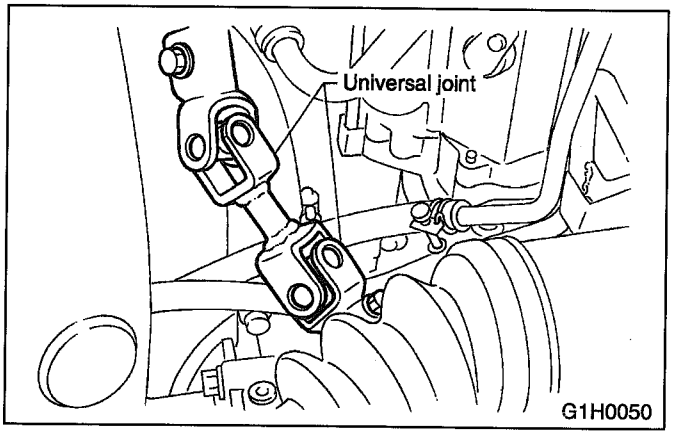
Maximum permissible play:
0.5 mm (0.020 in)

3) Drive vehicle and check the following items during operation.
(1) Steering force .....
The effort required for steering should be smooth and even at all points, and should not vary.
(2) Pull to one side .....
Steering wheel should not be pulled to either side while driving on a level surface.
(3) Wheel runout .....
Steering wheel should not show any sign of runout.
(4) Return factor .....
Steering wheel should return to its original position after it has been turned and then released.

2. STEERING SHAFT JOINT

1) When steering wheel free play is excessive, disconnect universal joint of steering shaft and check it for any play and yawing torque (at the point of the crossing direction). Also inspect for any damage to sealing or worn serrations.
If the joint is loose, retighten the mounting bolts to the specified torque.

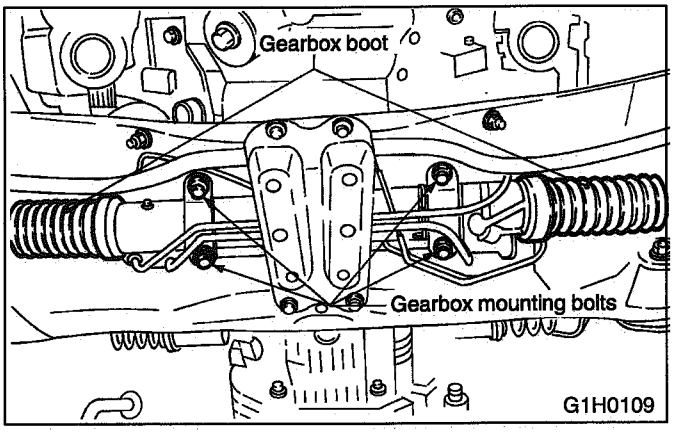
Tightening torque:
21 — 26 N.m (2.1 — 2.7 kg-m, 15 — 19 ft-lb)



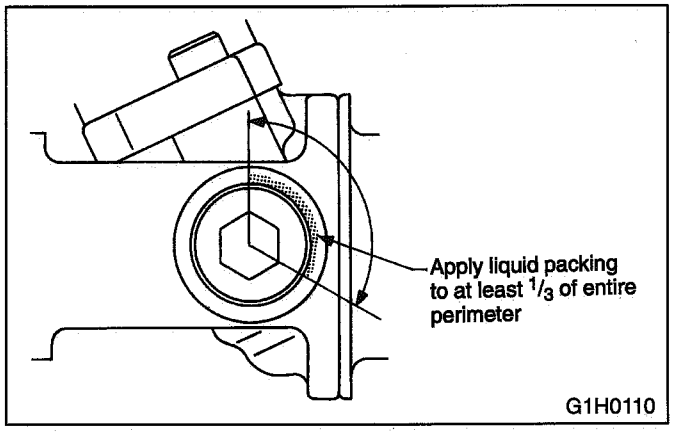
3. GEARBOX

1) With wheels placed on a level surface, turn steering wheel 90° in both the left and right directions.
While wheel is being rotated, reach under vehicle and check for looseness in gearbox.

Tightening torque:
47 — 71 N.m (4.8 — 7.2 kg-m, 35 — 52 ft-lb)



2) Check boot for damage, cracks or deterioration.
3) With vehicle on a level surface, quickly turn steering wheel to the left and right.
While steering wheel is being rotated, check the gear backlash. If any unusual noise is noticed, adjust the gear backlash in the following manner.
(1) Tighten adjusting screw to 5 N.m (0.5 kg-m, 3.6 ft-lb) and then loosen. Repeat this operation twice.
(2) Retighten adjusting screw to 5 N.m (0.5 kg-m, 3.6 ft-lb) and back off 30°.
(3) Apply liquid packing to at least 1/3 of entire perimeter of adjusting screw thread.



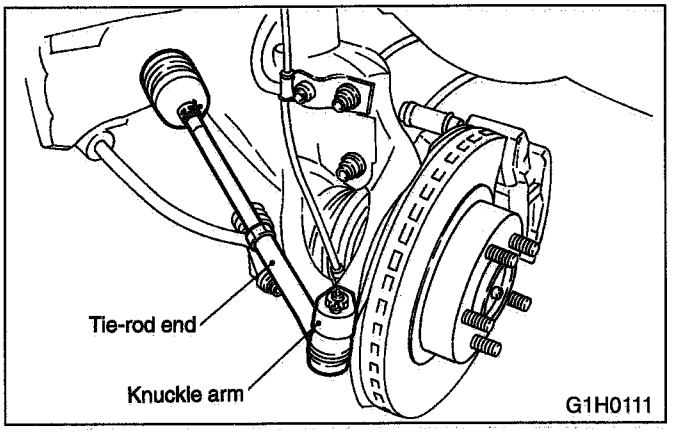
(4) Install lock nut. While holding adjusting screw with a wrench, tighten lock nut using SPANNER (926230000).

Tightening torque (Lock nut):
29 — 49 N.m (3.0 — 5.0 kg-m, 22 — 36 ft-lb)

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

4. TIE-ROD

1) Check tie-rod and tie-rod ends for bends, scratches or other damage.



2) Check connections of knuckle ball joints for play, inspect for damage on dust seals, and check free play of ball studs. If castle nut is loose, retighten it to the specified torque, then tighten further up to 60° until cotter pin hole is aligned.

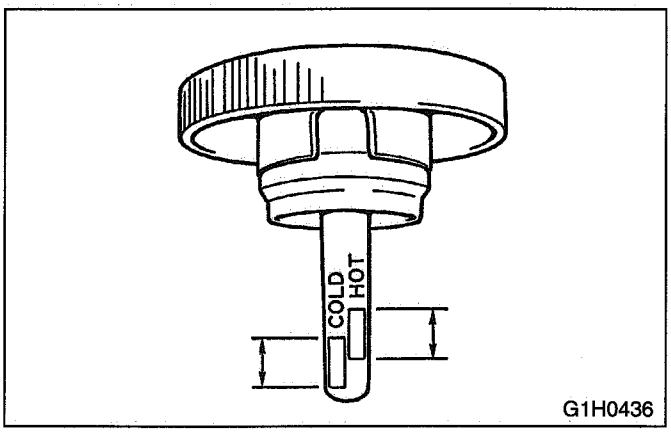
Tightening torque:
25 — 29 N.m (2.5 — 3.0 kg-m, 18 — 22 ft-lb)

3) Check lock nut on the tie-rod end for tightness. If it is loose, retighten it to the specified torque.

Tightening torque:
78 — 88 N.m (8 — 9 kg-m, 58 — 65 ft-lb)

5. POWER STEERING FLUID LEVEL

1) Place vehicle with engine "off" on the flat and level surface.
2) Check the fluid level by removing filler cap of oil pump.
(1) Check at temperature 21°C (70°F) of fluid temperature, read the fluid level on the "COLD" side.
(2) Check at temperature 60°C (140°F) of fluid temperature, read the fluid level on the "HOT" side.



3) Fluid level should be maintained in the each specified range on the indicator of filler cap.
If fluid level is at lower point or below, add fluid to keep the level in the specified range of indicator.
If fluid level is at upper point or above, drain fluid to keep the level in the specified range of indicator by using a syringe or the like.

Recommended fluid	Manufacturer
Dexron II, Dexron IIE or Dexron III type	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

Fluid capacity:
0.7 ℓ (0.7 US qt, 0.6 Imp qt)

6. POWER STEERING FLUID FOR LEAKS

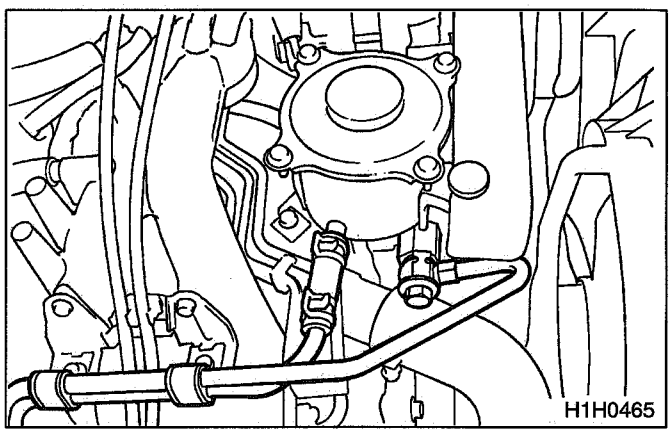
Inspect the underside of oil pump and gearbox for power steering system, hoses, piping and their couplings for fluid leaks.
If fluid leaks are found, correct them by retightening their fitting bolts (or nuts) and/or replacing their parts.

NOTE:
- Wipe the leakage fluid off after correcting fluid leaks, or a wrong diagnosis is taken later.
- Also pay attention to clearances between hoses (or pipings) and other parts when inspecting fluid leaks.

7. HOSES OF OIL PUMP FOR DAMAGES

Check pressure hose and return hose of oil pump for crack, swell or damage. Replace hose with new one if necessary.

NOTE:
Prevent hoses from revolving and/or turning when installing hoses.



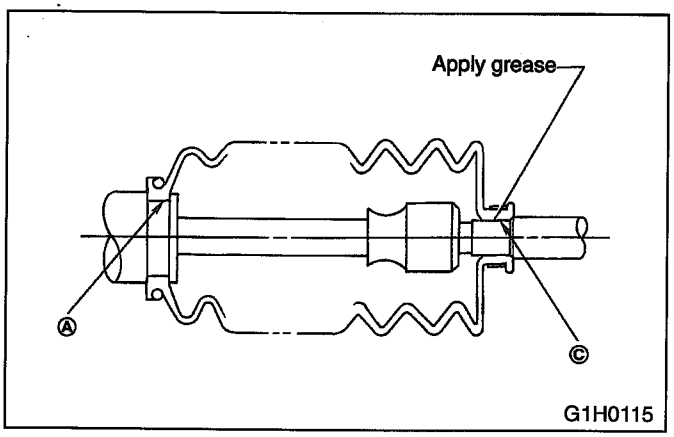
8. POWER STEERING PIPES FOR DAMAGE

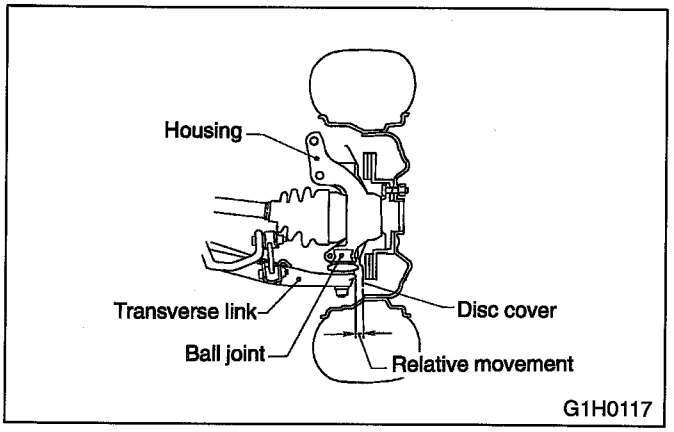
Check power steering pipes for corrosion and damage.
Replace pipes with new one if necessary.

9. GEARBOX BOOTS

Inspect both sides of gearbox boots as follows, and correct the defects if necessary.
1) Ⓐ and Ⓒ positions of gearbox boot are fitted correspondingly in Ⓐ and Ⓒ grooves of gearbox and the rod.
2) Clips are fitted outside of Ⓐ and Ⓒ positions of boot.
3) Boot does not have crack and hole.

NOTE:
Rotate Ⓒ position of gearbox boot against twist of it produced by adjustment of toe-in, etc.





10. FITTING BOLTS AND NUTS

Inspect fitting bolts and nuts of oil pump and bracket for looseness, and retighten them if necessary.
Inspect and/or retighten them when engine is cold. <Ref. to 4-3 [C200].>

11. SUSPENSION SYSTEM

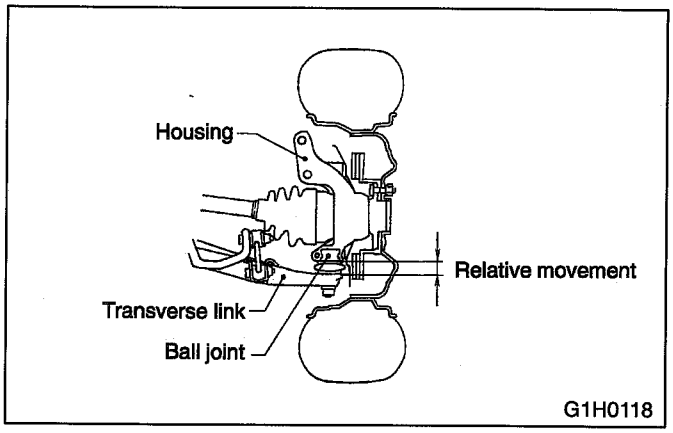
1) Play of front ball joint ..... Inspect every 24,000 km (15,000 miles) or 15 months, whichever occurs first.

(1) Jack up vehicle until front wheels are off ground.

(2) Next, grasp bottom of tire and move it in and out. If relative movement is observed between brake disc cover and end of transverse link, ball joint may be excessively worn.

(3) Next, grasp end of transverse link and move it up and down. Relative movement between housing and transverse link boss indicates ball joint may be excessively worn.

(4) If relative movement is observed in tests (2) and (3) above, remove and inspect ball joint according to chapter 4-1. If free play exceeds standard, replace ball joint.



2) Damage of dust seal ..... Inspect every 24,000 km (15,000 miles) or 15 months, whichever occurs first.
Visually inspect ball joint dust seal. If it is damaged, remove transverse link as instructed in chapter 4-1 and measure free play of ball joint.

(1) When looseness exceeds standard value, replace ball joint.

(2) If the dust seal is damaged, replace with the new ball joint.

NOTE:
When transverse link ball joint has been removed or replaced, check toe-in of front wheel. If front wheel toe-in is not at specified value, adjust according to chapter 4-1 so that toe-in conforms to service standard.

Transverse link's liquid-filled bushing
Check oil leaks at or around liquid-filled bushing if oil leaks replace bushing.

3) Wheel alignment and ground clearance (wheel arch height) ..... Inspect every 48,000 km (30,000 miles) or 30 months, whichever occurs first.

(1) Unload cargoes and set vehicle in curb weight (empty) condition.
(2) Then, check ground clearance (wheel arch height) of front and rear suspensions to ensure that they are within specified values.

(Adjusting procedure) — Ground clearance (wheel arch height)
When ground clearance (wheel arch height) is out of standard, visually inspect following components and replace deformed parts.
- Suspension components [Front and rear: strut assembly]
- Body parts to which suspensions are installed.

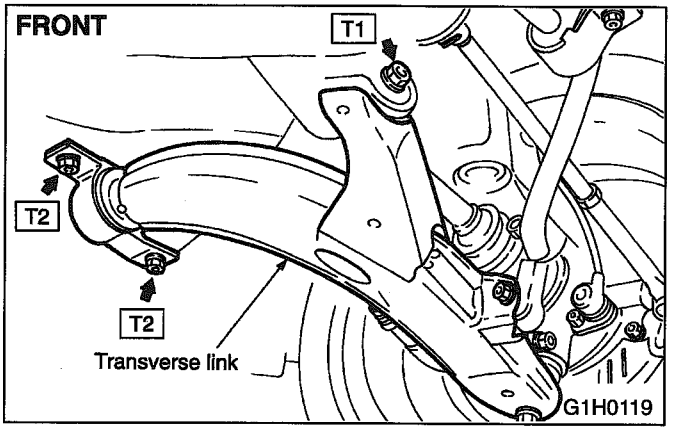
When no components are deformed, adjust ground clearance (wheel arch height) by replacing coil spring in the suspension whose ground clearance is out of standard.
(3) Check alignment of front suspension to ensure that following items conform to standard values provided in chapters 4-1 and 4-3.
- Toe-in
- Camber angle
- Caster angle
- Steering angle

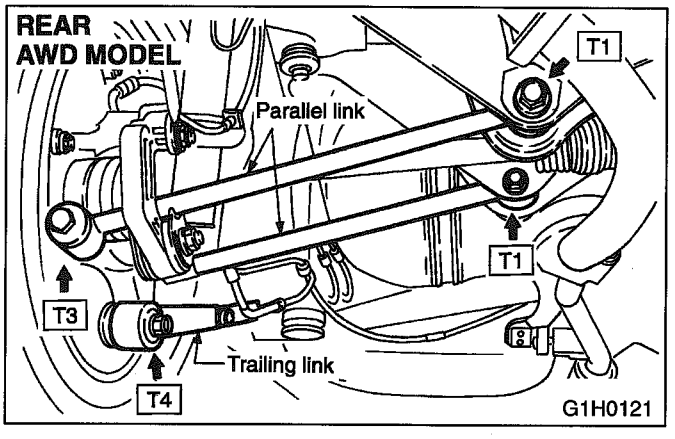
(Adjusting procedure) — Front suspension alignment
(a) Caster angles are not adjustable. When caster angle does not conform to standard value, visually inspect following components and replace deformed parts.
- Suspension components [Strut assembly, crossmember, transverse link, etc.]
- Body parts to which suspensions are installed.

(b) When toe-in and camber is out of standard value, adjust by the method described in chapter 4-1 so that it conforms to service standard.
(c) When right-and-left turning angles of tire are out of standard, adjust to standard value by method described in chapter 4-3.
(4) Check alignment of rear suspension to ensure that following items are within standard values.
- Toe-in
- Camber angle

(Adjusting procedure) — Rear suspension alignment
When toe or camber angle does not conform to standard value, visually inspect parts listed below. If deformation is observed, replace damaged parts.
- Suspension components [Strut assembly, lateral links, trailing link, crossmember, etc.]
- Body parts to which suspensions are installed.

When no components are deformed, adjust toe-in by the method described in chapter 4-1 so that it conforms to service standard.
4) Oil leakage of strut CP ..... Inspect every 48,000 km (30,000 miles) or 30 months, whichever occurs first.
Visually inspect strut CP for oil leakage as instructed in chapter 4-1. Replace strut if oil leaks excessively.
5) Tightness of bolts and nuts ..... Inspect every 48,000 km (30,000 miles) or 30 months, whichever occurs first. Check bolts shown in the figure for looseness. Retighten bolts to specified torque. If self-lock nuts and bolts are removed, replace them with new ones.





Tightening torque:
T1: 83 — 113 N.m
(8.5 — 11.5 kg-m, 61 — 83 ft-lbs)
T2: 196 — 294 N.m
(20 — 30 kg-m, 145 — 217 ft-lbs)
T3: 118 — 160 N.m
(12 — 16 kg-m, 87 — 116 ft-lbs)
T4: 98 — 127 N.m
(10 — 13 kg-m, 72 — 94 ft-lbs)

6) Damage to suspension parts
Check the following parts and the fastening portion of the car body for deformation or excessive rusting which impairs the suspension. If necessary, replace damaged parts with new ones. If minor rust formation, pitting, etc. are noted, remove rust and apply remedial anti-corrosion measures.

- Front suspension
  - Transverse link
  - Crossmember
  - Strut
- Rear suspension
  - Crossmember
  - Lateral links
  - Trailing link
  - Strut
- In the district where salt is sprayed to melt snow on a road in winter, check suspension parts for damage caused by rust every 12 months after lapse of 60 months. Take rust prevention measure as required.

18. Front and Rear Wheel Bearing Lubricant

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California									(I)								(I)
All states except California									(I)								(I)

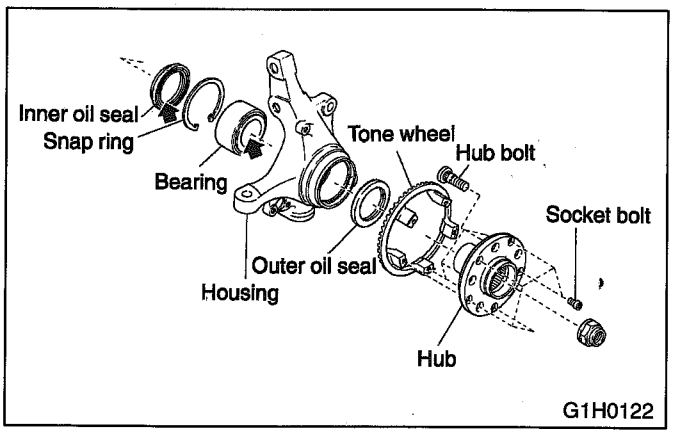
A: INSPECTION

1. FRONT WHEEL BEARING

1) Jack up the front of vehicle.
2) While holding front wheel by hand, swing it in and out to check bearing free play.
3) Loosen wheel nuts and remove front wheel.
4) If bearing free play exists in step 2) above, attach a dial gauge to hub and measure axial displacement in axial direction.

Service limit:
Straight-ahead position within 0.05 mm (0.0020 in)

5) Turn hub by hand to check for noise or binding.
If hub is noisy or binds, disassemble front axle and check condition of oil seals, bearing, etc.
6) Inspect the condition of front wheel bearing grease.

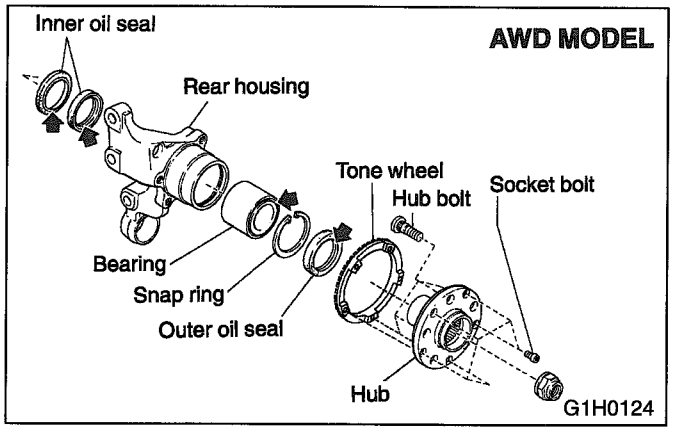


2. REAR WHEEL BEARING

1) Jack up the rear of vehicle.
2) While holding rear wheel by hand, swing it in and out to check bearing free play.
3) Loosen wheel nuts and remove rear wheel.
4) If bearing free play exists in step 2) above, attach a dial gauge to hub and measure axial displacement in axial direction.

Service limit:
Straight-ahead position within 0.05 mm (0.0020 in)

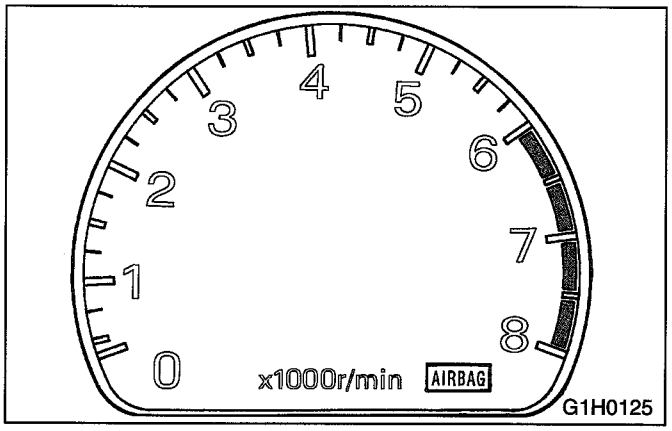
5) Turn hub by hand to check for noise or binding. If hub is noisy or binds, disassemble rear axle and check condition of oil seals, bearings, etc.
6) When the vehicle is an AWD vehicle, remove bolts and self-locking nuts, and remove front lateral link from cross member.
7) Remove the DOJ of rear drive shaft from rear differential. <Ref. to 4-2 [W2A0].>
8) While supporting rear drive shaft horizontally with one hand, turn hub with the other to check for noise or binding.
If hub is noisy or binds, disassemble rear axle and check condition of oil seals, bearings, etc.
9) Inspect the condition of rear wheel bearing grease.



19. Supplemental Restraint System (Airbag)

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California	Inspect every 10 years																
All states except California	Inspect every 10 years																

A: INSPECTION



Check the airbag system in accordance with the result of the self-diagnosis. Refer to "5-5 SUPPLEMENTAL RESTRAINT SYSTEM".

1) Ensure that airbag connectors are connected. If not, properly connect (also double lock the connector). When the ignition switch is turned ON with the connector(s) disconnected, the airbag warning light blinks to identify the fault.

2) Turn the ignition switch ON, and connect the airbag diagnosis terminal of the service connector (located below lower cover) to the ground terminal.

3) The warning light blinks to indicate a trouble code (a fault is identified). When the airbag system is in good order (no trouble codes are stored in the memory), the warning light blinks on and off at 0.6 second intervals (as long as the diagnosis terminal is connected to the ground terminal).

4) When the warning light indicates a trouble code, check the airbag system in accordance with the troubleshooting procedure. <Ref. to 5-5 [T4A0].>

20. Valve Clearance

MAINTENANCE INTERVAL [Number of months or km (miles), whichever occurs first]																	
Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
x1,000 km	4.8	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
x1,000 miles	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
California	Inspect every 160,000 km (100,000 miles)																
All states except California and Canada	Inspect every 160,000 km (100,000 miles)																

A: INSPECTION

1. SOHC MODEL

For the inspection procedures of the valve clearace on SOHC models, refer to "ON-CAR SERVICE". <Ref. to 2-2 [07A0].>

SPECIAL TOOLS 1-6

1. Engine Tools

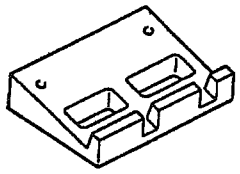
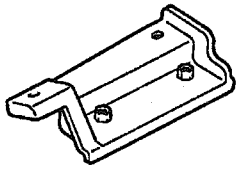
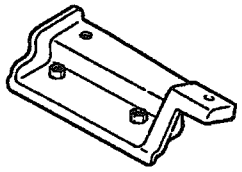
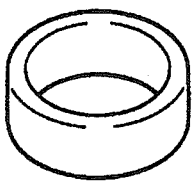
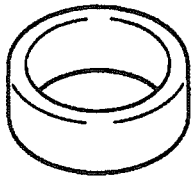
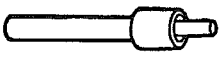
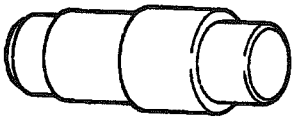
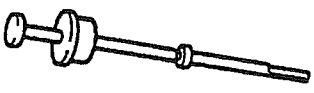
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0126	498267200	CYLINDER HEAD TABLE	• For replacing valve guides. • Used to remove and install valve springs.
 G1H0128	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).
 G1H0129	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 G1H0130	498497100	CRANKSHAFT STOPPER	Used to stop rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 G1H0132	498747100	PISTON GUIDE	• Used to install piston in cylinder. • For 2200 cc engine.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0132	498747000	PISTON GUIDE	• Used to install piston in cylinder. • For 1800 cc engine.
 G1H0133	498857100	VALVE OIL SEAL GUIDE	For press-fitting of intake and exhaust valve guide oil seals.
 G1H0134	499017100	PISTON PIN GUIDE	Used to install piston pin, piston and connecting rod.
 G1H0135	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used to remove and install connecting rod bushing.
 G1H0136	499097500	PISTON PIN REMOVER ASSY	Used to remove piston pin.

SPECIAL TOOLS

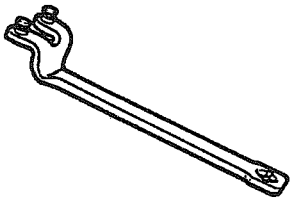
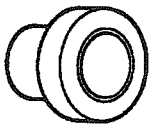
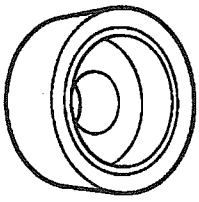
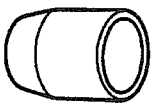
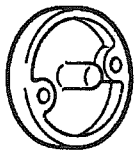
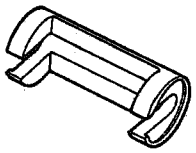
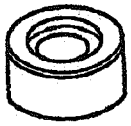
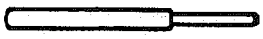
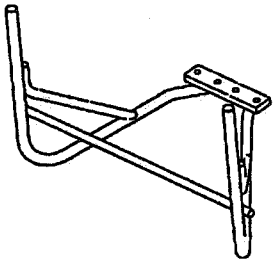
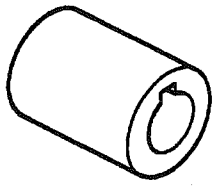
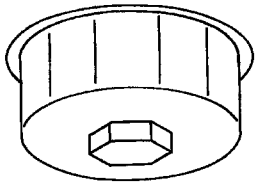
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0137	499207100	CAMSHAFT SPROCKET WRENCH	Used to remove and install camshaft sprocket.
 G1H0138	499587100	CAMSHAFT OIL SEAL INSTALLER	• Used to install crankshaft oil seal. • Used with CAMSHAFT OIL SEAL GUIDE (499597000).
 G1H0139	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used to install crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 G1H0140	499597000	CAMSHAFT OIL SEAL GUIDE	• Used to install camshaft oil seal. • Used with CAMSHAFT OIL SEAL INSTALLER (499587100).
 G1H0141	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used to install crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0142	499718000	VALVE SPRING REMOVER	Used to remove and install valve spring.
 G1H0143	499767000	VALVE GUIDE ADJUSTER	Used to install intake and exhaust valve guides.
 G1H0144	499767200	VALVE GUIDE REMOVER	For removing valve guides.
 G1H0145	499767400	VALVE GUIDE REAMER	For reaming valve guides.
 G1H0146	499817000	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).

SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0147	499977000	CRANK PULLEY WRENCH	Used to stop rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 G1H0148	499987500	CRANKSHAFT SOCKET	Used to rotate crankshaft.
 G1H0131	498547000	OIL FILTER WRENCH	Used to remove and install oil filter.

2. Manual Transmission and Differential Tools

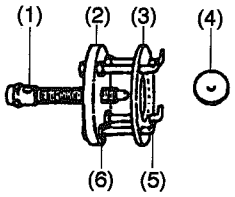
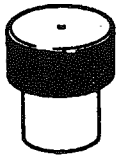
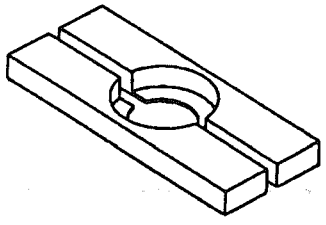
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0151	398791700	REMOVER II	Used to remove and install spring pin (6 mm).
 G1H0152	399411700	ACCENT BALL INSTALLER	Used to install reverse shifter rail arm.
 G1H0154	399527700	PULLER SET	Used to remove and install roller bearing (Differential). (1) BOLT (899521412) (2) PULLER (399527702) (3) HOLDER (399527703) (4) ADAPTER (398497701) (5) BOLT (899520107) (6) NUT (021008000)
 G1H0155	399780104	WEIGHT	Used to measure preload on roller bearing.
 G1H0156	498077000	REMOVER	Used to remove roller bearing of drive pinion shaft.

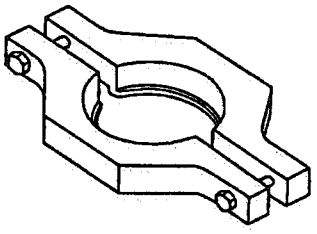
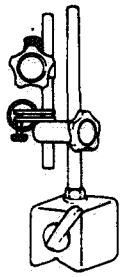
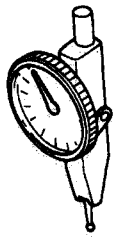
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0157	498077300	CENTER DIFFERENTIAL BEARING REMOVER	For removing the center differential cover ball bearing.
 G1H0158	498147000	DEPTH GAUGE	Used to adjust main shaft axial end play.
 G1H0159	498247001	MAGNET BASE	• Used to measure backlash between side gear and pinion, and hypoid gear. • Used with DIAL GAUGE (498247100).
 G1H0160	498247100	DIAL GAUGE	• Used to measure backlash between side gear and pinion, and hypoid gear. • Used with MAGNET BASE (498247001).
 G1H0161	498427100	STOPPER	For securing the drive pinion shaft assembly and driven gear assembly when removing the drive pinion shaft assembly lock nut.

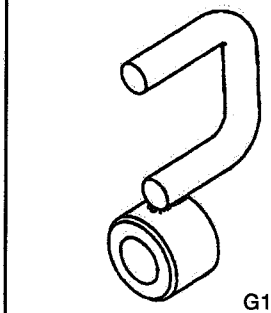
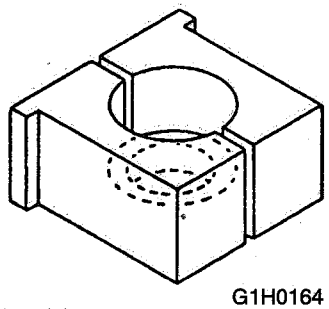
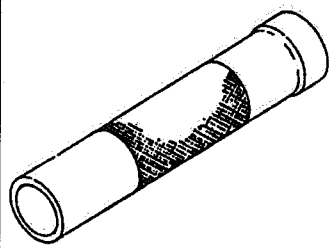
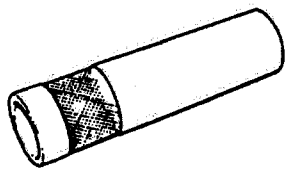
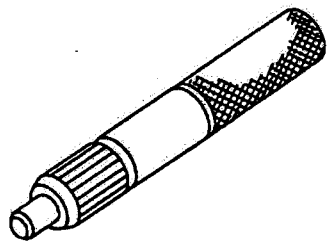
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0163	498787100	MAIN SHAFT STOPPER	Used to remove and install transmission main shaft.
 G1H0164	498937000	TRANSMISSION HOLDER	Used to remove and install transmission main shaft lock nut.
 G1H0165	499277100	BUSH 1-2 INSTALLER	Used to install 1st driven gear thrust plate and 1st-2nd driven gear bush.
 G1H0166	499277200	INSTALLER	For press fitting the 2nd driven gear, roller bearings, & 5th driven gear onto the driven shaft.
 G1H0167	499747100	CLUTCH DISC GUIDE	Used when installing clutch disc to flywheel.

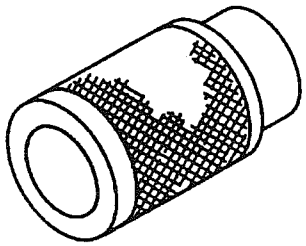
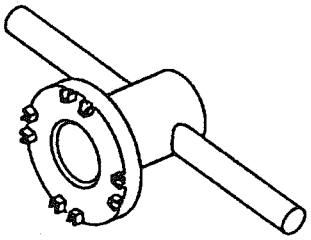
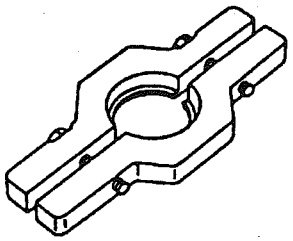
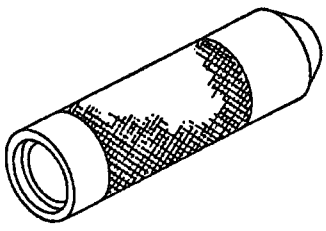
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0168	499757002	SNAP RING PRESS	Used to install snap ring (OUT 25), and ball bearing (25 x 26 x 17).
 G1H0169	499787000	WRENCH ASSY	Used to remove and install differential side retainer.
 G1H0171	499827000	PRESS	For installing speedometer oil seal when installing speedometer cable to transmission.
 G1H0172	499857000	5TH DRIVEN GEAR REMOVER	Used to remove 5th driven gear.
 G1H0173	499877000	RACE 4-5 INSTALLER	• Used to install 4th needle bearing race and ball bearing onto transmission main shaft. • Used with REMOVER (899714110).

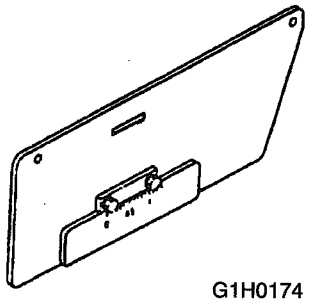
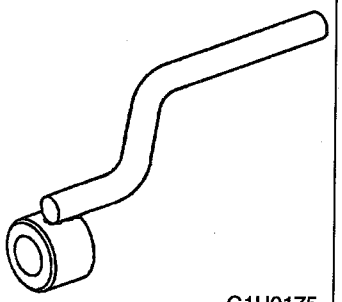
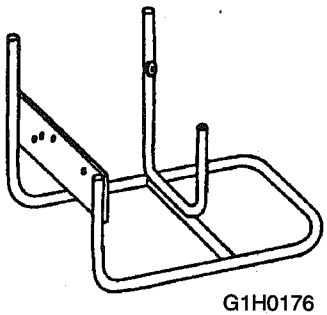
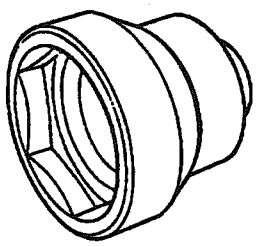
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0174	499917500	DRIVE PINION GAUGE ASSY	Used to adjust drive pinion shim.
 G1H0175	499927100	HANDLE	Used to fit transmission main shaft.
 G1H0176	499937100	TRANSMISSION STAND	Stand used for transmission disassembly and assembly.
 G1H0177	499987003	SOCKET WRENCH (35)	Used to remove and install driven pinion lock nut and main shaft lock nut.
 G1H0178	499987300	SOCKET WRENCH (50)	Used to remove and install driven gear assembly lock nut.

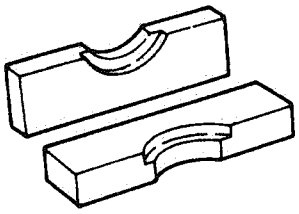
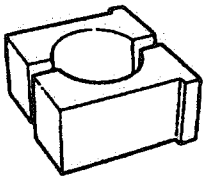
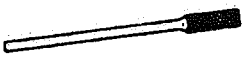
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0179	899714110	REMOVER	For fixing transmission main shaft, drive pinion, rear drive shaft.
 G1H0180	899864100	REMOVER	Used to remove parts on transmission main shaft and drive pinion.
 G1H0181	899884100	HOLDER	Used to tighten lock nut on sleeve.
 G1H0182	899904100	REMOVER	Used to remove and install straight pin.
 G1H0183	899988608	SOCKET WRENCH (27)	Used to remove and install drive pinion lock nut.

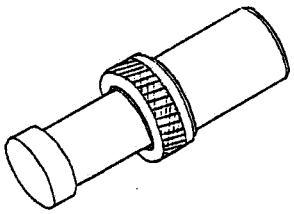
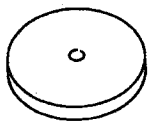
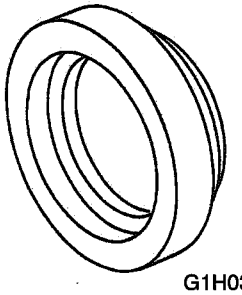
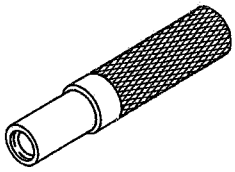
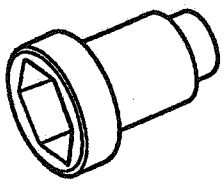
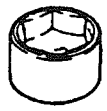
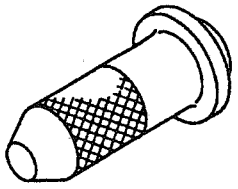
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0184	499547300	INSTALLER SET	Used to install adjusting washer of viscous coupling.
 G1H0315	398497701	ADADPTER	• Used to install roller bearing onto differential case. • Used with INSTALLER (499277100).
 G1H0330	499587000	INSTALLER	Used to install driven gears to driven shaft.
 G1H0328	899824100	PRESS	Used to install speedometer shaft oil seal.
 B1H0074	499987100	SOCKET WRENCH (35)	Used to remove and install drive pinion lock nut.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0177	899984103	SOCKET WRENCH (35)	Used to remove and install drive pinion lock nut.
 G1H0130	498497100	CRANKSHAFT STOPPER	Used to stop rotation of flywheel when loosening tightening bolt, etc.
 G1H0188	498057300	INSTALLER	Used to install extension oil seal.

3. Automatic Transmission and Differential Tools

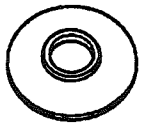
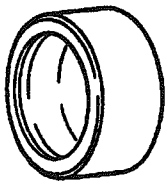
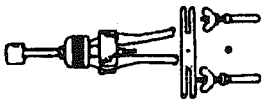
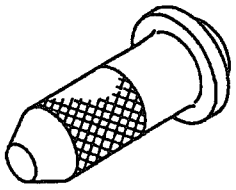
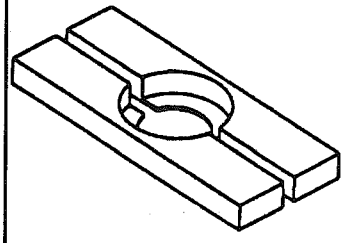
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0185	398177700	INSTALLER	Used to install reverse clutch and high clutch snap rings.
 G1H0186	398487700	DRIFT	Used to remove and install transmission case roller bearing.
 G1H0187	398527700	PULLER ASSY	Used to remove and install extension case roller bearing.
 G1H0188	498057300	INSTALLER	Used to install extension oil seal.
 G1H0189	498077000	REMOVER	For removing differential taper roller bearing.

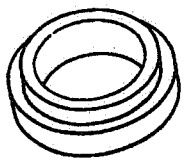
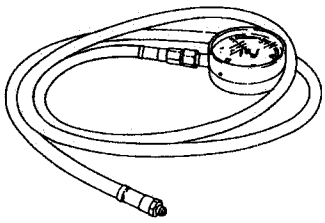
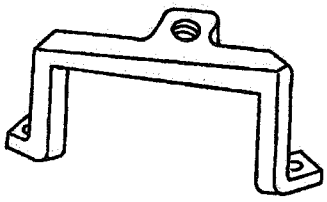
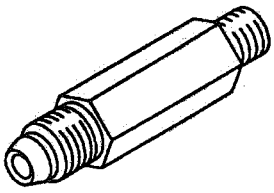
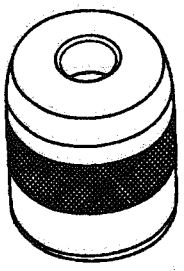
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0190	498267400	TABLE	Used to remove transfer piston seal.
 G1H0192	498575400	OIL PRESSURE GAUGE ASSY	Used when measuring oil pressure.
 G1H0193	498677010	COMPRESSOR	Used to remove band piston servo.
 G1H0194	498897200	ADAPTER	Used on oil pump housing when measuring reverse clutch pressure and line pressure.
 G1H0196	499247400	INSTALLER	• Used to install transfer outer snap ring. • Used with GUIDE (499257300).

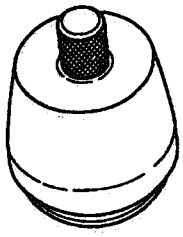
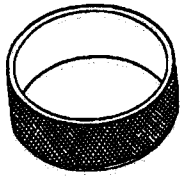
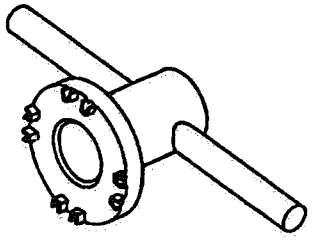
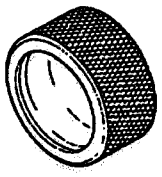
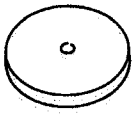
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0197	499257300	GUIDE	• Used to install transfer outer snap ring. • Used with INSTALLER (499247400).
 G1H0198	499257400	GAUGE GUIDE	Used to install transfer piston seal.
 G1H0199	499787000	WRENCH ASSY	Used to remove and install differential side retainer.
 G1H0200	398437700	DRIFT	Used to install converter case oil seal.
 G1H0201	398497701	INSTALLER	Used to install converter case oil seal.

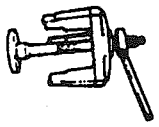
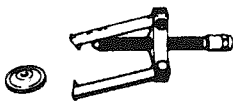
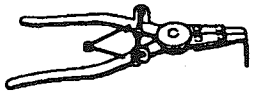
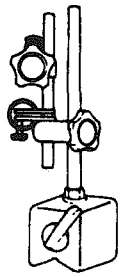
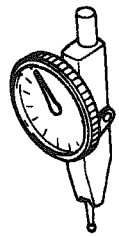
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0203	398673600	COMPRESSOR	Used to remove and install clutch spring.
 G1H0204	399703600	PULLER	Used to install band servo.
 G1H0205	399893600	PLIER	Used to remove and install clutch spring.
 G1H0159	498247001	MAGNET BASE	• Used when measuring gear backlash. • Used with DIAL GAUGE (498247100).
 G1H0160	498247100	DIAL GAUGE	• Used when measuring gear backlash. • Used with MAGNET BASE (498247001).

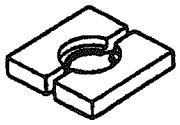
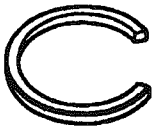
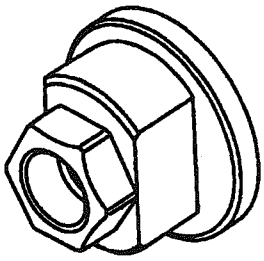
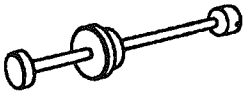
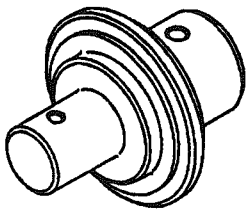
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0162	498517000	REPLACER	Used to remove front roller bearing.
 G1H0206	498627000	SEAT	Used to install clutch spring.
 G1H0207	498937100	HOLDER	Used to remove and install drive pinion lock nut.
 G1H0208	499095500	REMOVER ASSY	Used to remove axle shaft.
 G1H0209	499247300	INSTALLER	• Used to remove axle shaft. • Used with REMOVER (499095500).

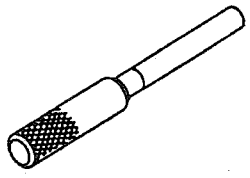
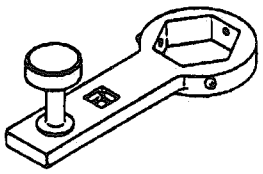
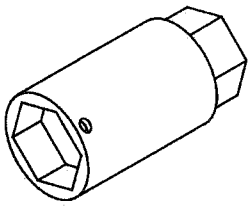
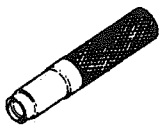
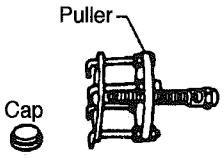
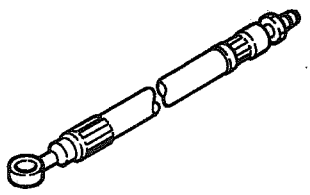
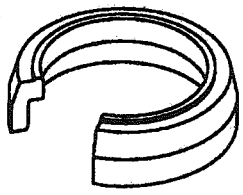
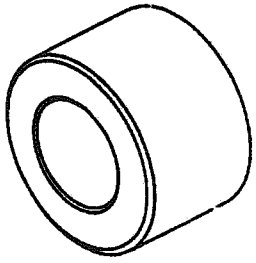
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0210	499267300	STOPPER PIN	Used to install and adjust inhibitor switch.
 G1H0211	499787100	WRENCH ASSY	Used to remove and install drive pinion lock nut.
 B1H0169	499787500	ADAPTER ASSY	Used to remove and install drive pinion lock nut.
 G1H0212	499827000	PRESS	Used to install speedometer shaft oil seal.
 G1H0213	899524100	PULLER SET	Used to remove reduction gear.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0214	498897700	ADAPTER SET	Used with PRESSURE GAUGE.
 B1H0066	398643600	GAUGE	Low & reverse brake, total end play, oil pump, drive pinion height.
 B1H0067	498627100	SEAT	Used to hold overrunning clutch piston retainer (return spring) when installing snap ring.
 B1H0068	499577000	GAUGE	Used when measuring the transmission case mating surface to the reduction gear end surface.

4. Rear Differential Tools (AWD Models)

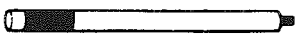
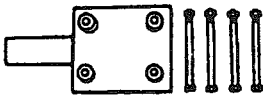
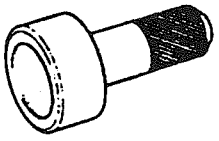
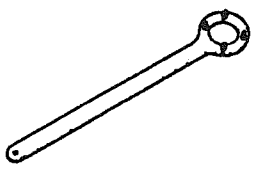
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0215	398477701	HANDLE	Used to install front and rear bearing cone.
 G1H0227	398477702	DRIFT	For press-fitting the bearing cone of differential carrier (front).
 G1H0218	398217700	ATTACHMENT SET	Stand for rear differential carrier disassembly and assembly.
 G1H0221	498447120	DRIFT	Used to install front oil seal.
 G1H0222	498427200	FLANGE WRENCH	Used to stop rotation of companion flange when loosening and tightening self-lock nut.

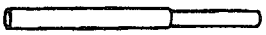
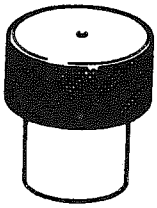
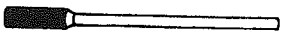
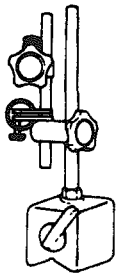
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0224	398467700	DRIFT	Used to remove drive pinion, pilot bearing and front bearing cone.
 G1H0234	399780104	WEIGHT	Used to install front bearing cone, pilot bearing, companion flange.
 G1H0235	899580100	INSTALLER	For press-fitting the front bearing cone, pilot bearing.
 G1H0237	899904100	STRAIGHT PIN REMOVER	Used to drive out differential pinion shaft lock pin.
 G1H0159	498247001	MAGNET BASE	• Used to measure backlash between side gear and pinion, and hypoid gear. • Used with DIAL GAUGE (498247100).

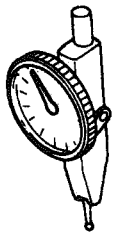
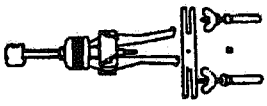
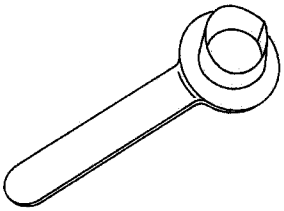
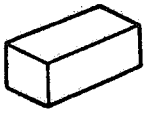
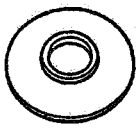
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0160	498247100	DIAL GAUGE	• Used to measure backlash between side gear and pinion, and hypoid gear. • Used with MAGNET BASE (498247001).
 G1H0382	398527700	PULLEY ASSY	Used to remove oil seal and side bearing cup.
 G1H0303	28099PA090	OIL SEAL PROTECTOR	• Used to install rear drive shaft into rear differential. • For protecting oil seal.
 G1H0378	398507704	BLOCK	Used to adjust pinion height and preload.
 G1H0355	398177700	INSTALLER	• Used to install rear bearing cone. • For T-type.

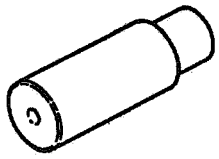
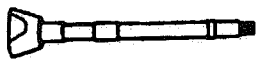
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0386	398457700	ATTACHMENT	• Used to remove side bearing retainer. • For T-type.
 G1H0356	398477703	DRIFT 2	• For press-fitting the bearing race (rear) of differential carrier. • For T-type.
 G1H0375	398437700	DRIFT	• Used to install said oil seal. • For T-type.
 G1H0376	398507702	DUMMY SHAFT	• Used to adjust pinion height and preload. • For T-type.
 G1H0377	398507703	DUMMY COLLAR	• Used to adjust pinion height and preload. • For T-type.

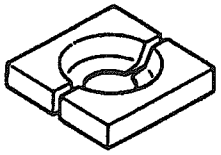
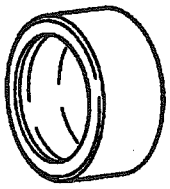
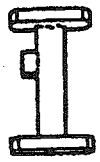
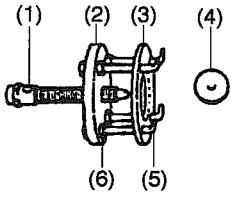
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0379	398517700	REPLACER	• Used to remove rear bearing cone. • For T-type.
 G1H0380	398487700	DRIFT	• For press-fitting the side bearing cone. • For T-type.
 G1H0381	398507701	GAUGE	• Used to adjust pinion height. • For T-type.
 G1H0154	399527700	PULLER SET	• Used to extrack side bearing cone. (1) BOLT (899521412) (2) PULLER (399527702) (3) HOLDER (399527703) (4) ADAPTER (398497701) (5) BOLT (899520107) (6) NUT (021008000) • For T-type.
 G1H0385	398227700	WEIGHT	• Used to install side bearing. • Used with GAUGE (398237700). • For T-type.

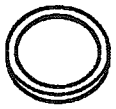
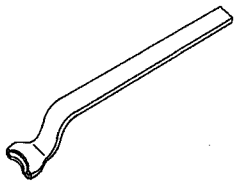
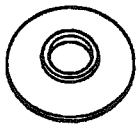
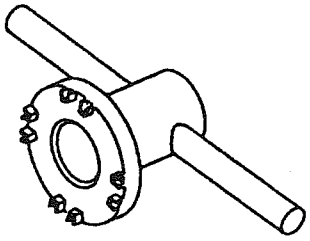
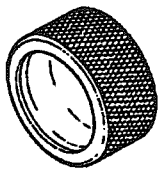
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0372	398237700	GAUGE	• Used to install side bearing. • Used with WEIGHT (398227700). • For T-type.
 G1H0338	28099PA100	DRIVE SHAFT REMOVER	• Used to remove rear drive shaft from rear differential. • For T-type.
 G1H0217	498175500	INSTALLER	• Used to install rear bearing cone. • For VA-type.
 G1H0169	399780111	WRENCH ASSY	• Used to remove and install side oil seal holder. • For VA-type.
 G1H0200	498447100	DRIFT	• Used to install oil seal. • For VA-type.

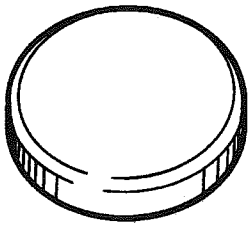
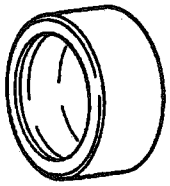
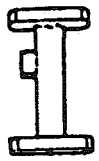
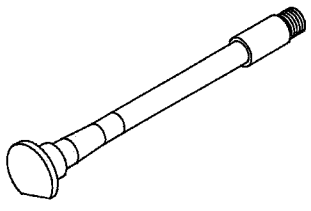
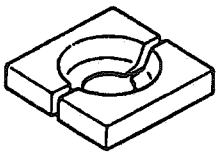
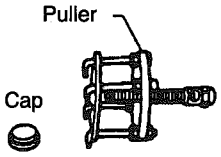
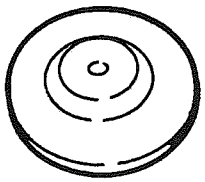
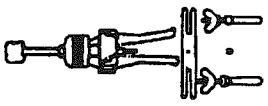
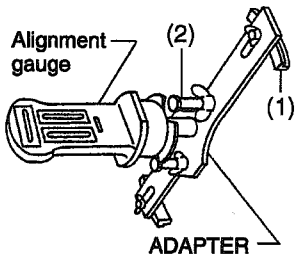
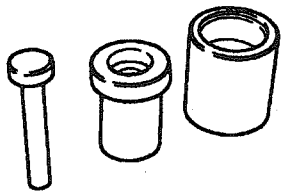
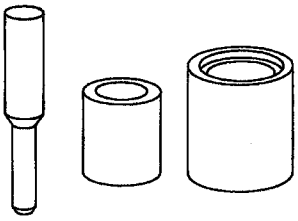
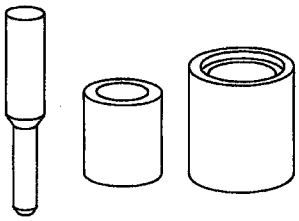
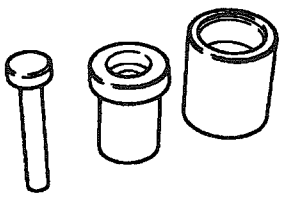
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0305	399520105	SEAT	• Used remove side bearing cone. • Used with PULLER SET (899524100). • For VA-type.
 G1H0225	498485400	DRIFT	• Used to install side bearing cone. • For VA-type.
 G1H0226	498505501	GAGE	• Pinion height adjustment. • For VA-type.
 G1H0227	498447110	BEARING OUTER RACE DRIFT	• For press-fitting the bearing race (front) of differential carrier. • For VA-type.
 B1H0193	498447150	DUMMY SHAFT	• Pinion height and Preload adjustment. • For VA-type.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0229	32285AA000	DUMMY COLLAR	• Pinion height and Preload adjustment. • For VA-type.
 G1H0231	498515500	REPLACER	• Used to remove rear bearing cone. • For VA-type.
 G1H0213	899524100	PULLER SET	• For removing side bearing cone. • For VA-type.
 G1H0236	899874100	INSTALLER	• Used to install companion flange. • For VA-type.
 G1H0304	499705404	SEAT	• Used to remove side bearing race. • Used with PULLEY ASSY (499705401). • For VA-type.

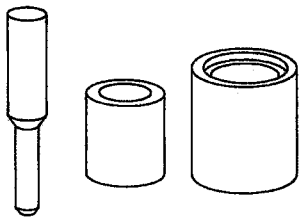
SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0232	499705401	PULLEY ASSY	• Used to remove side bearing race. • Used with SEAT (499705404). • For VA-type.

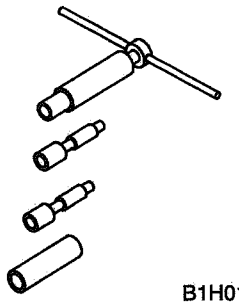
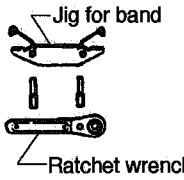
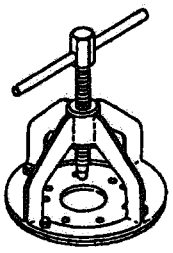
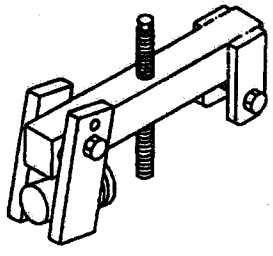
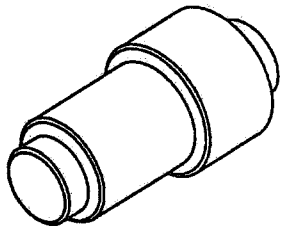
5. Suspension Tools

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B1H0170	927380000	ADAPTER	Used as an adapter for camber & caster gauge when measuring camber and caster. (1) 28199AC000 PLATE (2) 28199AC010 BOLT
 G1H0242	927680000	INSTALLER & REMOVER	Used to replace transverse link bushing (Front).
 G1H0243	927690000	INSTALLER & REMOVER	Used to replace lateral link bushing (12 dia).
 G1H0243	927700000	INSTALLER & REMOVER	Used to replace lateral link bushing (14 dia).
 G1H0242	927720000	INSTALLER & REMOVER	Used to replace trailing link bushing.

SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0243	927730000	INSTALLER & REMOVER	Used to replace rear housing bushing.
 G1H0246	927760000	STRUT MOUNT SOCKET	Used to disassemble and assemble strut mount.

6. Wheels and Axles Tools

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B1H0145	922431000	AXLE SHAFT INSTALLER	• Used to install axle shaft into housing. • Used with ADAPTER (927390000).
 G1H0248	925091000	BAND TIGHTENING TOOL	For tightening boot band.
 G1H0249	926470000	AXLE SHAFT PULLER	Used to remove front axle shaft.
 G1H0250	927060000	HUB REMOVER	• Used to remove front hub. • Used with HUB STAND (927080000).
 G1H0252	927100000	BEARING PULLER	• Used to disassemble and assemble front housing bearing. • Used with HOUSING STAND (927400000).

SPECIAL TOOLS

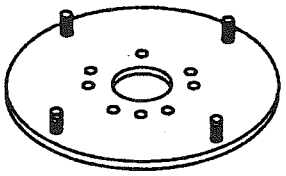
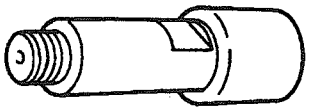
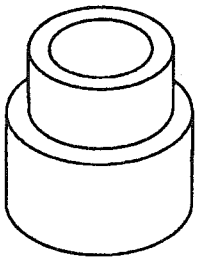
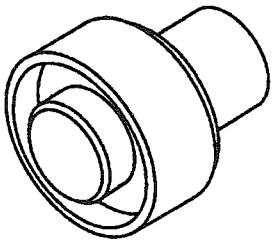
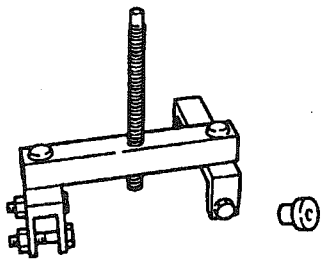
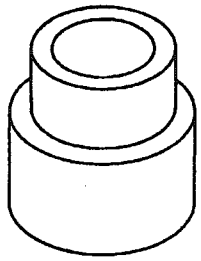
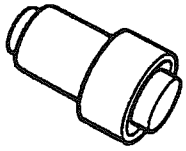
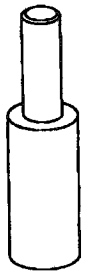
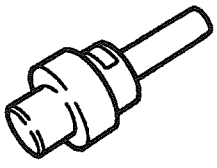
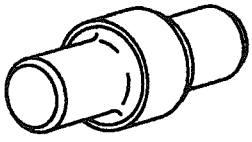
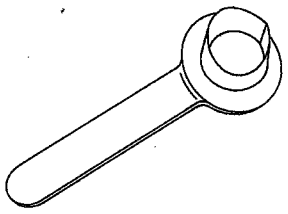
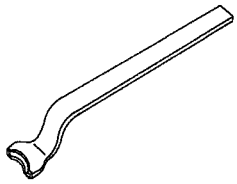
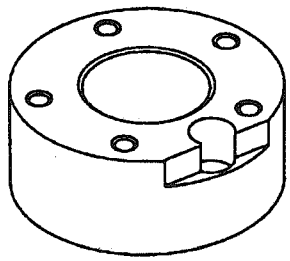
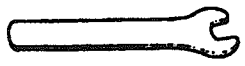
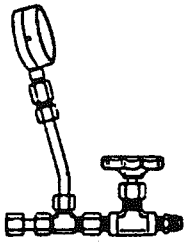
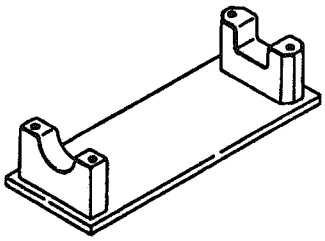
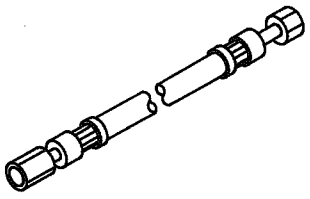
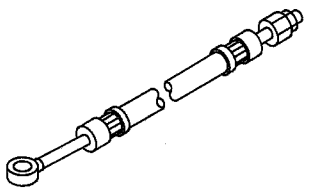
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0253	927140000	AXLE SHAFT PULLER PLATE	Same as plate 2 included in AXLE SHAFT PULLER (926470000).
 G1H0254	927390000	ADAPTER	Used as an adapter for AXLE SHAFT INSTALLER (922431000).
 G1H0255	927400000	HOUSING STAND	• Used to disassemble and assemble front housing bearing. • Used with BEARING PULLER (927100000).
 G1H0256	927410000	OIL SEAL INSTALLER	• Used to install oil seal into front housing. • Used with HOUSING STAND (927400000).
 G1H0257	927420000	HUB REMOVER	• Used to remove rear hub. • Used with HUB STAND (927080000).

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0255	927430000	HOUSING STAND	• Used to disassemble and assemble rear housing bearing. • Used with BEARING PULLER (927440000).
 G1H0258	927440000	BEARING REMOVER	• Used to disassemble and assemble rear housing bearing. • Used with HOUSING STAND (927430000).
 G1H0301	927120000	HUB INSTALLER	• Used to install hub. • Used with HUB STAND (927080000).
 G1H0259	927450000	HUB INSTALLER	• Used to press rear hub into housing assembly. • Used with HUB STAND (927080000).
 G1H0260	927460000	OIL SEAL INSTALLER	• Used to install outer bearing and sub bearing into housing. • Used with HOUSING STAND (927430000).

SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0303	28099PA090	OIL SEAL PROTECTOR	• Used to install rear drive shaft into rear differential. • For protecting oil seal.
 G1H0338	28099PA100	DRIVE SHAFT REMOVER	Used to remove rear drive shaft from rear differential.
 G1H0251	927080000	HUB STAND	• Used to disassemble and assemble hub bolt in hub. • Used to remove front and rear hub.

7. Steering System Tools

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0261	925700000	WRENCH	Used to remove and install tie-rod. Apply this tool to rack.
 G1H0262	925711000	PRESSURE GAUGE	For measuring oil pump pressure.
 G1H0263	926200000	STAND	Used when inspecting characteristic of gearbox assembly and disassembling it. Vise this tool and secure gearbox assembly using gearbox clamp.
To Gauge  B1H0172A	34099AC010 (Newly adopted tool)	ADAPTER HOSE A	Used with PRESSURE GAUGE (925711000).
To Gauge  B1H0185A	34099AC020 (Newly adopted tool)	ADAPTER HOSE B	Used with PRESSURE GAUGE (925711000).

SPECIAL TOOLS

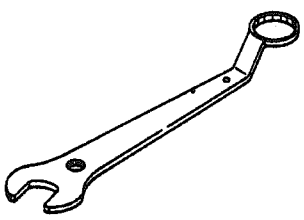
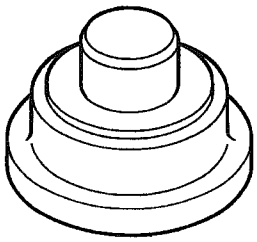
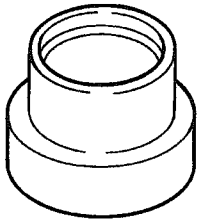
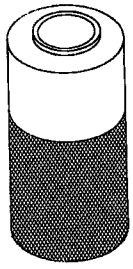
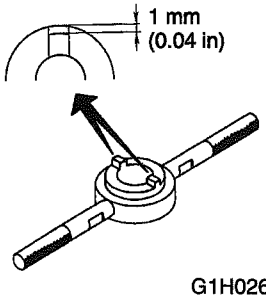
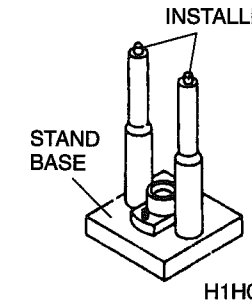
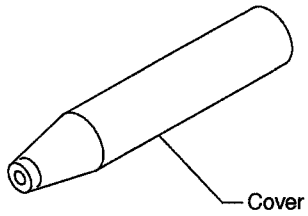
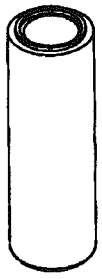
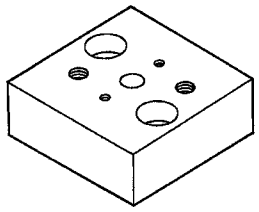
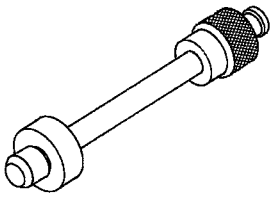
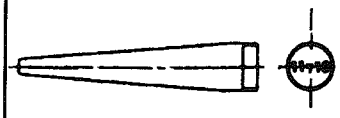
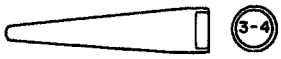
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0265	926230000	SPANNER	For the lock nut when adjusting backlash of gearbox. Measurement of rotating resistance of gearbox assembly.
 G1H0276	34099AA000	INSTALLER	Used to install oil seal and shaft of oil pump.
 G1H0278	34099AA020	INSTALLER	Used to install shaft of oil pump.
 G1H0277	927640000	INSTALLER B	Used to install ball bearing into housing.
 G1H0266	926340001	WRENCH	Used to remove and install circlip which secures rack stopper. If a WRENCH (926340000) is used, grind area (shown in figure) by 1 mm (0.04 in) in advance.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 H1H0475A	926370000	INSTALLER A	• Used to install valve assembly into valve housing assembly. • Used with STAND BASE (927630000).
 H1H0476A	926390001	COVER & REMOVER ASSY	Used to assemble rack assembly.
 B1H0069	926400000	GUIDE	• Right side of rack when installing rack bush. • Used with GUIDE (927660000).
 B1H0070	927660000	GUIDE	• Right side of rack when installing rack bush. • Used with GUIDE (926400000).
 G1H0272	927620000	INSTALLER B	Oil seal of valve housing. Used with INSTALLER A (926360000).

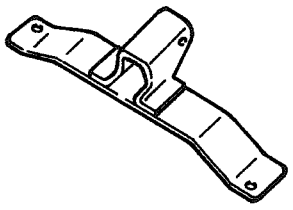
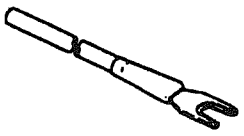
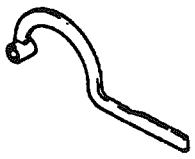
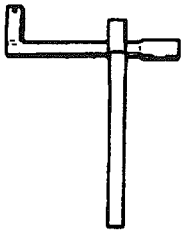
SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0273	927630000	STAND BASE	Used to assemble power steering gearbox.
 G1H0274	926360000	INSTALLER A	• Used as a guide to install oil seal. • Used with INSTALLER B (927620000).
 G1H0275	927650000	INSTALLER	Used to install oil seal.
 G1H0271	927610000	INSTALLER	Used to install oil seal into valve housing.

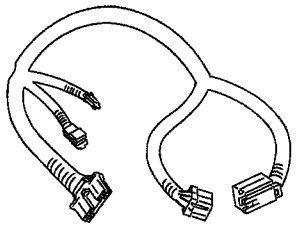
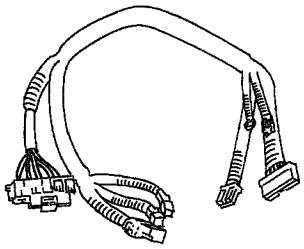
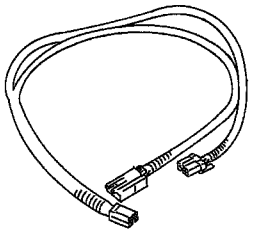
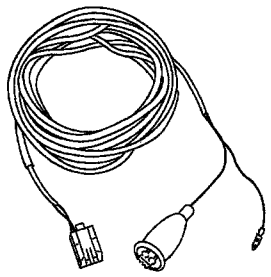
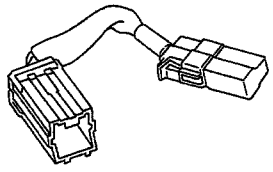
8. Brakes Tools

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0290	925460000	WHEEL CYLINDER 11/16" ADAPTER	Used to install cup onto wheel cylinder piston (Size 11/16 in).
 G1H0291	926460000	WHEEL CYLINDER 3/4" ADAPTER	Used to install cup onto wheel cylinder piston (Size 3/4 in).

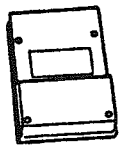
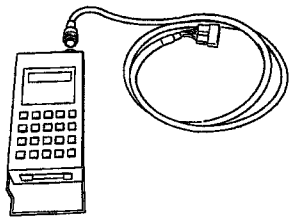
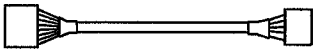
9. Body Tools

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0279	41099AA010	ENGINE SUPPORT BRACKET	For supporting engine.
 G1H0280	41099AA020	ENGINE SUPPORT	For supporting engine.
 G1H0281	925580000	PULLER	Trim clip.
 G1H0282	925610000	WRENCH	Door hinge.
 G1H0283	927780000	REMOVER	Used to remove and install trunk torsion bar.

10. Supplemental Restraint System Tools

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0284	98299PA000	HARNESS A	Used to check the supplemental restraint system.
 G1H0285	98299PA011	HARNESS B2	Used to check the supplemental restraint system.
 G1H0286	98299PA020	HARNESS C	Used to check the supplemental restraint system.
 G1H0287	98299PA030	DEPLOYMENT TOOL	Used to operate the supplemental restraint system when scraping the vehicle.
 G1H0389	98299PA040	AIR BAG RESISTOR	Used to check the steering column harness.

11. Select Monitor and Cartridge

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 G1H0288	498346200 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.
 G1H0127	498307500	SELECT MONITOR KIT	Troubleshooting for electrical systems.
 B1H0076	498357200	ADAPTER CABLE	Troubleshooting for electrical systems.

MECHANISM AND FUNCTION

FOREWORD

This portion of the manual has been prepared to provide information for the construction, operation and other technical details of SUBARU vehicles.
Read this manual thoroughly and make the most of it to give better service to your customers and improve your knowledge of vehicle maintenance.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

1. How to use this manual

- The description of this area is provided with three types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

• Area title	M. Mechanism and Function
• Large title (Heading)	1. Fuel Line (to denote the main item of explanation)
• Medium title (Section)	A. GENERAL (to denote a derivative item of explanation)
• Small title (Sub-section)	1. 1800 cc MODEL (to denote a derivative item of explanaion)

- The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.

(Example of usage)

Refer to 6 - 2 [M 1 A 0]

- Small title (Sub-section)
- Medium title (Section)
- Large title (Heading)
- Mechanism and Function
- Chapter No.

Title index No.

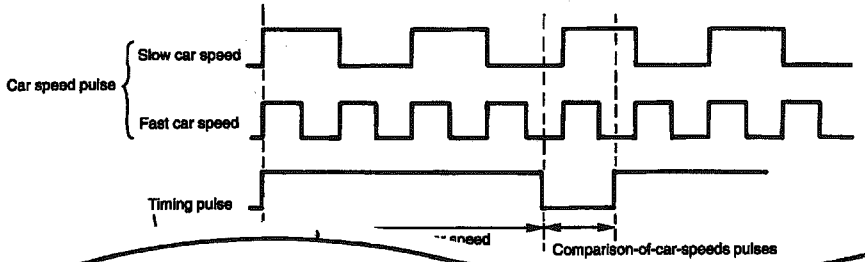
Large title

Medium title

1. Cruise Control

A. OPERATION

- The cruise control automatically controls car speed and allows the car to run at a constant speed without depressing the accelerator pedal.
- The cruise control unit compares the actual car speed detected by feedback signals from the speedometer with the speed set in the memory memorized when the set switch was turned on. A signal is then transmitted according to the difference between the two speeds. This signal is transmitted to the solenoid valve of the vacuum actuator located in the engine compartment. The movement of the actuator operates the throttle cam, thereby keeping the car speed constant.
- **Detection of car speed**



H0H0009

TABLE OF CONTENTS

ENGINE SECTION

EMISSION CONTROL SYSTEM AND VACUUM FITTING 2-1

1. System Application

There are three emission control systems which are as follows:

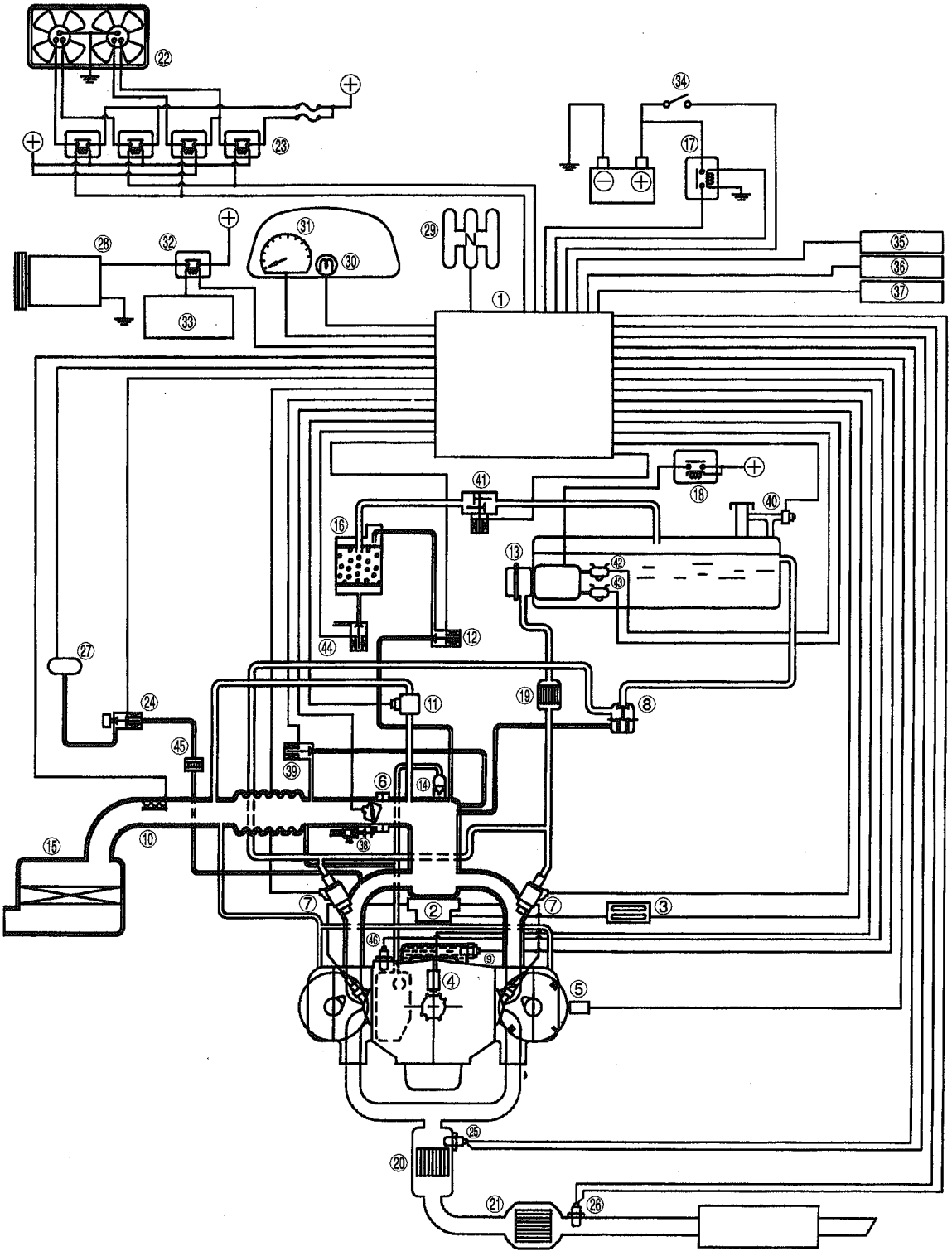
- Crankcase emission control system
- Exhaust emission control system
  - Three-way catalyst system
  - A/F control system
  - Ignition control system
  - EGR system (AT vehicles only)
- Evaporative emission control system

Item			Main components	Function
Crankcase emission control system			PCV valve	Draws blow-by gas into intake manifold from crankcase and burns it together with air-fuel mixture. Amount of blow-by gas to be drawn in is controlled by intake manifold pressure.
Exhaust emission control system	Catalyst system	Front	Three-way catalyst	Oxidizes HC and CO contained in exhaust gases as well as reducing NOx.
		Rear		
	A/F control system		ECM (Engine control module)	Receives input signals from various sensors, compares signals with stored data, and emits a signal for optimal control of air-fuel mixture ratio.
			Oxygen sensor	Detects density of oxygen contained exhaust gases.
			Mass air flow sensor	Detects amount of intake air.
			Throttle position sensor	Detects throttle position.
	Ignition control system		ECM	Receives various signals, compares signals with basic data stored in memory, and emits a signal for optimal control of ignition timing.
			Crankshaft position sensor	Detects engine speed (Revolution).
			Camshaft position sensor	Detects reference signal for combustion cylinder discrimination.
			Engine coolant temperature sensor	Detects coolant temperature.
			Knock sensor	Detects engine knocking.
	EGR system (AT vehicles only)		ECM	Receives various signals, compares signals with basic data stored in memory, and emits ON-OFF signal for EGR solenoid valve.
			EGR valve	Controls amount of exhaust gas to send to intake manifold.
			EGR control solenoid valve	Controls intake manifold pressure to transmit EGR valve for ON-OFF signal emitted from ECM.
			BPT (Back pressure transducer)	Controls operation of EGR valve according to engine load.

Item	Main components	Function
Evaporative emission control system	Canister	Absorbs evaporative gas which occurs in fuel tank when engine stops, and sends it to combustion chambers for a complete burn when engine is started. This prevents HC from being discharged into atmosphere.
	Purge control solenoid valve	Receives a signal from ECM and controls purge of evaporative gas absorbed by canister.
	Pressure control solenoid valve (1800 cc model)	Receives a signal from ECM and controls evaporative gas pressure in fuel tank.
	Vent control solenoid valve (1800 cc model)	Closes the evaporation line by receiving a signal from ECM to check the evaporation gas leak.

2. Schematic Drawing

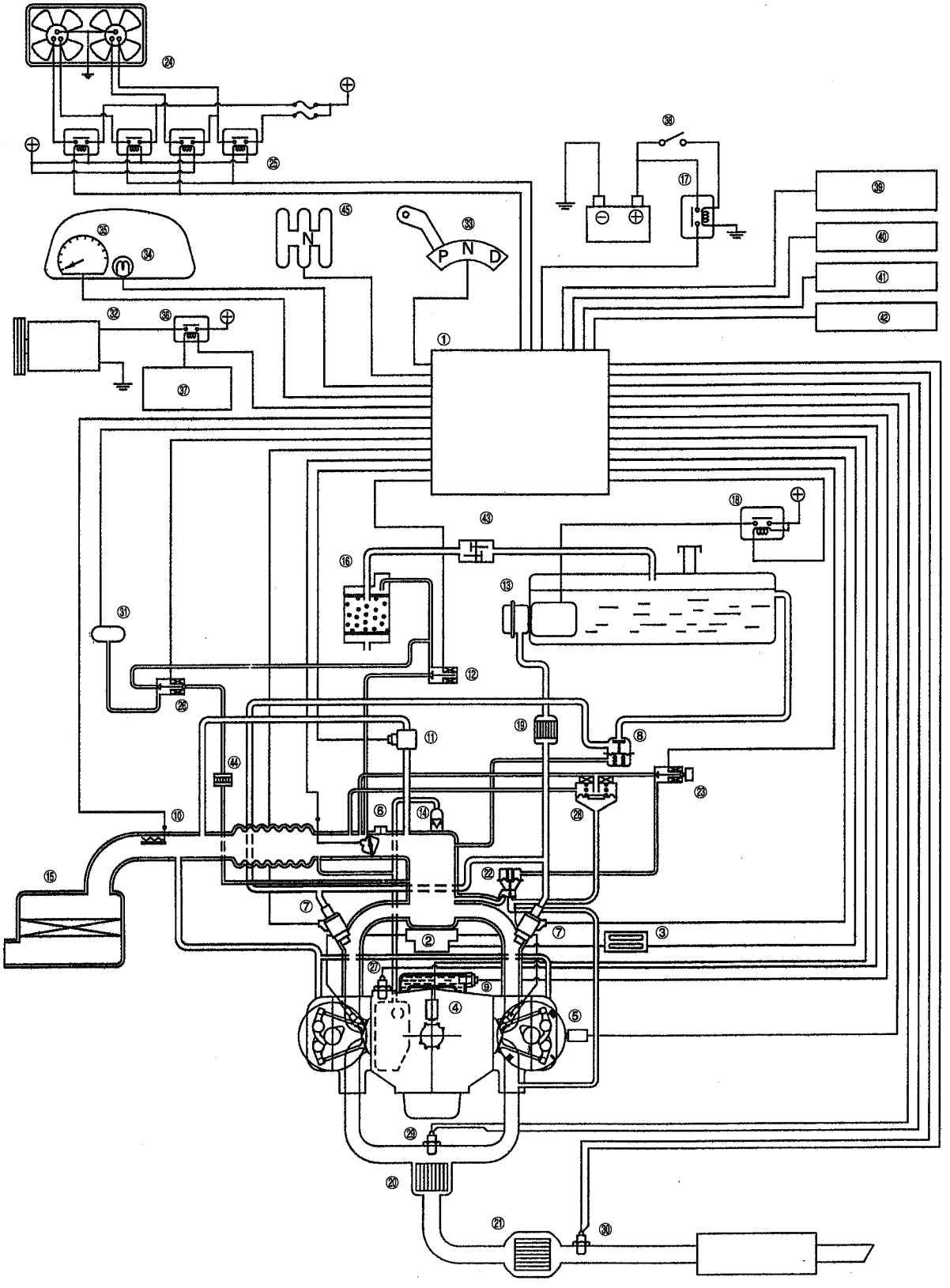
A: 1800 cc MT MODEL



H2H1546A

① Engine control module (ECM)
② Ignition coil
③ Ignitor
④ Crankshaft position sensor
⑤ Camshaft position sensor
⑥ Throttle position sensor
⑦ Fuel injectors
⑧ Pressure regulator
⑨ Engine coolant temperature sensor
⑩ Mass air flow sensor
⑪ Idle air control solenoid valve
⑫ Purge control solenoid valve
⑬ Fuel pump
⑭ PCV valve
⑮ Air cleaner
⑯ Canister
⑰ Main relay
⑱ Fuel pump relay
⑲ Fuel filter
⑳ Front catalytic converter
㉑ Rear catalytic converter
㉒ Radiator fan
㉓ Radiator fan relay
㉔ Pressure sources switching solenoid valve
㉕ Front oxygen sensor
㉖ Rear oxygen sensor
㉗ Pressure sensor
㉘ A/C compressor (With A/C models)
㉙ Neutral position switch
㉚ CHECK ENGINE malfunction indicator lamp (MIL)
㉛ Tachometer
㉜ A/C relay (With A/C models)
㉝ A/C control module (With A/C models)
㉞ Ignition switch
㉟ Vehicle speed sensor
㊱ Data link connector (For Subaru select monitor)
㊲ Data link connector (For Subaru select monitor and OBD-II general scan tool)
㊳ Throttle opener
㊴ FICD solenoid valve (With A/C models)
㊵ Fuel tank pressure sensor
㊶ Pressure control solenoid valve
㊷ Fuel temperature sensor
㊸ Fuel level sensor
㊹ Vent control solenoid valve
㊺ Filter
㊻ Knock sensor

B: 2200 cc MODEL



H2H1435A

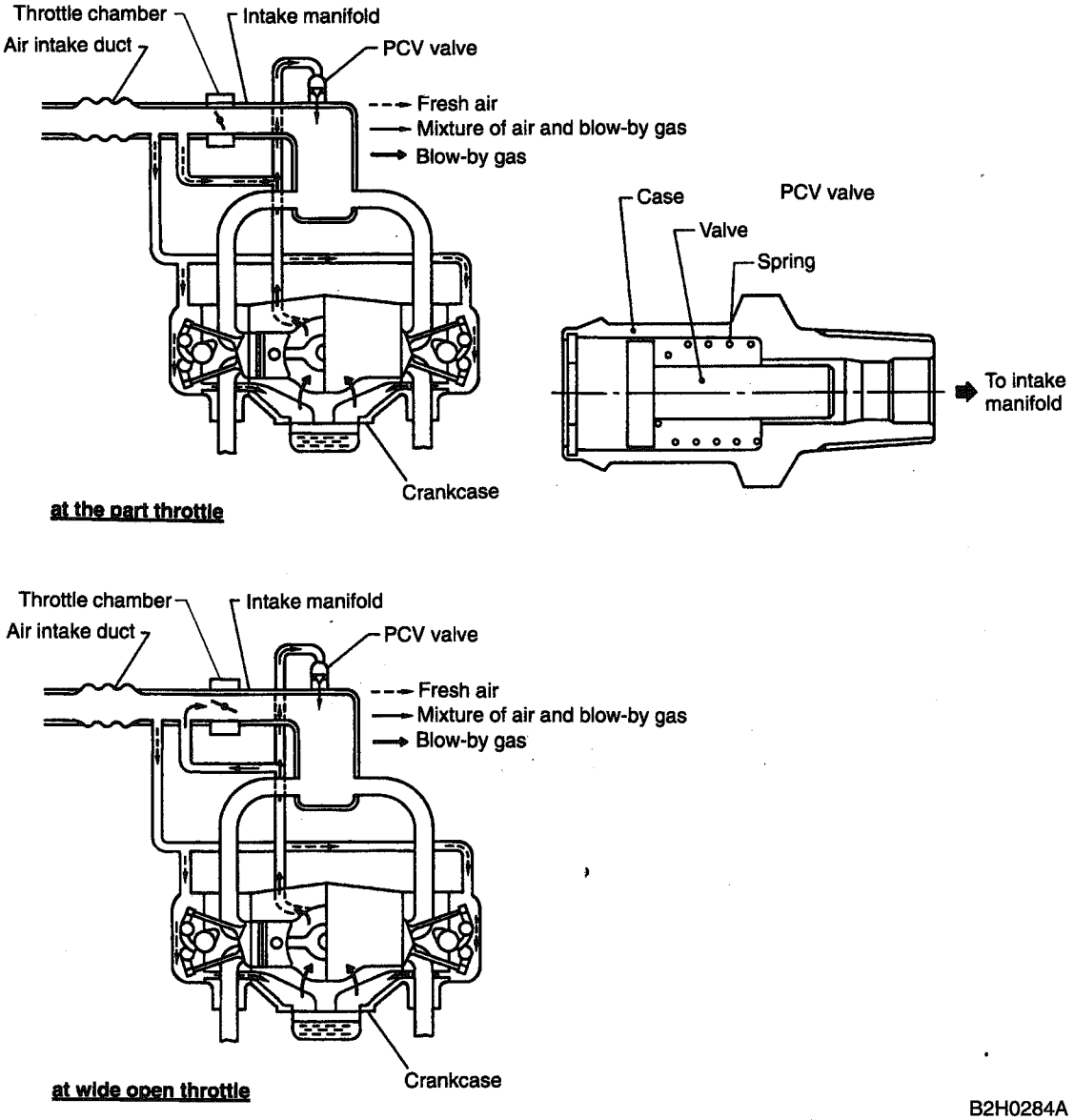
① Engine control module (ECM)
② Ignition coil
③ Ignitor
④ Crankshaft position sensor
⑤ Camshaft position sensor
⑥ Throttle position sensor
⑦ Fuel injectors
⑧ Pressure regulator
⑨ Engine coolant temperature sensor
⑩ Mass air flow sensor
⑪ Idle air control solenoid valve
⑫ Purge control solenoid valve
⑬ Fuel pump
⑭ PCV valve
⑮ Air cleaner
⑯ Canister
⑰ Main relay
⑱ Fuel pump relay
⑲ Fuel filter
⑳ Front catalytic converter
㉑ Rear catalytic converter
㉒ EGR valve (AT vehicles only)
㉓ EGR control solenoid valve (AT vehicles only)
㉔ Radiator fan
㉕ Radiator fan relay
㉖ Pressure sources switching solenoid valve
㉗ Knock sensor
㉘ Back-pressure transducer
㉙ Front oxygen sensor
㉚ Rear oxygen sensor
㉛ Pressure sensor
㉜ A/C compressor
㉝ Inhibitor switch (AT vehicles)
㉞ CHECK ENGINE malfunction indicator lamp (MIL)
㉟ Tachometer
㊱ A/C relay
㊲ A/C control module
㊳ Ignition switch
㊴ Transmission control module (TCM)
㊵ Vehicle speed sensor
㊶ Data link connector (Subaru select monitor)
㊷ Data link connector (OBD-II general scan tool)
㊸ Two way valve
㊹ Filter
㊺ Neutral position switch (MT vehicles)

3. Crankcase Emission Control System

• The positive crankcase ventilation (PCV) system is employed to prevent air pollution which will be caused by blow-by gas being emitted from the crankcase.
The system consists of a sealed oil filler cap, rocker covers with fresh air inlet, connecting hoses, PCV valve and an air intake duct.

• At the part throttle, the blow-by gas in the crankcase flows into the intake manifold through the connecting hose of crankcase and PCV valve by the strong vacuum of the intake manifold. Under this condition, the fresh air is introduced into the crankcase through connecting hose of rocker cover.

• At wide open throttle, a part of blow-by gas flows into the air intake duct through the connecting hose and is drawn to the throttle chamber, because under this is condition, the intake manifold vacuum is not so strong as to introduce all blow-by gases increasing with engine speed directly through the PCV valve.



4. Three-way Catalyst

• The basic material of three-way catalyst is platinum (Pt) and rhodium (Rh), and a thin film of their mixture is applied onto honeycomb or porous ceramics of an oval shape (carrier). To avoid damaging the catalyst, only unleaded gasoline should be used.

• The catalyst is used to reduce HC, CO and NOx in exhaust gases, and permits simultaneous oxidation and reduction. To obtain an excellent purification efficiency on all components HC, CO and NOx, a balance should be kept among the concentrations of the components. These concentrations vary with the air-fuel ratio.

• The air-fuel ratio needs to be controlled to a value within the very narrow range covering around the stoichiometric mixture ratio to purify the components efficiently.

5. A/F Control System

• The air/fuel control system compensates for the basic amount of fuel injection in response to a signal sent from the oxygen sensor to provide proper feedback control of the mixture. Thus, the theoretical air-fuel ratio is maintained to provide effective operation of the three-way catalyst. The basic amount of fuel injection is preset according to engine speed and loads, as well as the amount of intake air.

• This system also has a "learning" control function which stores the corrected data in relation to the basic amount of fuel injection in the memory map. A new air-fuel ratio correction is automatically added for quick response to the deviation of the air-fuel ratio. Thus, the air-fuel ratio is optimally maintained under various conditions while stabilizing exhaust gases, improving driving performance and compensating for changes in sensors' performance quality with elapse of time.

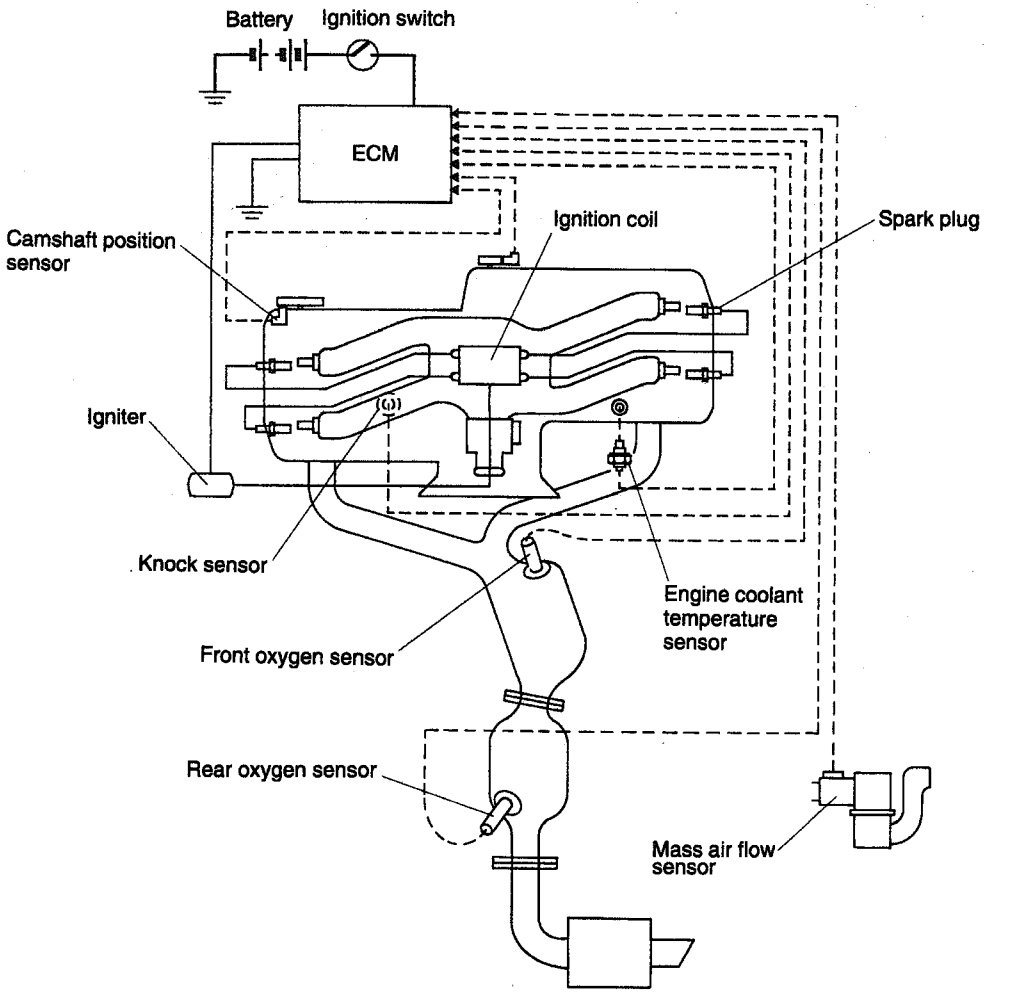
<Ref. to 2-7 [M5C0].>

6. Ignition Control System

• The ignition control system is controlled by the ECM.
The ECM determines the optimal ignition timing according to signals sent from various sensors (which monitor the operating conditions of the engine), and sends a signal to the igniter.

• The ECM has a "closed-loop" control function with map which provides superb transient characteristics for responsive ignition timing control.

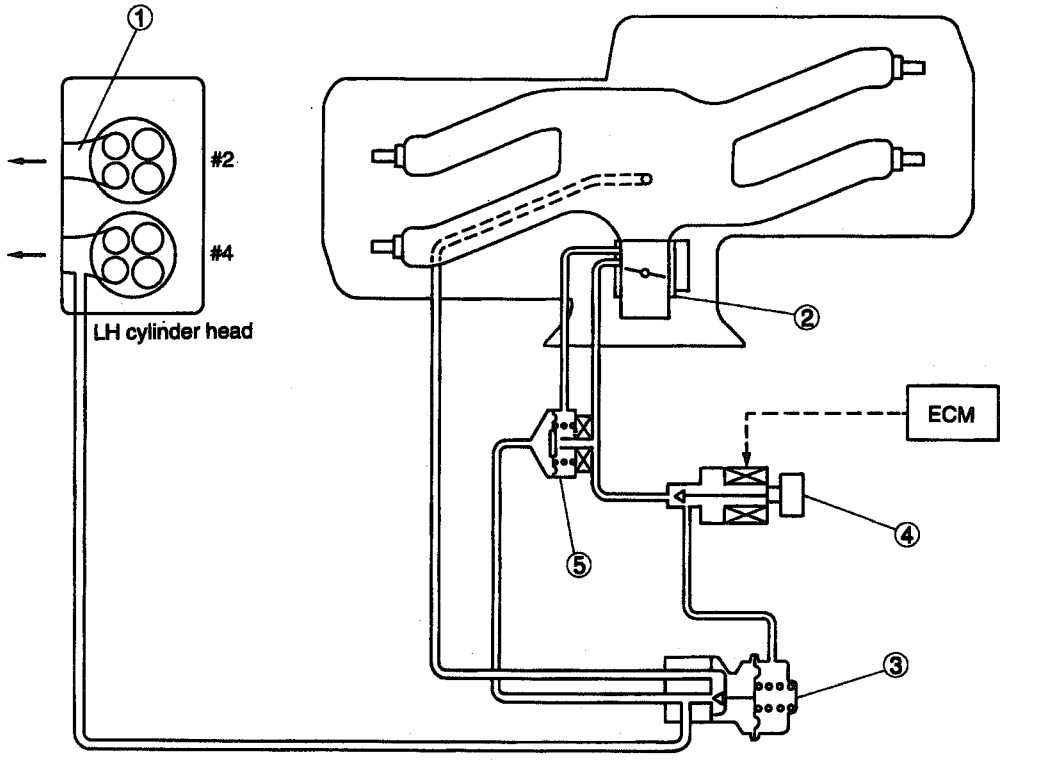
<Ref. to 2-7 [M5D0].>



7. EGR (Exhaust Gas Recirculation) System [AT Vehicles]

A: GENERAL

- The EGR system aims at reduction of NOx by lowering the combustion temperature through recirculation of a part of exhaust gas into cylinders via the intake manifold.
- This system consists of the EGR valve, EGR solenoid valve, and BPT (Back pressure transducer): The EGR valve is operated by the vacuum via a BPT from the throttle body and controls the exhaust gas flow from the exhaust manifold to the intake manifold. The EGR solenoid valve is controlled by the ECM according to the engine driving condition and opens/closes the vacuum line from the BPT to the EGR valve diaphragm. The BPT controls vacuum in order for the amount of the EGR that corresponds to the engine load to be obtained.

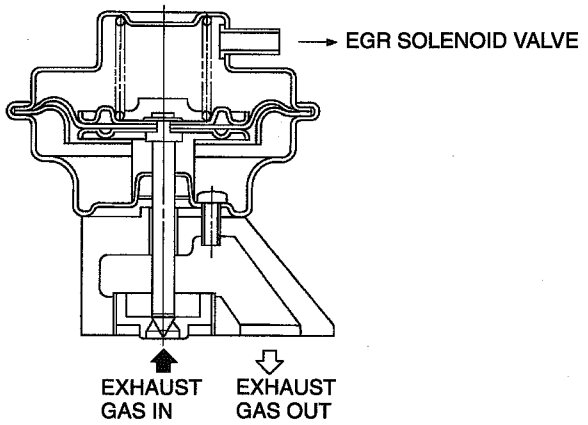


B2H0286A

① Exhaust port
② Throttle body
③ EGR valve
④ EGR solenoid valve
⑤ BPT

B: EGR VALVE

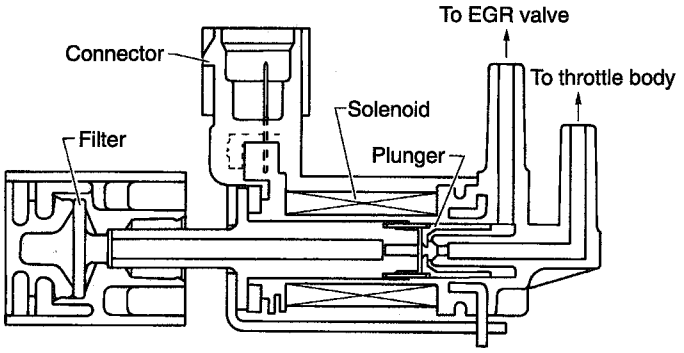
The EGR valve is situated between the exhaust manifold and collector. After opening EGR solenoid valve, EGR valve is opened for receiving throttle port pressure on diaphragm. Then, part of the exhaust gas is recirculated into collector chamber.



B2H0391

C: EGR SOLENOID VALVE

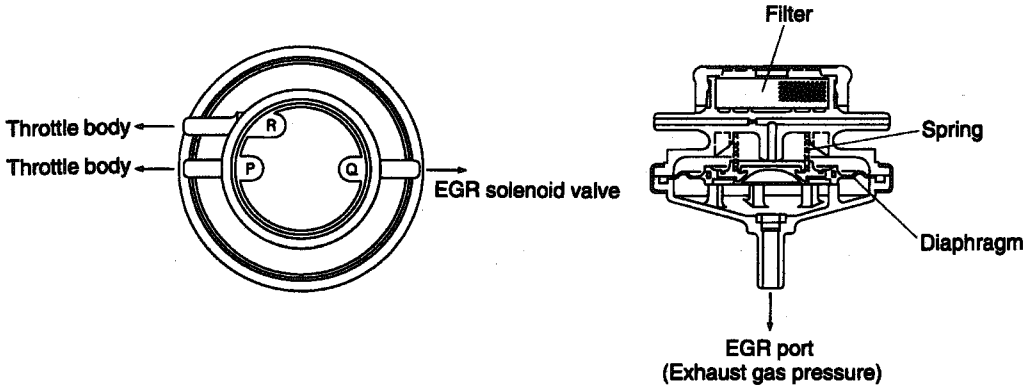
The EGR solenoid valve is situated between the throttle body and EGR valve. EGR solenoid valve is opened by a signal emitted from the ECM. Therefore, throttle port pressure is transmitted to diaphragm of EGR valve.



G2H0229

D: BPT

The BPT is installed between the throttle body and the EGR solenoid valve. The BPT, varying the throttle port vacuum that acts on the EGR valve according to the throttle opening angle and exhaust gas pressure, controls the rate of exhaust gas flow to the EGR valve.



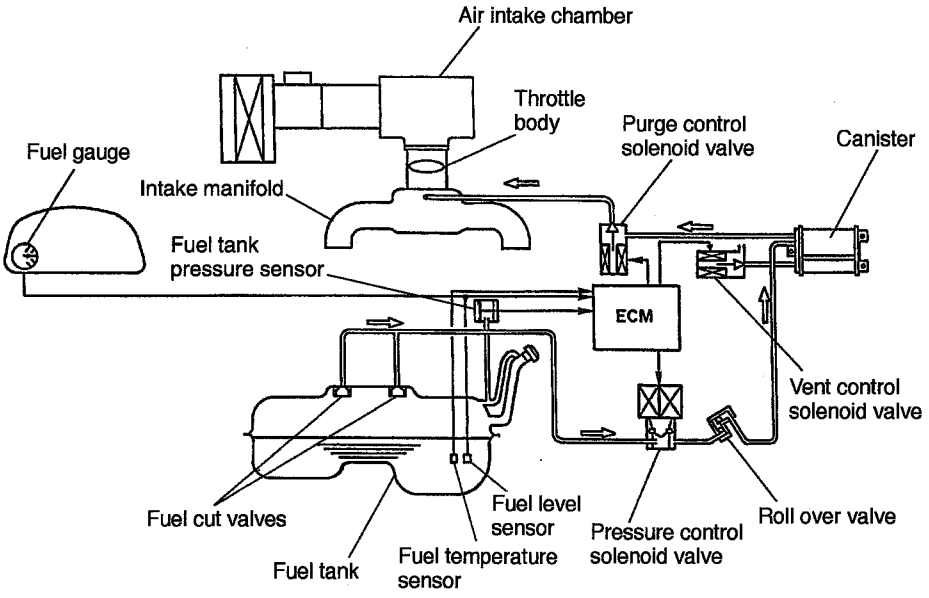
B2H0393A

8. Evaporative Emission Control System

A: GENERAL

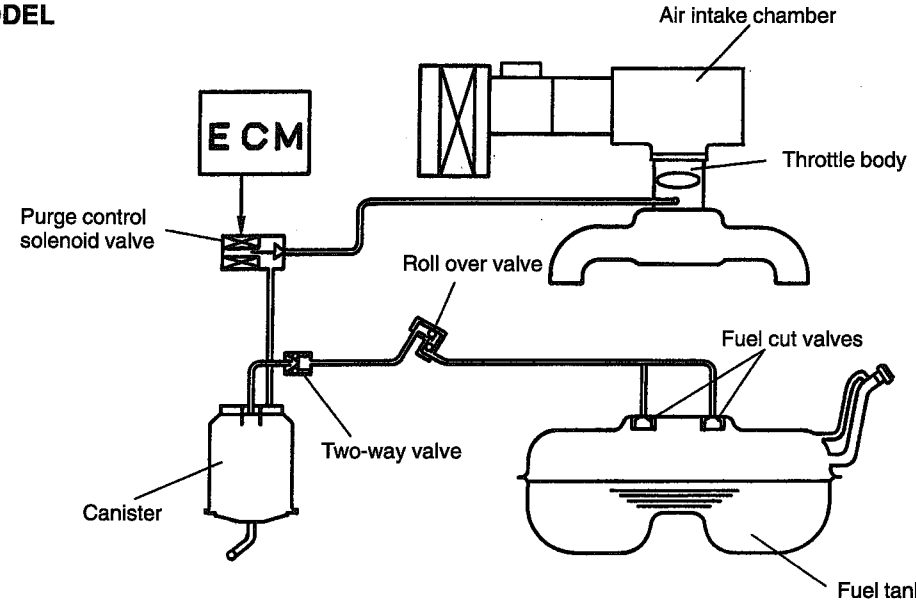
- The evaporative emission control system is employed to prevent evaporative fuel from being discharged into ambient atmosphere. This system includes a canister, purge control solenoid valve, fuel cut valve, their connecting lines, etc.
- Gasoline vapor evaporated from the fuel in the fuel tank is introduced into the canister through the evaporation line, and is absorbed on activated carbon in it. A fuel cut valve is also incorporated on the fuel tank line.
- The purge control solenoid valve is controlled by the ECM and provides optimal purge control according to the engine condition. On 1800 cc models, the signal from the fuel temperature sensor and fuel level sensor installed in the fuel tank is also used for this control.
- A pressure control solenoid valve incorporated in the fuel tank evaporation line controls the pressure/vacuum in the fuel tank according to the pressure/vacuum sensed by the fuel tank pressure sensor. [1800 cc models]

1800 cc MODEL



H2H1642A

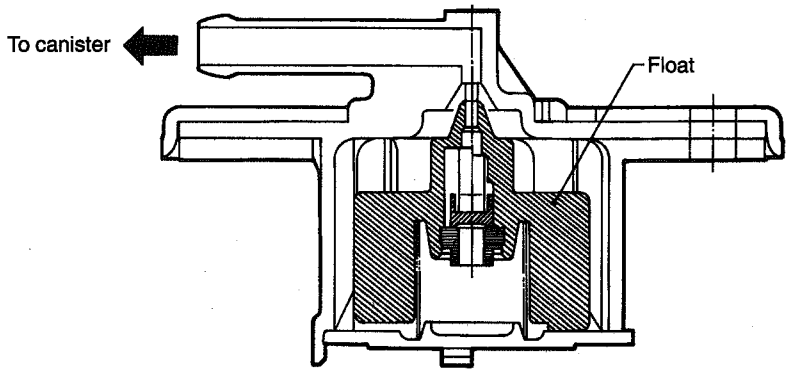
2200 cc MODEL



B2H1272B

B: FUEL CUT VALVE

On AWD model, the fuel cut valve is built onto the evaporation pipe of the fuel tank cap. The rising level of the fuel from the fuel tank causes the float to move up and close the cap hole so that no fuel can enter during evaporation line.

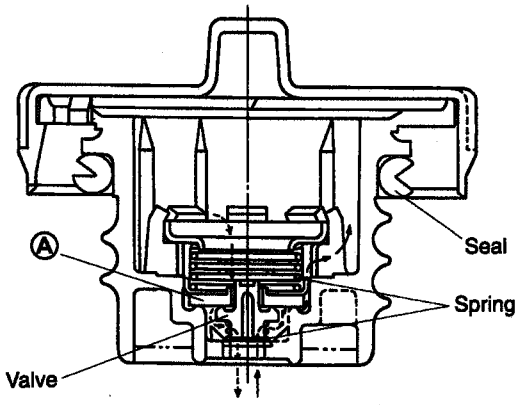


G2H0008

C: FUEL CAP

The relief valve is adopted to prevent the development of vacuum in the fuel tank which may occur in case of trouble in the fuel vapor line.

In normal condition, the filler pipe is sealed at Ⓐ and at the packing pressed against the filler pipe end. As vacuum develops in the fuel tank, atmospheric pressure forces the spring down to open the valve; consequently air is led into the fuel tank controlling the inside pressure.

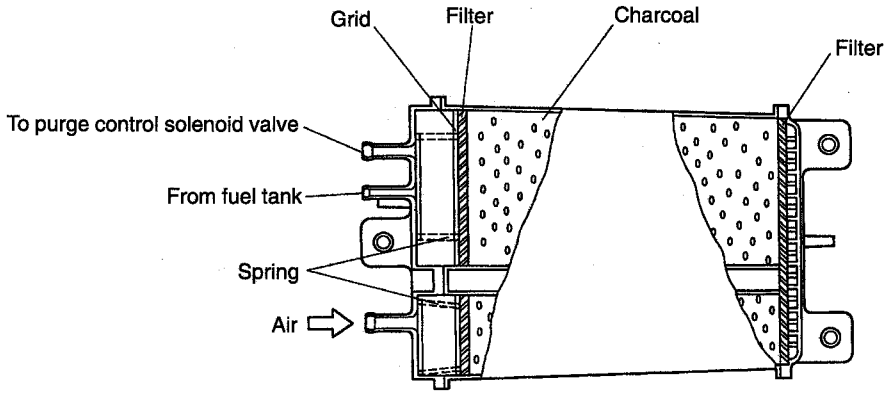


B2H0395A

D: CANISTER

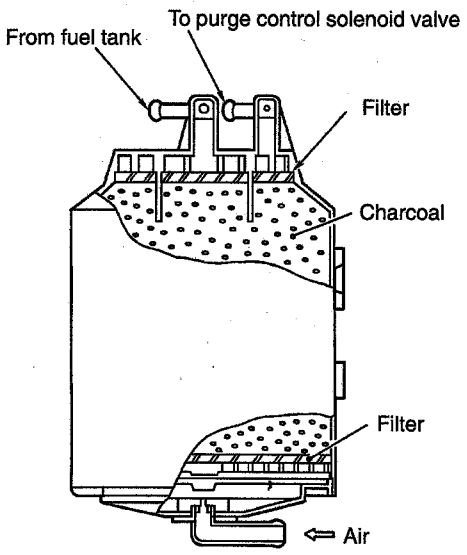
The canister temporarily stores the evaporation gas. When the purge control solenoid valve is opened from a signal sent from the ECM, the evaporation gas is sent into the collector chamber after being mixed with fresh external air.

1800 cc MODEL



H2H1164A

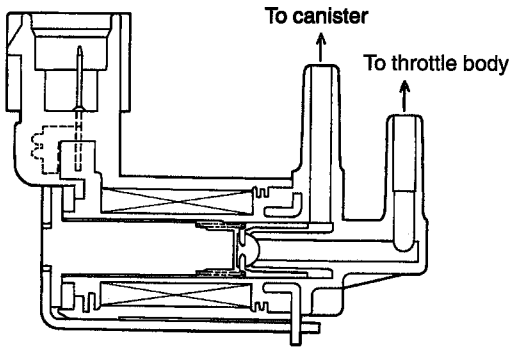
2200 cc MODEL



H2H1440A

E: PURGE CONTROL SOLENOID VALVE

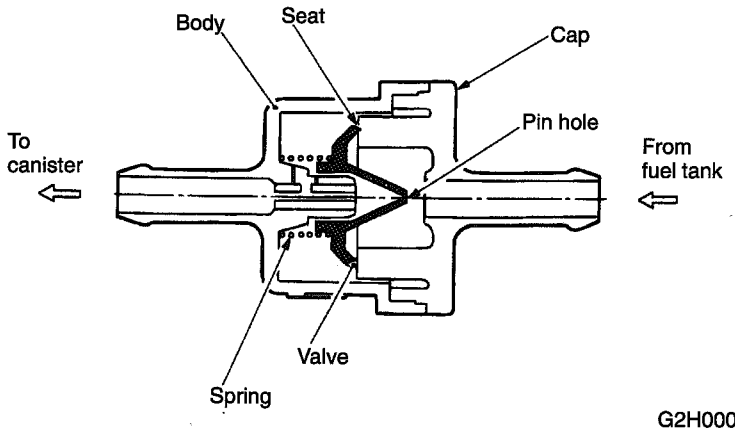
The purge control solenoid valve is on the evaporation line between canister and throttle body. It is built on the inside of collector chamber.



B2H0426

F: TWO-WAY VALVE [2200 cc MODEL]

- The two-way valve is located in the evaporation line between the fuel tank and canister. When evaporation gas pressure in fuel tank exceeds the specified value, the valve is pressurized to push the spring. This lifts the valve seat so that evaporative gas is discharged to the canister.
- When evaporation gas pressure in fuel tank drops specified value, the valve move to close the valve seat. However, air which enters from the inlet port of the canister is introduced into the fuel tank through the pin hole located at end of the valve.



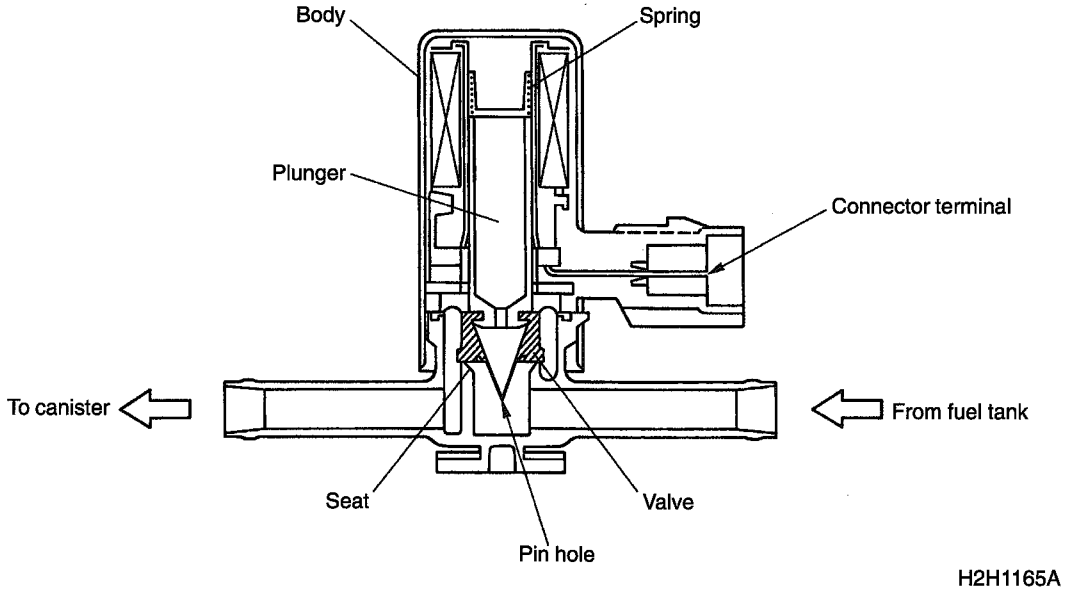
G2H0003

G: PRESSURE CONTROL SOLENOID VALVE [1800 cc MODEL]

The fuel tank pressure control solenoid valve located in the evaporation line between the fuel tank and the canister adjusts the pressure inside the fuel tank under the control of ECM.

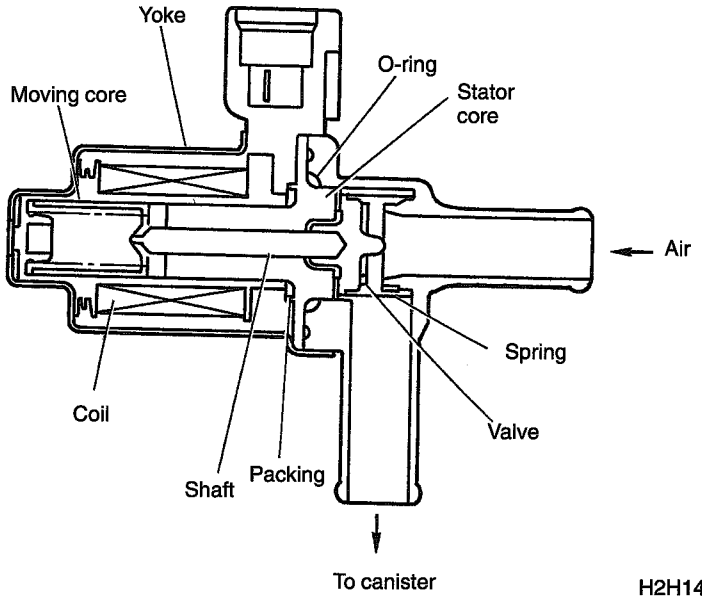
- While the engine is running, ECM detects the evaporation gas pressure in the fuel tank through the signal from the fuel tank pressure sensor installed at the fuel filler pipe.
When the evaporation gas pressure in the fuel tank exceeds the specified value, ECM moves up/down the fuel tank pressure control solenoid valve plunger to open/close the control valve.

- During the engine stop, the fuel tank pressure control solenoid valve works as a two-way valve. (Two-way valve operation is the same as that used in other models.)
When the evaporation gas pressure in the fuel tank exceeds the specified value, it overcomes the valve spring force and opens the valve, and the gas is lead to the canister.
When the evaporation gas pressure in the fuel tank drops under the specified value, the valve closes. When the pressure lowers further, air from the inlet port of the canister is introduced into the fuel tank through the pin hole at the end of the valve.



H: VENT CONTROL SOLENOID VALVE [1800 cc MODEL]

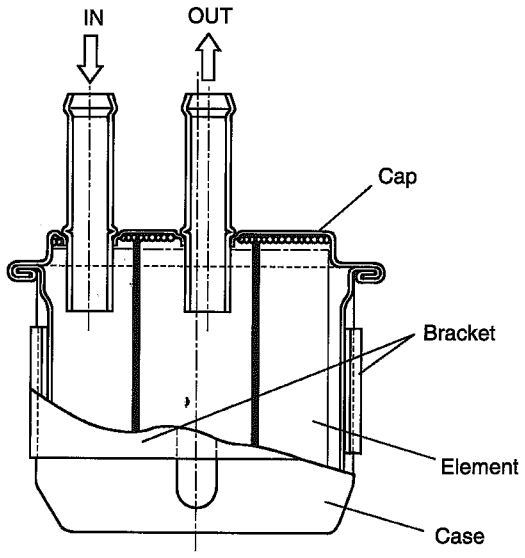
The vent control solenoid valve is installed at the intake port of the canister which opens to the atmosphere.
Normally, the valve is opened and the atmosphere is taken in the canister.
On the inspection of the evaporation gas leak at the evaporation line, this valve receives a signal from ECM and moves the shaft to the right to close the intake port of the canister.



H2H1441A

I: AIR FILTER [1800 cc MODEL]

The air filter is installed at the air inlet port of the vent control solenoid valve to clean the air taken in the canister through the vent control solenoid valve.

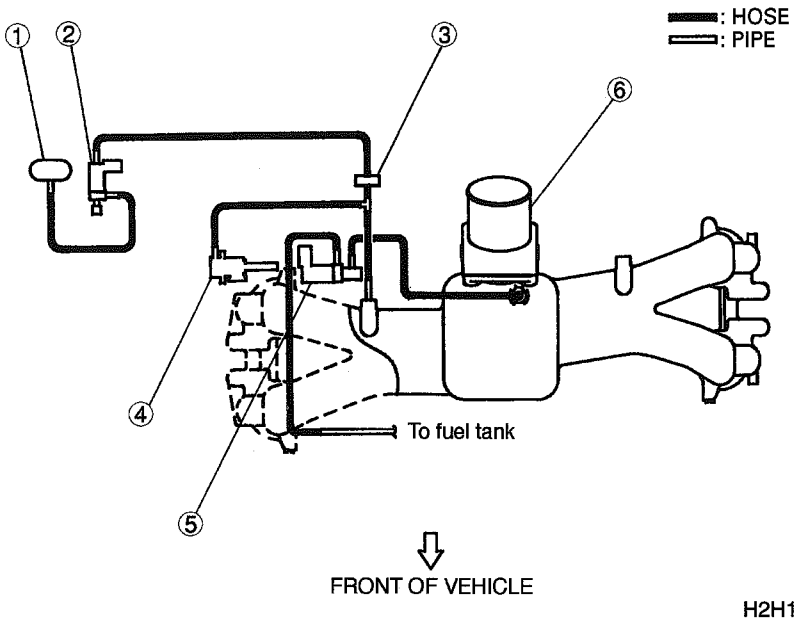


H2H1482A

9. Vacuum Fitting

The hose and pipe connections of collector chamber (intake manifold), throttle body and related parts are as shown in the illustration.

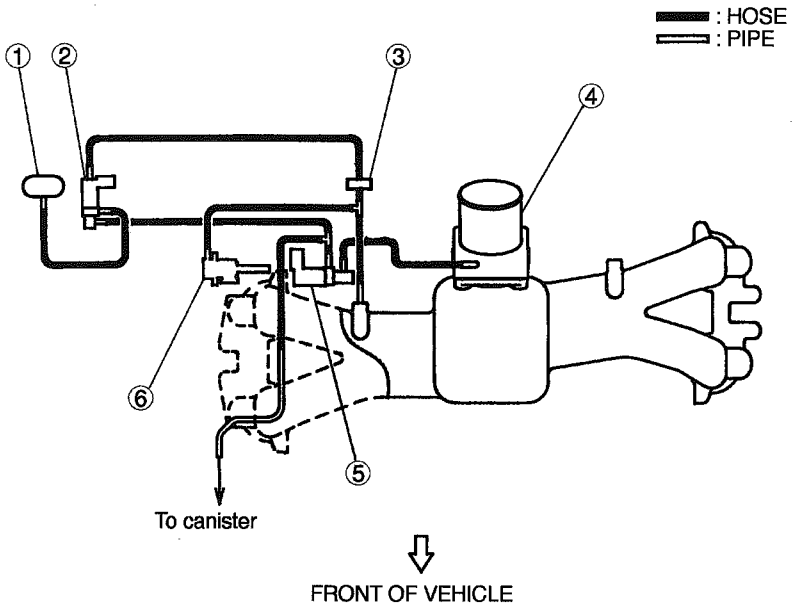
1800 cc MODEL



H2H1547A

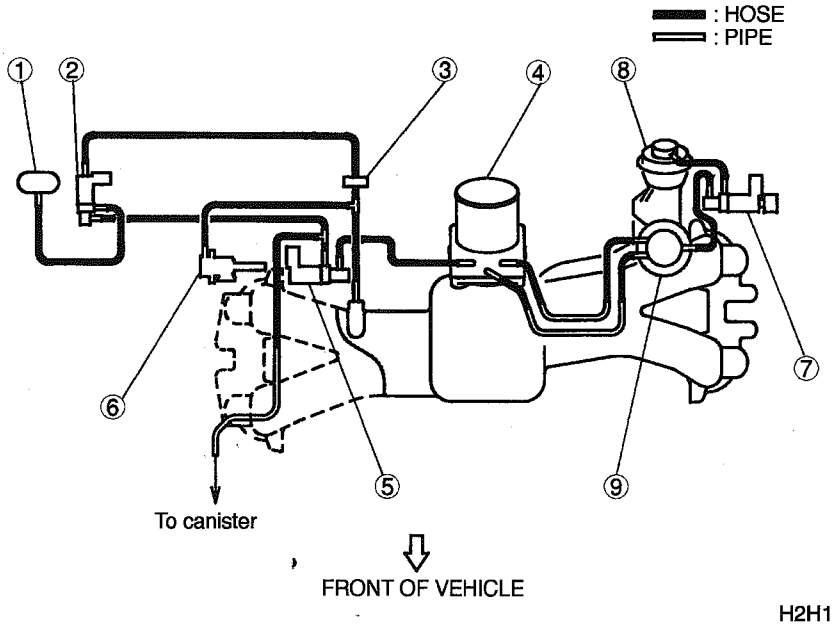
① Pressure sensor
② Pressure sources switching solenoid valve
③ Filter
④ Pressure regulator
⑤ Purge control solenoid valve
⑥ Throttle body

2200 cc MT MODEL



H2H1548A

2200 cc AT MODEL



H2H1549A

① Pressure sensor
② Pressure sources switching solenoid valve
③ Filter
④ Throttle body
⑤ Purge control solenoid valve
⑥ Pressure regulator
⑦ EGR control solenoid valve (AT vehicles only)
⑧ EGR valve (AT vehicles only)
⑨ BPT (AT vehicles only)

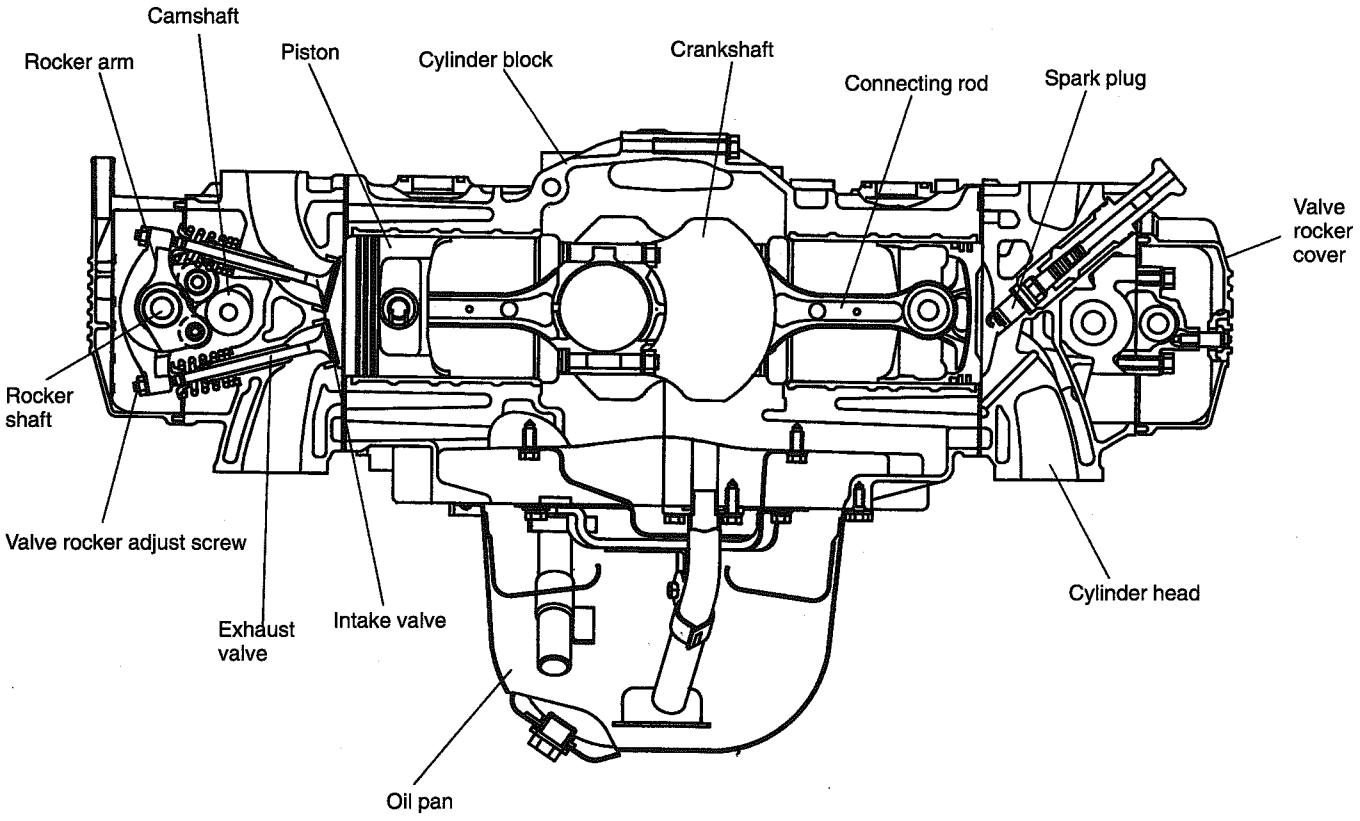
MEMO

1. General

The SUBARU engines are made from aluminum alloy and are horizontally opposed. There are 4-stroke cycle, water-cooled, SOHC 16-valve engines. The fuel system utilizes an MFI (multiple fuel injection) design.

A summary of the major construction and function features is as follows:

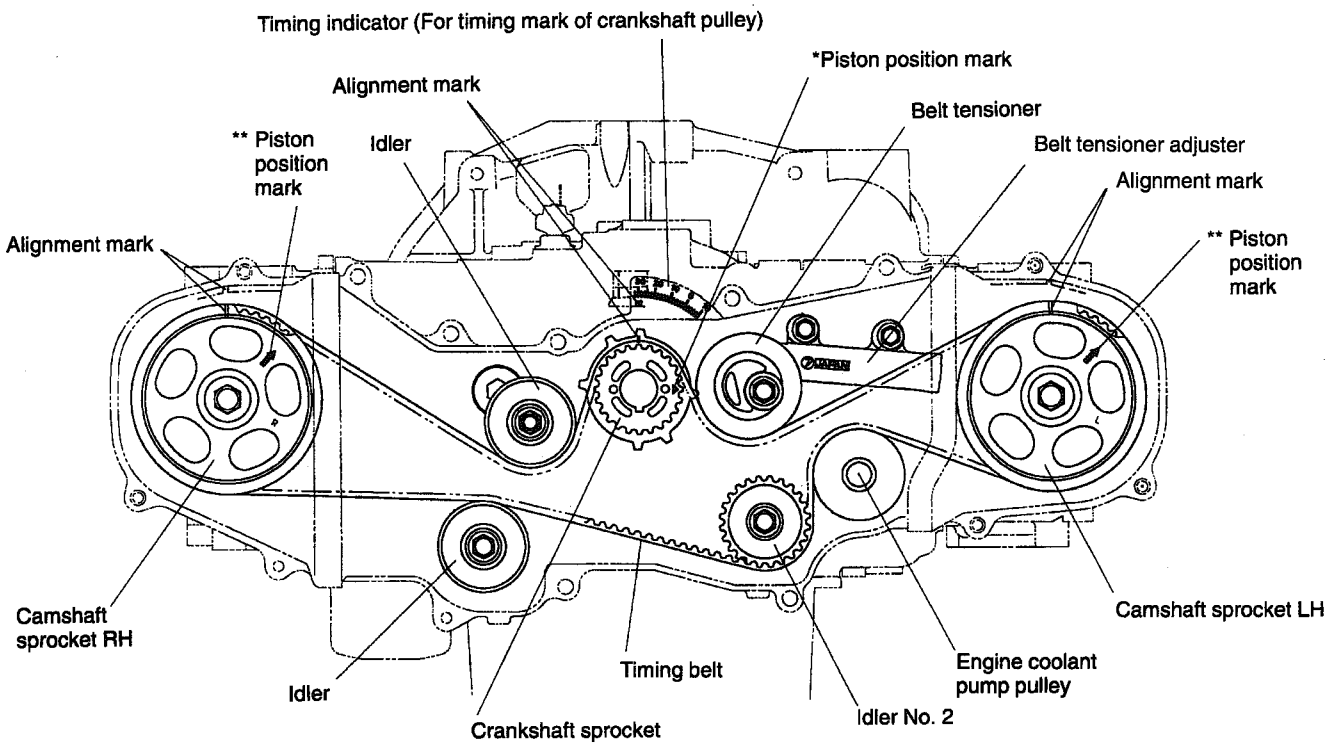
- The cylinder head is a center-plug type that utilizes pentroof combustion chambers. The four-valve design is provided with two intake valves and two exhaust valves per cylinder. The intake and exhaust ports are arranged in a cross-flow design.
- A single timing belt drives two camshafts on the left and right banks and the engine coolant pump on the left bank. Belt tension is automatically adjusted by belt tension adjuster to eliminate maintenance.
- The crankshaft is supported by five bearings to provide high rigidity and strength.
- The cylinder block is made from aluminum die cast which is integrated with cast-iron cylinder liners.



B2H1111A

2. Timing Belt

- A single timing belt drives two camshafts (one in the left bank and one in the right bank). The back of the belt also drives the water pump.
- The timing belt teeth have a specially designed round profile to provide quiet operation. The timing belt is composed of a strong and inflexible core wire, a wear-resistant canvas and heat-resistant rubber material.
- A hydraulic belt tensioner adjuster constantly maintains specified belt tension to properly drive the camshafts, as well as to provide a "maintenance-free" advantage.



B2H0294B

NOTE:
*: #1 piston is set at TDC (Top Dead Center) when piston-position mark on crankshaft sprocket is aligned with mark on cylinder block.
**: #1 piston is set at TDC (Top Dead Center) on compression stroke when piston-position mark on camshaft sprocket is aligned with mark on belt cover.

3. Belt Tensioner Adjuster

The belt tensioner adjuster provides a constant value of tension for the timing belt. Proper belt tension is maintained using a adjuster rod to push the timing belt via tensioner pulley. The location of the tensioner pulley shaft center is offset in relation to the center of the pulley's outside diameter.

The tensioner adjuster rod provides a rotary movement for the tensioner pulley by both tension of the spring housed in the adjuster.

- Belt tension action

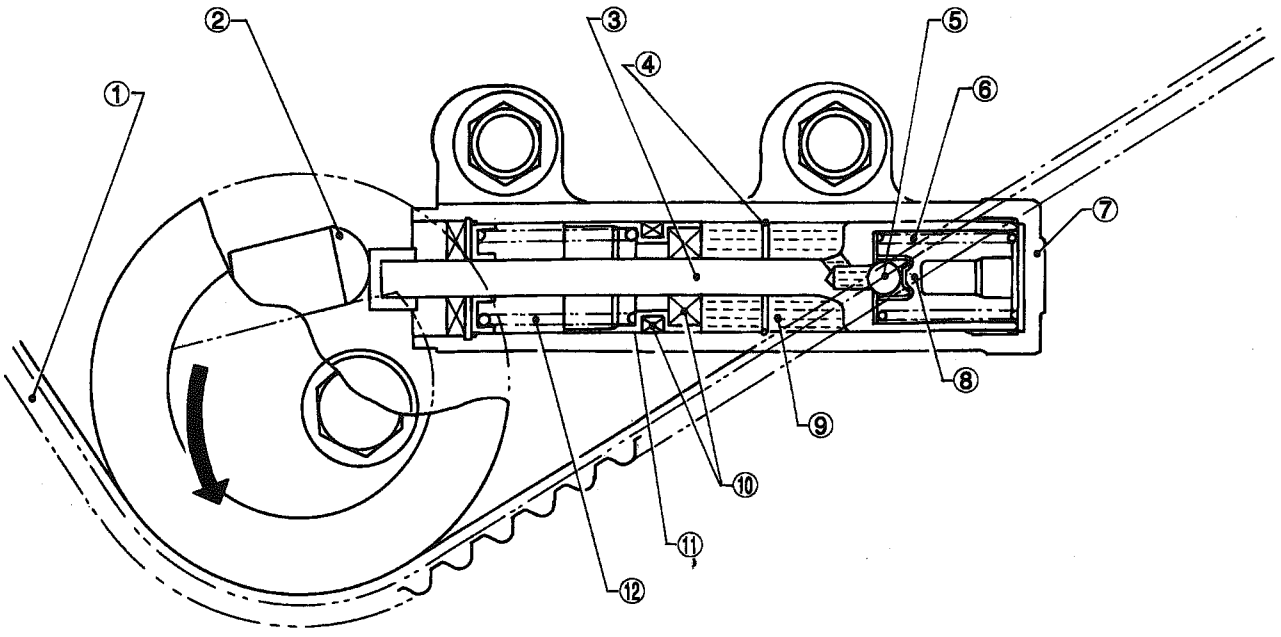
The adjuster rod is moved to the left by the force of the main spring. This causes silicone oil (which is held to constant pressure by compression-spring tension inside the reservoir chamber) to push the check ball so that silicone oil flows into the oil-pressure chamber.

The momentum which forces the adjuster rod out acts upon the tensioner arm so that the pulley is turned counterclockwise. Thus, timing belt tension is properly maintained.

- Balance to belt tension

When the timing belt reaction force is balanced by the main spring tension (to push the adjuster rod), the arm is held stationary to maintain constant belt tension.

When the timing belt reaction force increases to such an extent that the belt will be too tight, a small quantity of oil in the oil-pressure chamber gradually returns to the reservoir chamber via the adjuster body-to-rod clearance. This return of oil continually moves the rod until the reaction force of the timing belt balances with main spring force and oil pressure inside the oil-pressure chamber. Thus, belt tension is constantly maintained.

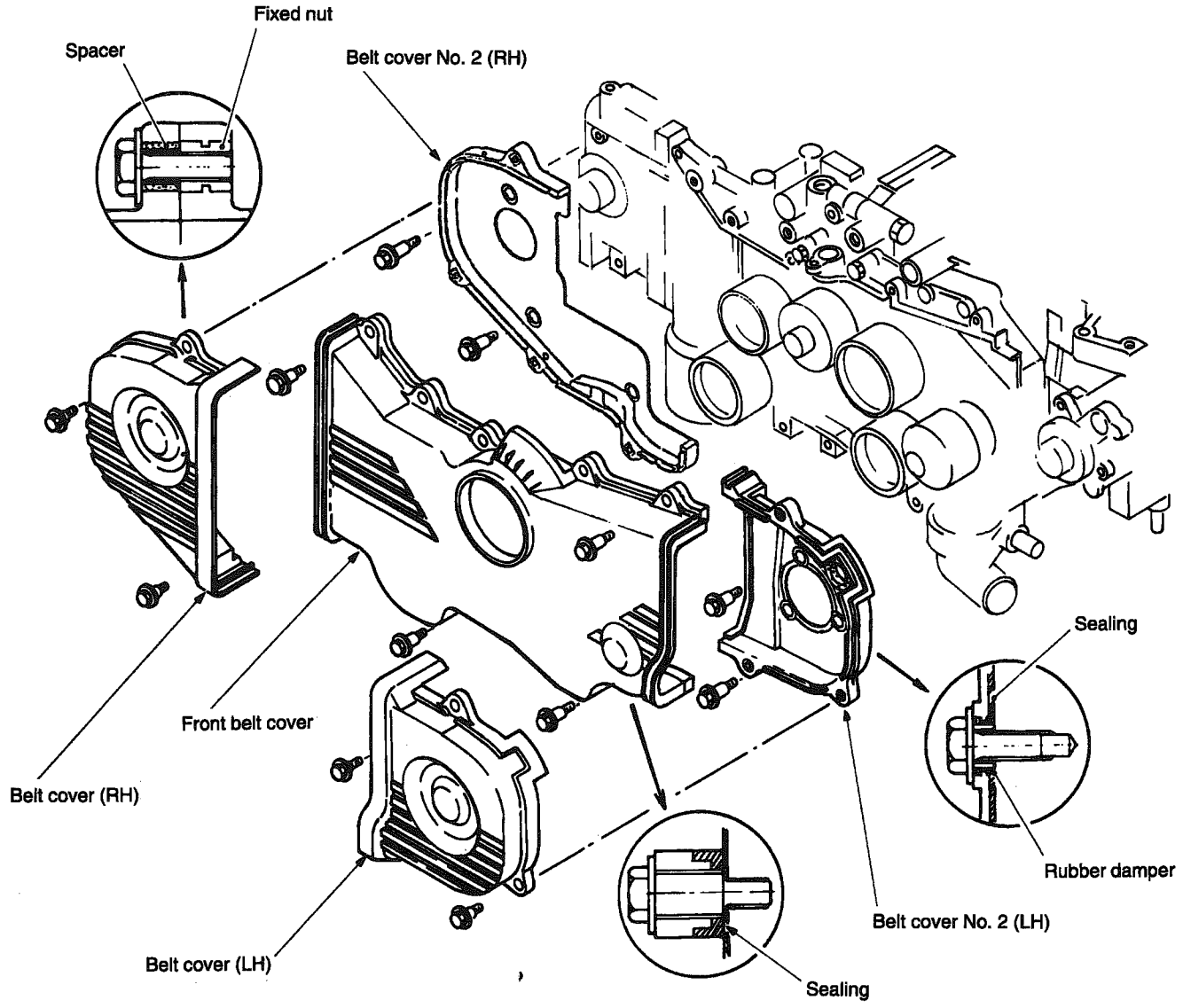


B2H0091A

① Timing belt
② Tensioner arm
③ Adjuster rod
④ Stopper
⑤ Check ball
⑥ Main spring
⑦ Adjuster body
⑧ Oil pressure chamber
⑨ Oil reservoir chamber (Silicone oil)
⑩ Oil seal
⑪ Piston
⑫ Compression spring

4. Belt Cover

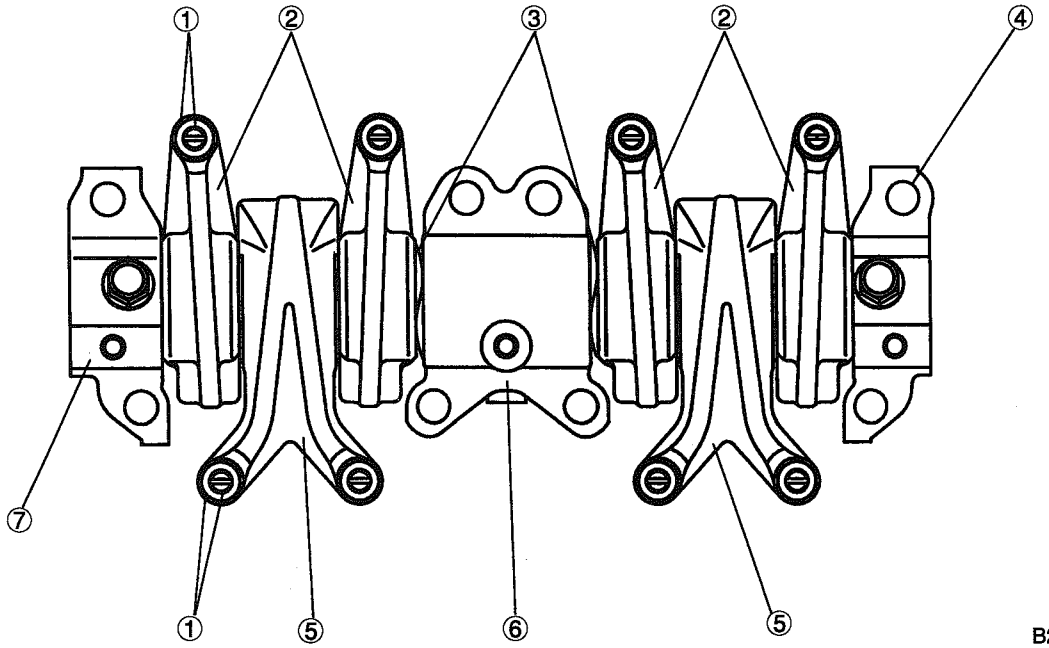
- The belt cover is made of synthetic resin molding which is lightweight and heat resistant. It has a totally enclosed design that utilizes rubber packing at the mating surface of the cylinder block. This eliminates the chance of dust and water from entering the interior.
- A floating design is utilized by placing rubber mounting between the cylinder block and belt cover to prevent the transmission of noise and vibration.
- The front belt cover has a graduated line for ignition-timing confirmation.



B2H0037A

5. Valve Rocker Assembly

- The rocker arm has a special surface treatment to improve the resistance to wear which would result from its movement on the rocker shaft.
- The valve side of the rocker arm is provided with a value rocker adjust screw & nut. Jurning of this screw can adjust valve clearance.
- The exhaust valve rocker arms have a "Y"- letter design, and each arm operates two exhaust valves.
- The rocker shaft has an oil passage in it.

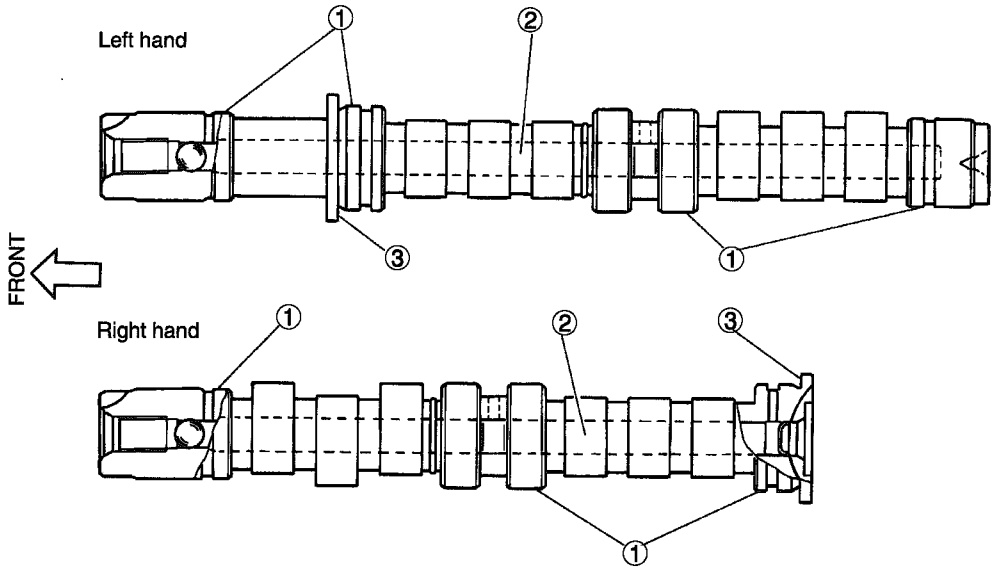


B2H1199A

① Valve rocker adjust screw & nut
② Intake valve rocker arm
③ Wave washer
④ Supporter
⑤ Exhaust valve rocker arm
⑥ Supporter
⑦ Supporter

6. Camshaft

- The cam surface is chill-hardened to improve the resistance against pitting which would result from the stress generated during contact with the roller.
- The right-hand camshaft is supported by three journals inside the cylinder head while the left-hand camshaft is supported by four journals.
- The flanges of these camshafts are also supported by the camshaft support ends to receive thrust force.

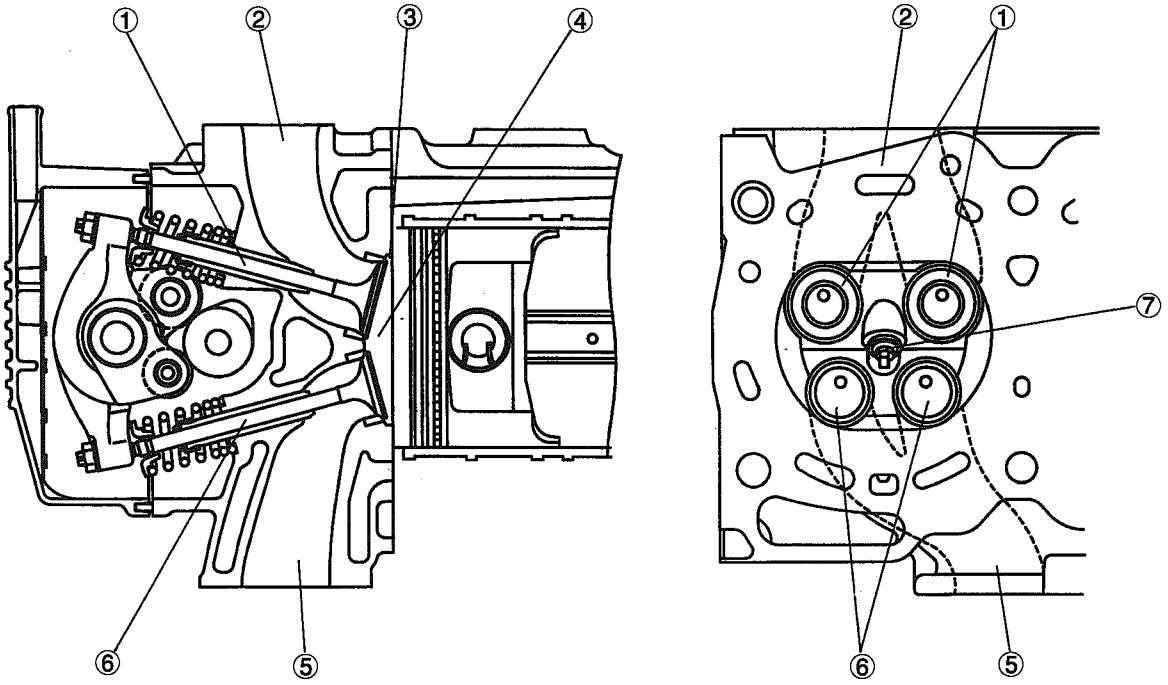


G2H0018

① Journal
② Oil passage
③ Portion affected by thrust force

7. Cylinder Head

- The cylinder head is made from aluminium die casting.
- Combustion chamber in the cylinder head is a compact, pentroof design and spark plug is located at the center of combustion chamber which feature a wide "squish" area for increased combustion efficiency.
- Four valves (two intake and two exhaust), which are arranged in a cross-flow design, are used per cylinder.
- The cylinder head gasket is made from carbon material (not asbestos). Its core is metal provided with metal hooks to increase resistance to both heat and wear.
- The inner side of grommets used in the cylinder bore are reinforced with wire to withstand both high combustion pressure and temperature.



① Intake valve
② Intake port
③ Squish area
④ Combustion chamber
⑤ Exhaust port
⑥ Exhaust valve
⑦ Spark plug

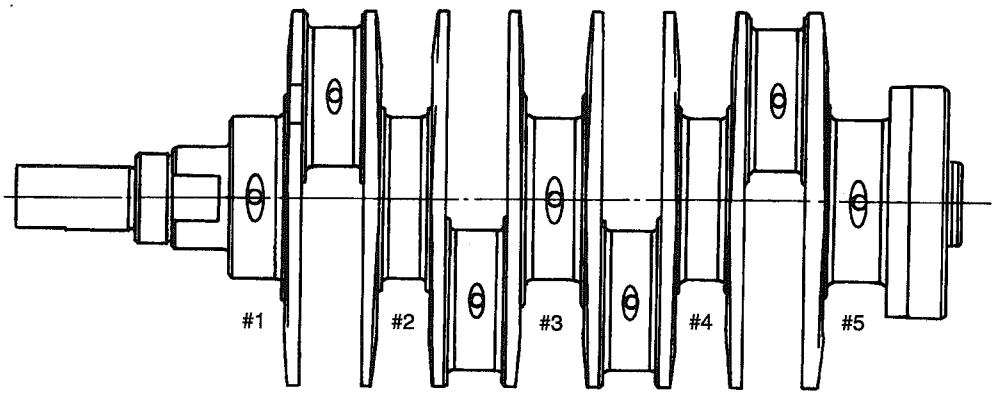
B2H0996A

8. Cylinder Block

- The cylinder block is made from aluminum die casting. The cylinder perimeter has an open-deck design which is lightweight, highly rigid and has superb cooling efficiency.
- The cylinder liners are made from cast iron and are dry types which are totally cast with aluminum cylinder block. Five main journal block designs are employed to increase stiffness and quiet operation.
- The oil pump is located in the front center of the cylinder block and the water pump is located at the front of the right-cylinder bank. At the rear of the right-cylinder block is a separator which eliminates oil mist contained in the blow-by gas.

9. Crankshaft

The crankshaft is supported by five bearings to provide high rigidity and strength. The corners of the crankshaft journals and webs, as well as the crank pins and webs, are finished with fillet-roll work to increase stiffness. The five crankshaft bearings are made from aluminum alloy and the No. 3 bearing is provided with a flanged metal to receive thrust force.

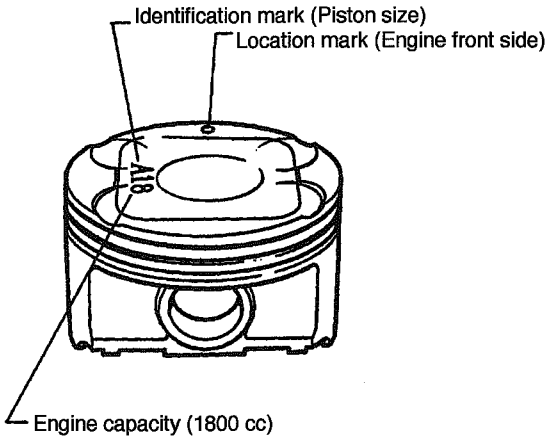


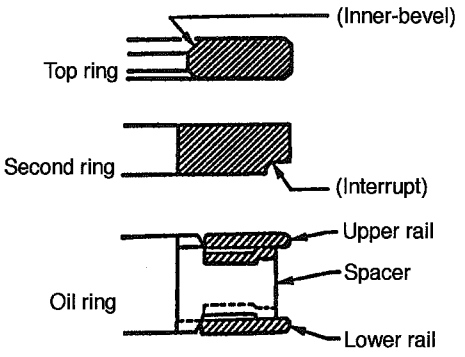
G2H0020

10. Piston

- The piston skirt has a "slipper" design to reduce weight and sliding friction. The oil control ring groove utilizes a slit design.
- The piston pin is located in an offset position. The Nos. 1 and 3 pistons are offset in the lower direction while the Nos. 2 and 4 pistons are offset in the upper direction.
- The piston head is recessed for both the intake and exhaust valves. It also has symbols used to identify the location and the direction of installation. By commonization in shape of a recess for the intake valve and a recess for the exhaust valve, the piston is common to the right and left banks.
- Three piston rings are used for each piston-two compression rings and one oil ring. The top piston ring has an inner-bevel design and the second piston ring has an interrupt design to reduce oil consumption.

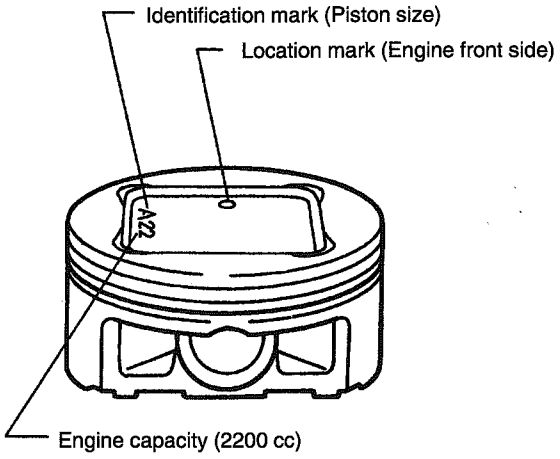
1800 cc MODEL

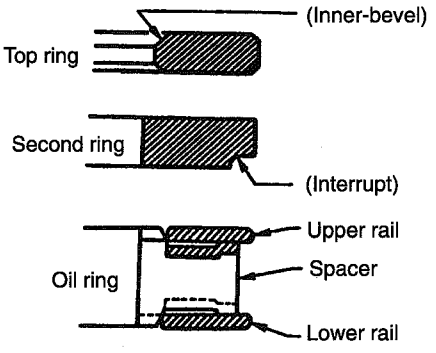




H2H1544A

2200 cc MODEL



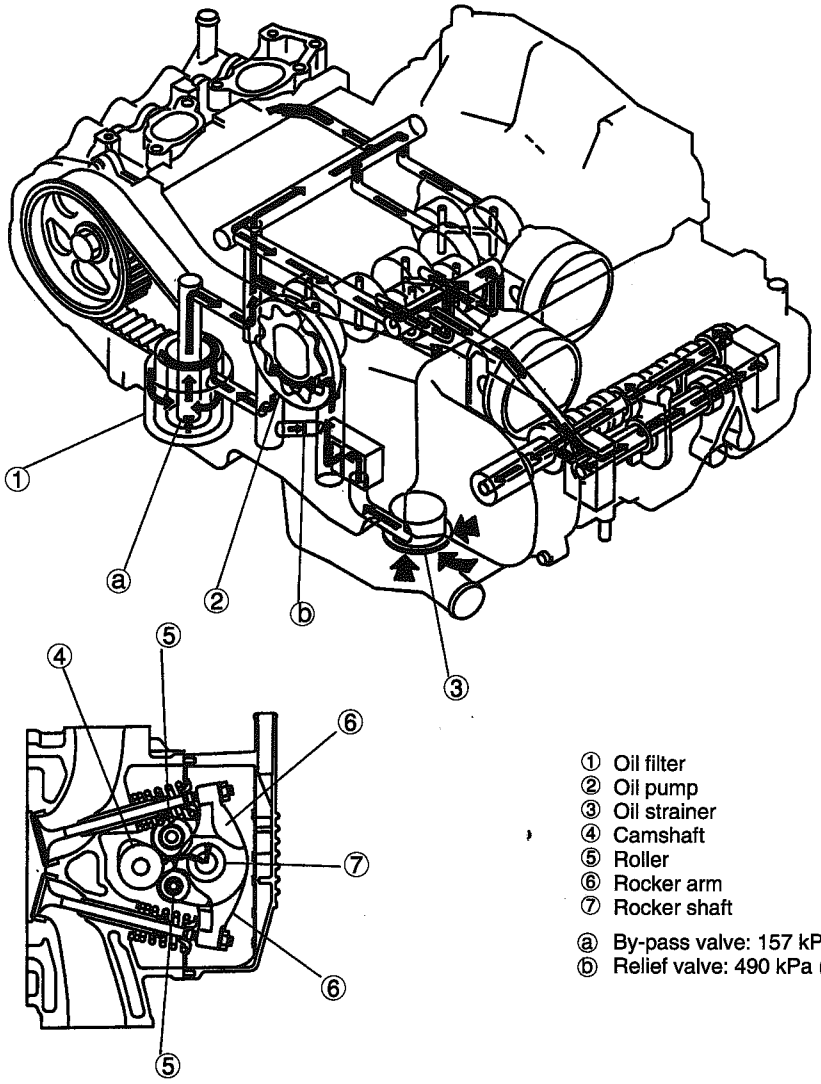


B2H1205B

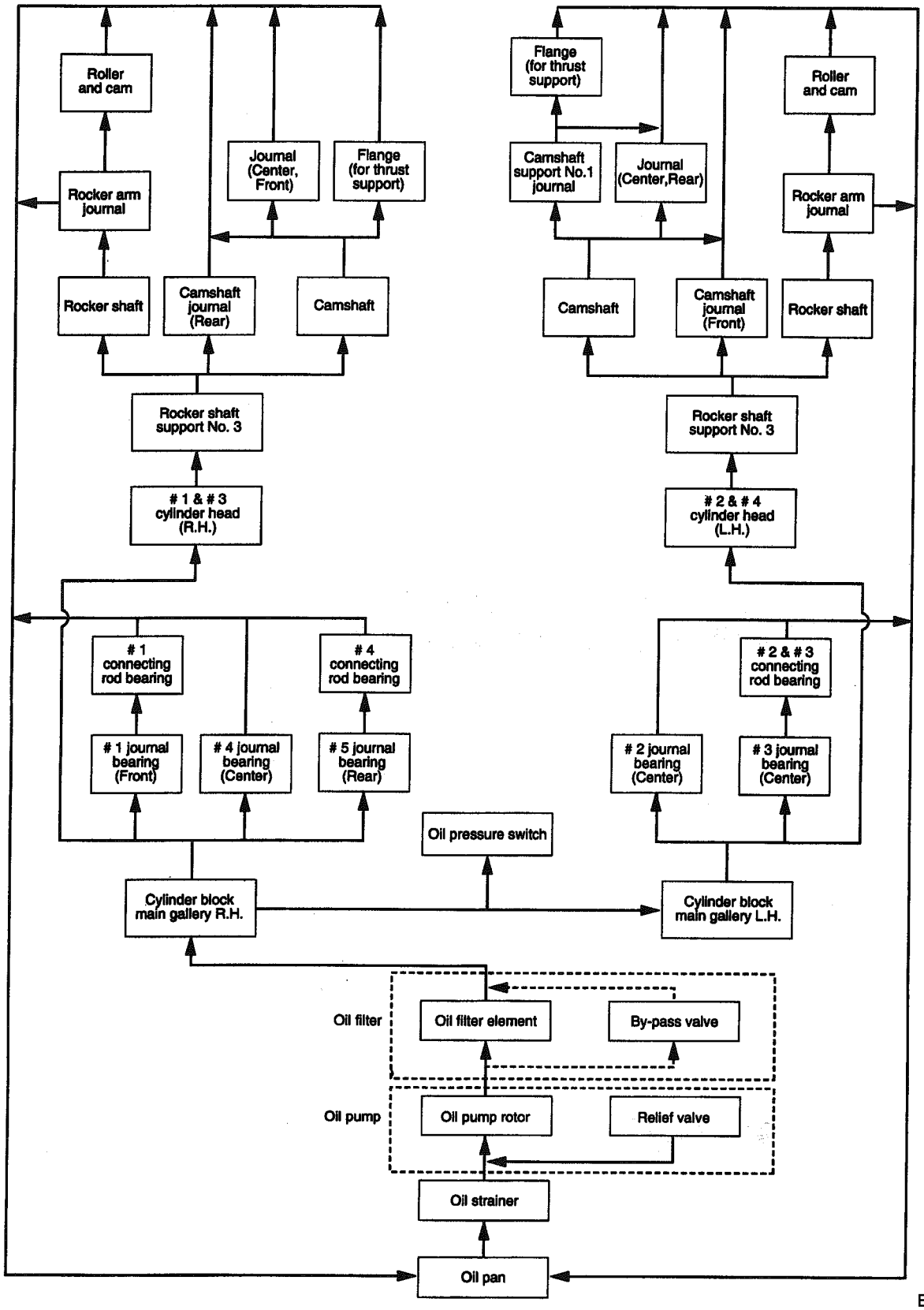
ENGINE LUBRICATION SYSTEM 2-4

1. General

- The lubrication system is a force-fed circulating design and oil pressure is regurated by relief valve built-in the oil pump.
- The oil pump utilizes a thin, large-diameter trochoid design to accomodate the high engine output. This pump is directly driven by the crankshaft.
- The full-flow, paper element type oil filter is provided to improve engine reliability and has a built-in by-pass valve to bypass the engine oil if filter is clogged.
- The oil pan is provided with baffle plates to eliminate the effect of oil suction caused by oil level variations during operation.
- Engine oil discharged from oil pump is delivered to the journal bearings, connecting rod bearings, etc., via the oil passage (on the lower right side of the cylinder block), oil filter, and the oil gallery (on the right of the cylinder block) to provide proper lubrication and cooling.
- Engine oil is also fed under pressure to the cylinder head valve mechanism after the flow is regulated by the orifice provided in the oil gallery.



2. Lubrication Lines

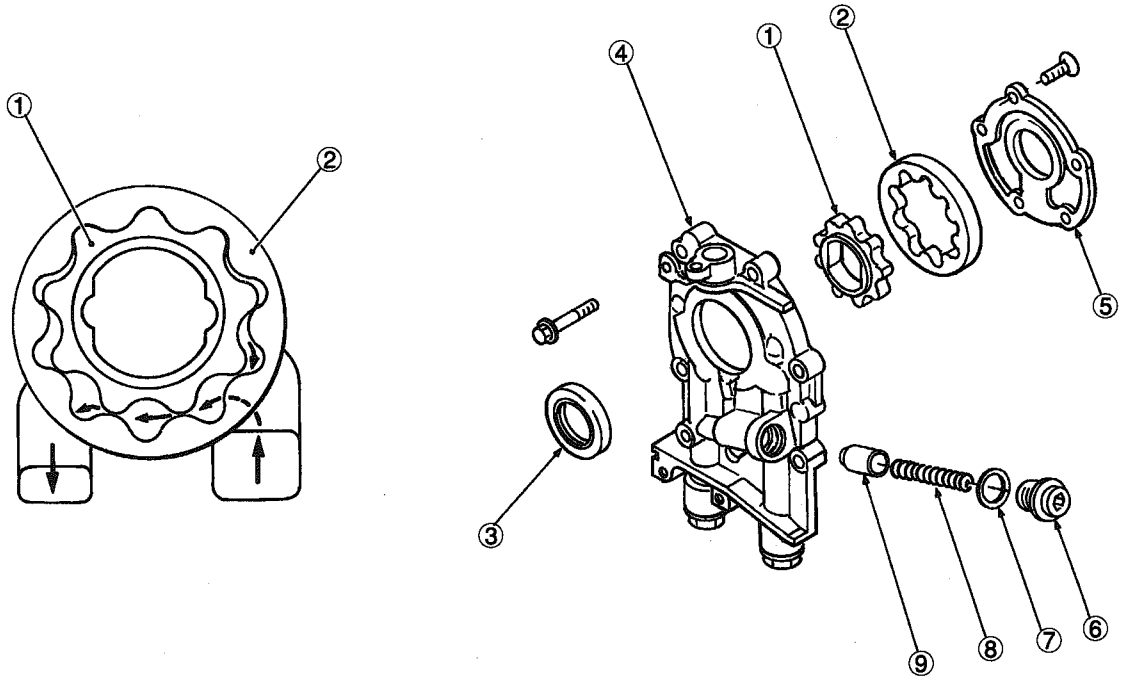


B2H1203A

3. Oil Pump

• The trochoid oil pump utilizes an internal oil circulation design which is accomplished by an inner rotor and outer rotor built into the pump body. When the inner rotor is driven by the crankshaft, the outer rotor is rotated, changing the size of the space between the two rotors (because of the different number of teeth used on the rotors).

• Engine oil is sucked into the large space created near the inlet side. It is then carried over to the discharge port and discharged due to it being gradually pressurized as the space carrying it becomes smaller. Oil pressure is regulated by the relief valve located on the discharge side. Excess oil is directly returned to the suction port.

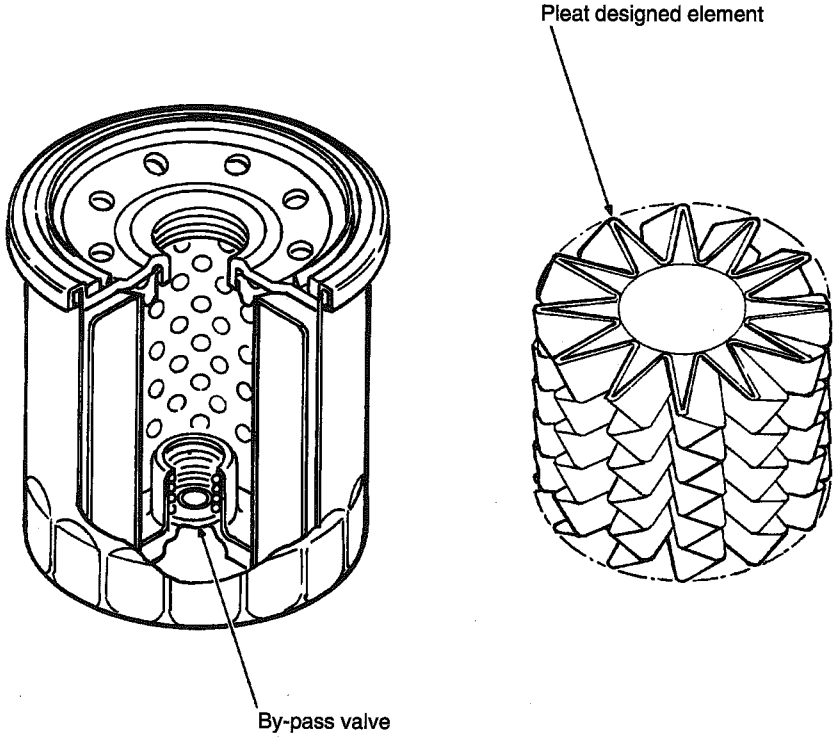


G2H0024

① Inner rotor
② Outer rotor
③ Oil seal
④ Oil pump case
⑤ Oil pump cover
⑥ Plug
⑦ Washer
⑧ Relief valve spring
⑨ Relief valve

4. Oil Filter

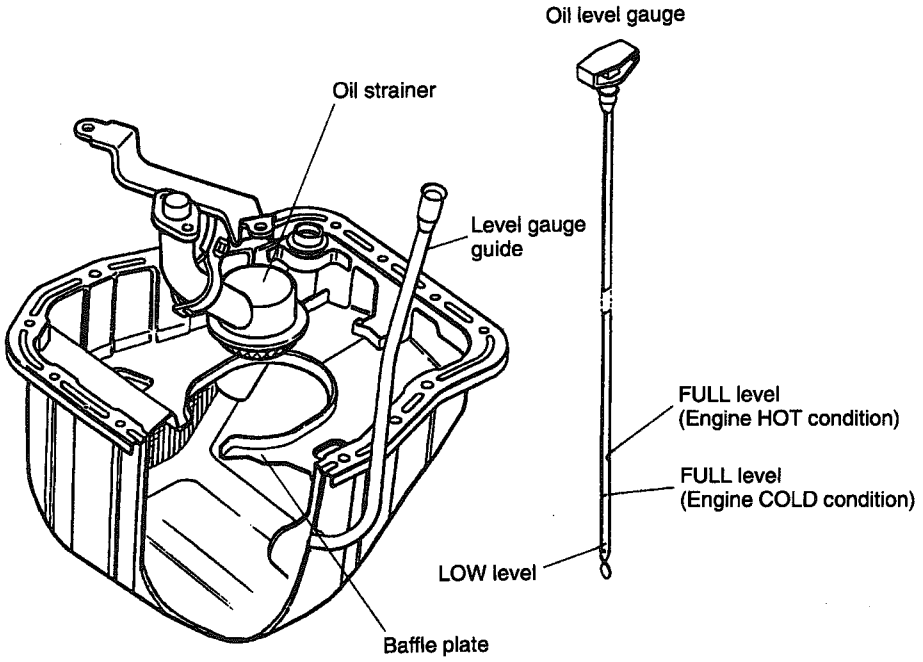
The oil filter is a full-flow cartridge type that utilizes a paper element. It also has a built-in by-pass valve. The filter element has a special pleat design to increase the effective filtering area.



G2H0025

5. Oil Pan & Oil Strainer

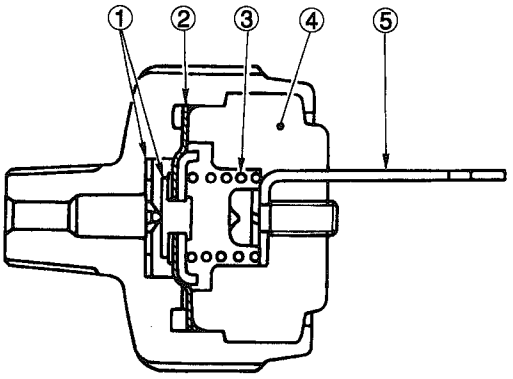
- The oil pan is joined to the cylinder block via liquid gasket. The oil strainer is a metal net type and removes large foreign particles from the engine oil. It is located in the middle of the oil pan. The pipe from the strainer is connected to the suction port on the left side of the cylinder block.
- Baffle plate is placed in the oil pan and the lower side of the cylinder block to stabilize the oil level and strengthen the oil pan.



B2H0299A

6. Oil Pressure Switch

The oil pressure switch is located on the front right upper portion of the cylinder block. The purpose of this switch is to monitor the operation of the oil pump as well as the lubricating oil pressure when the engine is running.



G2H0026

① Contact point
② Diaphragm
③ Spring
④ Molded portion
⑤ Terminal

- When oil pressure does not build up (with ignition switch "ON"):

The diaphragm is pushed toward the cylinder block by spring force (equivalent to the specified oil pressure). This closes the contact point to illuminate the oil pressure warning light in the combination meter.

- When oil pressure reaches the specified value (after engine starts):

After oil pressure reaches the specified value of [14.7 kPa (0.15 kg/cm^2, 2.1 psi)], the diaphragm, pushed by oil pressure, overcomes the spring force. This opens the contact point to turn the oil pressure warning light OFF.

MEMO

ENGINE COOLING SYSTEM 2-5

1. General

- The engine cooling system consists of a down-flow radiator which features high heat-dissipation performance, an electric motor fan, a water pump, a thermostat, and an engine coolant temperature sensor.
- The reserve tank is designed to eliminate the need for replenishing coolant.
- On models without an air conditioner, the ECM sends an ON or OFF switch signal to the radiator fan in response to signals from the engine coolant temperature sensor. On models with an air conditioner, the ECM sends ON or OFF switch signals to the radiator main fan and sub fan in response to signals from the engine coolant temperature sensor, vehicle speed sensor 2 and A/C switch.

2. Cooling Lines

This cooling system operates in three steps depending on the temperature of the engine coolant flowing through the cooling circuit.

- 1st step ... With thermostat closed

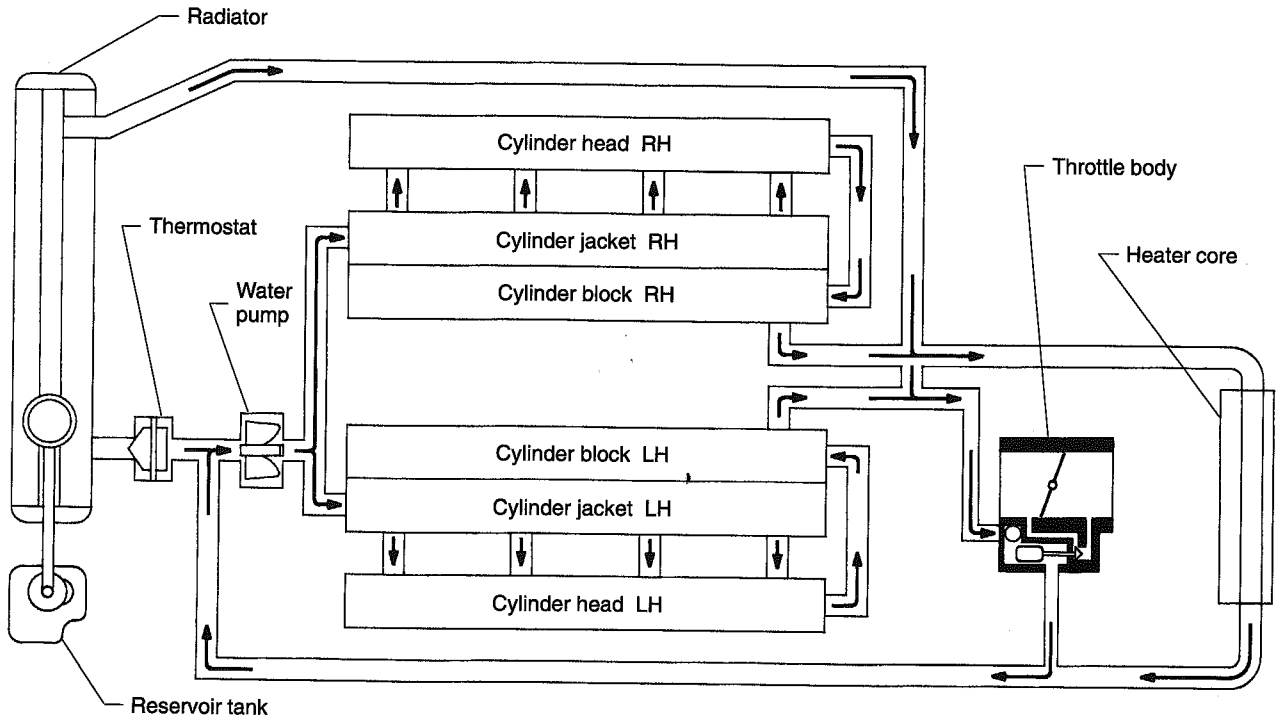
At the engine coolant temperature of below 76°C (169°F), the thermostat remains closed and the engine coolant flows through the bypass and heater circuits.
This permits the engine to warm up quickly.

- 2nd step ... With thermostat opened

When the engine coolant temperature is above 76 – 80°C (169 – 176°F), the thermostat opens and the engine coolant flows through the radiator where it is cooled.

- 3rd step ... With radiator fan operating

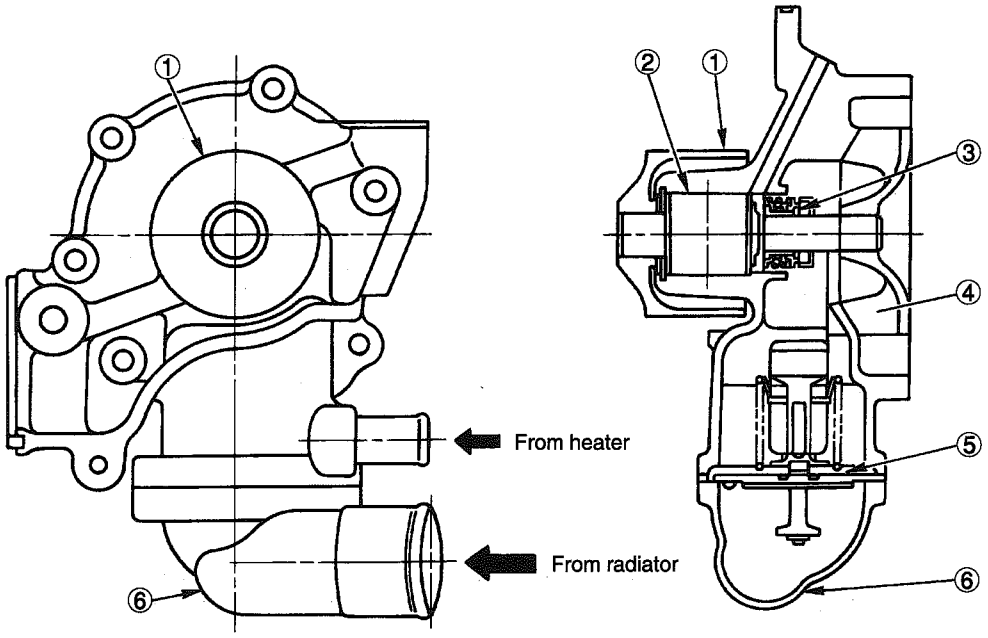
When the engine coolant temperature rises above 95°C (203°F), the ECM sends ON signal to the radiator fan in response to signal from the engine coolant temperature sensor and the radiator fan rotates.



G2H0027

3. Water Pump

The water pump is located on the left front portion of the cylinder block and is driven by the timing belt. The thermostat is built into the engine coolant inlet located on the lower side of the water pump. When the impeller rotates, engine coolant is drawing into the water pump from the lower pipe (which is connected to the radiator hose) via the thermostat. It then flows along the perimeter of the impeller and is delivered to the engine's engine coolant passage.

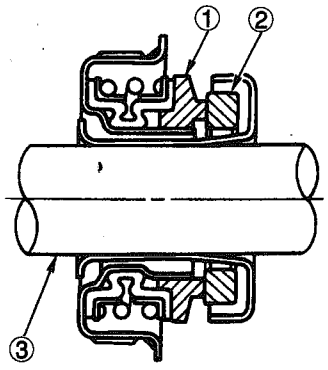


G2H0028

① Pulley
② Ball bearing
③ Mechanical seal
④ Impeller
⑤ Thermostat
⑥ Thermostat case

4. Mechanical Seal

The mechanical seal has its seat pressed into the water pump shaft to form the seal and water pump as a single unit. With this design, the water pump cannot be disassembled.

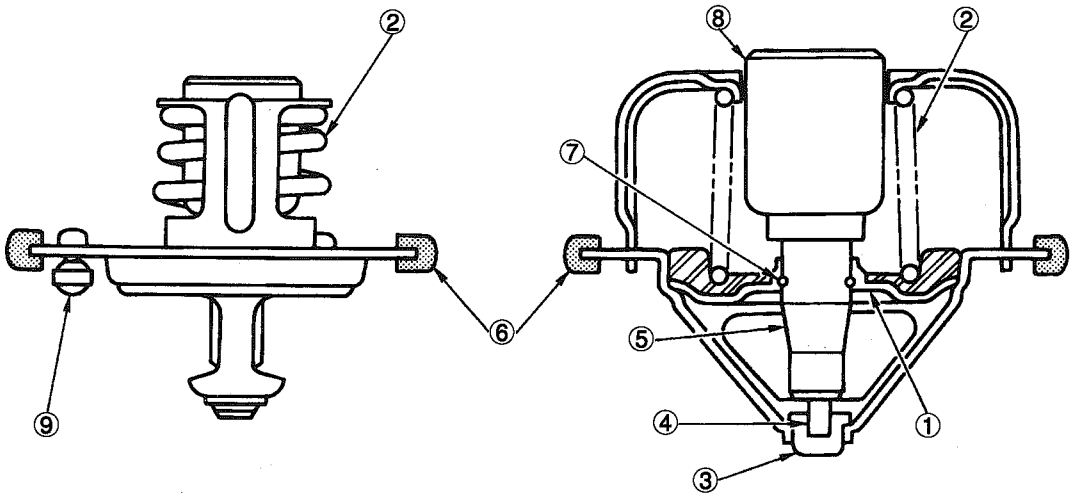


G2H0029

① Carbon seal
② Ceramics seat
③ Water pump shaft

5. Thermostat

The thermostat is powered to open the valve by a totally-enclosed wax pellet which expands with increased temperature. It provides the sure open-close operation of the valve and features high durability.

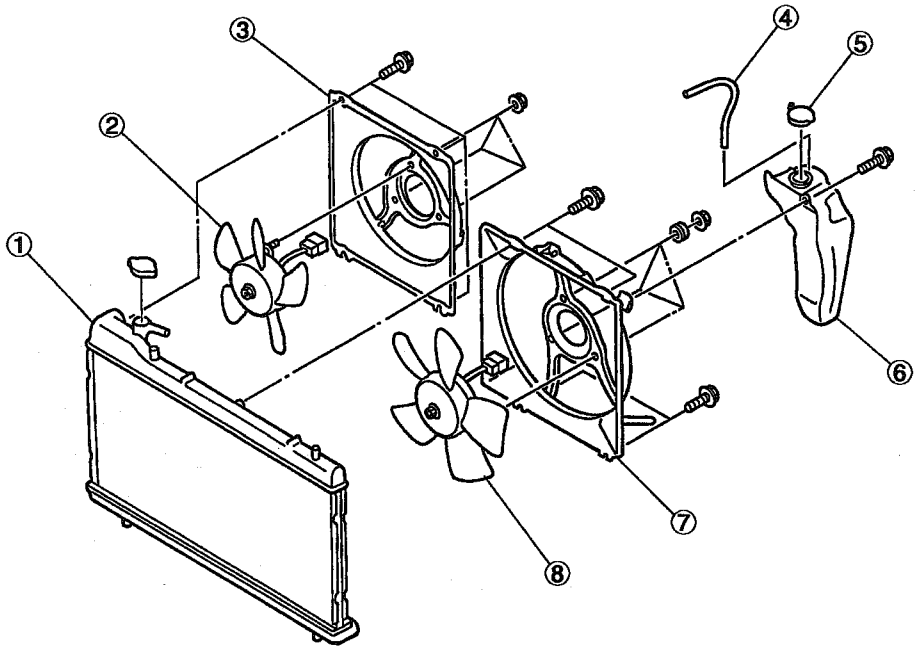


G2H0030

① Valve
② Spring
③ Stopper
④ Piston
⑤ Guide
⑥ Gum packing
⑦ Stop ring
⑧ Wax element
⑨ Jiggle valve

6. Radiator Fan

- The radiator fan is made of plastic. That is installed to the electric motor, and is located onto radiator straight by shroud.
- The vehicle without air conditioning has the radiator main fan only. Thus, the vehicle with air conditioning has the radiator sub fan, too.



H2H1702A

① Radiator
② Radiator sub fan & motor
③ Radiator sub fan shroud
④ Over flow hose
⑤ Reservoir tank cap
⑥ Reservoir tank
⑦ Radiator main fan shroud
⑧ Radiator main fan & motor

• The ON-OFF control of the radiator fan is governed by the ECM which receives signals sent from the engine coolant temperature sensor.

Vehicle speed	Engine coolant temperature		
	Less than 95°C (Less than 203°F)	Between 95 and 99°C (Between 203 and 210°F)	More than 100°C (More than 212°F)
	Operation of radiator main fan	Operation of radiator main fan	Operation of radiator main fan
Less than 19 km/h (Less than 12 MPH)	OFF	ON	ON
Between 20 and 69 km/h (Between 12 and 43 MPH)	OFF	ON	ON
Between 70 and 89 km/h (Between 43 and 55 MPH)	OFF	OFF	ON
More than 90 km/h (More than 56 MPH)	OFF	OFF	ON

• On models which are equipped with an air conditioning system, the ECM receives signals sent from the engine coolant temperature sensor, vehicle speed sensor 2 and A/C switch. These signals simultaneously turn ON or OFF the radiator main fan and radiator sub fan.

Vehicle speed	A/C compressor	Engine coolant temperature					
		Less than 95°C (Less than 203°F)		Between 95 and 99°C (Between 203 and 210°F)		More than 100°C (More than 212°F)	
		Operation of radiator fan		Operation of radiator fan		Operation of radiator fan	
		Main	Sub	Main	Sub	Main	Sub
Less than 19 km/h (Less than 12 MPH)	OFF	OFF	OFF	ON	OFF	ON	ON
	ON	ON	ON	ON	ON	ON	ON
Between 20 and 69 km/h (Between 12 and 43 MPH)	OFF	OFF	ON	ON	OFF	ON	ON
	ON	ON	ON	ON	ON	ON	ON
Between 70 and 89 km/h (Between 43 and 55 MPH)	OFF	OFF	OFF	OFF	OFF	ON	ON
	ON	ON	OFF	ON	ON	ON	ON
More than 90 km/h (More than 56 MPH)	OFF	OFF	OFF	OFF	OFF	ON	ON
	ON	OFF	OFF	ON	OFF	ON	ON

FUEL INJECTION SYSTEM 2-7

1. General

• The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.

With this system fuel, which is pressurized at a constant pressure, is injected into the intake air port of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where the electro-magnetic injection valve (fuel injector) opens only for a short period of time, depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.

• Further, all the operating conditions of the engine are converted into electric signals, and this results in additional features of the system, such as large improved adaptability, easier addition of compensating element, etc.

The MFI system also has the following features:

- Reduced emission of harmful exhaust gases.
- Reduced in fuel consumption.
- Increased engine output.
- Superior acceleration and deceleration.
- Superior startability and warm-up performance in cold weather since compensation is made for coolant and intake air temperature.

2. Air Line

A: GENERAL

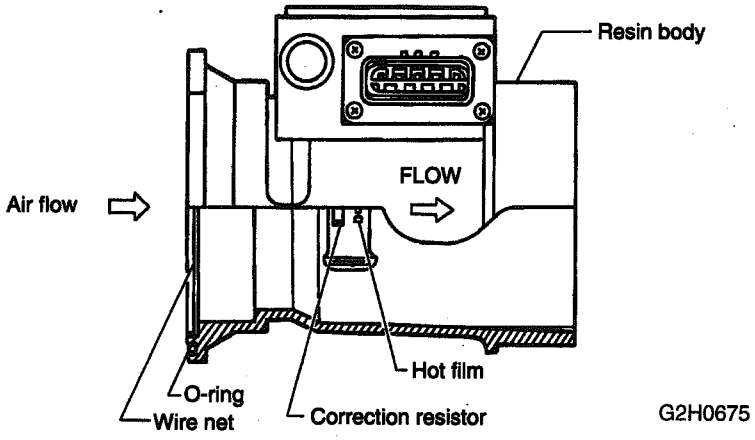
Air which is drawn in and filtered by the air cleaner is metered and sent to the throttle body via the air intake boot. From the throttle body, the air is regulated by the open-close operation of the throttle valve and is delivered to the intake manifold. It is then distributed to the respective cylinders to mix with fuel injected by the fuel injectors. Thus, the air-fuel mixture is delivered into the cylinder. Part of the air branched at the upstream of the throttle body is sent to the idle air control solenoid valve which regulates engine idle speed.

B: MASS AIR FLOW SENSOR

- The MFI system employs a hot-film type mass air flow sensor.

This mass air flow sensor converts the amount of air taken into the engine into an electric signal by utilizing the heat transfer phenomenon between the incoming air and a heating resistor (hot film) located in the air intake.

- The features of this flow sensor type are as follows:
  - High-altitude compensation is made automatically.
  - Quick response.
  - These are no moving parts.
  - They are compact.



C: THROTTLE BODY

In response to the depressing stroke of the throttle pedal, the throttle body opens/closes its valve to regulate the air volume to be taken in the combustion chamber.

During idling, the throttle valve is almost fully closed and the air flow through the throttle body is less than that passing through the carburetor.

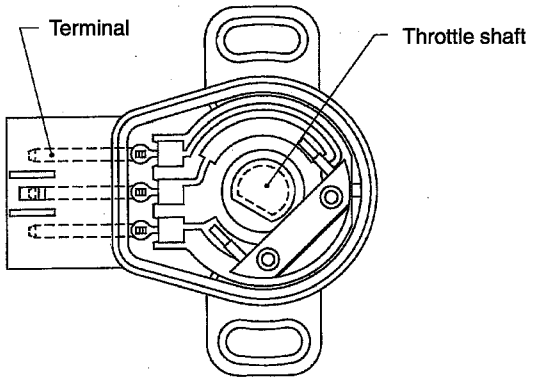
More than half of the air necessary for idling is supplied to the intake manifold via the idle air control solenoid valve.

And the idle air control solenoid valve properly controls the engine idle speed, so it does not need to be adjusted.

D: THROTTLE POSITION SENSOR

1. 1800 cc MODEL

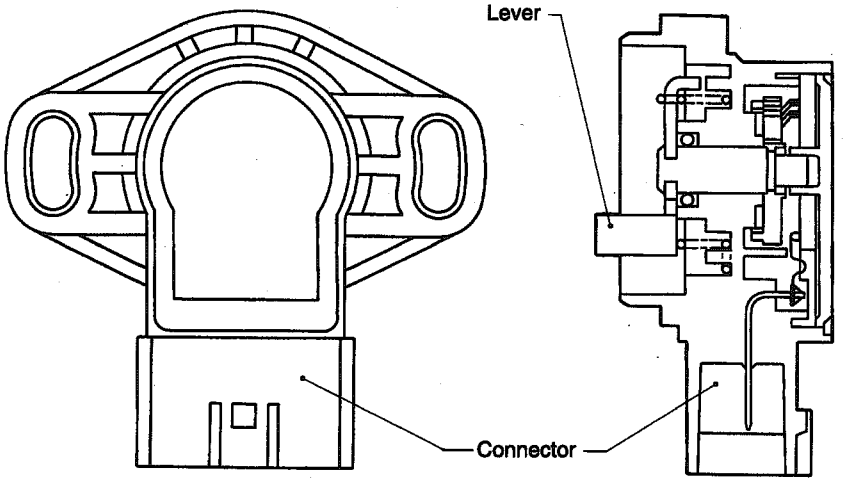
- A throttle position sensor is provided with a potentiometer which is interlocked with the throttle valve shaft.
- This throttle position sensor sends the ECM a potentiometer output signal corresponding to the opening of the throttle valve. When the level of this signal exceeds a predetermined value, the ECM interprets it as complete closure of the throttle valve and makes a control most suitable for the engine operation with the throttle valve fully closed. For correcting error of this signal, the ECM is provided with a learning function.
- Thus, the ECM precisely controls the air-fuel ratio during acceleration and deceleration as well as engine idling.



G2H0032

2. 2200 cc MODEL

- A throttle position sensor is provided with a potentiometer which is interlocked with the throttle valve shaft.
- This throttle position sensor sends the ECM a potentiometer output signal corresponding to the opening of the throttle valve. When the level of this signal exceeds a predetermined value, the ECM interprets it as complete closure of the throttle valve and makes a control most suitable for the engine operation with the throttle valve fully closed. For correcting error of this signal, the ECM is provided with a learning function.
- Thus, the ECM precisely controls the air-fuel ratio during acceleration and deceleration as well as engine idling.



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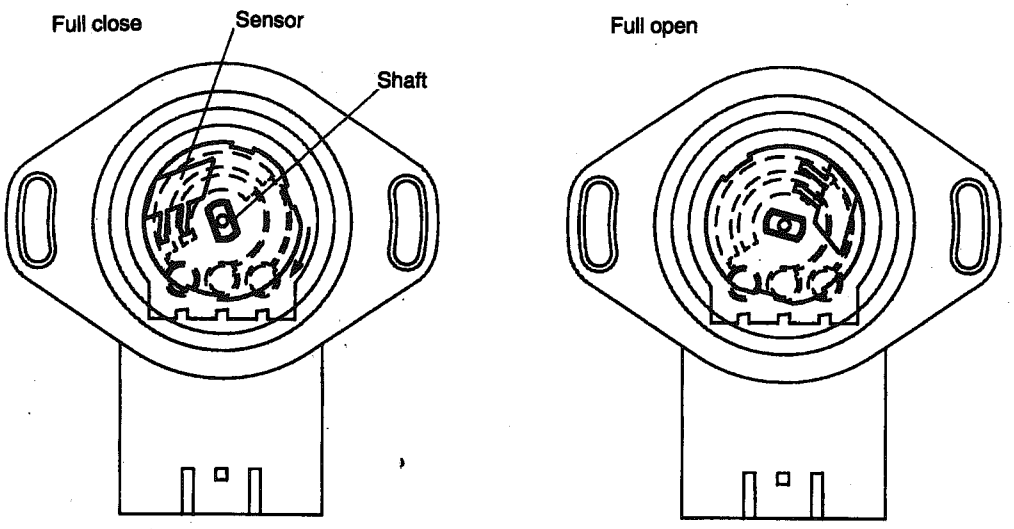
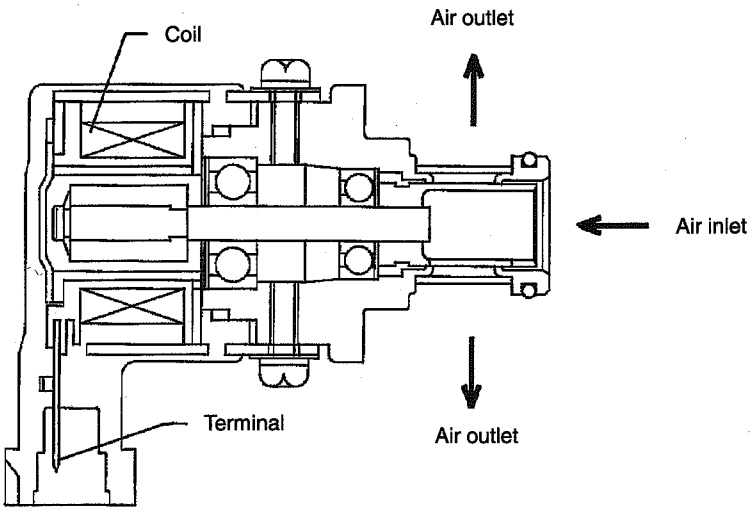


B2H0401A

E: IDLE AIR CONTROL SOLENOID VALVE

1. 1800 cc MODEL

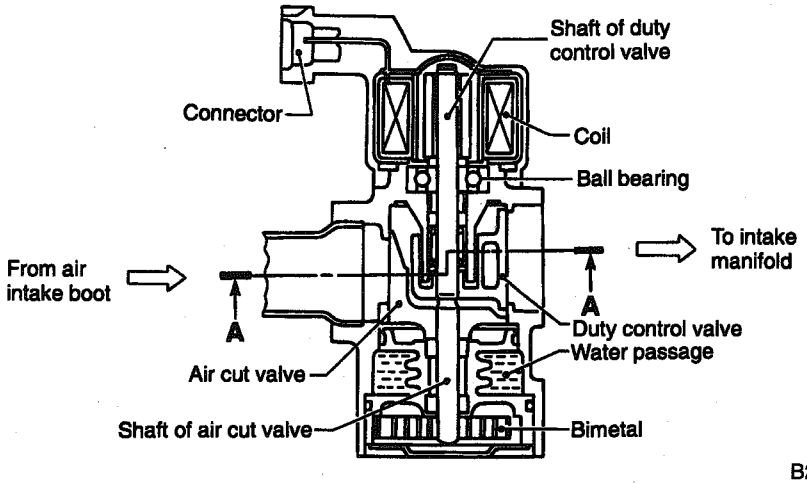
- The idle air control solenoid valve is incorporated in the injection body and regulates the amount of intake air which bypasses the throttle valve built into the injection body. It is activated by a signal sent from the ECM to mainly maintain engine idle speed to the target engine speed.
- The idle air control solenoid valve is a "current-proportion" solenoid type which consists of a coil, valve shaft, spring and housing. The housing is integral with the injection body and is provided with an air passage which is opened or closed by the valve.



G2H0033

2. 2200 cc MODEL

- Idle air control solenoid valve consists of an air cut valve, duty control valve, intake air passage and a coolant passage.
- Air cut valve contains a bimetallic substance which responds to coolant temperature, and a duty control valve which is operated by a signal sent from ECM.
- When engine coolant temperature is low, air cut valve is fully opened by the action of the bimetallic substance so that the air flow required for low engine coolant temperatures is maintained.
- ECM controls duty control valve to bring the operating engine speed as close to preset idle speed as possible.



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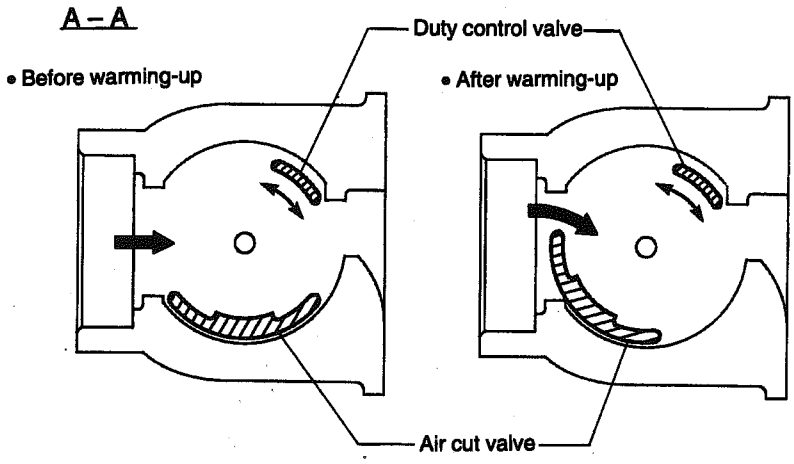


B2H0403A

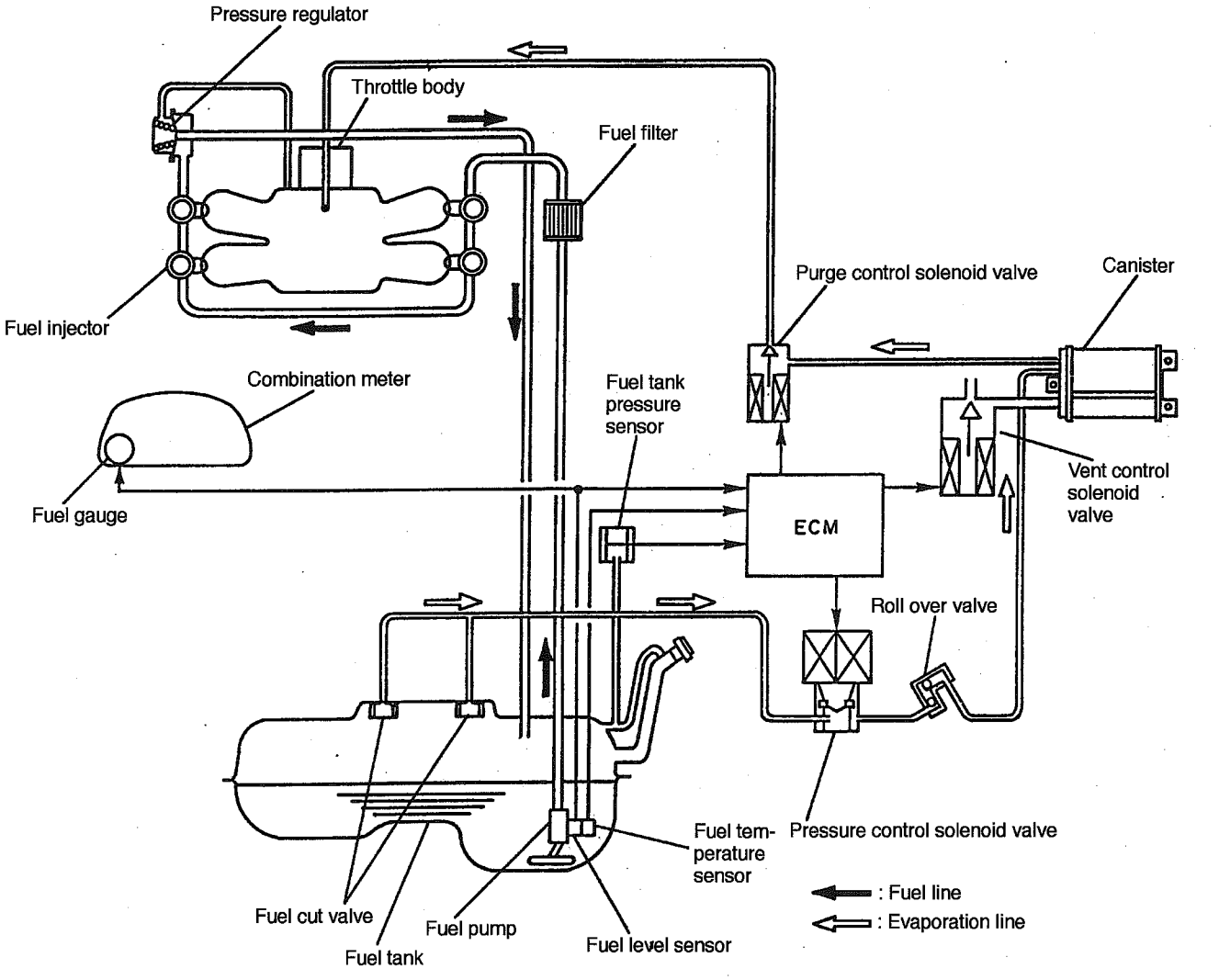
3. Fuel Line

A: GENERAL

1. 1800 cc MODEL

- Fuel pressurized by the fuel pump built into the fuel tank is delivered to fuel injectors by way of the fuel pipe and fuel filter. Fuel is regulated to the optimum pressure level by the pressure regulator on the way to the injectors.
- From the injectors, fuel is injected into the intake manifold where it is mixed with intake air, and is then delivered to the respective cylinders.

Fuel injection timing and the amount of fuel injected is regulated by the ECM.

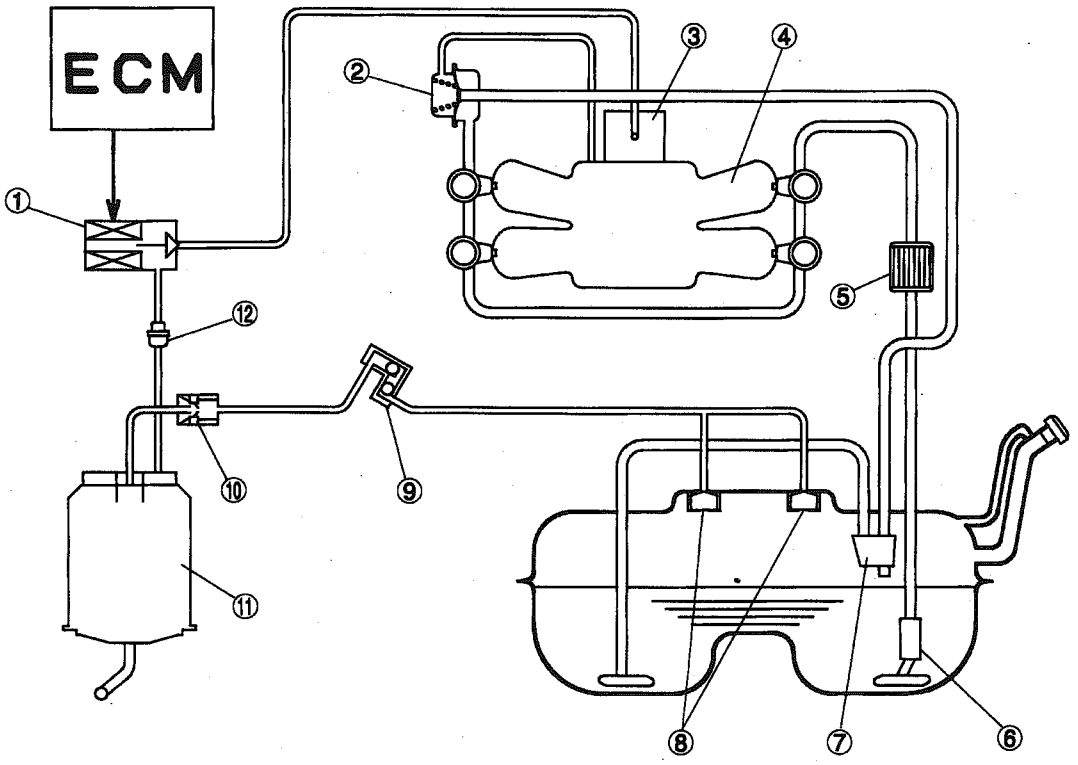


H2H1558A

2. 2200 cc MODEL

- Fuel pressurized by the fuel pump built into the fuel tank is delivered to fuel injectors by way of the fuel pipe and fuel filter. Fuel is regulated to the optimum pressure level by the pressure regulator on the way to the injectors.
- From the injectors, fuel is injected into the intake port of each cylinder where it is mixed with intake air.

Fuel injection timing and the amount of fuel injected is regulated by the ECM.

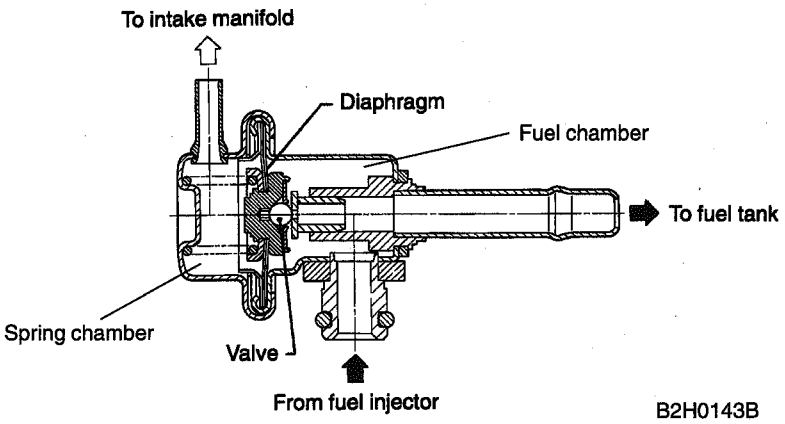


B2H0404A

① Purge control solenoid valve
② Pressure regulator
③ Throttle body
④ Intake manifold
⑤ Fuel filter
⑥ Fuel pump
⑦ Jet pump
⑧ Fuel cut valve
⑨ Roll over valve
⑩ Two-way valve
⑪ Canister
⑫ Check valve

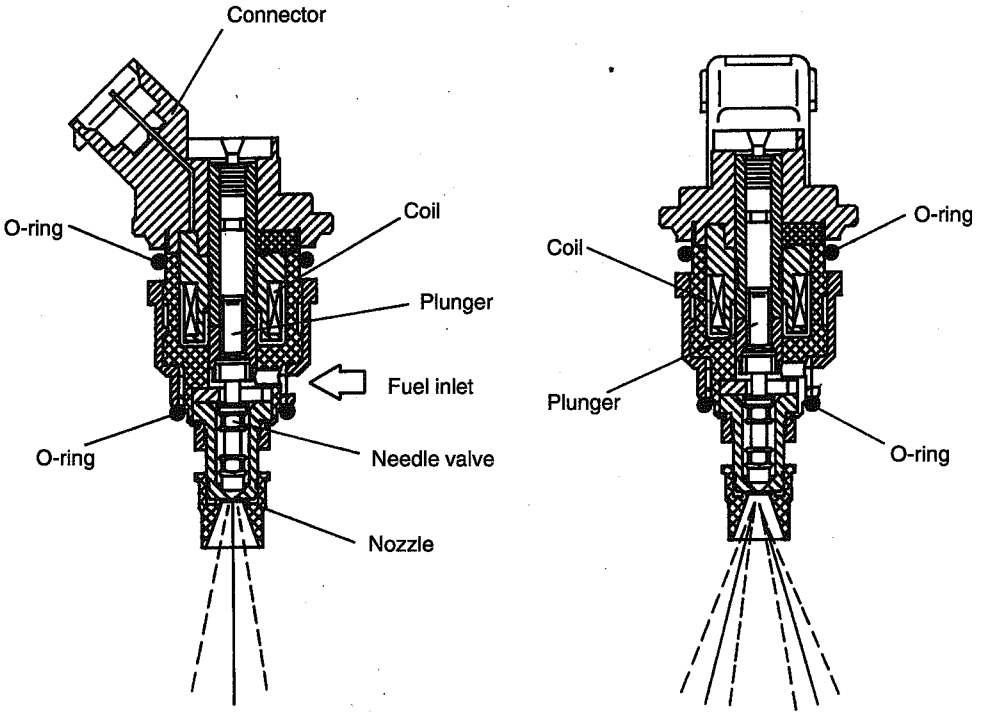
B: PRESSURE REGULATOR

- The pressure regulator is divided into the fuel chamber and the spring chamber by the diaphragm as illustrated below. Fuel is fed to the fuel chamber through the fuel inlet connected with the injector. A difference in pressure between the fuel chamber and the spring chamber connected with the intake manifold causes the diaphragm to be pushed down, and fuel is fed back to the fuel tank through the return line.
- By returning fuel so as to balance the above pressure difference and the spring force, the fuel pressure is kept at a constant level 250.1 kPa (2.55 kg/cm^2, 36.3 psi) against the intake manifold pressure.



C: FUEL INJECTOR

- The MFI system employs a gallery type (side-feed type) fuel injector.
- The gallery type fuel injector is installed in the fuel pipe to allow cooling of the injector by the fuel.
- The features of this type of fuel injector are as follows:
  - High heat resistance
  - Low driving noise
  - Easy to service
  - Small size
- The fuel injector injects fuel according to the valve open signal received from the ECM.
- The nozzle is attached on the top of the fuel injector. The needle valve is lifted by the solenoid coil through the plunger on arrival of the valve open signal.
- Since the injection opening, the lifted level of valve and the regulator-controlled fuel pressure are kept constant, the amount of fuel to be injected can be controlled only by the valve open signal from the ECM.
- The fuel is injected in two directions through the holes on the plate at the end of injector.

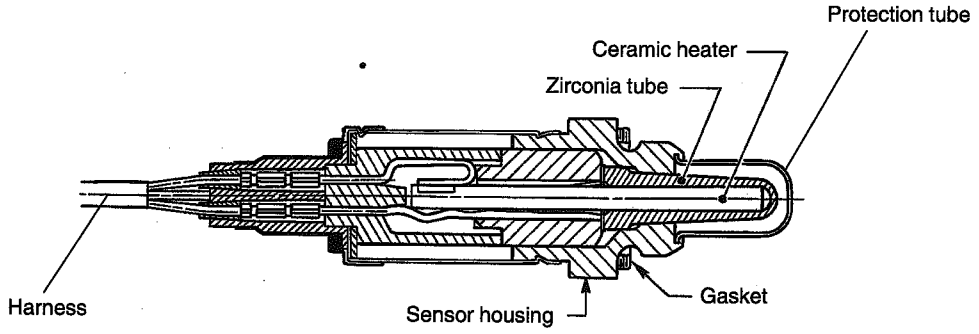


B2H0995A

4. Sensor and Switch

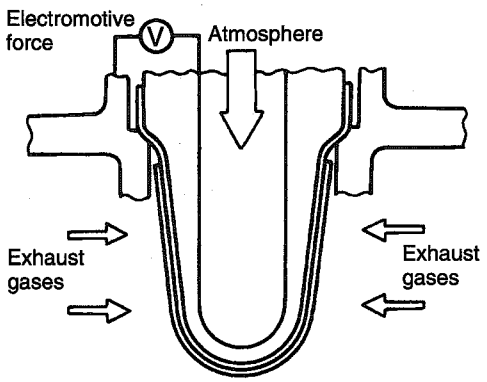
A: FRONT AND REAR OXYGEN SENSOR

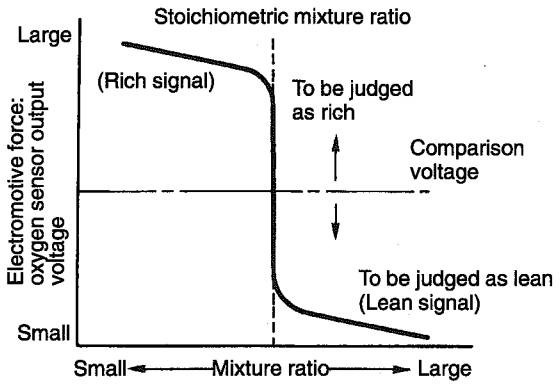
- The construction of the rear oxygen sensor is the same as that of the front oxygen sensor.
- The oxygen sensor is used to sense oxygen concentration in the exhaust gas. If the fuel ratio is leaner than the stoichiometric ratio in the mixture (i.e. excessive amount of air), the exhaust gas contains more oxygen. To the contrary, if the fuel ratio is richer than the stoichiometric ratio, the exhaust gas contains hardly any oxygen.
- Therefore, examination of the oxygen concentration in exhaust gas makes it possible to show whether the air/fuel ratio is leaner or richer than the stoichiometric ratio.
- The oxygen sensor has a zirconia tube (ceramic) which generates voltage if there is a difference in oxygen concentration between the inside and outside of the tube. Platinum is coated on the inside and outside of the zirconia tube for the purpose of catalysis and electrode provision. The sensor housing is grounded to the exhaust pipe, and the inside is connected to the ECM through the harness.
- A ceramic heater is employed to improve performance at low temperature.



H2H1224A

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases reacts almost completely through the catalytic action of the platinum coating on the surface of the zirconia tube. This results is a very large difference in the oxygen concentration between the inside and outside, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen concentration. The electromotive force is very small.
- The difference in oxygen concentration changes greatly in the vicinity of the optimum air-fuel ratio, and hence the change in the electromotive force is also large. By inputting this information into the ECM, the air-fuel ratio of the supplied mixture can be determined easily. The oxygen sensor does not generate much electromotive force when the temperature is low. The characteristics of the electromotive force stabilize at temperature of approximately 300 to 400°C (572 to 752°F).





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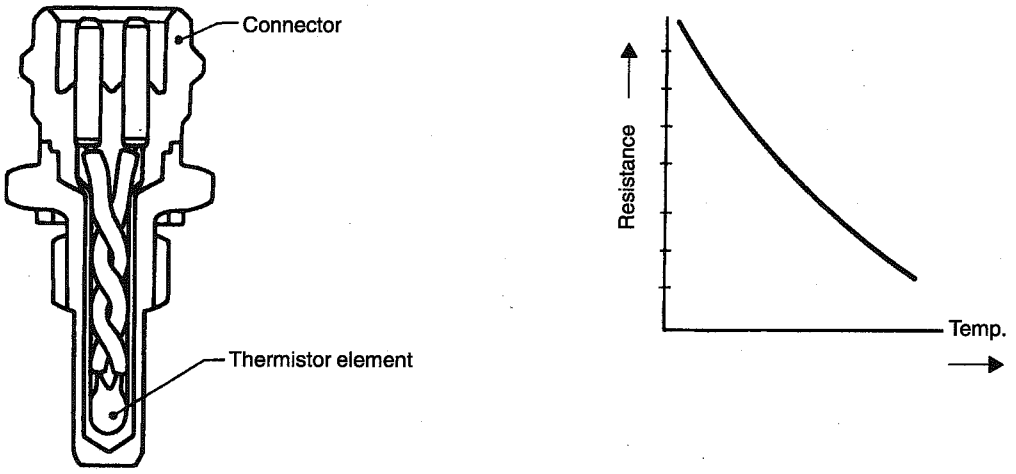
B: ENGINE COOLANT TEMPERATURE SENSOR

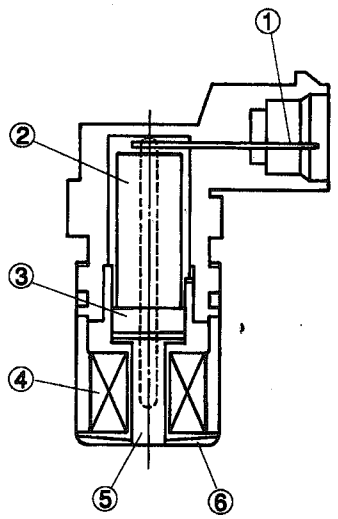
The engine coolant temperature sensor is located on the engine coolant pipe which is made of aluminum alloy. Its thermistor changes resistance with respect to temperature. A engine coolant temperature signal converted into resistance is transmitted to the ECM to control the amount of fuel injection, ignition timing, etc.



B2H0406A

C: CRANKSHAFT POSITION SENSOR

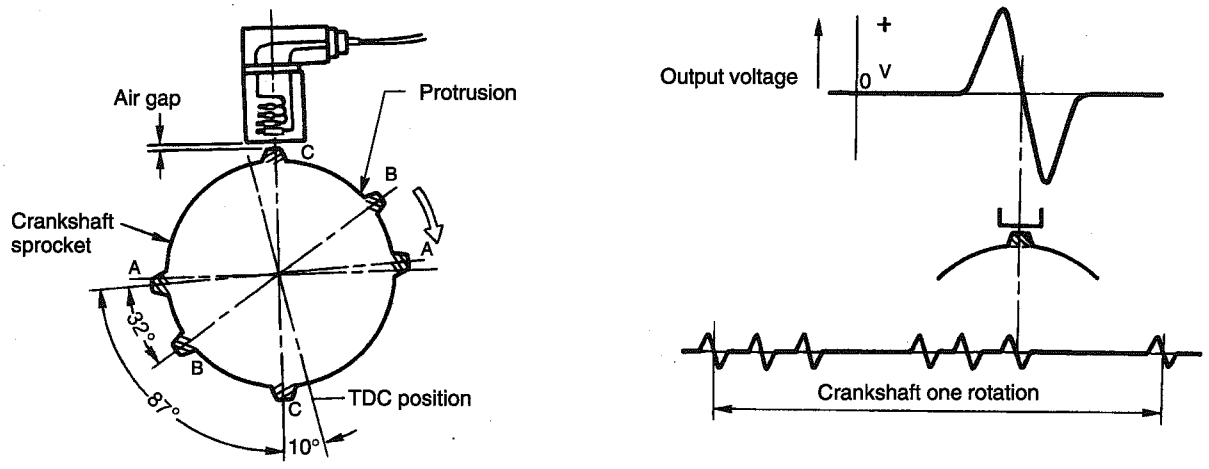
- The crankshaft position sensor is installed on the oil pump, located in the front center portion of the cylinder block, to detect the crankshaft position. It is designed so that the ECM accurately reads the number of pulses which occur when protrusions provided at the perimeter of the crankshaft sprocket (rotating together with the crankshaft) cross the crankshaft position sensor.
- The crankshaft position sensor is a molded type which consists of a magnet, core, coil, terminals, etc.



B2H0407A

① Terminal
② Yoke core
③ Magnet
④ Coil
⑤ Core
⑥ Cover

• The crankshaft sprocket is provided with six protrusions. Crankshaft rotation causes these protrusions to cross the crankshaft position sensor so that magnetic fluxes in the coil change with the change in air gap between the sensor pickup and the sprocket. The change in air gap induces an electromotive force which is transmitted to the ECM.

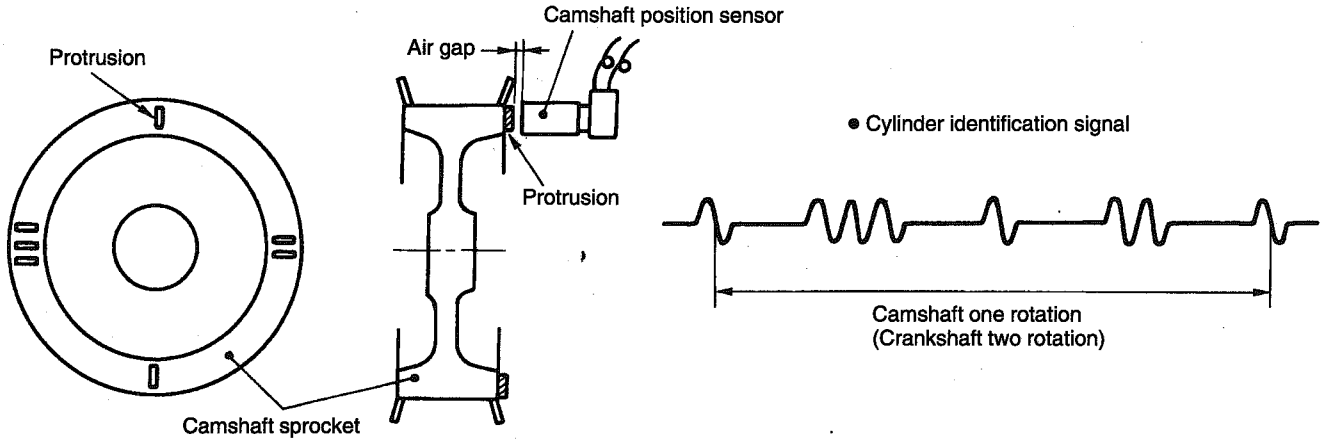


H2H1225A

D: CAMSHAFT POSITION SENSOR

• The camshaft position sensor is located on the left-hand camshaft support to detect the combustion cylinder at any one moment.

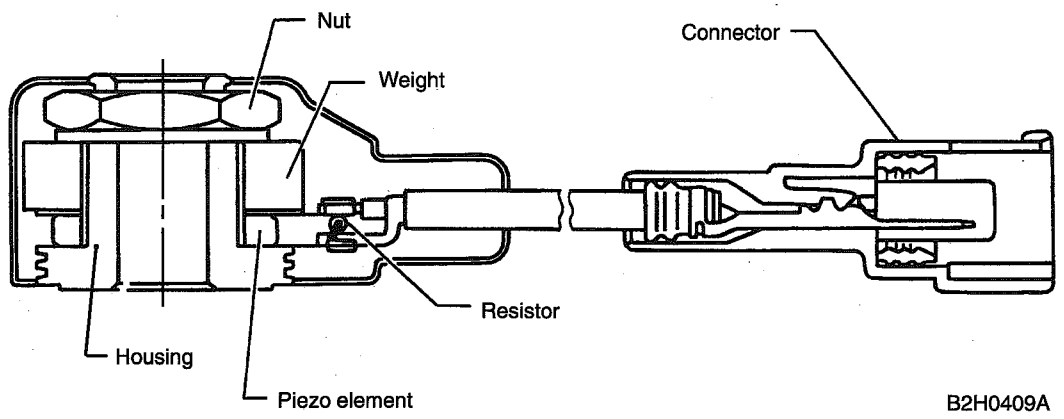
• It is designed so that the ECM accurately reads the number of pulses which occur when protrusions provided on the back of the left hand camshaft-drive sprocket cross the sensor.
Internal construction and the basic operating principle of the camshaft position sensor are similar to those of the crankshaft position sensor. A total of seven protrusions (one each at two locations, two at one location and three at one location) are arranged in four equal parts of the sprocket, as shown below.



B2H0408B

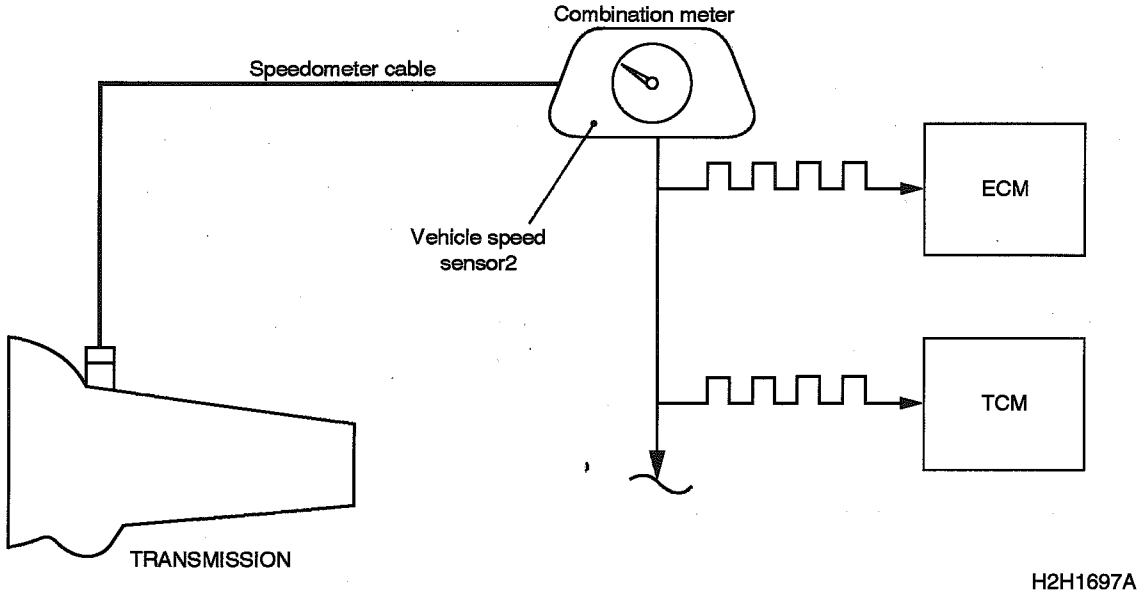
E: KNOCK SENSOR

- The knock sensor is installed on the cylinder block, and senses knocking signals.
- This knock sensor is a piezo-electric type which converts knocking vibrations into electric signals.
- It consists of a piezo-electric element, weight, and case. If knocking occurs in the engine, the weight in the case moves causing the piezo-electric element to generate a voltage.



F: VEHICLE SPEED SENSOR 2

- The vehicle speed sensor 2 consists of a magnet rotor which is rotated by a speedometer cable and a reed switch. It is built into the combination meter.
- One rotation of the magnet rotor turns the reed switch ON and OFF four times to produce a digital signal. The digital signal is used as a vehicle speed signal which is transmitted to the ECM.



5. Control System

A: GENERAL

The ECM (Engine Control Module) receives signals sent from various sensors and switches to judge the engine operating condition and emits output signals to provide the optimum control and/or functioning of various systems.

Major items governed by the ECM are as follow:

- Fuel injection control
- Ignition system control
- Idle air control
- Canister purge control*
- EGR system control*
- Radiator fan control
- Fuel pump control
- Air conditioner cut control
- On-board diagnosis function

* Canister purge control and EGR system control are described under "Chapter 2-1 Emission Control System".

B: INPUT AND OUTPUT SIGNALS

1. 1800 cc MODEL

	Unit	Function
Input signal	Mass air flow sensor	Detects the amount of intake air.
	Throttle position sensor	Detects the throttle position.
	Front and rear oxygen sensors	Detects the density of oxygen in exhaust gases.
	Crankshaft position sensor	Detects crankshaft position.
	Camshaft position sensor	Detects the relative cylinder positions.
	Engine coolant temperature sensor	Detects the engine coolant temperature.
	Knock sensor	Detects engine knocking.
	Vehicle speed sensor 2	Detects vehicle speed.
	Ignition switch	Detects ignition switch operation.
	Starter switch	Detects the condition of engine cranking.
	Neutral position switch (MT)	Detects gear position being in the neutral.
	Pressure sensor	Detects atmospheric pressure and intake manifold pressure.
	Heater circuit of front and rear oxygen sensor	Detects the abnormal for heater circuit of front and rear oxygen sensor.
	A/C switch	Detects the ON-OFF operation of the A/C switch.
	Fuel temperature sensor	Detects the temperature of the fuel in fuel tank.
	Fuel level sensor	Detects the level of the fuel in fuel tank.
	Fuel tank pressure sensor	Detects the evaporation gas pressure in fuel tank.
Output signal	Fuel injector	Injects fuel.
	Ignition signal	Turns primary ignition current ON or OFF.
	Fuel pump relay	Turns the fuel pump relay ON or OFF.
	A/C control relay	Turns A/C control relay ON or OFF.
	Radiator fan control relay	Turns radiator fan control relay ON or OFF.
	Idle air control solenoid valve	Adjusts the amount of idle air flowing through the throttle valve.
	Malfunction indicator lamp	Indicates trouble.
	Purge control solenoid valve	Controls the purge of evaporative gas absorbed by canister.
	Power supply	Controls the ON/OFF switching of main relay.
	Pressure sources switching solenoid valve	Switches the intake manifold pressure and atmospheric pressure that pressure sensor detects.
	Pressure control solenoid valve	Controls the evaporation gas pressure in fuel tank.
	Vent control solenoid valve	Closes the evaporation line between the fuel tank and canister to detect the leak of evaporation gases.

2. 2200 cc MODEL

	Unit	Function
Input signal	Mass air flow sensor	Detects the amount of intake air.
	Throttle position sensor	Detects the throttle position.
	Front and rear oxygen sensors	Detects the density of oxygen in exhaust gases.
	Crankshaft position sensor	Detects crankshaft position.
	Camshaft position sensor	Detects the relative cylinder positions.
	Engine coolant temperature sensor	Detects the engine coolant temperature.
	Knock sensor	Detects engine knocking.
	Vehicle speed sensor 2	Detects vehicle speed.
	Ignition switch	Detects ignition switch operation.
	Starter switch	Detects the condition of engine cranking.
	Park/Neutral position switch (AT)	Detects shift positions.
	Neutral position switch (MT)	Detects gear position being in the neutral.
	Torque control signal (AT)	Controls the engine torque.
	Pressure sensor	Detects atmospheric pressure and intake manifold pressure.
	Heater circuit of front and rear oxygen sensor	Detects the abnormal for heater circuit of front and rear oxygen sensor.
	Diagnostics of AT (AT)	Detects the self-diagnostics of AT.
	A/C switch	Detects the ON-OFF operation of the A/C switch.
Output signal	Fuel Injector	Injects fuel.
	Ignition signal	Turns primary ignition current ON or OFF.
	Fuel pump relay	Turns the fuel pump relay ON or OFF.
	A/C control relay	Turns A/C control relay ON or OFF.
	Radiator fan control relay	Turns radiator fan control relay ON or OFF.
	Idle air control solenoid valve	Adjusts the amount of idle air flowing through the throttle valve.
	Malfunction indicator lamp	Indicates trouble.
	Purge control solenoid valve	Controls the purge of evaporative gas absorbed by canister.
	Power supply	Controls the ON/OFF switching of main relay.
	EGR control solenoid valve (AT)	Controls the function of EGR system.
	Pressure sources switching solenoid valve	Switches the intake manifold pressure and atmospheric pressure that pressure sensor detects.

C: FUEL INJECTION CONTROL

• The ECU receives signals emitted from various sensors to control the amount of fuel injected and the fuel injection timing. Sequential fuel injection control is utilized over the entire engine operating range except during engine starts.

• The amount of fuel injected by the injector valve is dependent upon the length of time it remains open. The optimum fuel injection timing is determined by transmitting a signal to the injector from the ECM according to varying engine operations. Feedback control is also accomplished by means of a learning control. As a result, the fuel injection control system is highly responsive and accurate in design and structure.

• The sequential fuel injection system is designed so that fuel is injected at a specific time to provide maximum air intake efficiency for each cylinder. In other words, fuel injection is completed just before the intake valve begins to open.

1. FUEL INJECTION CHARACTERISTICS

Fuel injection timing is basically expressed as indicated below:

- During engine starts:
  Duration of fuel injection = Duration of fuel injection during engine starts
- During normal operation:
  Basic duration of fuel injection x correction factors + voltage correction time
  - Basic duration of fuel injection ..... The basic length of time fuel is injected. This is determined by two factors – the amount of intake air detected by the mass air flow sensor and the engine speed (rpm) monitored by the crankshaft position sensor.
  - Duration of fuel injection during engine starts ..... Determined according to the engine coolant temperature detected by a signal emitted from the engine coolant temperature sensor to improve starting ability.
  - Voltage correction time ..... Compensates for the fuel injector's time lag affected by the battery voltage.

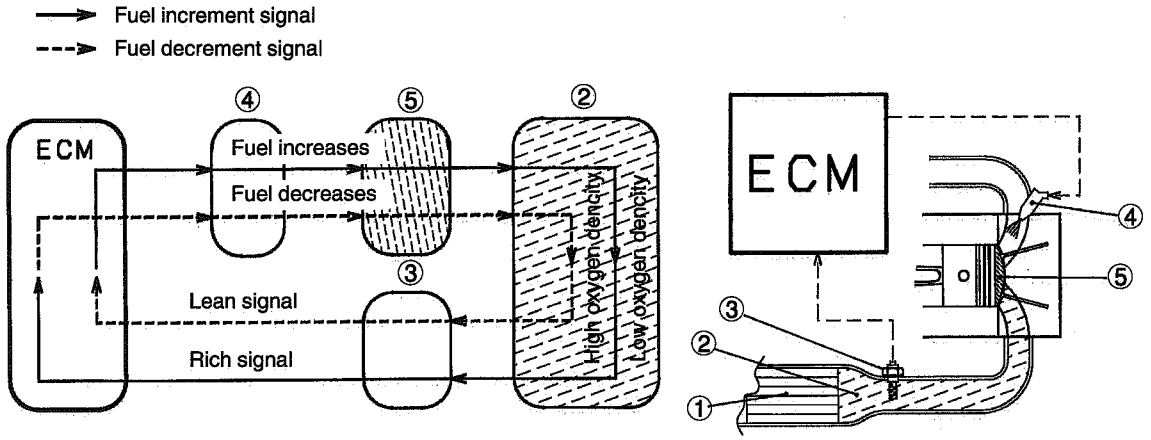
2. CORRECTION FACTORS

Correction factors are used to correct the basic duration of fuel injection so that the air-fuel ratio meets the requirements of varying engine operations.
These correction factors are classified as follows:

- Air-fuel ratio coefficient:
  Allotted to provide the optimum air-fuel ratio in relation to engine speed and the basic amount of fuel injected.
- Start increment coefficient:
  Increases the amount of fuel injected only when cranking the engine, which improves starting ability.
- Engine coolant temperature increment coefficient:
  Used to increase the amount of fuel injected in relation to a signal emitted from the engine coolant temperature sensor for easier starting of a cold engine. The lower the engine coolant temperature, the greater the increment rate.
- After-start increment coefficient:
  - Increases the amount of fuel injected for a certain period of time immediately after the engine starts to stabilize engine operation.
  - The amount of fuel to be compensated for depends on the water temperature during engine starting.
- Full increment coefficient:
  Increases the amount of fuel injected by a signal emitted from the throttle position sensor in relation to a signal emitted from the mass air flow sensor.
- Acceleration increment coefficient:
  Compensates for time lags of air flow measurement and/or fuel injection during acceleration to provide quick response.

3. AIR-FUEL RATIO FEEDBACK COEFFICIENT "ALPHA"

This feedback coefficient utilizes the oxygen sensor's electromotive force (voltage) as a signal to be entered into the ECM. When low voltage is entered, the ECM judges it as a lean mixture, and when high voltage is entered, it is judged as a rich mixture. In other words, when the air-fuel ratio is richer than the stoichiometric mixture ratio, the amount of fuel injected is decreased. When it is leaner, the amount of fuel injected is increased. In this way, the air-fuel ratio is compensated so that it comes as close to the stoichiometric mixture ratio as possible on which the three-way catalyst acts most effectively. (CO, HC and NOx are also reduced when the air-fuel ratio is close to stoichiometric mixture ratio.)



G2H0050

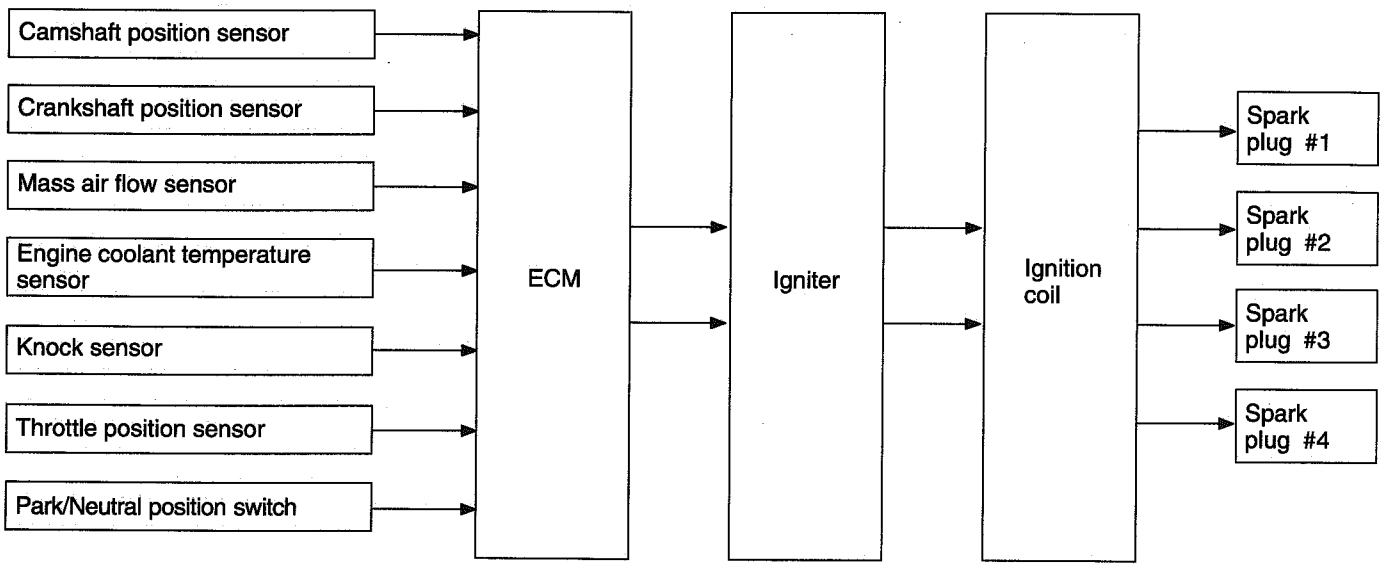
① Front catalyst
② Exhaust gas
③ Oxygen sensor
④ Fuel injector
⑤ Combustion chamber

4. LEARNING CONTROL SYSTEM

- In a conventional air-fuel feedback control system, the basic amount of fuel injected (according to engine speed and various loads) is stored in the memory. After the ECM receives a signal emitted from the oxygen sensor, the basic amount of fuel injected is corrected so that it is close to the stoichiometric mixture ratio. This means that the greater the air-fuel ratio is corrected, the lesser the control accuracy.
- In SUBARU engines, however, an air-fuel ratio learning control system constantly memorizes the amount of correction required in relation to the basic amount of fuel to be injected (the basic amount of fuel injected is determined after several cycles of fuel injection), so that the correction affected by feedback control is minimized. Thus, quick response and accurate control of variations in air-fuel ratio, sensors' and actuators' characteristics during operation, as well as in the air-fuel ratio with the time of engine operation, are achieved. In addition, accurate control contributes much to stability of exhaust gases and driving performance.

D: IGNITION SYSTEM CONTROL

- The ECM receives signals emitted from the mass air flow sensor, engine coolant temperature sensor, crankshaft position sensor, camshaft position sensor, etc., to judge the operating condition of the engine. It then selects the optimum ignition timing stored in the memory and immediately transmits a primary current OFF signal to the igniter to control the ignition timing.
- This system control type features a quick-to-response learning control method by which data stored in the ECM memory is processed in comparison with information emitted from various sensors and switches.
- Thus, the ECM constantly provides the optimum ignition timing in relation to output, fuel consumption, exhaust gas, etc., according to various engine operating conditions, etc.



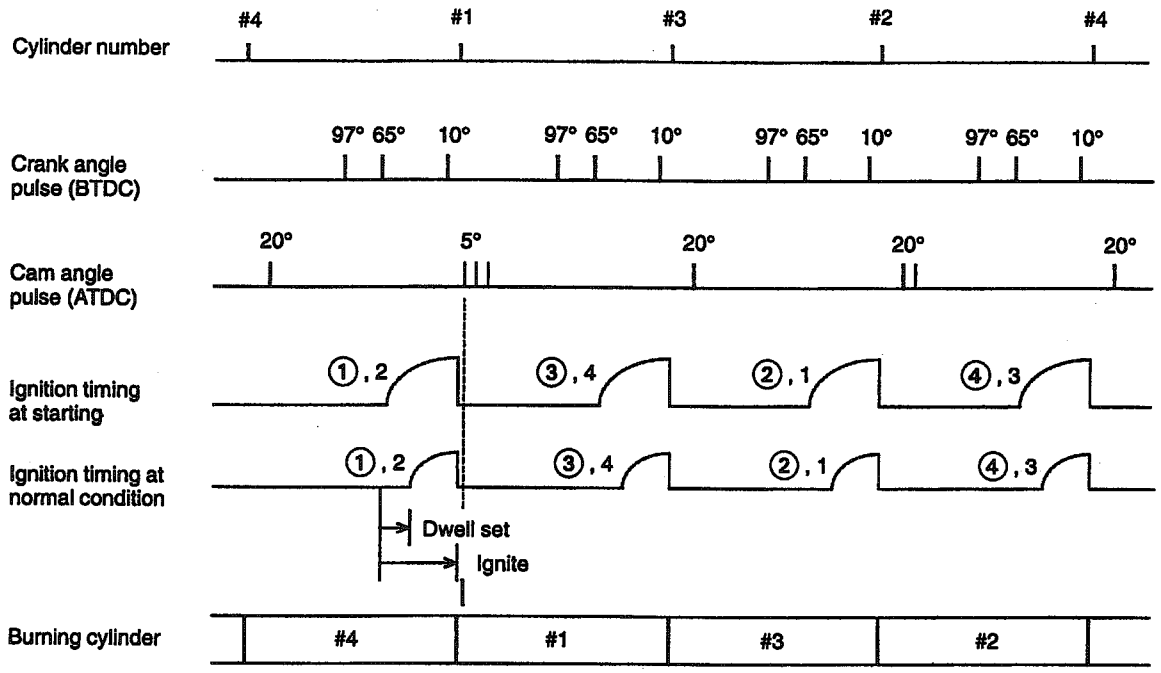
- Ignition control under normal engine conditions

Between the 97° signal and the 65° signal, the ECM measures the engine speed, and by using this data it decides the dwell set timing and ignition timing according to the engine condition.

- Ignition control under starting conditions

Engine speed fluctuate at the starting condition, so the ECM cannot control the ignition timing. When such a condition exists, ignition timing is fixed at 10° BTDC by using the 10° signal.

1800 cc MODEL



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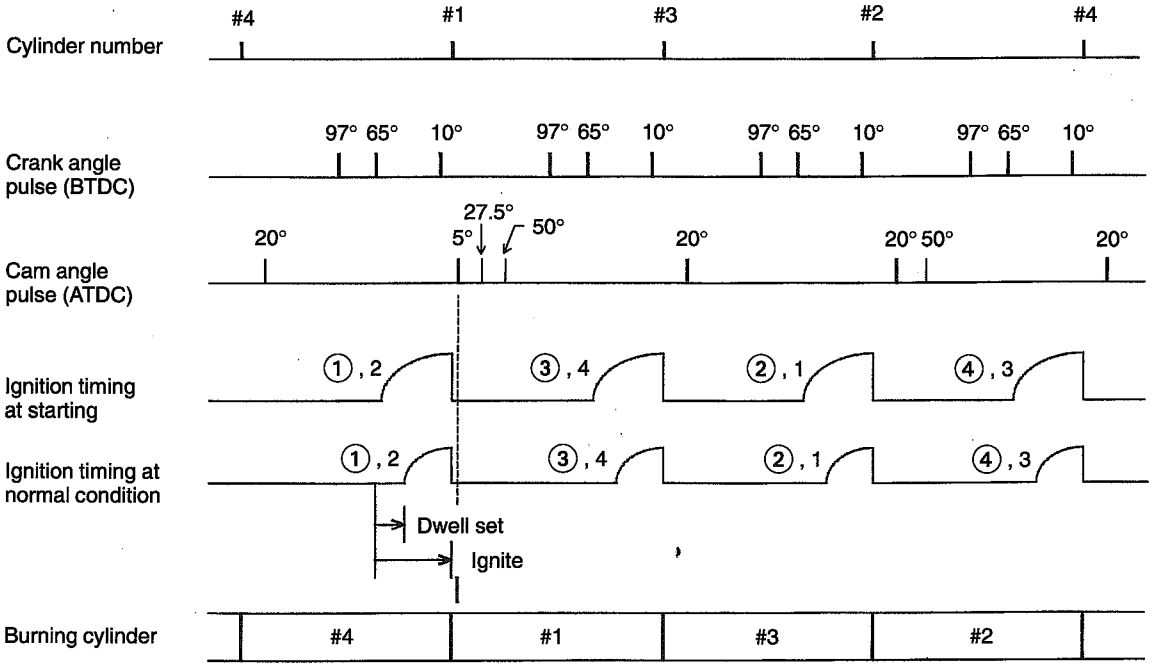
2200 cc MODEL



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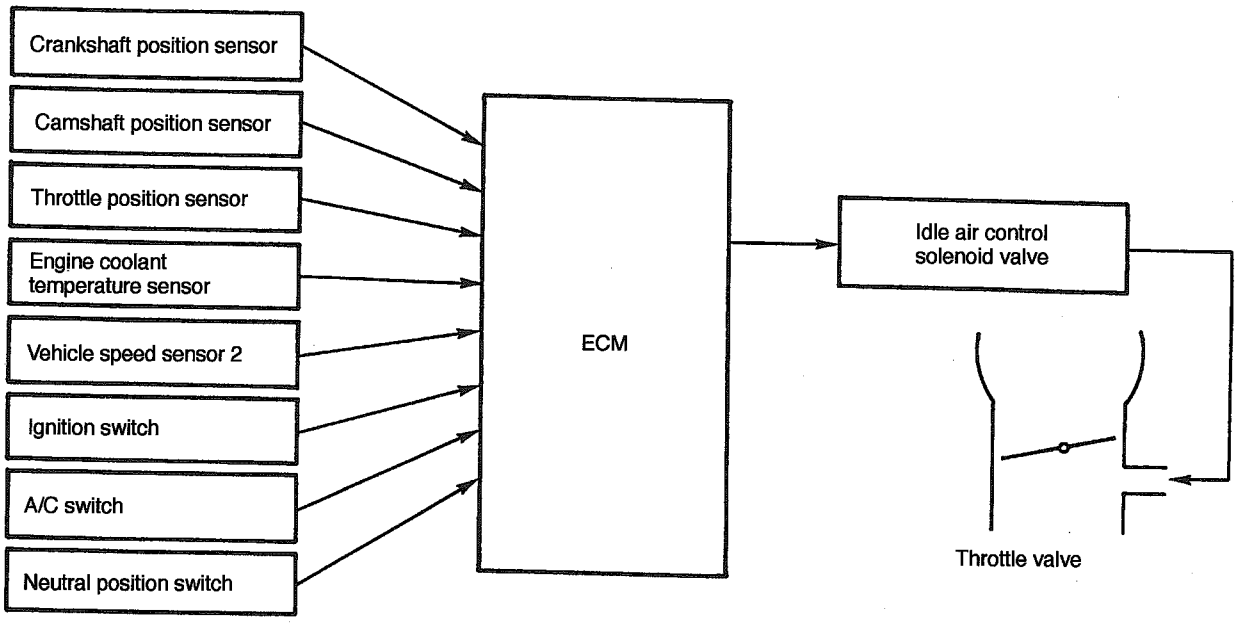
E: IDLE AIR CONTROL

1. 1800 cc MODEL

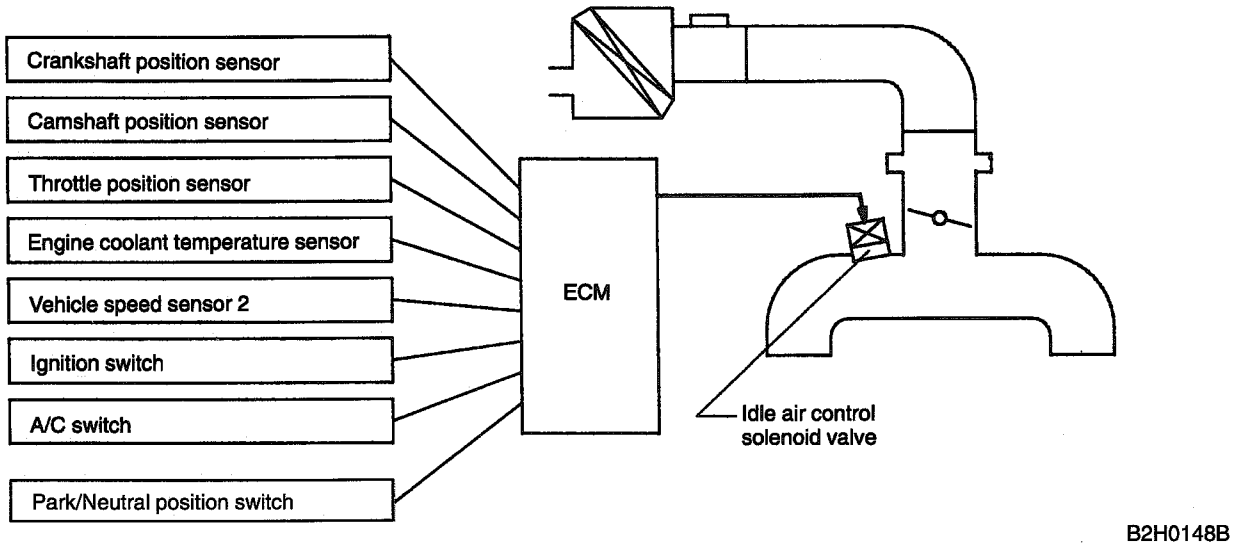
- The ECM activates the idle air control solenoid valve in advance to control the amount of by-pass air flowing through the throttle valve in relation to signals emitted from the crankshaft position sensor, camshaft position sensor, engine coolant temperature sensor and A/C switch, so that the proper idle speed specified for each engine load is achieved.
- The idle air control solenoid valve utilizes a duty solenoid design so that the amount of valve "lift" is determined by a certain operating frequency. For this reason, the by-pass air flow is regulated by controlling the duty ratio. The relationship between the duty ratio, valve lift and by-pass air flow is as follows:
  - Duty ratio (high) → Increases valve lift and by-pass air flow.
- By-pass air control features the following advantages:
  - Compensation for engine speed under A/C (air conditioning) system and electrical loads.
  - Increase in idle speed during early stage of warm up period.
  - A dashpot function during the time the throttle valve is quickly closed.
  - Prevention of engine speed variations over time.



H2H1560A

2. 2200 cc MODEL

- The ECM activates the idle air control solenoid valve in advance to control the amount of by-pass air flowing through the throttle valve in relation to signals emitted from the crankshaft position sensor, camshaft position sensor, engine coolant temperature sensor and A/C switch, so that the proper idle speed specified for each engine load is achieved.
- The idle air control solenoid valve is a rotary type and operates by duty cycle. For this reason, the by-pass air flow is regulated by controlling the duty ratio. The relationship between the duty ratio and by-pass air flow is as follows:
  - Duty ratio (high) → Increases by-pass air flow.
- By-pass air control features the following advantages:
  - Compensation for engine speed under A/C (air conditioning) system and electrical loads.
  - Increase in idle speed during early stage of warm up period.
  - A dashpot function during the time the throttle valve is quickly closed.
  - Prevention of engine speed variations over time.



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F: CANISTER PURGE CONTROL

• The ECM receives signals emitted from the engine coolant temperature sensor, vehicle speed sensor 2 and crankshaft position sensor to control the purge control solenoid.
Canister purge takes place during operation of the vehicle except under certain conditions (during idle, etc.).

• The purge line is connected to the throttle chamber to purge fuel evaporation gas from the canister according to the amount of intake air.

G: RADIATOR FAN CONTROL

• The ON-OFF control of the radiator fan is governed by the ECM which receives signals sent from the engine coolant temperature sensor and vehicle speed sensor 2.

Vehicle speed	Engine coolant temperature		
	Less than 95°C (Less than 203°F)	Between 95 and 99°C (Between 203 and 210°F)	More than 100°C (More than 212°F)
	Operation of radiator main fan	Operation of radiator main fan	Operation of radiator main fan
Less than 19 km/h (Less than 12 MPH)	OFF	ON	ON
Between 20 and 69 km/h (Between 12 and 43 MPH)	OFF	ON	ON
Between 70 and 89 km/h (Between 43 and 55 MPH)	OFF	OFF	ON
More than 90 km/h (More than 56 MPH)	OFF	OFF	ON

• On models which are equipped with an air conditioning system, the ECM receives signals sent from the engine coolant temperature sensor, vehicle speed sensor 2 and A/C switch. These signals simultaneously turn ON or OFF the radiator main fan and radiator sub fan.

Vehicle speed	A/C compressor	Engine coolant temperature					
		Less than 95°C (Less than 203°F)		Between 95 and 99°C (Between 203 and 210°F)		More than 100°C (More than 212°F)	
		Operation of radiator fan		Operation of radiator fan		Operation of radiator fan	
		Main	Sub	Main	Sub	Main	Sub
Less than 19 km/h (Less than 12 MPH)	OFF	OFF	OFF	ON	OFF	ON	ON
	ON	ON	ON	ON	ON	ON	ON
Between 20 and 69 km/h (Between 12 and 43 MPH)	OFF	OFF	OFF	ON	OFF	ON	ON
	ON	ON	ON	ON	ON	ON	ON
Between 70 and 89 km/h (Between 43 and 55 MPH)	OFF	OFF	OFF	OFF	OFF	ON	ON
	ON	ON	OFF	ON	ON	ON	ON
More than 90 km/h (More than 56 MPH)	OFF	OFF	OFF	OFF	OFF	ON	ON
	ON	OFF	OFF	ON	OFF	ON	ON

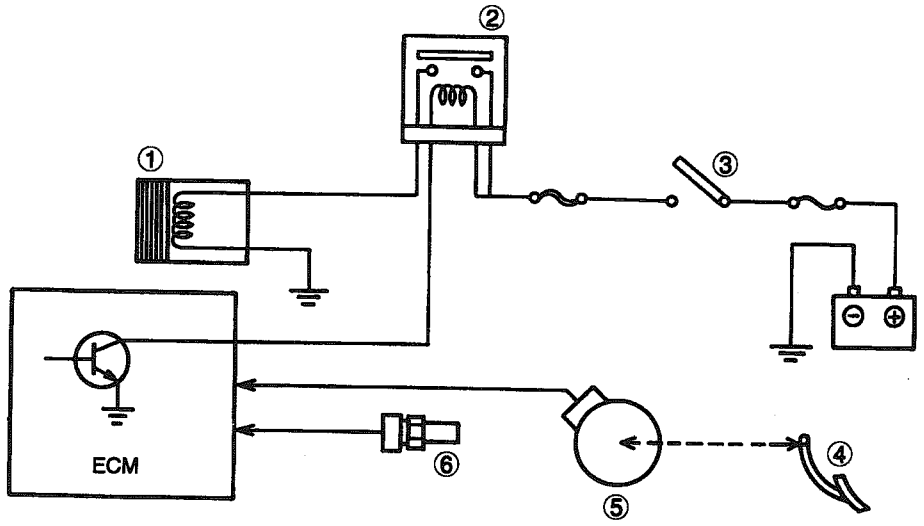
H: FUEL PUMP CONTROL

The ECM receives a signal emitted from the crankshaft position sensor and turns the fuel pump relay ON or OFF to control fuel pump operation. To improve safety, the fuel pump will stop if the engine stalls with the ignition switch ON.

Ignition switch ON	Fuel pump relay	Fuel pump
A certain period of time (after ignition switch is turned ON)	ON	Operates
While cranking the engine	ON	Operates
While engine is operating	ON	Operates
When engine stops	OFF	Does not operate

I: A/C CUT CONTROL

- When the ECM receives a "full-open" signal emitted from the throttle position sensor while the air conditioning system is operating, the A/C cut relay turns off for a certain period of time to stop the compressor. This prevents degradation of output during acceleration and stabilizes driveability.
- The A/C cut relay is also turned OFF when the engine coolant temperature is high.



B2H0411

① A/C compressor
② A/C cut relay
③ Ignition switch
④ Accelerator pedal
⑤ Throttle position sensor
⑥ Engine coolant temperature sensor

J: POWER SUPPLY CONTROL

- When the ECM receives an ON signal emitted from the ignition switch, current flows through the main relay. This turns the ignition relay ON so that power is supplied to the ignition coil, mass air flow sensor, idle air control valve, etc.
- Power to the above parts is turned off five seconds after the ECM receives an OFF signal from the ignition switch. The fuel injectors stop fuel injection immediately after the ignition switch is turned OFF because the injection signal is cut off.

6. On-board Diagnosis System

A: GENERAL

- The on-board diagnosis system detects and indicates a fault in various inputs and outputs of the complex electronic control. The CHECK ENGINE malfunction indicator lamp (MIL) on the combination meter indicates occurrence of a fault or trouble.
- When the malfunction indicator lamp comes on by the ECM having diagnosed occurrence of faults, the diagnostic trouble code (DTC) and the freeze frame engine condition are stored in the ECM.
- On the OBD-II conformable car, it is necessary to connect the Subaru Select Monitor (SSM) or General Scan Tool (GST) to data link connector in order to check the DTC.
- The SSM and GST not only can read out the DTC but also can erase the DTC or read out the freeze frame data and other pieces of engine data.
- Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.

B: FAIL-SAFE FUNCTION

For the part which has been judged faulty in the on-board diagnosis, the ECM generates the associated pseudo signal (only when convertible to electric signal) and carries out the computational processing. In this fashion, the fail-safe function is performed.

Refer to "DIAGNOSTICS SECTION".

MEMO

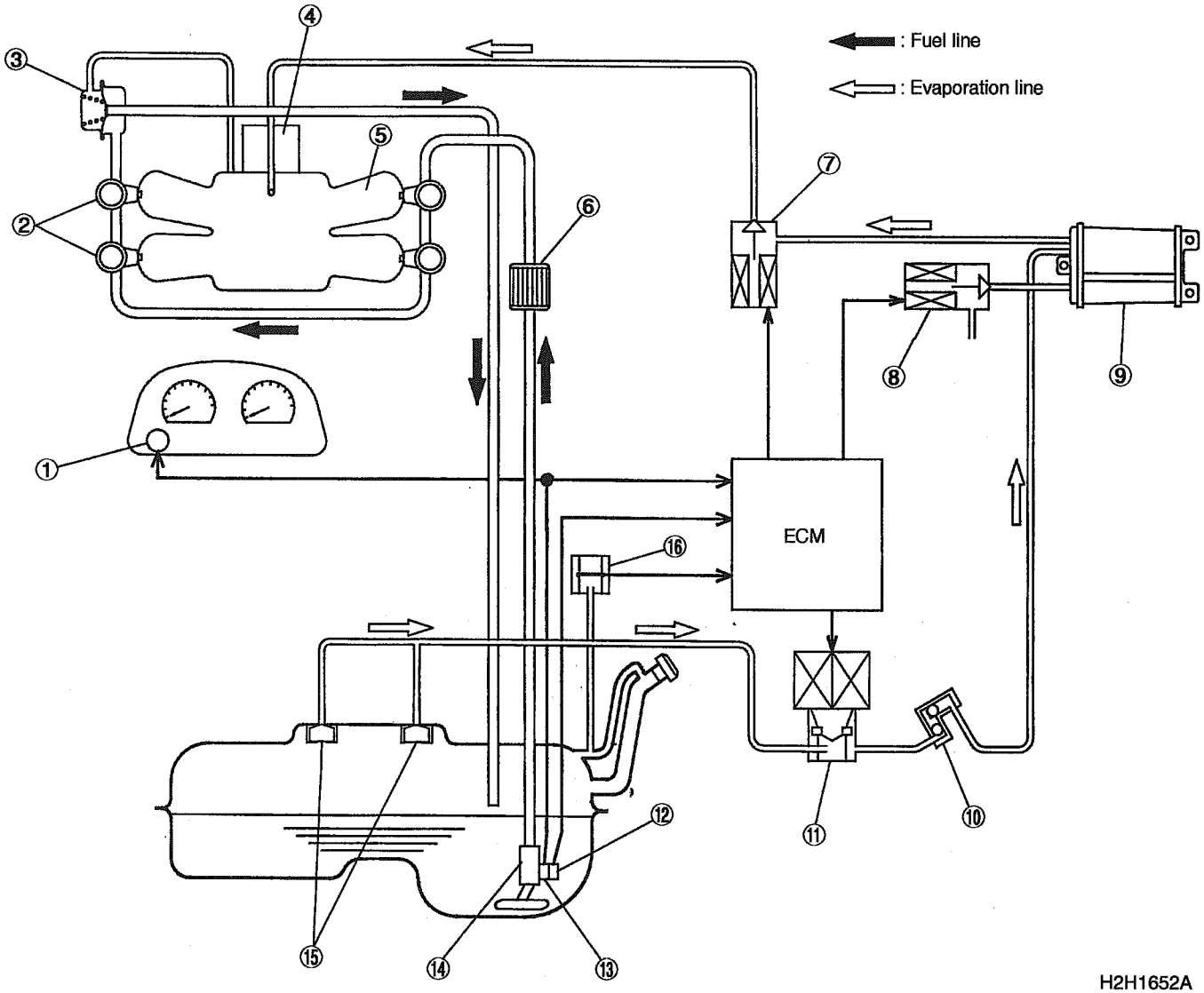
1. Fuel Lines

The fuel lines consist of a delivery line, return line, and an evaporation line.

- The delivery line supplies fuel from the fuel tank to the intake manifold and consists of a pump filter, fuel pump and fuel filter.
- The return line returns excess fuel to the fuel tank via the pressure regulator to maintain a constant level of fuel pressure.
- The fuel tank is equipped with a jet pump so that the fuel level of both fuel tank chambers can always be kept equal.

A: 1800 cc MODEL

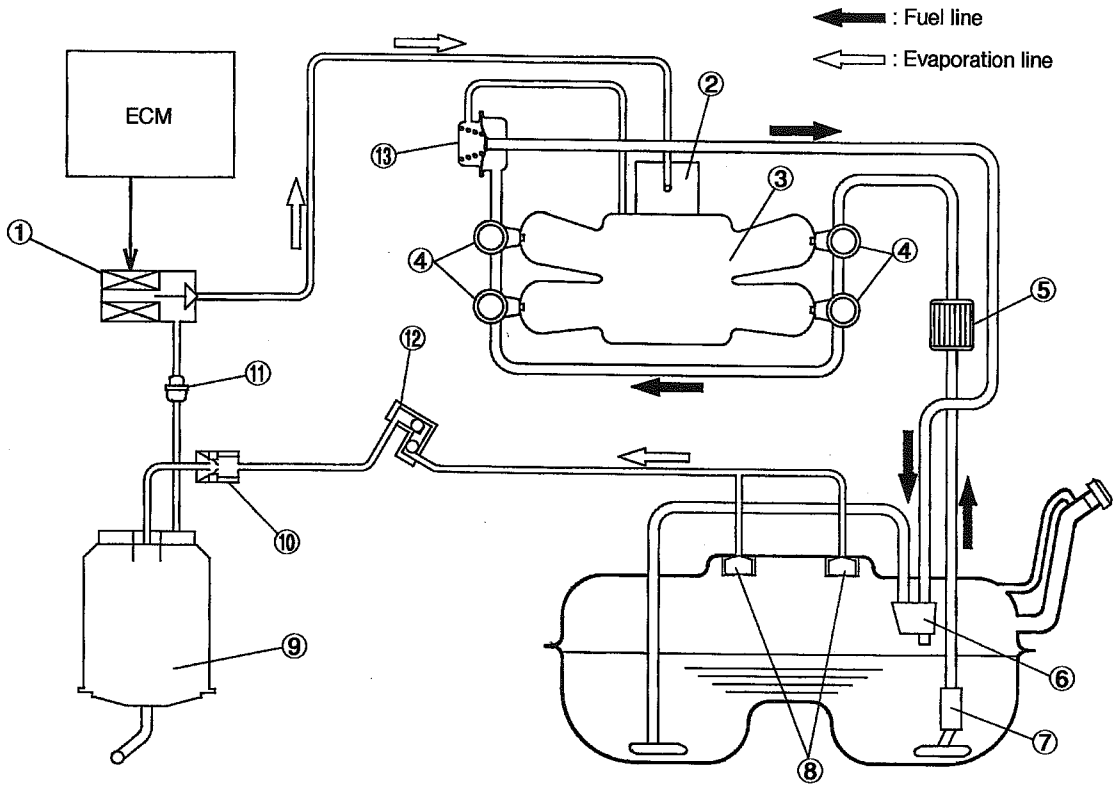
- The evaporation line consists of a canister, vent control solenoid valve, roll over valve, fuel cut valve, fuel temperature sensor, fuel level sensor, fuel tank pressure sensor, pressure control solenoid valve and purge control solenoid vavle.



① Fuel gauge
② Fuel injector
③ Pressure regulator
④ Throttle body
⑤ Intake manifold
⑥ Fuel filter
⑦ Purge control solenoid valve
⑧ Vent control solenoid valve
⑨ Canister
⑩ Roll over valve
⑪ Pressure control solenoid valve
⑫ Fuel temperature sensor
⑬ Fuel level sensor
⑭ Fuel pump
⑮ Fuel cut valve
⑯ Fuel tank pressure sensor

B: 2200 cc MODEL

• The evaporation line consists of a purge control solenoid valve, two-way valve and canister. And two fuel cut valves are additionally provided.

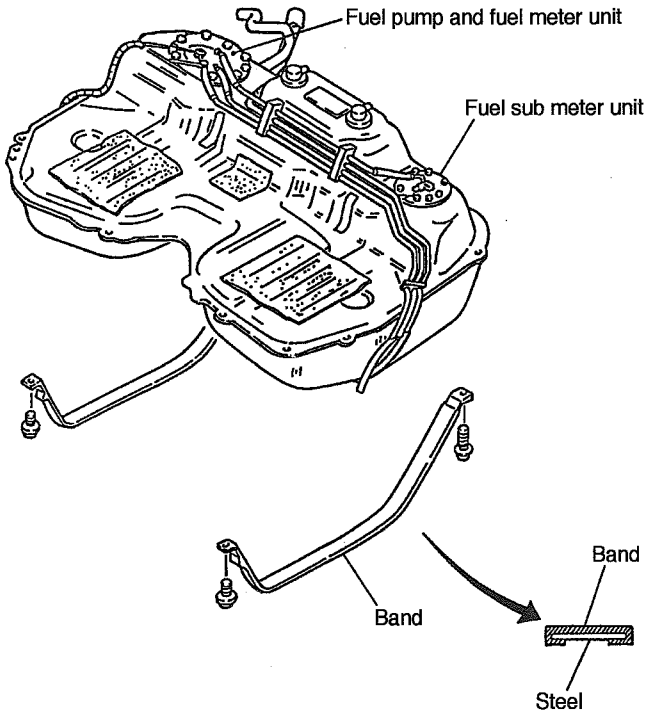


H2H1651A

① Purge control solenoid valve
② Throttle body
③ Intake manifold
④ Fuel injector
⑤ Fuel filter
⑥ Jet pump
⑦ Fuel pump
⑧ Fuel cut valve
⑨ Canister
⑩ Two-way valve
⑪ Check valve
⑫ Roll over valve
⑬ Pressure regulator

2. Fuel Tank

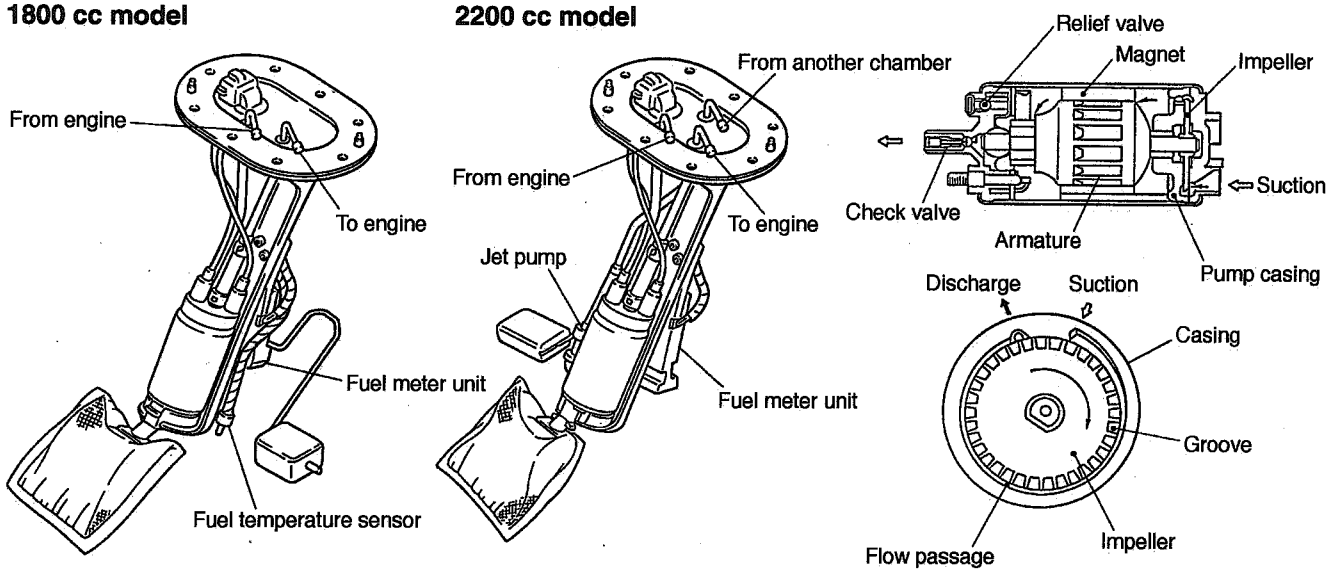
- The fuel tank is located under the rear seat and secured with hold down bands. The fuel tank utilizes a dented design to prevent interference with the rear differential.
- The fuel tank has two chambers, and is provided with a suction jet pump which transfers fuel from one chamber to another. Each fuel chamber has a built-in fuel sub meter unit.



H2H1653A

3. Fuel Pump

The impeller type fuel pump consists of a motor, impeller, pump casing, pump cover, relief valve, check valve and pump filter. It is built into the fuel tank together with the fuel meter unit to provide quiet operation.

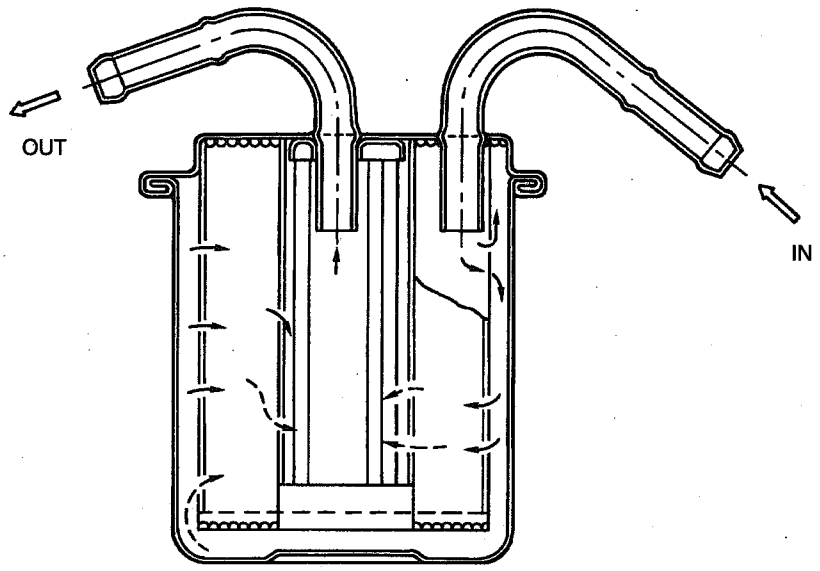


H2H1654A

- When the engine starts, fuel pump relay activates. This operates the motor to rotate the impeller.
- Fuel entering a vane groove of the impeller flows along the fuel passage and into the next vane groove by centrifugal force. During the time fuel flows from one groove to the next, a pressure differential is produced by friction of the flow.
- Thus, fuel pressure increases while the action is described in step 2) above is repeated, and fuel is discharged from the pump casing. Fuel under pressure then passes through the clearance between the armature and the magnet and is discharged from the fuel pump.
- As fuel discharge pressure reaches the specified value, the relief valve opens. This discharges fuel under pressure into the fuel tank. Fuel from the fuel tank then returns to the suction port and passes through the fuel pump. This action of fuel flow is repeated. In this manner, the relief valve prevents an abnormal increase in fuel pressure.
- When the engine and fuel pump stop, spring force acts on the check valve to close the discharge port so that fuel pressure remains in the fuel delivery line.

4. Fuel Filter

The fuel filter utilizes a pressure-withstanding, cartridge design. It has a filter element built into the metal case. With this design, fuel flows from the perimeter of the element to the interior of the filter.

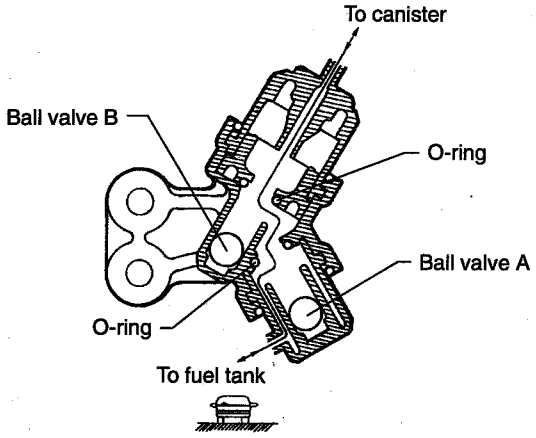


G2H0059

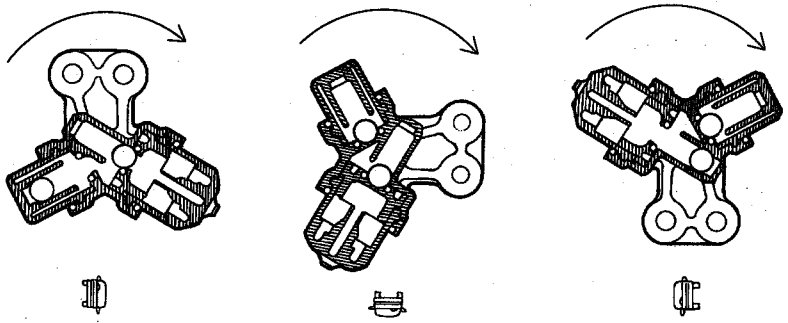
5. Roll Over Valve

The roll over valve is for prevention of fuel leakage in the event of the vehicle rolling over.

Normal position



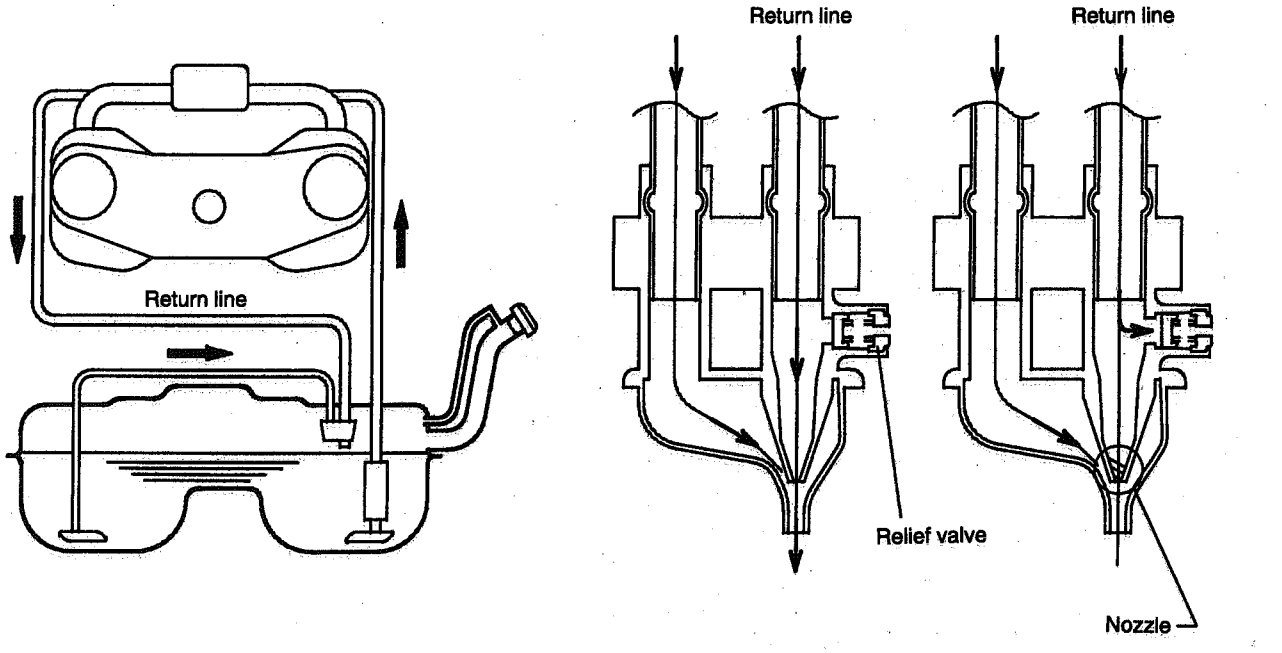
Roll over position



G2H0060

6. Jet Pump (2200 cc Model)

- The jet pump utilizes the velocity of fuel returning from the engine to produce negative pressure inside the jet pump.
- This negative pressure allows fuel to be sucked up.
- When the return line nozzle is clogged, the fuel sent back through the return line flows back into the fuel tank via the relief valve.



B2H0012A

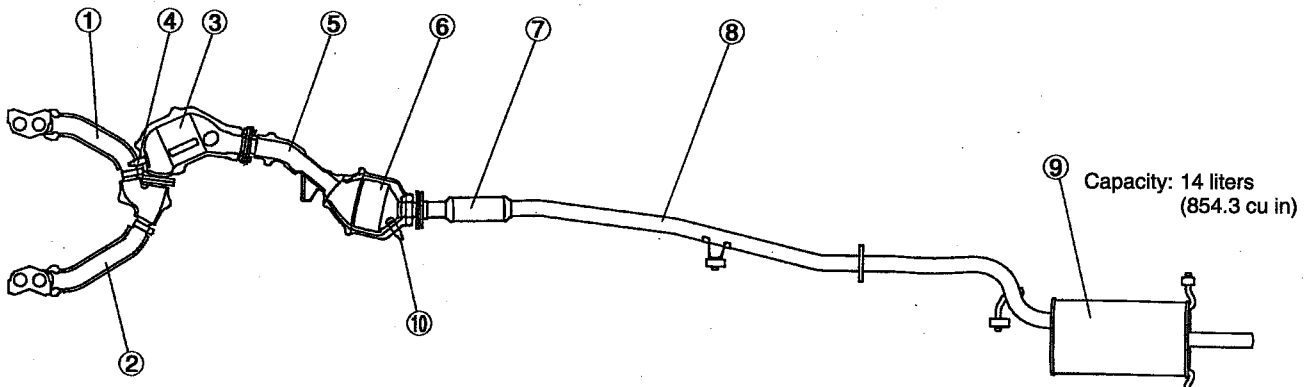
EXHAUST SYSTEM 2-9

1. General

The exhaust system consists of a front exhaust pipe, catalytic converter (s), a center exhaust pipe, a rear exhaust pipe and a muffler. The front catalytic converter is located immediately behind the front exhaust pipe, and the rear catalytic converter is incorporated in the center exhaust pipe.

The exhaust system features an improved sound suppression design; the two branches of the front exhaust pipe join at a point almost equal in distance from the engine's exhaust ports and the rear exhaust pipe has a resonance chamber in addition to a large capacity muffler.

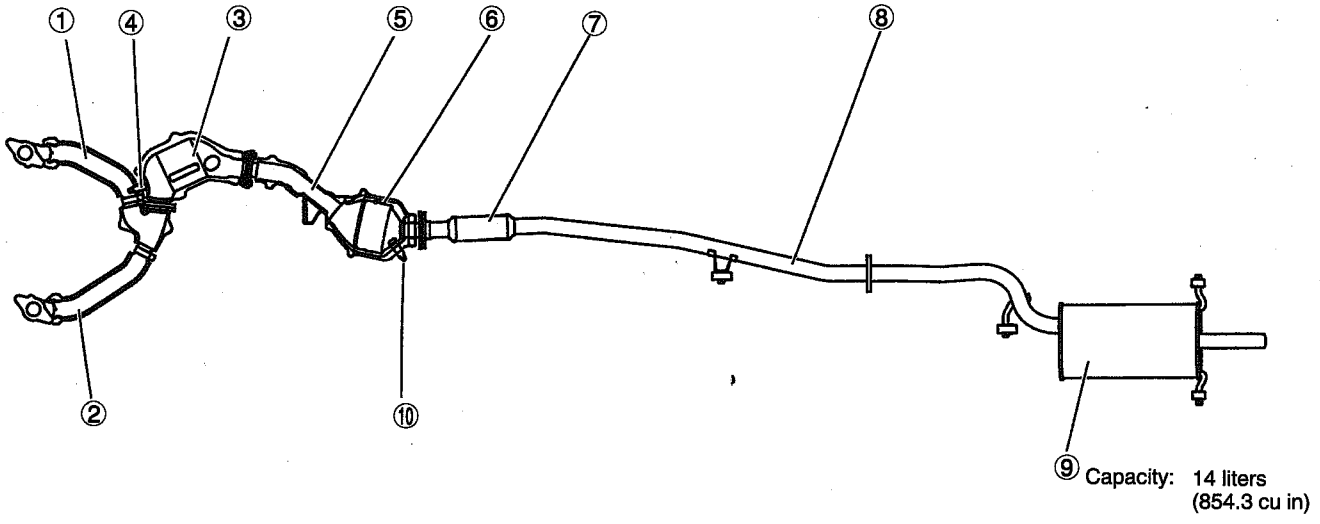
A: 1800 cc MODEL



H2H1655A

① Front exhaust pipe RH
② Front exhaust pipe LH
③ Front catalytic converter
④ Front oxygen sensor
⑤ Center exhaust pipe
⑥ Rear catalytic converter
⑦ Resonance chamber
⑧ Rear exhaust pipe
⑨ Muffler
⑩ Rear oxygen sensor

B: 2200 cc MODEL



H2H1430A

① Front exhaust pipe RH
② Front exhaust pipe LH
③ Front catalytic converter
④ Front oxygen sensor
⑤ Center exhaust pipe
⑥ Rear catalytic converter
⑦ Resonance chamber
⑧ Rear exhaust pipe
⑨ Muffler
⑩ Rear oxygen sensor

1. Outline

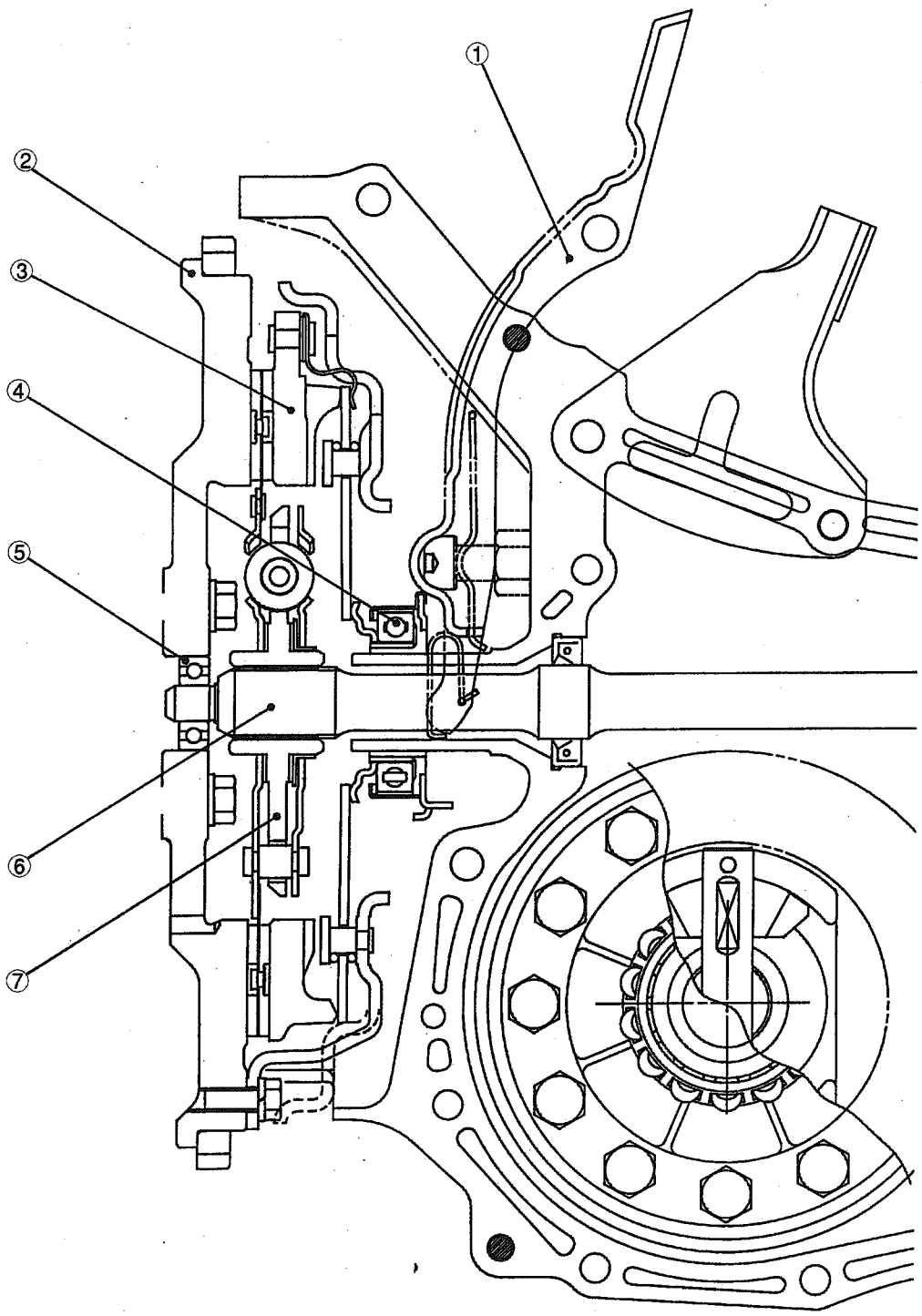
- The clutch control is of a simple yet reliable design using a cable which directly moves the release fork back and forth. This ensures smooth and reliable clutch control with minimum frictional resistance.
- The clutch itself is a push type clutch. When the clutch pedal is depressed, the self-aligning release bearing is caused to slide on a guide pressing the center of the diaphragm spring. The warped diaphragm spring disengages the pressure plate from the clutch disc.
The clutch using a diaphragm spring has the advantage of little variation in push load even when the clutch disc facing is worn.
The diaphragm spring is located inside the clutch cover.
- The clutch has a clutch disc between the flywheel and the pressure plate.
- Inside the clutch cover, there is a diaphragm spring and a pressure plate combined with each other by means of strap plates, which also serve to prevent the pressure plate from turning.
- The flywheel, whose outer diameter is 314.8 mm (12.394 in), is of flat design for better heat radiation and abrasion powder removal.

2. Operation

Applying foot pressure to the clutch pedal moves the release lever. This causes the release bearing to slide on the guide, pressing the diaphragm spring in the center. The spring is warped and the force having pressed the pressure plate is lost. As a result, the flywheel, clutch disc and pressure plate are disengaged, disconnecting the driving power.

The push type clutch has the point of action at the tips of the diaphragm spring fingers, through which the pressure plate is pressed to the clutch disc. When the power transmission is to be interrupted, the diaphragm spring is forced to warp using the pivots established on the inward side of the spring finger tips (on the principle of the lever and fulcrum) to disengage the pressure plate from the clutch disc.

3. Cross Sectional View



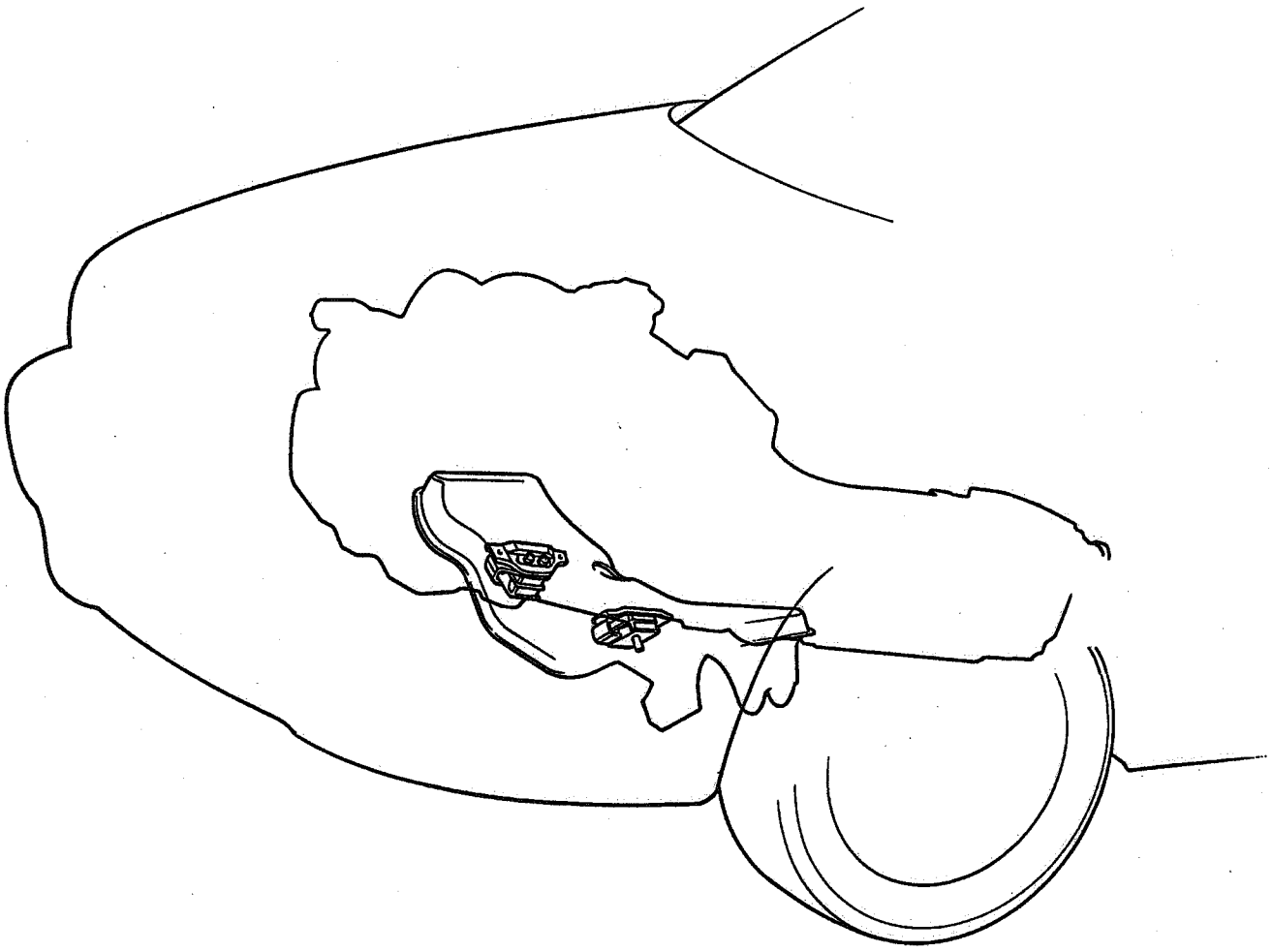
H2H1561A

① Release lever
② Flywheel
③ Clutch cover
④ Release bearing
⑤ Ball bearing
⑥ Transmission main shaft
⑦ Clutch disc

MEMO

ENGINE AND TRANSMISSION MOUNTING SYSTEM 2-11

1. Engine Mounting System



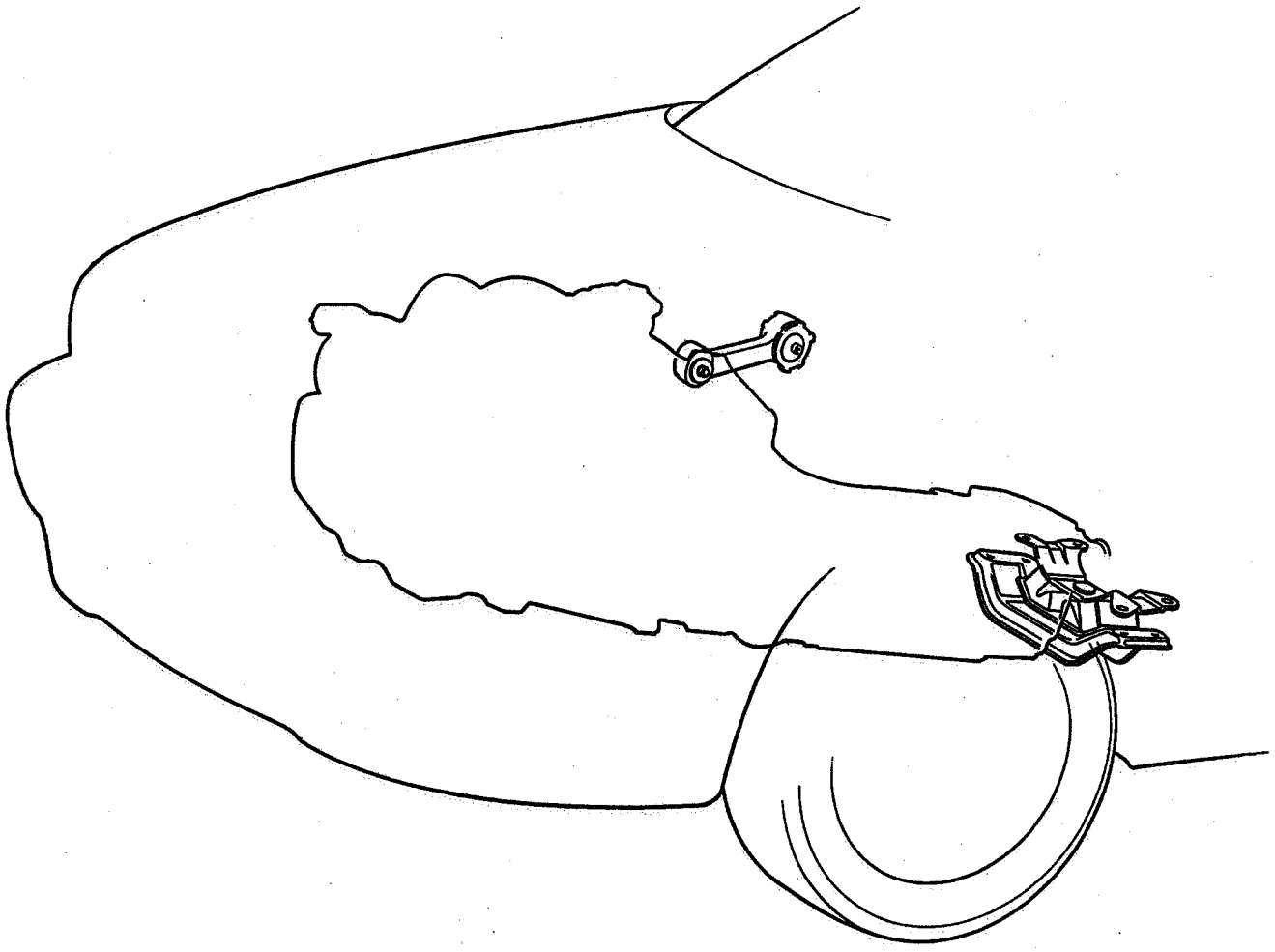
H2H1656

2. Transmission Mounting System

A: GENERAL

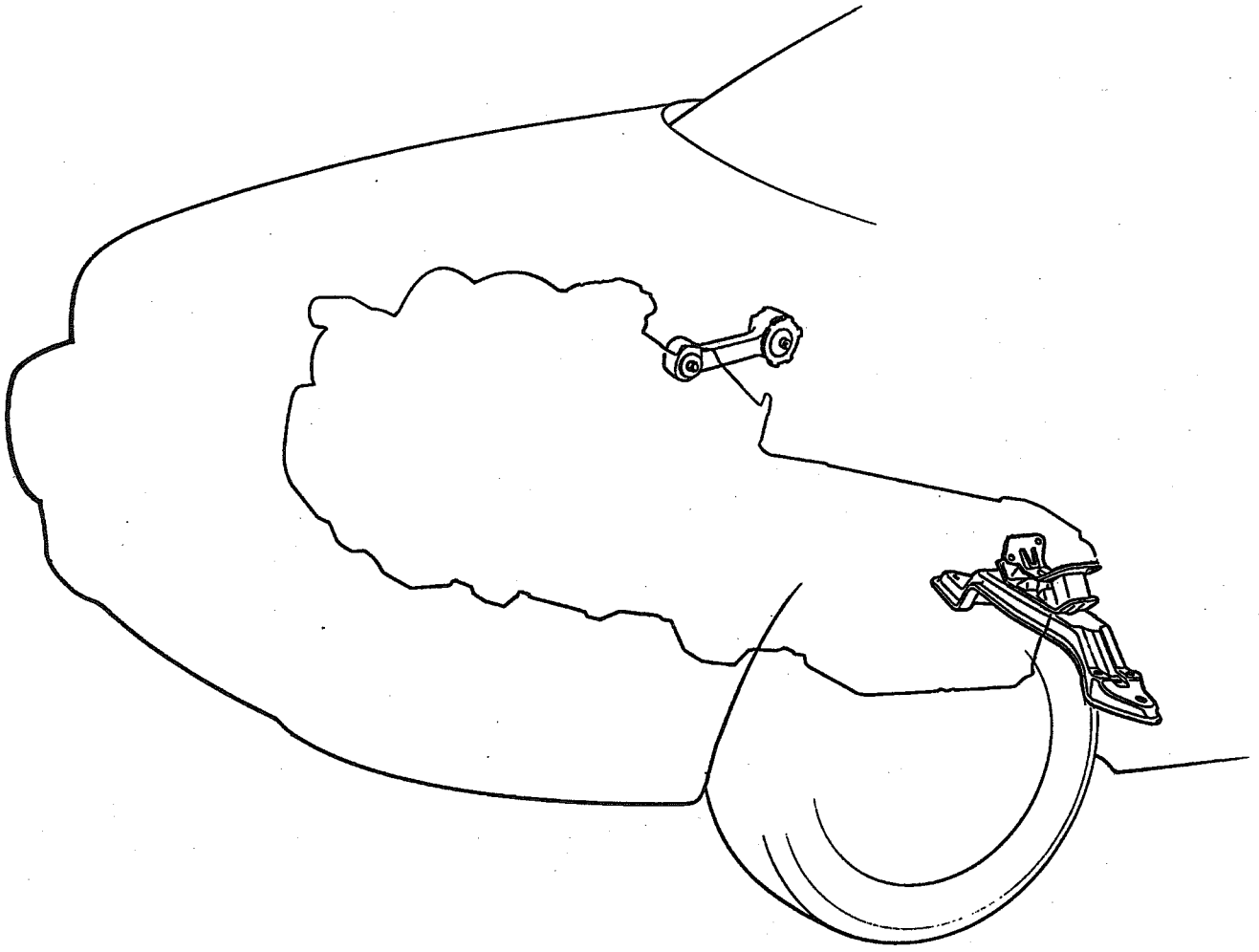
The pitching stopper made of resin is a non-adjusting type with a slot provided on the transmission end to be used as a bolt hole.

B: MT MODEL



H2H1657

C: AT MODEL



H2H1658

TRANSMISSION AND DIFFERENTIAL SECTION

MANUAL TRANSMISSION AND DIFFERENTIAL 3-1

1. General

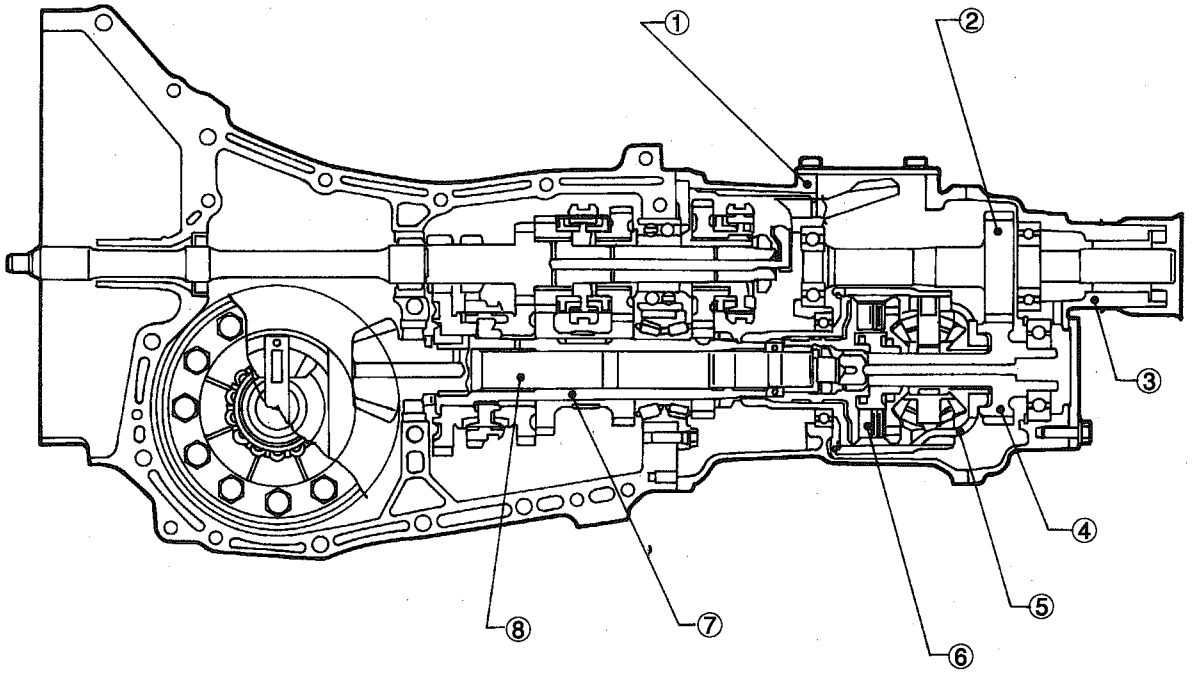
The transmission provides five forward speeds and one reverse speed and utilizes a floor shift lever design for gear selection. All forward gears are provided with synchromesh mechanisms that utilize inertia lock-key designs.

The transmission is unitized with the differential and housed in an aluminum case which is unitized with the clutch housing. The aluminum case is divided into left and right halves. Major features of the transmission are as follows: The clutch shaft has been extended to form a mainshaft, the countershaft combines the function of the final reduction drive pinion shaft, and the hypoid gear is "offset" to form a compact power train design. The forward gears are helical and feature high toothface strength, high engagement ratios and quiet operation. Reverse direction is achieved by engaging a selective-sliding reverse idler gear with the drive gear on the mainshaft and the driven gear on the 1st-2nd synchronizer hub of the drive pinion shaft. The 1st gear on the pinion side utilize subgear to reduce noise.

It is a compact, "full-time" transmission that utilizes a center differential provided with a viscous coupling at the rear of a transfer unit. The viscous coupling serves as a differential-action control.

The center differential utilizes a highly reliable, bevel gear. It not only delivers an equal amount of drive power to both the front and rear, but controls the difference in rotating speed between the front and rear wheels. A viscous coupling and center differential gears are located in the center differential case to connect the front and rear wheel drive shafts. With this arrangement, the transfer system realized a compact construction.

In addition, the viscous-coupling serves as a differential-action control to eliminate a mechanical lock mechanism.



G3H0162

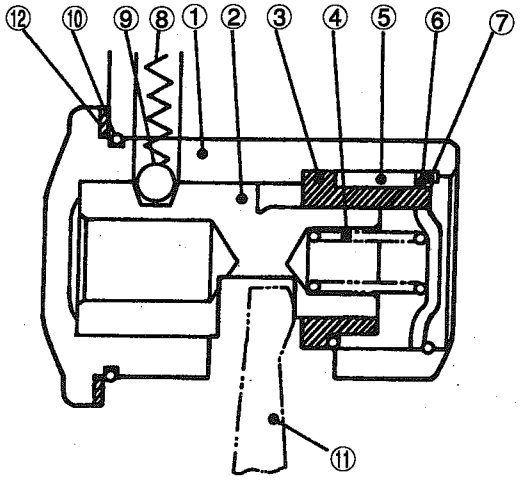
① Transfer case
② Transfer driven gear
③ Extension
④ Transfer drive gear
⑤ Center differential
⑥ Viscous coupling
⑦ Driven shaft
⑧ Drive pinion shaft

2. Reverse Check Mechanism

A: CONSTRUCTION

The sleeve ① is bolted to the transmission case. The shaft ② is inserted in the sleeve ①. On the smaller-diameter side of this shaft ②, the cam ③ is loosely mounted so that it can rotate, and the sleeve ① holds the cam in place with its stepped part.

The spring ④, which is inserted in the shaft ② presses the shaft to the left. Further, the spring ⑤ is placed in between the cam ③ and sleeve ①, which forces the cam ③ to the left and in the direction of rotation. Both springs are held down with the plate ⑥ that is attached to the sleeve ① with the snap ring ⑦. The shaft ② has a groove for reverse accent, in which the ball ⑨ and spring ⑧ are put through a hole drilled in the sleeve ①.

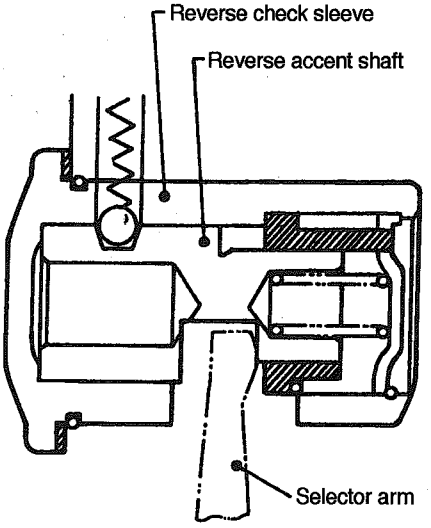


B3H0479B

① Reverse check sleeve
② Reverse accent shaft
③ Reverse check cam
④ Reverse return spring
⑤ Reverse check spring
⑥ Reverse check plate
⑦ Snap ring
⑧ Reverse accent spring
⑨ Ball
⑩ O-ring
⑪ Selector arm
⑫ Select adjust shim

B: OPERATION

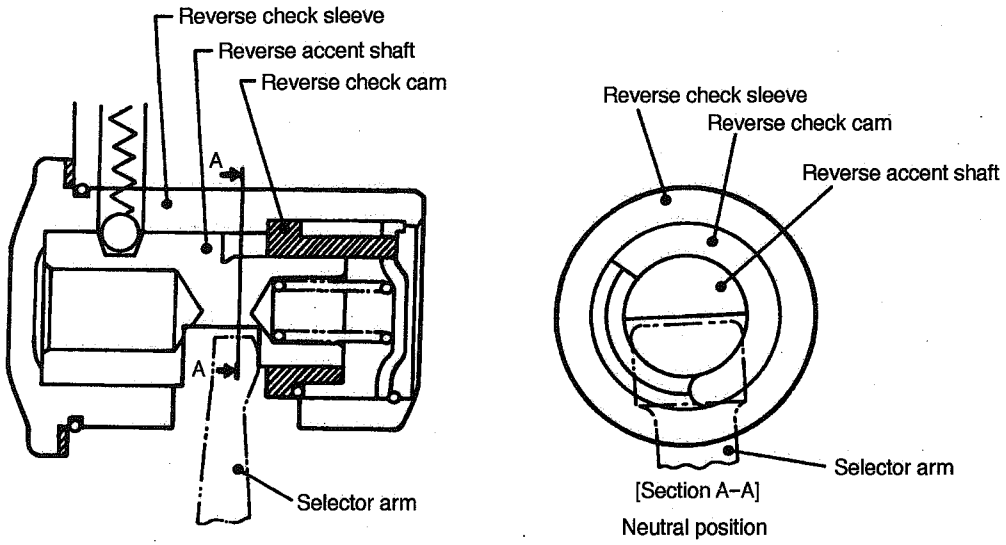
The sleeve and shaft have a notch, and the arm is placed between the notches. The position of the arm shown is the neutral position (hereafter referred to as (N) position). The point where the arm stops when moved to the left is the 1st and 2nd position. Opposite this, the point where the arm stops when moved to the right is the 5th and reverse position.



B3H0479A

1. WHEN 5TH AND REVERSE SIDE IS SELECTED

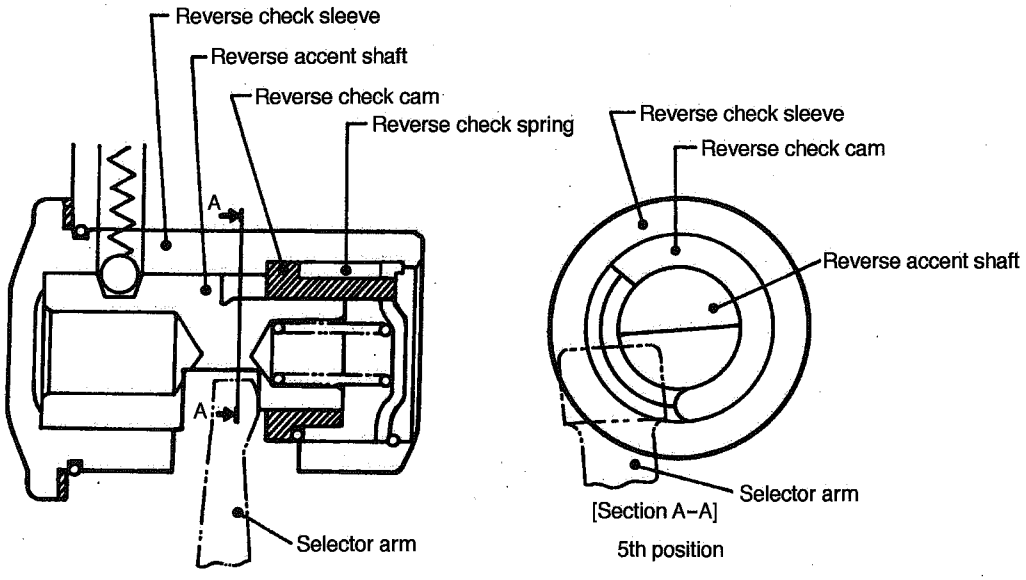
The arm pushes the shaft and cam simultaneously and moves to the 5th and reverse side.



B3H0480

2. WHEN SHIFT IS MADE TO 5TH

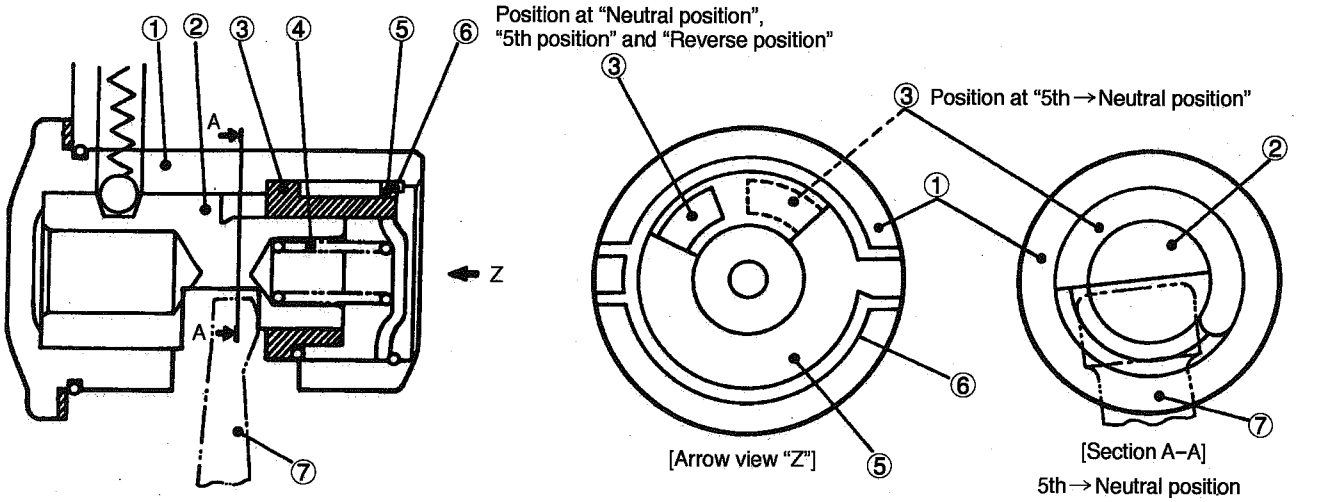
The arm moves to the 5th side pushing the shaft. When the arm pulls out of the cam, the cam is returned to the original position by the spring.



B3H0481

3. WHEN SHIFT IS MADE FROM 5TH TO REVERSE

The arm moves to the reverse side pushing the shaft and runs against the cam that has already returned. The cam has, as shown in figure [Arrow view "Z"], a stopper, which hits against the plate Thus, the cam cannot rotate further. Accordingly, the arm comes to a stop at a point where it has turned the cam to a certain degree (i.e., (N) position), and the cam is pushed back to the (N) position by the shaft (i.e., the spring).

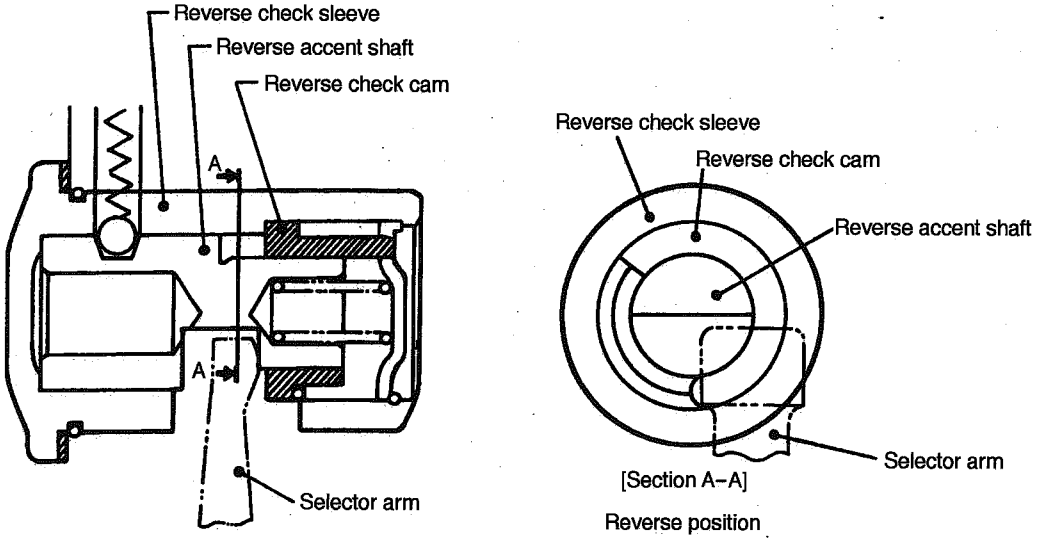


① Reverse check sleeve
② Reverse accent shaft
③ Reverse check cam
④ Reverse return spring
⑤ Reverse check plate
⑥ Snap ring
⑦ Selector arm

B3H0482A

4. WHEN SHIFT IS MADE TO REVERSE

The arm again moves to the 5th and reverse side. When the shift is made to reverse, the arm ⑪ moves to the reverse position while pushing the shaft and cam together.



B3H0483

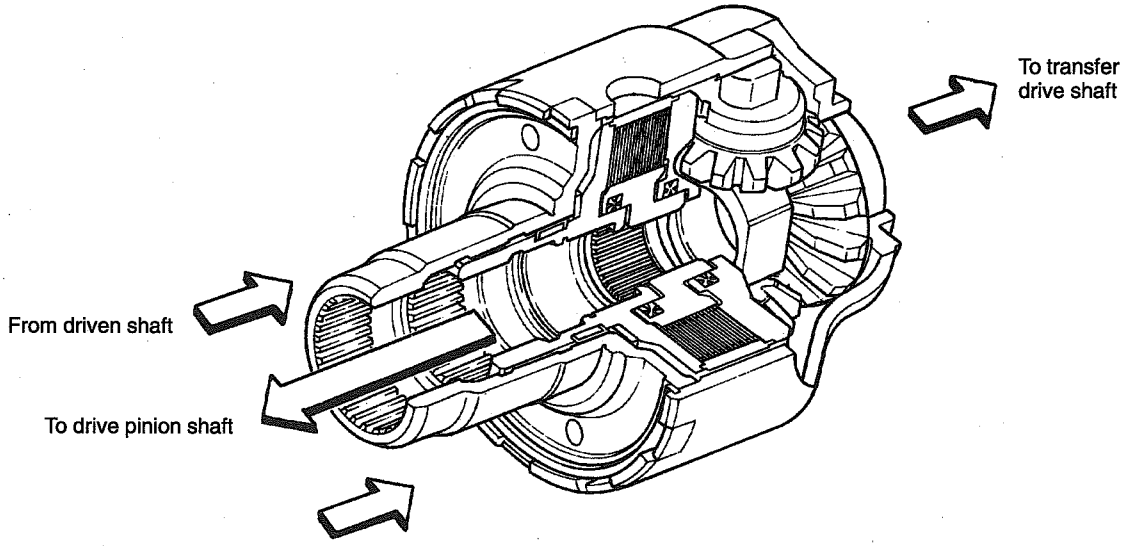
3. Center Differential

A: CONSTRUCTION

The center differential utilizes a "shaft-to-shaft" design which connects the front-wheel drive pinion shaft and the rear-wheel drive transfer drive gear shaft via viscous coupling to achieve compact construction. With this arrangement, viscous torque is generated by a difference in rotating speed between the two shafts so that both differential action and drive torque distribution are properly controlled.

The center differential provides a means of distributing engine torque (transmitted to the tubular driven shafts by way of the clutch, mainshaft and various gears) to the front- and rear-wheel drive shafts equally, as well as absorbing the difference in rotating speed between the front and rear wheels during turns.

When the front and/or rear wheels spin on muddy roads, etc., viscous coupling controls the differential action so that the optimum drive torque is automatically distributed to these wheels.

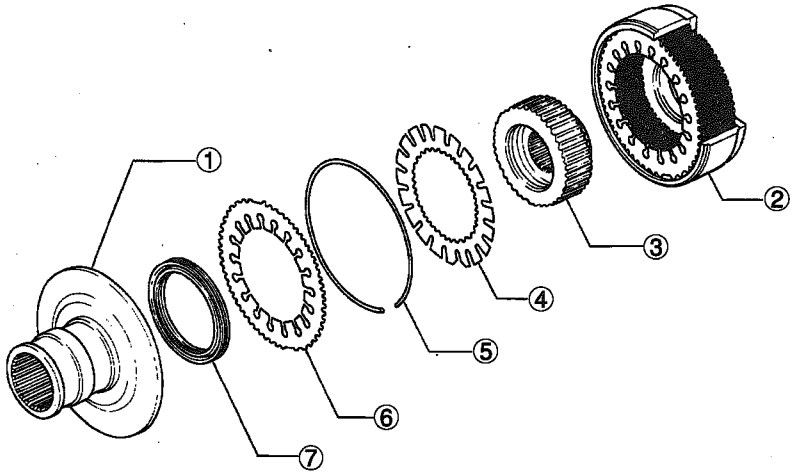


G3H0163

B: MECHANISM OF VISCOUS COUPLING

The viscous coupling housing contains a number of inner and outer plates which are arranged alternately. The inner plate has its internal perimeter fitted to the external hub splines while the outer plate has its external perimeter fitted to the internal housing splines. A spacer ring is provided to position the perimeter of the outer plate. The inner plate has no spacer ring and moves slightly between the adjacent outer plates, along the hub splined in the axial direction.

A mixture of silicone oil and air is sealed in the space inside the viscous coupling housing. An "X" seal ring prevents silicone oil from entering the transmission. This could occur when silicone oil is highly pressurized due to an increase in rotating speed difference between the front and rear wheels.



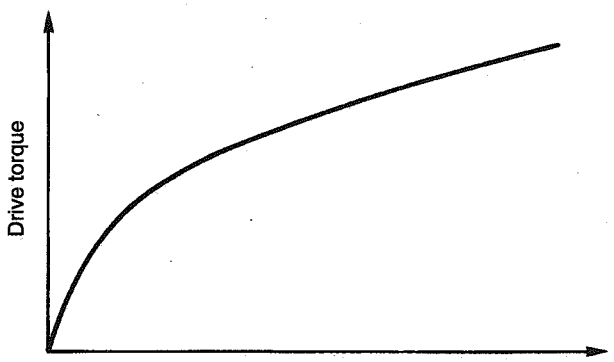
G3H0164

① Cover
② Housing
③ Hub
④ Inner plate
⑤ Spacer ring
⑥ Outer plate
⑦ Oil seal

1. TORQUE CHARACTERISTICS

When a difference in rotating speed between the viscous coupling housing and the hub occurs, a viscous shearing force is generated in the silicone oil placed between the outer and inner plates. The torque is then transmitted by the silicone oil between the housing and the hub.

The greater the difference in rotating speed between the viscous coupling housing and the hub, the greater the shearing force of the silicone oil. The relationship between the torque transmission and rotation speed difference is shown in the figure. As can be seen from the figure, the smaller the rotating speed difference, the lesser the torque transmission and the differential-action.



G3H0165

2. "HUMP" PHENOMENON

Silicone oil is heated and expands as differential action continues. This crushes air inside the viscous coupling so that the silicone oil "charging rate" will increase. As differential action continues, internal pressure will abruptly increase so that inner and outer plates (alternately arranged) come in contact. This causes quick torque transmission to occur, which is called a "hump" phenomenon.

The "hump" phenomenon eliminates the rotating speed difference between the housing and hub (which results in a state similar to "direct coupling"). This in turn decrease internal pressure and temperature. The viscous coupling returns to the normal operation. (The "hump" phenomenon does not occur under normal operating conditions.)

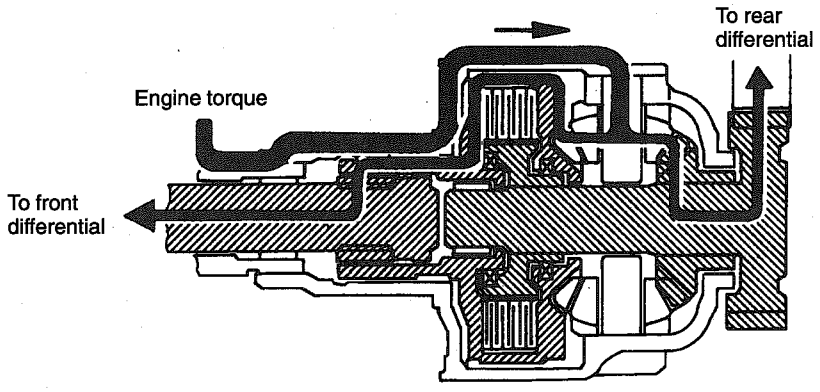
C: FUNCTION

During normal driving (when there is no speed difference between the front and rear wheels), the center differential delivers drive power to the front and rear wheels at a torque ratio of 50:50.

When a rotating speed difference occurs between the front and rear wheels, the center differential action is controlled by viscous coupling so that optimum drive forces are automatically distributed to the two.

1. DURING NORMAL DRIVING

During normal straight driving (on flat roads at constant speed), all four wheels rotate at the same speed. The center differential delivers engine torque to the front and rear drive axles. The viscous coupling does not perform the differential-action control because there is no rotating speed difference between the front and rear drive shafts.

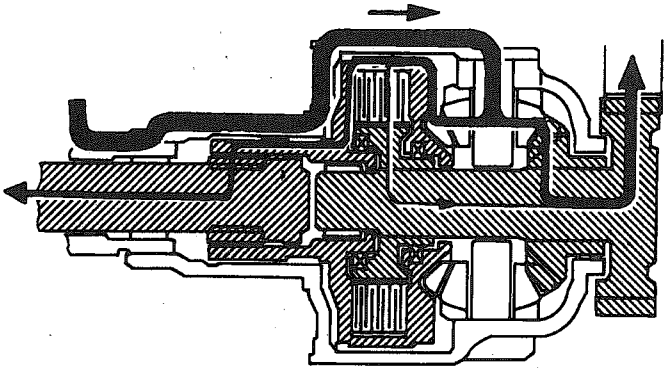


G3H0166

2. DURING TURNS AT LOW SPEEDS

During turns at low speeds, a rotating speed difference occurs between the front and rear wheels, as well as the left and right wheels. In other words, the front wheels rotate faster than the rear wheels. When there is a small rotating speed difference (when vehicle speed is low), the center differential acts to absorb the rotating speed difference, making it possible to drive smoothly.

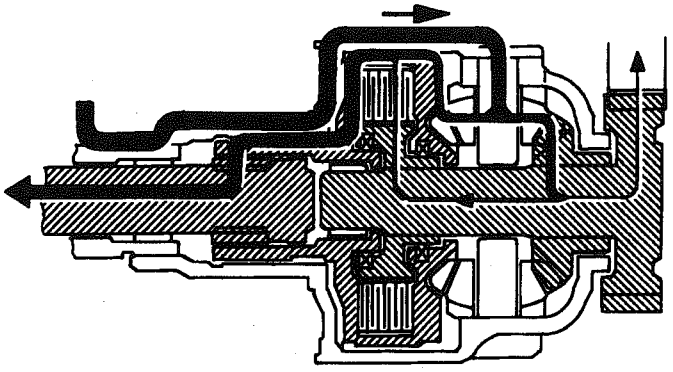
Although a slight rotating speed difference is transmitted to the viscous coupling, less torque transmission occurs because of the small rotating speed difference.



G3H0167

3. ACCELERATION DURING STANDING STARTS ON A LOW "μ" ROAD

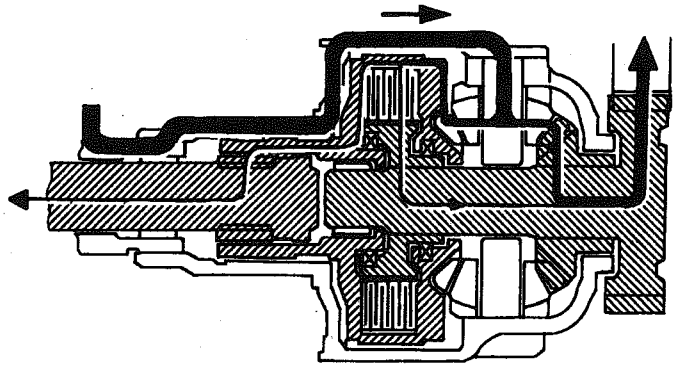
During rapid acceleration from standing starts on a slippery (low "μ") road, front and rear wheel weight distribution changes. When the rear wheels begin to spin, the rotating speed difference between the two shafts increase simultaneously. This causes the viscous coupling to activate to that more torque is transmitted to the front wheels than to the rear. In addition, the center-differential's action is also restricted. In this way, acceleration performance during standing starts on low "μ" roads is greatly enhanced.



G3H0168

4. DRIVING ON ROUGH ROADS

When one of the wheels begins to spin during rough-road driving, the rotating speed difference between the shafts is increased by the differential's action. At this point, the viscous coupling delivers large torque to the differential on the side which is not spin ring. In this way, driving stability on rough roads is increased. (The figure below shows an example of front wheel slip.)



G3H0169

AUTOMATIC TRANSMISSION AND DIFFERENTIAL 3-2

1. General

A: OUT LINE

This system utilizes a microcomputer for accurate control of the vehicle speed, engine brake operation, lock-up operation, gear shift timing and others. It corresponds to the throttle opening, actual vehicle speed, engine rpm and range position signal. Further, it is also provided with an automatic drive pattern selecting function which selects between the "normal drive pattern" suitable for ordinary economical driving and the "power drive pattern" suitable for acceleration and uphill driving depending upon depression of the accelerator pedal.

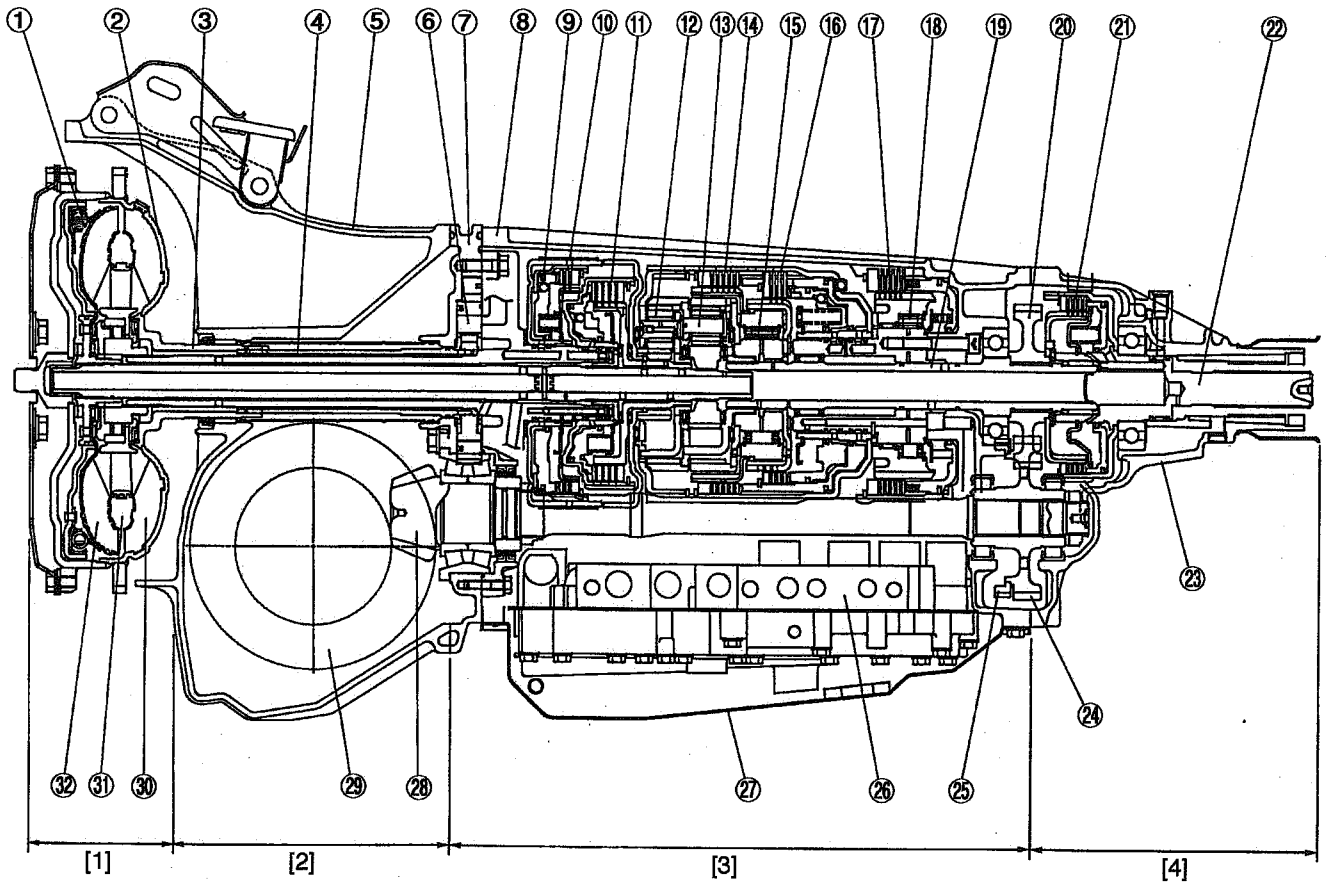
An electronically controlled full-time AWD system designed uniquely for SUBARU on the basis of the FWD transmission is adopted. This system has a transfer hydraulic pressure control unit incorporating duty solenoid and a multi-plate transfer (MPT) consisting of a wet type multi-plate clutch on the rear of the automatic transmission section.

The control unit stores optimum transfer clutch torque (duty ratio) data for various driving conditions. When actual driving conditions (vehicle speed, throttle opening, gear range, wheel slip, etc.) are detected by various sensors, the control unit selects the most suitable duty ratio from memory, and controls the transmitting torque of the transfer clutch by means of the hydraulic pressure controlling duty solenoid.

B: FEATURES

- Two one-way clutches and four accumulators are used to reduce gear shift shock and gear select shock, and a fully electronic control system is employed for accurate gearshift control from 1st to 4th speed, hydraulic oil pressure (line pressure), lock-up operation, etc.
- A hydraulic lock-up type torque converter clutch, variable delivery oil pump, gear train with two sets of simple planetary gears (permitting four forward and one reverse stage) are used to improve driving dynamics and fuel consumption.
- A push-pull cable featuring less vibration to the high rigid transmission case and control unit is used for improved quietness during driving.
- A on-board diagnostics function and fail-safe function are incorporated for improved serviceability and reliability.
- The transfer clutch capacity can be accurately controlled by means of the electronic control system. This is especially effective for eliminating tight corner braking phenomenon which occurs at low speeds, thereby achieving smooth driving.
- An optimum rear wheel drive distribution is achieved which corresponds to engine output and gear shift position and improves fuel consumption and steering stability.
- For the car equipped with ABS, the braking performance is improved by the control of the clutch and gear locking at a particular shift position through ABS operation-time control.
- Driveability and comfort are improved with the use of manual range.

C: CROSS SECTIONAL VIEW



H3H1206A

① Lock-up clutch
② Torque converter clutch
③ Input shaft
④ Oil pump drive shaft
⑤ Torque converter clutch case
⑥ Oil pump
⑦ Oil pump housing
⑧ Transmission case
⑨ Reverse clutch
⑩ Brake band
⑪ High clutch
⑫ Front planetary gear
⑬ Rear planetary gear
⑭ Forward clutch
⑮ One-way clutch (3-4)
⑯ Overrunning clutch
⑰ Low & Rev. brake
⑱ One-way clutch (1-2)
⑲ Reduction drive shaft
⑳ Reduction drive gear
㉑ Transfer clutch
㉒ Rear drive shaft
㉓ Extension case
㉔ Reduction driven gear
㉕ Parking gear
㉖ Control valve
㉗ Oil pan
㉘ Drive pinion shaft
㉙ Hypoid drive gear
㉚ Impeller
㉛ Stator
㉜ Turbine

[1] Torque converter clutch section
[2] Final reduction section
[3] Automatic transmission section
[4] Transfer section

2. Torque Converter Clutch

A: CONSTRUCTION

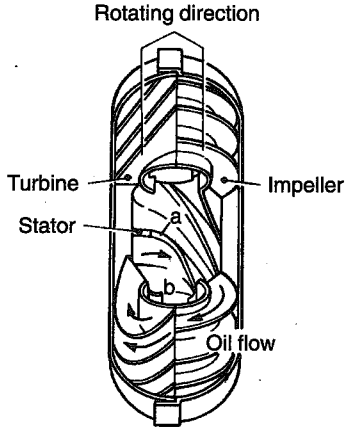
- The torque converter clutch is composed of impeller, turbine, stator, and lock-up clutch. It is filled with oil; therefore it must not be disassembled.
- The impeller is directly coupled to the crankshaft via a drive plate. A sleeve for driving the oil pump, which is the source of the hydraulic pressure for the automatic transmission, is welded to the rear of the impeller.
- The turbine transmits multiplied engine torque in the torque converter clutch range, unmultiplied engine torque in the coupling range, or engine torque itself directly through the lock-up clutch to the automatic transmission via the input shaft spline fitted to the internal spline of the turbine hub.
- The stator incorporates a Sprague type one-way clutch. The stator is spline-fitted to the oil pump cover via the inner race of the one-way clutch, and secured to the torque converter clutch case.

B: FUNCTION

When the impeller rotates, centrifugal force pushes out oil which then enters the turbine. The oil flows along the turbine blade and exerts force on the blade. This causes the turbine to rotate and power is transmitted to the input shaft.

If turbine speed is below impeller speed, the oil leaving the turbine flows in the direction impeding impeller rotation (a in figure). This direction is then changed by the stator so that the oil will assist impeller rotation (b in figure). With this action, the torque is multiplied.

The stator is subject to reverse torque when it changes the direction of oil flow, hence it must be secured to the casing. As turbine speed increases and approaches impeller speed, the oil from the turbine begins to push directly on the back of the stator blade. (This changeover point is called the "coupling point".) If the stator is still fixed under this condition, the oil flow will be impeded by the stator. To avoid this, the stator is mounted to the case via a one-way clutch so that it can rotate freely in the same direction as the impeller and turbine.

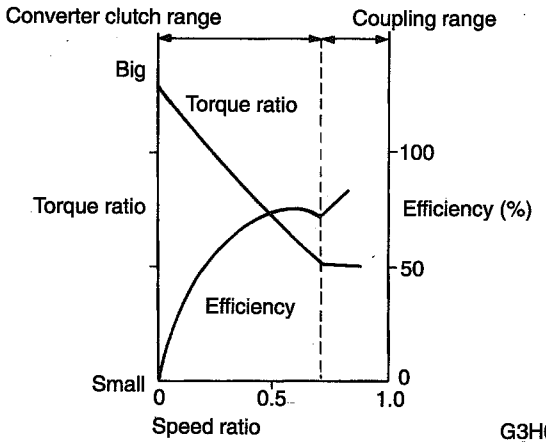


G3H0174

C: PERFORMANCE

The torque converter clutch characteristics are shown in the following graph. The torque converter clutch range refers to a range where the impeller and turbine rotate at different speeds and the torque is multiplied by a fixed stator. In the coupling range, on the other hand, the turbine rotates at high speed, and the stator is also rotating. The coupling range provides no torque multiplication because the torque converter clutch functions as a fluid coupling in this range.

If the impeller (engine side) alone is rotating with stationary turbine (vehicle standstill) when the speed ratio is zero (0), this state is called the stall point. In this state, the torque ratio of impeller and turbine is the largest. The torque ratio in this state is called the stall torque ratio, and the engine rpm is called the stall rpm.



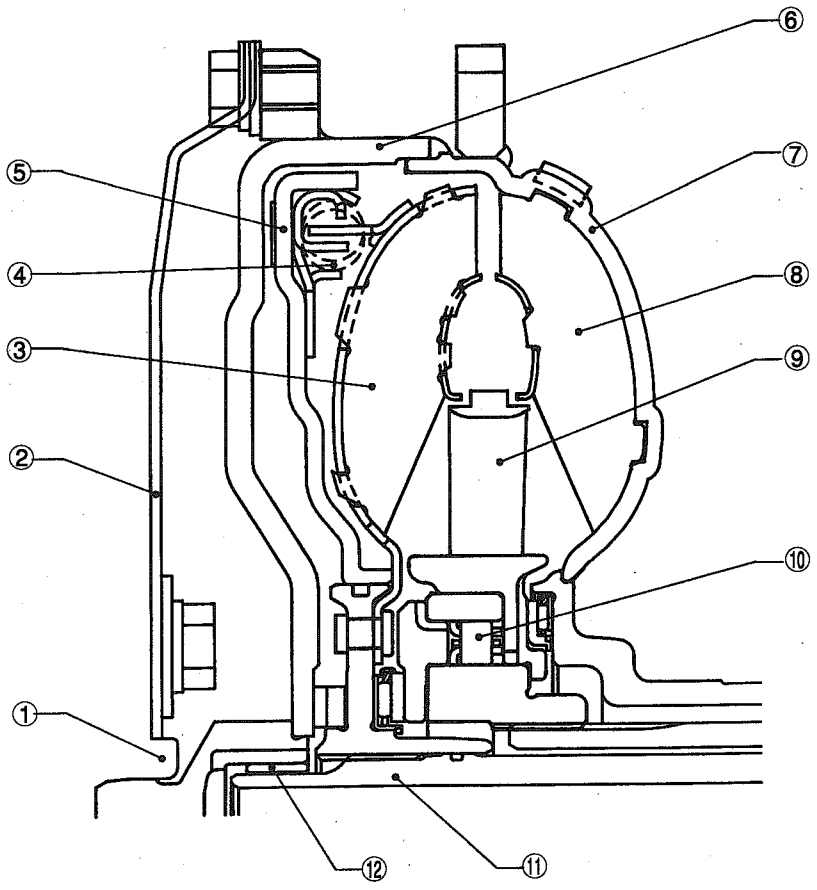
3. Lock-up Control System

A: CONSTRUCTION AND FUNCTION

This system causes the impeller and turbine to be coupled directly without the aid of oil when the engine rpm reaches a certain level. This direct coupling eliminates torque converter clutch slip and thus leads to a reduction in engine rpm, which in turn results in less fuel consumption and less noise.

The single plate type lock-up clutch is used, and the transition hydraulic oil pressure is controlled for reducing the lock-up shock of the clutch thereby achieving smooth lock-up operation.

The lock-up clutch is fitted with torsional dampers are adopted for reducing the vibration and noise in the driving system.



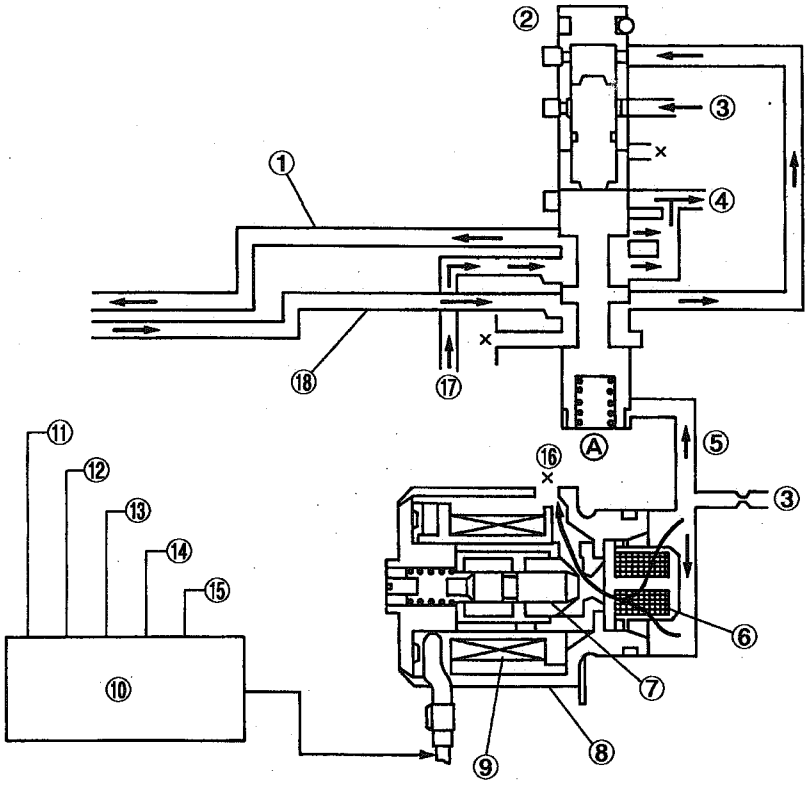
B3H0604A

① Crankshaft
② Drive plate
③ Turbine
④ Torsional damper
⑤ Lock-up piston
⑥ Front cover
⑦ Impeller cover
⑧ Impeller
⑨ Stator
⑩ One-way clutch
⑪ Input shaft
⑫ Bush

B: LOCK-UP OPERATION

Oil pressure at the lock-up control duty solenoid valve is drained by a signal from the automatic transmission control module so that no lock-up duty pressure is developed and the lock-up control valve remains in condition Ⓐ. As a result, hydraulic oil flows into the lock-up apply circuit. On the other hand, the lock-up release circuit drains. This causes a pressure differential across the lock-up piston. The piston is then forced against the impeller cover and turned as an integral unit with the cover. Thus, power from the engine is directly transmitted to the transmission input shaft. That is, the transmission is directly coupled to the engine.

The lock-up control valve is pushed downward by torque converter clutch regulator pressure and pilot pressure.



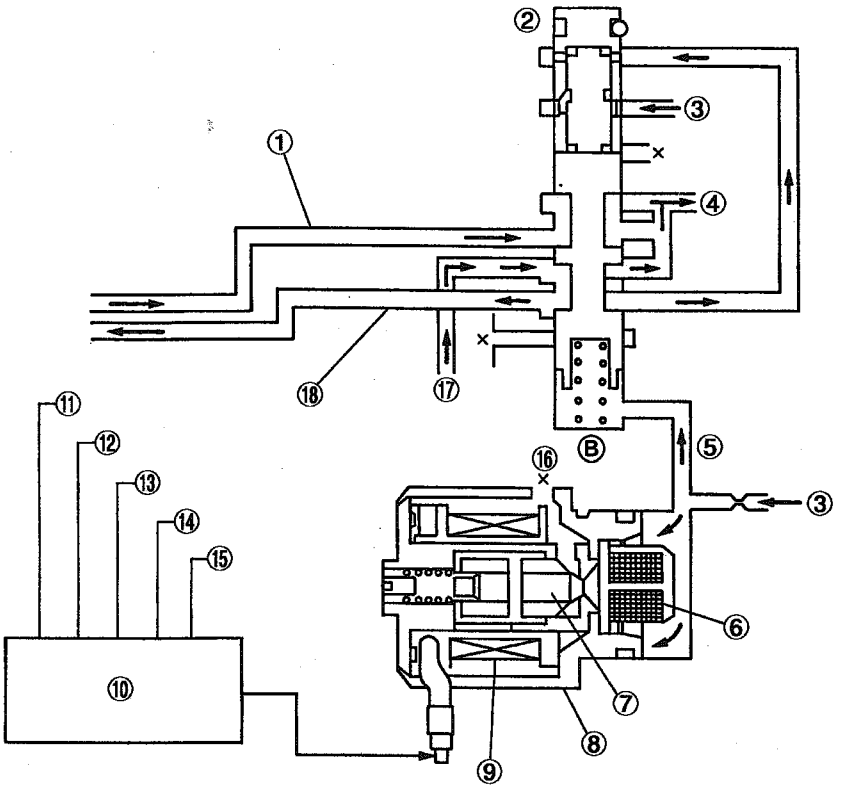
B3H0486B

① Lock-up apply circuit
② Lock-up control valve
③ Pilot pressure
④ To cooler
⑤ Lock-up duty pressure or pilot pressure
⑥ Filter
⑦ Plunger
⑧ Duty solenoid B (lock-up)
⑨ Coil
⑩ TCM
⑪ Vehicle speed sensor
⑫ Throttle position sensor
⑬ Engine speed signal
⑭ ATF temperature sensor
⑮ Range signal
⑯ Drain
⑰ Torque converter clutch regulator pressure
⑱ Lock-up release circuit

C: NON-LOCK-UP OPERATION

In this mode, the lock-up control duty solenoid is driven at a 5% duty ratio. This causes the lock-up duty pressure (pilot pressure) to be generated. With this pressure, the lock-up control valve is set to condition Ⓑ, and hydraulic oil flows into the lock-up release circuit. On the other hand, the lock-up apply circuit is connected to the oil cooler in the radiator. Accordingly, the relationship between "lock-up release pressure lock-up apply pressure" is established. As a result, the lock-up piston is forced to separate from the impeller cover, and power is transmitted from impeller to turbine to input shaft, as with an ordinary torque converter clutch coupling.

It is pushed upward by lock-up duty pressure and spring force.



B3H0487B

① Lock-up apply circuit
② Lock-up control valve
③ Pilot pressure
④ To cooler
⑤ Lock-up duty pressure or pilot pressure
⑥ Filter
⑦ Plunger
⑧ Duty solenoid B (lock-up)
⑨ Coil
⑩ TCM
⑪ Vehicle speed sensor
⑫ Throttle position sensor
⑬ Engine speed signal
⑭ ATF temperature sensor
⑮ Range signal
⑯ Drain
⑰ Torque converter clutch regulator pressure
⑱ Lock-up release circuit

D: SMOOTH CONTROL

When the lock-up clutch activates, the clutch partially engages. Lock-up apply pressure increases smoothly to engage the lock-up clutch.

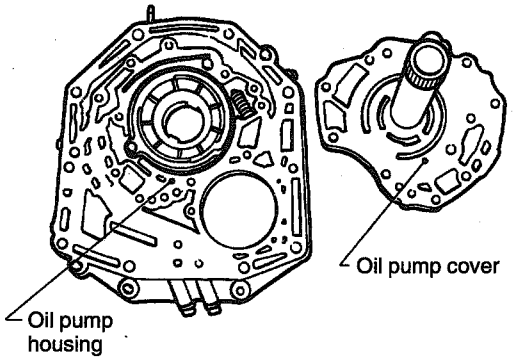
E: NON-LOCK-UP OPERATION DURING "1ST, 2ND AND 3RD SPEED", "N", "R" AND "P" POSITION

In this mode of operation, pilot pressure is generated, and the lock-up control valve is pushed upward where lock-up is inoperative.

4. Oil Pump

A: CONSTRUCTION

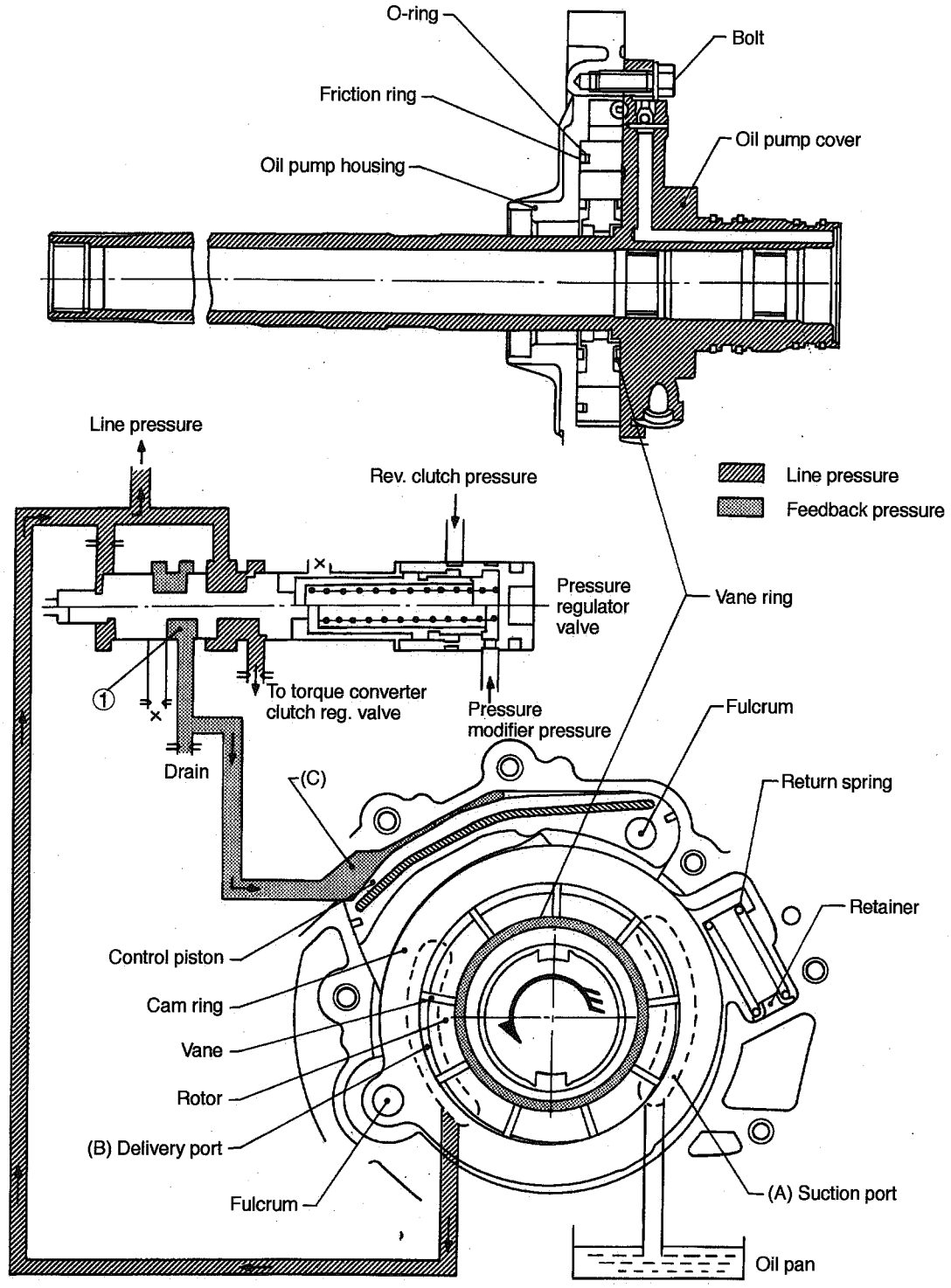
The vane pump is housed in the oil pump housing. It consists of a rotor, vanes, vane rings, cam ring, control piston, return spring, seal ring and oil pump cover.



G3H0178

B: FUNCTION

- The automatic transmission fluid (ATF) is drawn through the oil strainer mounted under the control valve ASSY, and is routed to the transmission case, to the oil pump housing, and to the oil pump cover. It then goes to the suction port of section (A) shown in the Figure.
- The ATF sucked into section (A) rotates in the direction of the arrow (driven directly by engine), and is compressed at the delivery side of section (B). It is then discharged.
- The discharged ATF flows from the oil pump cover to the oil pump housing. It then goes to the transmission case, the control valve and to the regulator valve, thus serving as hydraulic oil and lubricating oil for the torque converter clutch, valves, clutch and brake.
- As engine speed increases, the delivery rate of the vane pump also increases.
- Feedback pressure from the regulator valve is applied to section (C) in the Figure. The cam ring position (the amount of eccentricity) is controlled by this pressure so that the pump delivery rate remains constant at speeds exceeding the preset pump speed.
- As the cam ring position changes, the suction volume at section (A) varies. In this manner, the pump delivery volume is controlled.
- Hydraulic pressure (feedback pressure) from the oil passage ① of the pressure regulator valve is applied to the back of the control piston.


O-ring
Bolt
Friction ring
Oil pump cover
Oil pump housing
Line pressure
Rev. clutch pressure
Line pressure
Feedback pressure
Pressure regulator valve
Vane ring
To torque converter clutch reg. valve
Pressure modifier pressure
Fulcrum
Drain
(C)
Return spring
Retainer
Control piston
Cam ring
Vane
Rotor
(B) Delivery port
Fulcrum
(A) Suction port
Oil pan

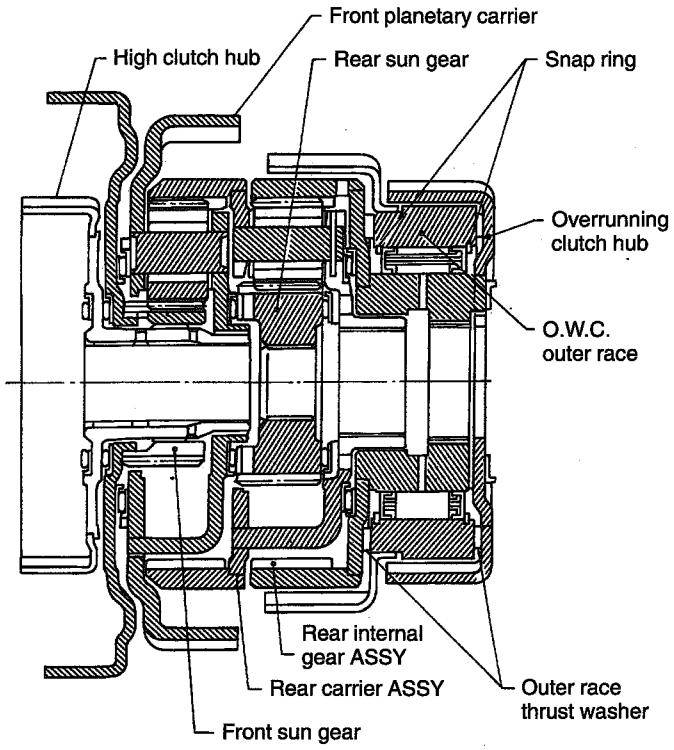
B3H0488C

5. Planetary Gear

A: CONSTRUCTION

The planetary gear train uses two sets of simple planetary gears (front planetary gear and rear planetary gear), four sets of multi-plate clutches (reverse clutch, high clutch, forward clutch, and overrunning clutch), one brake band, one set of multi-plate brake, and two sets of one-way clutches (one-way clutch 1-2 and one-way clutch 3-4) in order to allow shifting of four forward speeds and one reverse speed.

Two sets of simple planetary gears are used to allow gear shifting from 1st speed to 4th speed or to reverse. Both the front and rear planetary gear carriers are made from pressed steel which is electron-beam welded to other structural members. The front planetary gear has three pinions while the rear planetary gear has four pinions. Both are part of an integral unit, and disassembling is not allowed.



G3H0180

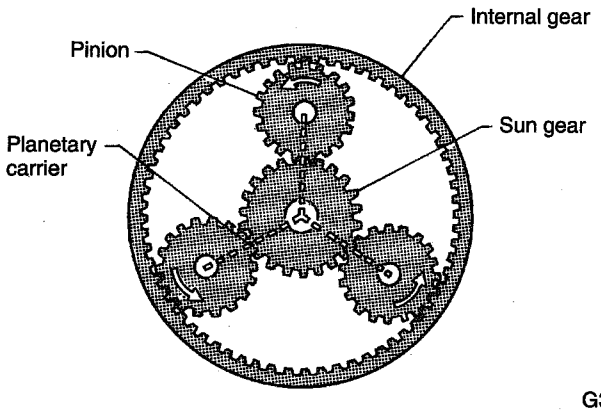
B: FUNCTION

The automatic transmission uses a planetary gear system instead of the parallel shaft (two shafts) gear system adopted in the manual transmission.

The advantage of the planetary gear system is that it is compact because it has only one center shaft. The gear ratio can be changed by simply locking or releasing or rotating certain portions, unlike the manual transmission that requires changing gear engagement.

The construction of the planetary gear is shown on the previous page. The sun gear is located at the center, and each of the pinion gears revolves around the sun gear while rotating on its axis. These gears are all enclosed in a large ring, called the internal gear. Each pinion gear is supported by a planetary carrier, so that the pinion gears revolve an equal amount in the same direction. As mentioned above, the planetary gear consists of four elements: the sun gear, pinion gears, internal gear, and planetary carrier. The gears are shifted by imposing certain conditions on two of the following three elements: sun gear, internal gear, and planetary carrier.

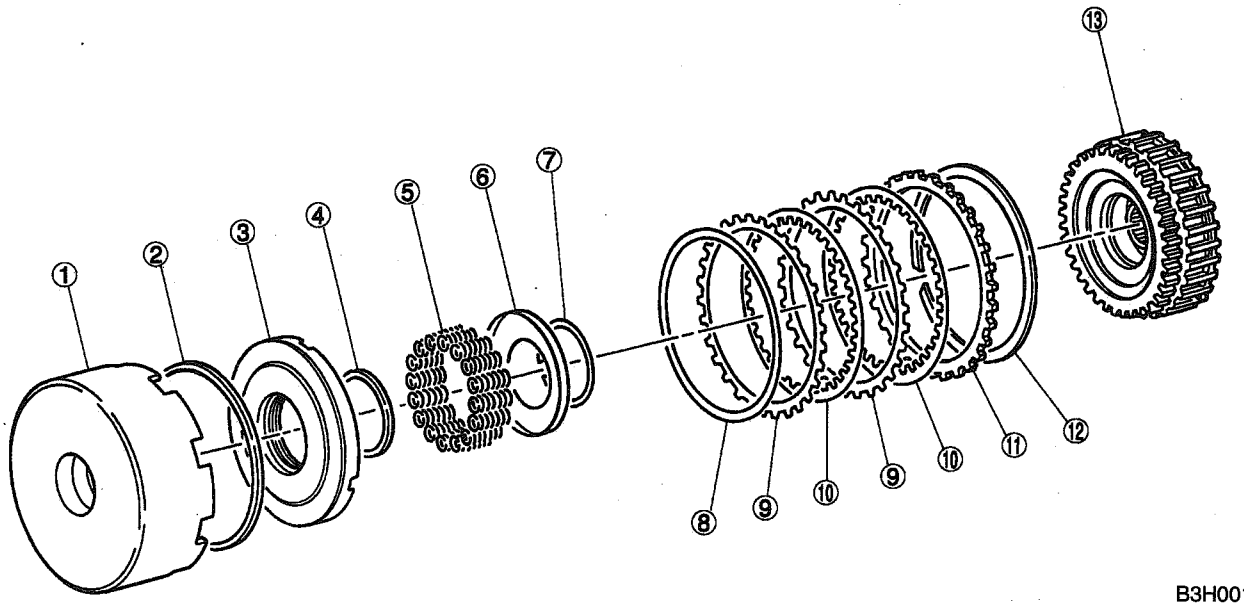
The clutches and brakes are used to impose the conditions on the planetary gear set.



G3H0181

6. Reverse Clutch

A: CONSTRUCTION



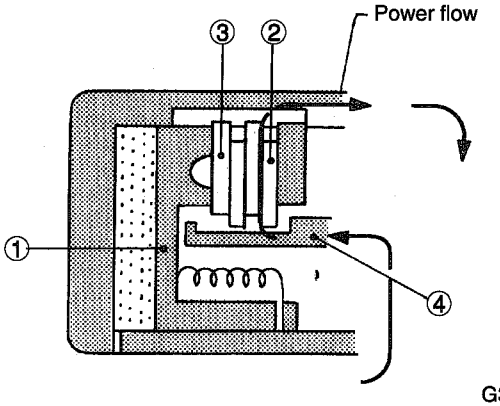
B3H0012A

① Reverse clutch drum
② Lip seal
③ Reverse clutch piston
④ Lathe cut seal ring
⑤ Spring
⑥ Spring retainer
⑦ Snap ring
⑧ Dish plate
⑨ Driven plate
⑩ Drive plate
⑪ Retaining plate
⑫ Snap ring
⑬ High clutch drum

B: FUNCTION

1. DURING OPERATION

Hydraulic pressure is applied to the reverse clutch piston ① from the control valve when shifting in reverse. The drive plate ② and driven plate ③ are connected by this pressure, and engine power from the high clutch drum ④ is transmitted to the front sun gear.

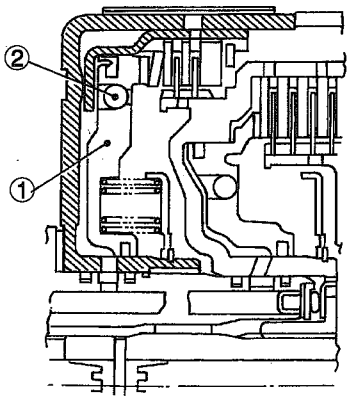


G3H0183

2. DURING NON-OPERATION

When the shift lever is in any position other than reverse, no hydraulic pressure is applied to the reverse clutch piston ①. Hence the drive plate and driven plate are separated, and no power is transmitted.

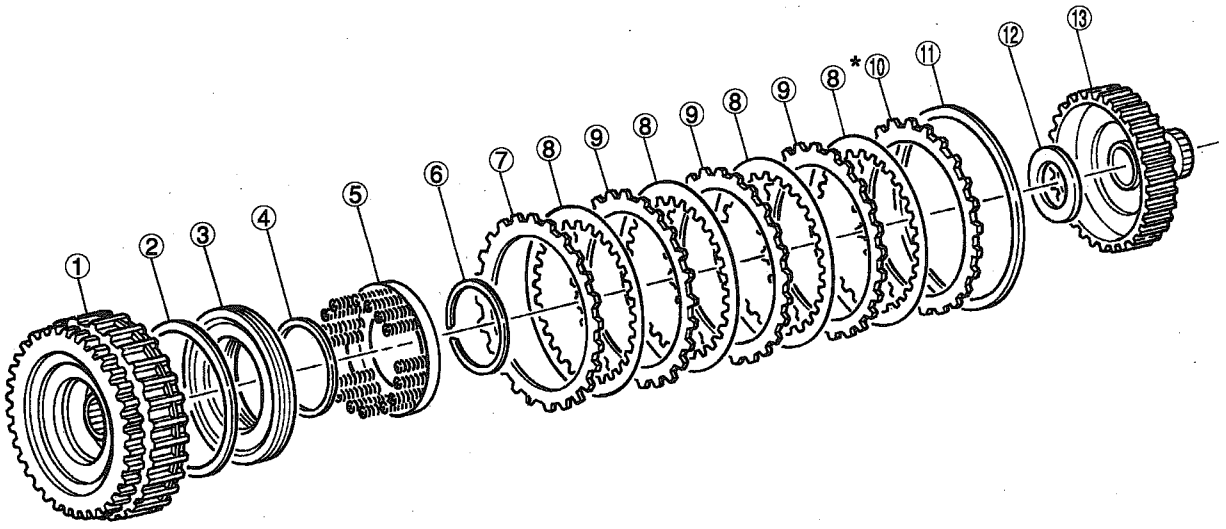
The check ball ② is built into the clutch piston. This check ball releases oil pressure from the clutch piston while the drum rotates idle. It thus avoids build-up of residual pressure in the clutch drum and a resultant half-engaged clutch, which may otherwise be caused by centrifugal oil pressure.



G3H0184

7. High Clutch

In 3rd and 4th speed operation, hydraulic pressure is applied to the high clutch from the control valve and another hydraulic pressure controller. The clutch plates (drive and driven plates) are connected by this hydraulic pressure, and engine power from the input shaft is transmitted to the front planetary carrier through the high clutch hub.



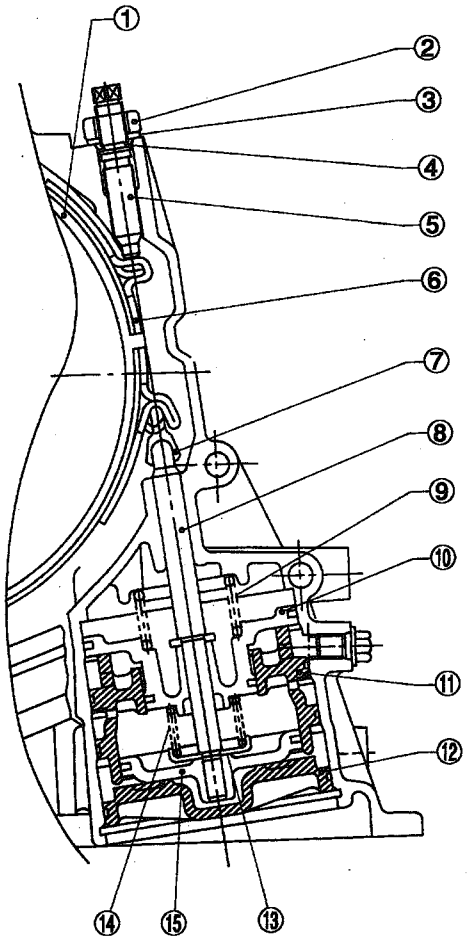
G3H0185

*: Selective parts
① High clutch drum
② Lathe cut seal ring
③ High clutch piston
④ Lathe cut seal ring
⑤ Spring retainer
⑥ Snap ring
⑦ Driven plate (Thinner)
⑧ Drive plate
⑨ Driven plate (Thicker)
*⑩ Retaining plate
⑪ Snap ring
⑫ Thrust needle bearing
⑬ High clutch hub

8. Band Brake

A: CONSTRUCTION

The band brake consists of a flex type brake band, a band brake adjusting mechanism, two servo pistons, two retainers, two return springs, a stem, a strut, and others. The band brake can be adjusted as installed on the vehicle.



H3H0147A

① Rev. clutch drum
② Lock nut
③ Washer
④ O-ring
⑤ Brake band adjusting screw
⑥ Brake band ASSY
⑦ Strut
⑧ Band servo piston stem
⑨ Return piston spring
⑩ Band servo piston (1-2)
⑪ Retainer
⑫ O.D. servo retainer
⑬ Retainer
⑭ O.D. return spring
⑮ Band servo piston O.D. (3-4)

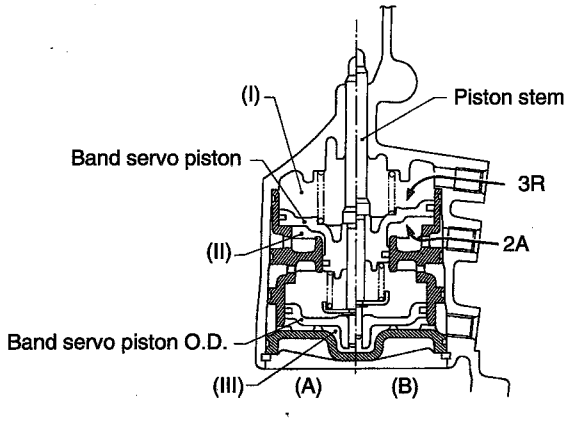
B: FUNCTION

One end of the brake band is secured to the transmission case via the brake band adjusting screw.

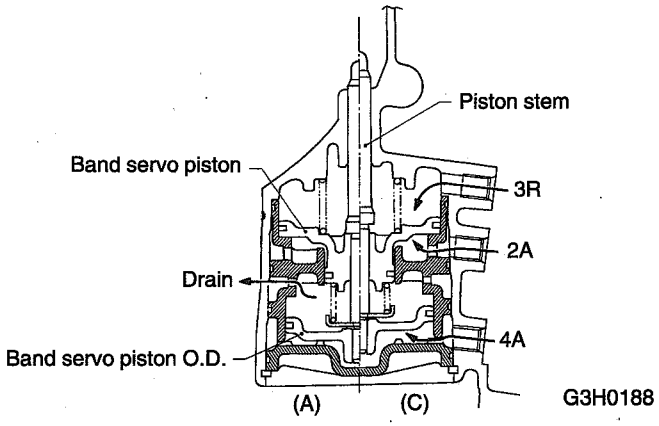
When no hydraulic pressure is applied to the servo piston from the hydraulic pressure controller, the servo piston and band servo piston O.D. are forced downward by the return spring, as shown in (A) of the Figure.

When hydraulic pressure 2A is applied to the servo chamber (II), it causes the band servo piston to come into contact with the stepped portion of the band servo piston stem, thereby pushing the band servo piston stem upward to state (B). Under this condition, the brake band slowly tightens the reverse clutch drum and fixes the front sun gear of the front planetary gear. (2nd speed state)

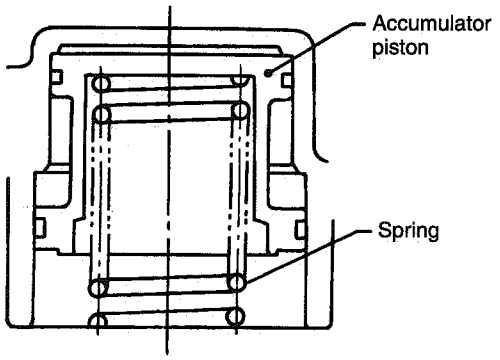
Next, when the release pressure 3R to the servo chamber (I) and the hydraulic operating pressure 2A to the servo chamber (II) are applied simultaneously, the band servo piston is pushed downward by the force of the return spring and the pressure difference between chamber (I) and chamber (II), caused by the difference in operating areas of the band servo pistons. Under this condition, state (A) is resumed, and the brake band loosens and releases the reverse clutch drum. (3rd speed state)



When hydraulic pressure 4A is applied to the servo chamber (III) under the 3rd speed condition, the band servo piston O.D. is brought into contact with the retainer installed at the lower end of the band servo piston stem. Hence, the stem is pushed upward. As a result, state (C) is achieved where the brake band slowly tightens the reverse clutch drum and fixes the front sun gear of the front planetary gear. (4th speed state)



The accumulator is built into the transmission case as shown in the Figure. When hydraulic pressures 2A, 3R, and 4A are applied from the hydraulic control unit to the respective servo chambers, the hydraulic shock loads are absorbed by the accumulator. This is because the accumulator piston moves slowly, and the brake band is tightened or released slowly. This results in smooth gear-shift operation.

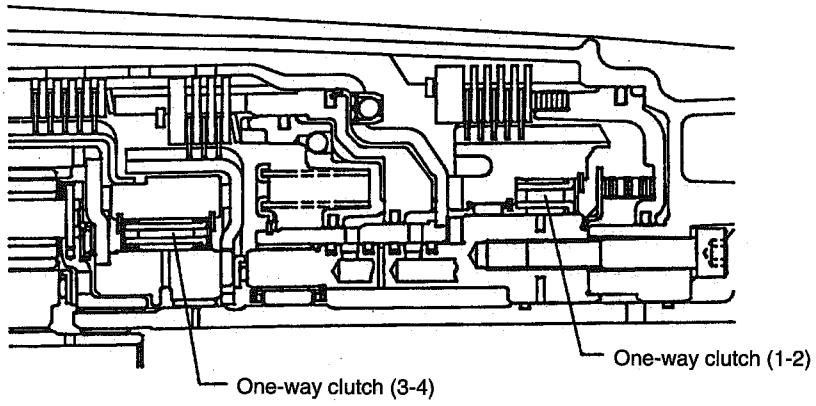


G3H0189

9. One-way Clutch

A: CONSTRUCTION

The one-way clutch (O.W.C.) is a Sprague type. Two clutches are used. One is mounted between the one-way clutch outer race and the rear internal gear ASSY. The other is located between the forward clutch drum and the one-way clutch inner race.

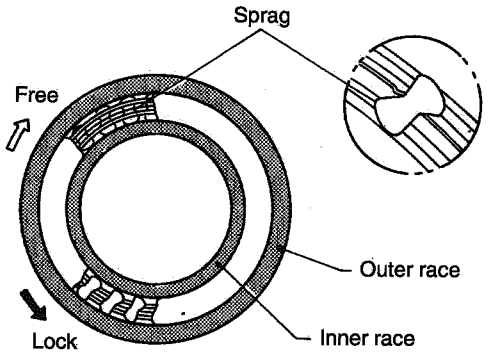


H3H1207A

B: FUNCTION

The former O.W.C. (3-4) is provided to prevent counterclockwise rotation (as viewed from the front) of the rear internal gear ASSY of the rear planetary gear during 1st, 2nd and 3rd speeds of the "D" range, "3" range, "2" range and "1st". At the 4th speed of the "D" range, therefore, the rear internal gear ASSY rotates clockwise so that the O.W.C. rotates freely to ensure smooth transition between 3rd and 4th speeds.

On the other hand, the latter O.W.C. (1-2) is provided to prevent counterclockwise rotation (as viewed from the front) of the forward clutch ASSY during 1st speed of the "D" range and 1st speed of the "3" range. Therefore, when shifting from 1st speed of the "D" range or "3" range to 2nd speed, the forward clutch ASSY rotates clockwise. As a result, the O.W.C. now rotates freely ensuring smooth transition between 1st and 2nd speeds.

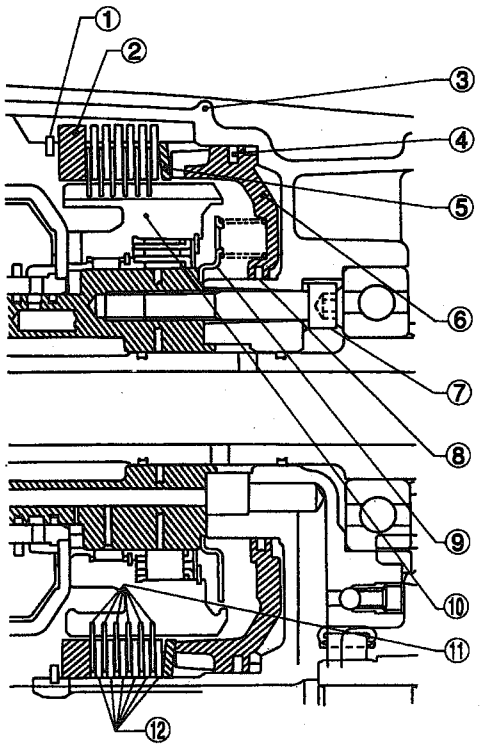


As viewed from the front of body G3H0190

10. Low & Reverse Brake

A: CONSTRUCTION

The piston, dish plate, drive plate, driven plate, retaining plate and snap ring are mounted directly to the transmission case. The spring retainer which is integral with the spring is secured to the inner race of the transmission case engagement surface.



B3H0013A

① Snap ring
② Retaining plate
③ Transmission case
④ Lathe cut seal ring
⑤ Dish plate
⑥ Piston
⑦ Bolt
⑧ Lathe cut seal ring
⑨ Clutch spring retainer
⑩ Forward clutch drum
⑪ Drive plate
⑫ Driven plate

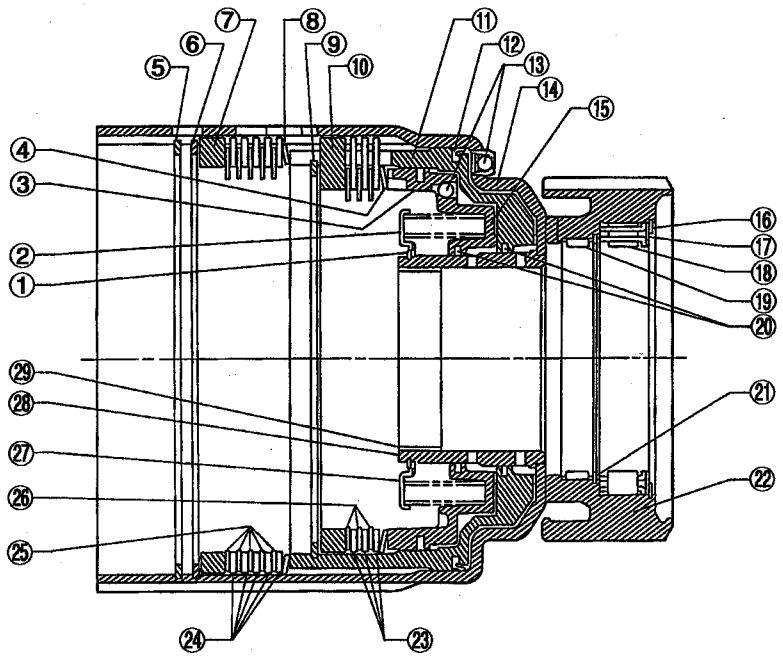
B: FUNCTION

During 1st speed of the "2" range and 1st speed of the "1st", and reverse, hydraulic pressure from the hydraulic pressure controller is applied to the low & reverse piston. This pressure causes the drive plate and driven plate to engage, and the forward clutch to be fixed.

11. Forward Clutch & Overrunning Clutch

A: CONSTRUCTION

The forward clutch drum is manufactured by pressing sheet metal. The clutch drum, outer race and sleeve are welded together by the electron beam welding technique. This clutch drum accommodates two multi-plate clutches (forward clutch and overrunning clutch). The overrunning clutch piston is mounted on the internal periphery of the forward clutch piston for common use of the return spring and reduction in size.



B3H0014B

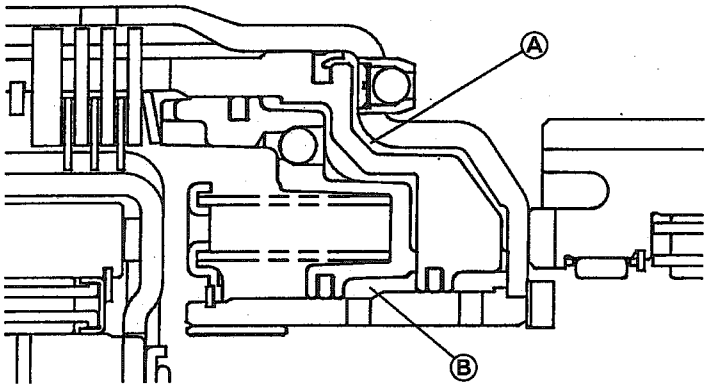
① Snap ring
② Retainer
③ Lathe cut seal ring
④ Dish plate
⑤ Snap ring
⑥ Snap ring
⑦ Retaining plate
⑧ Dish plate
⑨ Snap ring
⑩ Retaining plate
⑪ Forward clutch piston
⑫ Lip seal
⑬ Drift ball
⑭ Forward clutch drum
⑮ Overrunning clutch piston
⑯ Snap ring
⑰ Plate
⑱ One-way clutch (1-2)
⑲ Needle bearing
⑳ Lathe cut seal ring
㉑ Snap ring
㉒ Outer race
㉓ Driven plate
㉔ Driven plate
㉕ Drive plate
㉖ Drive plate
㉗ Return spring
㉘ Sleeve
㉙ Bushing

B: FUNCTION

When hydraulic pressure is applied to the pressure chamber Ⓐ from the hydraulic pressure controller during forward operation in the "D", "3", "2" range or "1st", the forward clutch piston forces the overrunning clutch piston. This causes the drive and driven plates of the forward clutch to engage while causing the drive and driven plates of the overrunning clutch to slide forward.

A groove is provided on the outside of the retaining plate and driven plate of the overrunning clutch in which the forward clutch piston slides.

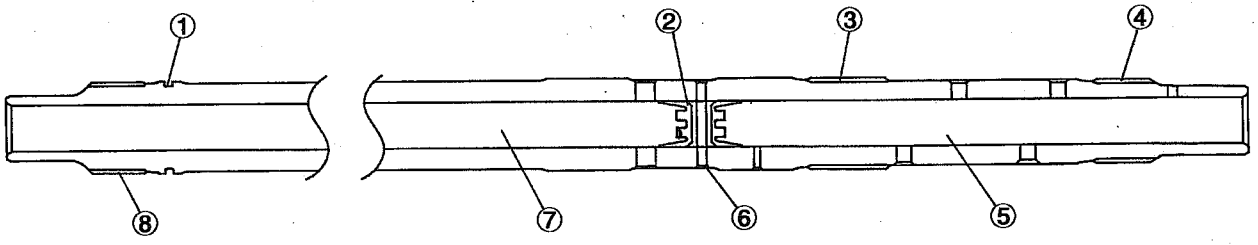
When hydraulic pressure is applied to the pressure chamber Ⓑ from the hydraulic pressure controller during "3" range, "2" range or "1st" operation, the forward clutch piston is forced onto the side of the forward clutch drum. The overrunning clutch piston, however, is moved to the left by the hydraulic pressure. This causes the drive and driven plates of the overrunning clutch to engage. When this occurs, the outside splines of the overrunning clutch retaining plate and driven plate fit into the internal spline grooves of the forward clutch. This allows power to be transmitted between the overrunning clutch hub and the forward clutch drum.



H3H1233A

12. Input Shaft

The input shaft front end is spline-fitted to the torque converter clutch turbine hub. The rear end is spline-fitted to the high clutch drum and rear sun gear. Power from the torque converter clutch is transmitted to the high clutch drum and rear sun gear. The input shaft is hollow. A seal is fitted inside the shaft by a roll pin. The torque converter clutch side of the shaft becomes the drain circuit for the lock-up mechanism. The other side becomes the lubricating circuit for the planetary gears and high clutch.

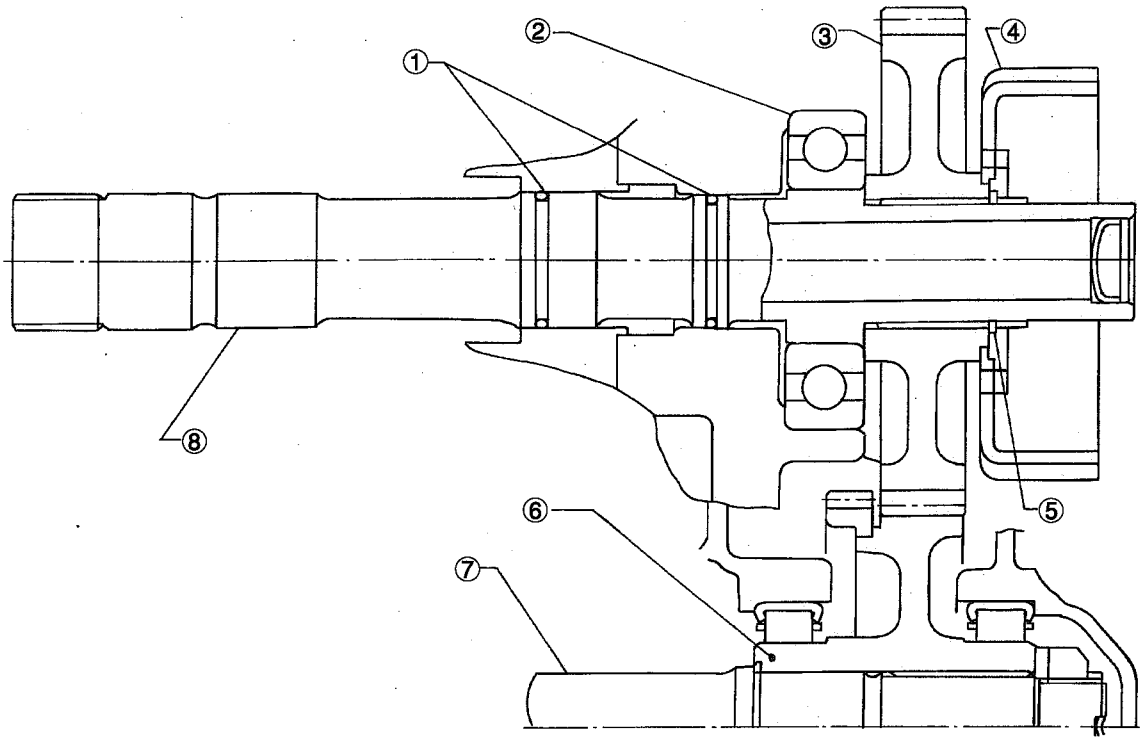


H3H1208A

① O-ring groove
② Seal
③ High clutch drum fitting surface
④ Rear sun gear fitting surface
⑤ Lubricating circuit
⑥ Roll pin
⑦ Drain circuit for lock-up mechanism
⑧ Turbine hub fitting surface

13. Reduction Gear

Engine power is transmitted from the rear planetary carrier to the reduction drive shaft and the reduction drive gear. In a AWD vehicle, power is then transmitted to the front final gear through the reduction driven gear and drive pinion. Power to the rear wheels is transmitted from the transfer clutch hub, welded to the side of the reduction drive gear, and passes through the transfer clutch (multi-plate clutch), to the rear drive shaft → propeller shaft → rear differential → rear wheel.



B3H0493A

① Seal ring
② Ball bearing
③ Reduction drive gear
④ Transfer clutch hub
⑤ Snap ring
⑥ Reduction driven gear
⑦ Washer
⑧ Drive pinion shaft
⑨ Reduction drive gear shaft

14. Range Select Mechanism

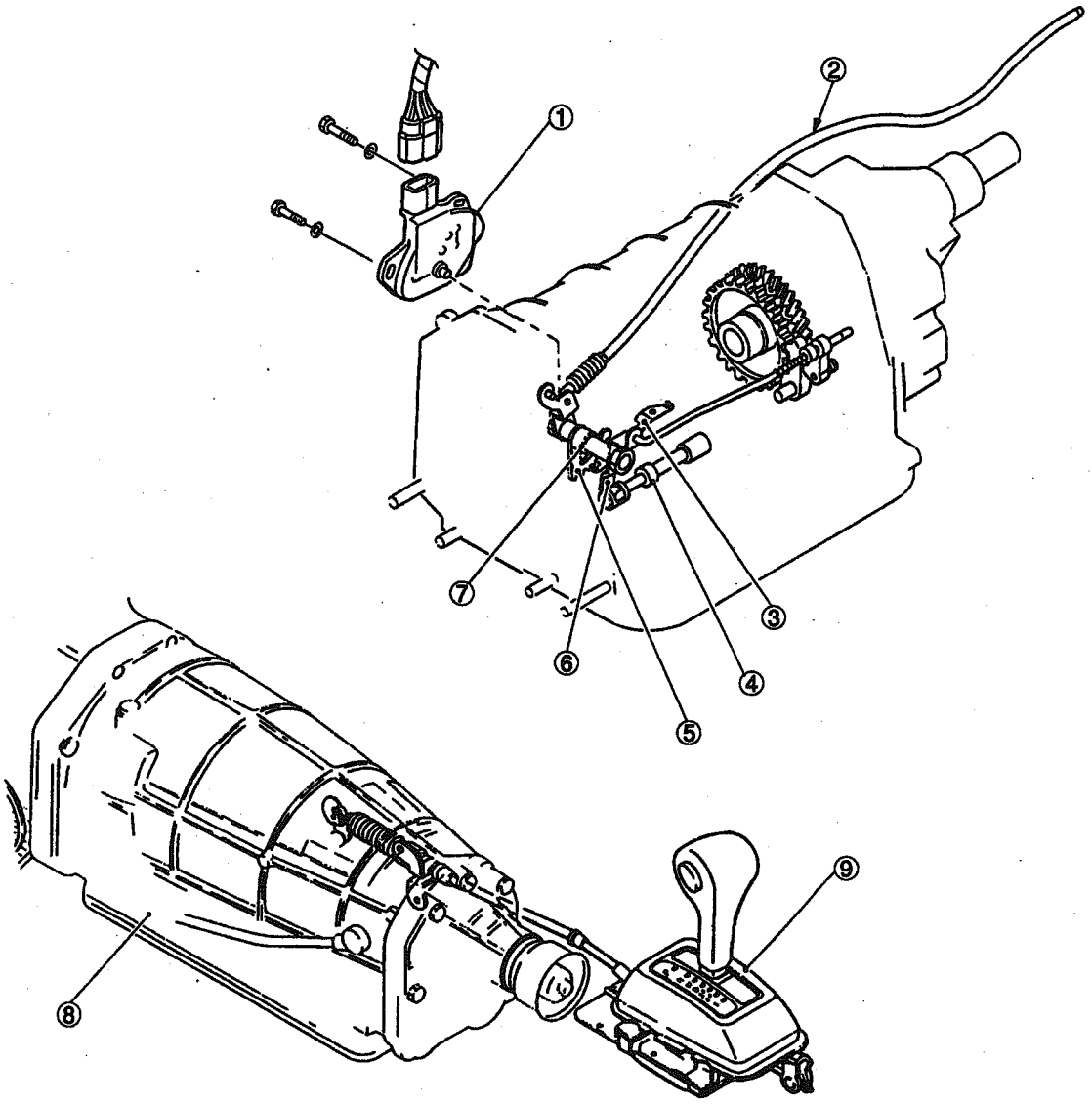
The range select mechanism consists of a select lever (on the floor/center console in the driver's compartment), push-pull cable, linkages, manual valve, parking pawl, etc.

When the select lever is moved either forward or backward, the push-pull cable moves in the corresponding direction. This turns the manual shaft by way of the range select lever. At this point, the pin at the end of the range select lever turns the inhibitor switch arm to transmit a range signal to the control module.

A manual plate and manual lever are attached to the manual shaft. The manual plate is fan-shaped and is provided with seven grooves on its edge corresponding to shift ranges (from "P" to "1"). A detent spring roller fits into the groove corresponding to the range selected. This regulates effort required to operate the select lever.

A hydraulically controlled manual valve is installed on the lower pin of the manual lever. It slides in response to rotation of the manual shaft, thereby selecting an oil passage inside the lower valve body in response to the position (P, R, N, D, 3, 2 or 1) of the select lever.

A parking rod located on the upper portion of the lever mechanically holds the output shaft when the select lever is shifted to "P".



H3H1210A

① Inhibitor switch
② Push-pull cable
③ Detent spring
④ Manual valve
⑤ Manual plate
⑥ Manual lever
⑦ Range select lever
⑧ Transmission case
⑨ Select lever ASSY

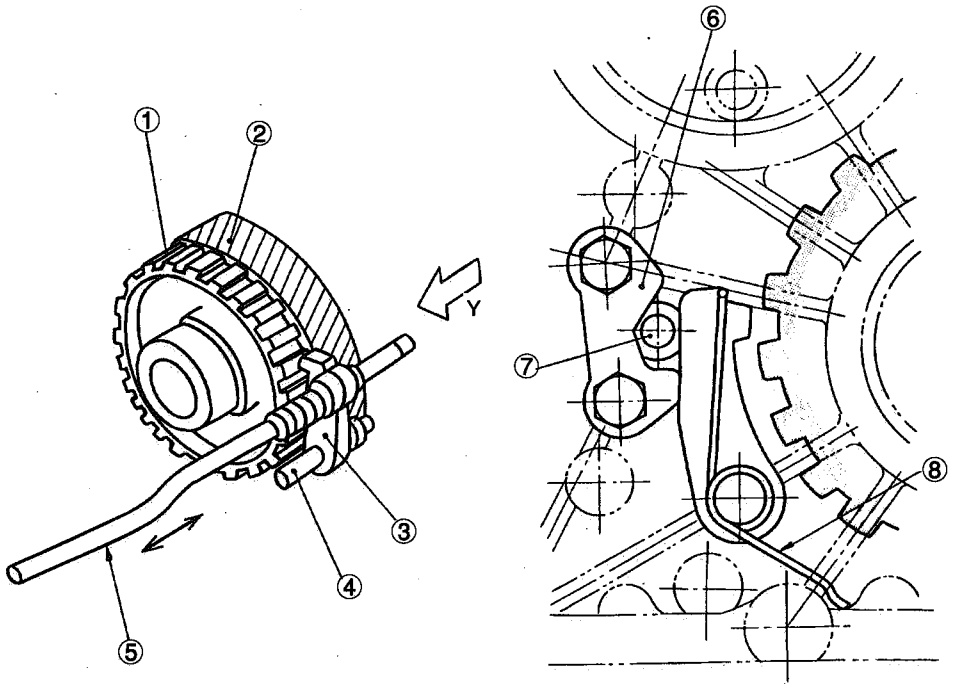
15. Parking Mechanism

The end of the parking pawl engages mechanically with the gear groove of the parking gear. This gear is spline-fitted to the drive pinion shaft.

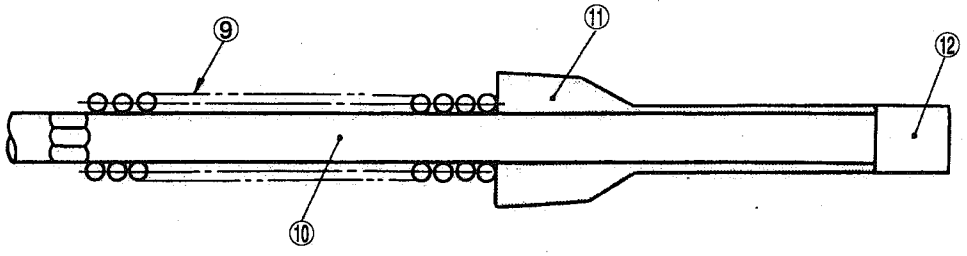
When the select lever is set to "P", the manual lever connected to the manual shaft turns, moving the parking rod backward. A cam and spring are installed on the rear of the parking rod. The parking cam slides freely on the parking rod. The parking rod and cam contact the "V" groove of the actuator (secured to the transmission case) and the back of the parking pawl. With this arrangement, when the parking rod moves backward, the cam moves to the back of the parking pawl and the "V" groove of the actuator. The parking pawl turns in the direction of the parking gear using the parking pawl shaft as a pivot. It then engages with the parking gear groove.

If the end of the parking pawl rides over the tooth of the parking gear so that the parking cam does not move midway between the pawl and actuator, the parking rod will move to "P". This compresses the parking spring so that the parking cam is ready to move to "P". Under this condition, if the vehicle moves slightly, the parking gear will rotate to engage the pawl completely.

Except for the P range, the parking pawl is tensed by the parking pawl return spring in the direction that moves away from the parking gear.



View Y



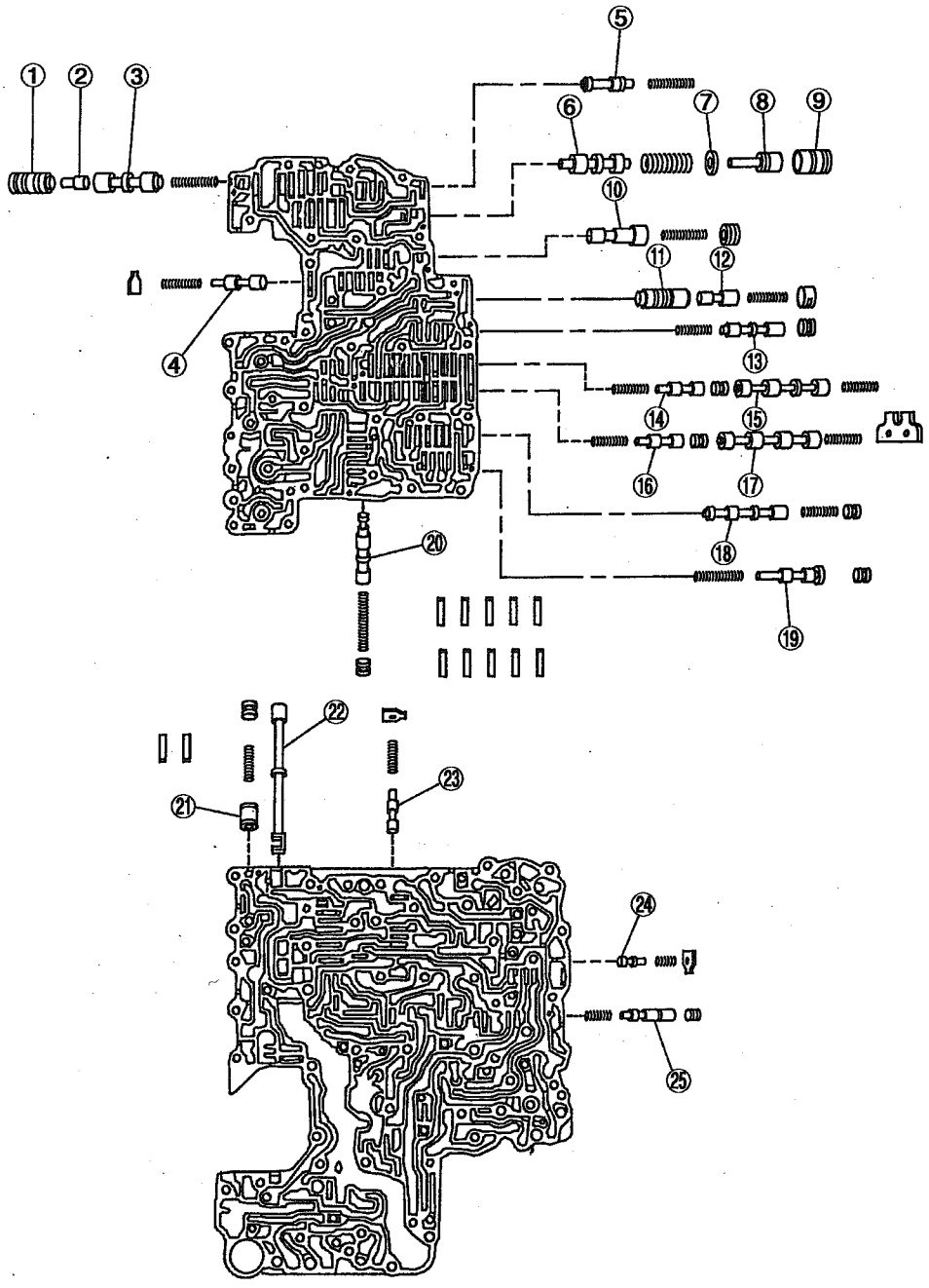
G3H0200

① Parking gear
② Reduction driven gear
③ Parking pawl
④ Parking pawl shaft
⑤ Parking rod
⑥ Parking actuator
⑦ Parking rod
⑧ Parking pawl return spring
⑨ Parking spring
⑩ Parking rod
⑪ Parking cam (slides on parking rod)
⑫ Stopper

16. Hydraulic Control Valve

The hydraulic control system consists of an oil pump, control valve bodies, clutches, brakes and connecting passages and pipes. When it is activated manually, or automatically by the electronic control system, it hydraulically controls the gearshifting mechanism.

A: CONSTRUCTION

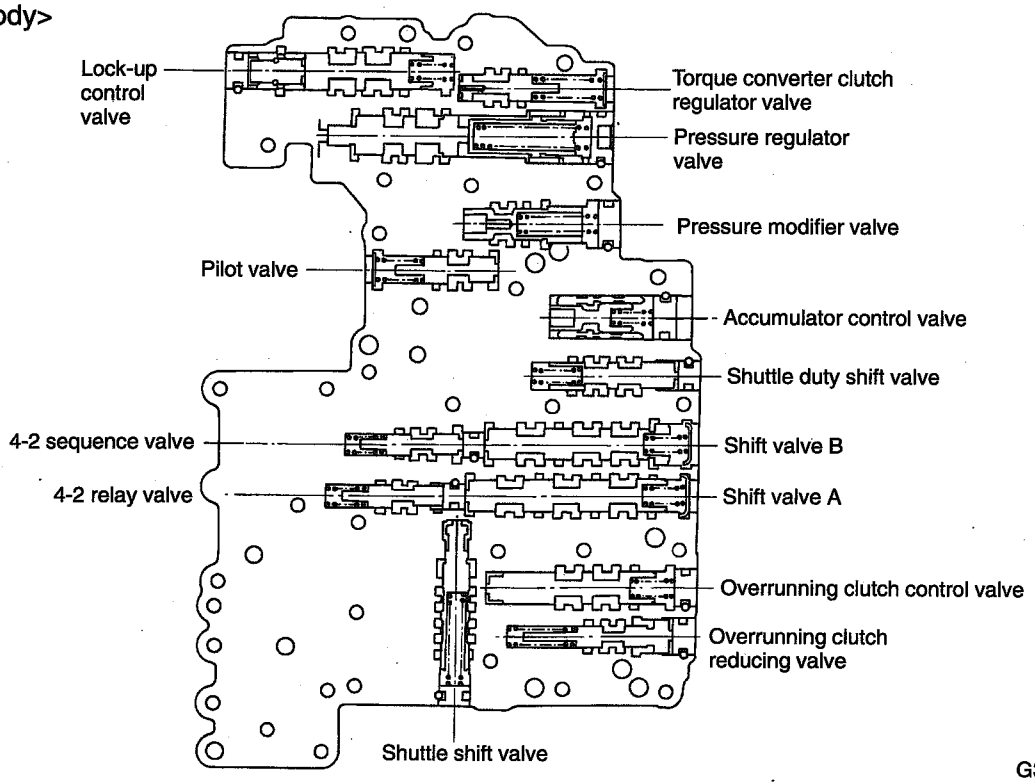


H3H1211A

① Lock-up control sleeve
② Lock-up control plug
③ Lock-up control valve
④ Pilot valve
⑤ Torque converter clutch regulation valve
⑥ Pressure regulator valve
⑦ Washer
⑧ Pressure regulator plug
⑨ Pressure regulator sleeve
⑩ Pressure modifier valve
⑪ Accumulator control sleeve
⑫ Accumulator control plug
⑬ Shuttle duty shift valve
⑭ 4-2 sequence valve
⑮ Shift valve B
⑯ 4-2 relay valve
⑰ Shift valve A
⑱ Overrunning clutch control valve
⑲ Overrunning clutch reducing valve
⑳ Shuttle shift valve
㉑ Accumulator piston
㉒ Manual valve
㉓ 1st reducing valve
㉔ 3-2 timing valve
㉕ Servo charger valve

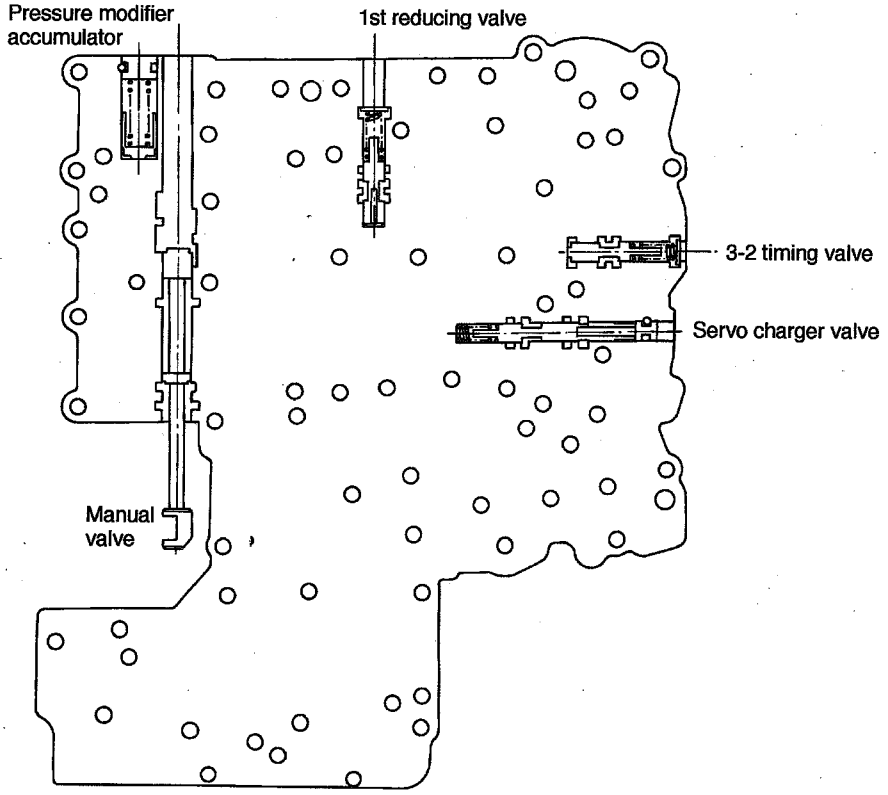
B: VALVE BODY CONFIGURATION

<Upper valve body>



G3H0743

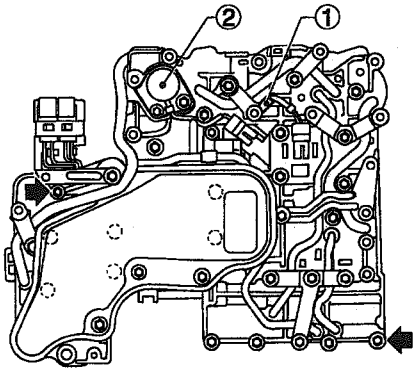
<Lower valve body>



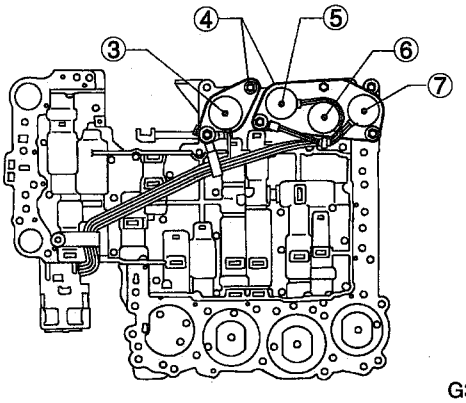
B3H0598

C: SOLENOID AND SENSOR LOCATION

The control valve body is fitted with Solenoid 1 (shift), Solenoid 2 (shift), Solenoid 3 (overrunning clutch), Duty solenoid A (line pressure), Duty solenoid B (lock-up) and an ATF temperature sensor.



G3H0207



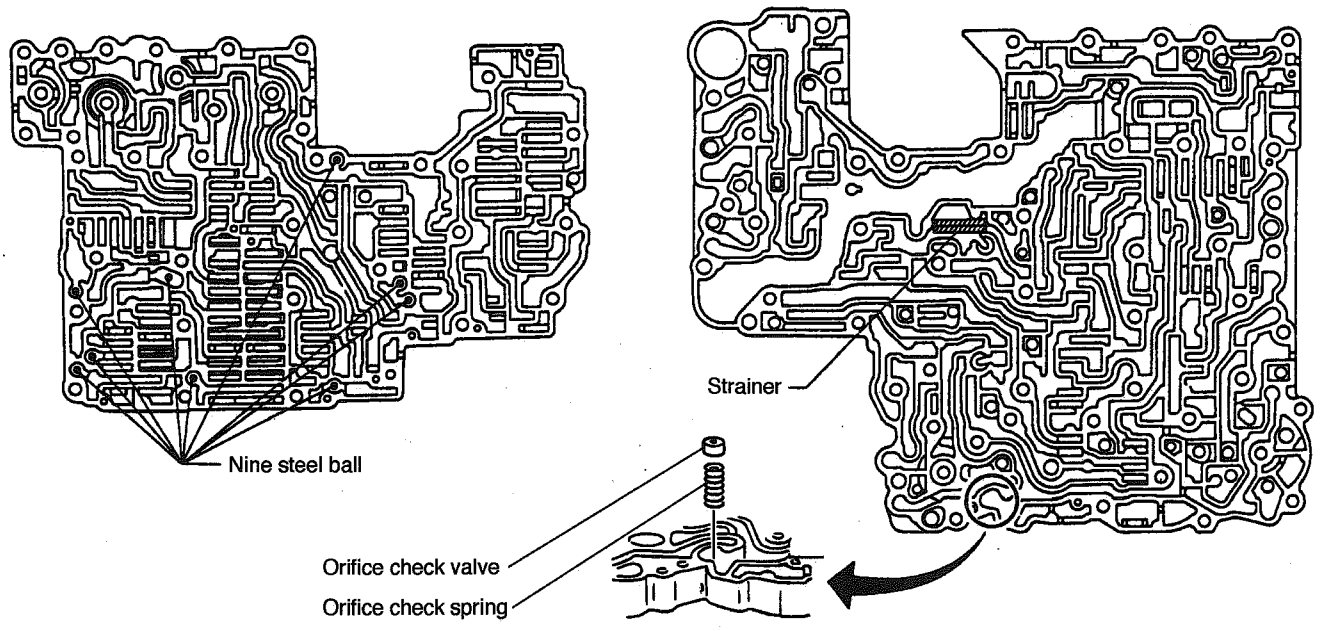
G3H0744

① ATF temperature sensor
② Duty solenoid B (lock-up)
③ Duty solenoid A (line pressure)
④ Solenoid ASSY
⑤ Solenoid-2 (shift)
⑥ Solenoid-1 (shift)
⑦ Solenoid-3 (overrunning clutch)

D: STEEL BALL, STRAINER AND ORIFICE LOCATION

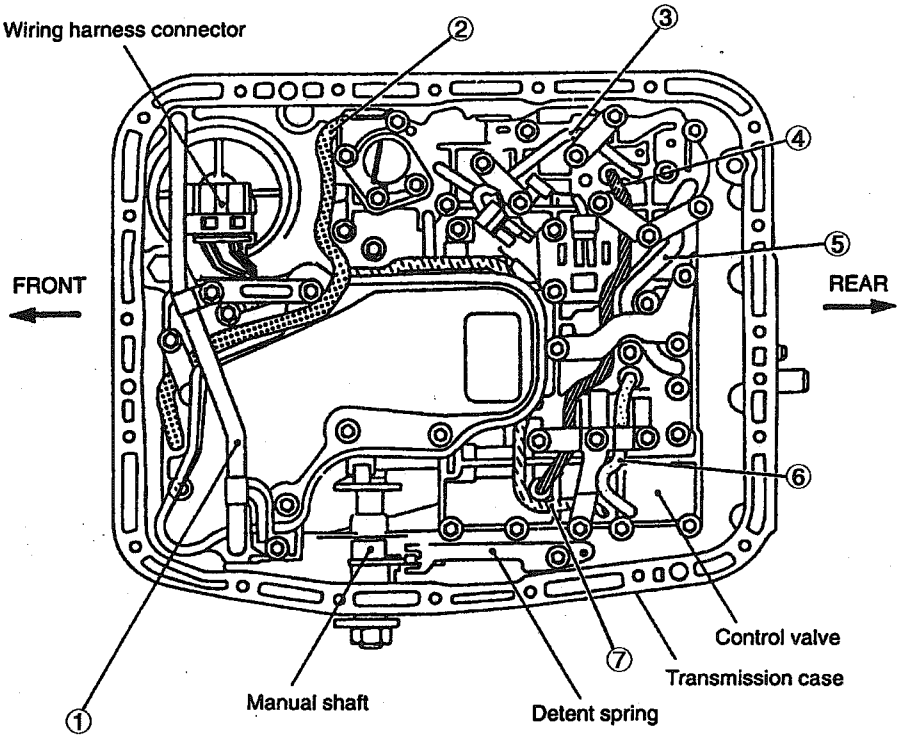
<Upper valve body>

<Lower valve body>



B3H0503

E: PIPE LOCATION



H3H1212A

< Pipe names >

No.	Description	Hydraulic circuit
①	Oil cooler outlet pipe	Cooling line from control valve to oil cooler inside radiator
②	Reverse clutch pressure pipe	Accumulator circuit of reverse clutch pressure
③	4A pressure pipe	4A pressure circuit
④	3R pressure pipe	3R pressure circuit
⑤	Forward clutch pressure pipe	Supply line to N → D accumulator
⑥	Pilot pressure pipe	Pilot pressure supply line to shuttle shift valve S
⑦	Pressure-modifier pressure pipe	Supply line to pressure modifier accumulator

F: FUNCTION

<table>
<tr><th>Name</th><th>Function</th></tr>
<tr><td>• Pressure regulator valve
• Pressure regulator plug
• Pressure regulator sleeve plug</td><td>Regulates the pressure of oil delivered from the oil pump to an optimum level (line pressure) corresponding to vehicle running conditions.</td></tr>
<tr><td>Pressure modifier valve</td><td>An auxiliary valve for the pressure regulator valve. This valve adjusts pressure used to regulate line pressure to an optimum level corresponding to running conditions.</td></tr>
<tr><td>Pressure modifier accumulator piston</td><td>Smoothes the pressure regulated by the pressure modifier valve to prevent pulsation in line pressure.</td></tr>
<tr><td>Pilot valve</td><td>Creates the constant pressure (pilot pressure) necessary to control line pressure, lock-up, overrunning clutch, 3-2 timing, and gearshift operations from line pressure.</td></tr>
<tr><td>• Accumulator control plug
• Accumulator control sleeve</td><td>Adjusts accumulator back pressure to correspond to running conditions.</td></tr>
<tr><td>Manual valve</td><td>Delivers line pressure to each circuit corresponding to the selected position.
<table>
<tr><th>Circuit</th><th>①</th><th>②</th><th>③</th><th>④</th></tr>
<tr><td>Range</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td></td><td></td><td></td><td></td></tr>
<tr><td>R</td><td></td><td></td><td></td><td>○</td></tr>
<tr><td>N</td><td></td><td></td><td></td><td></td></tr>
<tr><td>D</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>○</td><td>○</td><td></td><td></td></tr>
<tr><td>1</td><td>○</td><td>○</td><td>○</td><td></td></tr>
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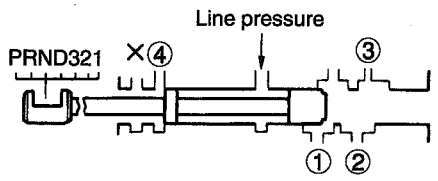


G3H0211
When the valve is set in the "line pressure no delivery" position, the pressure is relieved.</td></tr>
<tr><td>Shift valve A</td><td>Simultaneously changes three different oil passages using shift solenoid 1 output pressure corresponding to such operating conditions as vehicle speed and throttle position. Combined with shift valve B, this valve permits automatic shifting of 1st ↔ 2nd ↔ 3rd ↔ 4th speeds.</td></tr>
<tr><td>Shift valve B</td><td>Simultaneously changes three different oil passages using shift solenoid 2 output pressure corresponding to such operating conditions as vehicle speed and throttle position. Combined with shift valve A, this valve permits automatic shifting of 1st ↔ 2nd ↔ 3rd ↔ 4th speeds.</td></tr>
<tr><td>Shuttle shift valve</td><td>Changes the 3-2 timing control and overrunning clutch control oil passages corresponding to the throttle position. When the throttle is wide open, the overrunning clutch becomes inoperative to prevent interlocking at 4th speed.</td></tr>
<tr><td>Overrunning clutch control valve</td><td>Changes oil passages so as to prevent simultaneous operation of the overrunning clutch when the brake band is actuated at 4th speed. (Operation of overrunning clutch at D4 speed results in interlocking.)</td></tr>
</table>

Name	Function
4-2 relay valve	Memorizes the 4th speed position, and prevents gear shifting from 4th to 3rd to 2nd speeds due to combined operation of the 4-2 sequence valve, shift valve A and shift valve B when shifting down from 4th to 2nd speeds.
4-2 sequence valve	Inhibits release of band servo operating pressure acting at 4th speed until the high clutch operating pressure and band servo release pressure (same hydraulic circuit) are drained when shifting down from 4th speed to 2nd speed.
Servo charger valve	The 2nd speed band servo actuating hydraulic circuit has an accumulator and one-way orifice for relieving shift shock when shifting from 1st speed to 2nd speed. The servo charger valve is installed to ensure sufficient oil flow when shifting down from 4th to 2nd speed, or from 3rd to 2nd speed. It operates at 3rd or higher speeds and supplies the 2nd speed band servo actuating pressure by bypassing the one-way orifice.
3-2 timing valve	When shifting down from D 3rd to D 2nd speed, the timing valve retards the release of band-servo pressure and creates a temporary neutral condition so that vehicle speed can be changed smoothly.
"1st" Reducing valve	Reduces the low & reverse brake operating pressure so as to relieve engine braking shock when changing from "2" range 2nd speed to 1st speed.
Overrunning clutch reducing valve	Reduces the operating pressure applied to the overrunning clutch so as to relieve engine braking shock. In the "2" and "3" ranges, line pressure is applied to the valve to raise the pressure adjusting point, thereby increasing engine braking capacity.
Torque converter clutch regulator valve	Prevents excessive rise of torque converter clutch pressure.
• Lock-up control valve • Lock-up control plug • Lock-up control sleeve	Controls the operation of the lock-up function. Smoothes the transition between the lock-up state and release state.
Shuttle duty shift valve	Changes the oil passage so that output pressure to the duty solenoid B (lock-up) will be applied to the lock-up valve in the "D" range 2nd, 3rd, or 4th speed. (Lock-up at 1st speed is inhibited.) <NOTE> Lock-up control is not actuated if the lock-up solenoid does not generate output pressure when signaled from the control unit, even if the vehicle is in the "D" range 2nd, 3rd, or 4th speeds.

17. Gear Shifting Mechanism

A: OPERATION TABLE

Selector lever operation		Rev./C	B/B	High/C	FWD/C	OWC (3-4)	OVR/C	Lo/ Rev./B	OWC (1-2)
P									
R		○						○	
N									
D	1ST				○	○			○
	2ND		○		○	○			
	3RD			○	○	○			
	4TH		○	○	○				
3	1ST				○	○			○
	2ND		○		○	○			
	3RD			○	○	○	○		
	4TH		○	○	○				
2	1ST								
	2ND		○		○	○	○		
	3RD			○	○	○	○		
	4TH		○	○	○				
1	1ST				○	○	○	○	
	2ND		○		○	○	○		
	3RD			○	○	○	○		
	4TH		○	○	○				

B3H0293

	1st	2nd	3rd	4th	Rev.
Input member	R_S	R_S	R_S F_C R_I	R_S F_C	R_S F_S
Output member	F_I R_C	F_I R_C	F_I R_C	F_I R_C	F_I R_C
Fixed member	F_C R_I	F_S		F_S	F_C
Free member	F_S	F_C R_I	F_S	R_I	R_I
Gear ratio	2.785	1.545	1.000	0.694	2.272

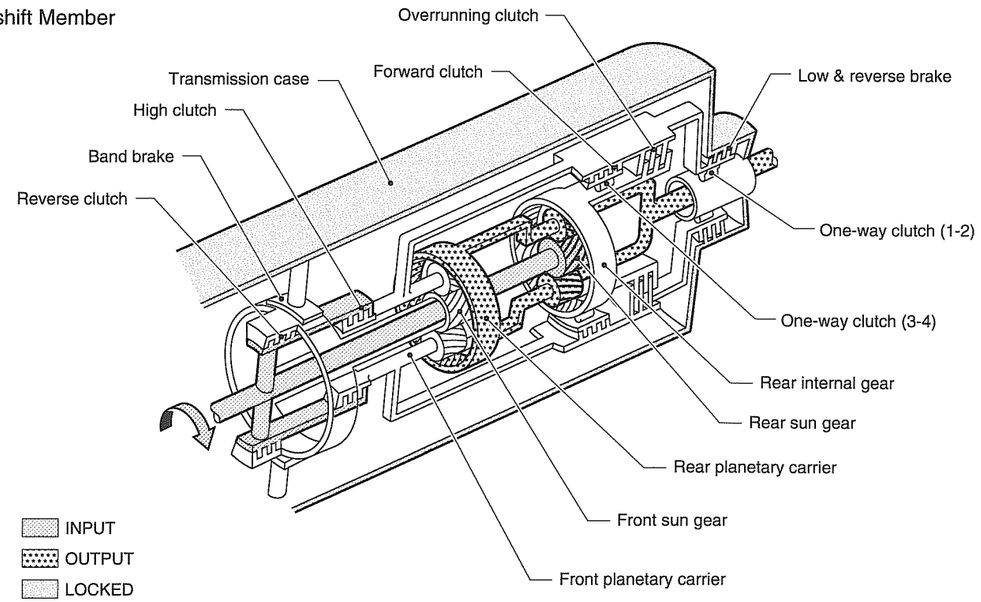
Abbr.
FS : Front sun gear
RS : Rear sun gear
FC : Front planetary carrier
RC : Rear planetary carrier
FI : Front internal gear
RI : Rear internal gear

G3H0213

MEMO

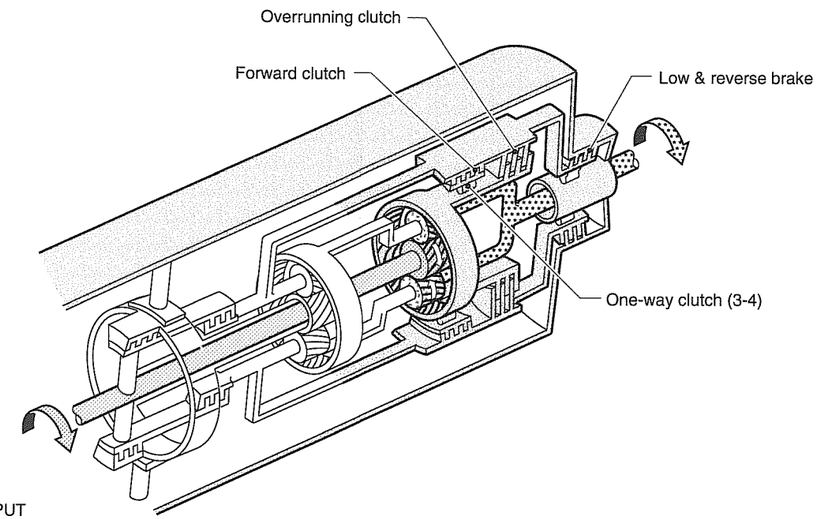
B: SCHEMATIC DRAWING

Gearshift Member



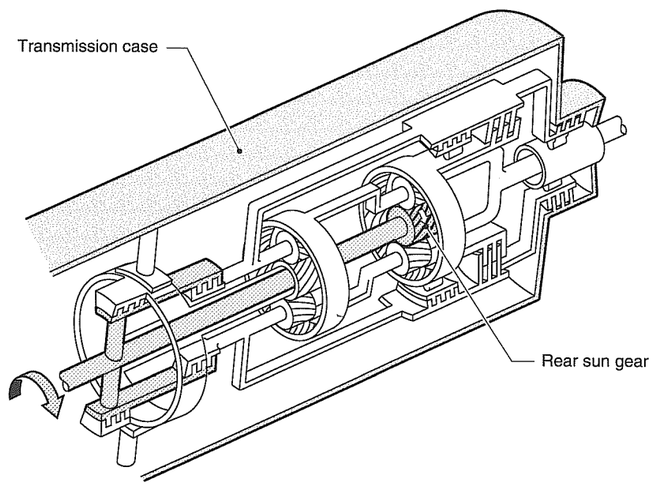
H3H1213

1st ("1")



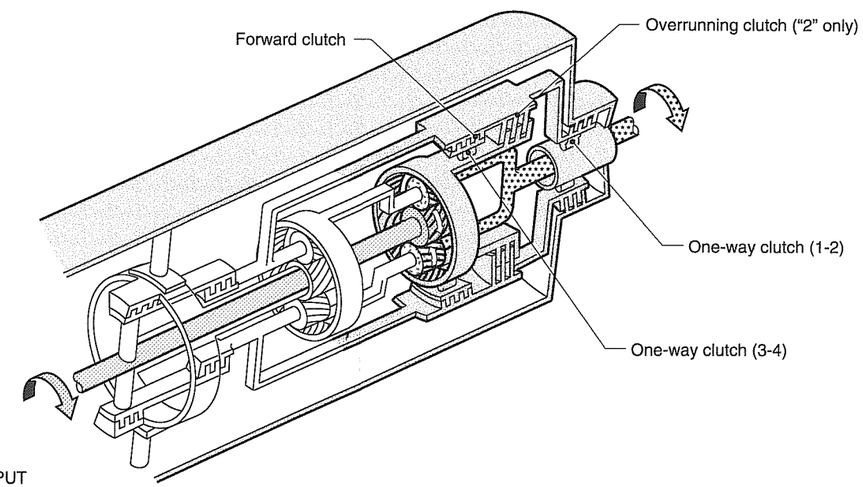
H3H1215

"N" and "P"



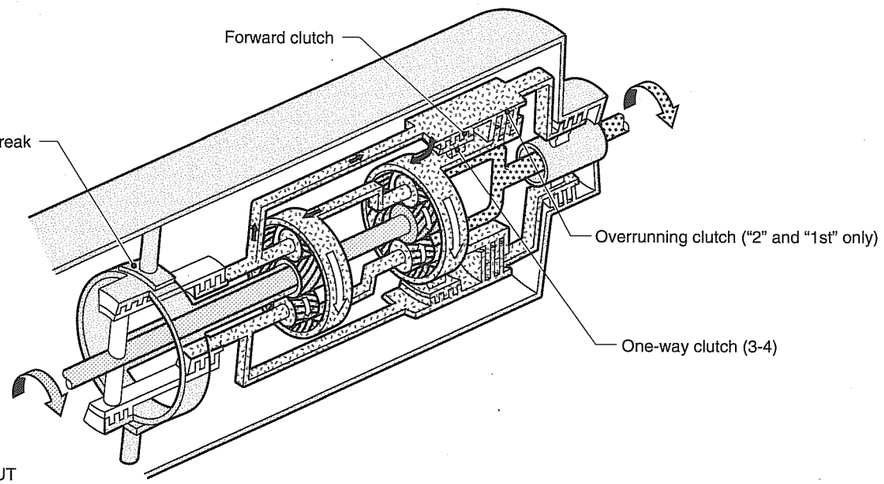
H3H1214

1st ("D", "3" and "2")



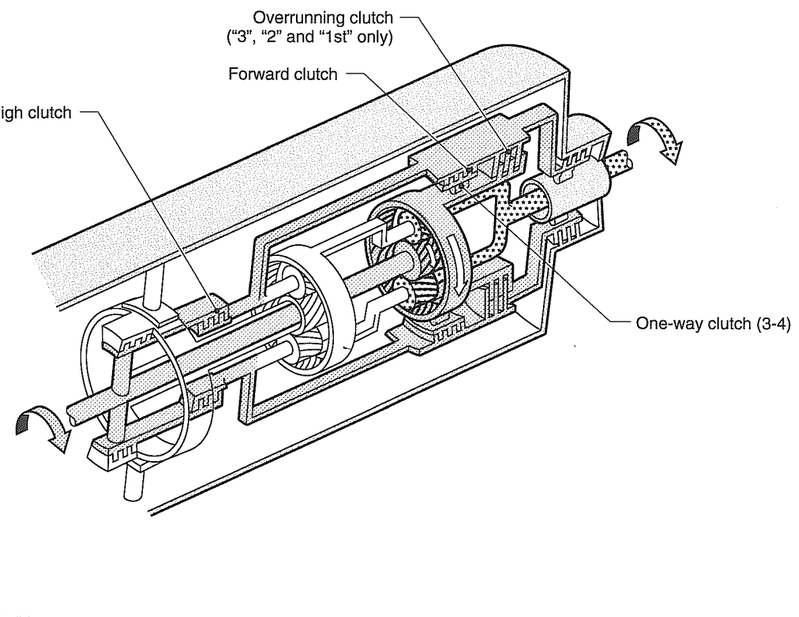
H3H1216

2nd ("D", "3" and "2")



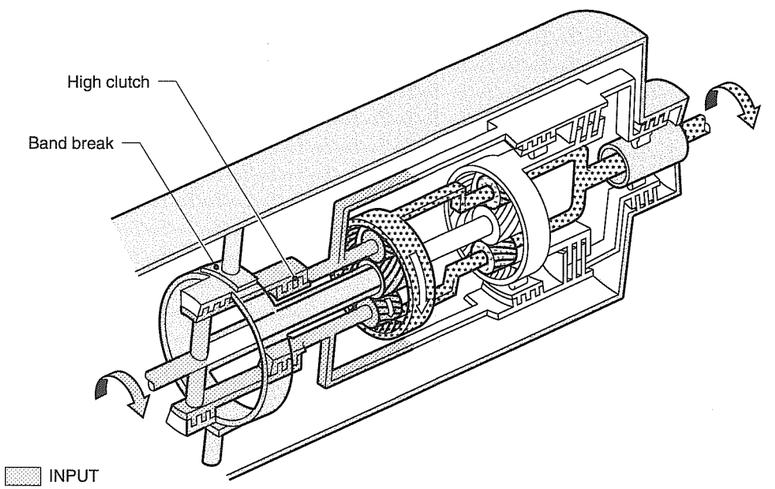
H3H1217

3rd ("D" and "3")



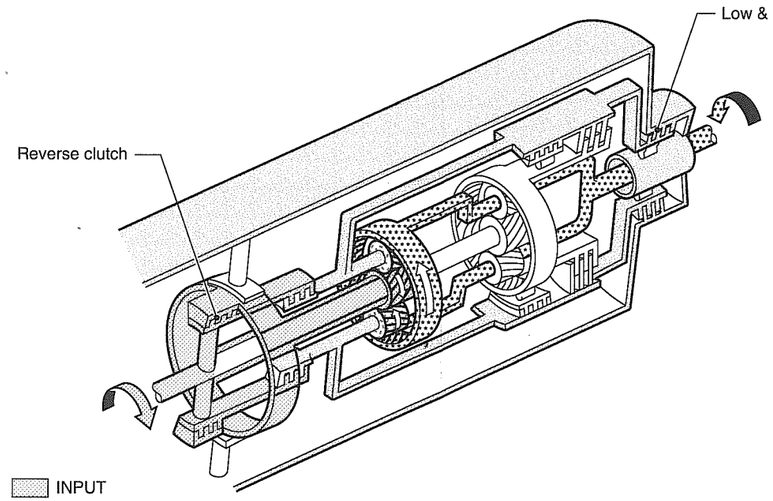
H3H1218

4th



H3H1219

Rev.

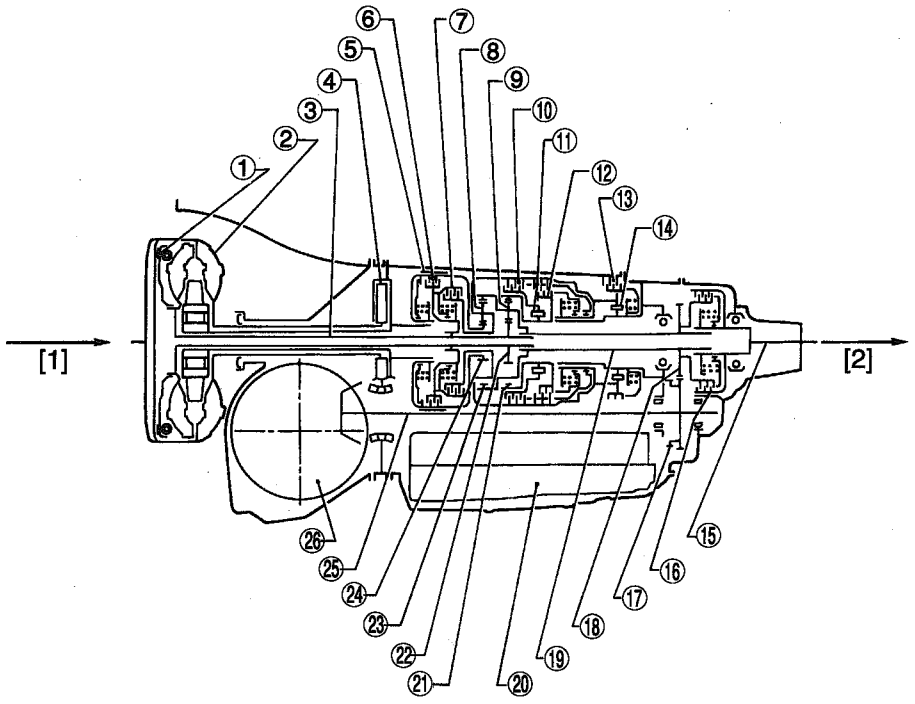


H3H1220

18. Power Train

A: OPERATION

The gear train consists of two sets of planetary gears, four sets of multi-plate clutches, one brake band, one set of multi-plate brake and two sets of one-way clutches.



G3H0223

① Hydraulic lock-up clutch
② Torque converter clutch
③ Input shaft
④ Oil pump
⑤ Brake band (Contacts at 2nd and 4th speeds.)
⑥ Reverse clutch (Operates while moving in reverse.)
⑦ High clutch (Operates at 3rd and 4th speeds.)
⑧ Front planetary gear
⑨ Rear planetary gear
⑩ Forward clutch
⑪ Forward one-way clutch (3-4)
⑫ Overrunning clutch
⑬ Low & reverse brake
⑭ Low one-way clutch (1-2)
⑮ Rear drive shaft
⑯ Transfer clutch
⑰ Parking gear
⑱ Reduction gear
⑲ Reduction drive shaft
⑳ Electronic oil pressure control mechanism
㉑ Rear internal gear
㉒ Rear sun gear
㉓ Front internal gear
㉔ Front sun gear
㉕ Drive pinion
㉖ Front differential (To front axles)
[1] From engine
[2] To propeller shaft

B: N RANGE

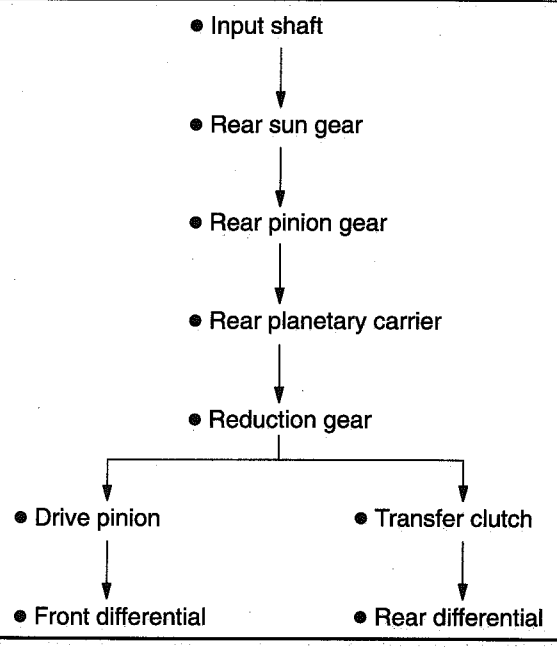
Because both the forward clutch and reverse clutch are in the release positions, the power of the input shaft is not transmitted to the drive pinion or the rear drive shaft.

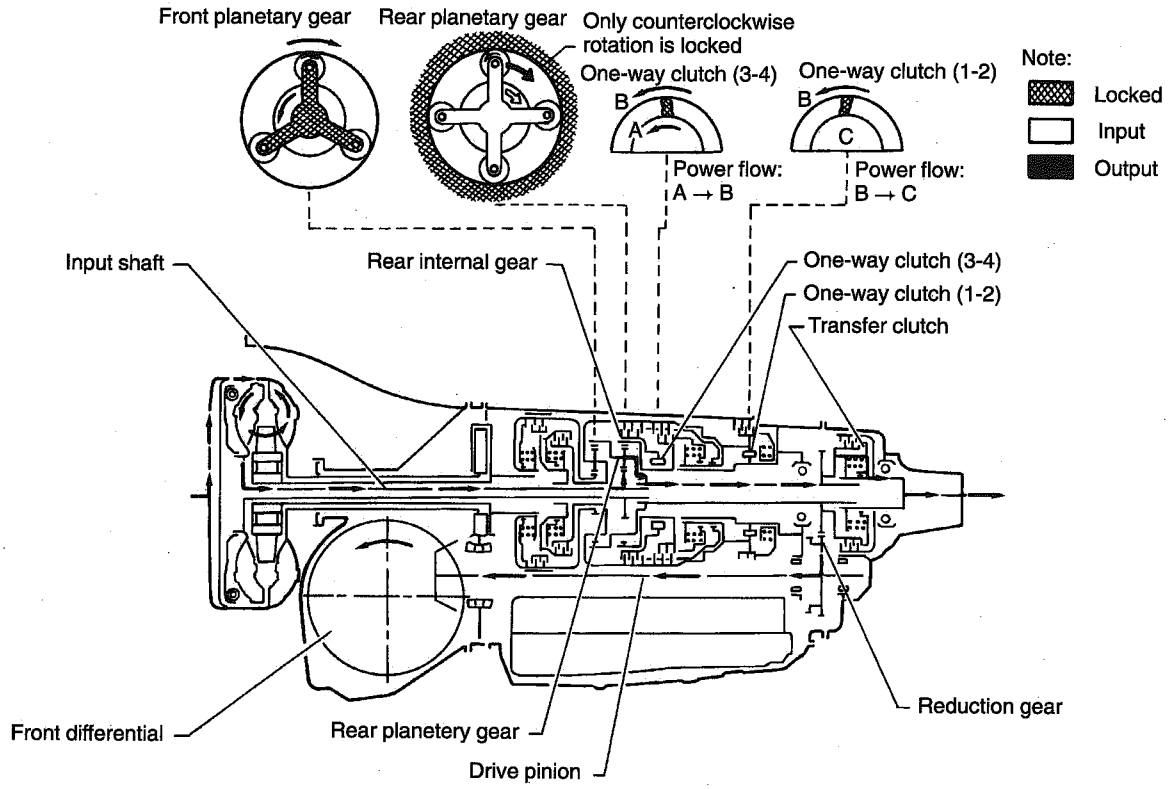
C: P RANGE

All controls do not operate, just as in the N range. The parking pawl interlocked with the selector lever meshes with the parking gear to mechanically hold the output shaft stationary, thus locking the power train.

D: FIRST SPEED OF D OR 3 RANGE (D_1, 3_1)

- When the throttle is open wide, as during acceleration in the low-speed range, the forward clutch, one-way clutch (3-4) and one-way clutch (1-2) operate to prevent the rear internal gear from turning in the reverse direction.
- While coasting, the rear internal gear turns normally and the one-way clutch (3-4) is released and idles. Therefore, no power is transmitted and the engine does not provide braking action.
- During deceleration, the overrunning clutch is applied and the one-way clutch (3-4) is prevented from idling; however, since the one-way clutch (1-2) is released and is idling, reverse power is not transmitted and engine braking is not performed.

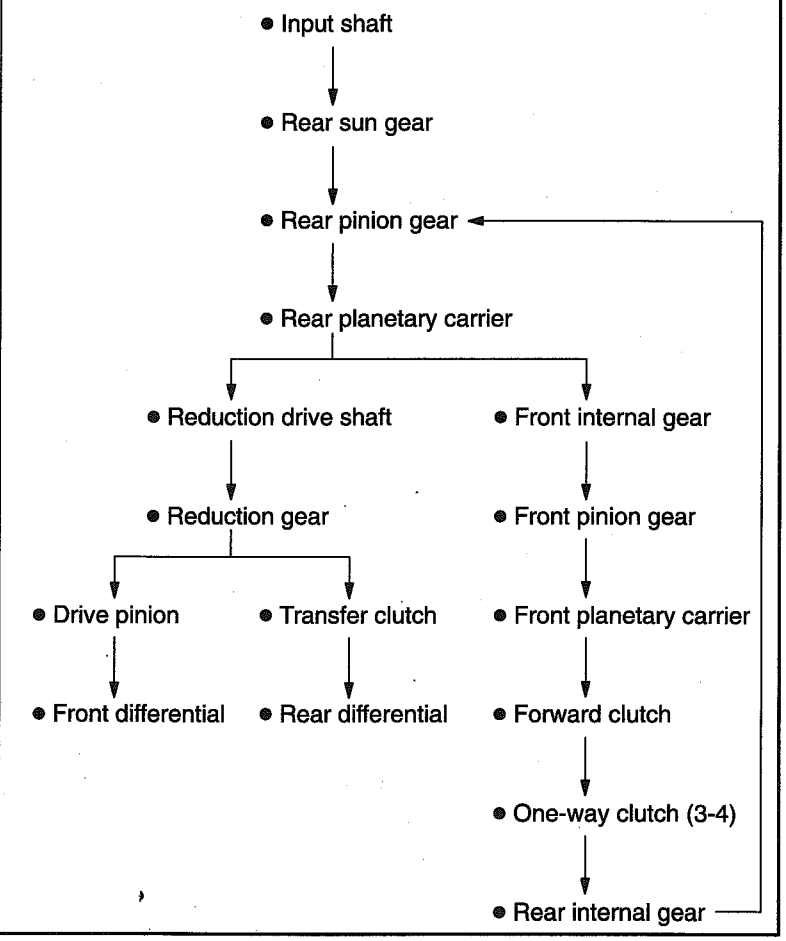
Operating condition of parts		Power flow (in acceleration)
• Forward clutch	: Applied	
• One-way clutch (3-4)	: Operating	
• One-way clutch (1-2)	: Operating	
• Overrunning clutch ("2" range only)	: Applied	

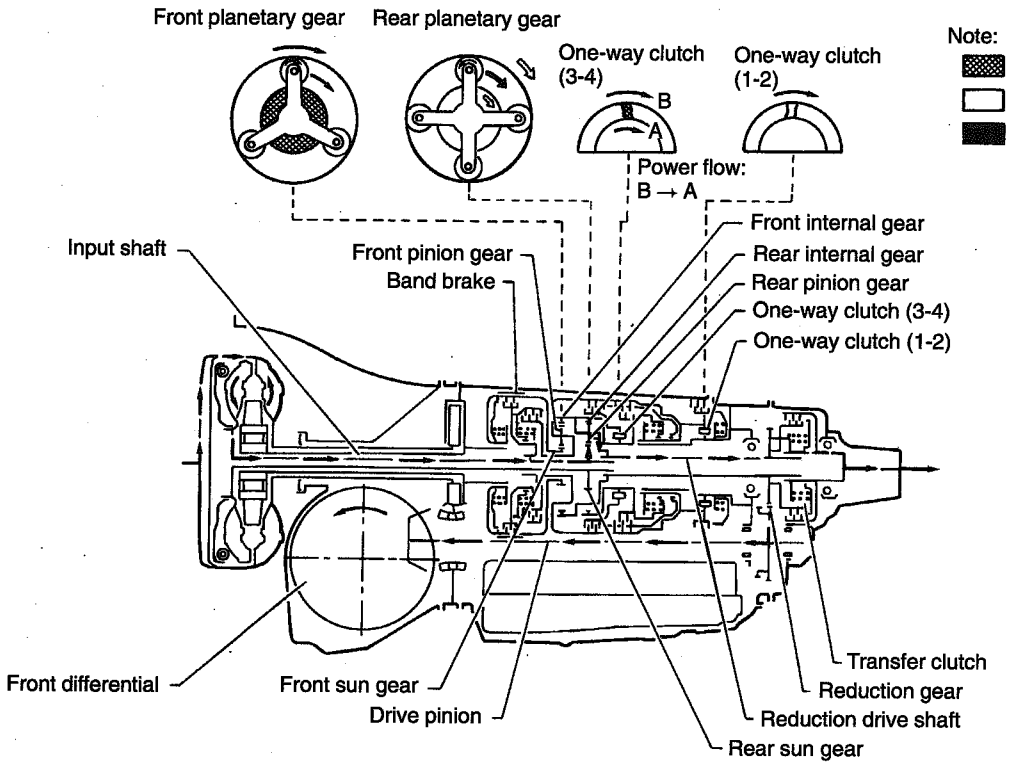

Front planetary gear
Rear planetary gear
Only counterclockwise rotation is locked
One-way clutch (3-4)
One-way clutch (1-2)
B
A
B
C
Power flow: A → B
Power flow: B → C
Note:
Locked
Input
Output
Input shaft
Rear internal gear
One-way clutch (3-4)
One-way clutch (1-2)
Transfer clutch
Front differential
Rear planetery gear
Drive pinion
Reduction gear

G3H0224

E: SECOND SPEED OF D, 3 OR 2 RANGE (D_2, 3_2, 2_2)

- During acceleration, the forward clutch is applied and connects the front planetary gear to the internal gear through the one-way clutch (3-4). Power is transmitted from the input shaft to the rear sun gear, turning the rear planetary carrier (i.e. front internal gear).
Also, since the band brake is applied and the front sun gear is locked, the rear internal gear turns normally through the front planetary carrier and the forward clutch and one-way clutch (3-4) that are connected to that carrier. Thus, speed increases in proportion to the rotation of the rear internal gear compared with the first speed.
- Since the rear internal gear turns normally while coasting, the one-way clutch (3-4) is released and idles. Accordingly, reverse power is not transmitted to the engine and engine braking is not provided.
- During deceleration at "2" range, the overrunning clutch operates to check idling of the one-way clutch (3-4). Reverse power is transmitted to the engine, providing engine braking action.

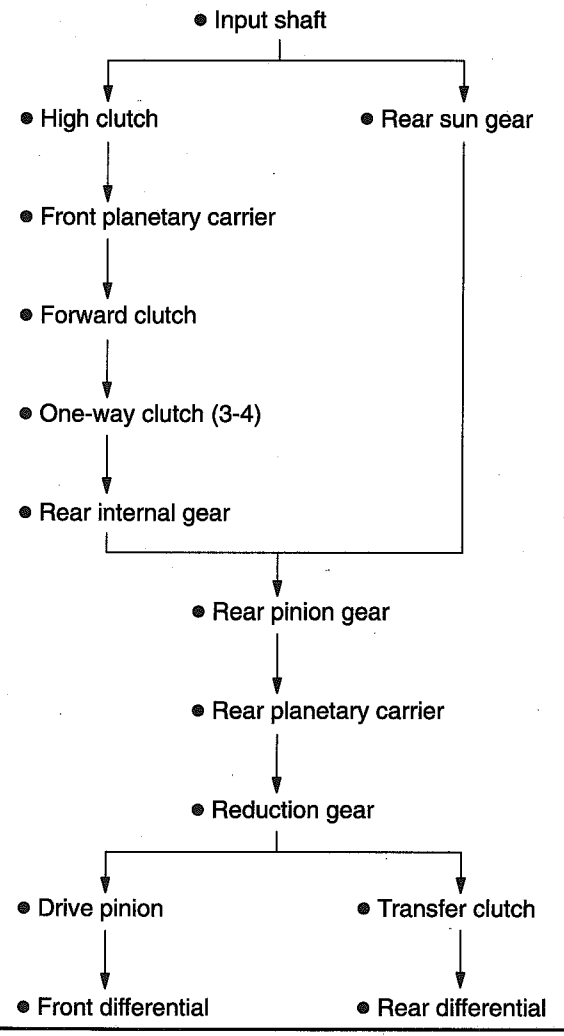
Operating condition of parts		Power flow (in acceleration)
• Brake band	: Applied	
• Forward clutch	: Applied	
• One-way clutch (3-4)	: Operating	
• Overrunning clutch ("2" range only)	: Applied	

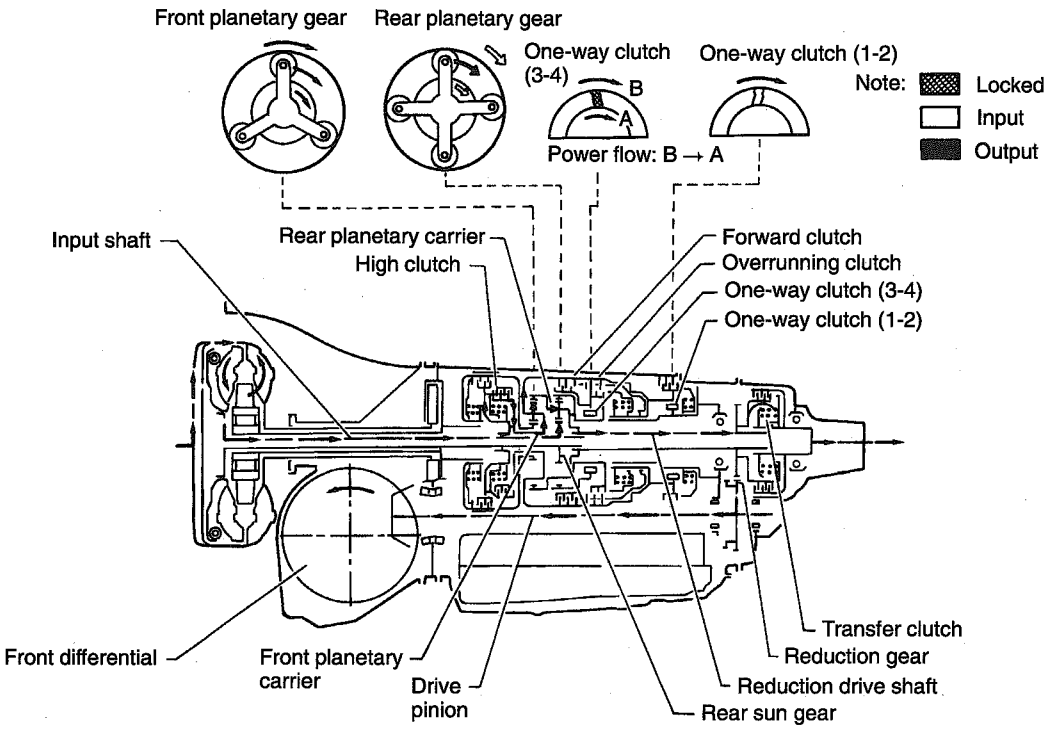

Front planetary gear
Rear planetary gear
One-way clutch (3-4)
One-way clutch (1-2)
B
A
Note:
Locked
Input
Output
Power flow:
B → A
Input shaft
Front pinion gear
Band brake
Front internal gear
Rear internal gear
Rear pinion gear
One-way clutch (3-4)
One-way clutch (1-2)
Front differential
Front sun gear
Drive pinion
Transfer clutch
Reduction gear
Reduction drive shaft
Rear sun gear

G3H0225

F: THIRD SPEED OF D OR 3 RANGE (D_3, 3_3)

- During acceleration, the high clutch is applied and the input shaft and front planetary carrier are connected. Further, the forward clutch and one-way clutch (3-4) operate to connect the front planetary carrier to the rear internal gear. Power is transmitted from the input shaft to the rear sun gear and rear internal gear. The rear sun gear and rear internal gear turn normally at the same speed. Therefore, the rear planetary carrier, rear sun gear and rear internal gear rotate normally as a unit.
- While coasting at "D", because the rear internal gear turns normally, the one-way clutch (3-4) idles in a released state. Thus, reverse power is not transmitted to the engine and engine braking action is not provided.
- During deceleration at "3", "2" or "1st" range, the overrunning clutch is applied and checks the reverse rotation of the one-way clutch (3-4). Thus, reverse power is transmitted to the engine and engine braking is performed.

Operating condition of parts	Power flow (in acceleration)
• High clutch : Applied • Forward clutch : Applied • One-way clutch (3-4) : Operating • Overrunning clutch ("3", "2" and "1st" ranges only) : Applied	


Front planetary gear
Rear planetary gear
One-way clutch (3-4)
B
A
One-way clutch (1-2)
Note:
Locked
Input
Output
Power flow: B → A
Input shaft
Rear planetary carrier
High clutch
Forward clutch
Overrunning clutch
One-way clutch (3-4)
One-way clutch (1-2)
Front differential
Front planetary carrier
Drive pinion
Transfer clutch
Reduction gear
Reduction drive shaft
Rear sun gear

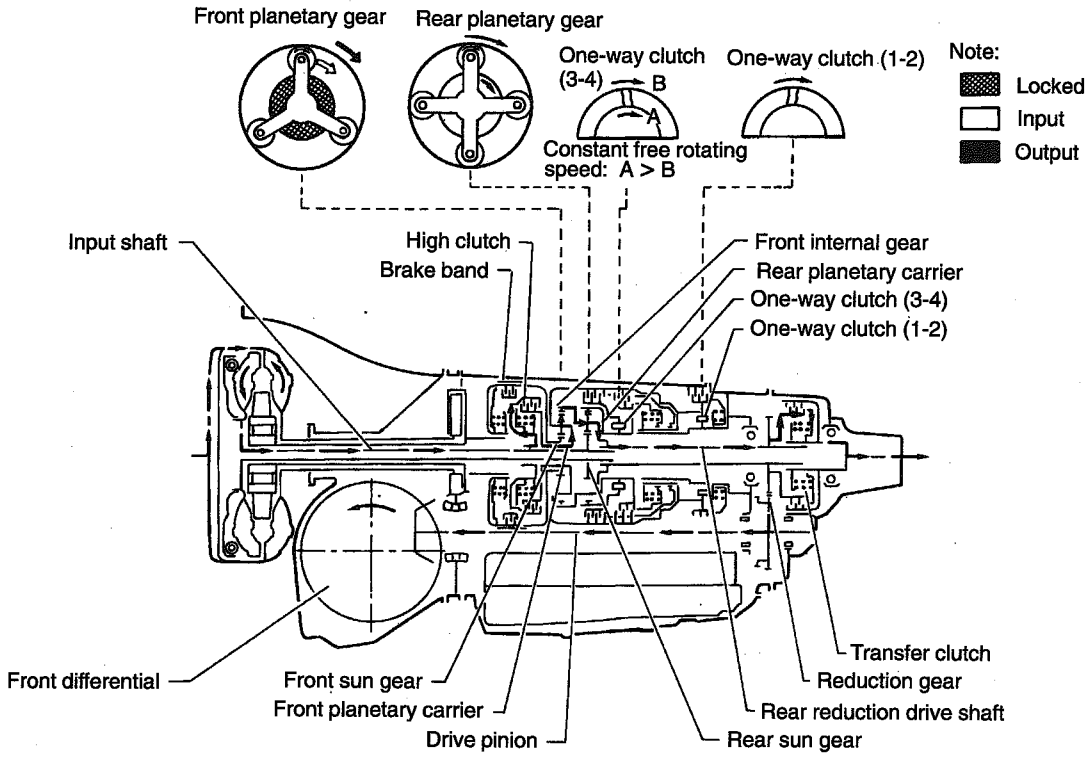
G3H0226

G: FOURTH SPEED (D_4) OF D RANGE

• During acceleration, the high clutch is applied and connects the input shaft to the front planetary carrier. Also, the forward clutch is applied, but it runs idle due to the one-way clutch (3-4) and takes no part in power transmission. Power is transmitted from the input shaft to the front planetary carrier by the function of the high clutch.
When the front planetary carrier turns normally, because the front sun gear is held-stationary by the brake band, the speed of the front internal gear increases and is delivered to the meshing reduction drive shaft in normal rotation.

• While coasting, because power transmission does not go through the one-way clutch, reverse power is transmitted to the engine and engine braking is performed.

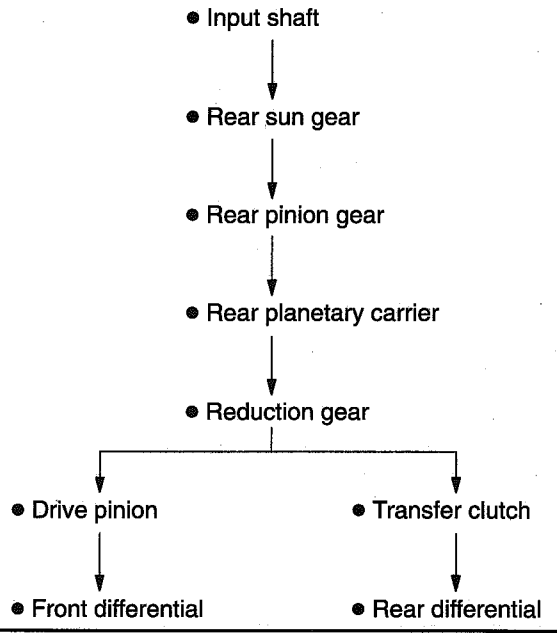
Operating condition of parts		Power flow (in acceleration)
• High clutch	: Applied	• Input shaft ↓ • High clutch ↓ • Front planetary carrier ↓ • Front pinion gear ↓ • Front internal gear ↓ • Rear planetary carrier ↓ • Reduction drive shaft ↓ • Reduction gear ↓ ↓ • Drive pinion • Transfer clutch ↓ ↓ • Front differential • Rear differential
• Brake band	: Contracted	
• Forward clutch (Takes no part in power transmission.)	: Applied	

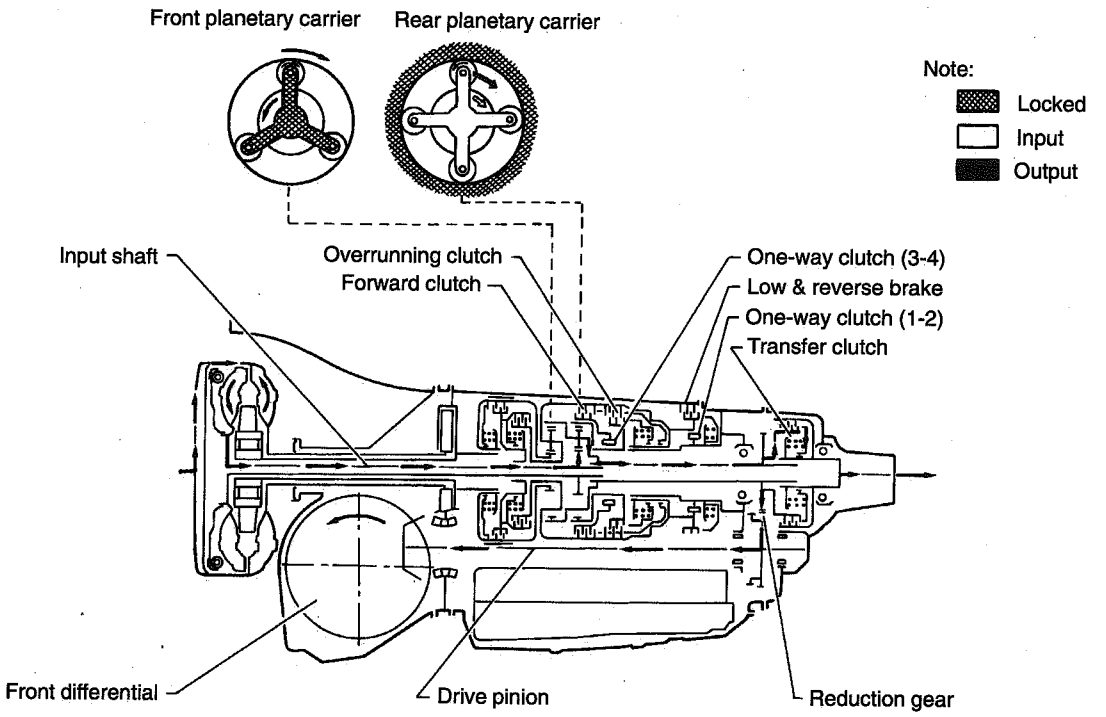

Front planetary gear
Rear planetary gear
One-way clutch (3-4)
B
A
One-way clutch (1-2)
Constant free rotating speed: A > B
Note:
Locked
Input
Output
Input shaft
High clutch
Brake band
Front internal gear
Rear planetary carrier
One-way clutch (3-4)
One-way clutch (1-2)
Front differential
Front sun gear
Front planetary carrier
Drive pinion
Rear sun gear
Rear reduction drive shaft
Reduction gear
Transfer clutch

G3H0227

H: FIRST SPEED OF 1 RANGE

- During acceleration, the forward clutch and overrunning clutch are applied and the front planetary carrier and rear internal gear are connected. Also, the low & reverse brake is applied so that the front planetary carrier and internal gear remain stationary.
The power flow is the same as in the first speed of "D", "3" and "2" range (except for the following points) and engine braking is performed.
- The low & reverse brake operates in place of the one-way clutch (1-2) and locks the rear internal gear.
- In coasting and deceleration, low & reverse brake and overrunning clutch are operating, so that reverse power is transmitted to the engine and engine braking action is provided.

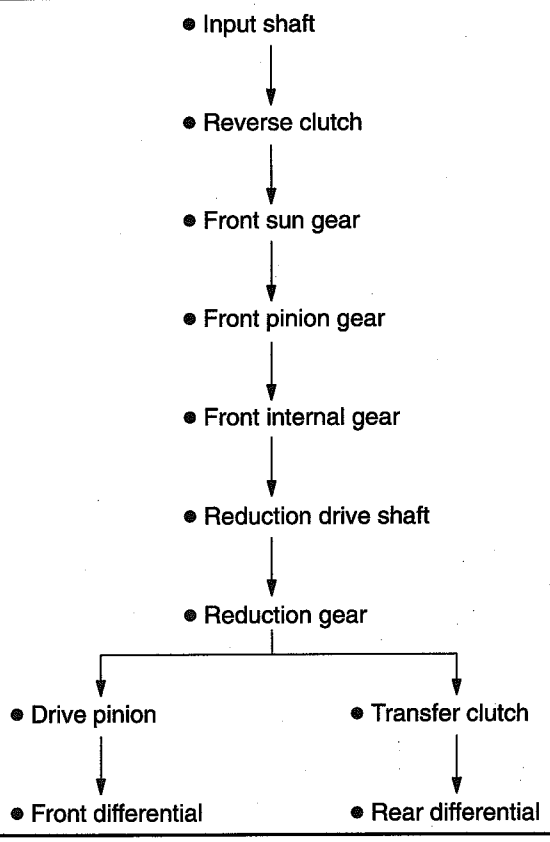
Operating condition of parts		Power flow (in acceleration)
• Forward clutch	: Applied	
• One-way clutch (3-4)	: Applied (in acceleration)	
• Overrunning clutch	: Applied	
• Low & reverse brake	: Operating	

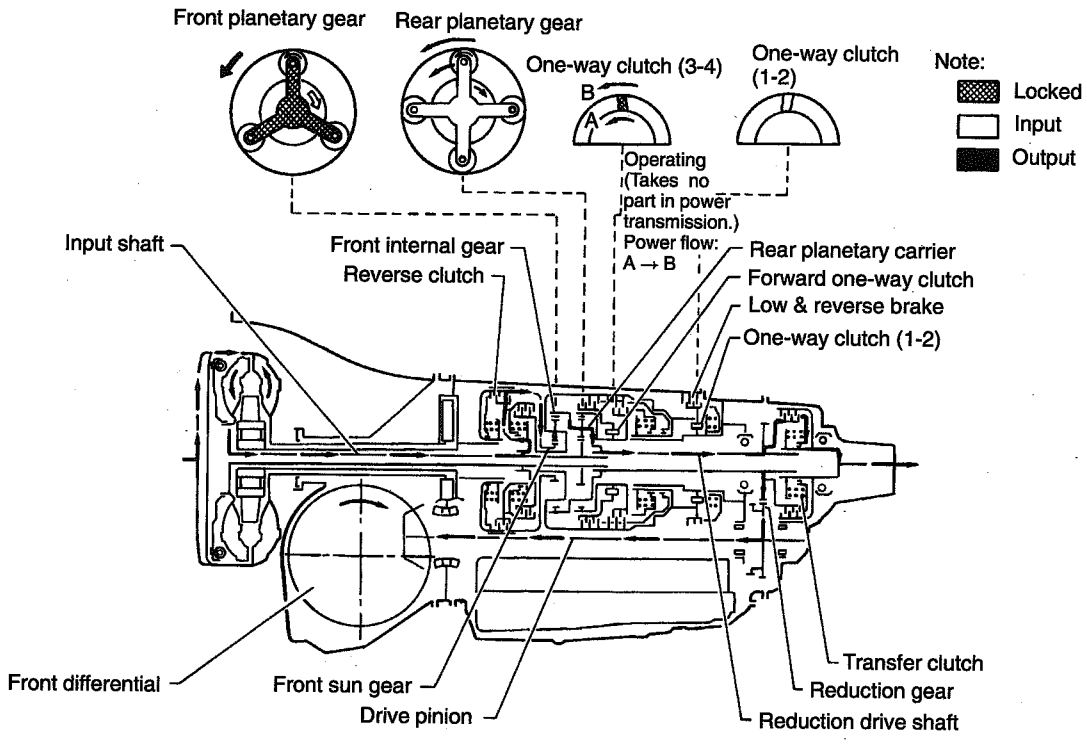

Front planetary carrier
Rear planetary carrier
Note:
Locked
Input
Output
Input shaft
Overrunning clutch
Forward clutch
One-way clutch (3-4)
Low & reverse brake
One-way clutch (1-2)
Transfer clutch
Front differential
Drive pinion
Reduction gear

G3H0228

I: R RANGE

The reverse clutch is applied and power is transmitted from the input shaft through the reverse clutch to the front sun gear. Also, the low & reverse brake operates to lock the front planetary carrier. Therefore, when the front sun gear turns normally, the front internal gear slows and reverses.

Operating condition of parts	Power flow
• Reverse clutch : Applied • Low & reverse brake : Operating	

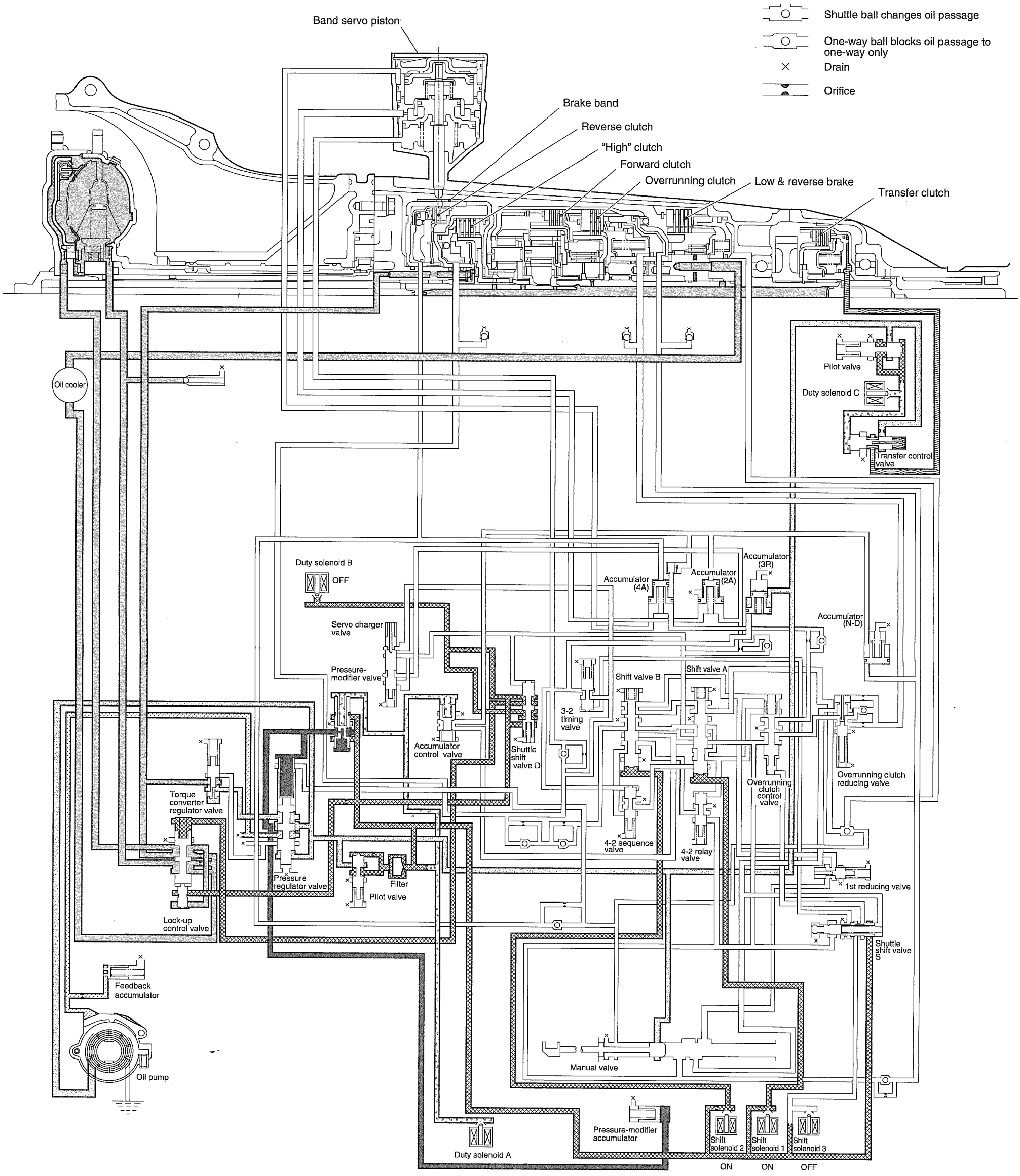

Front planetary gear
Rear planetary gear
One-way clutch (3-4)
B
A
One-way clutch (1-2)
Note:
Locked
Input
Output
Operating (Takes no part in power transmission.)
Power flow: A → B
Input shaft
Front internal gear
Reverse clutch
Rear planetary carrier
Forward one-way clutch
Low & reverse brake
One-way clutch (1-2)
Front differential
Front sun gear
Drive pinion
Transfer clutch
Reduction gear
Reduction drive shaft

G3H0229

MEMO

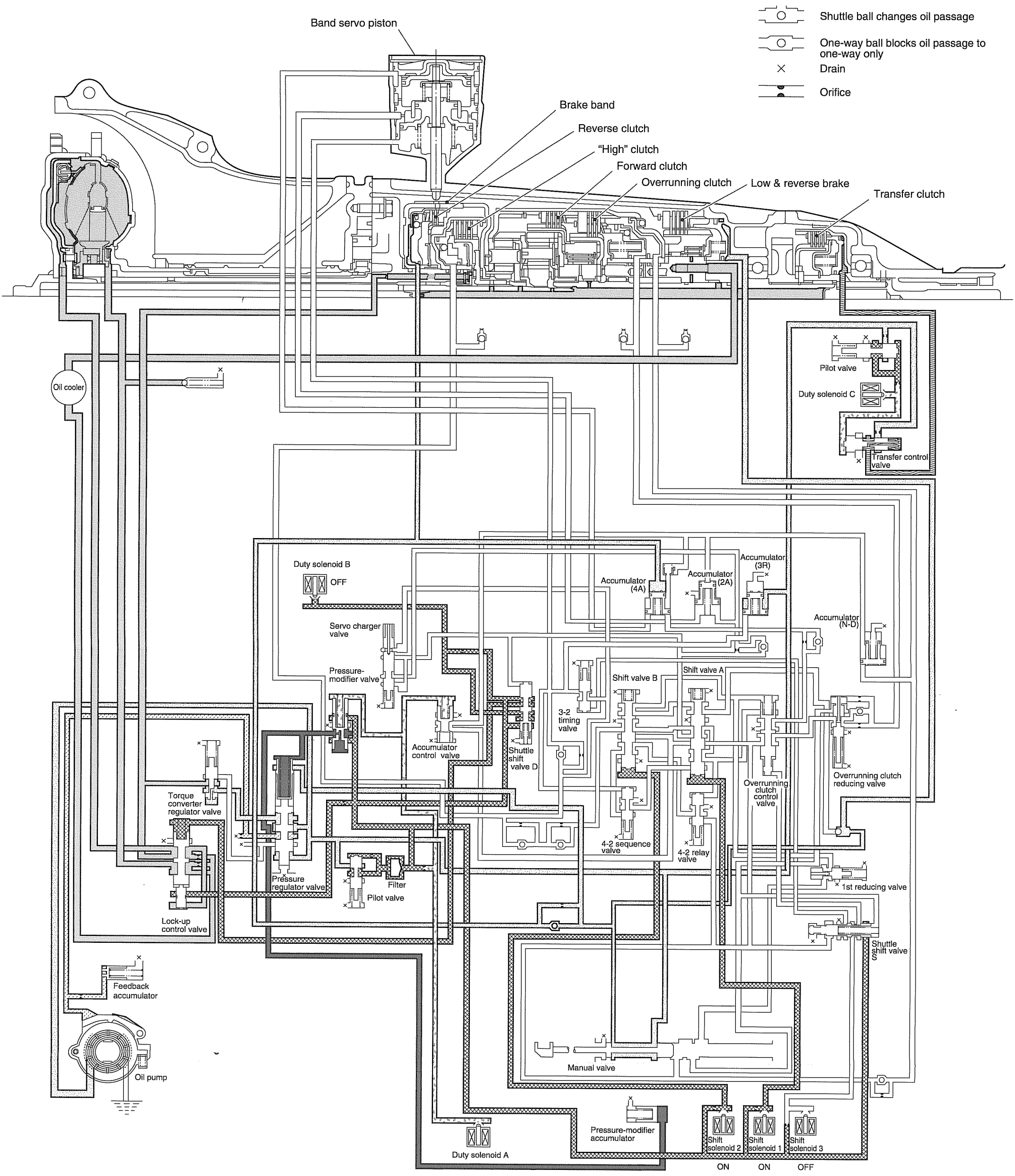
19. Schematic Drawing

A: N RANGE AND P RANGE



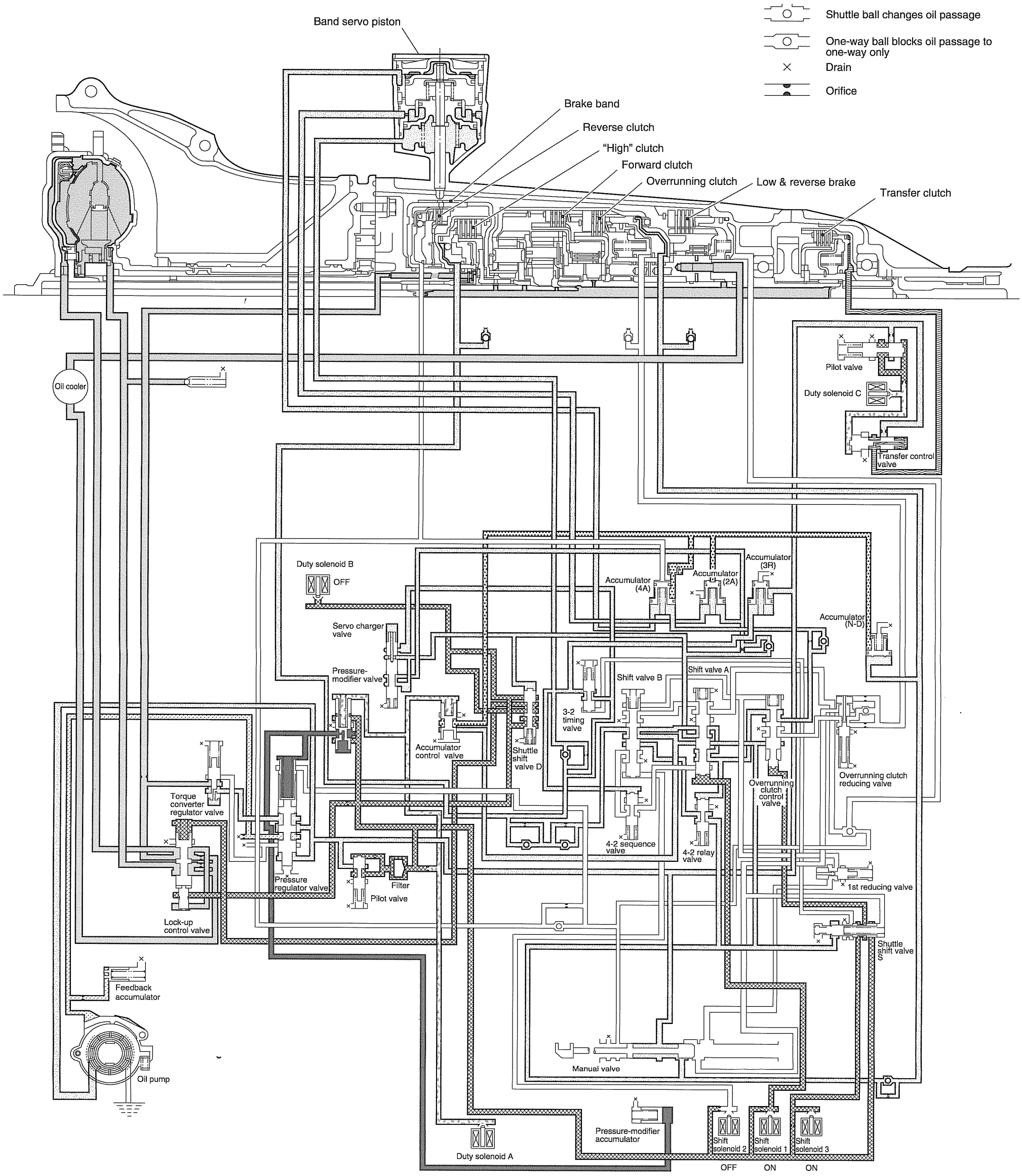
H3H1221

B: R RANGE



H3H1222

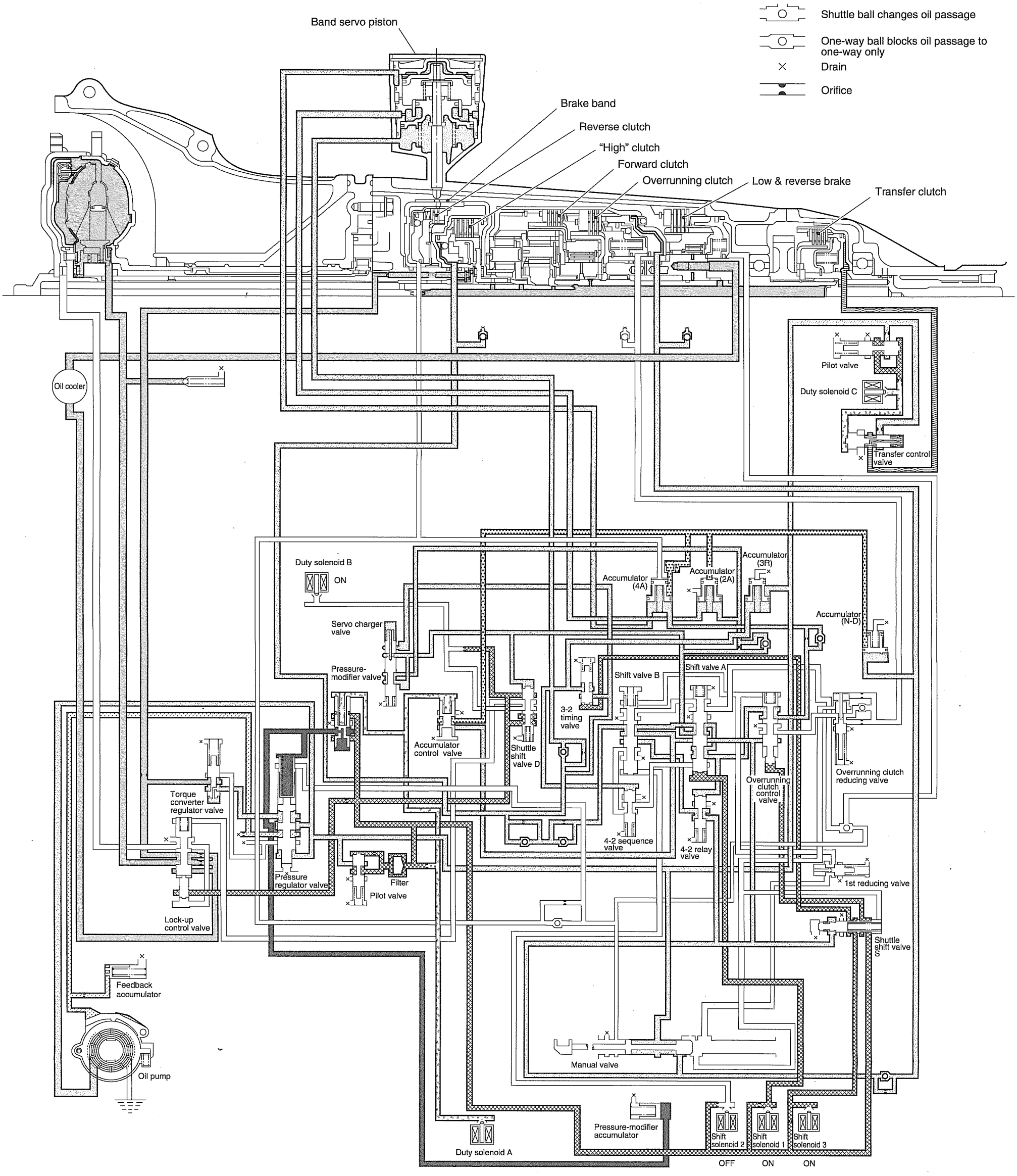
C: FOURTH SPEED OF D RANGE



Line pressure
Pressure-modifier pressure
Pilot pressure
Duty-A pressure
Duty-C pressure
Oil pump control pressure
Accumulator control pressure
Overrunning clutch pressure
"1" reducing pressure
Transfer clutch pressure
Torque converter pressure
Cooler pressure
Lubricant pressure

H3H1223

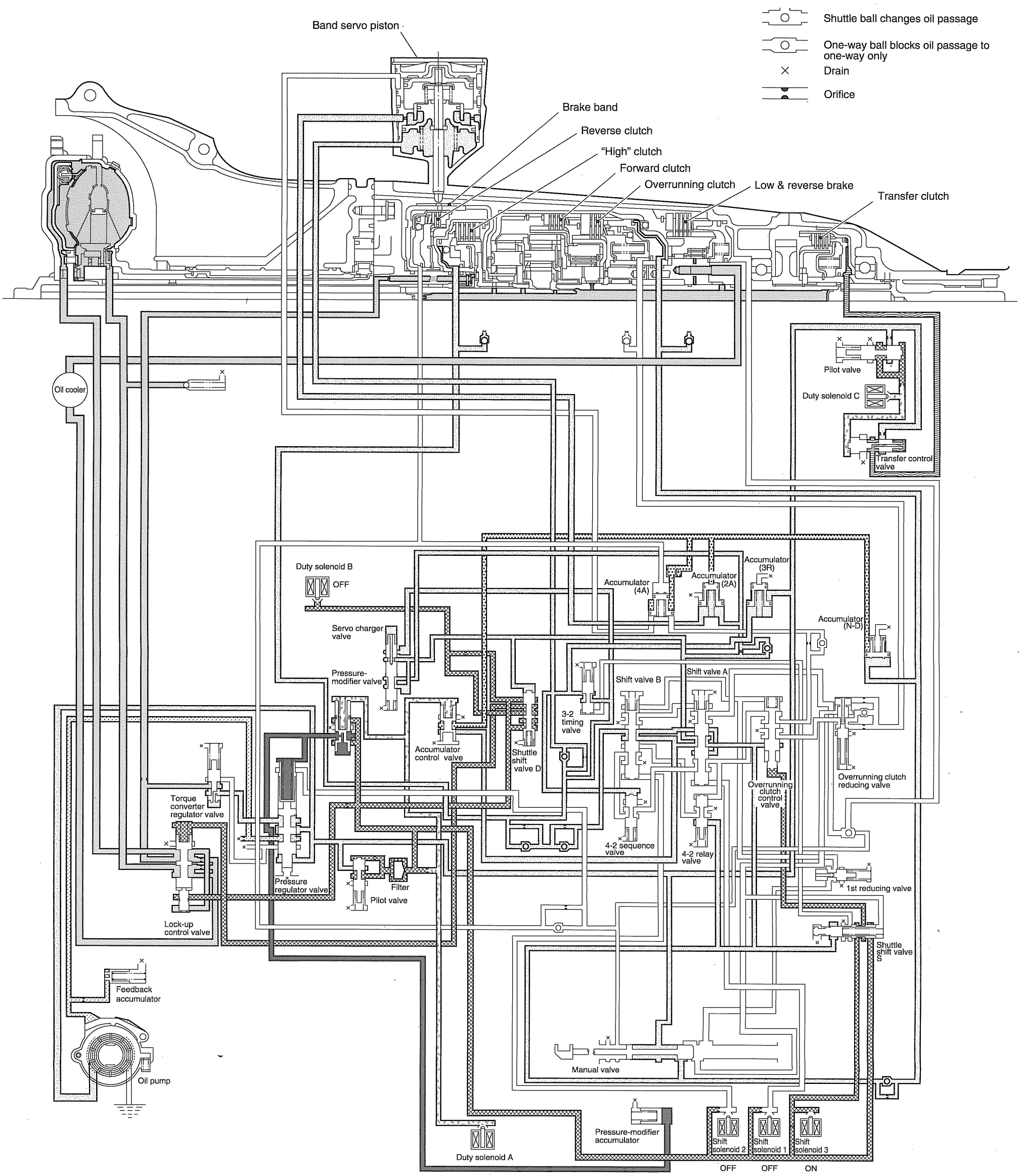
D: FOURTH SPEED OF D RANGE (LOCK-UP)



Line pressure
Pressure-modifier pressure
Pilot pressure
Duty-A pressure
Duty-C pressure
Oil pump control pressure
Accumulator control pressure
Overrunning clutch pressure
"1" reducing pressure
Transfer clutch pressure
Torque converter pressure
Cooler pressure
Lubricant pressure

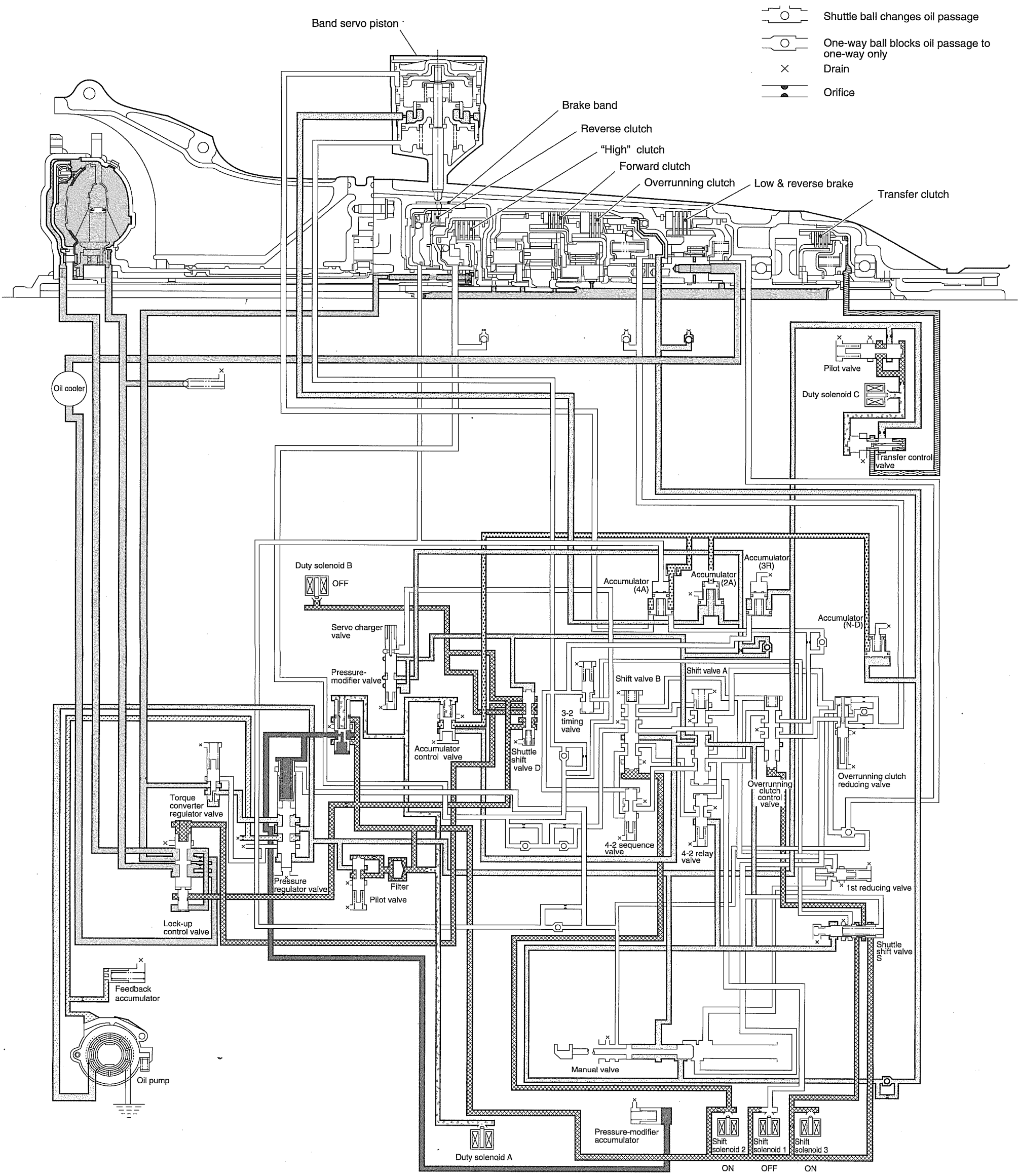
H3H1224

E: THIRD SPEED OF D OR 3 RANGE



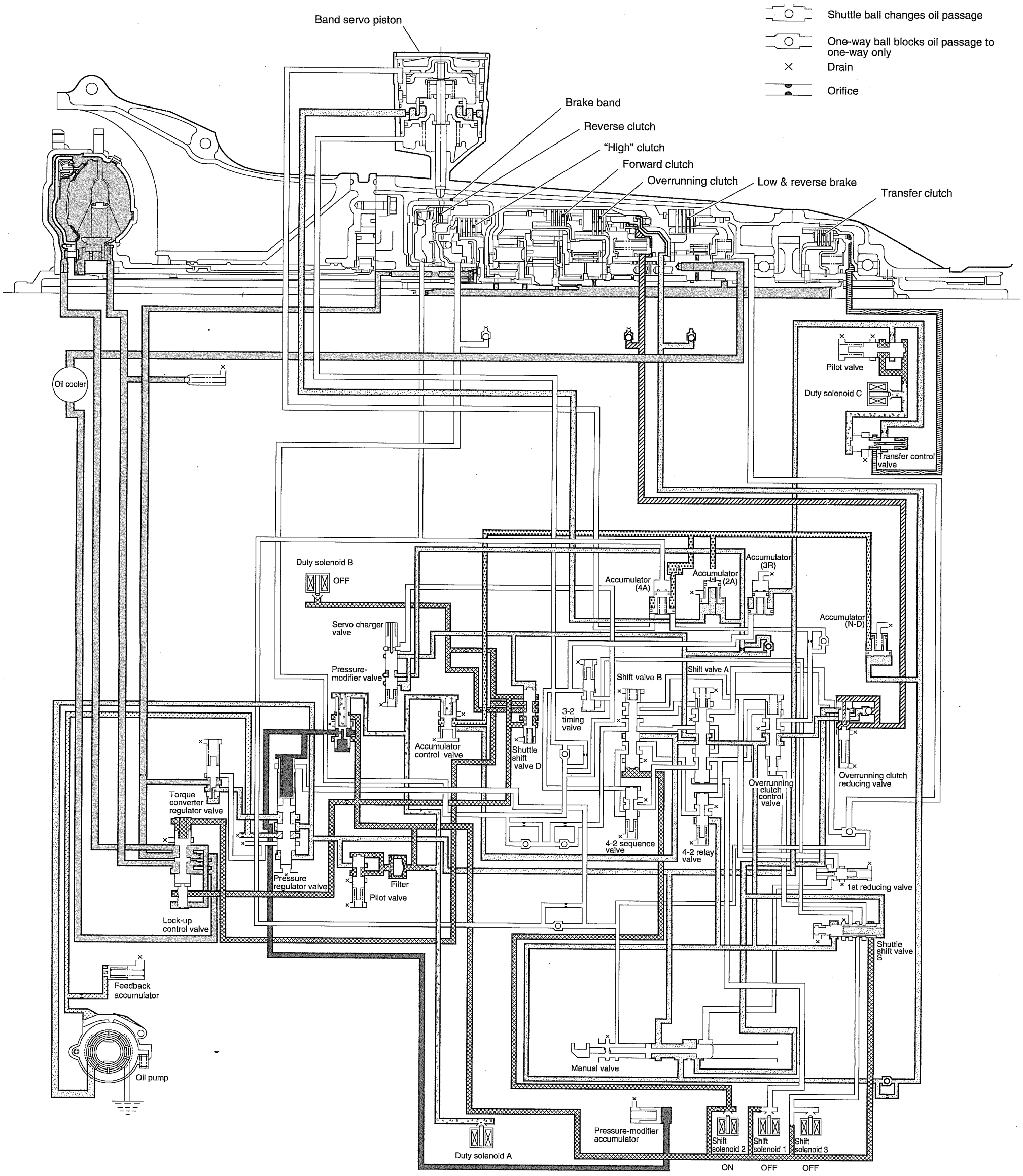
H3H1225

F: SECOND SPEED OF D OR 3 RANGE



H3H1226

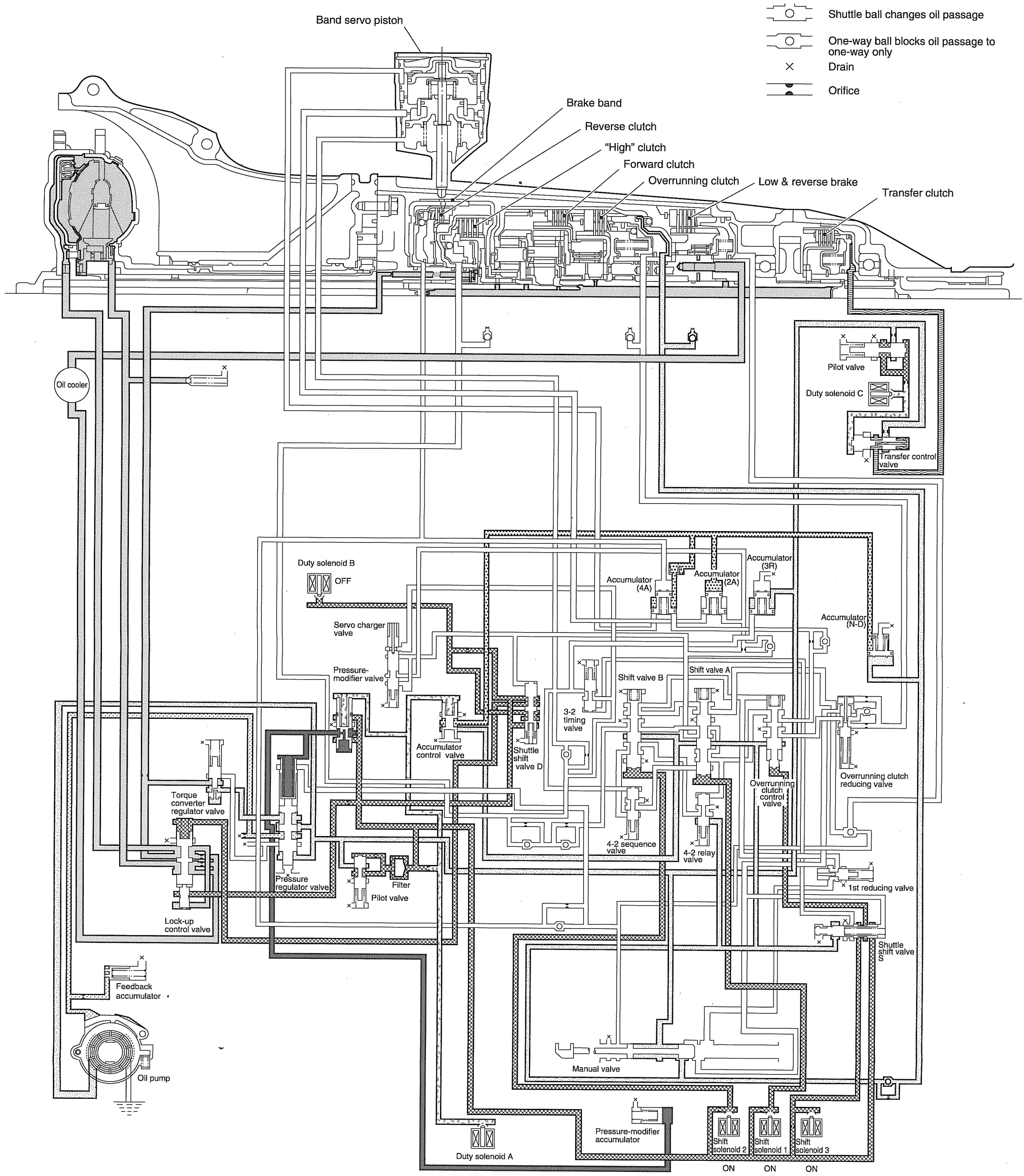
G: SECOND SPEED OF 2 RANGE



Line pressure
Pressure-modifier pressure
Pilot pressure
Duty-A pressure
Duty-C pressure
Oil pump control pressure
Accumulator control pressure
Overrunning clutch pressure
"1" reducing pressure
Transfer clutch pressure
Torque converter pressure
Cooler pressure
Lubricant pressure

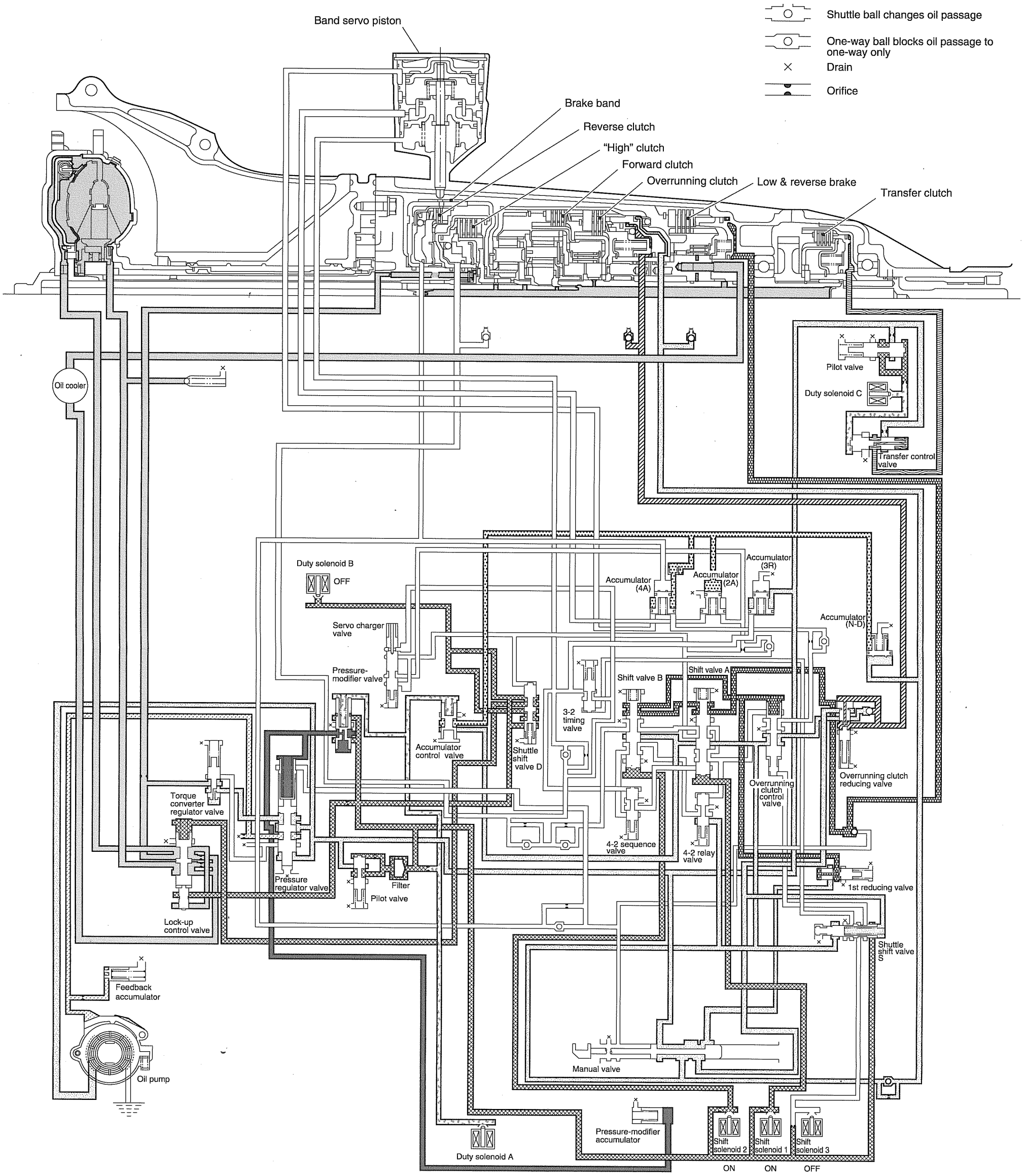
H3H1227

H: FIRST SPEED OF D OR 3 RANGE



H3H1228

I: FIRST SPEED OF 1 RANGE



- Line pressure
- Pressure-modifier pressure
- Pilot pressure
- Duty-A pressure
  Duty-C pressure
- Oil pump control pressure
- Accumulator control pressure
- Overrunning clutch pressure
- "1" reducing pressure
- Transfer clutch pressure
- Torque converter pressure
  Cooler pressure
  Lubricant pressure

H3H1229

20. Final Reduction Gears

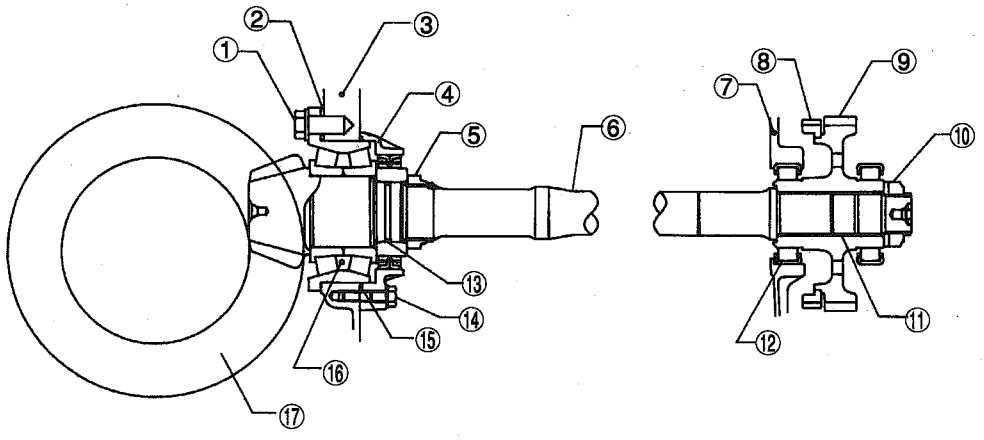
A: GENERAL

The hypoid drive gear is mounted to the cast iron oil pump housing by double taper roller bearings. The hypoid driven gear and the differential are mounted to the differential case. Both ends rotate and are supported by taper roller bearings in the converter case.

B: HYPOID GEAR

The front end of the drive pinion shaft is supported by the double-taper roller bearing on the oil pump housing. The rear end is supported by two roller bearings on the transmission case and extension case. The double-taper roller bearing is preloaded by tightening the lock nut to a specified torque via the collar. The tooth contact of the hypoid gear is adjusted by changing the shim thickness between the double-taper roller bearing flange and oil pump housing.

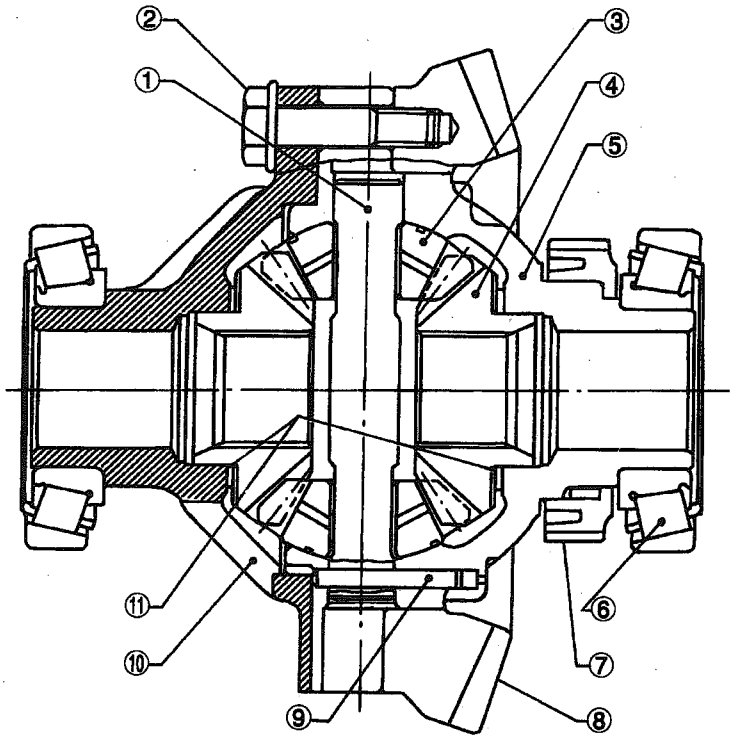
The rear end of the drive pinion shaft is spline-fitted to the reduction driven gear, which is secured with a lock nut. The external helical spline has some lead, and the reduction driven gear is force-fitted to this shaft end.



B3H0494B

① Bolt
② Shim
③ Oil pump housing
④ Oil seal retainer
⑤ Lock nut
⑥ Drive pinion shaft
⑦ Transmission case
⑧ Parking gear
⑨ Reduction driven gear
⑩ Lock nut
⑪ Spline
⑫ Roller bearing
⑬ O-ring
⑭ Bolt
⑮ O-ring
⑯ Double taper roller bearing
⑰ Hypoid drive gear

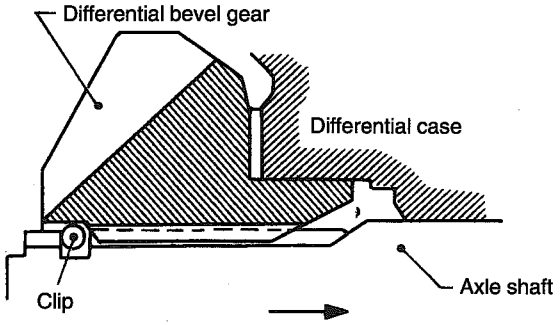
C: DIFFERENTIAL GEAR



G3H0741

① Pinion shaft
② Bolt
③ Differential bevel pinion
④ Differential bevel gear
⑤ Right-hand differential case
⑥ Taper roller bearing
⑦ Speedometer drive gear
⑧ Hypoid drive gear
⑨ Straight pin
⑩ Left-hand differential case
⑪ Selective washer

The differential bevel gear is locked to the axle shaft by a clip.

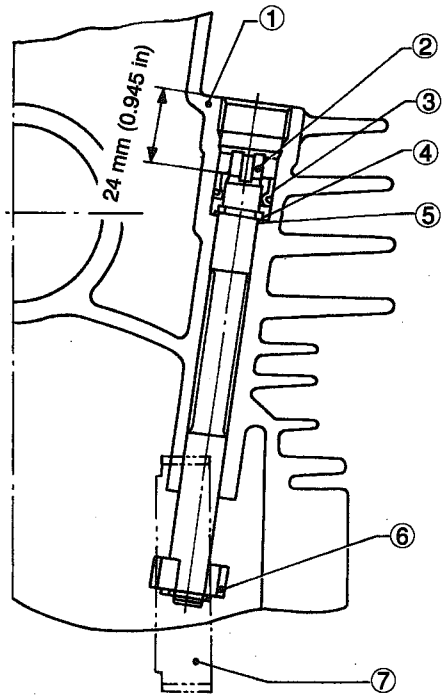


Pull-off load in the direction of arrow: 1,177 N (120 kg, 265 lb)

G3H0197

D: SPEEDOMETER GEAR

The speedometer drive gear is mounted directly on the differential case, and the speedometer driven gear is mounted to the torque converter case. With this arrangement, the speedometer drive and driven gears are properly lubricated.



G3H0198

① Converter case
② Speedometer shaft
③ Oil seal
④ Snap ring
⑤ Washer
⑥ Speedometer driven gear
⑦ Speedometer drive gear

21. AWD Transfer System

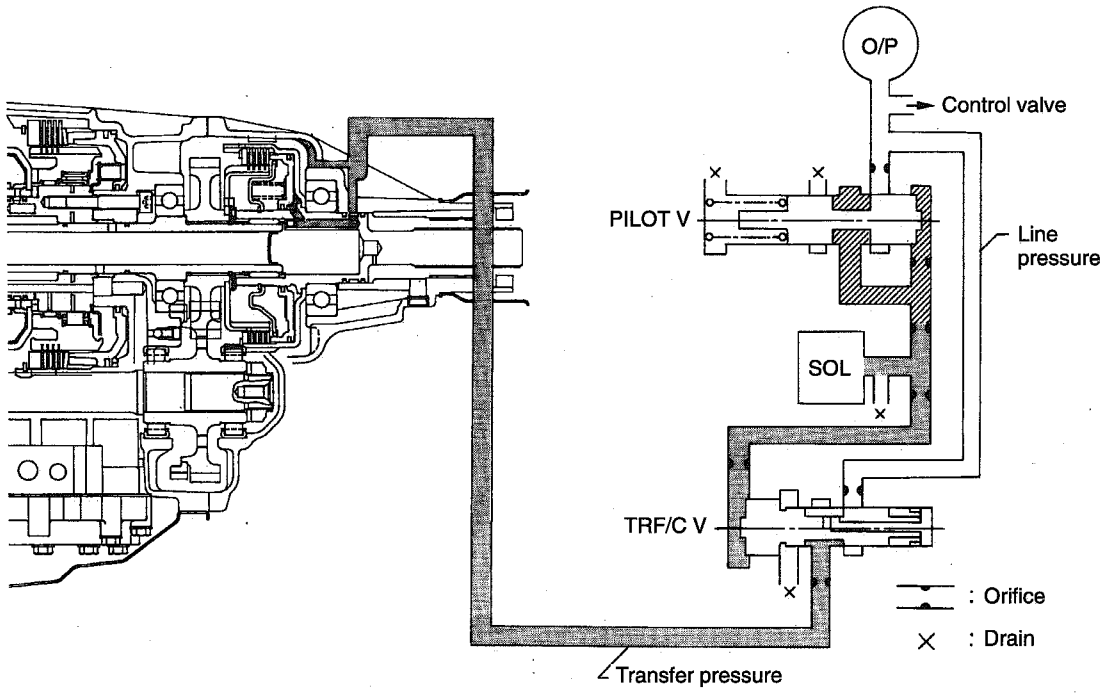
A: OUTLINE

This is the electronically controlled MP-T (multi-plate transfer) type AWD transfer system, originally designed for SUBARU, consisting of a transfer hydraulic pressure control unit incorporating a vehicle speed sensor, control unit, and duty solenoid and a transfer clutch (hydraulic multi-plate clutch).

The control unit stores optimum transfer clutch torque data for a variety of driving conditions. When actual driving conditions (vehicle speed, throttle opening, gear range, wheel slip, etc.) are detected by various sensors, the control unit selects a duty ratio most suitable to the given condition from the memory. It then controls the operation of the transfer clutch by means of the hydraulic pressure which controls the duty solenoid and provides optimum rear torque distribution.

Various sensors and the control unit also serve as gear shift control, lock-up control and hydraulic pressure control.

The AWD transfer unit is housed in the extension case together with the bearing, rear drive shaft, etc.



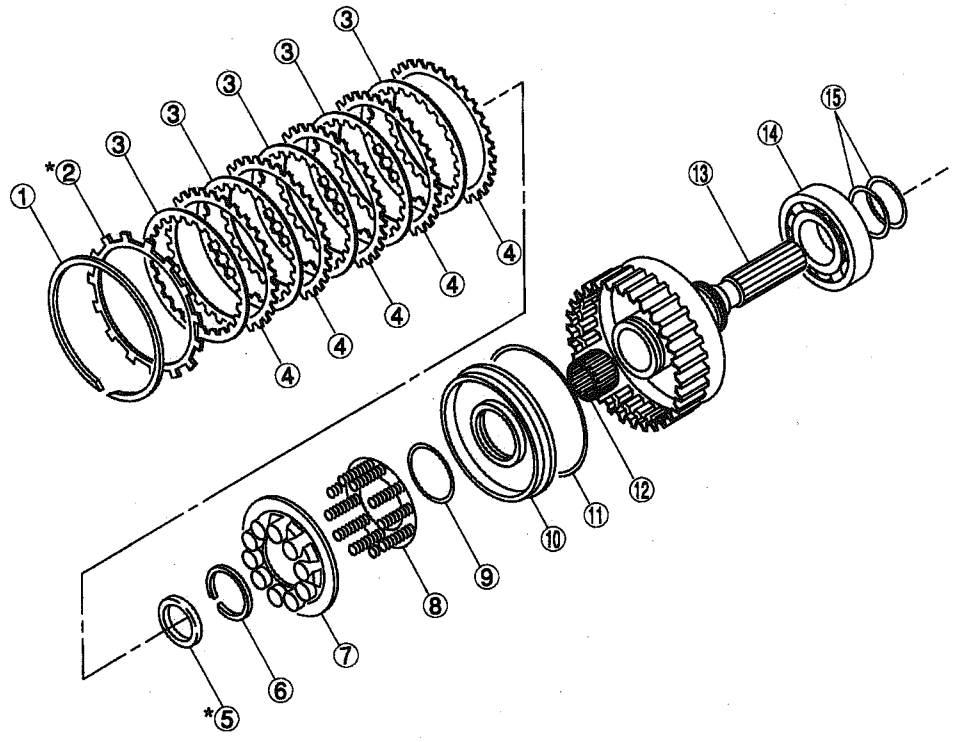
G3H0201

B: TRANSFER CLUTCH (MULTI-PLATE CLUTCH)

The transfer unit consists of a hydraulic multi-plate clutch and a transfer hydraulic control system incorporating a duty solenoid valve. It is housed in the extension case together with the bearings, rear drive shaft, etc.

The transmission control unit has duty ratios memorized in advance according to running conditions. In order to obtain the optimum transfer torque for the running condition, the oil pressure that is applied to the drive plates and driven plates is controlled by applying oil pressure to the transfer piston from the transfer oil pressure control device including the duty solenoid.

Also, the transfer clutch drum and rear drive shaft are joined to each other by welding. The rear drive shaft has drilled oil passages for transfer clutch control and also for lubrication of extension bushing and ball bearing in it.



B3H0297A

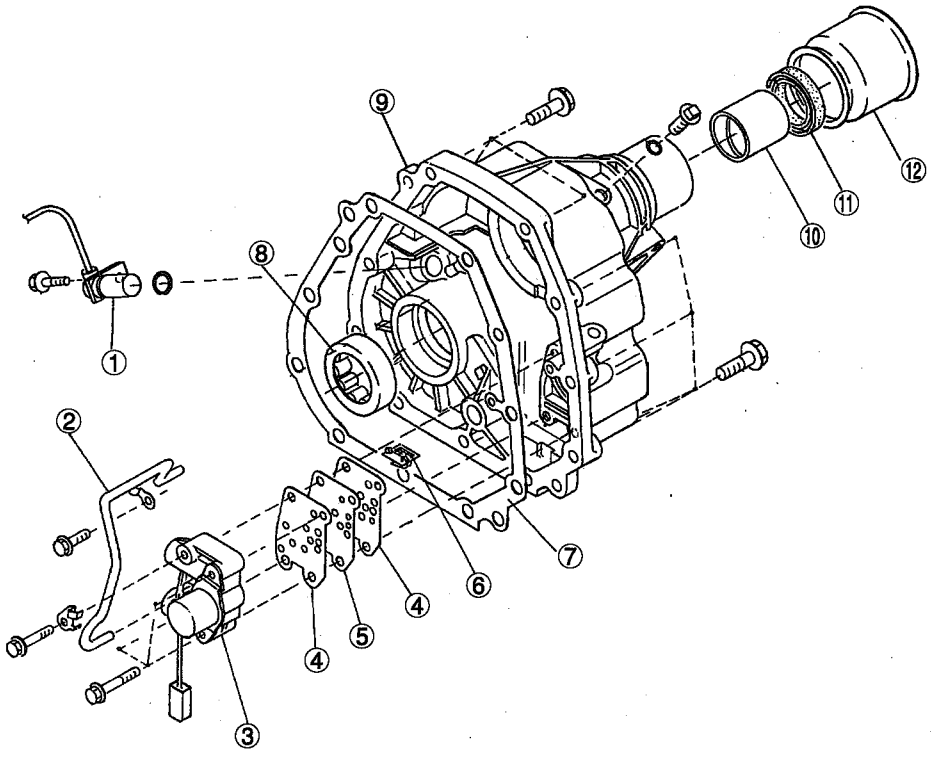
*: Selective parts
① Snap ring
*② Pressure plate
③ Drive plate
④ Driven plate
*⑤ Thrust needle bearing
⑥ Snap ring
⑦ Transfer piston seal
⑧ Spring retainer
⑨ Lathe cut seal ring
⑩ Transfer clutch piston
⑪ Lathe cut seal ring
⑫ Needle bearing
⑬ Rear drive shaft
⑭ Ball bearing
⑮ Seal ring

C: TRANSFER OIL PRESSURE CONTROL DEVICE

The transfer valve body is bolted to the side of the extension case through two gaskets and one separate plate.

Operating oil for the transfer valve body is routed to the extension case through a pipe connecting the discharge circuit of the oil pump on the front of the transmission case to the rear of the case. It is then delivered to the oil pressure circuit provided in the plane on which the transfer valve body is mounted.

This line pressure is reduced to a fixed level by the pilot valve, and becomes the initial pressure of the duty solenoid C. Line pressure is also delivered to the transfer control valve where it is regulated by duty pressure variations to control the oil pressure so that optimum rear torque distribution is obtained according to running conditions.



G3H0742

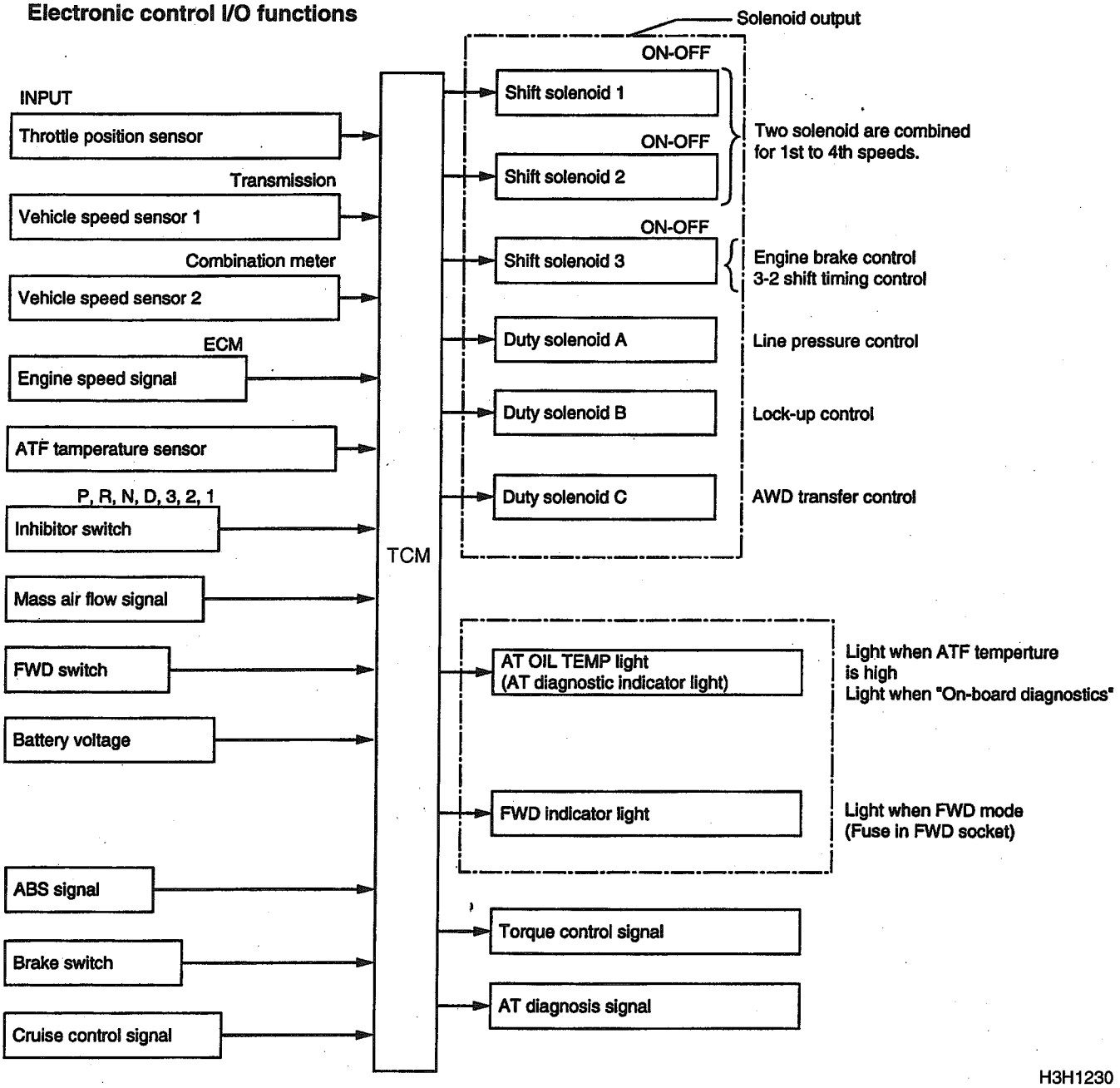
① Vehicle speed sensor 1 (AWD)
② Transfer pipe
③ Duty sol.C (transfer)
④ Gasket
⑤ Plate
⑥ Filter
⑦ Gasket
⑧ Roller bearing
⑨ Extension case
⑩ Bushing
⑪ Oil seal
⑫ Dust seal

22. Electronic-Hydraulic Control System

A: GENERAL

The electronic-hydraulic control system consists of various sensors and switches, a transmission control module (TCM) and the hydraulic controller including solenoid valves. The system controls the transmission proper including shift control, lock-up control, overrunning clutch control, line pressure control, auto pattern select control and shift timing control. It also controls the AWD transfer clutch. In other words, the system detects various operating conditions from various input signals and sends output signals to shift solenoids 1, 2 and 3 and duty solenoids A, B and C (a total of six solenoids).

Electronic control I/O functions



H3H1230

B: INPUT SIGNAL

Signal name	Major function
Throttle position sensor	Detects throttle position and determines shift point, line pressure and lock-up vehicle speed according to engine load.
Vehicle speed sensor 1 (mounted to transmission)	Detects vehicle speed. This signal is used to control shifting, lock-up, line pressure, and transfer clutch.
Vehicle speed sensor 2 (mounted to transmission)	Used to control transfer clutch and as backup in case of failure of vehicle speed sensor 1.
Engine speed	Detects engine speed. This signal is used for lock-up clutch smooth, control at lock-up.
Inhibitor switch	Used to determine shifting and line pressure for respective ranges "P", "R", "N", "D", "3", "2" and "1".
ATF temperature sensor	Detects ATF temperature. This signal is used for inhibition of lock-up, release of OD and detection of ATF temperature.
FWD switch	Used to change the mode from AWD to FWD. Also used to adapt the vehicle to FWD tester roller. Changeover from AWD to FWD can be accomplished by inserting a fuse into the fuse holder.
ABS signal	When ABS is operating, to optimize ABS control, transfer clutch torque is controlled to eliminate the influence of engine braking and reduce the degree of coupling between front and rear wheels.
Cruise control signal	Detects operation of cruise control, and expands "4th" operating range.
Mass air flow signal	Used to determine line pressure of shift change.

C: OUTPUT SIGNAL

Signal name	Function
Shift solenoids 1, 2	Controls shift stage by turning solenoid ON/OFF. Relationship between solenoid operation and shifting stage is shown in Table below. When shifting, timing is controlled for each solenoid to reduce shock.
Shift solenoid 3 (Overrunning clutch)	Controls 3-2 shift timing and overrunning clutch operation. Shift timing is controlled by controlling release speed of oil pressure to reduce shock while downshifting. The overrunning clutch is controlled so that it will operate during coasting to apply engine brake.
Duty solenoid A (line pressure)	Regulates the line pressure according to driving conditions.
Duty solenoid B (lock-up)	Regulates the hydraulic pressure of the lock-up clutch and operates in three modes (open, smooth and lock-up).
Duty solenoid C (transfer pressure)	Regulates the hydraulic pressure of the transfer clutch and controls the driving force to the rear drive shaft.
AT OIL TEMP light	Light when ATF becomes hot (exceeds a set temperature level). This light is also used for "on-board diagnostics".
Torque control signal	Reduces engine torque at racing select and gear change.

D: CONTROL ITEM

Control item			Description of control
Transmission control	Gear shift control	Normal shift control ● Normal pattern ● Power pattern	Upshifting and downshifting are set for each range, gear position and pattern according to throttle position and vehicle speed.
		Control with ABS	Gear is locked in 3rd position when ABS signal enters.
		ATF low temperature control	Shifting into 4th gear is prevented when ATF temperature is below the preset value.
	Automatic pattern select control	Power pattern control	Power pattern is selected when throttle opening change speed exceeds the preset value.
		Normal pattern control	When throttle opening is less than the preset value normal pattern is resumed.
	Lock-up control	Normal lock-up control	Lock-up ON/OFF is set for 4th gear, gear position, and pattern according to throttle position and vehicle speed. (Basically lock-up is OFF during gear shifting.)
		Smooth control	Smooth lock-up is performed when lock-up is switched on.
	Overrunning clutch control	Engine brake control	Overrunning clutch is operated according to range, vehicle speed, order to apply engine brake properly.
		3-2 timing control	This control speeds the release of servo piston pressure 3R when shifting down from 3rd to 2nd, thereby preventing engine racing.
	Line pressure control	Ordinary control	Line pressure is regulated according to throttle position, vehicle speed and range signals.
		Shifting control	Line pressure is regulated when shifting to lessen shifting shock.
		Starting control	Line pressure is at a minimum so as to reduce engine cranking load.
	Shift timing control	Shift step control	ON/OFF timing for shift solenoid is controlled.
		Lock-up control	When shifting, the lock-up clutch is temporarily released.
		Overrunning clutch control (3rd to 2nd: small throttle opening in coasting, 2nd to 1st: in coasting)	When shifting down, the overrunning clutch is temporarily disconnected to reduce shifting shock.
		Line pressure control	When shifting, line pressure is controlled to the optimum level so as to reduce shifting shock.
AWD transfer clutch control	Ordinary transfer control		Transfer oil pressure is regulated according to the throttle position angle and vehicle speed.
	1st range control		Transfer oil pressure is increased.
	Slip control		Immediately after detecting a slip, transfer oil pressure is controlled to the same pressure as 1st range. (This control is canceled if V ≧ 60 km/h (37 MPH), or when throttle is closed fully.)
	Control it turns		Transfer oil pressure is reduced after detecting the turn.
	ABS control		Transfer oil pressure is adjusted to set level immediately after reception of ABS signal.

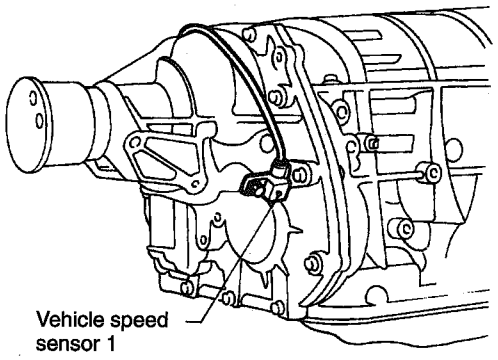
E: THROTTLE POSITION SENSOR

The throttle position sensor provides electrical signals corresponding to the throttle position. The throttle position and accelerator depression speed are detected by this throttle position sensor output.

F: VEHICLE SPEED SENSOR 1

The vehicle speed sensor 1 (output shaft rotation sensor) is mounted to the extension case (from the outside of the case). The sensor outputs a pulse signal which is transmitted to the TCM where it is converted to vehicle speed.

The transfer clutch drum is connected directly to the rear wheel driving propeller shaft. Vehicle speed sensor 1 on the AWD model defects rear-wheel speed.



G3H0231

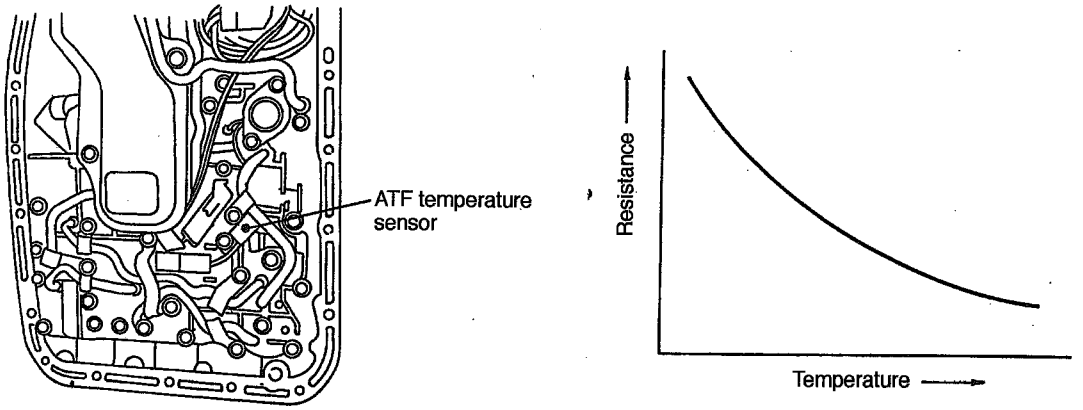
G: VEHICLE SPEED SENSOR 2 (BUILT IN METER)

The vehicle speed sensor 2 is in the combination meter.

The reed switch nearby speedometer is turned to ON or OFF by rotating of the speedometer inner shaft and that pulse signal is transmitted to the TCM.

H: ATF TEMPERATURE SENSOR

This sensor is mounted to the control valve in the transmission. It detects temperature change as an analog electrical signal. The output characteristics of the sensor are shown below.



H4H1411A

I: INHIBITOR SWITCH

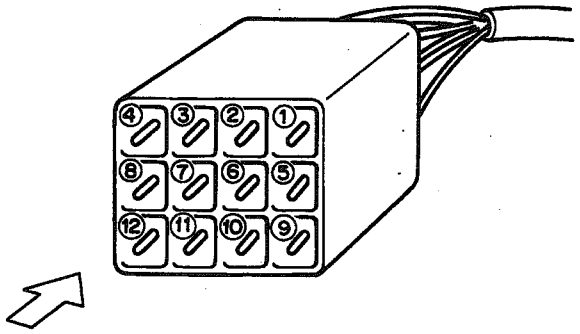
The inhibitor switch assures safety when starting the engine. This switch is mounted on the right side of the transmission case, and is operated by the range selector lever.

When the selector lever is set to "P" or "N", the electrical circuit is connected in the inhibitor switch and the starter circuit is energized for cracking the engine.

When the selector lever is set to "R", "D", "3", "2", or "1" range, the electrical circuit is disconnected in the inhibitor switch. Hence engine cranking is disabled. In the "R" range, the backup light circuit is completed in the switch, and the backup lights come on.

In addition to the above function, the inhibitor switch incorporates a circuit for detecting the selected range position and sending the range signal to the TCM.

Inhibitor switch side connector



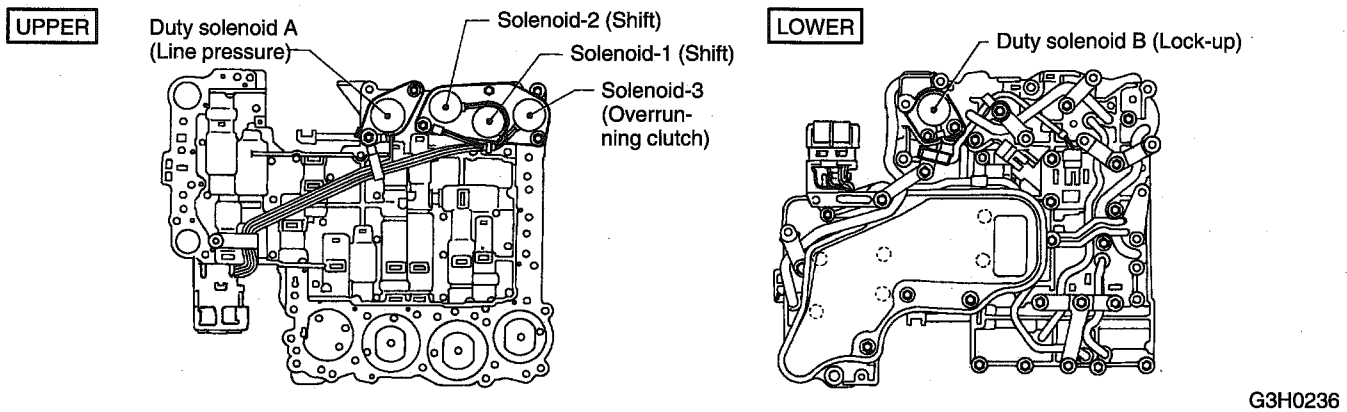
B3H0016A

PIN NO.	4	3	2	1	8	7	6	5	12	11	10	9
CODE POSITION	B	Y	Br	YG	W	BY	R	GW	BY	BW	BW	RW
P	○	○							○	○		
R	○		○								○	○
N	○			○					○	○		
D	○				○							
3	○					○						
2	○						○					
1	○							○				

G3H0997

J: SHIFT SOLENOID 1 AND 2

These solenoids are mounted to the control valve. They are turned ON or OFF according to signals sent from the TCM. The gear positions are changed according to the ON and OFF condition of these solenoids.



G3H0236

K: SHIFT SOLENOID 3 (OVERRUNNING CLUTCH)

This solenoid is also mounted to the control valve. It is turned ON or OFF according to the signal sent from the TCM. This operation controls the engagement and disengagement of the overrunning clutch.

L: DUTY SOLENOID A (LINE PRESSURE)

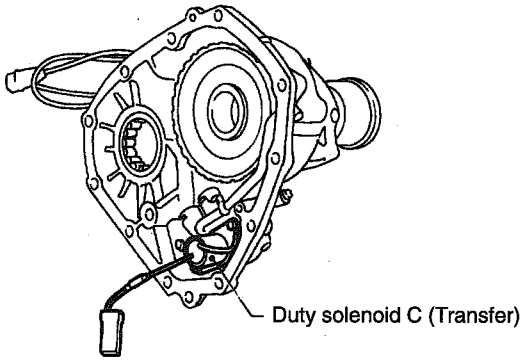
This solenoid is mounted to the control valve, and its duty ratio is controlled by the signal sent from TCM. This solenoid then controls the pressure modifier valve and pressure regulator valve to adjust the line pressure to an optimum pressure level suitable for operating conditions.

M: DUTY SOLENOID B (LOCK-UP)

This solenoid is mounted to the control valve, and its duty ratio is controlled by the signal sent from TCM. It then controls the lock-up control valve to provide smooth engagement and disengagement of the lock-up clutch.

N: DUTY SOLENOID C (TRANSFER)

This solenoid is mounted to the transfer control valve on the side of extension case, and its duty ratio is controlled by the signal sent from TCM. It then controls the transfer control valve for controlling the transfer clutch hydraulic oil pressure.



G3H0237

23. Transmission Control Module (TCM)

TCM receives various sensor signals and determines the running conditions of the vehicle. It then sends control signals to each solenoid according to the preset gearshift characteristic data, lock-up operation data, and transfer clutch torque data (duty ratio).

A: CONTROL SYSTEM

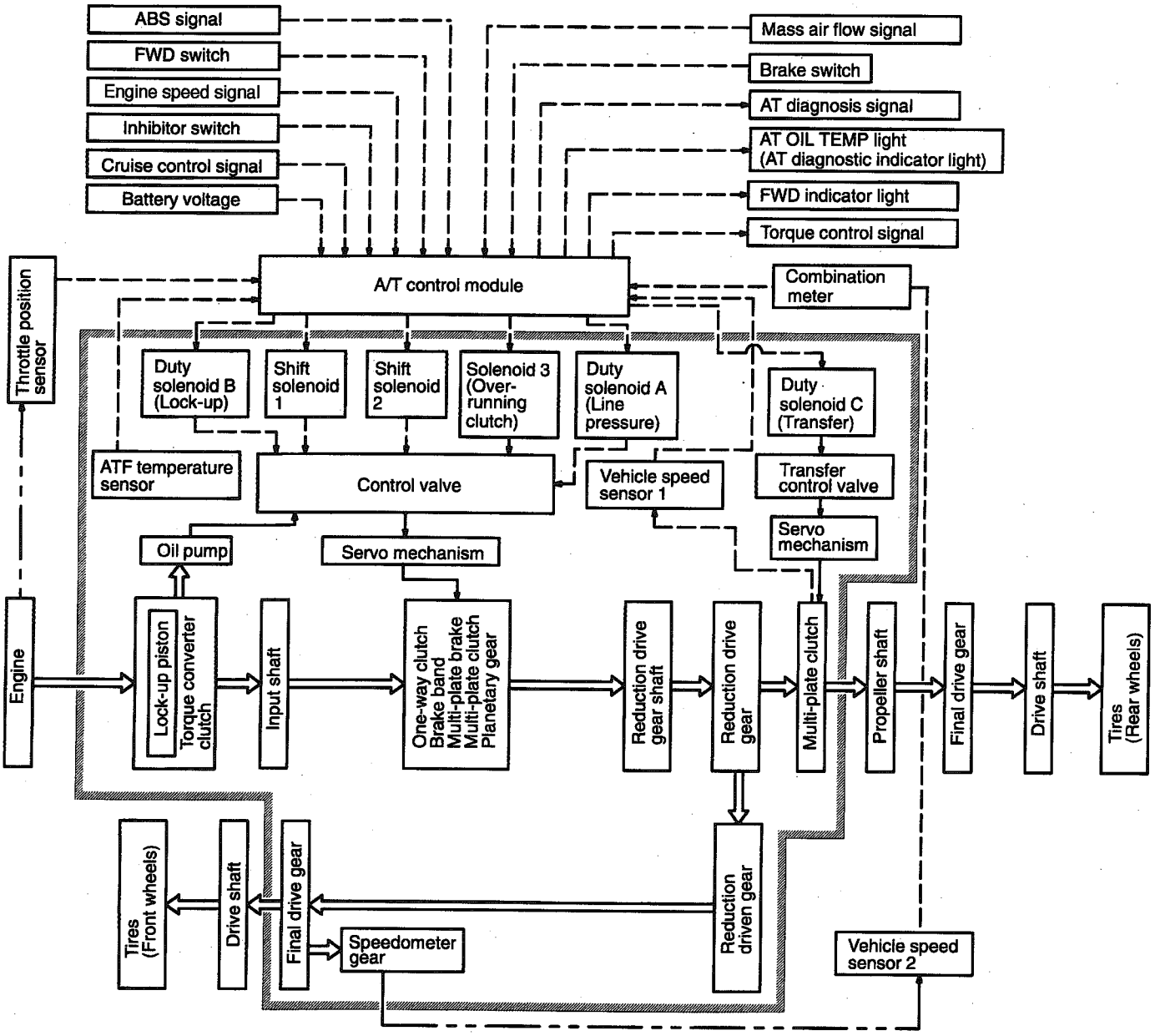
Input signal / Control item	Throttle position sensor	Vehicle speed sensor 1	Vehicle speed sensor 2	Engine speed (rpm)	ATF temperature sensor	Inhibitor switch	FWD switch	ABS signal	Cruise control signal	Brake switch
1. Shift control (1) Ordinary shift control	○	○	○	○		○				
(2) ABS operation control	○							○		○
(3) Hydrauric oil temperature control					○					
(4) Cruise control signal									○	
(5) Low oil temperature control					○					
2. Lock-up control (1) Ordinary lock-up control	○	○	○	○		○			○	
(2) Smooth control		○	○	○						
(3) Low oil temperature control					○					
3. Overrunning clutch control (1) Engine brake control	○	○	○			○			○	
(2) 3-2 timing control	○	○	○							
4. Line-pressure control (1) Ordinary line pressure control	○	○	○	○	○	○				
(2) Shifting control	○	○	○			○				
(3) Starting control				○	○					
5. Shift pattern select control (1) Power drive pattern control	○	○	○		○	○				
(2) Return to normal drive pattern	○	○	○			○				

B3H0599

Input signal / Control item	Throttle position sensor	Vehicle speed sensor 1	Vehicle speed sensor 2	Engine speed (rpm)	ATF temperature sensor	Inhibitor switch	FWD switch	ABS signal	Cruise control signal	Brake switch
6. Shift timing control (1) Shift range control	○					○				
(2) Lock-up control	○					○				○
(3) Overrunning clutch control	○					○				
(4) Line pressure control	○	○	○			○				
7. AWD transfer clutch control (1) Ordinary transfer control	○	○	○		○	○	○			
(2) 1st range control	○	○	○			○				
(3) Slip detection control	○	○	○							
(4) Steering control	○	○	○							
(5) ABS operating control	○							○		○

B3H0600

B: SYSTEM DIAGRAM



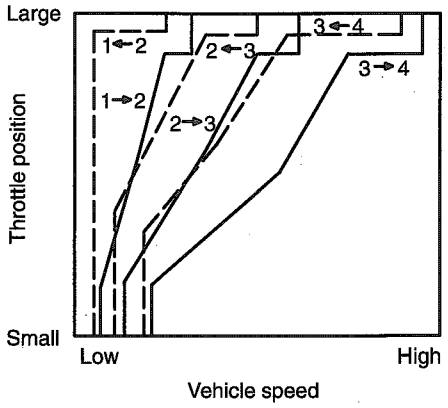
: Power transmitting route
: Hydraulic pressure control circuit
: Mechanical signal
: Electrical signal

B3H0507

C: SHIFT CONTROL

Gearshifting is controlled in response to driving conditions, according to the shift point characteristic data, as shown in the following diagram, stored in the TCM. Solenoids are operated at the proper time corresponding to the shift pattern, throttle position, and vehicle speed for smooth shifting.

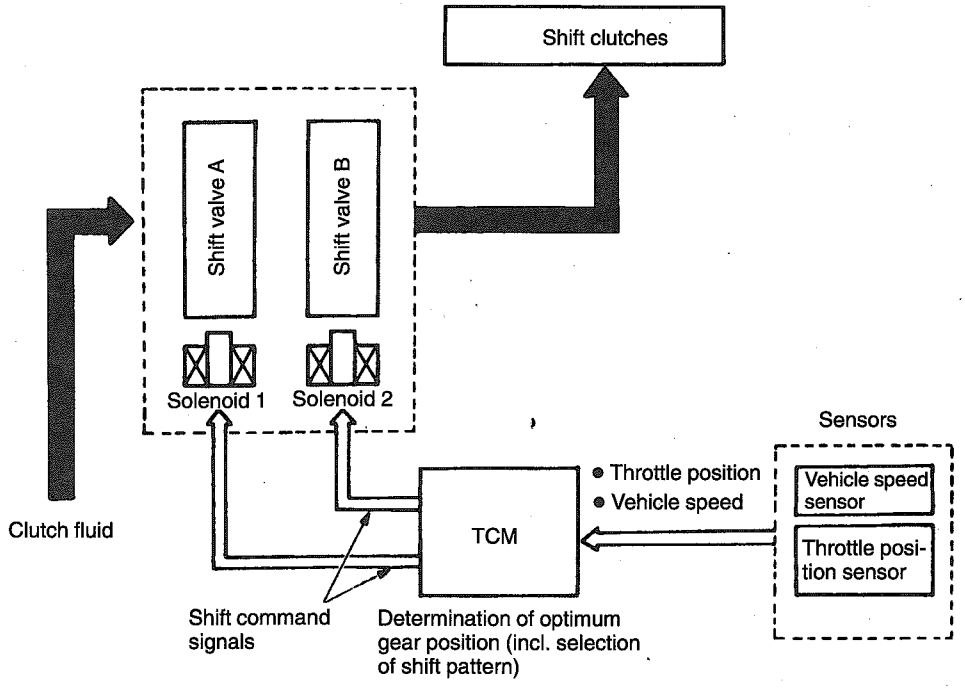
NOTE:
When oil temperature is below approximately 10°C (50°F), the vehicle cannot be shifted to the 4th range.



	Solenoid 1	Solenoid 2
1st	ON	ON
2nd	OFF	ON
3rd	OFF	OFF
4th	ON	OFF

G3H0752

- Control module activates both solenoids 1 and 2 in response to throttle and vehicle speed signals.
- Shift valve moves in response to solenoid operation, supplying/interrupting clutch pressure to the line.
- Gears are shifted by ON-OFF operation of both solenoids as indicated in Table.



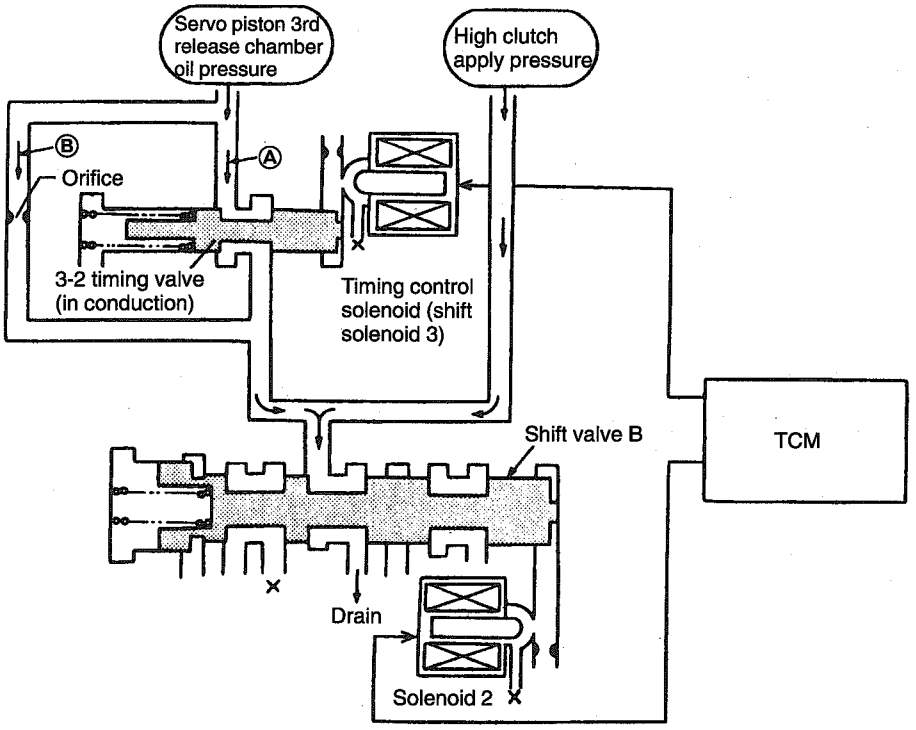
G3H0753

D: 3-2 TIMING CONTROL

When shifting from 3rd to 2nd, the high clutch is disengaged. At the same time, oil pressure (which releases the brake band) is also released from the servo piston 3rd release chamber (3R).

At this point, the servo piston moves to release oil pressure from the 3rd release chamber (3R) and apply oil pressure to the 2nd apply chamber. This causes the brake band to be applied. In other words, high clutch "release" and brake band "application" are properly timed by electronic control. This eliminates engine rev-up under no load or hesitation.

- When the 3-2 timing valve conducts, oil pressure applied to the 3rd release chamber is quickly released through passage Ⓐ.
- When the 3-2 timing valve does not conduct, oil pressure applied to the 3rd release chamber is slowly released through passage Ⓑ (provided with an orifice).



G3H0754

E: LOCK-UP CONTROL

The lock-up engaging and disengaging conditions are set for each gear shift range, gear position and shift pattern and correspond to the throttle position and vehicle speed, and the duty solenoid is electronically controlled by TCM controls the lock-up clutch. The lock-up clutch engagement and disengagement are controlled by the lock-up control valve.

<When engaging and disengaging>

The shuttle shift valve D is actuated by the hydraulic pressure from the shift valve A. It controls the position of the lock-up control valve for engaging or disengaging the lock-up clutch.

1. NON-LOCK-UP OPERATION (1ST, N, R, AND P RANGE)

Since no operating pressure is generated from the shift valve A, the shuttle shift valve D sets the lock-up control valve in the "disengaging" position.

The lock-up operating pressure (torque converter clutch regulator pressure) acts on the lock-up clutch disengaging circuit, while the engaging circuit communicates with the oil cooler circuit. Accordingly, the lock-up clutch is disengaged by the pressure difference.

2. LOCK-UP OPERATION (4TH SPEED OF D RANGE)

The operating pressure generated by the shift valve A is applied to the shuttle shift valve D, which pushes the lock-up control valve to the "engaging" position. Since the lock-up operating pressure is applied to the engaging side circuit while the disengaging circuit is drained, the lock-up clutch is engaged by the pressure difference.

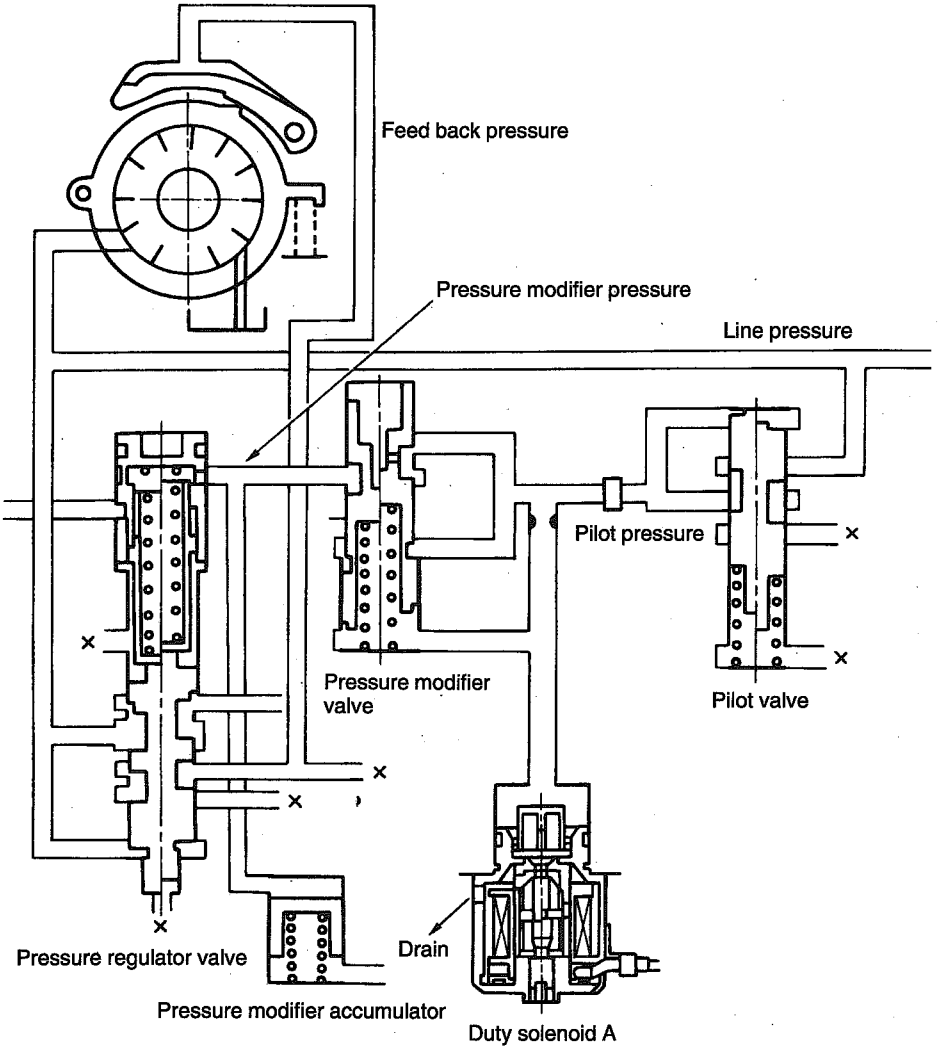
<Smooth control>

The duty solenoid B is controlled by the TCM and controls the operation of the lock-up control valve. Because the lock-up operating pressure is controlled by the lock-up control valve, the force applied to the lock-up clutch is controlled for smooth clutch operation.

When locking up, the clutch is set in the half-engaged state beforehand. After this, the lock-up operating pressure is gradually increased to achieve smooth locking up.

F: LINE-PRESSURE CONTROL

- The oil pump delivery pressure (line pressure) is regulated to the constant pilot pressure by the pilot valve.
- The pilot pressure applied to the pressure modifier valve is regulated by the line pressure controlling duty solenoid A and changed into the pressure modifier pressure.
- The pressure modifier valve is an auxiliary valve for the pressure regulator valve, and it creates a signal pressure (pressure modifier pressure) for regulating the line pressure to an optimum pressure corresponding to the driving conditions.
- This pressure modifier pressure is applied to the pressure regulator valve to control the oil pump delivery pressure.
- The delivery pressure of the oil pump is regulated to an appropriate pressure (line pressure) corresponding to the driving condition to reduce the loss in the oil pump driving time and acceleration shock.
- The pressure modifier pressure regulated by the pressure modifier valve is smoothed by the pressure modifier accumulator and pulsation in the line pressure is eliminated.



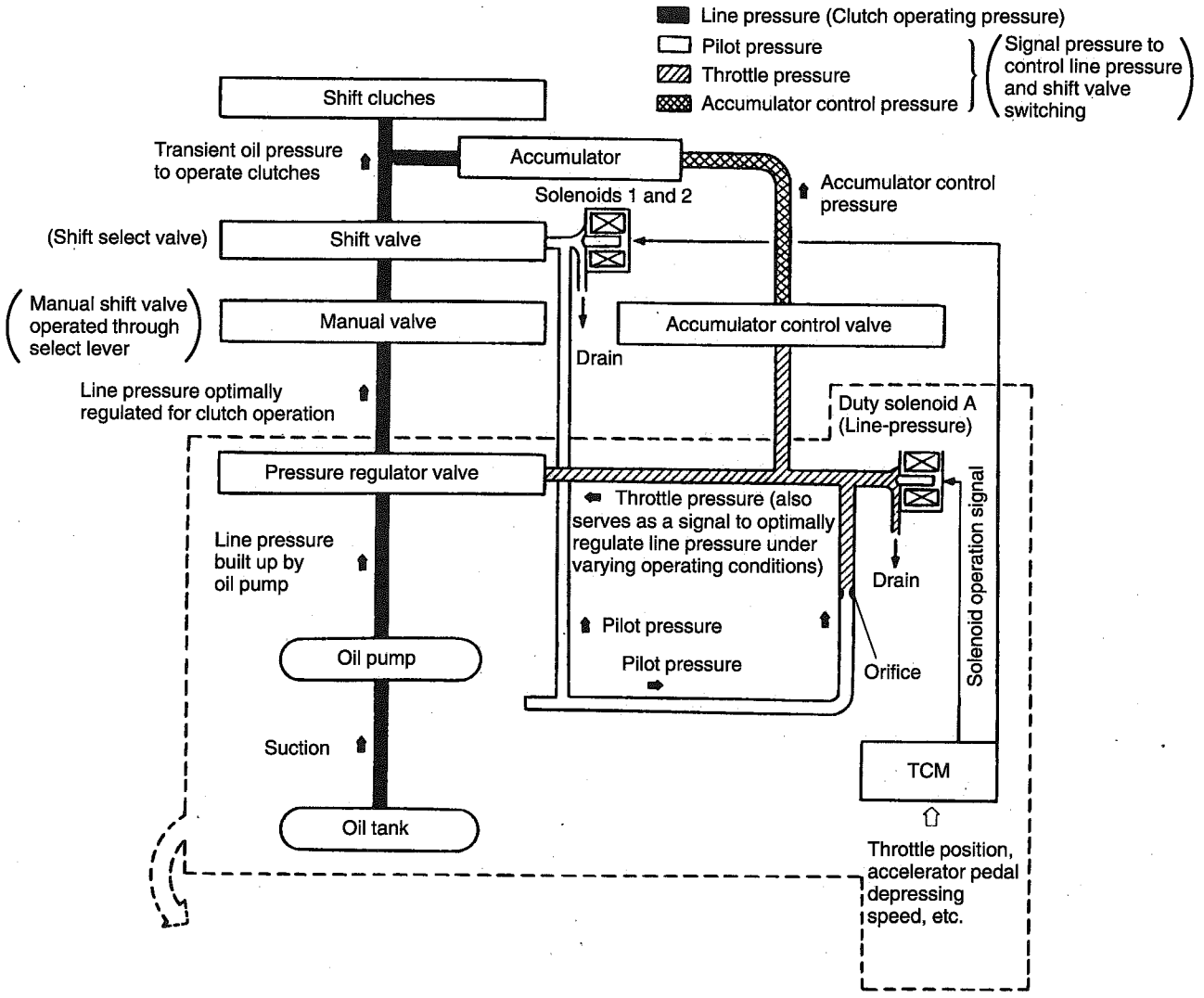
G3H0245

G: LINE-PRESSURE SHIFTING CONTROL

1. FUNCTION

Oil pressure which engages shift clutches (to provide 1st through 4th speeds) is electronically controlled to meet varying operating conditions.

In other words, line pressure decreases to match the selected shift position, minimizing shifting shock.



G3H0755

2. ELECTRONIC CONTROL OF CLUTCH OIL PRESSURE IN SUMMARY

- Solenoids activate through the TCM which receives various control signals (throttle signal, etc.)
- Control signals are converted into throttle pressure, which is transmitted to the pressure regulator valve.
- The pressure regulator valve optimally regulates line pressure (built-up by oil pump) in response to throttle pressure, matching varying operating conditions.

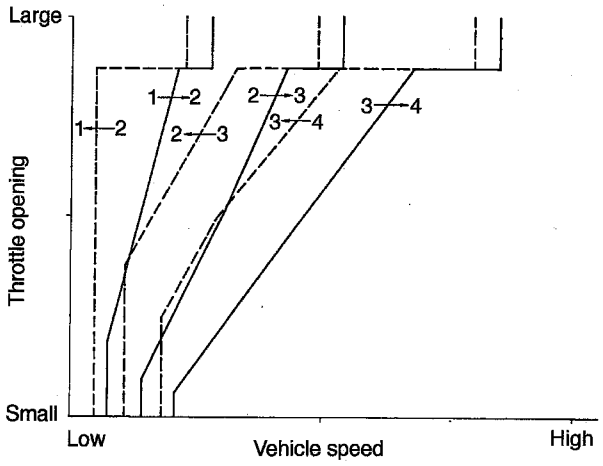
H: SHIFT PATTERN SELECT CONTROL

Shift pattern is selectable automatically between a normal pattern suitable for ordinary economy running and a power pattern suitable for climbing uphill or rapid acceleration.

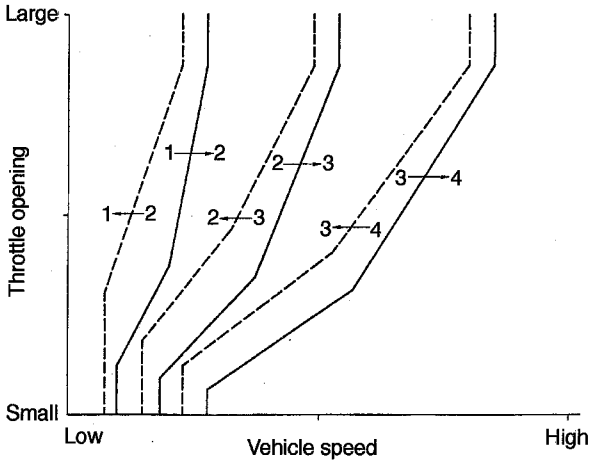
In the power pattern, the shift down point and shift up point are set higher than those of the normal pattern.

Selector position	Changeover from normal to power pattern
D, 3 range	Performed automatically corresponding to accelerator pedal depression.

"D" range (Normal pattern)



"D" range (Power pattern)



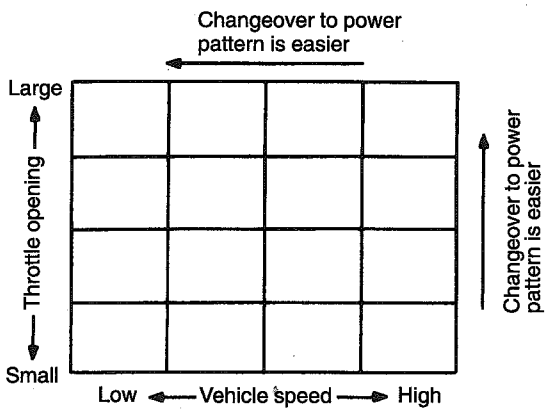
H3H1231

1. NORMAL PATTERN TO POWER PATTERN

Select lever	D, 3 range
Accelerator depression speed	Greater than set value

Depending on throttle opening and vehicle speed, 16 areas as shown in the figure are set. Accelerator depression speed for pattern changeover is set for each area.

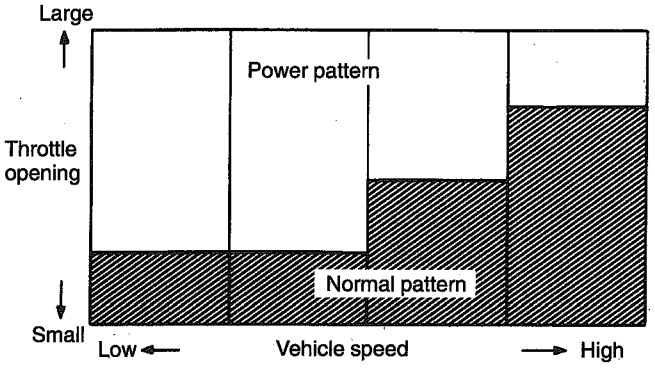
When the accelerator depression speed exceeds this set value, the pattern changes from normal to power.



G3H0248

2. POWER PATTERN TO NORMAL PATTERN

The power pattern is shifted to the normal pattern, depending on car speed. Shifting to the normal pattern is determined by the throttle position as shown in Figure below. Time lag in shifting is also determined by car speed. The maximum time lag is 3 seconds.



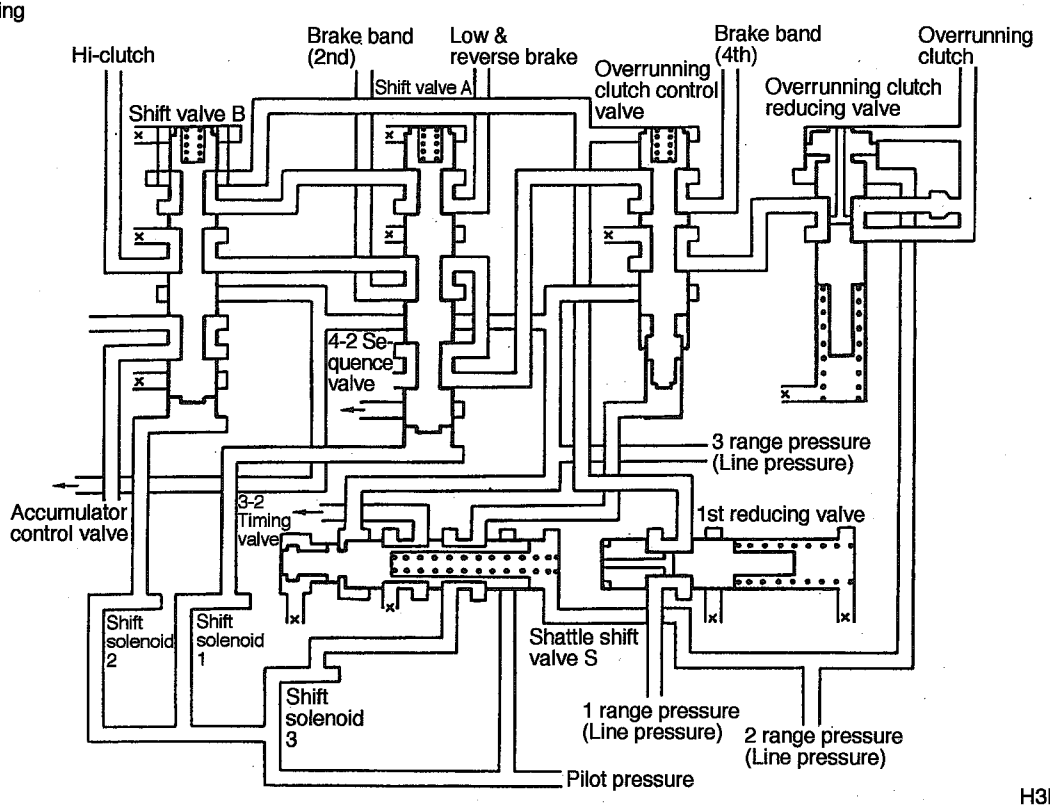
G3H0249

I: ENGINE BRAKE CONTROL

The TCM controls the shift solenoid corresponding to such input signals as throttle position, vehicle speed, shift range, and cruise control signals to automatically control the operation of the overrunning clutch and for positive application of engine brake.

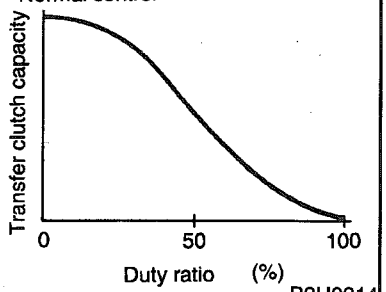
- In range D or 3, the overrunning clutch is kept inoperative by the action of the shuttle shift valve S when the throttle position is large. With small throttle valve opening, the overrunning clutch is engaged by the action of shift solenoid 3.
- In range 2, the overrunning clutch is engaged by the operation of shift solenoid 3.
- In range 1, the overrunning clutch is engaged irrespective of the operation of shift solenoid 3.

D. 3rd ranges
Throttle opening angle: Small

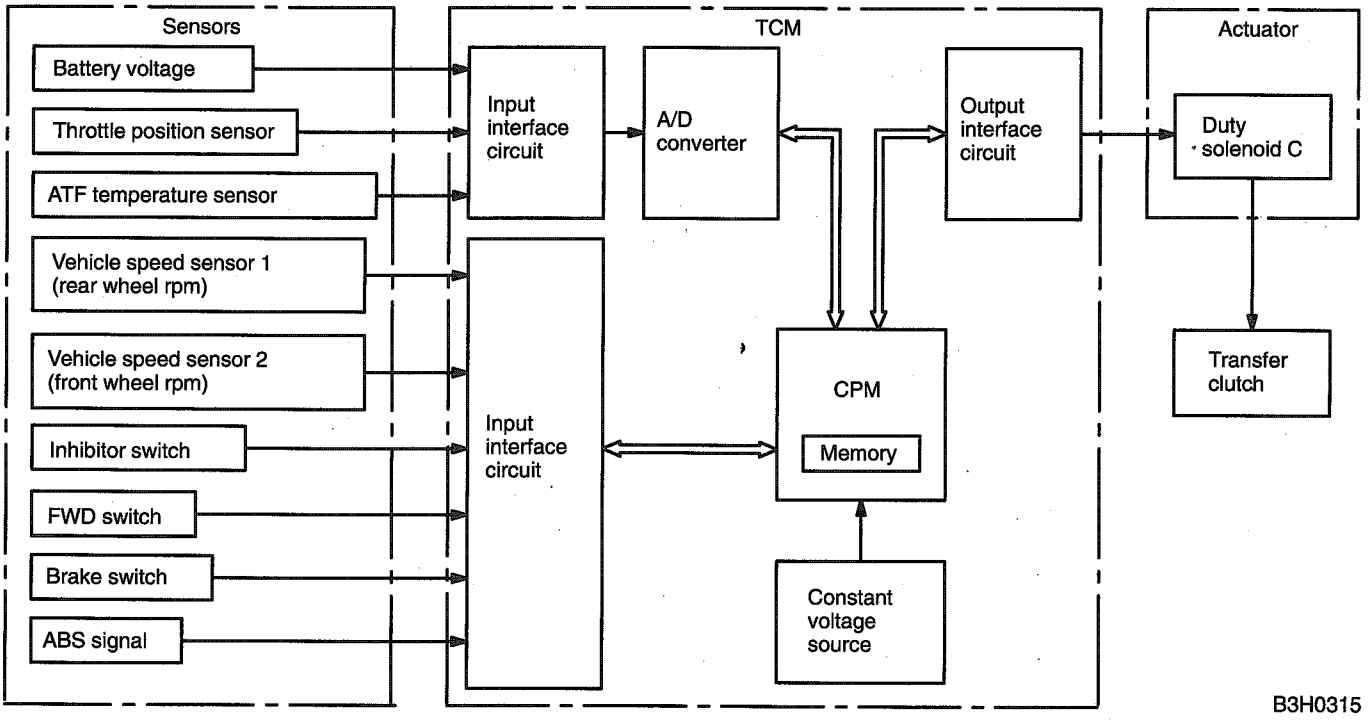


H3H1232A

J: TRANSFER CLUTCH CONTROL

Control item		Type of control	Gear position	Remarks
1	Basic control	Regulates transfer oil pressure in response to throttle position and vehicle speed.	1st thru 4th and reverse	Normal control  B3H0314
2	Control in 1st range	Increases transfer oil pressure (as compared with basic control 1.)	1st	–
3	Control during "slip" detection	Increases transfer oil pressure to the same as in 1st range immediately after "slip" detection.	1st thru 4th and reverse	Release: At more than set vehicle speed and fully closed throttle
4	Control in turns	Decreases transfer oil pressure upon detection of vehicle turns.	1st thru 4th and reverse	–
5	Control in ABS operation	Regulates to the specified transfer oil pressure quickly when the ABS signal is input.	1st thru 4th and reverse	–
6	Control in P and N range	Regulates to the specified transfer oil pressure quickly when shifted to the P or N range.	P and N	–

G3H0759



B3H0315

K: TRANSFER CONTROL

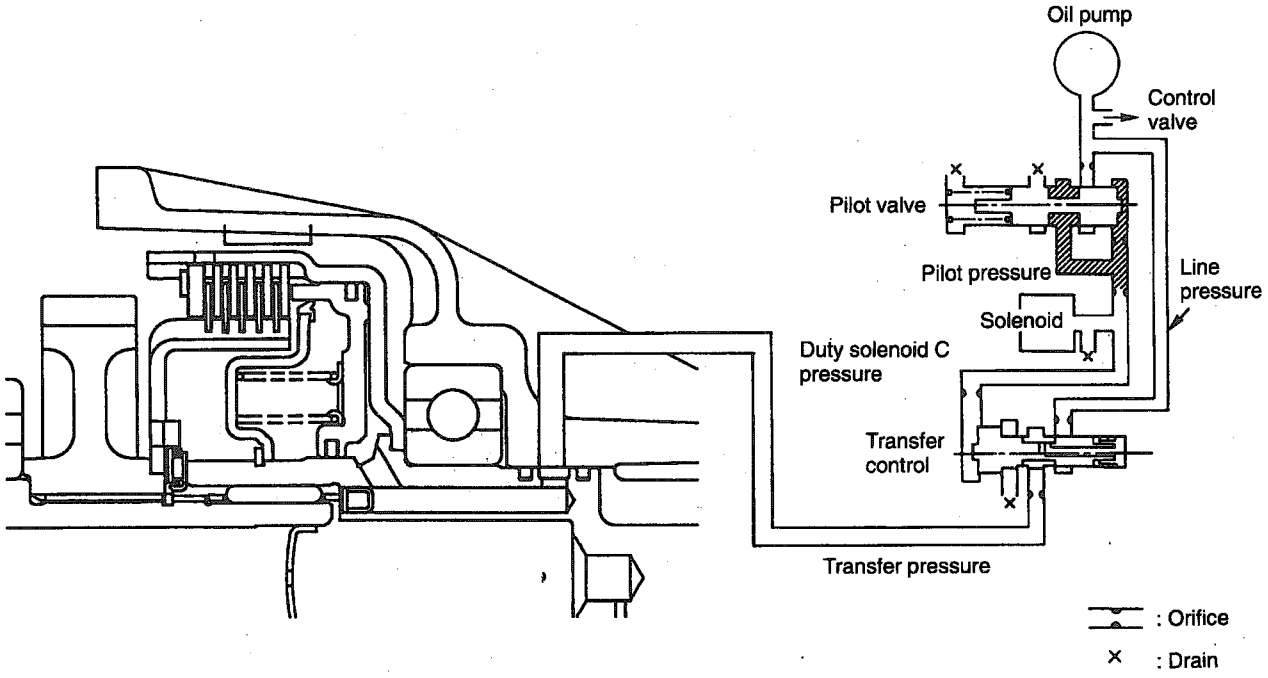
The transfer hydraulic pressure control module is fitted with the transfer valve body attached to the side face of the extension case via gasket and separate plate.

The hydraulic oil of the transfer hydraulic pressure control module is led from the oil pump delivery pressure circuit on the transmission case front to the transmission case rear. From there it is further led to the extension case where it is fed to the hydraulic circuit of the transfer valve body.

The hydraulic oil pressure (line pressure) is regulated by the transfer pilot valve, duty solenoid C and transfer control valve for obtaining optimum rear torque distribution corresponding to the driving conditions.

- The line pressure regulated to a proper pressure corresponding to the driving condition is further regulated to a constant pilot pressure by the transfer pilot valve.
- The pilot pressure is regulated to the transfer duty pressure by the duty solenoid C whose duty ratio is controlled by the TCM corresponding to the driving condition. (The transfer duty pressure varies with the degree of duty control.)
- The transfer duty pressure is applied to the transfer control valve.
- The line pressure is led also to the transfer control valve where the pressure is regulated to the transfer clutch pressure by the transfer duty pressure. (The transfer clutch pressure varies with the transfer duty pressure.)
- The transfer clutch pressure is applied to the transfer clutch and causes the clutch to be engaged.

In this way, the transfer clutch pressure is varied so that optimum rear torque distribution can be achieved which corresponds to the vehicle driving conditions.



B3H0318A

24. On-board Diagnostics System

A: FUNCTION

The on-board diagnostics system is capable of detecting any trouble which has occurred in any of the following input and output signal systems.

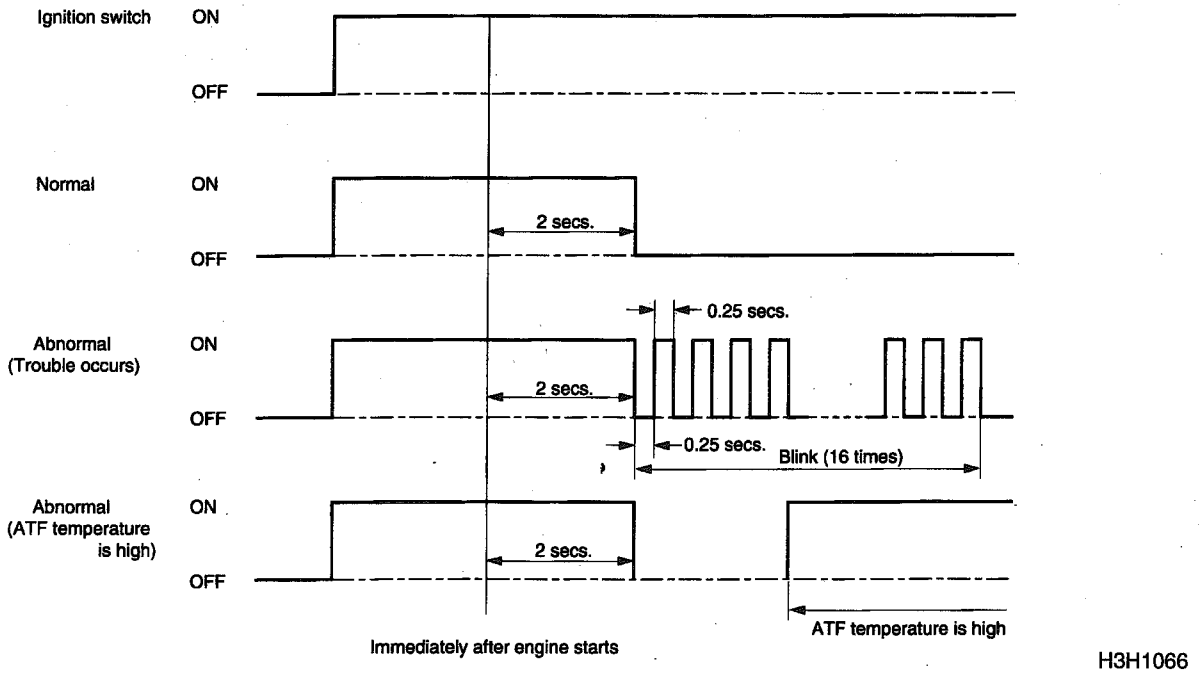
ITEM		
	Vehicle speed sensor 1	Duty solenoid C
	Vehicle speed sensor 2	ATF temperature sensor
	Throttle position sensor	Engine speed signal
	Shift solenoid 1	Duty solenoid A
	Shift solenoid 2	Mass air flow signal
	Shift solenoid 3	Torque control signal
	Duty solenoid B	—

The results of on-board diagnostics are displayed by flashing ATF Temperature indicator lamp.

- Repeated flashing at 4 Hz ...Error such as battery trouble
- Repeated flashing at 2 Hz ...Normal
- Output of trouble code ...Check faulty portion
- Continued lighting of lamp ...Error in inhibitor switch, diagnosis switch, idle switch, or wiring

B: OPERATION OF INDICATOR LAMP

If trouble occurs in any of the on-board diagnostics items, the following display appears on the ATF Temperature indicator only once directly after starting the engine.



H3H1066

C: TROUBLE CODE

TROUBLE CODE	ITEM
11	Duty solenoid A
12	Duty solenoid B
13	Shift solenoid 3
14	Shift solenoid 2
15	Shift solenoid 1
21	ATF temperature sensor
22	Mass air flow signal
23	Engine speed
24	Duty solenoid C
25	Torque control signal
31	Throttle position sensor
32	Vehicle speed sensor 1
33	Vehicle speed sensor 2

D: SELECT MONITOR

Various data and ON/OFF signals being processed in the TCM can be monitored by connecting the select monitor to the select monitor terminal located under the instrument panel. The trouble codes of the present and past problems can be indicated using a particular code.

1. FUNCTION MODE

Function mode	Description	Abbrev.	Unit
01	Source voltage	VB	V
02	Rear wheel speed	VSP 1	m/h
03	Rear wheel speed	VSP 1	km/h
04	Front wheel speed	VSP 2	m/h
05	Front wheel speed	VSP 2	km/h
06	Engine rpm	EREV	rpm
07	ATF temperature	ATFT	°F
08	ATF temperature	ATFT	°C
09	Throttle position sensor	THV	V
10	Gear position	GEAR	GEAR
11	Line pressure duty	PLDTY	%
12	Lock-up duty	LUDTY	%
13	AWD duty	4WDTY	%
14	Battery voltage of throttle position sensor	THVCC	V
15	Mass air flow signal	AFM	V

25. Fail-safe Function

A fail-safe function is provided to maintain driveability even if trouble should occur in the vehicle speed sensor, throttle position sensor, inhibitor switch, or any of the solenoids.

- Vehicle speed sensor

A dual speed-sensing system is used. The speed signal is taken from the transmission (output shaft speed sensor) and also from a sensor built into the speedometer. Even if one sensor system fails, the vehicle can be controlled normally with the other sensor system.

- Throttle position sensor

If throttle position sensor becomes faulty, the mass air flow signal is backup.

- Inhibitor switch

If two signals are inputted due to inhibitor switch failure, the vehicle can be driven under the following priority.

D > N (P) > R > 3 > 2 > 1 >

- Shift solenoid 1 and 2

If trouble occurs in either of solenoids 1 and 2, both solenoids are turned OFF, and the vehicle is made driveable in the 3rd hold range.

If both solenoids should fail, the mechanical hydraulic circuit is used.

- Shift solenoid 3 (Overrunning clutch)

If the overrunning clutch solenoid fails, the solenoid is turned OFF. The overrunning clutch will engage so that the engine brake will be applied when reducing vehicle speed.

- Duty solenoid A (Line pressure)

If duty solenoid A fails, the solenoid is turned OFF and line pressure is raised to maximum to enable vehicle operation.

- Duty solenoid B (Lock-up)

If duty solenoid B fails, the solenoid is turned OFF and lock-up is released.

- Duty solenoid C (Transfer)

When the duty solenoid C becomes inoperative, it turns OFF. This causes maximum oil pressure to be applied to the transfer clutch so that the power is always transmitted to rear axles. (Direct-coupling AWD)

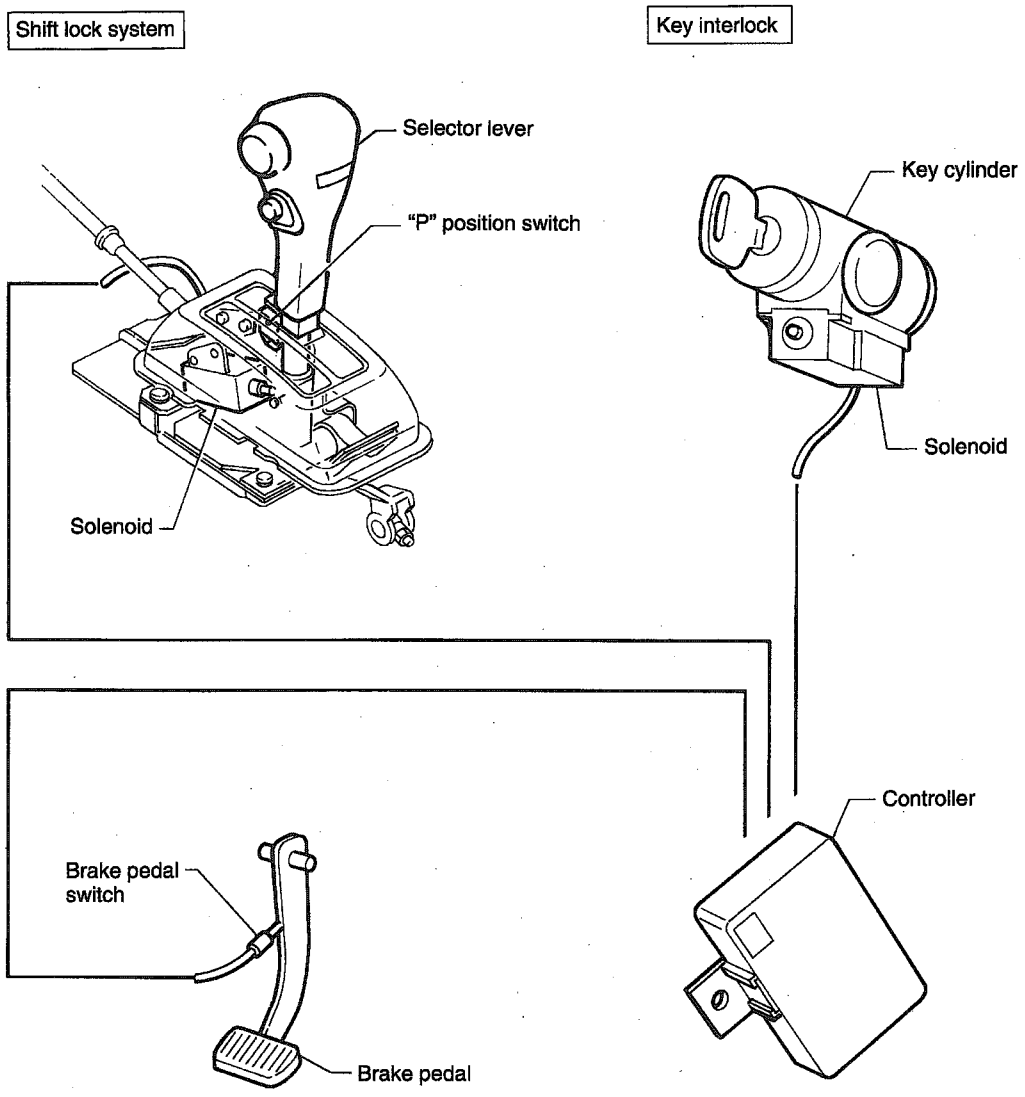
MEMO

TRANSMISSION CONTROL SYSTEM 3-3

1. Shift Lock System (With Key Interlock)

A: GENERAL

To increase safety during "standing start", a shift lock system is utilized to prevent shifting of the selector lever from "P" to any other position unless the brake pedal is depressed. This system is also provided with a key interlock which prevents removal of the ignition key from the key cylinder unless the selector lever is set at "P".

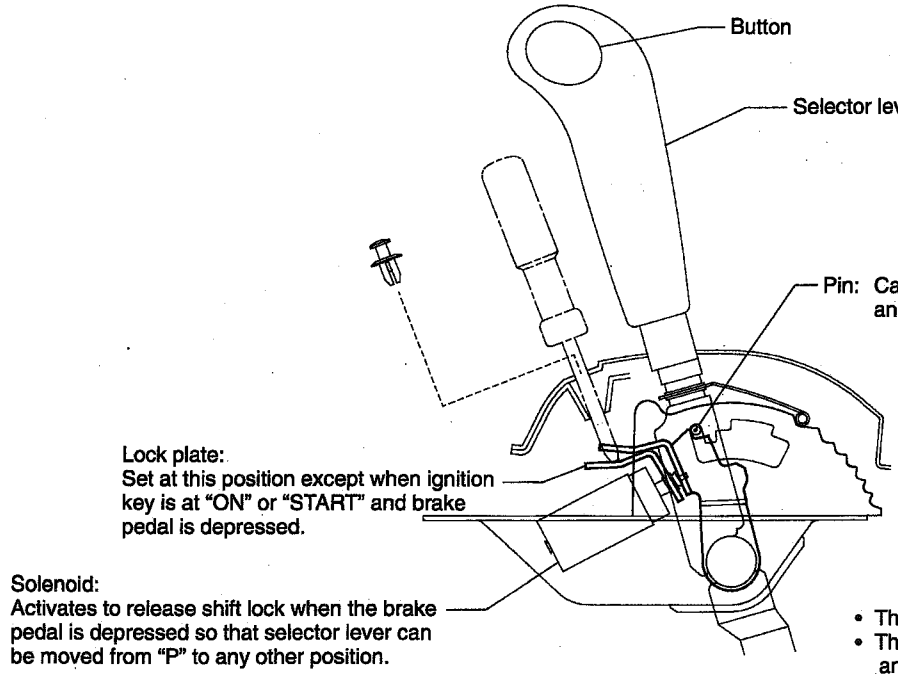


G3H0258

B: SHIFT LOCK SYSTEM

The selector lever can be moved from "P" to any other position in the following cases:

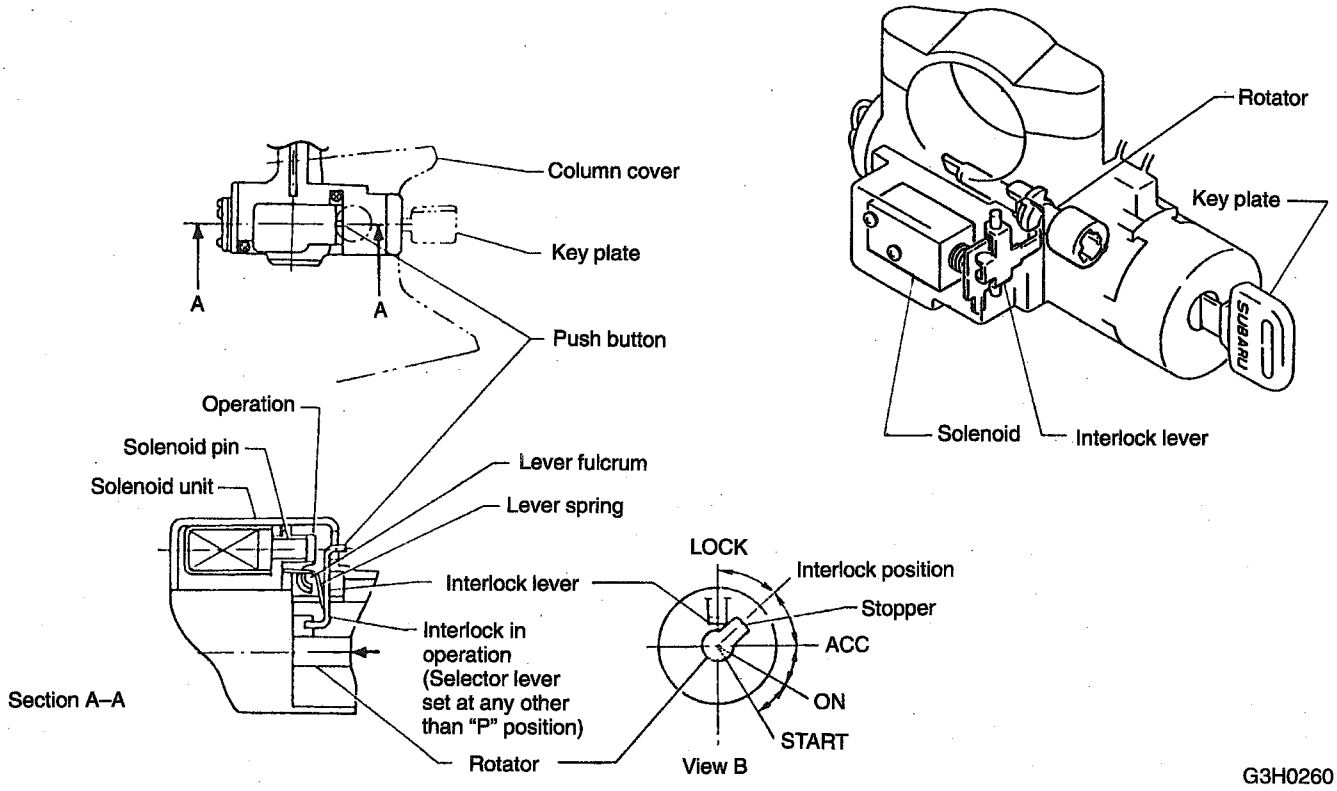
The brake pedal is depressed with the ignition key set at "ON" or "START". The ignition key can be rotated from the "ACC" to the "LOCK" position and then removed from its key cylinder only when the selector lever is set at "P".



G3H0259

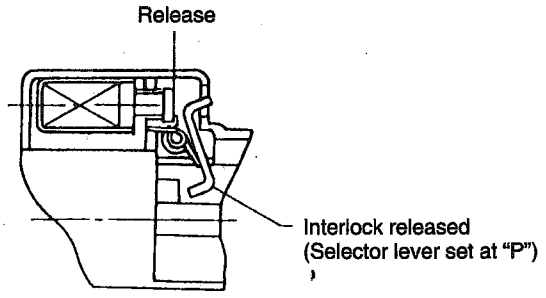
C: KEY INTERLOCK

When the selector lever is set at any position other than "P", the solenoid pin is ready for operation so that the interlock lever comes in contact with the rotator which turns together with the key plate. Thus, the ignition key is prevented from rotating up to the "LOCK" position.



G3H0260

When the selector lever is moved to "P", P position switch in the selector lever assembly turned ON, and the solenoid pin moves to the release position so that the lever spring disengages the interlock lever from the rotator's stopper. As a result, the key plate can be rotated to the "LOCK" position. The key plate can be inserted into or removed from the "LOCK" position only.

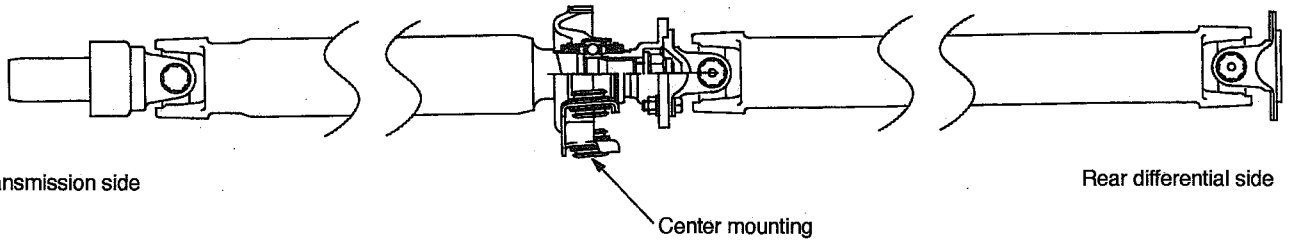


G3H0261

Page

1. Propeller Shaft

The propeller shaft model utilizes a 2-piece design that is provided with three joints.

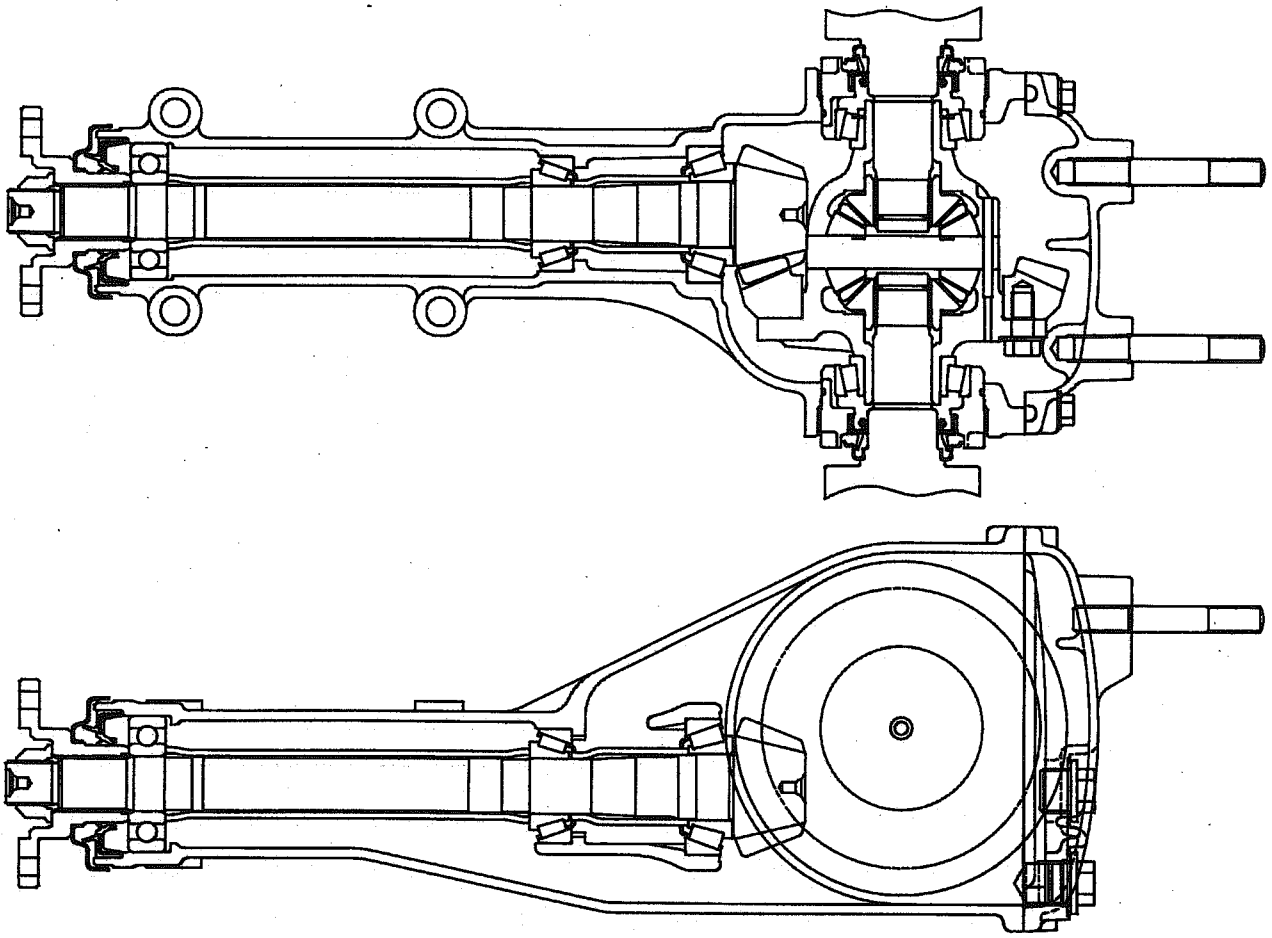


H3H1195A

2. Rear Differential

A: VA-TYPE (EXCEPT 2200 cc MT VEHICLES)

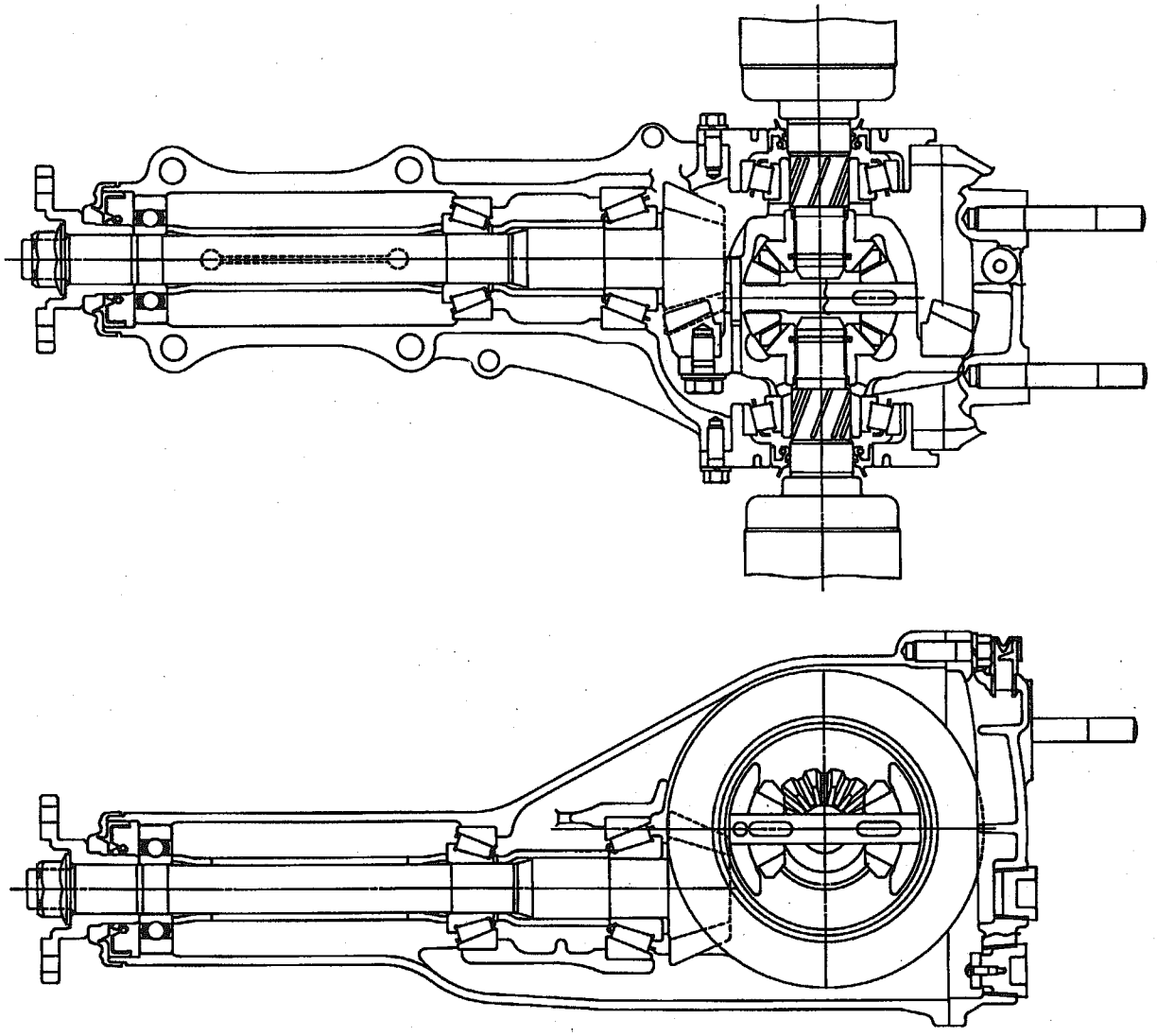
A hypoid drive gear with a nominal diameter of 152 mm (5.98 in) is used and the drive pinion shaft is supported on three bearings, the bearing preload being adjusted by a selective spacer and washer. The drive pinion height is adjusted by selecting washers located at the drive pinion neck using Dummy Shaft and Gauge.



H3H1196

B: T-TYPE (2200 cc MT VEHICLES)

A hypoid drive gear with a nominal diameter of 160 mm (6.30 in) is used and the drive pinion shaft is supported on three bearings, the bearing preload being adjusted by a selective spacer and washer. The drive pinion height is adjusted by selecting washers located at the drive pinion neck using Dummy Shaft and Gauge.



H3H1060

MECHANICAL COMPONENTS SECTION

SUSPENSION 4-1

Page

1. Front Suspension

A: OUTLINE

The front suspension is a strut-type independent suspension, with cylindrical double-acting oil damper and coil spring. The top of the strut assembly's is mounted on the body through the cushion rubber, which has resulted in elimination of any vibration by combined use of other rubbers to improve passenger comfort. This type also maintains a wide distance between the upper and lower supporting points and makes adjustment of the caster unnecessary.

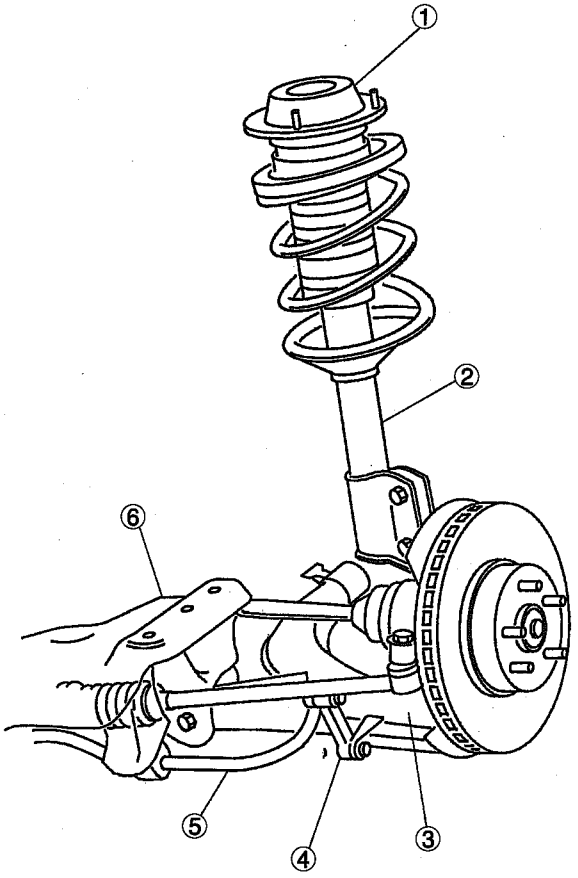
The transverse link utilizes an "L" arm design to increase steering stability and reduce road noise. The transverse link has a maintenance free ball joint with a nut fitting at the outer end, and the inner end front side fitted to the front crossmember through the cushion rubber. The rear side of the inner end is bolted to the vehicle body through a fluid-filled bushing.

The front crossmember is bolted to the vehicle body.

The stabilizer is attached to the front crossmember through the cushion rubbers and its ends are connected to the stabilizer links through the rubber bushings.

The lower end of the stabilizer link is connected to the transverse link through rubber bushings.

A camber angle adjustment mechanism, which uses eccentric bolts, is provided at the joint of the damper strut and housing.



H4H1040A

① Strut mount
② Strut
③ Transverse link
④ Stabilizer link
⑤ Stabilizer
⑥ Front crossmember

2. Rear Suspension

A: OUTLINE

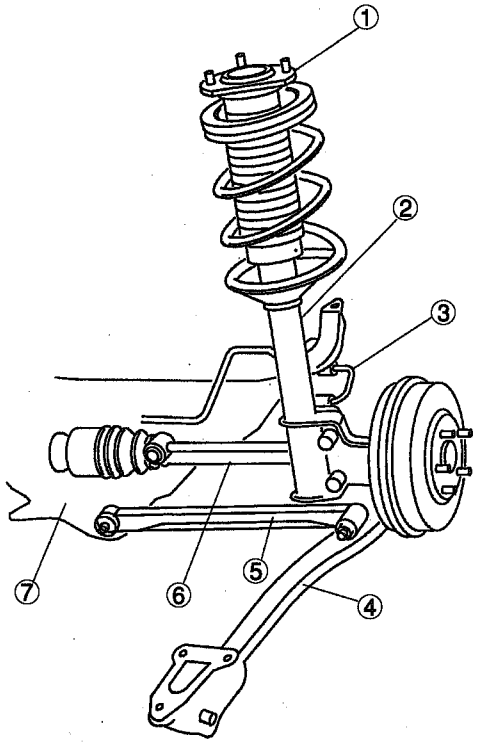
The rear suspension is an independent, dual link strut type. It consists of two parallel lateral links, a trailing link, and strut assembly's. The strut assembly consists of a cylindrical double-acting oil damper and coil spring.

The respective component parts of this suspension are optimally designed to act in response to vertical, lateral and longitudinal loads transmitted from the tires. Thus, riding comfort and steering stability are substantially enhanced.

- Longitudinal loads act on the trailing link.
- Vertical loads act on the coil spring, strut and rubber mount (which is located on the top of strut).
- Lateral loads act on the two lateral links.

The crossmember is installed on the body frame via bushings.

The stabilizer that extends to the rear of the crossmember, is installed on the body frame via a bracket and to the rear lateral link on the wheel side via stabilizer link.



H4H1039A

① Strut mount
② Strut
③ Stabilizer
④ Trailing link
⑤ Front lateral link
⑥ Rear lateral link
⑦ Rear crossmember

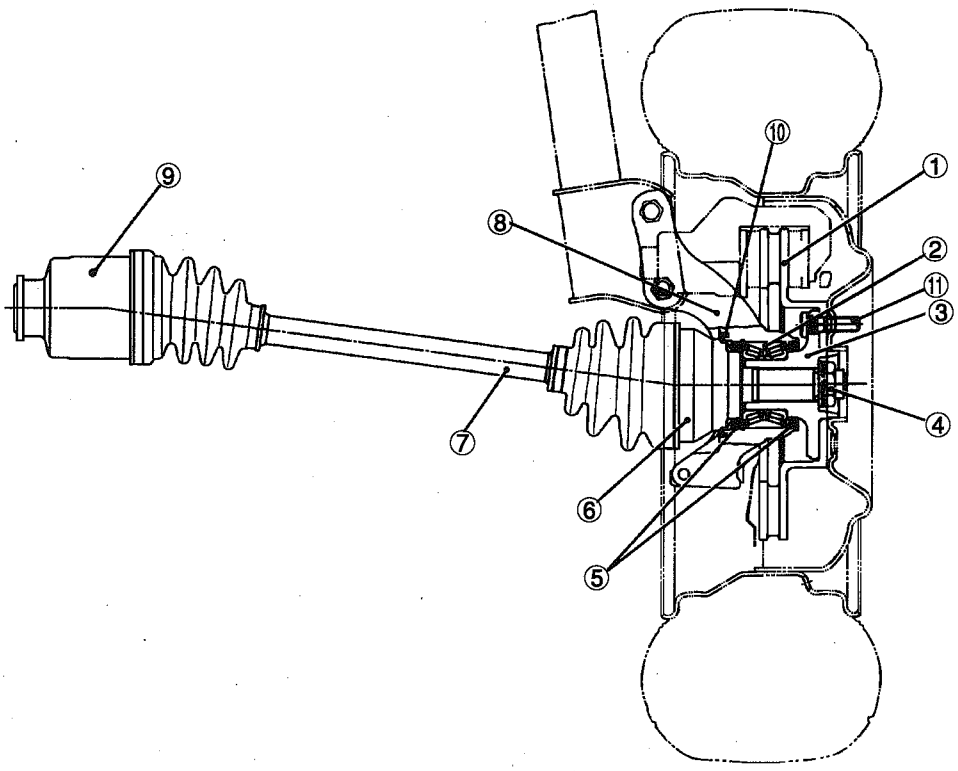
MEMO

WHEELS AND AXLES 4-2

1. Front Axle

A: GENERAL

- The inboard end of the axle shaft is connected to the transmission via a constant velocity joint (double offset joint: DOJ) which provides flexible capabilities in the longitudinal direction while the outboard end is supported by taper roller bearings located inside the housing via a bell joint (BJ) which features a large operating angle.
Since the drive shaft employs constant velocity joints, it provides smooth, even rotation of the drive wheels without any vibration.
- The bearing utilizes a preloaded, non-adjustable tapered roller unit design.
The hub is fitted to the tapered roller bearing inside the housing.
- The BJ's spindle is "serration-fitted" to the hub and is clinched to it with axle nuts.
- The disc rotor is an external mounting type. It is secured together with the disc wheel using hub bolts to facilitate maintenance of the disc rotor.

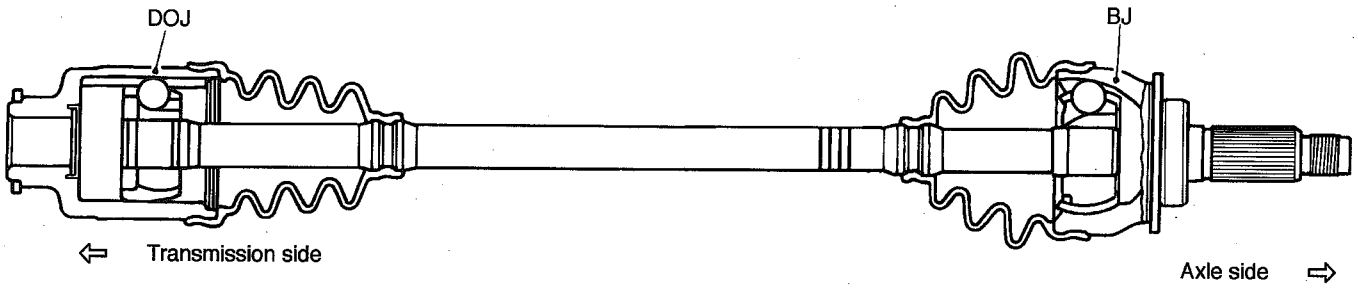


G4H0019

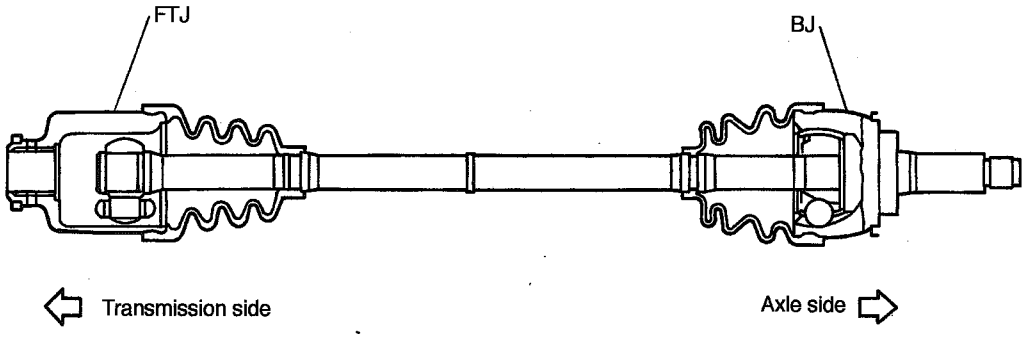
① Disc rotor
② Bearing
③ Hub
④ Caulking nut
⑤ Oil seal
⑥ BJ (Bell Joint)
⑦ Front drive shaft
⑧ Housing
⑨ DOJ (Double Offset Joint) or FTJ (Free-ring Tripod Joint)
⑩ Baffle plate
⑪ Hub bolt

B: FRONT DRIVE SHAFT

- For the constant-velocity joint on the transmission side, the double offset joint (DOJ) and the free ring tripod joint (FTJ) are adopted.
DOJ slides in the axial direction and also provides the maximum operating angle of 23°.
FTJ slides in the axial direction and also provides the maximum operating angle of 20°.
- For the constant-velocity joint on the wheel side, the bell joint (BJ) is adopted.
The maximum operating angle of BJ is 47.5°.



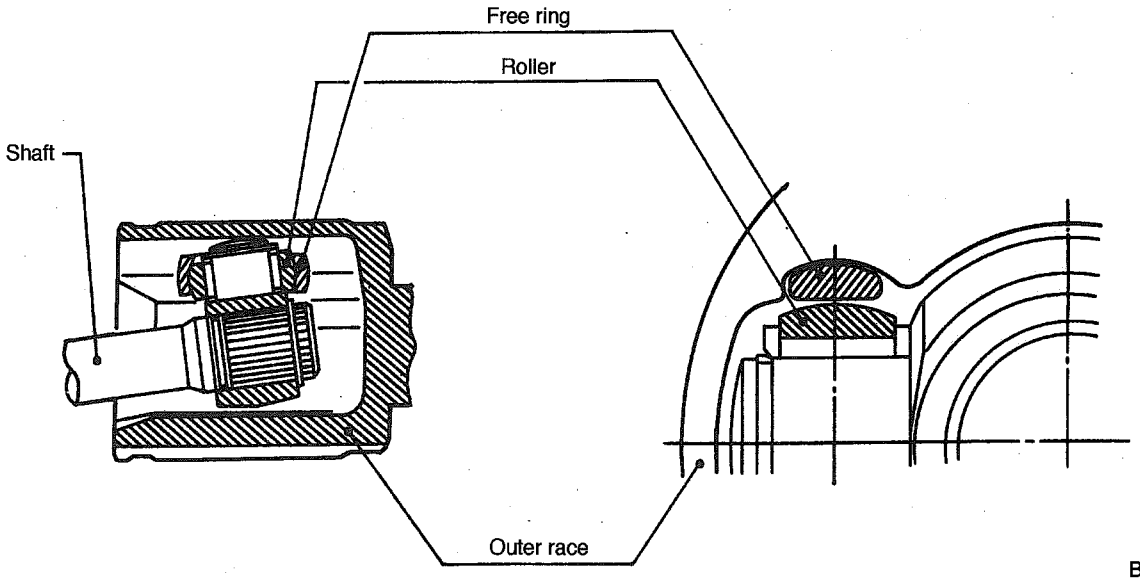
B4H1066A



B4H1067B

1. CONSTRUCTION OF FREE-RING TRIPOD JOINT (FTJ)

The FTJ is an improved version of the TJ (tripod joint) to minimize sliding resistance.
In the previous TJ design, the roller rotated only in the axial direction. When the joint was subjected to a "bending" angle in the sliding direction, the roller slipped causing resistance.
In the new FTJ design, the outer surface of the roller is provided with a free ring to minimize roller slippage, greatly reducing sliding resistance.

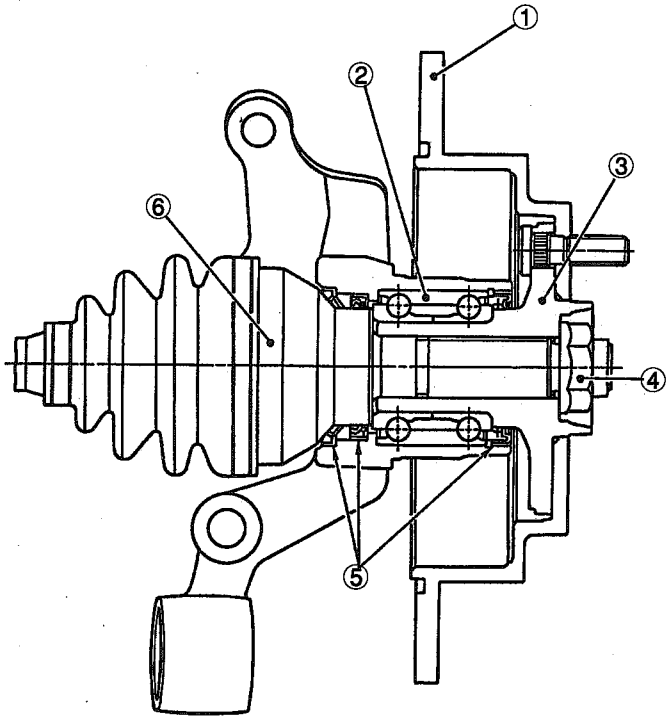


B4H1068A

2. Rear Axle

A: GENERAL

- The inboard end of the axle shaft is connected to the transmission via a constant velocity joint (double offset joint: DOJ) which provides flexible capabilities in the longitudinal direction.
- The outboard end is supported by angular contact ball bearings located inside the housing via a bell joint (BJ) which features a large operating angle. Since the drive shaft employs constant velocity joints, it provides smooth, even rotation of the drive wheels without any vibration.
- The bearing is a preloaded, non-adjustable angular contact ball unit type.
The hub is fitted to the angular contact ball bearing inside the housing.
- The BJ's spindle is "serration-fitted" to the hub and is clinched to it with axle nuts.
- The disc rotor is externally mounted to facilitate maintenance. Hub bolts and axle nuts are also used to secure the front axle.

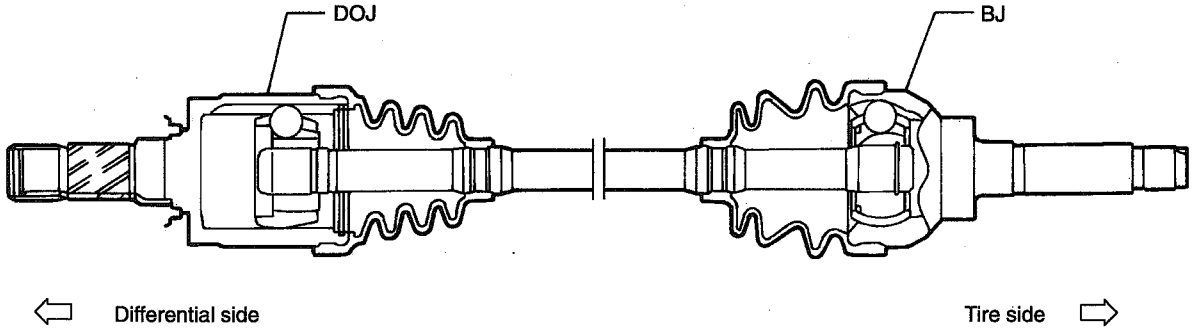


H1H1054A

① Disc rotor
② Bearing
③ Hub
④ Caulking nut
⑤ Oil seal
⑥ BJ (Bell Joint)

B: REAR DRIVE SHAFT

- The constant-velocity joint on the differential side is a double offset type (DOJ) which can be disassembled for maintenance. It provides the maximum operating angle of 23° and can be moved in the axial direction.
- DOJ outer race and the rear differential spindle are combined in order to improve resistance to corrosion.
- The constant-velocity joint on the tire side is a bell type (BJ) which provides a maximum operating angle of 46°.



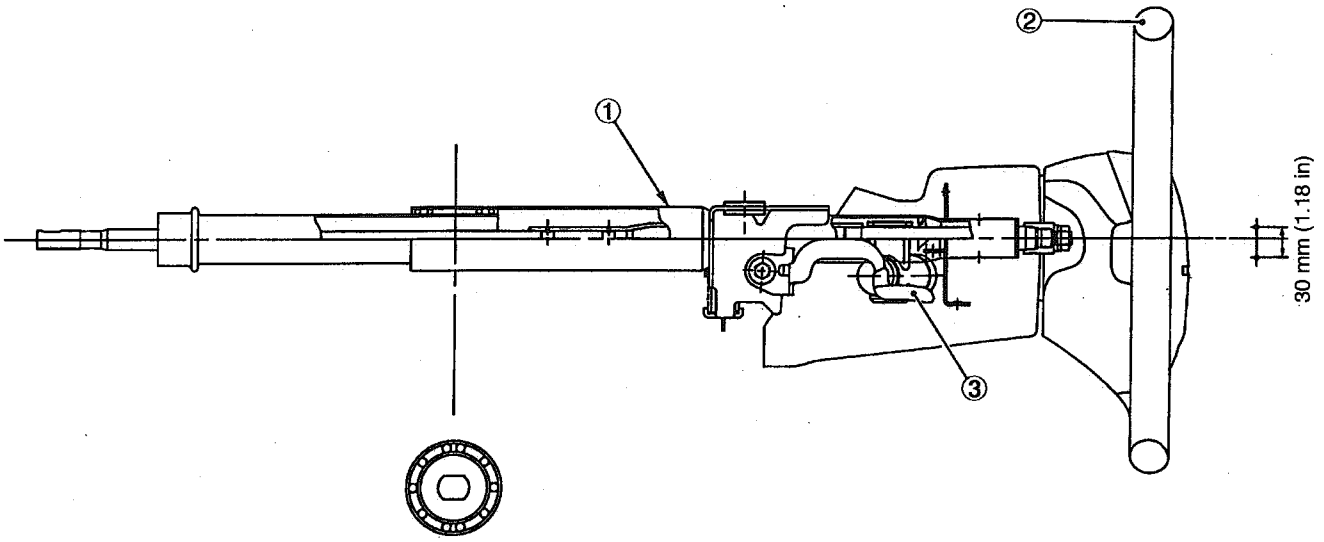
G4H0023

STEERING SYSTEM 4-3

1. Tilt Steering Column

A: TILT MECHANISM

• The steering wheel vertical position can easily be adjusted within 30 mm (1.18 in) range, by using the tilt lever to release the steering column and locking it at the desired position.



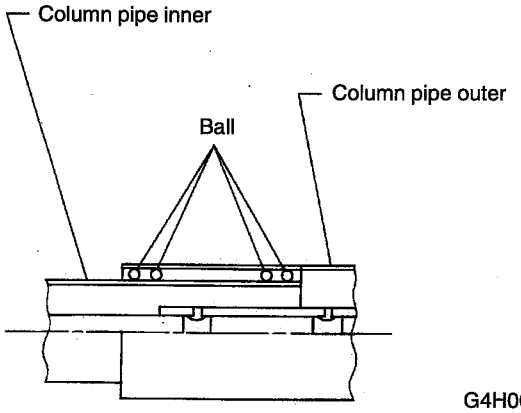
H4H1132A

① Tilt steering column
② Steering wheel
③ Tilt lever

B: IMBEDDED BALL TYPE ENERGY-ABSORBING MECHANISM

- Construction of the steering column is simplified to reduce weight since energy absorption is no longer required for the steering column.
- The energy-absorbing characteristic is regulated by imbedded ball height.

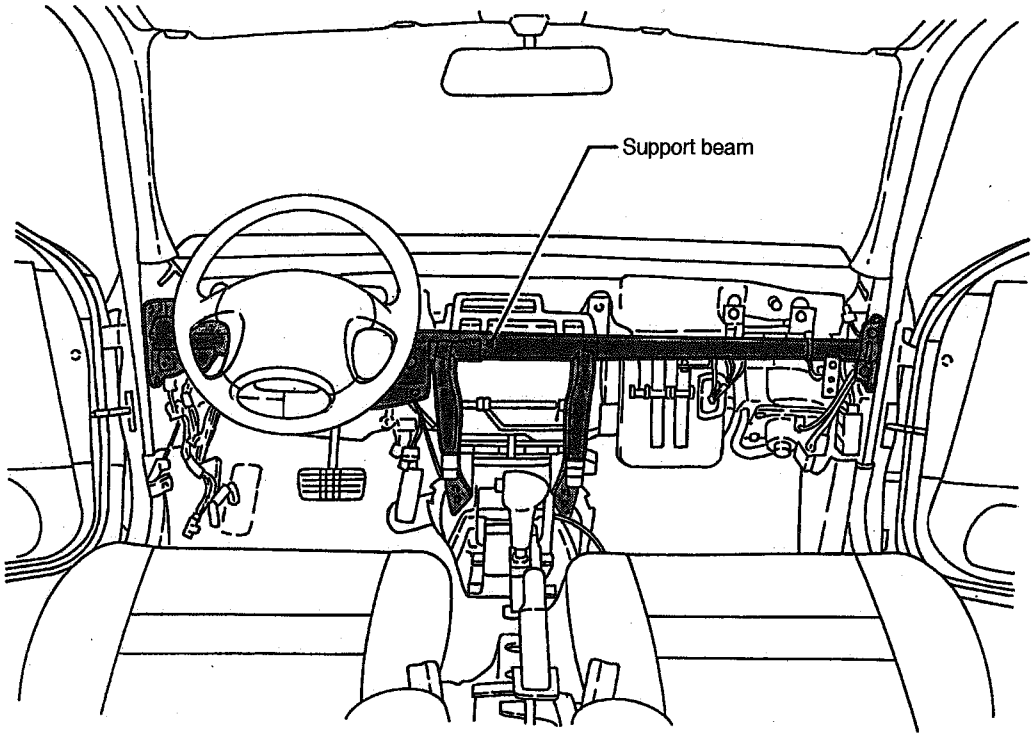
When vehicle is involved in a frontal collision, the bolt located between outer and inner column pipes acts to give plastic strain to the two pipes in relation to relative movement of the two pipes. The result is effective collision absorption.



G4H0006

C: STEERING SUPPORT BEAM

The steering column is held by a support beam located close to the steering wheel to reduce the overhang. The upper bearing is also located close to the steering wheel to increase supporting rigidity, as well as to reduce the problem of a shaking or shimmying wheel.

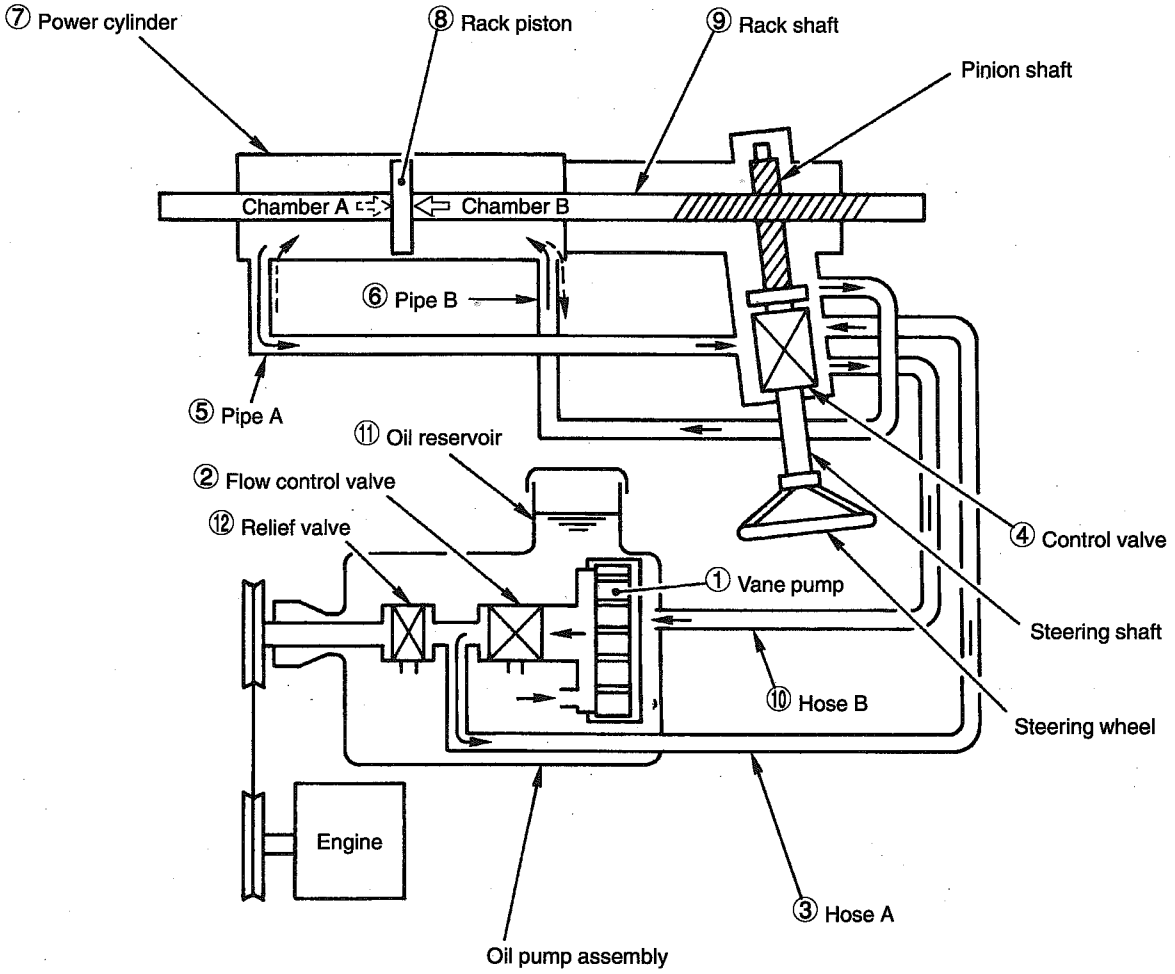


H4H1133A

2. Power Steering System

A: HYDRAULIC SYSTEM

- Vane pump ① is belt-driven from the engine to discharge oil under pressure.
- Oil under pressure is controlled by the flow control valve ② located inside the oil pump assembly in response to engine speed and is delivered to control valve ④ via hose A ③.
- When the steering wheel is turned, control valve ④ connected to the pinion shaft activates to form an oil flow circuit corresponding to the rotation direction of the steering wheel. Oil will then be delivered to chamber A or B via pipe A ⑤ or B ⑥.
- Oil in chamber A or B acts on rack pinion ⑧ to produce the force required to move rack shaft ⑨ to the left or the right. This helps reduce the effort required to operate the steering wheel.
- Movement of rack piston ⑧ in turn causes oil in the other chamber to return to oil reservoir ⑪ via pipe A ⑤ or B ⑥, control valve ④ and hose B ⑩.
  - If the hydraulic system becomes inoperative, the steering shaft will then be connected to the pinion shaft mechanically via control valve ④. Thus, the steering shaft can act as one similar to a manual steering system to move the rack and pinion.
  - To control the maximum oil pressure setting, relief valve ⑫ is built into flow control valve ② of the oil pump assembly to release excess oil pressure.



System operation

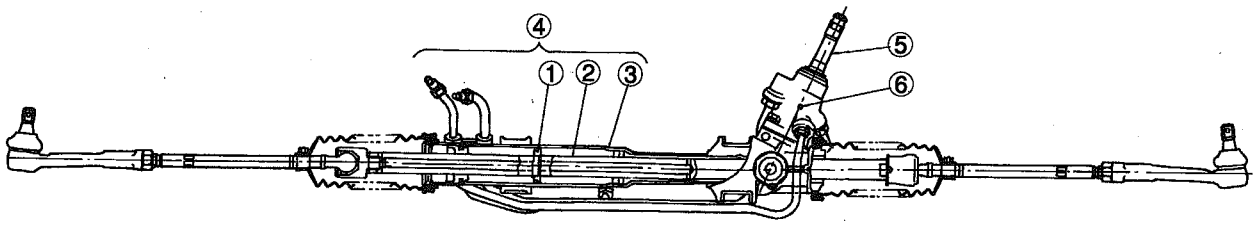
G4H0008

B: GEARBOX ASSEMBLY

1. POWER CYLINDER

The gearbox is integrated with a built-in control valve and power cylinder. The rack shaft is used as a power cylinder piston and a rotary control valve is located in such a manner as to enclose the pinion shaft.

The control valve and power cylinder are connected to each other by two pipes through which hydraulic oil flows.

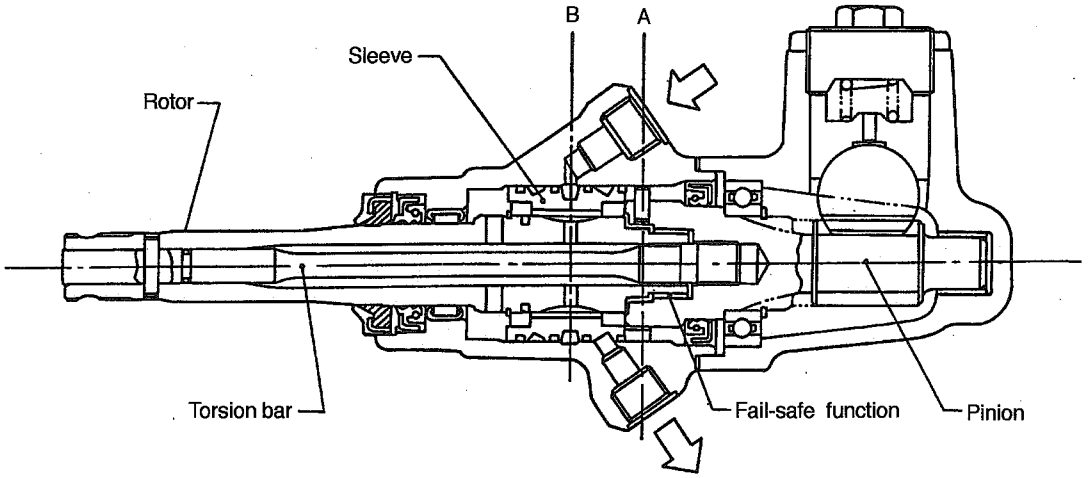


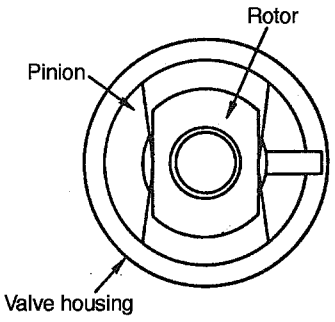
G4H0009

① Piston
② Rack shaft
③ Cylinder
④ Power cylinder
⑤ Pinion shaft
⑥ Control valve

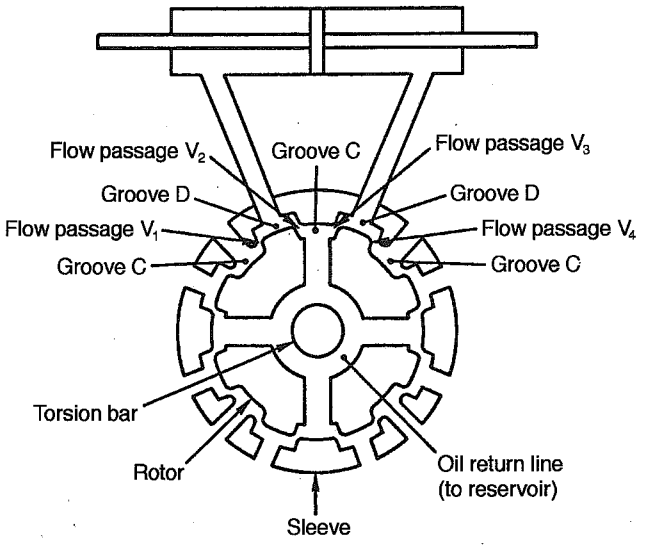
2. CONTROL VALVE

The control valve consists of a rotor (which rotates together with the steering shaft), a pinion (which is connected to the rotor and torsion bar), and a sleeve (which rotates together with the pinion). Oil grooves C and D are located in the rotor and sleeve to form oil flow passages V_1 through V_4. The pinion and rotor are meshed with adequate clearance. They utilize a fail-safe design.



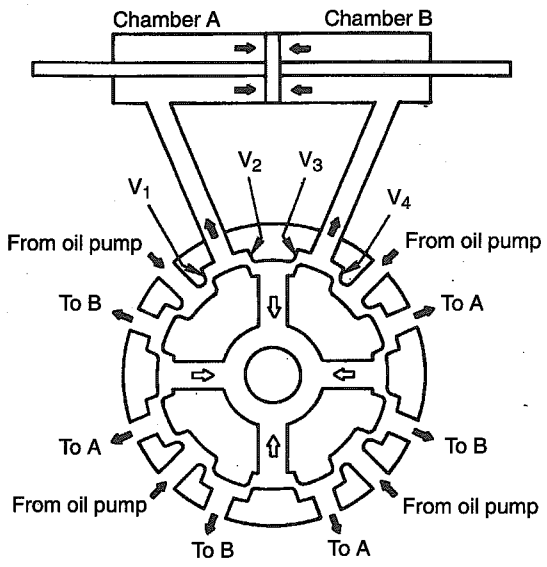


Fail-safe function



Cross-section view B of oil passage switching curcuit

H4H1134A



When no steering force is applied.

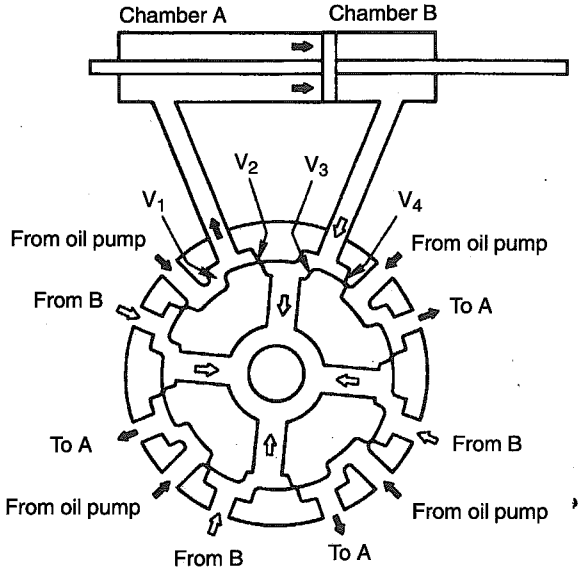
G4H0011

- Operating principle

When the torsion bar twists in relation to the steering force, a relative rotational displacement occurs between the rotor and sleeve. This displacement changes the cross-sectional area of oil passages V_1, V_2, V_3 and V_4, which in turn switches oil passages and controls oil pressure.

- When no steering force is applied:

The rotor and sleeve are held at the neutral position. Oil passages V_1, V_2 and V_3, which are formed by valve grooves C and D are open equally. Under this condition, oil delivered from the oil pump returns to the oil reservoir so that neither oil pressure builds up nor does the power cylinder activate.



When steering force is applied.

G4H0012

- When steering force is applied:

When the steering wheel is turned to the right, for example, oil passages V_1 and V_3 open while oil passages V_2 and V_4 nearly close.

At this point, oil under pressure in chamber A increases in response to the throttle position of oil passages V_2 and V_4 so that the rack piston moves to the right. Oil in chamber B, on the other hand, is discharged through oil passage V_3, returning to the oil reservoir.

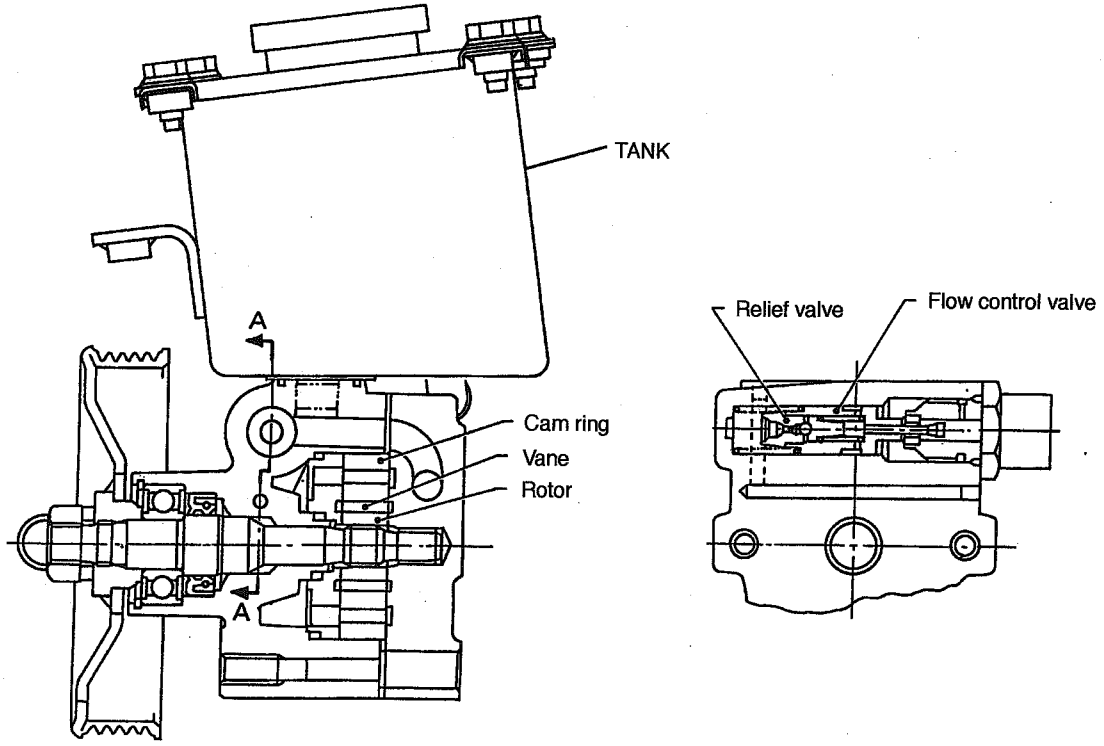
- Fail-safe function

If oil pressure fails to build up due to a broken oil pump drive belt, torque is transmitted from the valve rotor to the pinion by way of the fail-safe function.

C: OIL PUMP & TANK

The oil pump is belt-driven from the engine. The oil flow is controlled in response to engine speed so that an adequately "heavy" steering effort is maintained during high-speed operation.

The oil pump is a vane type. It is integrated with an tank and houses the flow control and relief-valves.

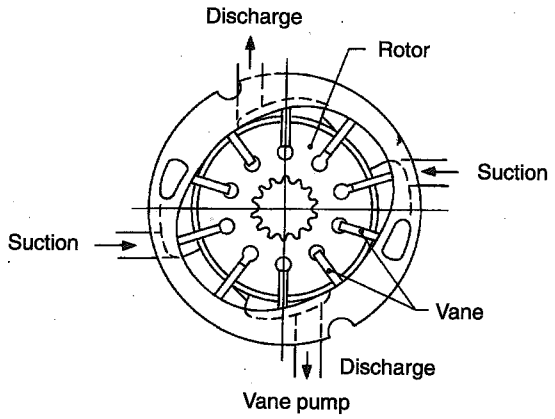


H4H1044A

1. VANE PUMP

The vane pump consists of a rotor, cam rings, and ten vanes.

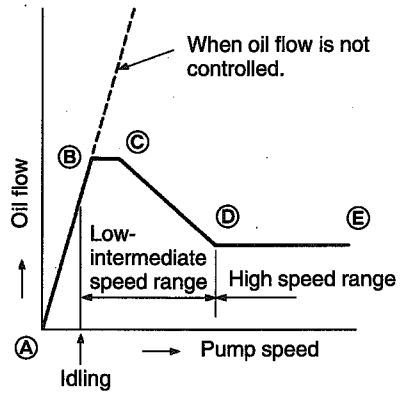
When the rotor rotates, the vane located in each groove of the rotor is radially swung out by centrifugal force and pressed against the cam ring. The tip of the vane slides along the inner oval wall of the cam ring so that oil is delivered to the chamber formed by the rotor, cam ring and vane by way of a pea-shaped groove. Oil from the chamber is discharged into the oil circuit via the discharge port.



G4H0014

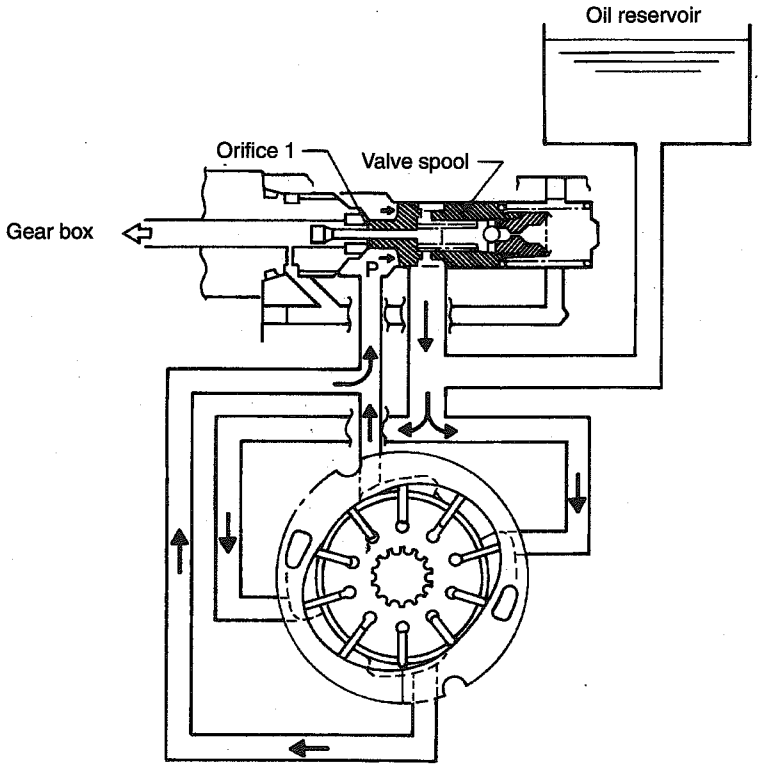
2. FLOW CONTROL VALVE

The flow control valve adequately regulates the discharge flow of oil which increases in proportion to pump speed and delivers it to the gearbox. It consists of orifices 1 and 2, valve spool, return port and flow control spring. When a pressure differential occurs between the front and rear of orifice 2 in response to increases in discharge flow, the valve spool moves against the tension of the flow control spring so that the oil flow is controlled by the open and close operation of the return port and orifice 2.



G4H0015

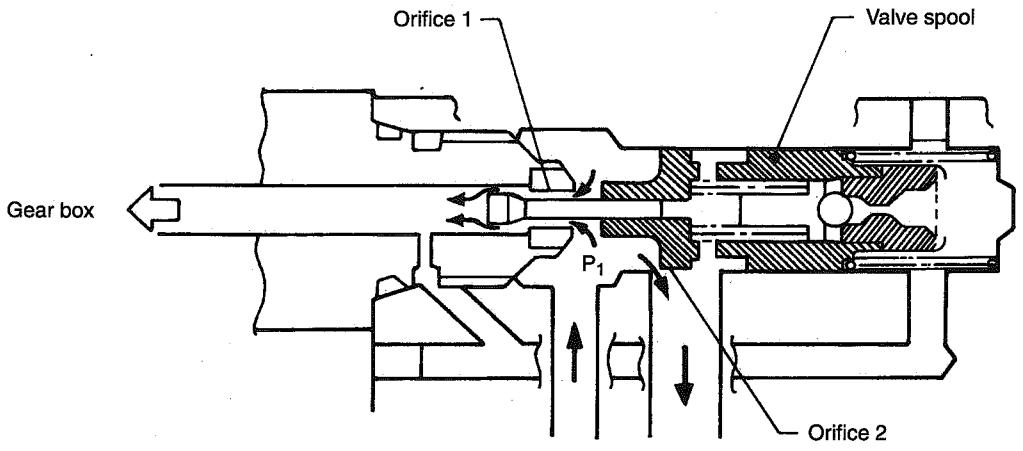
- When the pump begins to rotate, P increases, and the valve spool is moved to the right by this pressure. In the pump speed range A to B, the total amount of oil delivered by the pump is sent to the gear box through orifice 1.
  - Pump speed range A to B



G4H0016

• As the pump speed increases, P_1 increases further, and the valve spool is pushed further to the right. As a result, orifice 2 opens. Accordingly, a constant flow of oil is maintained.

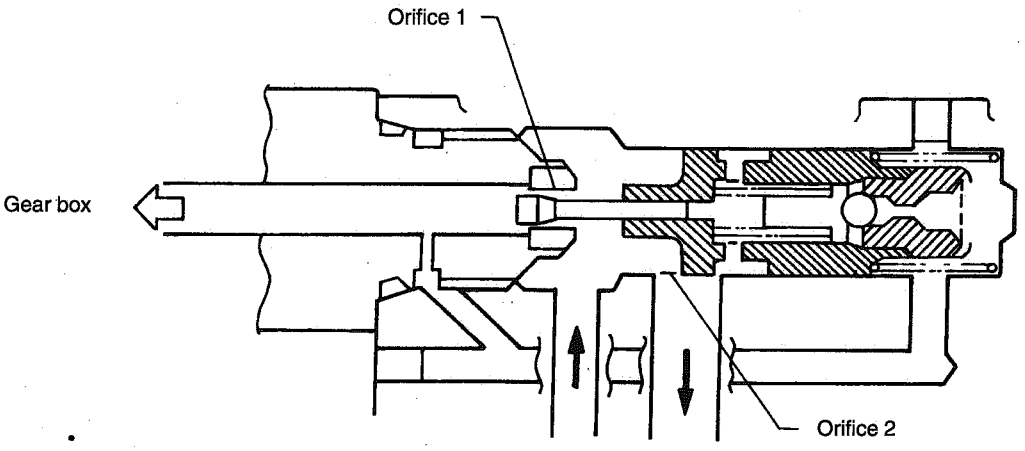
• Pump speed range B to D



G4H0017

• When the pump speed increases further, the valve spool is pushed to the far right position. At this spool position, orifice 1 is restricted while orifice 2 opens wide.
Accordingly, the oil flow decreases.

• Pump speed range D to E

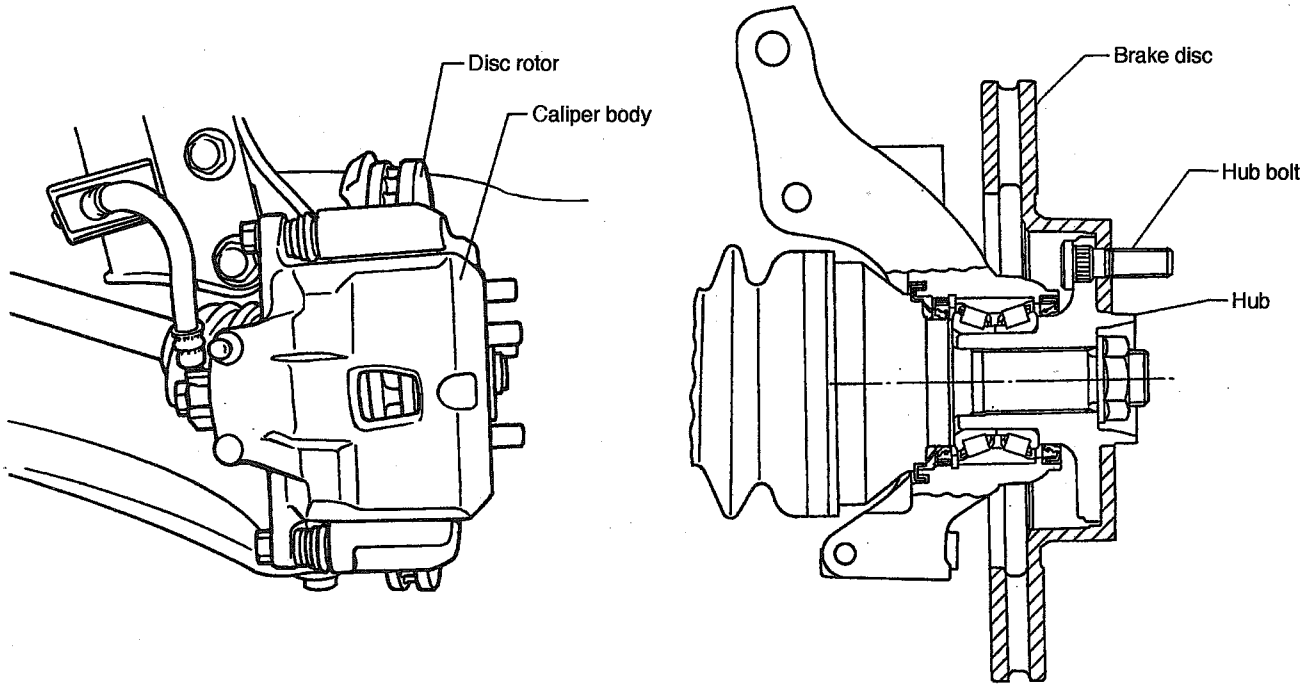


G4H0018

Page

1. Disc Brake

- The front brakes are ventilated disc types which feature high heat dissipation and superb braking stability. In addition, the front brake quickly restores the original braking performance even when wet.
- The brake disc, which is externally mounted, is secured together with the disc wheel using the hub bolts, to facilitate removal or installation when servicing the vehicle.
- The inner brake pad is provided with an indicator which indicates pad wear limits.

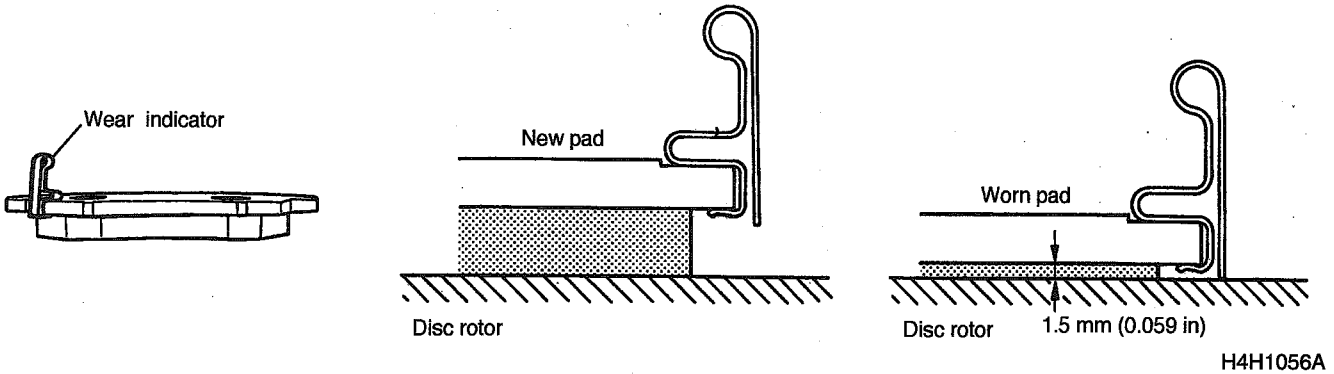


H4H1055A

A: PAD WEAR INDICATOR

A wear indicator is provided on the inner disc brake pads. When the pad wears down to 1.5 mm (0.059 in) the tip of the wear indicator comes into contact with the disc rotor, and makes a squeaking sound as the wheel rotates.

This indicates that the pad needs to be replaced.



H4H1056A

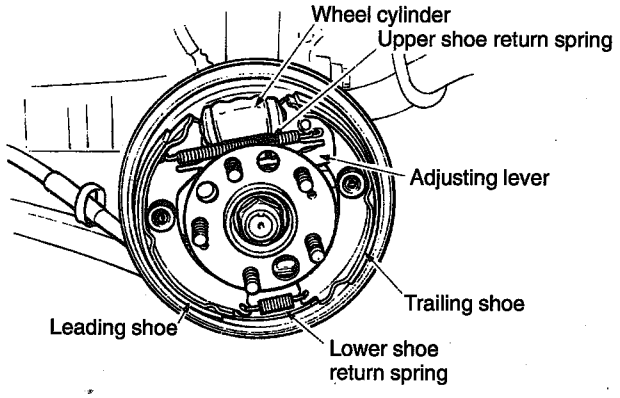
B: FRICTIONAL MATERIAL OF BRAKE PADS

Frictional brake pad materials do not contain asbestos and are not harmful.

2. Rear Drum Brake

• The drum brake is a leading-trailing type. When fluid pressure is applied to the wheel cylinder, the piston moves to expand the leading and trailing shoes while the lower shoe return spring joint acts as a pivot. Thus, the shoes come in contact with the inner surface of the drum, producing braking action.

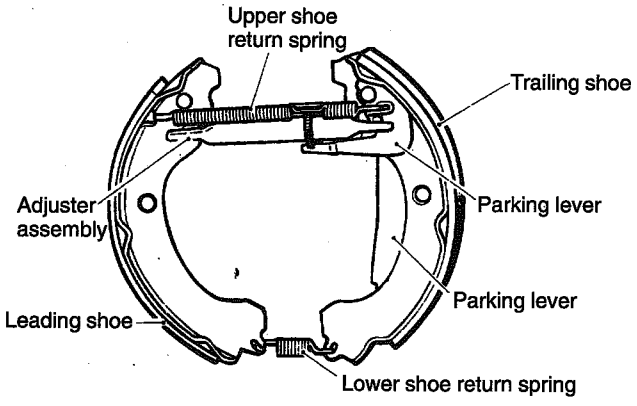
• When brakes are applied during the forward movement, the tip of the brake leading shoe lining is pressed against the inner surface of the drum so as to oppose the drum direction. This increases the braking force. The trailing shoe, however, undergoes a force that pushes back so that braking force applied to the trailing shoe decreases.
The above shoe operation is reversed while the vehicle is backing up, with the braking force exerted on the trailing shoe greater than that on the leading shoe. It follows that there is no difference in braking force between the directions in which the vehicle moves.



G4H0034

A: AUTOMATIC ADJUSTER

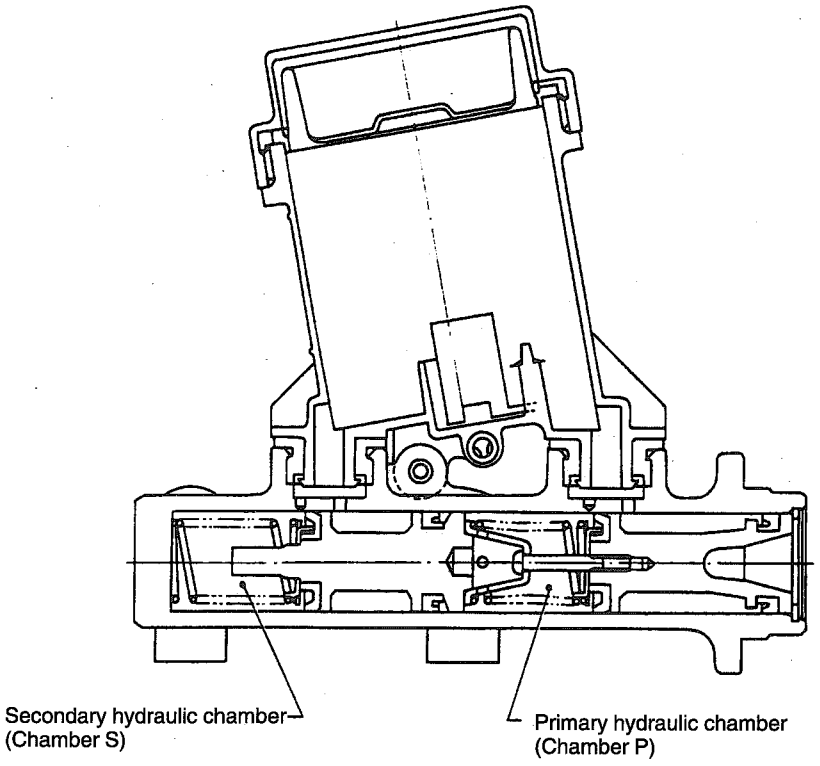
The brake lining-to-drum clearance is automatically compensated for by the automatic adjuster. When the brake shoe is contracting after expansion, the adjuster lever rotates the adjuster assembly's screw to lengthen adjuster assembly so that the clearance is maintained at the specified value.



G4H0035

3. Master Cylinder

- A sealed reservoir tank is adopted to extend the service life of the brake fluid.
- The fluid level indicator is built into the reservoir tank for easy and correct monitoring of the fluid level when adding brake fluid.

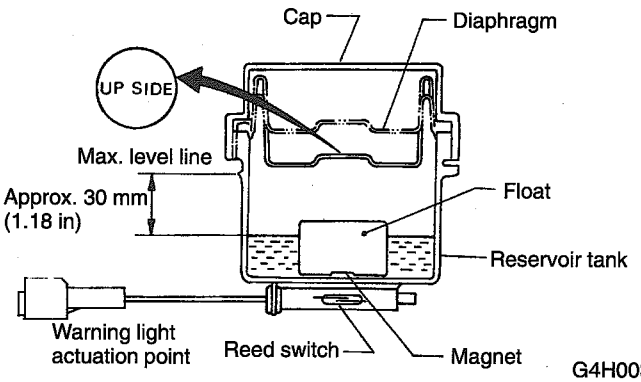


G4H0036

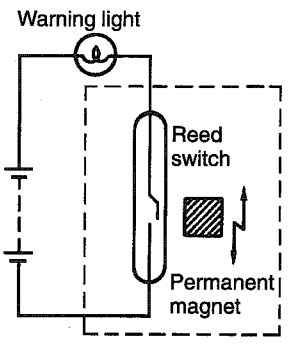
A: BRAKE FLUID LEVEL INDICATOR

Under normal conditions, the float remains above the reed switch, and the magnetic force from the permanent magnet in the float is unable to activate it. Therefore, the circuit is kept open, and the warning light remains off. The float lowers as the brake fluid level lowers, and if it falls below the specified fluid level [approx. 30 mm (1.18 in) below the MAX level line], the reed switch will be activated by the permanent magnet, closing the circuit. In this event, the warning light comes on and warns the driver of a reduction of the brake fluid level.

However, the warning light may be lighted momentarily even when the brake fluid surface is still above the specified level, if the vehicle body tilts or swings largely.



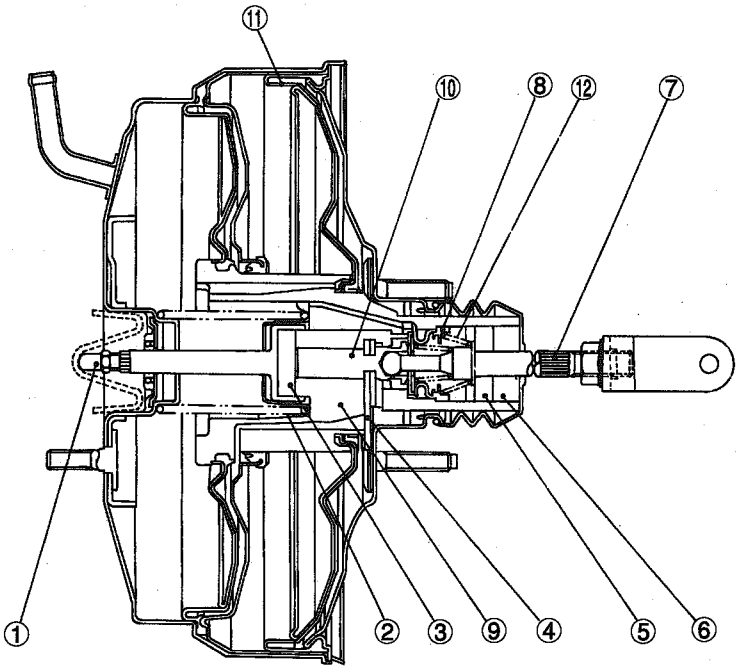
G4H0037



G4H0038

4. Brake Booster

The brake booster is a tandem type that utilizes two small diameter diaphragms to provide high brake boosting effects.



G4H0039

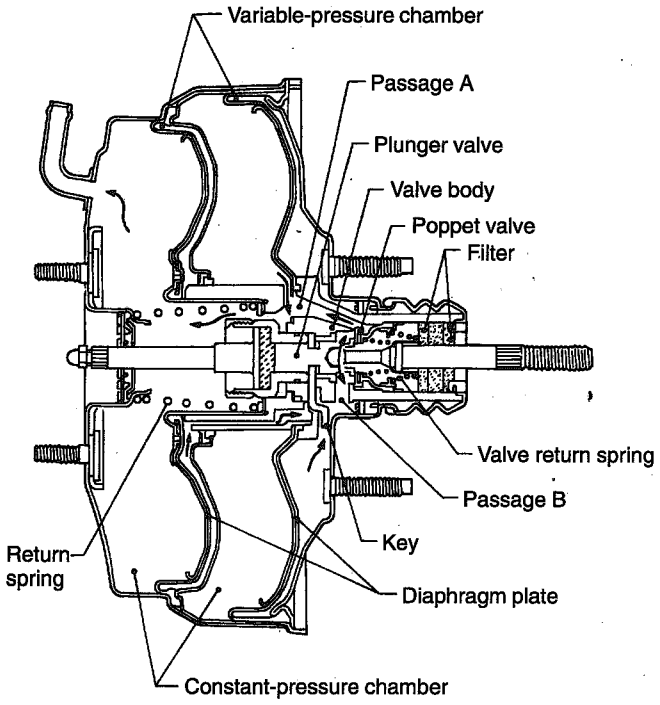
① Push rod
② Return spring
③ Reaction disc
④ Key
⑤ Filter
⑥ Silencer
⑦ Operating rod
⑧ Poppet valve
⑨ Valve body
⑩ Plunger valve
⑪ Diaphragm plate
⑫ Valve return spring

A: OPERATION

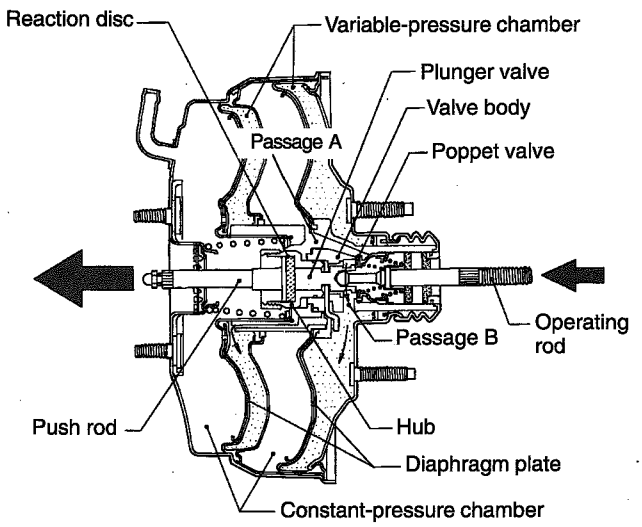
1. BRAKE BOOSTER "OFF"

The plunger valve comes in contact with the poppet valve so that atmospheric air passing through the filter and silencer is shut out by the atmospheric valve (of the poppet valve).

The plunger valve is moved to the key at the right by the return spring so that the poppet valve is held at the right. Since the vacuum valve of the valve body and the poppet valve are kept away from each other, passage A is linked with passage B and the constant-pressure chamber is also linked with the variable-pressure chamber. At this point, pressure differential does not occur between the two chambers; the diaphragm plate is moved back to the right by return spring tension.



G4H0040



G4H0041

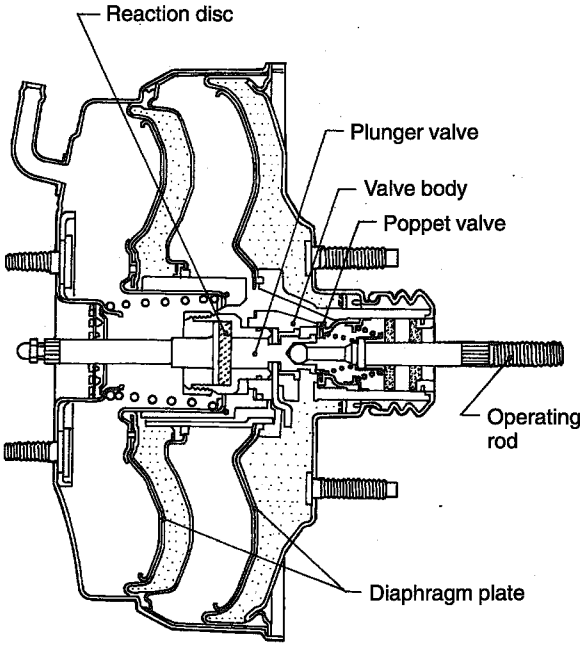
2. BRAKE BOOSTER "ON"

When the brake pedal is depressed, the operating rod pushes the plunger valve so that the poppet valve comes in contact with the vacuum valve of the valve body. This shuts off the circuit between passages A and B, as well as the circuit between the constant- and variable-pressure chambers.

Further movement of the plunger valve moves the atmospheric valve away from it so that atmospheric air is directed to the variable-pressure chamber via passage B. This produces a pressure differential between the constant- and variable-pressure chambers.

As a result, the diaphragm and its plate are moved to the left as a single unit.

The power applied to the diaphragm plate by the pressure differential is then transmitted to the reaction disc via a hub, as well as to the push rod, and produces a booster output.

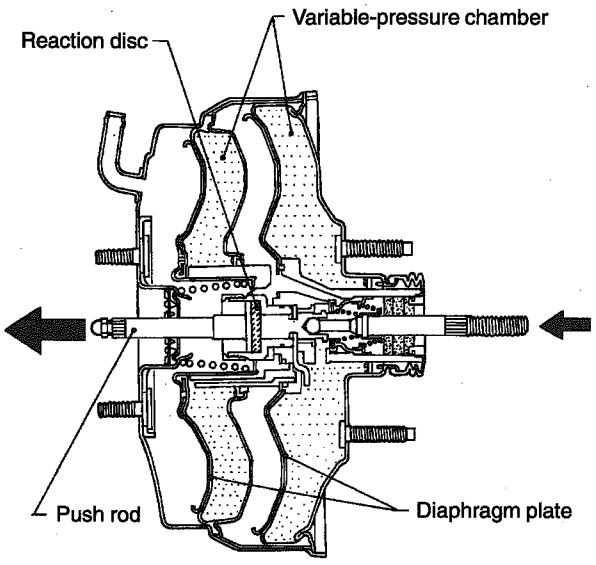


G4H0042

3. BRAKE BOOSTER UNDER MEDIUM LOAD

The poppet valve comes in contact with the plunger valve and valve body when a force pushes the center of the reaction disc (at the contact portion of the plunger valve) via the operating rod and plunger valve. This occurs when brake pedal depression is balanced with a force pushing the plunger valve (via the push rod and reaction disc) due to the reaction force of oil pressure delivered from the master cylinder.

As a result, pressure differential is maintained between the constant-pressure chamber and variable-pressure chamber unless the pedal depression force is changed.

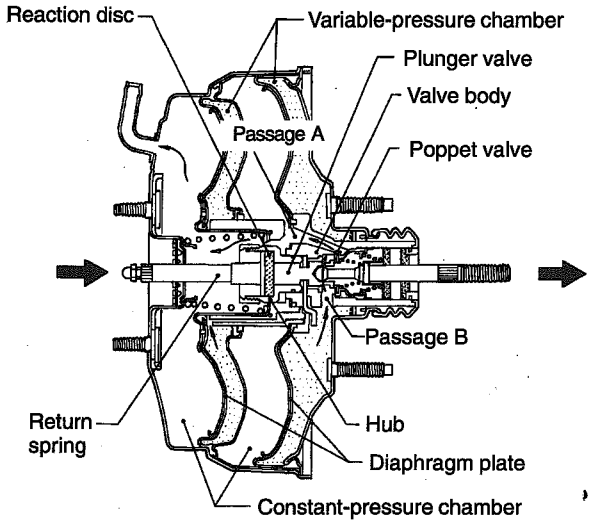


G4H0043

4. BRAKE BOOSTER UNDER FULL-LOAD CONDITIONS

When pedal depression increases to such an extent that the variable-pressure chamber is maintained at atmospheric pressure, the maximum pressure differential acts on the diaphragm plate.

Further pedal depression does not act on the diaphragm plate but rather on the push rod.



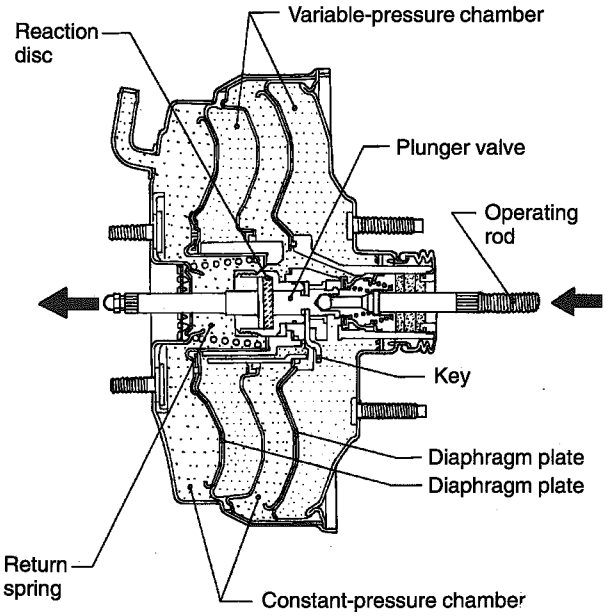
G4H0044

5. BRAKE BOOSTER RELEASED

When the force of brake pedal depression decreases, the forces acting on the reaction disc and plunger valve are unbalanced, so that the plunger valve is moved to the right.

The plunger valve then comes in contact with the atmospheric valve of the poppet valve to shut off the passage between the variable-pressure chamber and atmospheric air and, at the same time, moves the poppet valve back. Movement of the poppet valve opens the vacuum valve so that passages A and B are linked with each other.

Air from the variable-pressure chamber is then delivered to the constant-pressure chamber. This eliminates any pressure differential between the two chambers. As a result, the diaphragm plate is pushed back to the "release" position by the return spring.



G4H0045

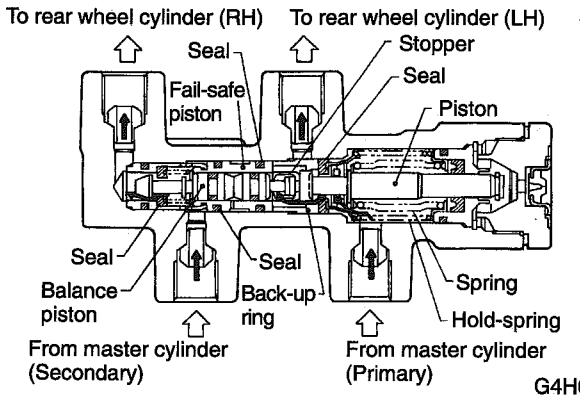
6. BRAKE BOOSTER WITH NO VACUUM

When the brake pedal is depressed while the constant- and variable-pressure chambers are held at atmospheric pressure, the operating rod moves to the left. This moves the plunger valve which in turn pushes the hub via the key.

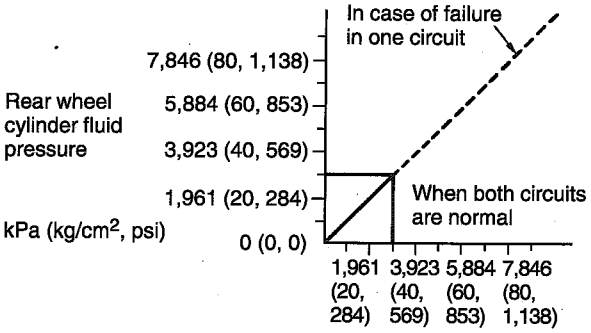
The reaction disc (which is built into the hub) then moves the master cylinder piston via the push rod. At this point a boosting force does not occur, but oil pressure is produced by movement of the master cylinder piston. As a result, the system serves as a hydraulic brake.

5. Proportioning Valve

The proportioning valve for dual piping systems is adopted for controlling the braking force.



G4H0046



G4H0047

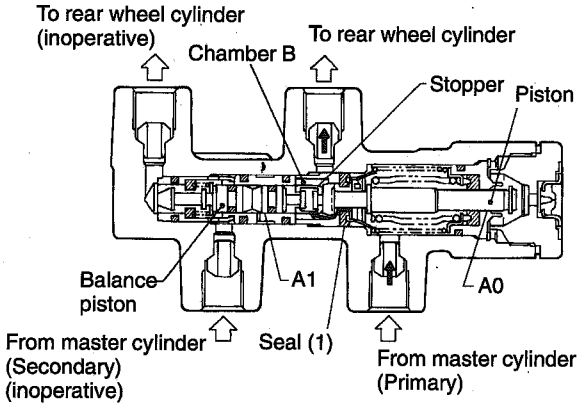
A: OPERATION DURING NORMAL CONDITIONS

When the fluid pressure in the master cylinder is low (the fluid pressure before the split point), the piston is pressed by the spring load and the valve remains inoperative. As a result, the fluid pressure in the master cylinder is held equal to the fluid pressure in the rear wheel cylinder.

- When the master cylinder fluid pressure rises, the piston in the primary circuit is moved rightward against the spring load, and brought into contact with the seal (1) (as shown in the figure). The master cylinder fluid pressure chamber (chamber A) is therefore cut off from the rear wheel cylinder fluid pressure chamber (chamber B), and the fluid pressure to the rear wheel cylinder is thus controlled. (The pressure at this moment is the split point pressure.)

If the fluid pressure in chamber A rises further, the piston is moved leftward, off the seal (1), and this causes the fluid pressure in chamber B to rise. The piston is then moved rightward, and brought into contact with the seal (1) again. After this, the piston repeats this contact with the seal (1) in this way, thereby controlling the fluid pressure in the rear wheel cylinder.

- When the fluid pressure in chamber B is controlled in the secondary circuit, the balance piston is moved rightward by the fluid pressure difference between chamber B and chamber C, and brought into contact with the seal (2), and the fluid pressure in chamber D is controlled. Since sectional areas A1 and A2 are equal, the balance piston is pushed by equal forces from the right and left. If the fluid pressure rises in chamber B, the balance piston performs control to equalize the fluid pressure in chamber D and chamber B by repeating open-close operation with the seal (2).

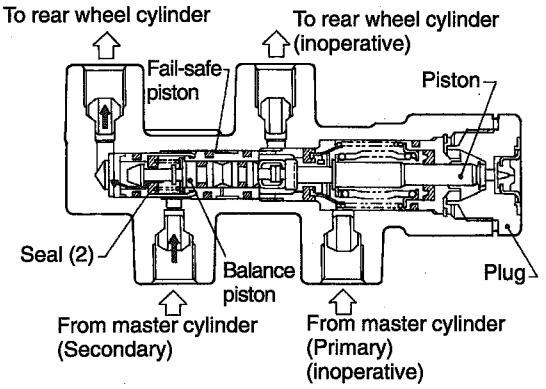


G4H0048

B: OPERATION IN CASE OF CIRCUIT FAILURE

1. FAILURE OF PRIMARY CIRCUIT

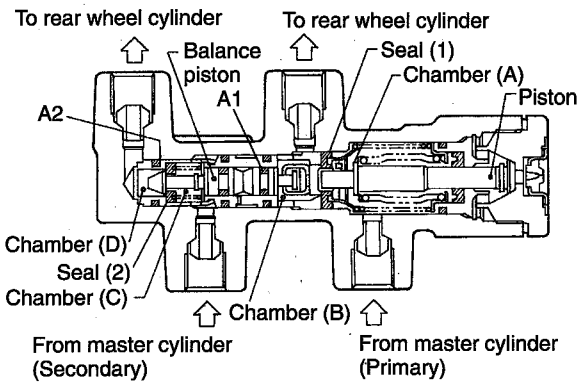
If the primary circuit fails, the fail-safe piston and balance piston are moved rightward by the fluid pressure in the master cylinder in the secondary circuit until the piston contacts the plug. In this case, the balance piston remains off the seal (2), and no split point is created in the graph. That is, the fluid pressure in the secondary side rear wheel cylinder is equal to the fluid pressure in the master cylinder.



G4H0049

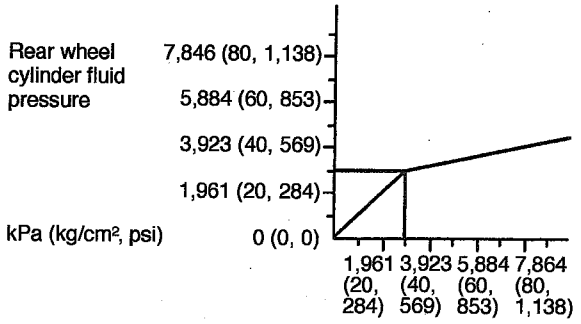
2. FAILURE OF SECONDARY CIRCUIT

If the secondary circuit fails, the balance piston is moved leftward by the fluid pressure in chamber B until the end of the piston contacts the stopper. Since sectional area A1 is greater than A2, the piston remains unmoved even after the master cylinder fluid pressure has reached the split point, and the piston is kept off the seal (1). Hence, no split point is created in the graph, and the rear wheel cylinder fluid pressure of the primary circuit is kept equal to the master cylinder fluid pressure.



G4H0050

6. Proportioning Valve (with ABS models)



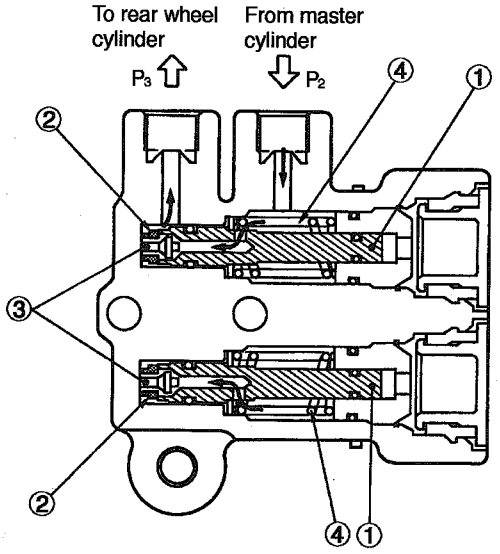
Master cylinder fluid pressure kPa (kg/cm², psi)
In case of split point 2,942 kPa (30 kg/cm², 427 psi)

H4H1130

A: OPERATION

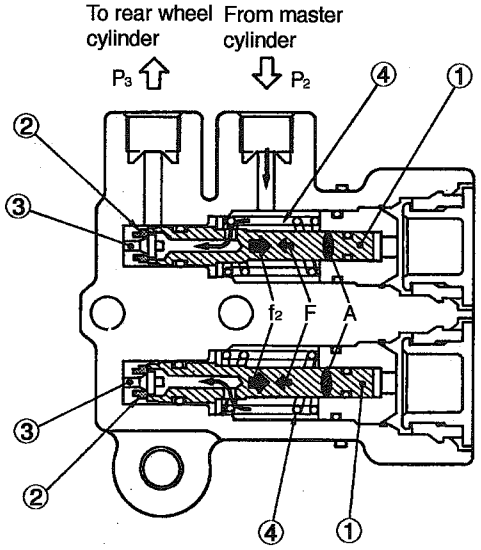
- Operation before the split point
  - Piston ① is held by spring ④ so that valve ③ is kept away from valve seat ②.

  Under this condition, fluid pressure "P_3" to rear wheel cylinders equals fluid pressure "P_2" from master cylinder.



H4H1127A

- Operation near the split point
  - Force "f_1", applied to piston ① by spring ④, is spring force "F". In other words, "f_1" = "F".
  - Force "f_2" is also applied to piston ① in the direction opposite to spring force "F" due to fluid pressure "P_2" generated by master cylinder according to cross sectional area "A".
  - Force "f_2" increases respondingly with fluid pressure "P_2". When "f_2" is greater than piston ① moves in direction opposite to spring force "F". This causes valve ② to come in contact with valve seat ③, blocking fluid passage.



H4H1128A

- Immediately before fluid passage is closed, fluid pressure "P_2" is held equal to pressure "P_3". When brake pedal is depressed to increase fluid pressure "P_2", piston ① moves in the same direction as spring force "F", opening fluid passage.

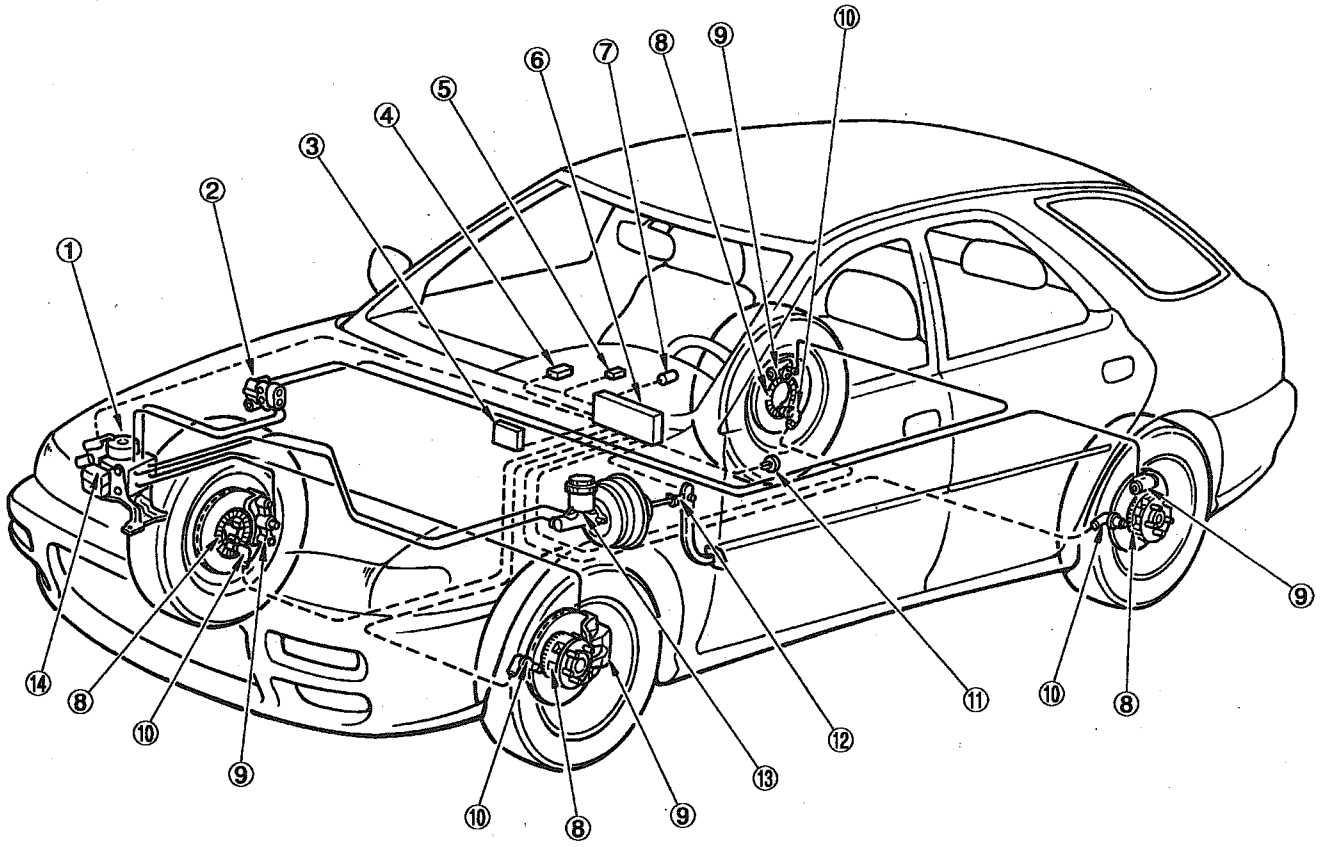
However, since fluid passage is closed again immediately after pressure "P_2" equals "P_3", pressure "P_3" is held at a value of less than pressure "P_2".

7. Anti-lock Brake System (ABS)

A: FEATURE

- The ABS (Anti-lock brake system) electrically controls brake fluid pressure to prevent wheel "lock" during braking on slippery road surfaces, thereby improving directional/steering stability as well as shortening the braking distance.
- If the ABS becomes inoperative, the fail-safe system activates to ensure it acts as a conventional brake system. The warning light also comes on to indicate that the ABS is malfunctioning.
- The front-and-rear wheels utilize a 4-sensor, 4-channel control design: the front wheels have an independent control design*1 and the rear wheels have a select low control design*2.

*1: A system which independently controls fluid pressure to left and right front wheels.
*2: A system which provides the same fluid pressure control for the two rear wheels if either wheel starts to "lock."

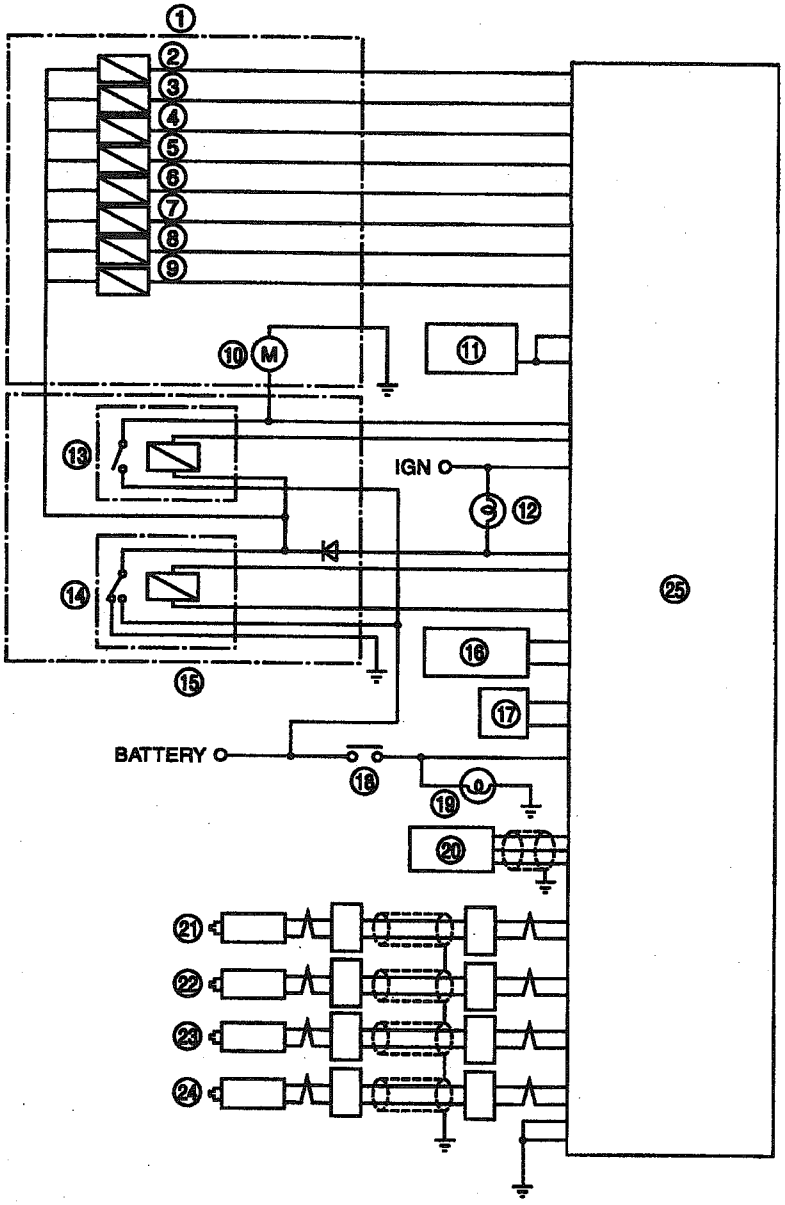


H4H1057A

① Hydraulic control unit
② Proportioning valve
③ Transmission control module (only AT vehicle)
④ Data link connector (for SUBARU selecor monitor)
⑤ ABS diagnosis connector
⑥ ABS control module
⑦ ABS warning light
⑧ Tone wheel
⑨ Wheel cylinder
⑩ ABS sensor
⑪ G sensor (only AWD vehicle)
⑫ Brake switch
⑬ Master cylinder
⑭ Relay box

B: FUNCTIONS OF SENSORS AND ACTUATORS

Name	Function
ABS control module (ABSCM)	• Calculates and determine the conditions of the wheels and body from the wheel speeds and makes a proper decision suitable for the current situation to control the hydraulic unit. • In the ABS operation mode, the module outputs a cooperative control signal to the AT control module. (AT vehicles only) • Whenever the ignition switch is placed at ON, the module makes a self diagnosis. When anything wrong is detected, the module cuts off the system. • Communicates with the Subaru select monitor.
Hydraulic unit (H/U)	In the ABS operation mode, the H/U changes fluid passages to control the fluid pressure of the wheel cylinders in response to an instruction from the ABSCM. The H/U also constitutes the brake fluid passage from the master cylinder to the wheel cylinders together with pipings.
Wheel speed sensor (ABS sensor)	Detects the wheel speed in terms of a change in the magnetic flux density passing through the sensor, converts it into an electrical signal, and outputs the electrical signal to the ABSCM.
Tone wheel	Gives a change in the magnetic flux density by the teeth around the tone wheel to let the ABS sensor generate an electrical signal.
G sensor (AWD vehicle only)	Detects a change in G in the longitudinal direction of the vehicle and outputs it to the ABSCM in terms of a change in voltage.
Relay box	Accommodates the valve relay and motor relay.
Valve relay	Serves as a power switch for the solenoid valve and motor relay coil in response to an instruction from the ABSCM. The valve relay also constitutes one of the duplicated ABS warning light drive circuits.
Motor relay	Serves as a power switch for the pump motor in response to an instruction from the ABSCM.
Stop light switch	Transmits the information on whether the brake pedal is depressed or not to the ABSCM for use as a condition in determining ABS operation.
ABS warning light	Alerts the driver to an ABS fault. When the diagnosis connector and diagnosis terminal are connected, the light flashes to indicate a trouble codes in response to an instruction from the ABSCM.
AT control module (TCM) (AT vehicles only)	Provides shift controls (fixing the speed at 3rd changing front and rear wheel transmission characteristics on AWD vehicle) in response to an instruction from the ABSCM.



B4M0787A

① Hydraulic control unit
② Front left inlet solenoid valve
③ Front left outlet solenoid valve
④ Front right inlet solenoid valve
⑤ Front right outlet solenoid valve
⑥ Rear left inlet solenoid valve
⑦ Rear left outlet solenoid valve
⑧ Rear right inlet solenoid valve
⑨ Rear right outlet solenoid valve
⑩ Motor
⑪ Transmission control module (only AT module)
⑫ ABS warning light
⑬ Motor relay
⑭ Valve relay
⑮ Relay box
⑯ Data link connector
⑰ ABS diagnosis connector
⑱ Stop light switch
⑲ Stop light
⑳ G sensor (only AWD model)
㉑ Front left ABS sensor
㉒ Front right ABS sensor
㉓ Rear left ABS sensor
㉔ Rear right ABS sensor
㉕ ABS control module

C: THEORY OF ABS CONTROL

When the brake pedal is depressed during operation, wheel speed as well as vehicle speed decreases. The difference which occurs between wheel speed and vehicle speed is called the "slip" phenomenon. The magnitude of this action is expressed by "slip" the ratio which is determined by the following equation:

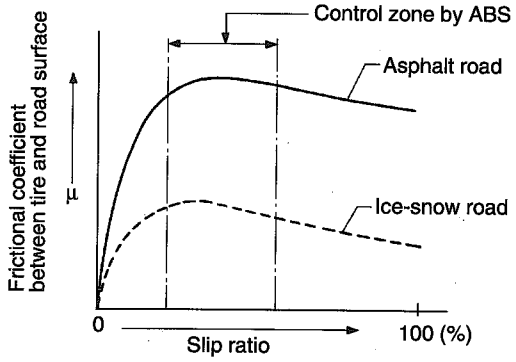
$$\text{Slip ratio} = \frac{\text{Vehicle speed} - \text{Wheel speed}}{\text{Vehicle speed}} \times 100\ \%$$

When the "slip" ratio is 0 % vehicle speed equals wheel speed and the wheel rotates without any slippage. When the "slip" is 100 % the wheel locks and does not rotate (wheel speed = 0) although vehicle speed exists.

The relationship between the frictional force of a wheel in the fore-and-aft direction and the "slip" ratio is shown by two characteristic curves in figure.

These curves are determined by the relationship between the wheel and road surface. Where the same type of wheel are used; the curve shown by a solid line indicates wheels driven on asphalt or paved roads, the curve shown by dotted lines refers wheels subjected to slippery (snowy or icy) roads.

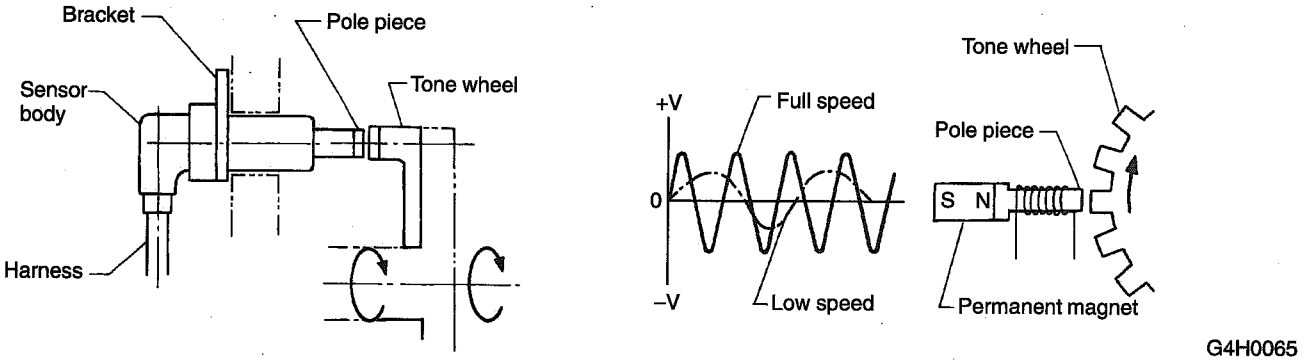
When different types of wheels are used, although the road surface is the same, these curves will change. In general, the frictional coefficient between wheel and road surface in relation to an increase in the "slip ratio" will reach the maximum value in the 8 – 30 % range and will tend to decrease after that.



G4H0064

D: ABS SENSOR

The ABS sensor detects wheel speed and consists of a permanent magnet, coil, tone wheel, etc. The magnetic flux produced by the permanent magnet varies with the tone wheel (which rotates together with the wheel) and the sensor emits an alternating voltage corresponding with the wheel speed by electromagnetic induction.



E: ABS CONTROL MODULE (ABSCM)

The ABSCM is a digital control type electronic control module accommodating two microcontrol modules (MCMs); master and slave. Both MCMs process the same program and monitor the respective outputs, and when a mismatch occurs, cut off the system to activate the fail-safe function.

A maximum of 3 trouble codes are stored in the EEP ROM and if 3 or more areas fail, then only the 3 most recent failures are stored. The trouble codes remain stored until they are erased.
This ABSCM induces a sequence control pattern and facilitates the checking of the hydraulic unit.

- ABS control

Based on the four wheel speed signals, the ABSCM calculates a simulated body speed or body deceleration rate, while referencing the G sensor output as an auxiliary means, and compares them with the wheel speeds and wheel deceleration rates. If it determines that the wheels are about to lock, it controls the solenoid valve or motor pump of the H/U to adjust the brake fluid pressures that act on the wheel cylinders, thereby preventing the wheels from locking.
The ABSCM controls the right and left front wheel fluid pressures independently and controls the rear wheel fluid pressures on the basis of the wheel which is more likely to lock (Select-low control).

- Select monitor associated functions

The Subaru select monitor may be used to perform the following operations.

- To read out analog data
- To read out ON/OFF data
- To read out or erase trouble code
- To read out status information in the event of trouble (Freeze frame data)
- To initiate ABS sequence control pattern

- Indication functions

The ABS warning light can be made to indicate the following three states.

- ABS trouble
- Flashes to indicate trouble codes in diagnosis mode.
- Valve ON/OFF when sequence control pattern is in effect

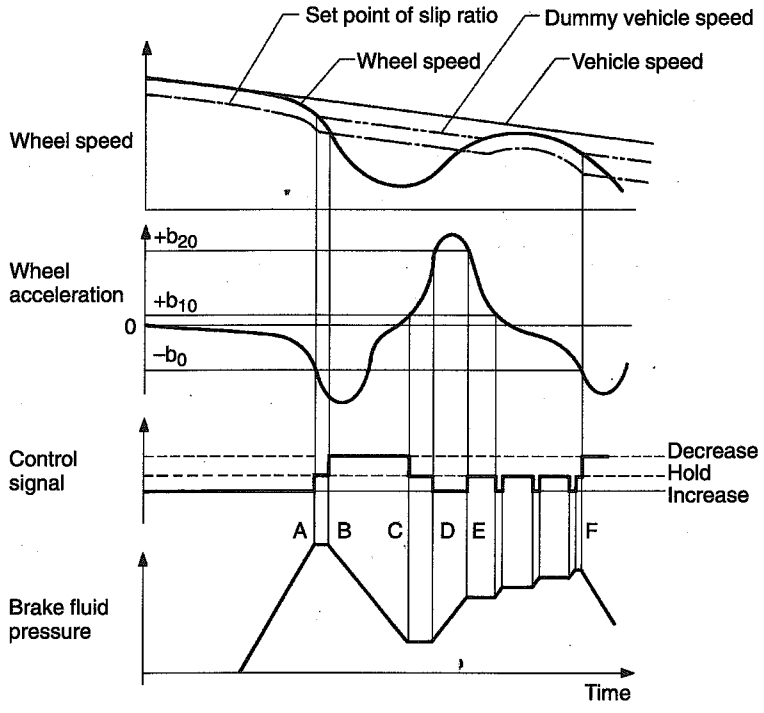
F: ABS CONTROL CYCLE CURVES

As the brake pedal is depressed, brake fluid pressure increases correspondingly, which in turn decreases wheel speed. When brake fluid pressure reaches point "A" (where wheel deceleration exceeds "$-b_0$"), the control module transmits a "hold" signal to hold the brake fluid pressure in wheel cylinder at that point. At the same time, the control module computes a "dummy" vehicle speed. When the wheel speed drops below the slip ratio setting (= speed less than the dummy vehicle speed based on the predetermined value) at point "B" of the brake fluid pressure, the control module then transmits a "decrease" signal to prevent wheel lock-up. This causes the brake fluid pressure to decrease.

After brake fluid pressure is decreased, wheel acceleration increases. When it exceeds the wheel acceleration setting "$+ b_{10}$" at point "C" (brake fluid pressure), the control module transmits a "hold" signal to hold the brake fluid pressure at that point. When wheel acceleration setting value "$+ b_{20}$" is exceeded and when brake fluid pressure is at point "D", the control module judges that wheel lock-up will not occur and then transmits an "increase" signal to increase brake fluid pressure.

When wheel acceleration drops below "$+ b_{20}$" at point "E" (which occurred due to a brake fluid pressure increase), the repetition of the "hold" and "increase" signals takes place a at constant cycle.

When wheel deceleration exceeds "$-b_0$", at point "F" of the brake fluid pressure, the control module immediately transmits a "decrease" signal to decrease brake fluid pressure.

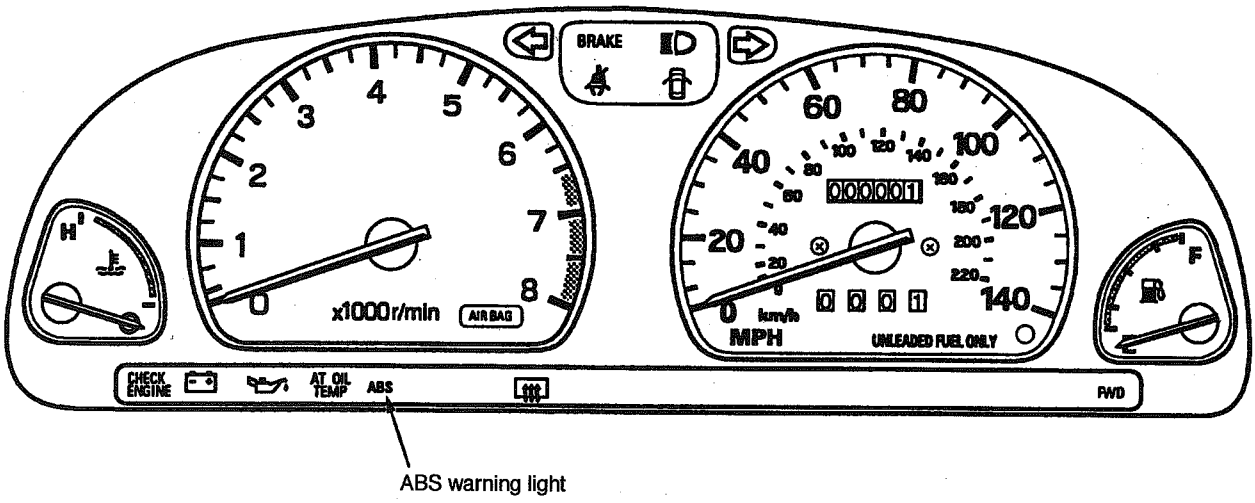


G4H0067

G: ABS WARNING LIGHT

When a signal system or the ABS control module becomes inoperative, the warning light in the combination meter comes on to indicate that the system or control module is malfunctioning. At the same time, current flowing through the hydraulic control unit is interrupted so that the brake system functions as a conventional brake system. The circuit through which the warning light comes on utilizes a dual system design.

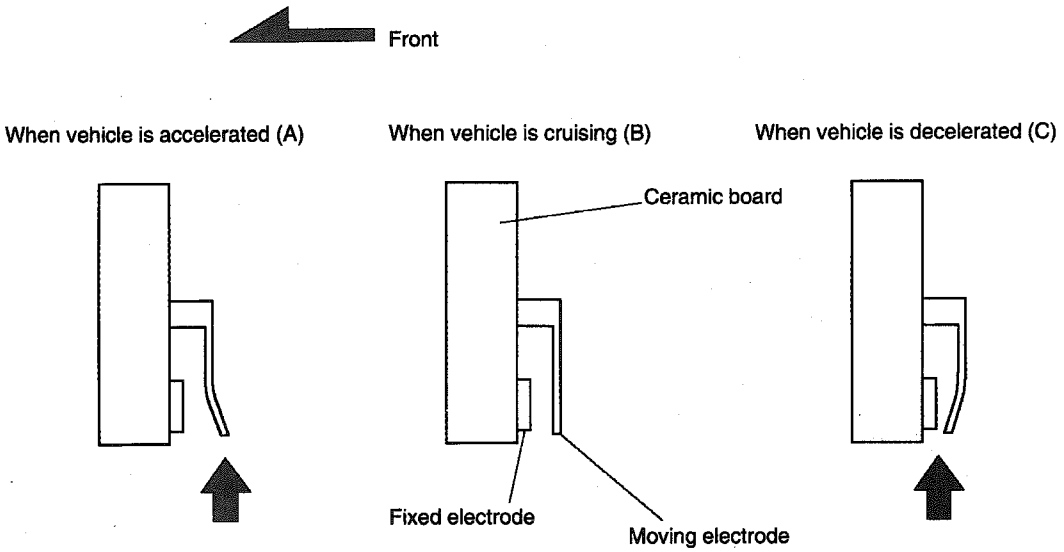
If the warning light comes on upon detection of a system malfunction, call a trouble code and identify it using the warning light.

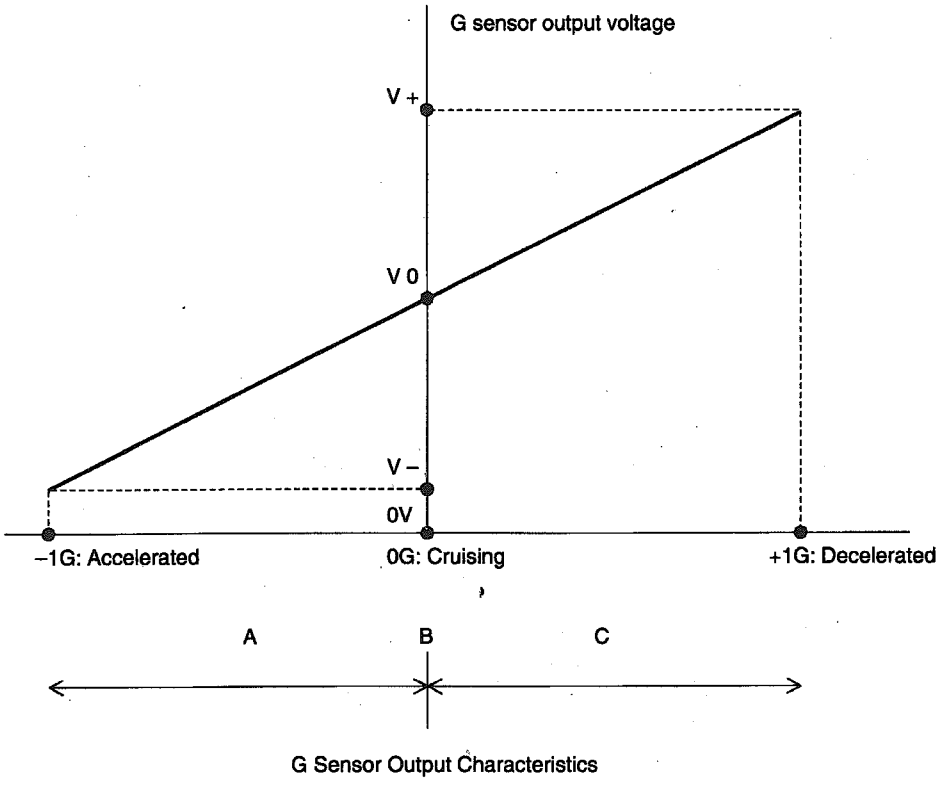


H4H1129A

H: G SENSOR

The G sensor detects a change in G in the longitudinal direction.
It detects the motion of the moving electrode built into the sensor in terms of a change in the capacitance of the capacitor and outputs it to the ABSCM in terms of a change in voltage.





G Sensor Output Characteristics

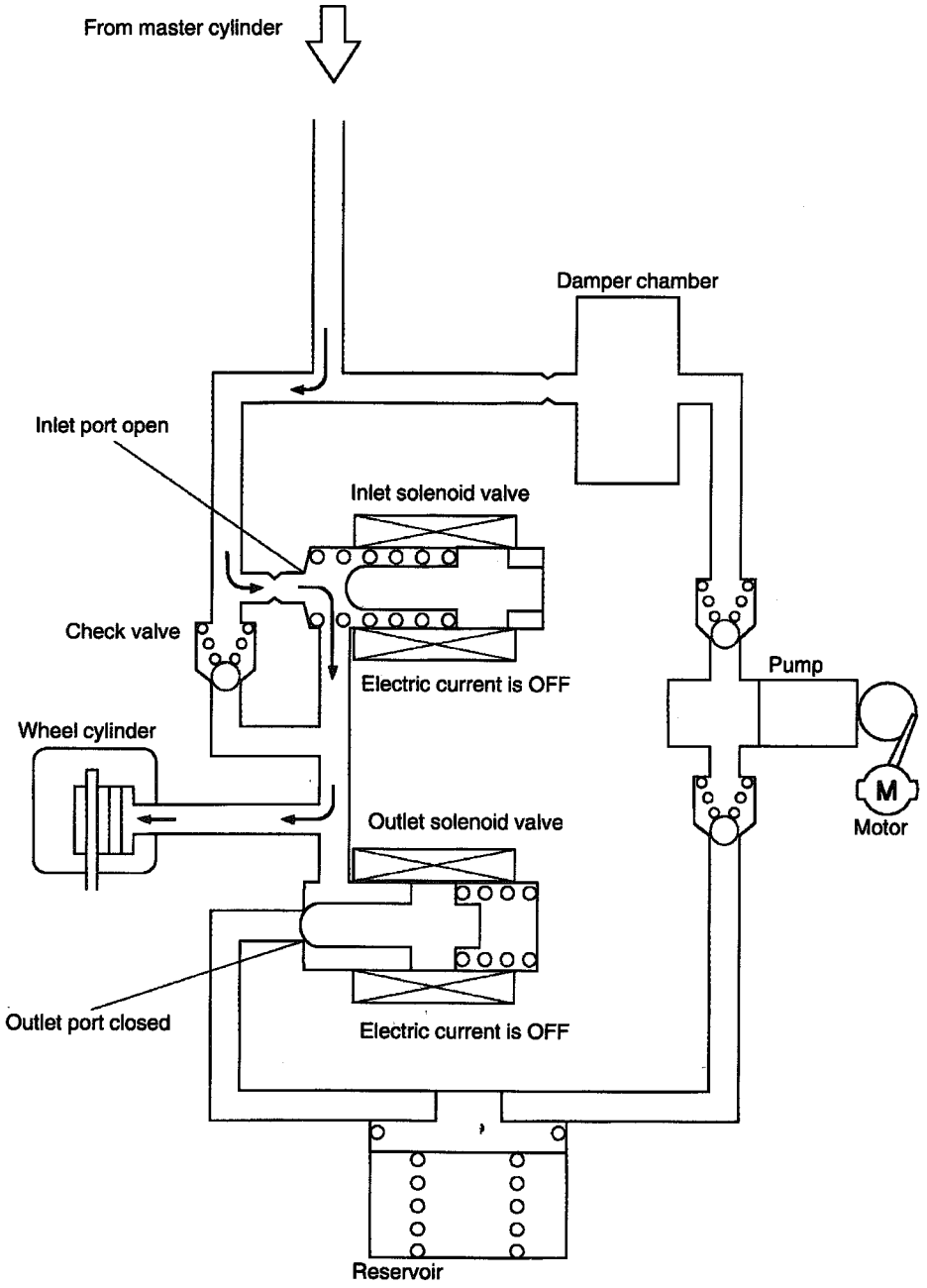
B4H0988

I: HYDRAULIC CONTROL UNIT (H/C)

- The H/U is a fluid pressure controller comprising a motor, solenoid valve, housing, relay, etc. It constitutes two diagonally independent brake fluid circuits for a cross piping vehicle.
  - The pump motor rotates an eccentric cam to let the plunger pump generate a hydraulic pressure.
  - The housing accommodates the pump motor, solenoid valve, reservoir, etc., and also constitutes a brake fluid passage.
  - The plunger pump is a hydraulic pump which drains off the brake fluid which, when the pressure is reduced, is discharged to the reservoir, and sends it toward the master cylinder
  - The solenoid valve is a 2-position type solenoid valve which switches the brake fluid passages between the wheel and master cylinder and reservoir sides in response to an instruction from the ABSCM.
    For each wheel cylinder, a pair of normally-closed and -opened solenoid valves are provided.
  - The reservoir is a fluid chamber which temporarily stores the brake fluid to be discharged from the wheel cylinder when the pressure is reduced.
  - The damper chamber suppresses the pulsation of the brake fluid which, when the pressure is reduced, is discharged from the plunger pump, thereby minimizing the kickbacks to the brake pedal.
  - The valve relay controls the solenoid valve and motor relay energizing power supply in response to an instruction from the ABSCM. In normal (IG ON) condition, the relay is actuated to supply power to the solenoid valve and motor relay. When an error occurs in the system, the valve relay is forced to OFF to keep the fluid pressure circuit in the normal mode (normal brake mode) and also constitute the ABS warning light operating circuit.
  - The motor relay supplies power to the pump motor to operate the plunger pump in response to an instruction from the ABSCM in the ABS control mode.
- The H/U has four operating modes; normal mode (control OFF: normal brake mode), "increase", "hold" and "decrease" modes (control ON in all the three modes).

1. DURING NORMAL BRAKING (EXPLAINED WITH ONE WHEEL'S CONTROL AS AN EXAMPLE)

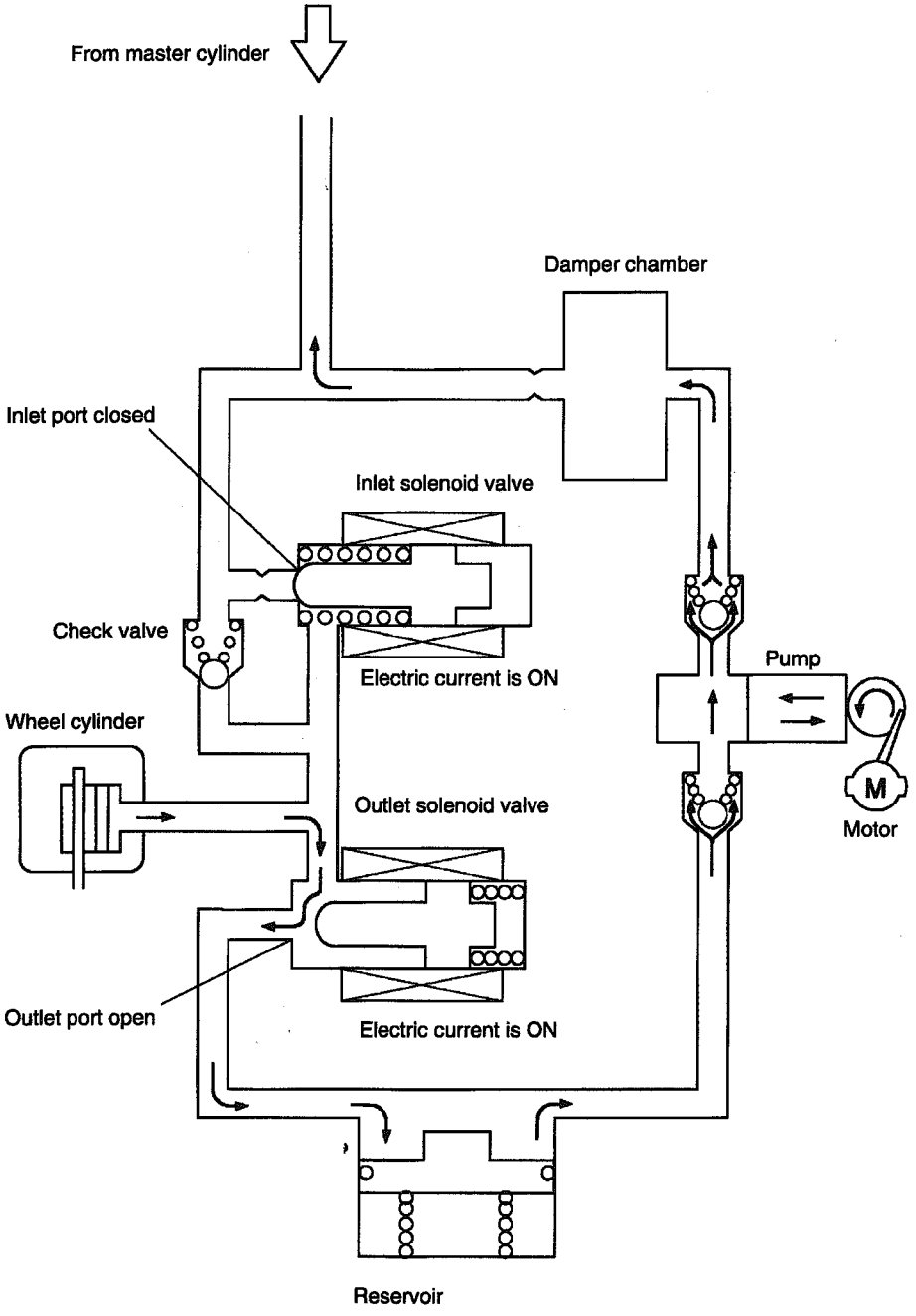
Since no current is supplied to the inlet and outlet solenoid valves, no solenoid valve attracting force is generated. So the valves remain stationary.
Accordingly, the inlet port of the inlet solenoid valve is in an opened state, whereas the outlet port of the outlet solenoid valve is in a closed state. So the fluid pressure of the master cylinder is transmitted to the wheel cylinder to produce a brake force in the wheel cylinder.



B4H0989

2. PRESSURE "DECREASE" ACTION WITH ABS IN OPERATION (EXPLAINED WITH ONE WHEEL'S CONTROL AS AN EXAMPLE)

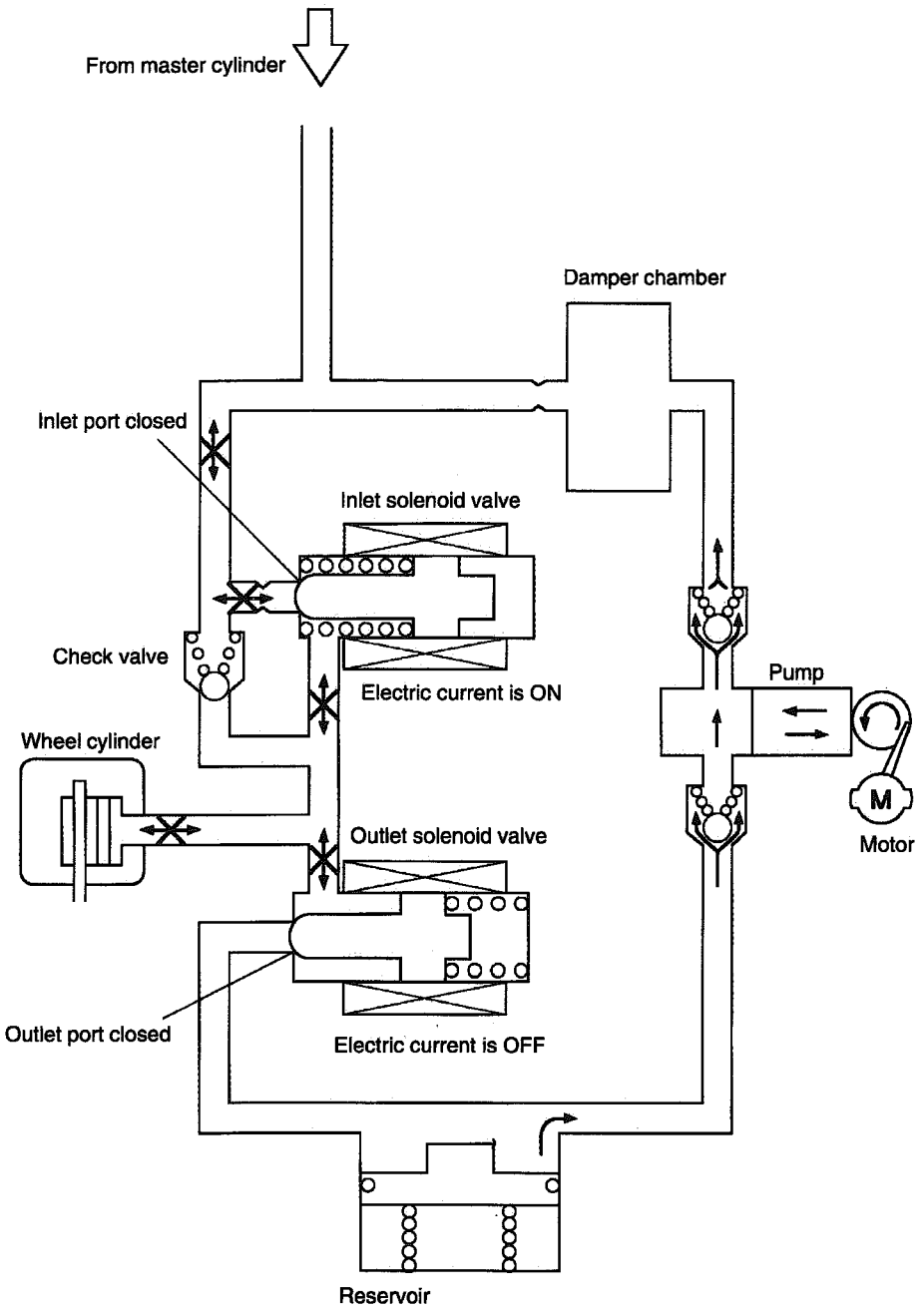
Current is supplied to the inlet and outlet solenoid valves, and the generated solenoid valve attracting forces close the inlet port and open the outlet port.
Accordingly, the wheel cylinder is isolated from the master cylinder and becomes clear to the reservoir, allowing the brake fluid to flow to the reservoir. So the fluid pressure of the wheel cylinder is decreased.
The brake fluid collected in the reservoir is fed to the master cylinder by the pump.



B4H0990

3. PRESSURE "HOLD" ACTION WITH ABS IN OPERATION (EXPLAINED WITH ONE WHEEL'S CONTROL AS AN EXAMPLE)

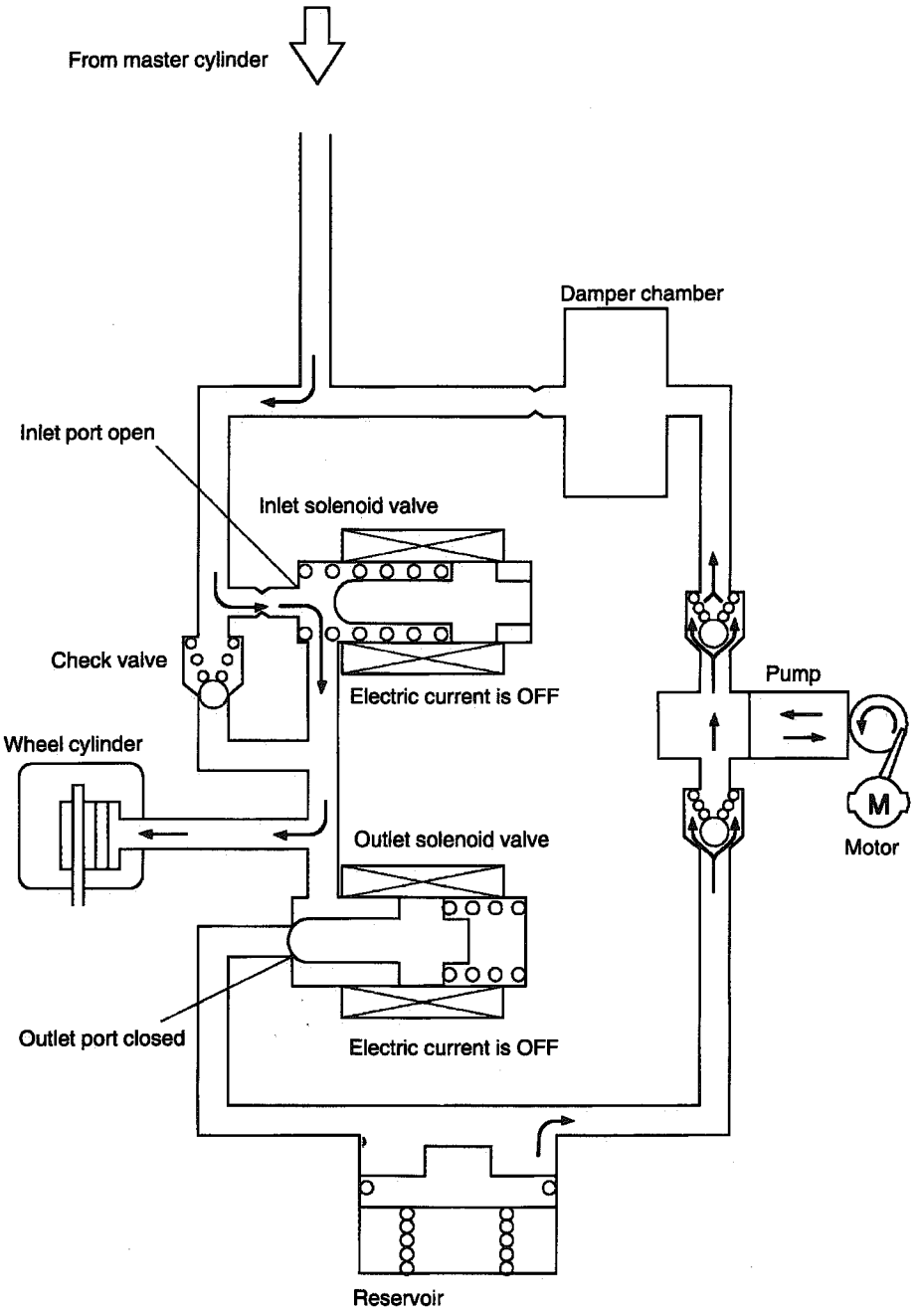
Current is supplied to the inlet solenoid valve, and the generated solenoid valve attracting force closes the inlet port.
Since no current is supplied to the outlet solenoid valve, the output port remains in a closed state. As a result, the wheel cylinder, master cylinder and reservoir are blocked, and the fluid pressure of the wheel cylinder is maintained constant.
During ABS operation, the pump motor continues to operate.



B4H0991

4. PRESSURE "INCREASE" ACTION WITH ABS IN OPERATION (EXPLAINED WITH ONE WHEEL'S CONTROL AS AN EXAMPLE)

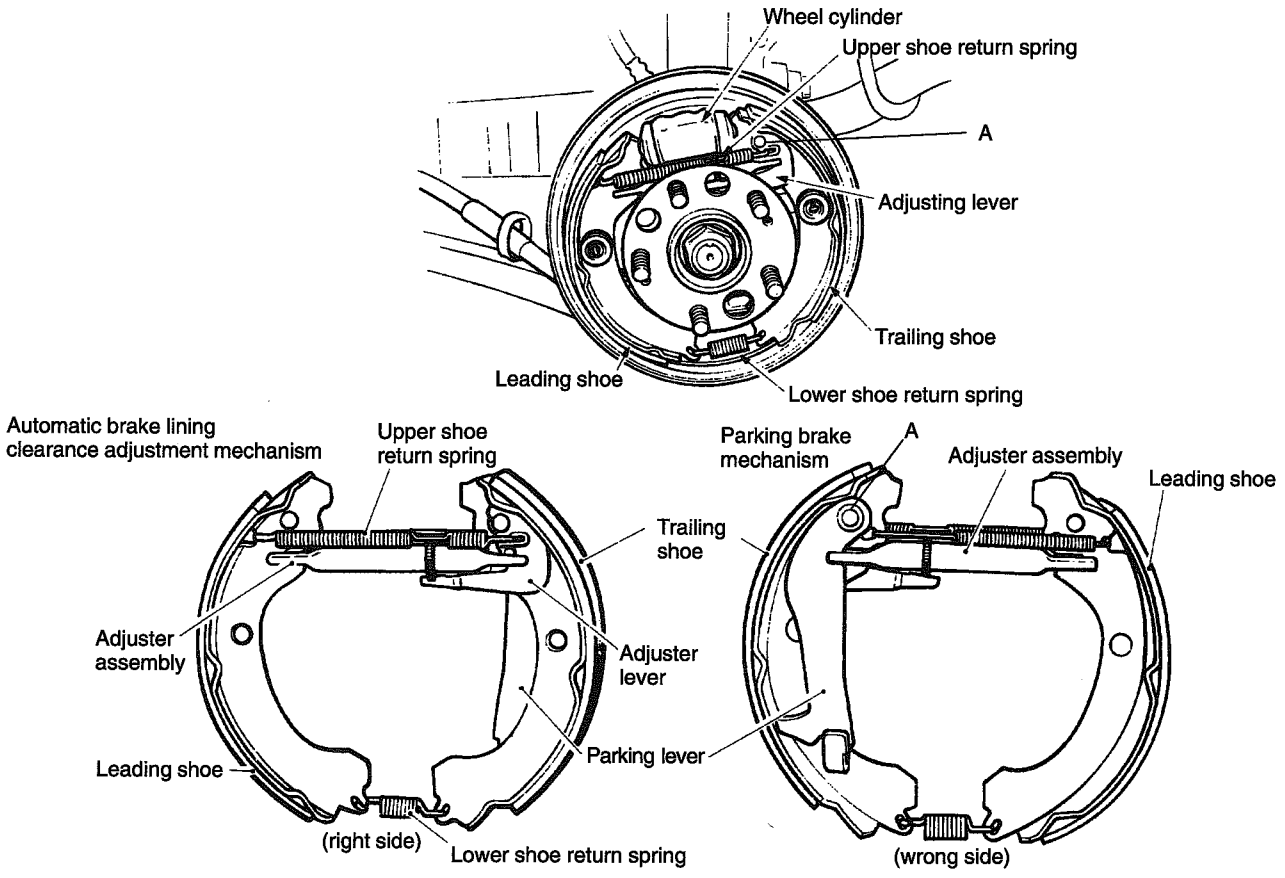
Since no current is supplied to the inlet and outlet solenoid valves, no solenoid valve attracting force is generated. So the valves remain stationary.
Accordingly, the inlet port of the inlet solenoid valve is in an opened state, whereas the outlet port of the outlet solenoid valve is in a closed state. So the fluid pressure of the master cylinder is transmitted to the wheel cylinder to increase the brake force in the wheel cylinder.
During ABS operation, the pump motor continues to operate.



B4H0992

8. Parking Brake (Rear Drum Brake)

When the parking brake lever is moved up, a lever in the drum brake moves with point "A" as a fulcrum so that the trailing shoe expands. The leading shoe also expands by way of the adjuster assembly. In this way, braking force will occur.



G4H0077

PEDAL SYSTEM AND CONTROL CABLES 4-5

1. Pedal Effort Reducing Mechanism

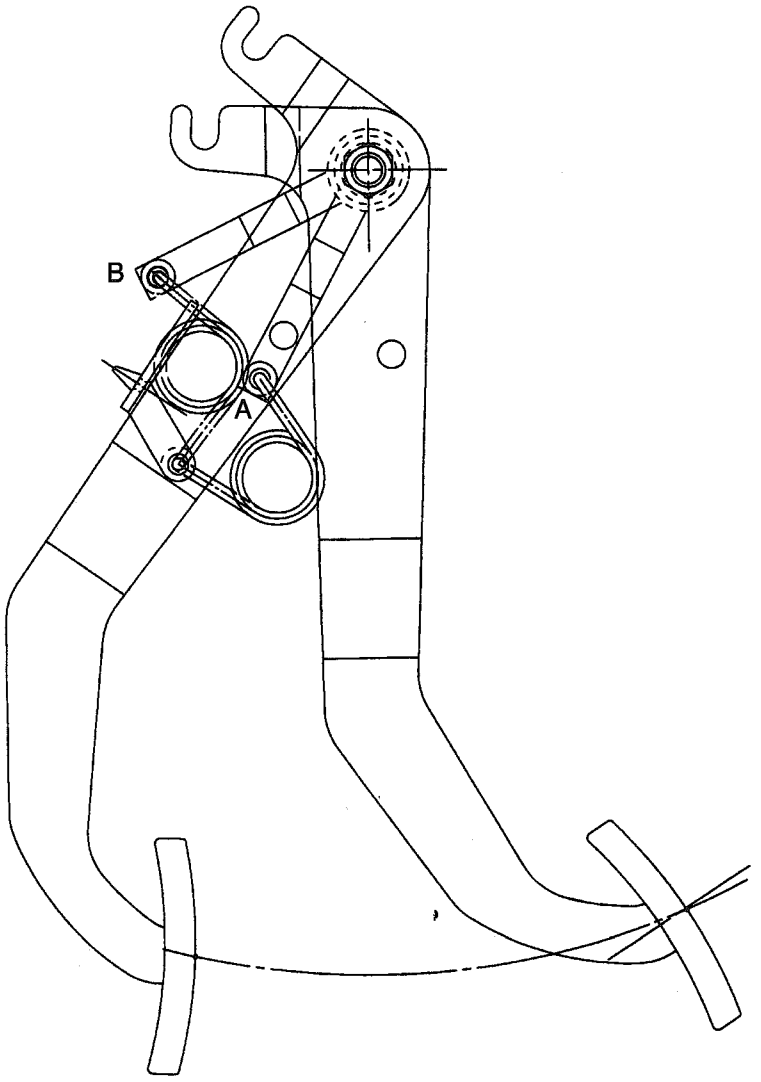
The pedal effort reducing mechanism uses a mechanical turnover system as shown below. It is installed on vehicles which require a large force for the clutch pedal.

A: CONSTRUCTION

An arm is made integral with the clutch pedal, and spring-hook is connected to the arm end bushing.

B: OPERATION

When the clutch pedal is depressed, point A moves toward point B, spring-hook makes a swing. The pedal depressing effort becomes small when the prolonged line of the spring-hook passes over the center of the pedal shaft.



G4H0001

HEATER AND VENTILATOR 4-6

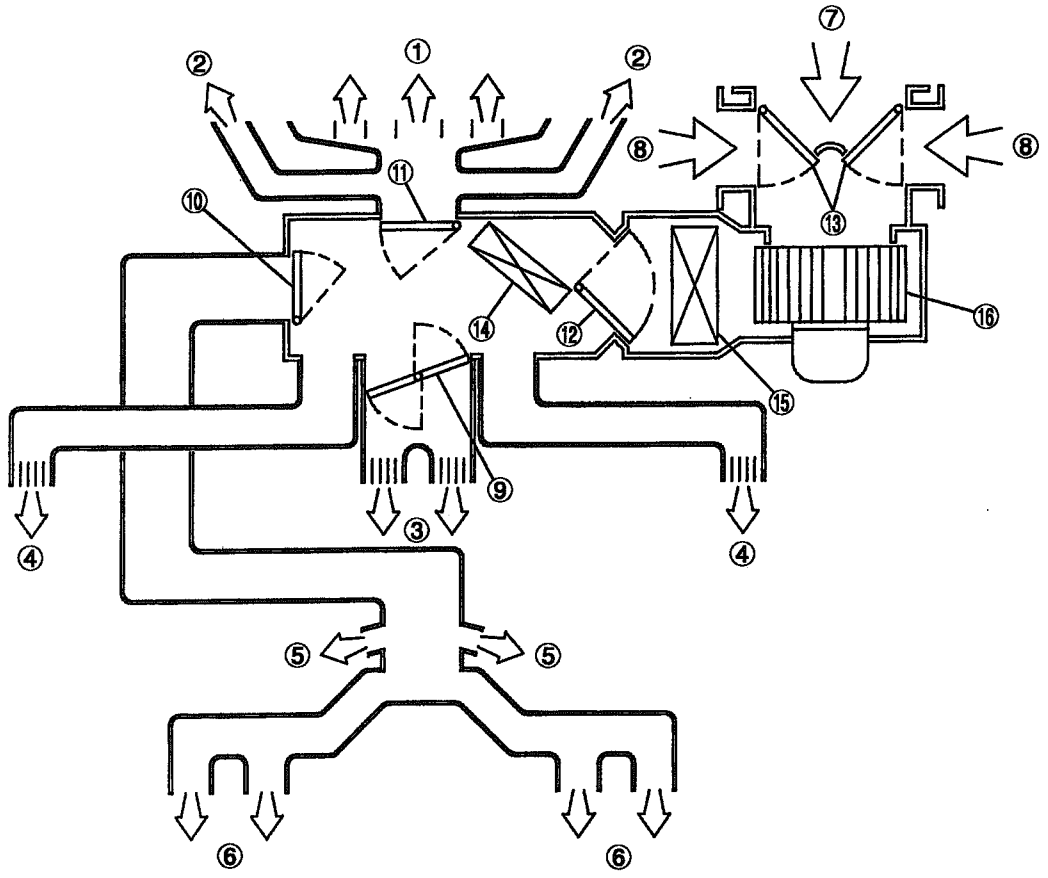
1. Heater System

The heater control unit is located in the middle portion of the instrument panel.

The heater unit is provided with mode doors and an air mix door. The intake unit is provided with an intake door and blower motor. The heater unit and the intake unit are regulated by heater control unit.

Fresh outside air is introduced into the compartment through the center and side ventilator grilles when the blower fan is operated.

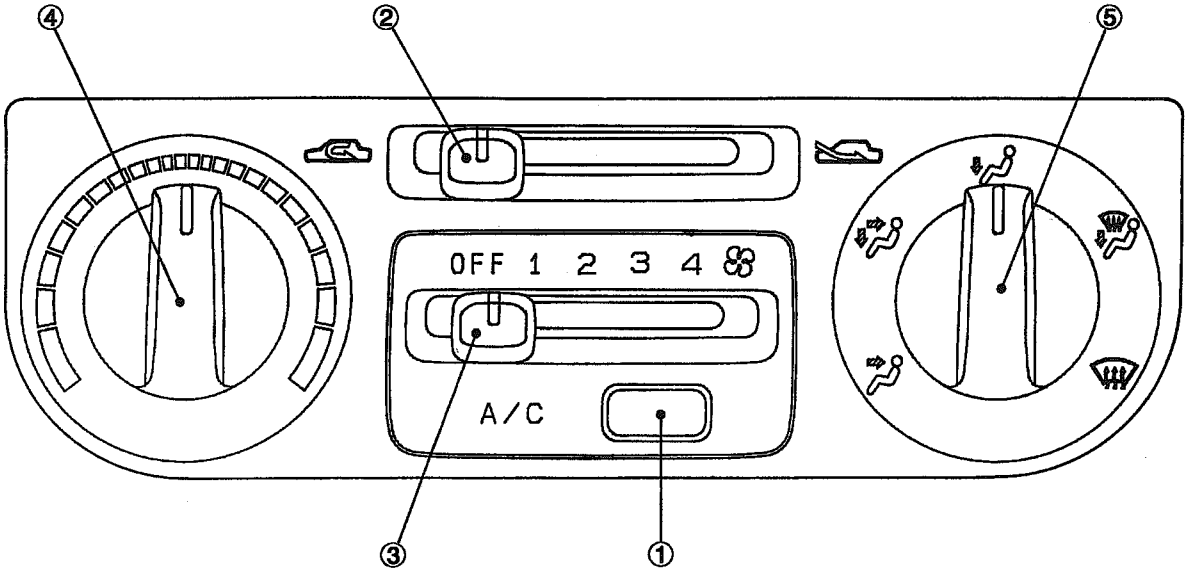
All models are equipped with the front side window defroster, and all models are further equipped with the rear heater duct.



H4H1096A

① Front defroster outlet
② Side defroster outlet
③ Center outlet
④ Side outlet
⑤ Front heater outlet
⑥ Rear heater outlet
⑦ Fresh inlet air
⑧ Recirc air
⑨ Vent door
⑩ Heater door
⑪ Defroster door
⑫ Air mix door
⑬ Intake door
⑭ Heater core
⑮ Evaporator (A/C model)
⑯ Blower fan

2. Switch Function

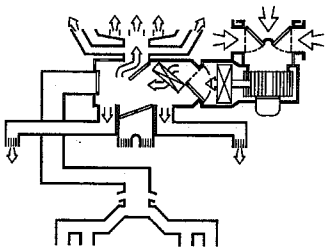
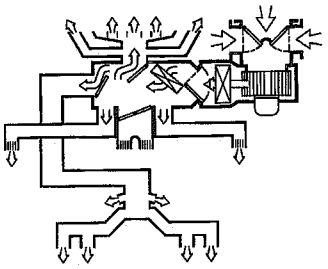
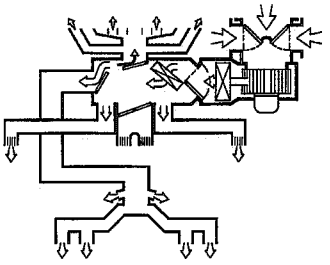
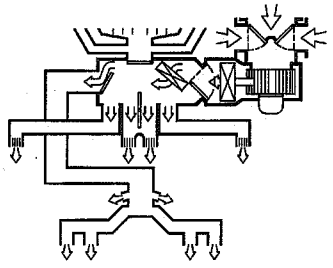
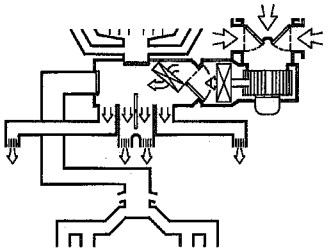


1	A/C switch	Indicator	*ON		OFF	
		Compressor	ON		OFF	
		*: When fan switch is "ON", indicator light and compressor turn "ON".				
2	Recirc switch	Switch position				
		Intake door position	Recirc		Fresh	
3	Fan switch	Switch position	1	2	3	4
		Fan speed	1st	2nd	3rd	4th
4	Temperature control switch	Outlet air temperature can be variably controlled from COLD to HOT.				
5	Mode selector switch	Switch position				 
		Air outlet	Vent	Vent Heat	Heat	DEF Heat / DEF

H4H1036

3. Mode Selector Switch and Air Flow

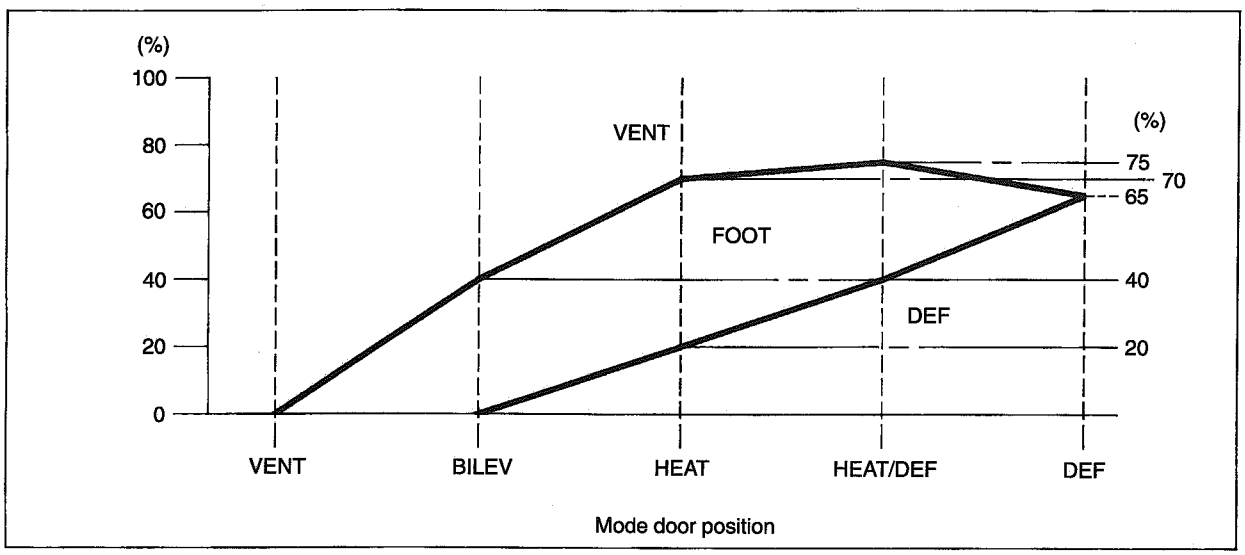
A: AIR FLOW

Mode selector switch position	Air flow
 DEF	
 DEF/HEAT	
 HEAT	
 BI – LEVEL	
 VENT	

H4H1037

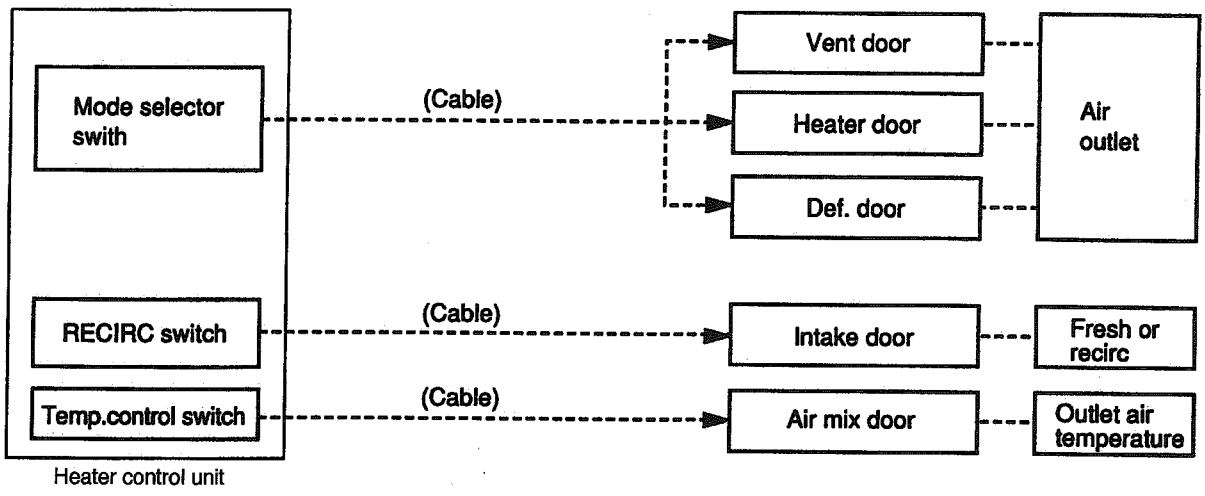
B: AIR DISTRIBUTION RATIO

Figure shows air distribution ratios corresponding to mode door position.



G4H0030

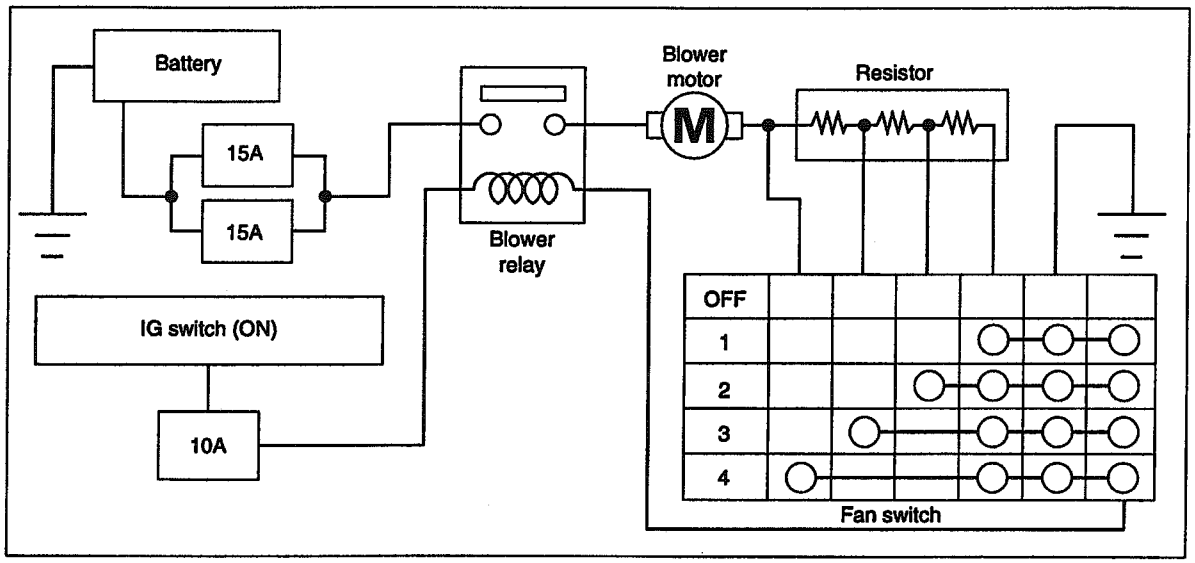
C: SYSTEM FLOW



H4H1038

4. Blower System

Operation of the blower relay is controlled by turning ON and OFF the ignition switch. When the ignition switch is ON and the fan switch is operated from 1st to 4th speed, electric current from the battery goes through the blower motor, the resistor, the fan switch and ground. The resistor is switched by the position of the fan switch, and controls the blower motor speed from 1st to 4th.



H4H1097

AIR CONDITIONING SYSTEM 4-7

1. Air Conditioning Cycle

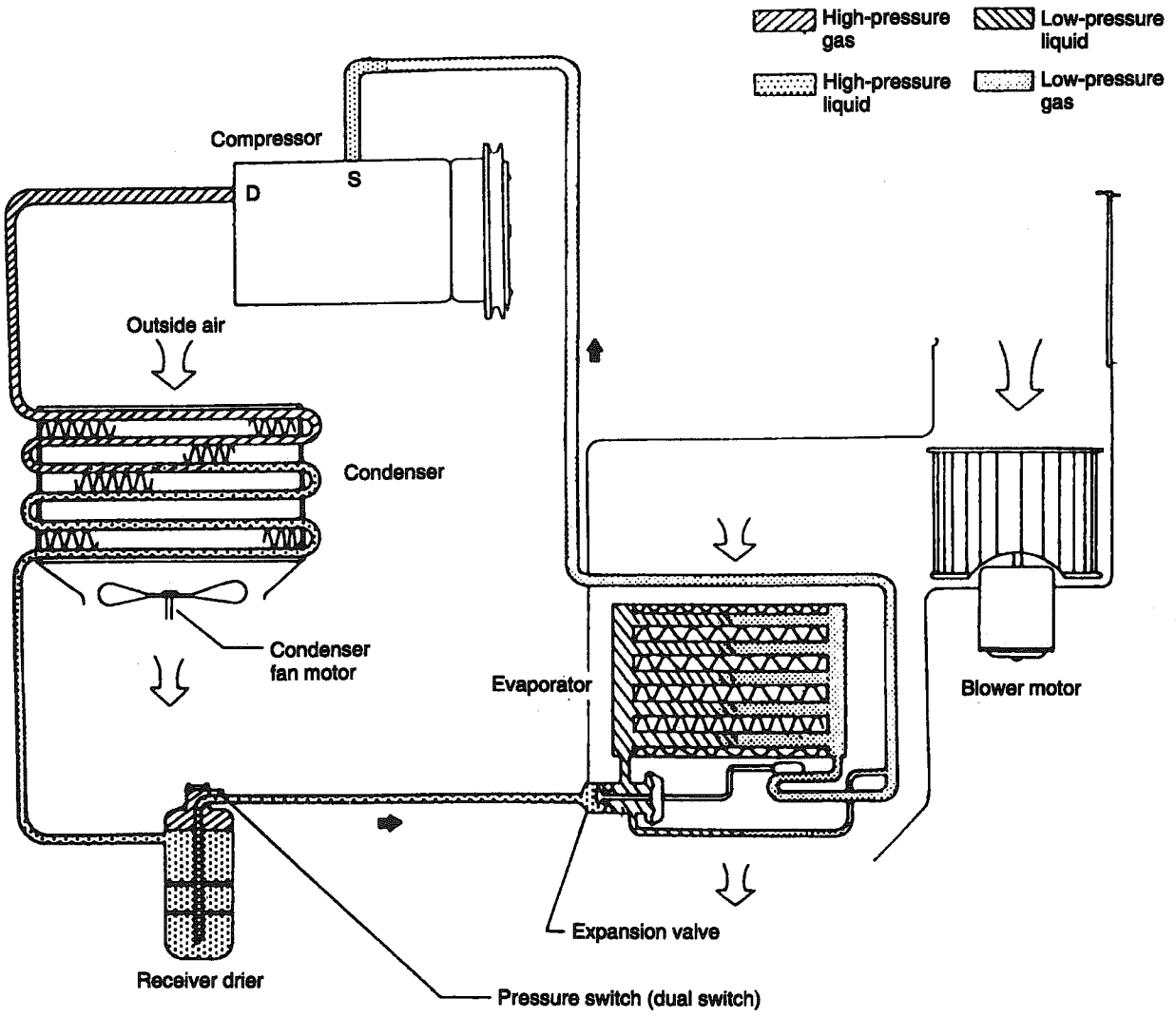
A: GENERAL

The refrigerant flows in the standard pattern, that is, through the compressor, the condenser, the receiver drier, through the evaporator, and back to the compressor.

The refrigerant flow through the evaporator coil is controlled by an externally equalized expansion valve, located inside the evaporator case.

The compressor repeats on and off to maintain the evaporator temperature within a specified range. When the evaporator coil temperature falls below a specified point, the thermo control amplifier interrupts the compressor operation. When the evaporator coil temperature rises above the specification, the thermo control amplifier allows compressor operation.

The refrigerant system is protected against excessively high or low pressures by the dual switch, located on the receiver drier. If the system pressure rises above, or falls below the specifications, the dual switch opens to interrupt compressor operation.

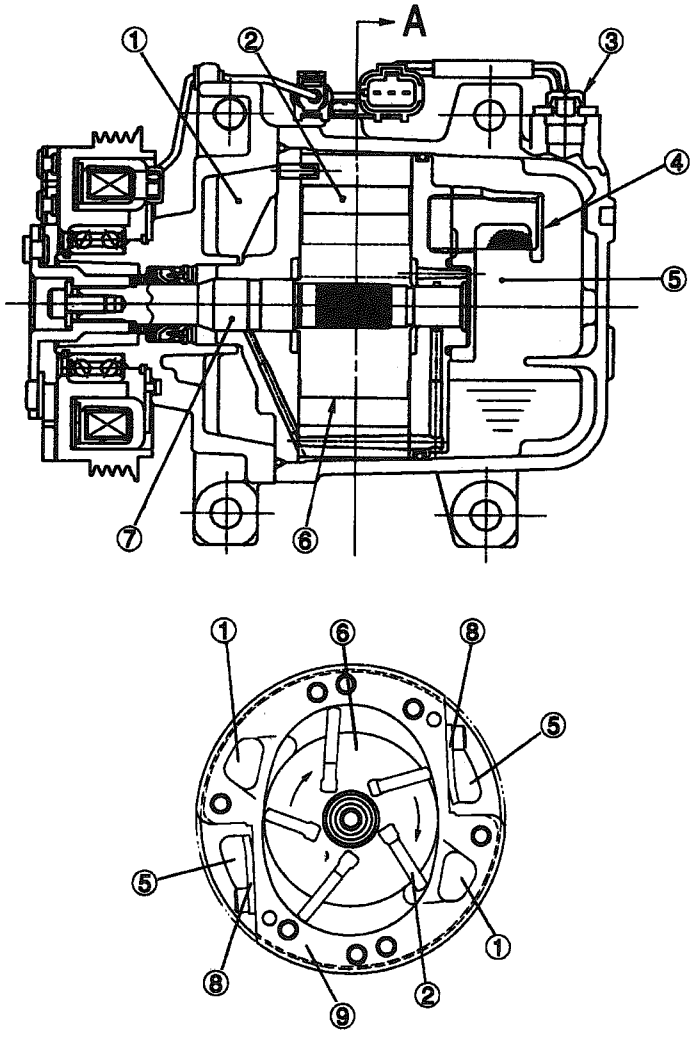


G4H0302

2. Compressor

A: GENERAL

The vane rotor type compressor turns around the center axis of the elliptical cylinder, and the vanes, with their ends in contact with the inside wall of the cylinder, move up and down the rotor grooves. The vanes are positioned around the rotor, each equally spaced apart from another. Both sides of the cylinder are sealed by side blocks. The space, enclosed by the neighboring vanes, two side blocks, outer circumference of the rotor and inside wall of the cylinder, becomes smaller as the rotor turns, thereby compressing the internal gas. When the end of a vane sliding on the inside wall of the cylinder goes past the suction port, the vane closes the suction port. The compression stroke at the position. When the gas ahead of the vane is compressed and discharged through the discharge valve, the next vane is already on the suction stroke. Since suction and compression of the gas are separately performed in this manner, the compressed gas left behind in the discharge port never returns to the suction port. Since no suction valve is required, there is no loss caused by a suction valve. (A low pressure check valve is provided on the front head and a high pressure trigger valve provided on the rear head to apply a pressure to the back plane of vane.)



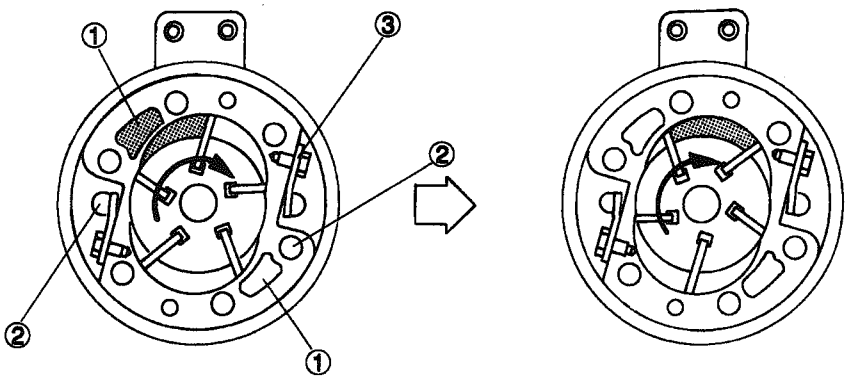
① Suction port
② Vane
③ Thermal protector
④ Oil separator
⑤ Discharge port
⑥ Rotor
⑦ Rotor shaft
⑧ Discharge valve
⑨ Cylinder

B: FUNCTION

During the period the truly round rotor turns through half a rotation (180 degrees), a cycle of the suction, compression and discharge strokes is completed. Each time the rotor turns through a rotation (360 degrees), the vanes complete two cycles each, or 10 cycles in total.

1. SUCTION

The refrigerant gas, that leaves the evaporator as the compressor turns, enters the low pressure chamber of the compressor, and is drawn in from the suction port as the vanes turn.

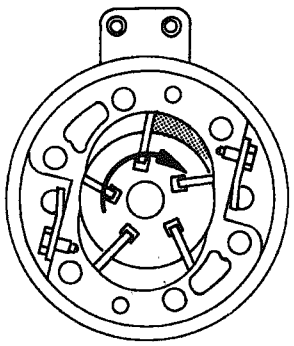


G4H0304

① Suction port
② Discharge port
③ Discharge valve

2. COMPRESSION

When suction is completed, the refrigerant gas in the cylinder chamber enclosed by the vanes is compressed as the vanes rotate. In this case, air tightness between the vane ends and cylinder inside surface is maintained by a lubricant.

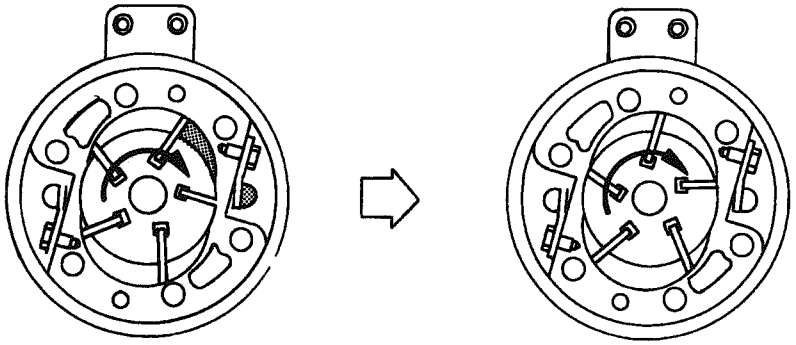


G4H0305

3. DISCHARGE

When continuous compression causes the pressure in the cylinder chamber to rise to the extent that the pressure exceeds the pressure in the high pressure chamber, the refrigerant gas is discharged. Even when the pressure in the cylinder chamber is lower than that in the high pressure chamber, the cylinder gas never flows back to the cylinder chamber, as the discharge valve is pressed into the closed position by the pressure in the high pressure chamber.

The compressor repeated the above-mentioned cycle. Each time the rotor turns through a rotation, the five chambers partitioned by the vanes in the cylinder go through the suction, compression and discharge strokes twice each.



G4H0306

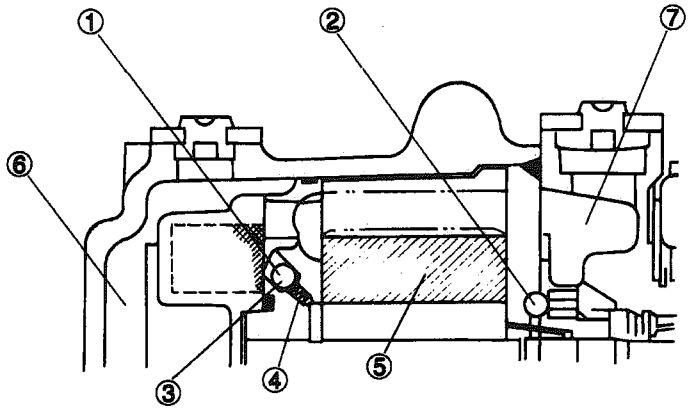
C: TRIGGER VALVE

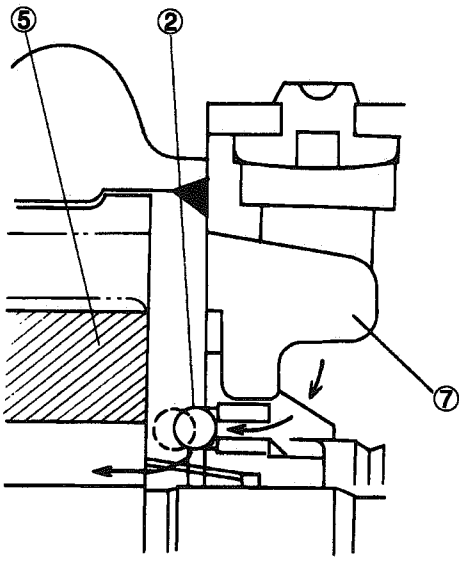
To ensure that when the compressor is started, the vanes move out smoothly under all conditions, and minimize the noise that will be produced when the vanes strike the cylinder at the time, a mechanism combining the low pressure side check valve and high pressure side trigger valve has been adopted. When the vehicle is parked for a long period in the middle of summer for example, the suction side pressure may be slightly higher than the discharge side pressure. When the compressor is started under such a condition, the low pressure side check valve introduces the low pressure side gas to the back plane of vane, thereby causing the vane to move out.

When the compressor starts compression, the check valve is closed by the vane back pressure.

When the balance pressure or discharge side pressure is slightly higher, the high pressure side trigger valve, immediately after the compressor has been started, introduces the high pressure side pressure to the back plane of vane, thereby causing the vane to move out.

When the compressor normally starts compression and causes the discharge pressure to rise, the trigger valve closes.





① Trigger valve
② Check valve
③ Ball
④ Spring
⑤ Vane
⑥ High pressure side
⑦ Low pressure side

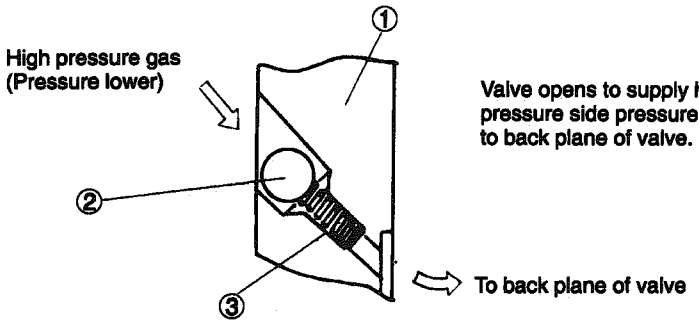
G4H0307

1. WHEN COMPRESSOR IS STOPPED

The pressure in the compressor is maintained constant, as the valves are kept in the opened state by springs.

2. WHEN COMPRESSOR IS RESTARTED

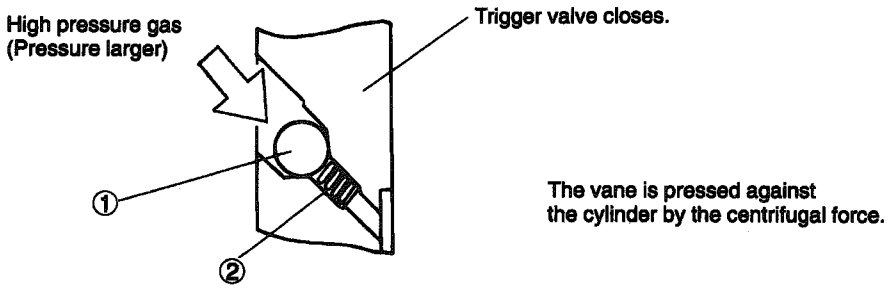
When the compressor resumes rotation, the high pressure side trigger valve is placed in the opened state, thereby applying the high pressure side pressure directly to the back plane of vane to cause the vane to move out.



G3H0308

3. WHEN COMPRESSOR IS IN REGULAR OPERATION

When the high pressure side pressure rises to the extent that it overcomes spring action, the valve closes, and the centrifugal force causes the vane to move out.

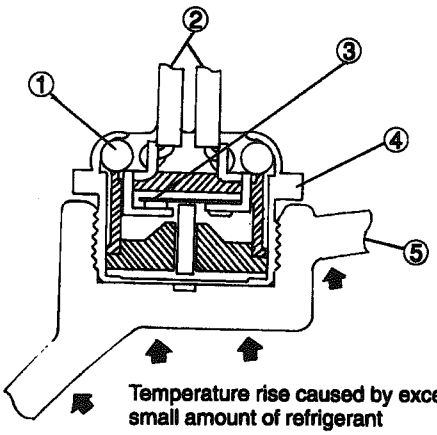


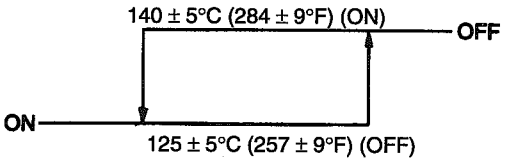
G4H0309

D: COMPRESSOR SAVING SENSOR

The compressor saving sensor, mounted on the surface of the compressor case, forces the compressor to the OFF state when the gas temperature rises or the case surface temperature becomes abnormally high due to poor lubrication.

When the compressor case surface temperature falls, the compressor restarts.





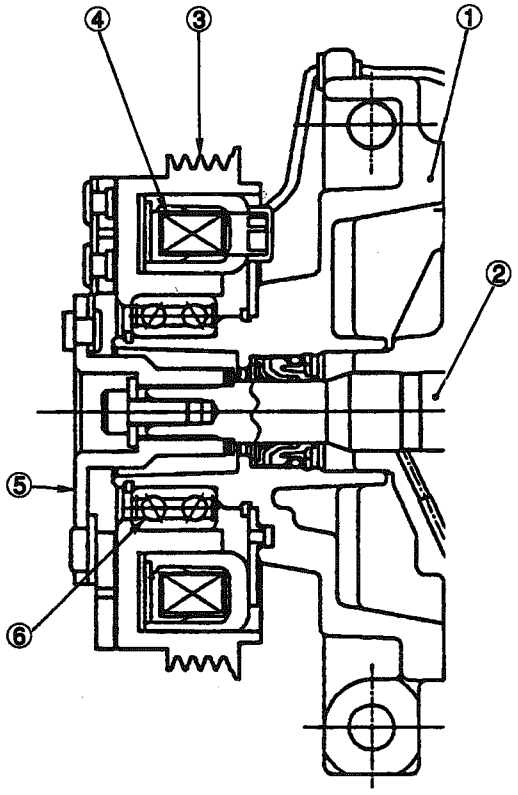
Operating characteristics

H4H1119A

① O-ring
② Harness
③ Point
④ Case
⑤ Compressor shell

E: MAGNET CLUTCH

The magnet clutch serve to transmit engine power to the compressor unit. It is built into the compressor shaft. When current flow through the magnet clutch coil, the drive plate is attracted so that the pulley and compressor shaft rotate as a unit. When the compressor is not in use, the pulley alone rotates freely.



G4H0311

① Compressor unit
② Rotor shaft
③ Clutch pulley
④ Magnet clutch coil
⑤ Drive plate
⑥ Front bearing

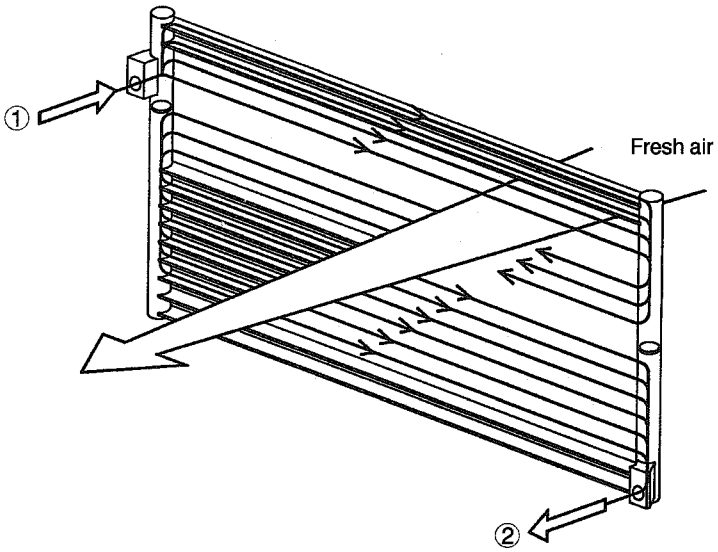
3. Condenser

A: MECHANISM

The high-temperature and high-pressure gaseous refrigerant discharged from the compressor is cooled down and turned into the liquid state in the condenser which is cooled by the ambient air delivered by the cooling fan.

The condenser is composed of tubes and radiating fins.

The heat from hot refrigerant radiates to the ambient air when high-temperature gaseous refrigerant passes through the condenser tubes.



G4H0758

① Refrigerant inlet (High pressure gas refrigerant)
② Refrigerant outlet (High pressure liquid refrigerant)

4. Receiver Drier

A: MECHANISM

The amount of refrigerant circulating varies with the heat load changes. The receiver drier supplies the amount of refrigerant necessary for the cycle according to such changes.

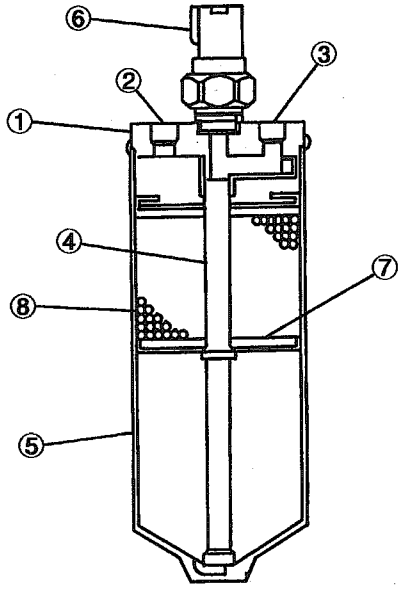
1) It removes bubbles from the condensed refrigerant so that only liquid refrigerant may be delivered to the expansion valve. (If bubbles are present, the refrigerant passing through the expansion valve varies in quantity, temperature, and pressure, resulting in insufficient cooling.)

2) It removes moisture from the refrigerant.

3) It removes foreign substance from the refrigerant.

4) It permits a visual observation of the amount of refrigerant through the sight glass.

The receiver-drier consists of a strainer to remove foreign substance, desiccant to absorb moisture from refrigerant, a sight glass to check the amount of refrigerant.



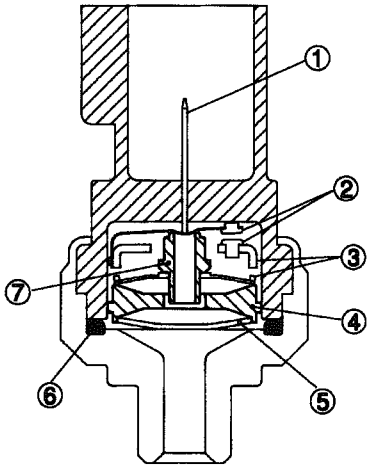
H4H1120A

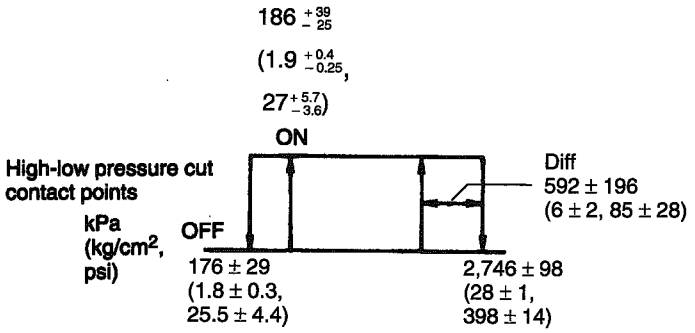
① Head block – flat
② Inlet
③ Outlet
④ Inside pipe
⑤ Body
⑥ Dual switch
⑦ Strainer
⑧ Desiccant

B: DUAL SWITCH

The dual switch is located in the high-pressure line of the refrigeration cycle. It consists of a diaphragm which receives pressure, diaphragm springs, pin and contact points. Two types of contact points are used. One type activates when the internal pressure is low or when it is too high while the other type controls the operation of the condenser fan.

- Prevention of operation when there is no gases in the line due to absence of refrigerant — (during low-pressure operation)
- Protection of refrigeration cycle from abnormal refrigerant pressure rise — (during high-pressure operation)





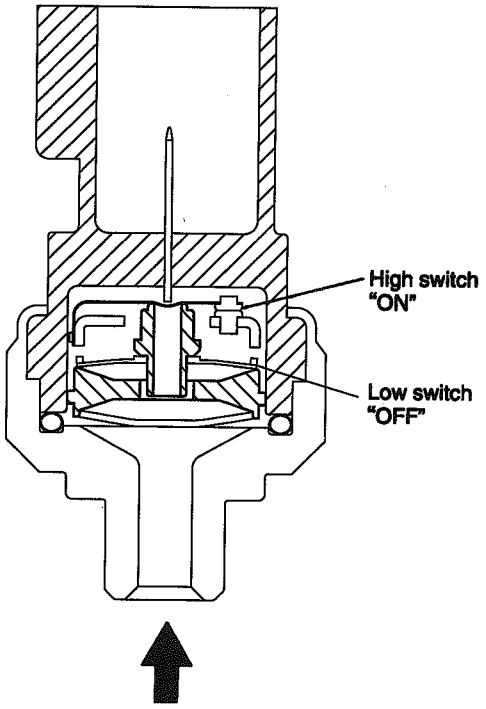
H4H1026A

① Point terminal
② High switch
③ Low switch
④ Disc
⑤ Diaphragm
⑥ O-ring
⑦ Rod

1. ABNORMAL LOW-PRESSURE OPERATION

- All contact points are open (OFF) since the tension of the diaphragm springs is greater than refrigerant pressure.
- Approx. 186 kPa (1.9 kg/cm^2, 27 psi) < P < approx. 1,471 kPa (15 kg/cm^2, 213 psi)

When refrigerant pressure is greater than 186 kPa (1.9 kg/cm^2, 27 psi), diaphragm spring is inverted so that low switch is opened (OFF).

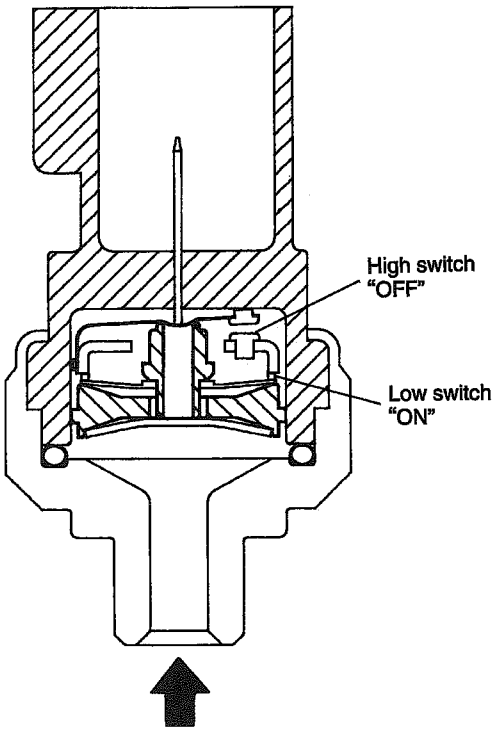


Abnormal low pressure
Approx. 186 kPa (1.9 kg/cm^2, 27 psi) or less

G4H0976

2. ABNORMAL HIGH-PRESSURE OPERATION

When refrigerant pressure is greater than 2,746 kPa (28 kg/cm^2, 398 psi), diaphragm spring is inverted so that high switch is opened (OFF) and low switch is closed (ON).



Abnormal high pressure
Approx. 2,746 kPa (28 kg/cm^2, 398 psi) or more

H4H1121A

5. Evaporator

A: MECHANISM

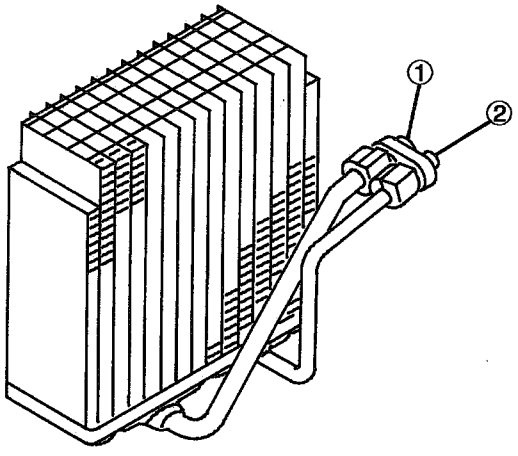
An airstream produced by a blower passes through the cooling fins and tubes. This air is warmer than the refrigerant and gives up its heat to the fins, tubes and then to the refrigerant itself. As the low pressure refrigerant moves through the evaporator, heat given up by the air passing through the evaporator causes the refrigerant to begin to boil. By the time the refrigerant has passed through the evaporator, it becomes a vapor. As the heat is absorbed by the boiling refrigerant, the fins and tubes turn cold and in turn cool the air passing over them. Moisture contained in the air condenses to water drops as it passes around the cooling tubes and fins of the evaporator. Water and dirt are then discharged outside the vehicle through the drain hose.

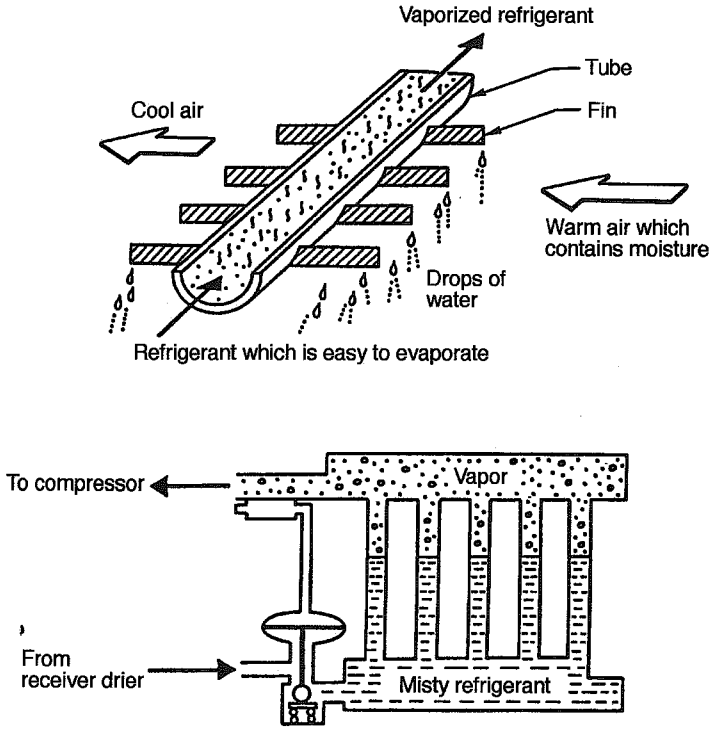
The evaporator is a laminated type and consists of thin, rectangular aluminum plates arranged in many layers and fins that are attached between them. The operation of the evaporator is as follows:

Misty refrigerant (very close to liquid form) from the expansion valve at a low pressure, enters the lower tube of the evaporator, where it soaks up heat from the compartment. The refrigerant boils and vaporizes quickly due to the rapid heat exchange. Then the refrigerant is pushed upward by the force of the bubble generated during the exchange and passes evaporating into the upper tube. When it reaches to upper tank, the refrigerant is in a thoroughly vaporized form.

The evaporator has a single tank, and its surface has been given a multiple treatment.

- Rustproof treatment
- Waterproof treatment
- Moldproof treatment





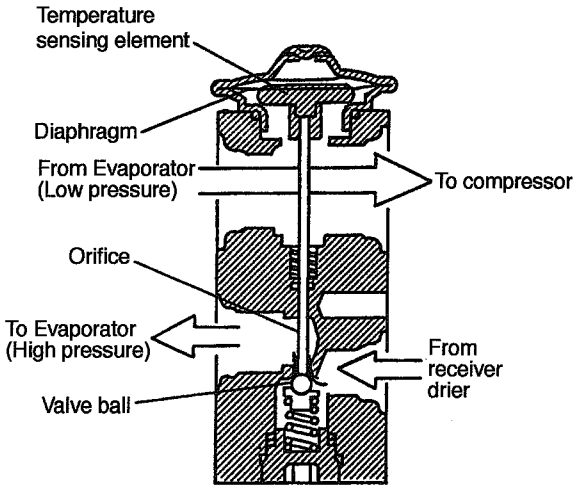
H4H1122A

① Outlet
② Inlet

6. Expansion Valve

A: MECHANISM

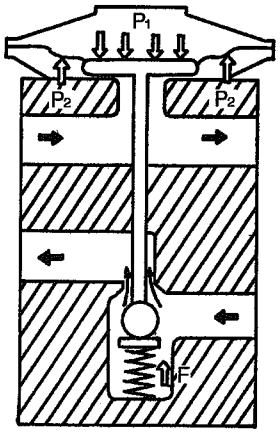
The expansion valve is attached to the evaporator inlet and outlet pipe. It converts high pressure liquid refrigerant which comes from the liquid tank to misty, low pressure refrigerant, and delivers to the evaporator. Being at low pressure and low temperature, the liquid refrigerant evaporates in the evaporator removing heat from the compartment. It automatically controls the flow rate of refrigerant to obtain the necessary cooling ability required by the fluctuating heat load.
The refrigerant temperature is sensed by the temperature sensing element installed at the low pressure refrigerant passage in the expansion valve, and the flow rate of the refrigerant is controlled by changing the lift of the valve ball at the high pressure side.



H4H1123A

B: FUNCTION

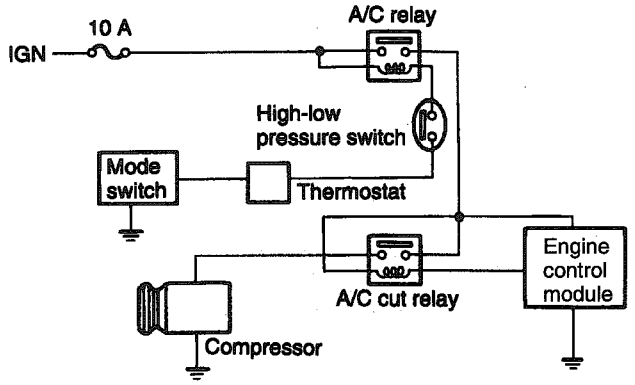
If the heat load of the air conditioner system increases, the refrigerant temperature at the evaporator outlet rises and therefore increases the pressure P_1 at around the temperature sensing area. As this pressure P_1 becomes higher than the resultant force of evaporator outlet (low pressure side) pressure P_2 and the spring force F ($P_1 > P_2 + F$), the diaphragm is pressed down, opening the valve ball connected to the diaphragm to increase the flow of the refrigerant.
If the heat load decreases, the action contrary to the one mentioned above takes place, closing the valve to decrease the flow of the refrigerant.



H4H1124

7. Compressor Clutch "ON" Delay System

When air conditioning system relay operates, a signal is entered into engine control unit. Engine control unit then judges engine operation and activates A/C cut relay. Maximum clutch "ON" delay occurs 0.8 seconds after A/C cut relay activates.



G4H0343

8. Compressor Control System

A: GENERAL

NOTE:
Circuit diagram of air conditioning system. <Ref. to 6-3 [D5003].>

1) When the A/C switch and fan switch are turned ON, the A/C relay activates. The compressor and F.I.C.D.* are turned on, and then the main and sub fans also operate. Blower relay operates to direct the air flowrate determined by FAN switch position.

2) The thermo amplifier activates to stop the compressor clutch, F.I.C.D.*, and main and sub fans.

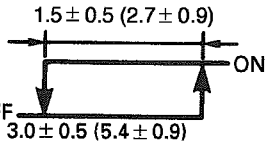
3) When the "High-Low" pressure switch operates, the compressor clutch and F.I.C.D.* stop but the main and sub fans are operating.

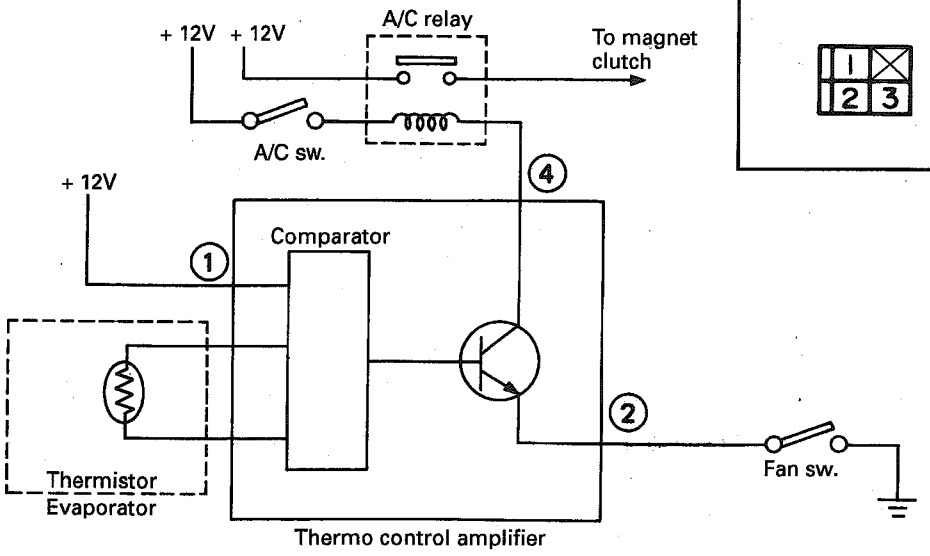
4) When the fan control switch operates, both the main and sub fans operate.

*: 1800 cc model

B: THERMO CONTROL AMPLIFIER

The thermo control amplifier disconnects the magnet clutch circuit to prevent the evaporator from becoming frosted when the temperature of the evaporator fin drops close to "2°C (36°F)". As the evaporator is cooled, the thermistor (located on the evaporator fin) interrupts the "base" current of the amplifier. This in turn deenergizes the A/C relay coil, which in turn disconnects the magnet clutch circuit.

Thermo control amp. harness connector	Thermo control amp. operation °C (°F)
	

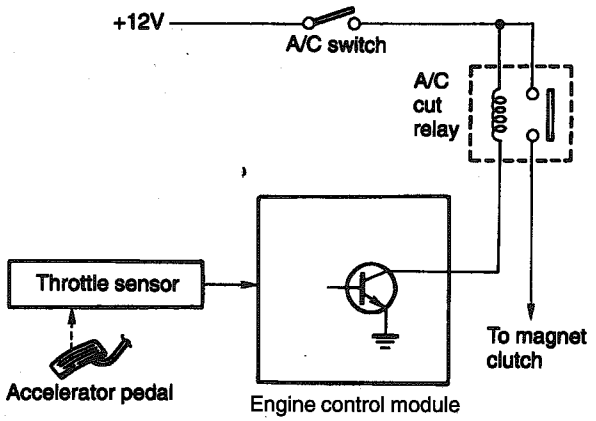


G4H0764

C: ACCELERATION CUT SYSTEM

The A/C switch turns the A/C system on or off. The on-off operation of the switch is transmitted to the ECM.

The A/C cut relay breaks the current flow to the compressor, through the use of an output signal from the ECM, for a certain period of time when a "full-throttle" signal (emitted from the throttle sensor) enters the ECM while the compressor is operating. This prevents the degradation of acceleration performance and stabilizes the main fuse box located on the left side of the engine compartment.

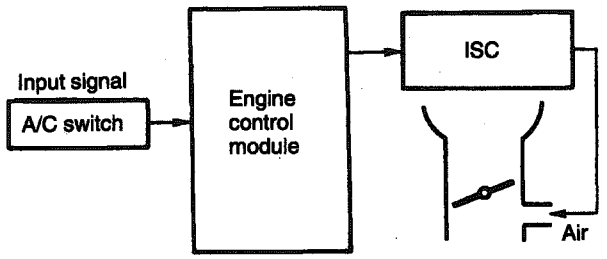


G4H0346

D: I.S.C. (2200 cc MODEL)

The I.S.C. increases engine idle speed when the compressor is turned ON.

The Engine Control module activates the idle speed control solenoid valve in advance to control the amount of by-pass air flowing through the throttle body in relation to the signal emitted from the A/C switch, so that the proper idle speed specified for each engine load is achieved.



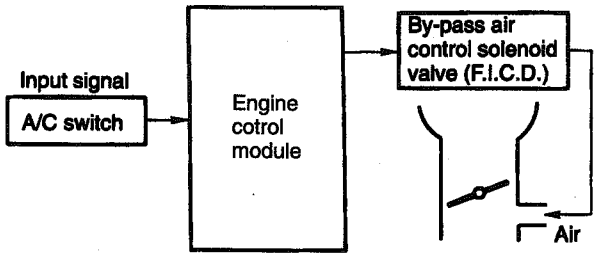
B4H0181

Idle speed				
	A/C ON		A/C OFF	
	Neutral	D-range	Neutral	D-range
MT	850 ± 50	–	700 ± 50	–
AT	850 ± 50	700 ± 50	700 ± 50	650 ± 50

E: F.I.C.D. (1800 cc MODEL)

The F.I.C.D. increases engine idle speed when the compressor is turned ON.

The Engine Control module activates the by-pass air control solenoid valve in advance to control the amount of by-pass air flowing through the throttle body in relation to the signal emitted from the A/C switch, so that the proper idle speed specified for each engine load is achieved.



G4H0347

	Idle speed			
	A/C ON		A/C OFF	
	Neutral	D-range	Neutral	D-range
MT	850 ± 50	–	700 ± 50	–
AT	850 ± 50	700 ± 50	700 ± 50	650 ± 50

F: FAN CONTROL

The main fan and sub fan are switch turn ON and OFF, according to the operating modes shown in the following table.

Vehicle speed	A/C compressor	Engine coolant temperature					
		Less than 95°C (Less than 203°F)		Between 95 and 99°C (Between 203 and 210°F)		More than 100°C (More than 212°F)	
		Operation of radiator fan		Operation of radiator fan		Operation of radiator fan	
		Main	Sub	Main	Sub	Main	Sub
Less than 19 km/h (Less than 12 MPH)	OFF	OFF	OFF	ON	OFF	ON	ON
	ON	ON	ON	ON	ON	ON	ON
Between 20 and 69 km/h (Between 12 and 43 MPH)	OFF	OFF	OFF	ON	OFF	ON	ON
	ON	ON	ON	ON	ON	ON	ON
Between 70 and 89 km/h (Between 43 and 55 MPH)	OFF	OFF	OFF	OFF	OFF	ON	ON
	ON	ON	OFF	ON	ON	ON	ON
More than 90 km/h (More than 56 MPH)	OFF	OFF	OFF	OFF	OFF	ON	ON
	ON	OFF	OFF	ON	OFF	ON	ON

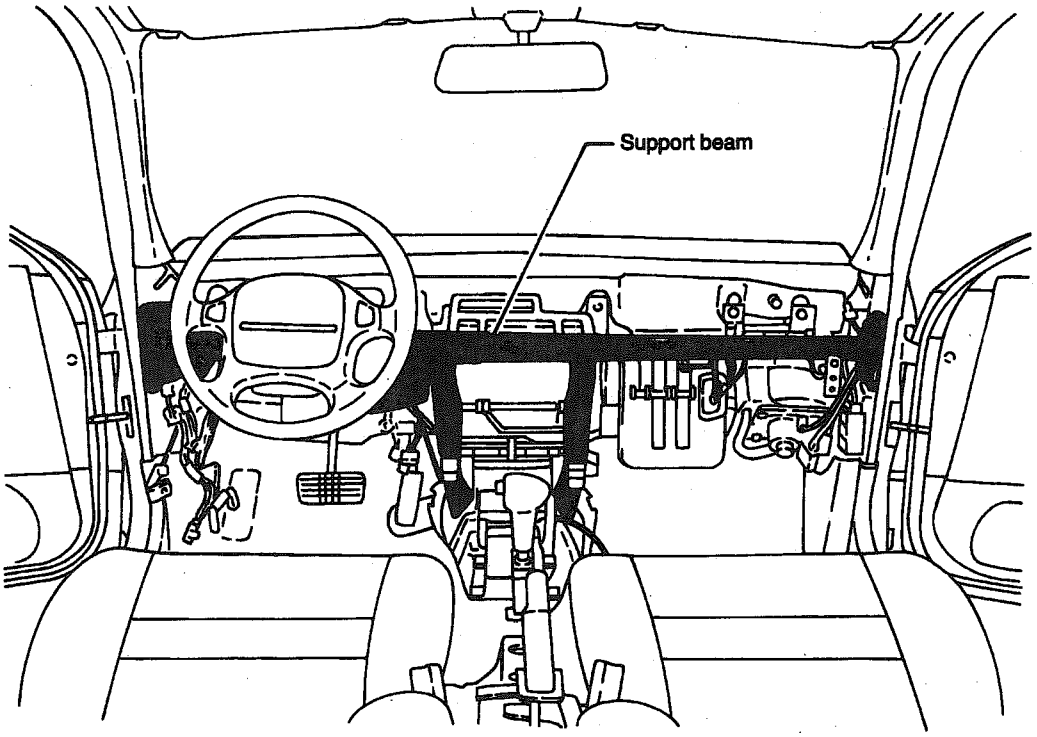
BODY SECTION

BODY AND EXTERIOR 5-1

1. Steering Support Beam

A steering support beam is provided between the left and right front pillars to reinforce the steering column.

It also minimizes vibration and steering column extension in a collision.



G5H0001

2. Quietness

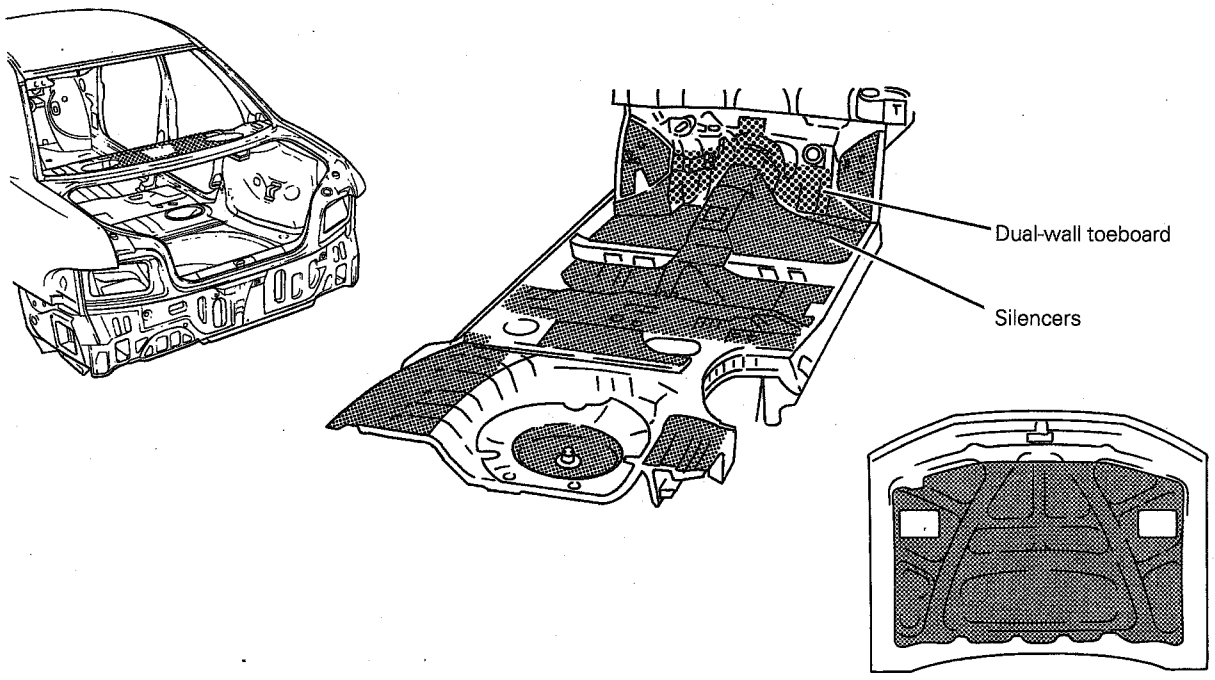
Silencers, dual-wall panels, sound-absorbing materials, etc. are utilized in conjunction with a high-rigidity and vibration/noise-proof body structure in order to provide a quiet passenger compartment.

A: SILENCERS

They (= asphalt sheets) minimize the transmission of noise/vibration into the passenger compartment.

B: DUAL-WALL TOEBOARD

The toeboard is a dual-wall design consisting of an asphalt sheet placed between two steel panels to reduce the transmission of noise and vibration from the engine compartment to the passenger compartment.



H5H0675

3. Body Sealing

A: SEALED PARTS

All gauge hole and other holds used during the body manufacturing process are plugged to prevent entry of water and dust.

Any time the vehicle body has been repaired, etc., the affected holds should be properly plugged with the use of the specified plugs.

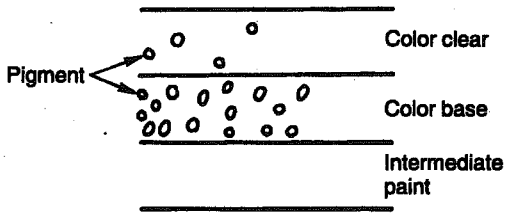
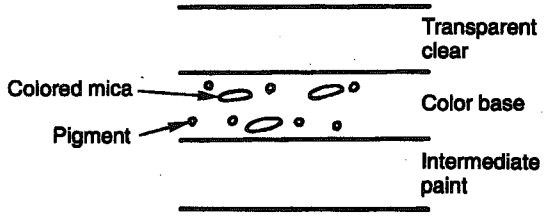
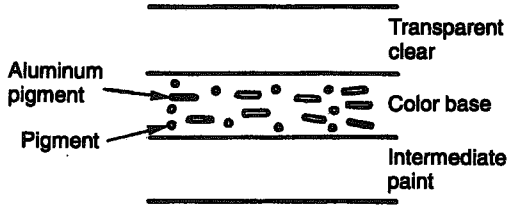
4. Painting

A: SPECIFICATION

Color name	Color code
WHITE	230
STRONG RED MICA	309
BRIGHT RED2	559
GREEN Ⓜ	64C
BLUE Ⓜ	66C
BLACK MICA	47A
★ GREEN Ⓜ / SLATE Ⓜ	6W2 (64C / 49B)
★ DARK BLUE MICA2 / SLATE Ⓜ	6W3 (52D / 49B)
★ BRIGHT RED2 / SLATE Ⓜ	5U1 (559 / 49B)
★ WHITE / SLATE Ⓜ	5Y1 (230 / 49B)

Ⓜ: Metallic
★: 2-tone

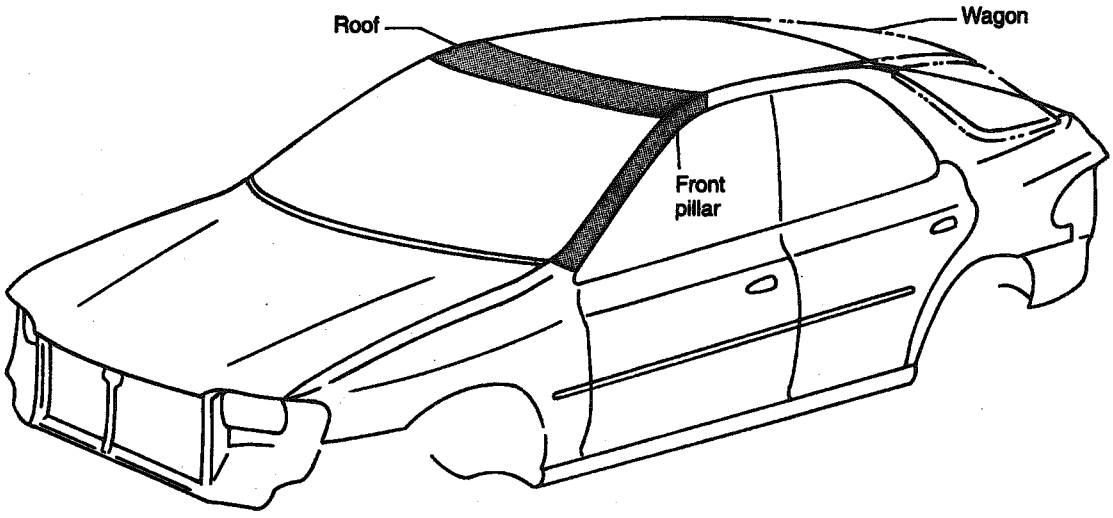
B: PAINT FILM STRUCTURE

Color name	Paint film structure
• WHITE • BRIGHIT RED2	 G5H0004
• STRONG RED MICA • BLACK MICA • DARK BLUE MICA2	 G5H0005
• GREEN Ⓜ • BLUE Ⓜ • SLATE Ⓜ	 G5H0006

Ⓜ: Metallic

5. Anti Chipping Coat (ACC) Application

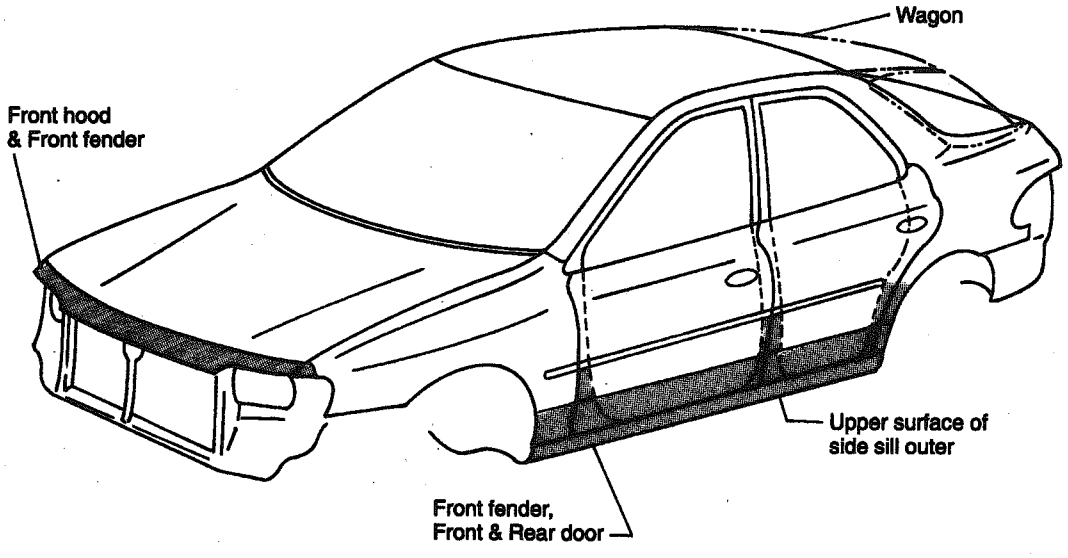
The following information for the Sedan is basically the same as that for the Wagon.



G5H0007

6. Stone Guard Coating (SGC) Application

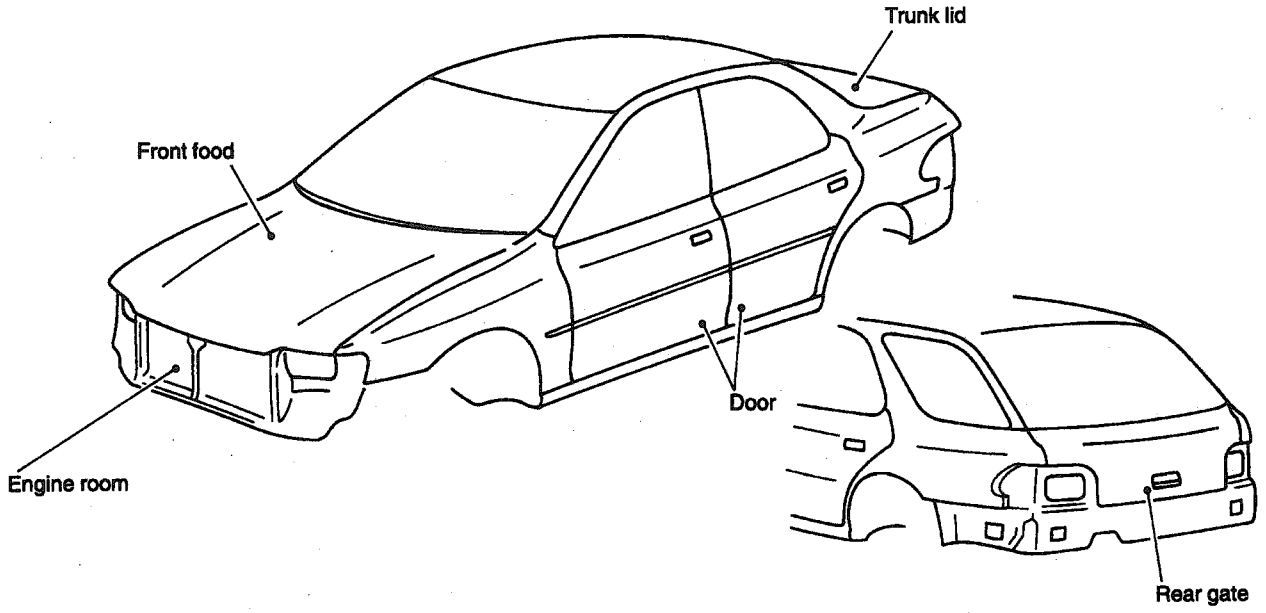
The following information for the Sedan is basically the same as that for the Wagon.



G5H0008

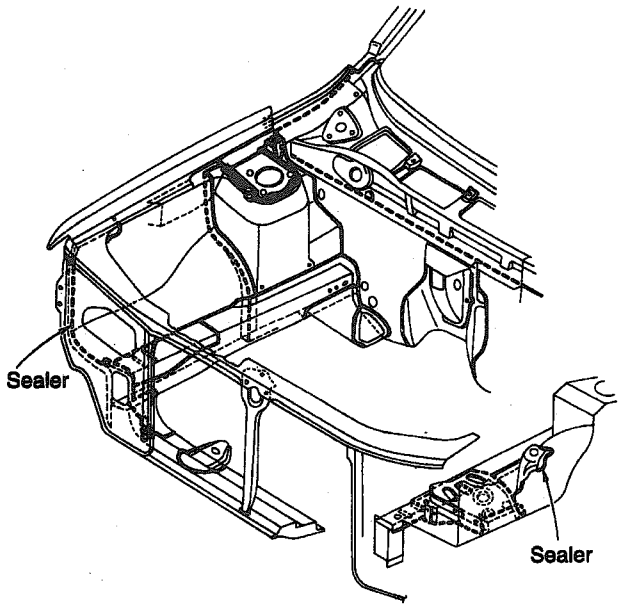
7. Sealer Application

The following information for the Sedan is basically the same as that for the Wagon.



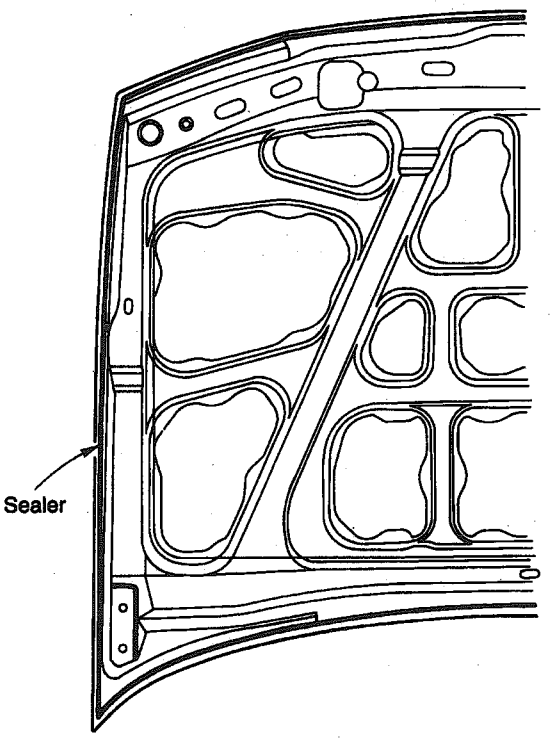
G5H0009

A: ENGINE ROOM



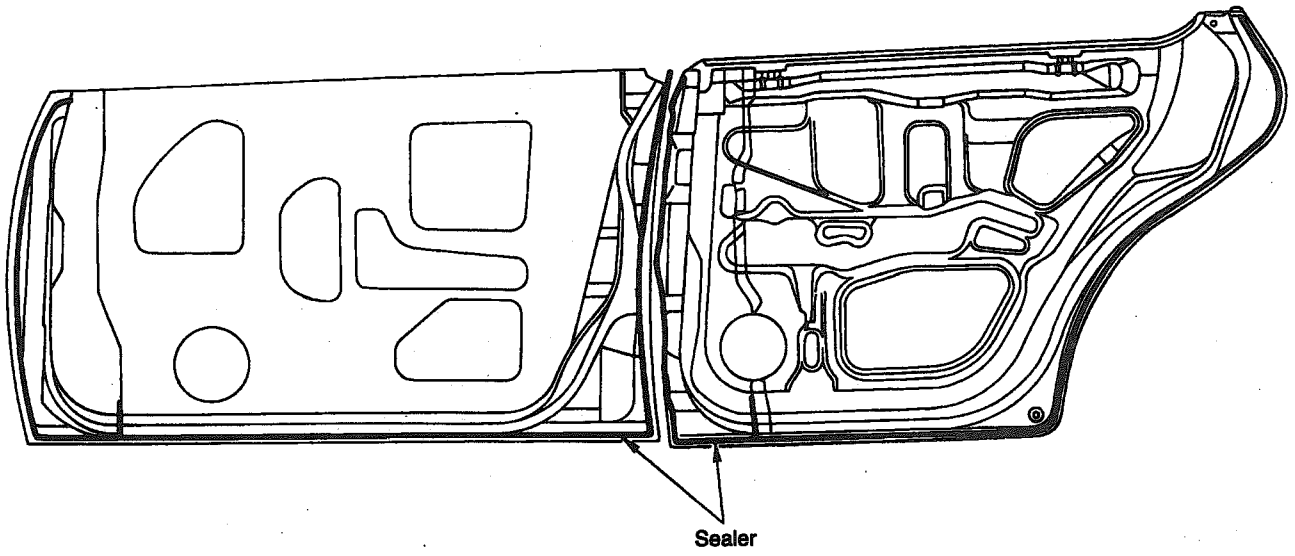
G5H0010

B: FRONT HOOD



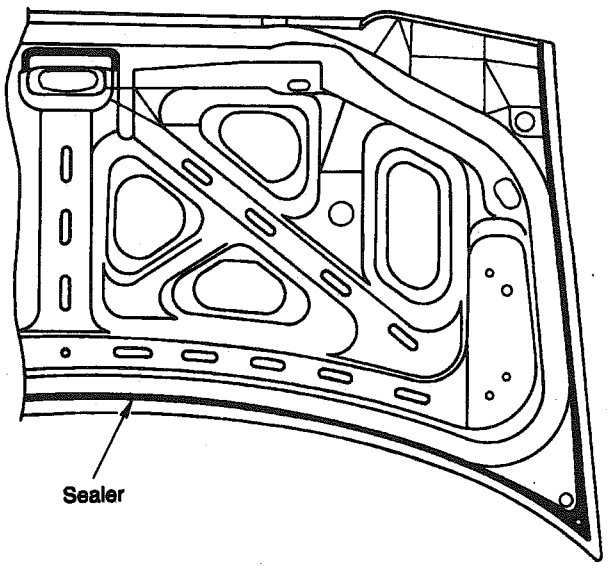
G5H0011

C: DOOR

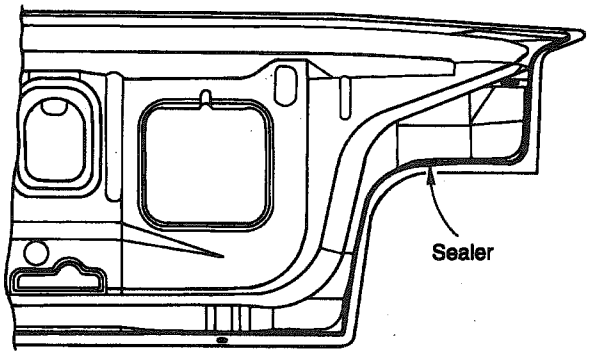


G5H0012

D: TRUNK LID

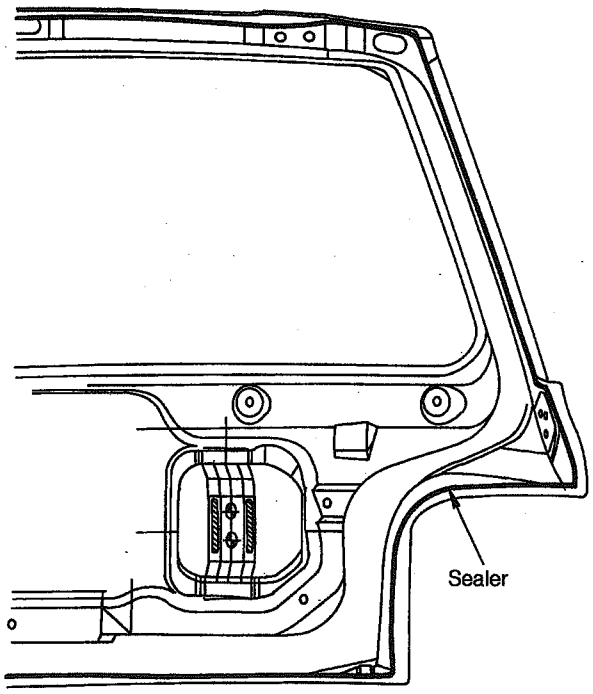


G5H0014



G5H0015

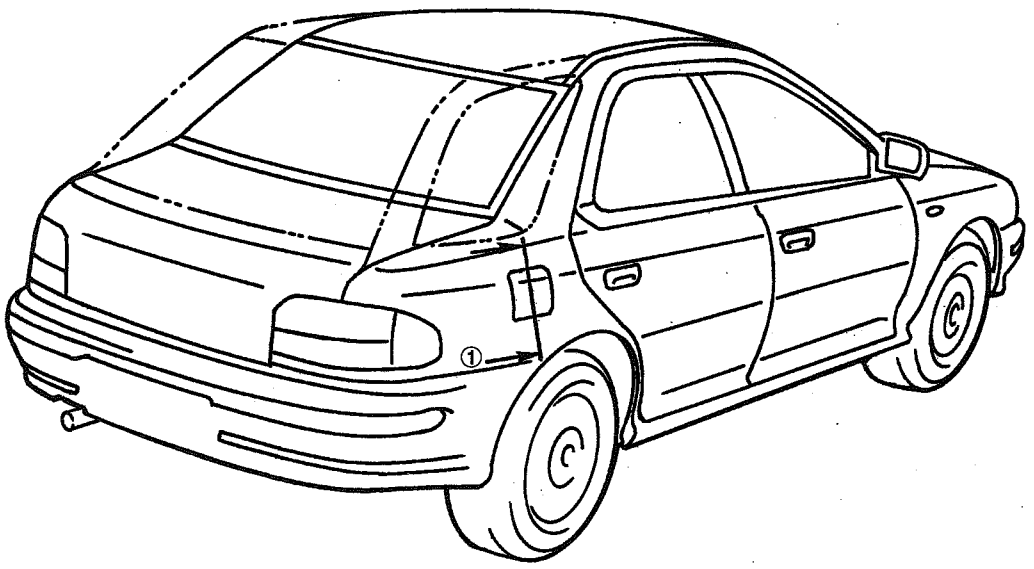
E: REAR GATE

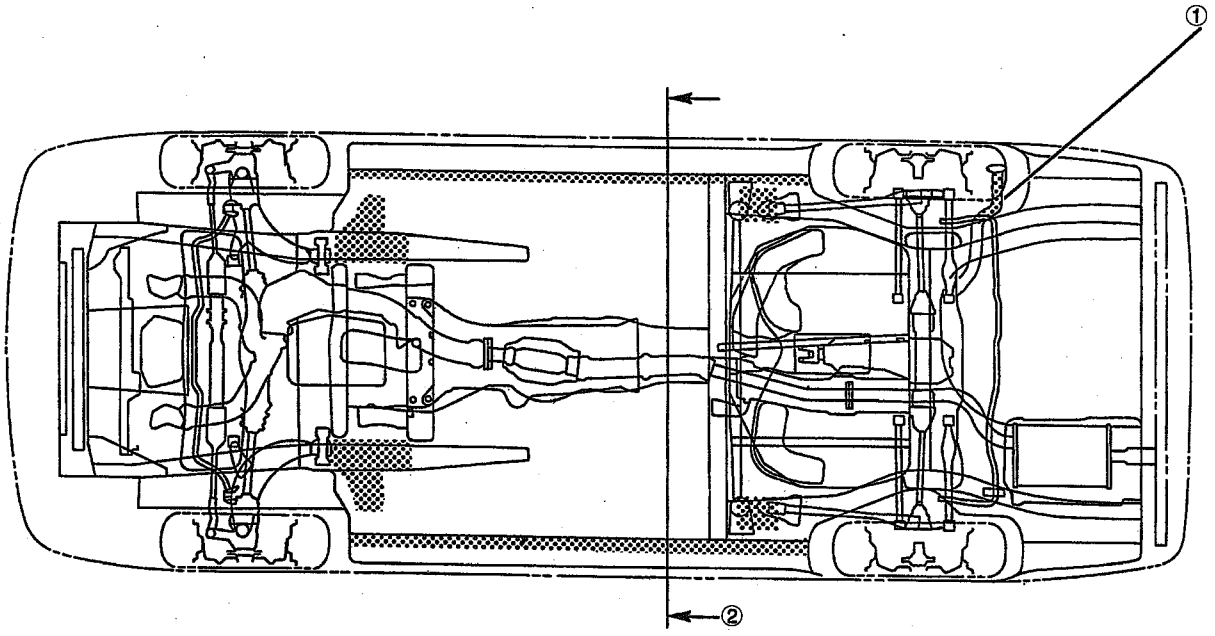


H5H0724

8. Anti-rust Wax (Bitumen Wax) Application

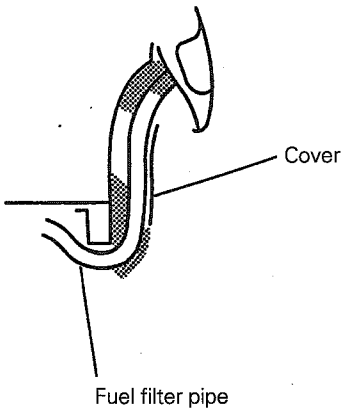
The following information for the Sedan is basically the same as that for the Wagon.





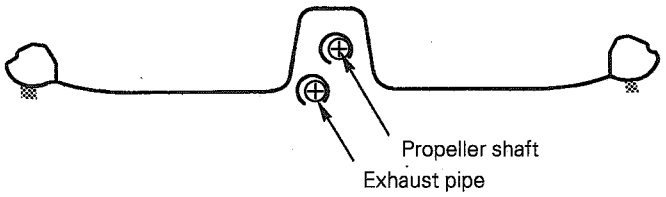
H5H0676

①



H5H0679

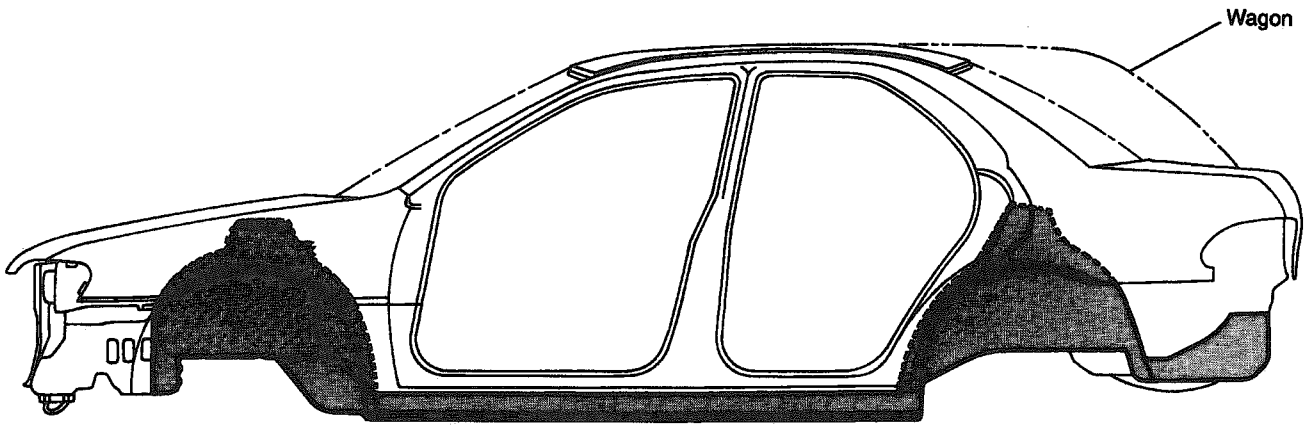
②



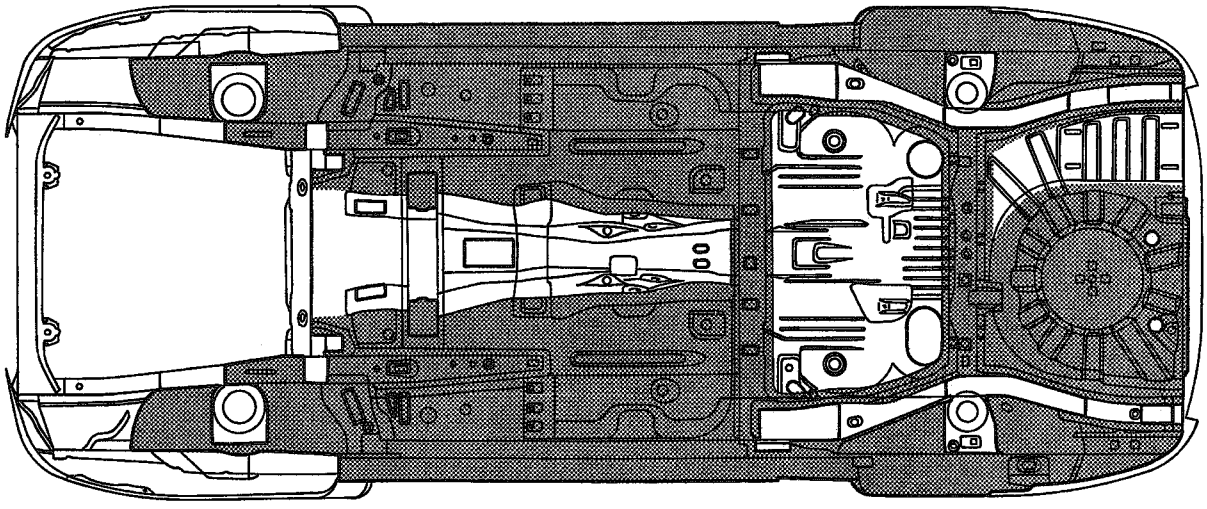
H5H0677

9. Polyvinyl Chloride (PVC) Application

The following information for the Sedan is basically the same as that for the Wagon.



G5H0031

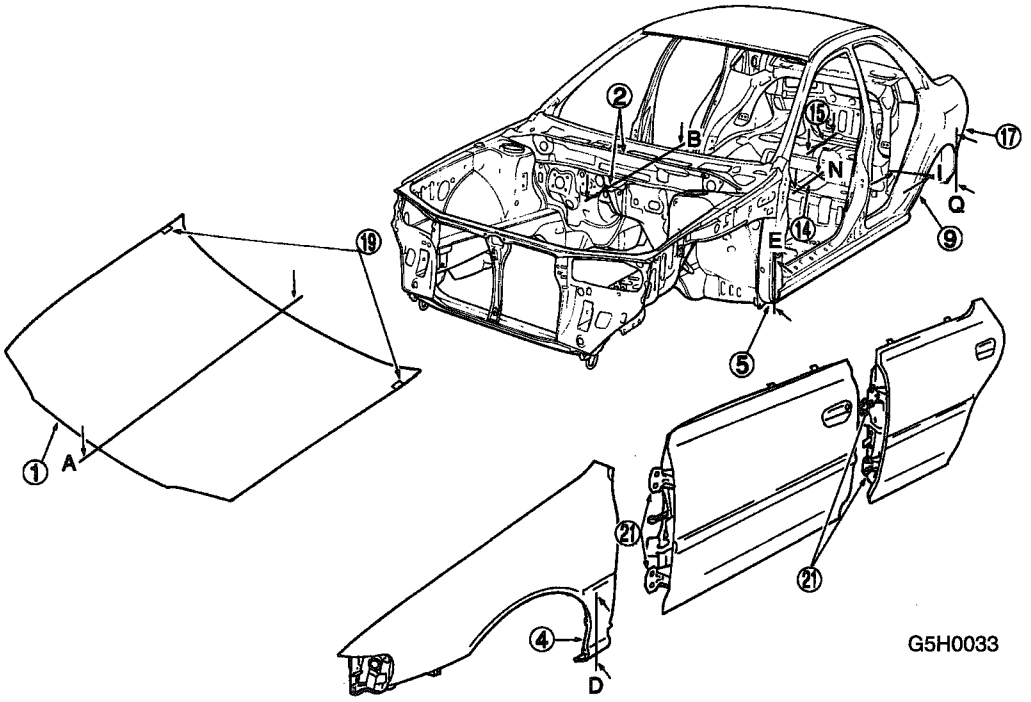


■ : Polyvinyl chloride

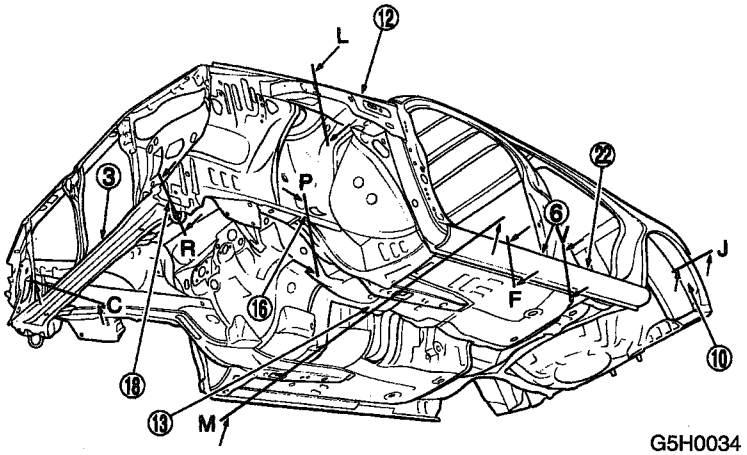
H5H0678

10. Hot Wax Application

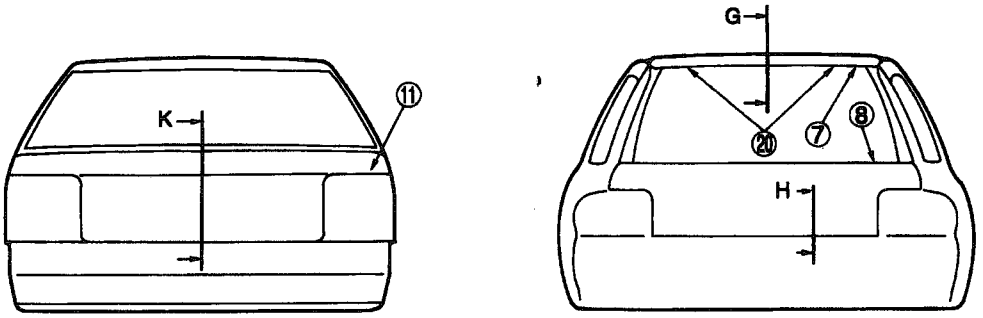
The following information for the Sedan is basically the same as that for the Wagon.



G5H0033

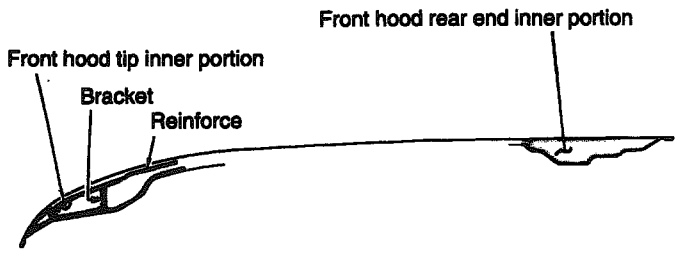


G5H0034



G5H0035

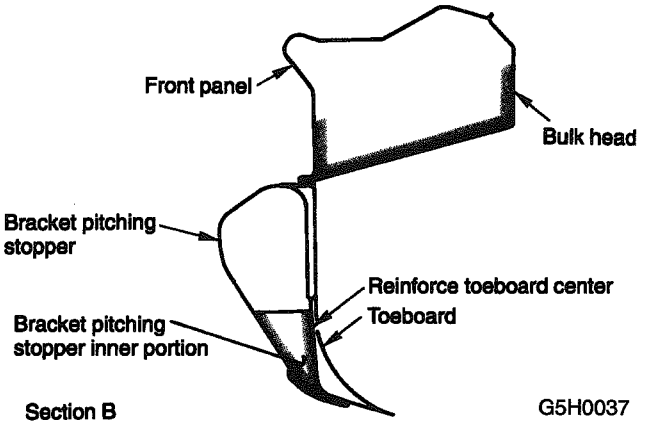
① Rear and Front End Section of Front Hood



Section A

G5H0036

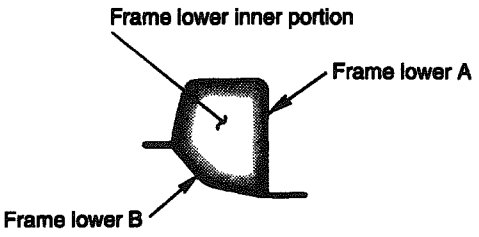
② Front Bulk Head & Bracket Pitching Stopper



Section B

G5H0037

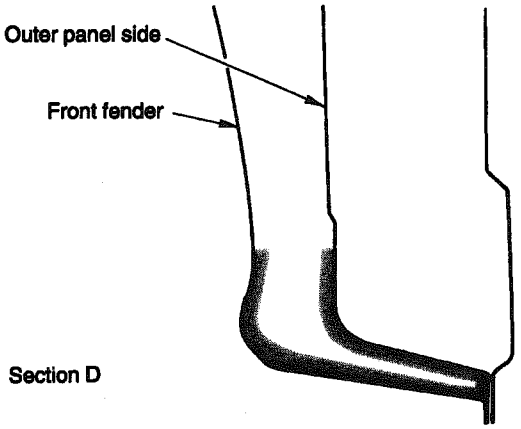
③ Radiator Panel Lower



Section C

G5H0038

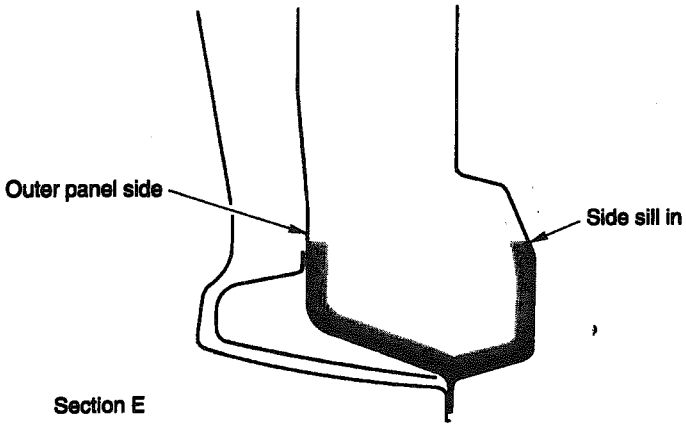
④ Rear Section of Front Fender



Section D

G5H0039

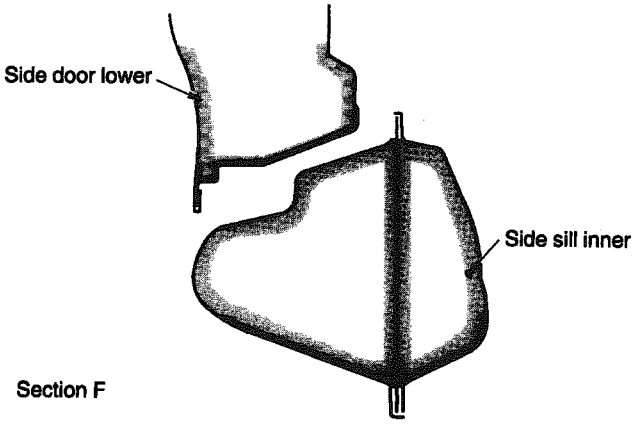
⑤ Lower Section of Front Piller



Section E

G5H0040

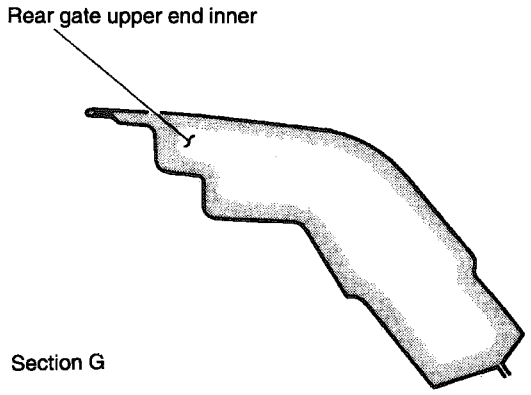
⑥ Side Sill Inner and Side Door Lower



Section F

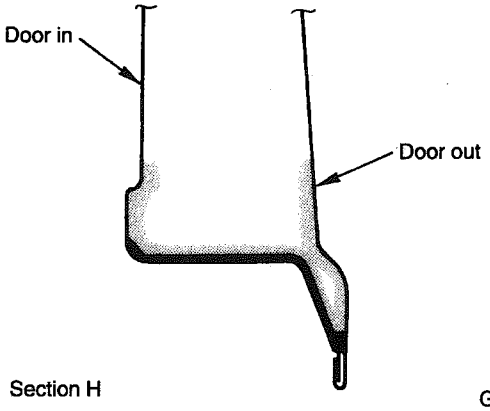
G5H0041

⑦ Rear Gate Upper End (Inner)



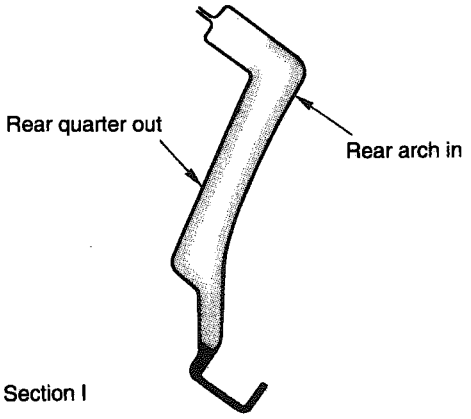
G5H0042

⑧ Rear Gate Lower End



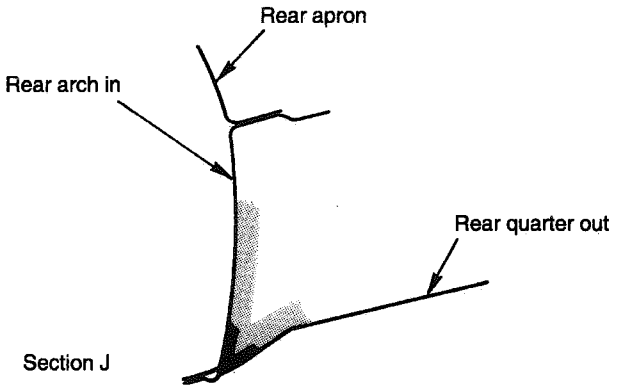
G5H0043

⑨ Rear Quarter Panel Front Outer



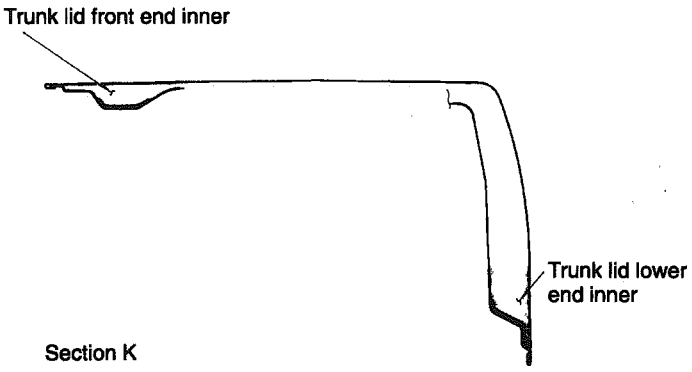
G5H0044

⑩ Rear Quarter Panel Rear Outer



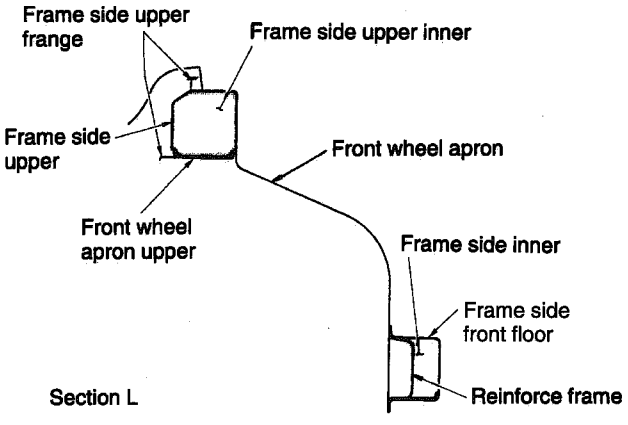
G5H0045

⑪ Rear and Front End Section of Trunk Lid



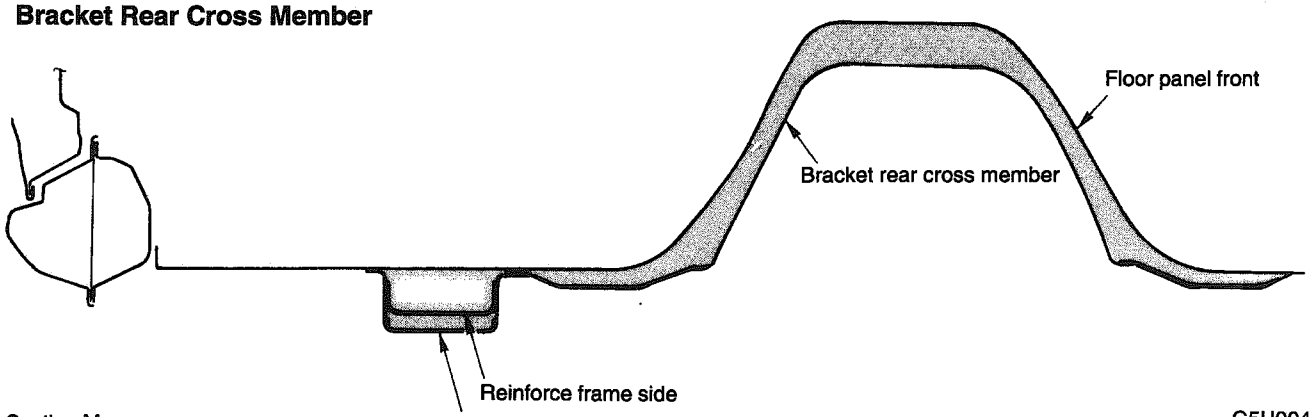
G5H0046

⑫ Frame Side Inner, Frame Side Upper and Frame Side Upper Frange



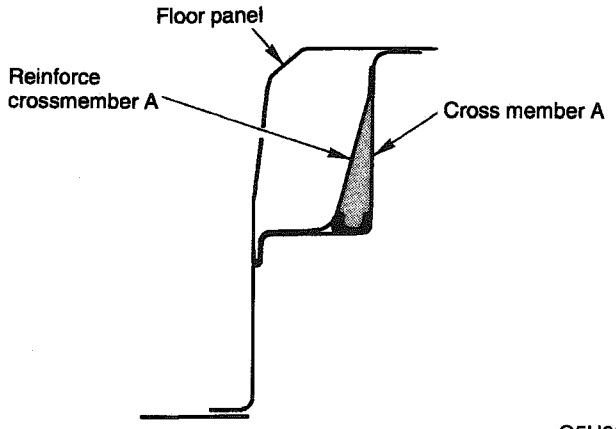
H5H0722

⑬ Bracket Rear Cross Member



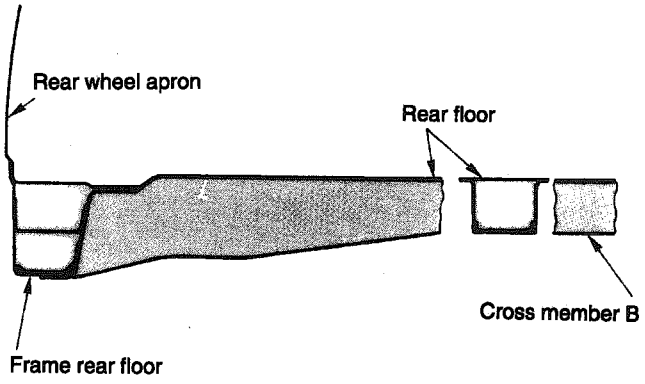
Section M G5H0048

⑭ Cross Member A



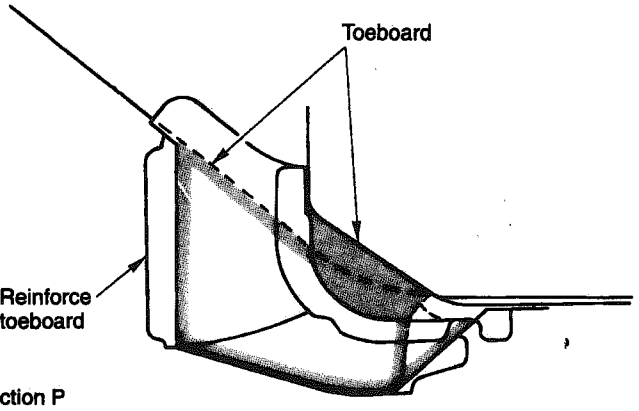
Section N G5H0049

⑮ Cross Member B Inner Portion



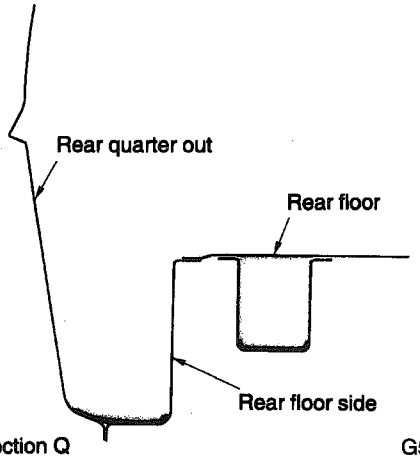
Section O G5H0050

⑯ Reinforce Toeboard Inner



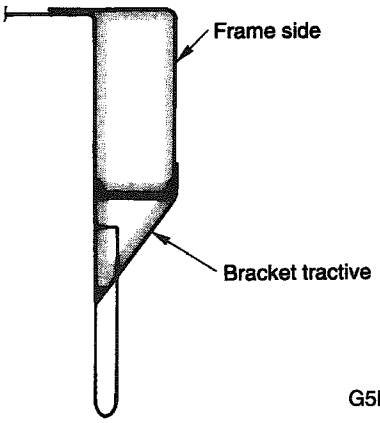
Section P G5H0051

⑰ Rear Quarter Out Lower End Inner



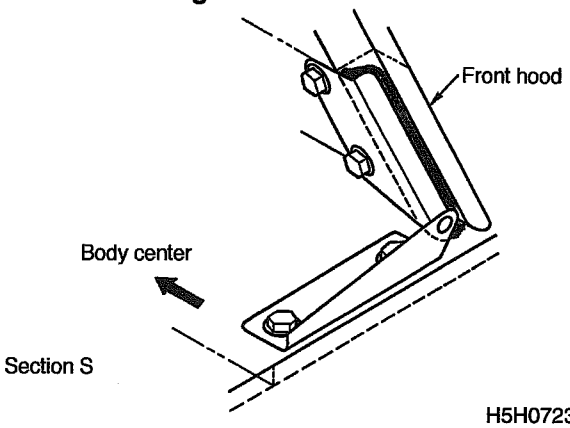
Section Q G5H0052

⑱ Reinforce Tie Down Hook Inner



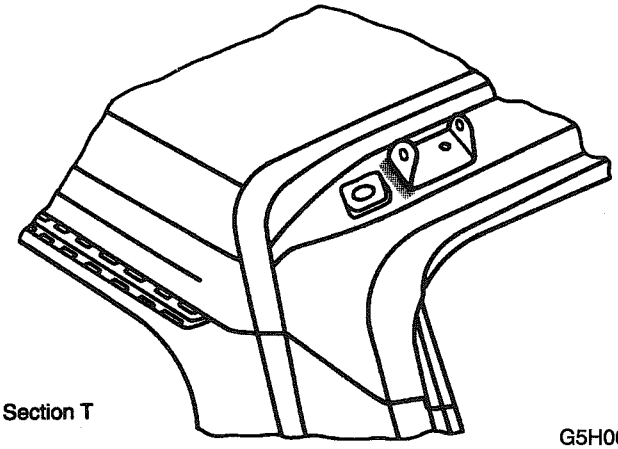
Section R G5H0053

⑲ Front Hood Hinge



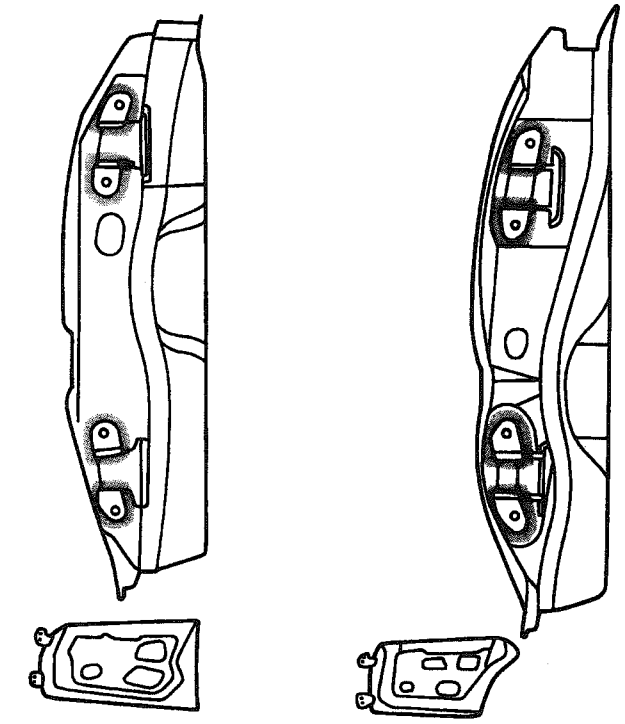
H5H0723A

⑳ Rear Gate Hinge



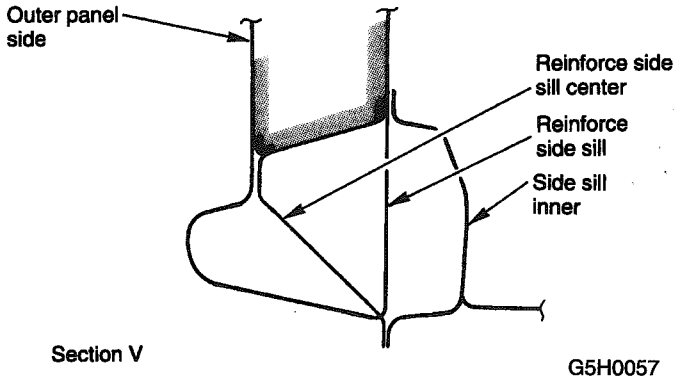
G5H0055

㉑ Front and Rear Door



G5H0056

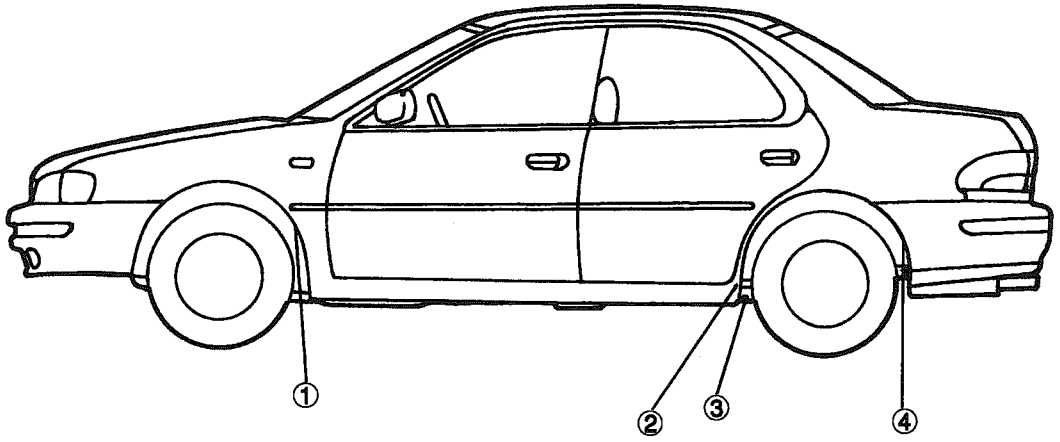
㉒ Center Pillar Lower and Inside



G5H0057

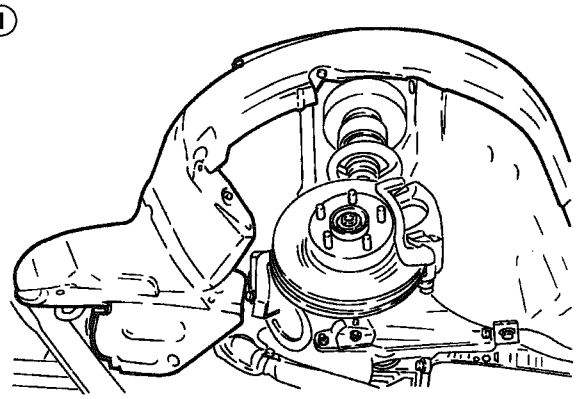
11. Rustproof Parts

The following information for the Sedan is basically the same as that for the Wagon.



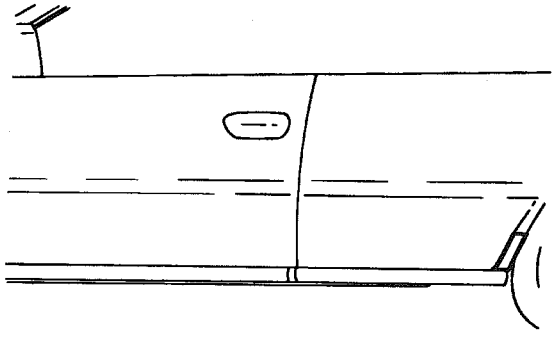
G5H0061

①



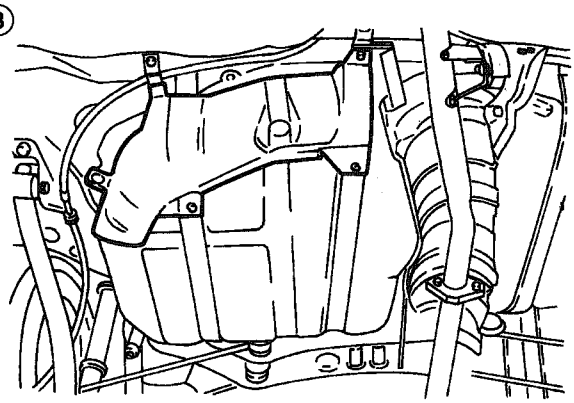
G5H0062

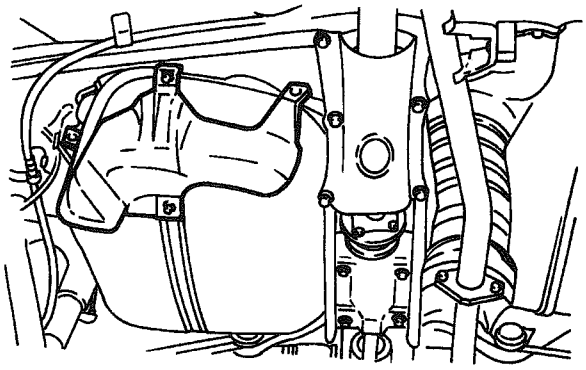
②



G5H0063

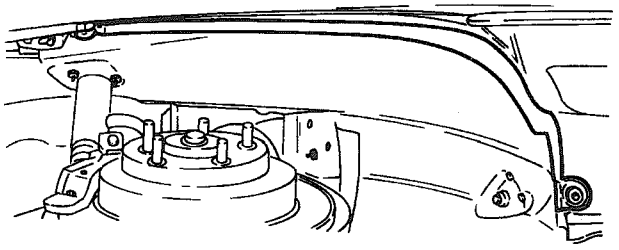
③





G5H0064

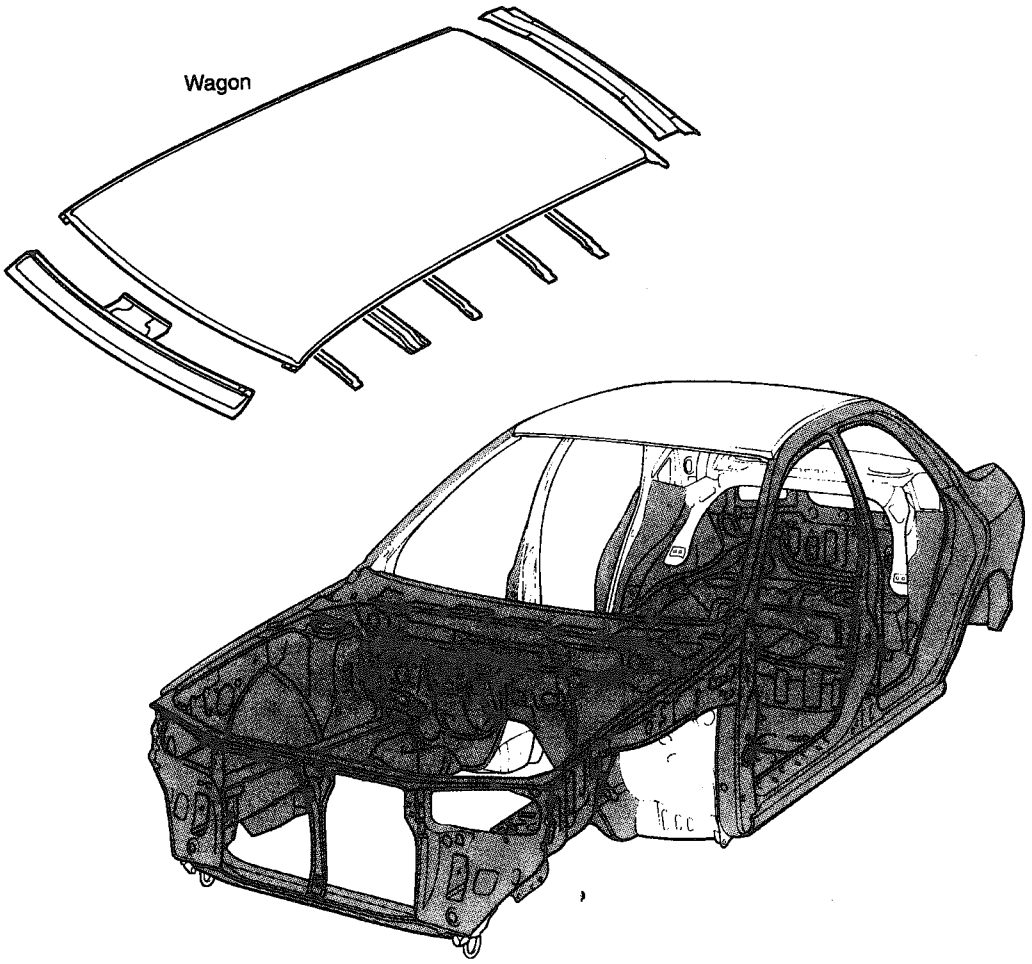
④



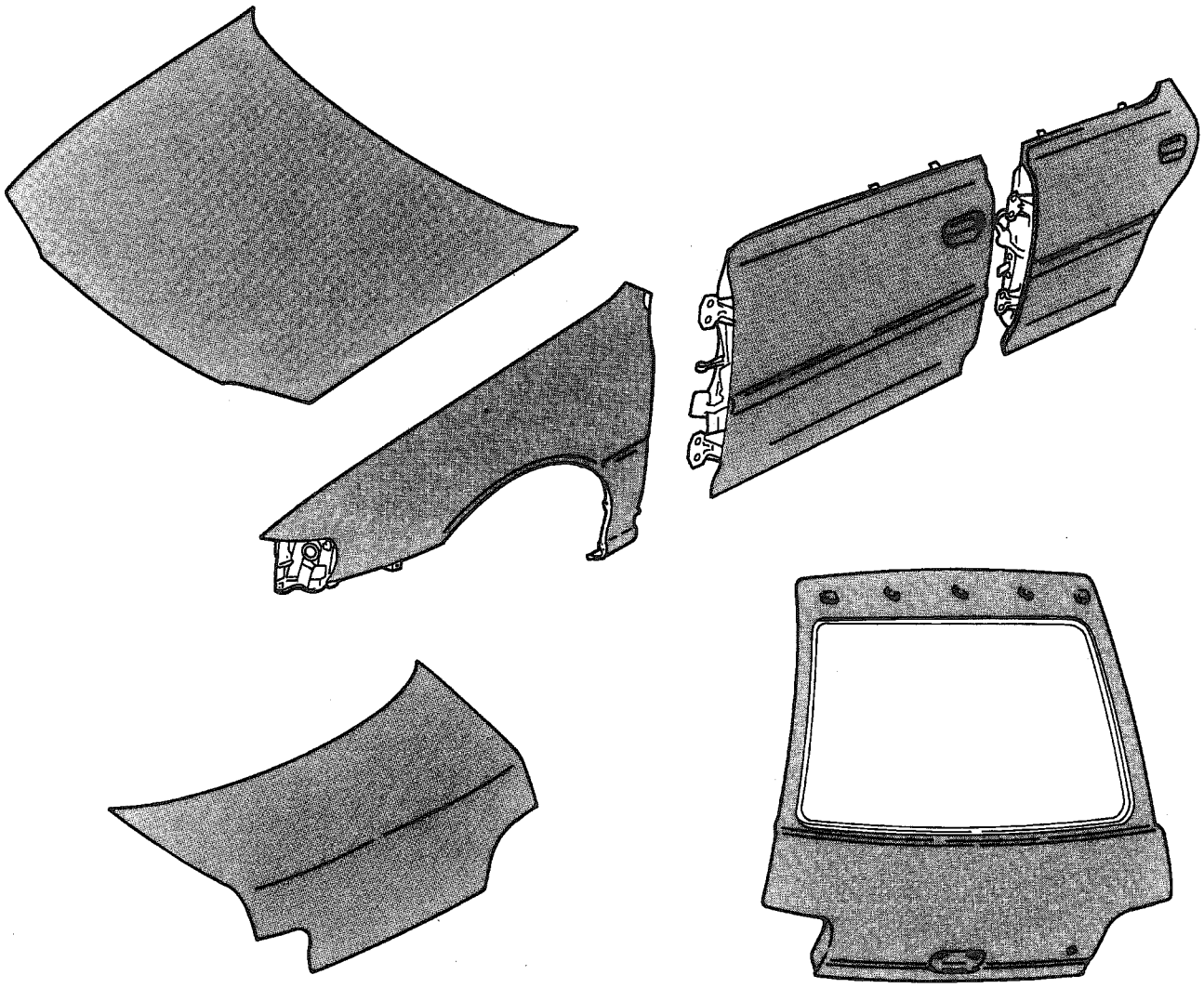
G5H0089

12. Galvanized Sheet Metal Application

The following information for the Sedan is basically the same as that for the Wagon.



G5H0059



: Galvanized both side

G5H0059

13. Sunroof

The sunroof has two operating mechanisms. One raises the rear of the slide panel for ventilation and the other fully opens the panel.

The sunroof also has the following features:

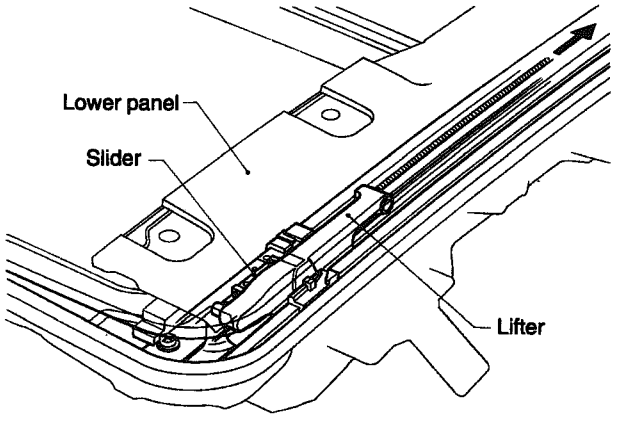
- Use of the outer slide type provides the sunroof function despite the small size of the roof.
- The reduced thickness of the roof provides extra-overhead clearance in the passenger compartment.
- Die-cast aluminum is used for roof components, thus reducing weight.
- Sheet metal components are copper-plated for rust proofing.

Operation (Operating time)	When opened:	Fully closed → tilted-up → Pause after tilt-up → Slides to rear in tilted-up mode → Fully open (Fully closed → 0.5 — 1.5 sec → Pause after tilt-up → 5.0 — 6.0 sec → Fully open)
	When closed:	Fully open → Slides to front in tilted-up mode → Pause with 150 mm (5.91 in) open → From tilt-up to tilt-down while sliding → Fully closed (Fully open → 2.5 — 3.5 sec → Pause with 150 mm (5.91 in) open → 3.0 — 4.0 sec → Fully closed)

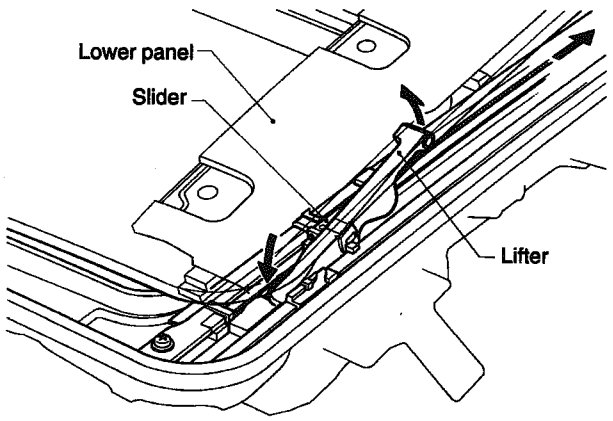
A: TILT-UP MECHANISM

1. OPERATION

- The lower panel installed with the outer panel is secured to the lifter.
- When the "OPEN" switch is pressed, the slider is pulled back by the motor.
- The slider guide pin moves along the guide hole to tilt the rear of the lifter up.
- When the "OPEN" switch is pressed again, the slider is pulled back further. Since the slider guide pin is located at the rear end of the lifter guide hole, the lifter and slider move back as a unit to open the sunroof.



G5H0065

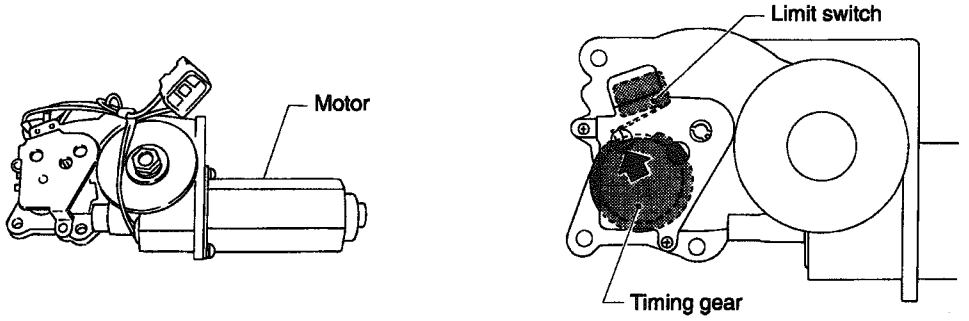


G5H0066

B: SUNROOF MOTOR

1. CONSTRUCTION

The sunroof motor consists essentially of a motor, timing gear and limit switch. The timing gear is provided with a pinion gear cam mechanism, and the limit switch turns the relay on or off according to the tilt-up position of the slide panel.

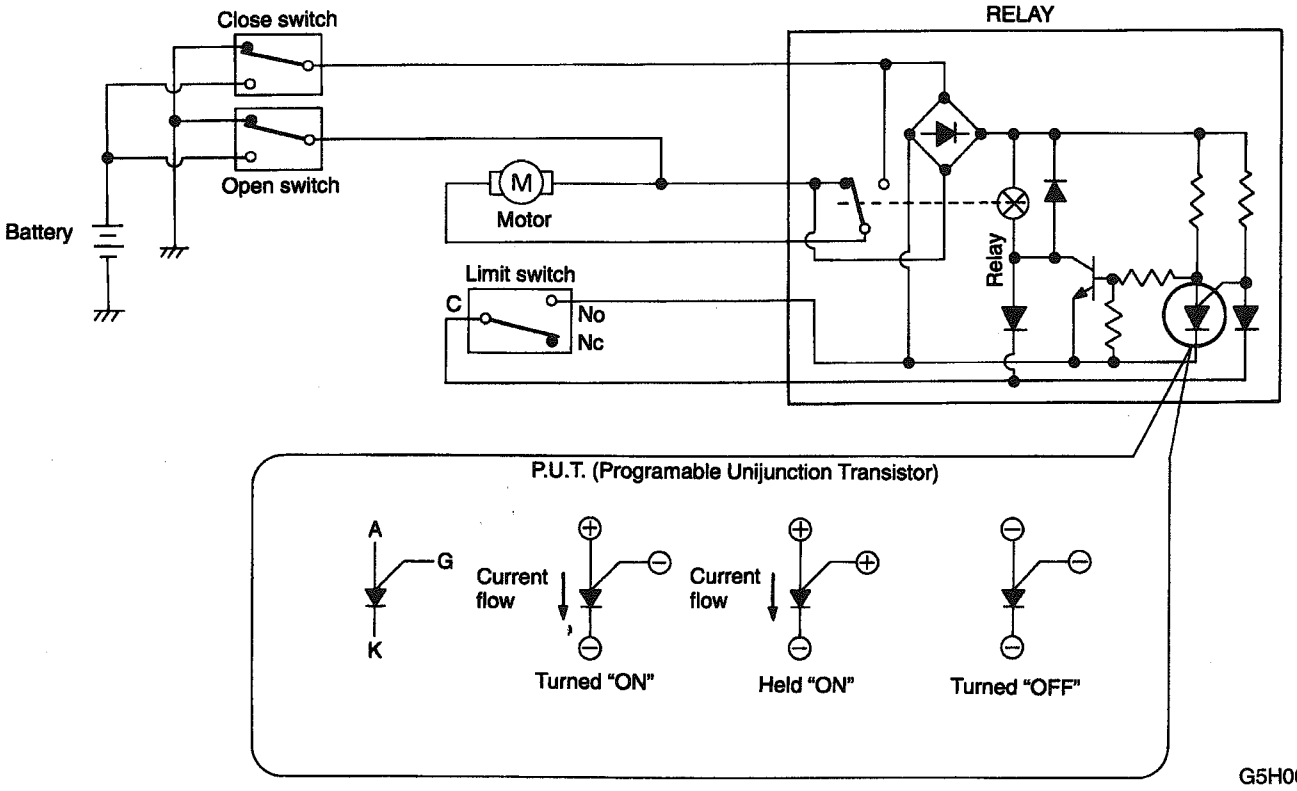


G5H0067

C: LIMIT SWITCH

1. CONSTRUCTION

This switch closes or opens according to the tilt-up position of the slide panel. It also activates when the slide panel reaches the 150 mm (5.91 in) open position.



G5H0068

D: SYSTEM OPERATION

1. SLIDE OPERATION

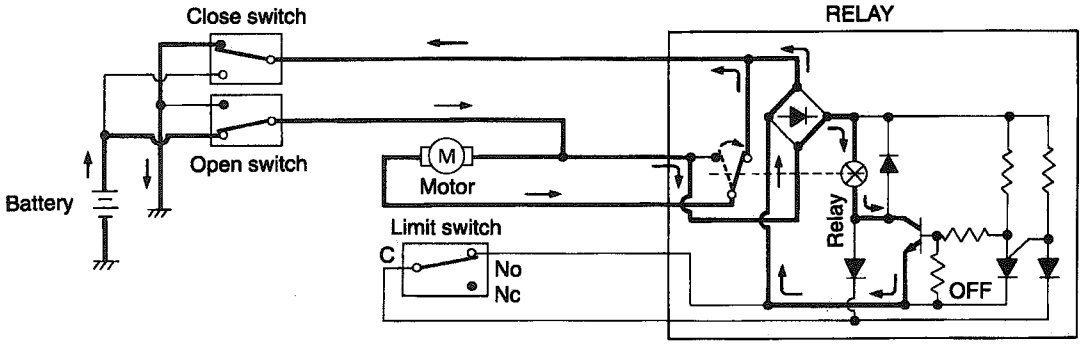
The slide panel continuously opens while the "OPEN" switch is pressed, and stops at the specified tilt-up position.

When the switch is released and pressed again, the slide panel continues to move to the fully open position.

The slide panel continuously closes while the "CLOSE" switch is pressed, and stops at approximately the 150 mm (5.91 in) open position. When the switch is released and pressed again, the slide panel continues to move to the fully closed position.

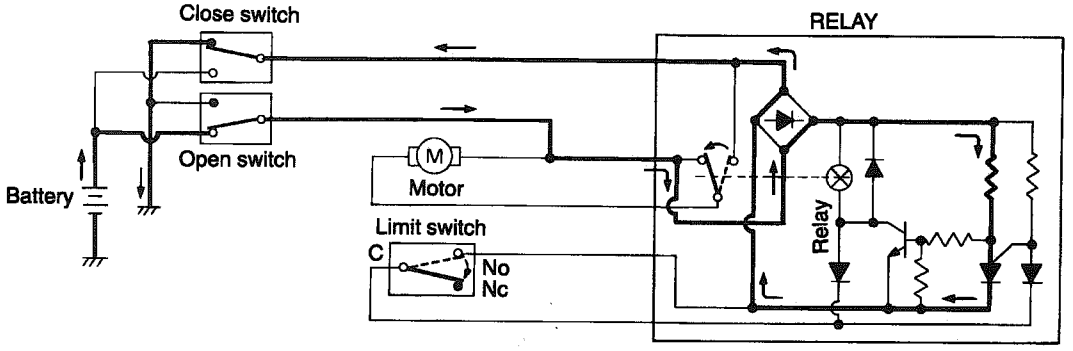
2. OPEN OPERATION

• When the "OPEN" switch is pressed, current flows to activate the transistor and relay so that the motor rotates in the direction thet opens the slide panel. (The P.U.T. is held "OFF".)



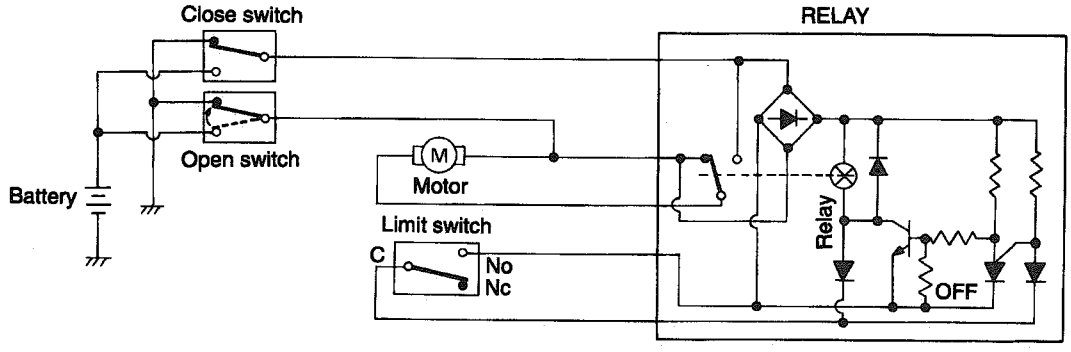
G5H0069

• The limit switch turns from "ON" to "OFF" so that the P.U.T. turns ON. This turns the transistor and relay off, and the motor will then stop.



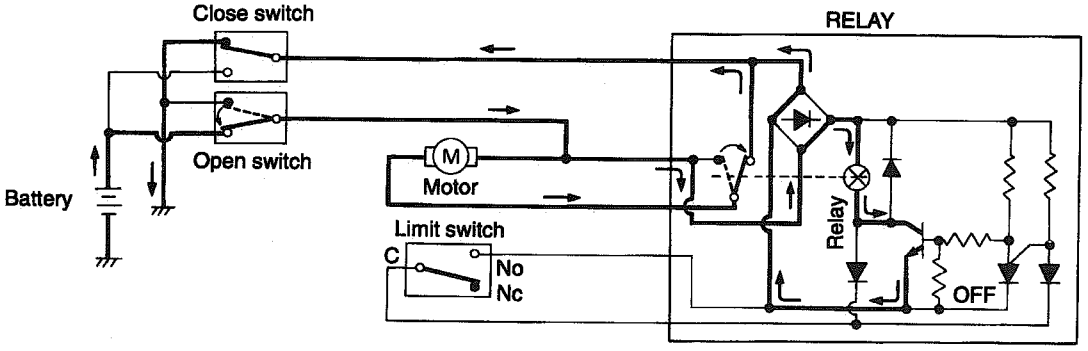
G5H0070

• When the "OPEN" switch is released, the P.U.T. turns OFF. The circuit is then held in a stand-by mode for ready operation.



G5H0071

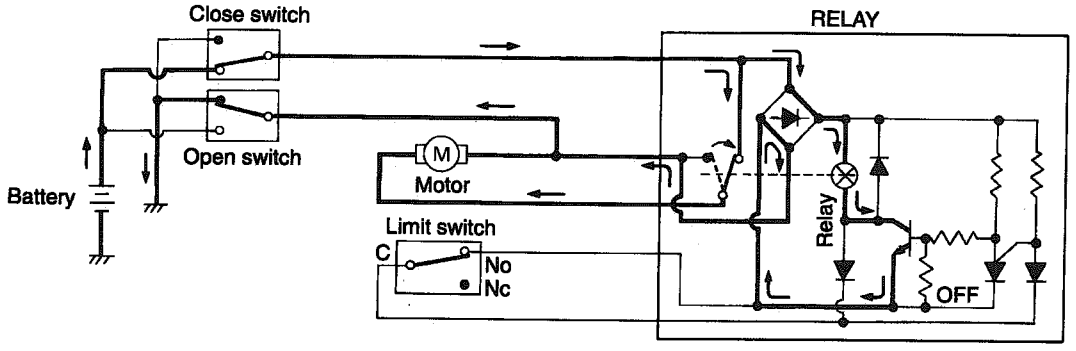
• When the "OPEN" switch is pressed again, the transistor and relay turn ON (the P.U.T. is held OFF). The motor will then rotate in the direction that opens the slide panel fully.



G5H0072

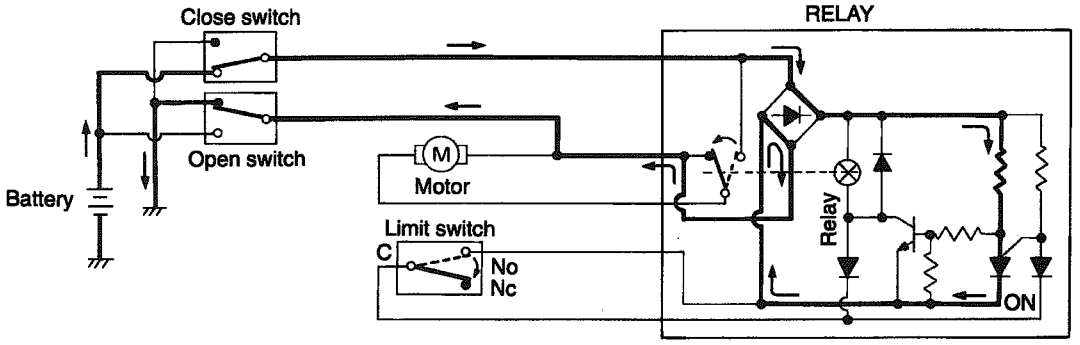
3. CLOSED OPERATION

• When the "CLOSE" switch is pressed, current flows to turn the transistor and relay ON (the P.U.T. is held OFF), the motor rotates in the direction that closes the slide panel.



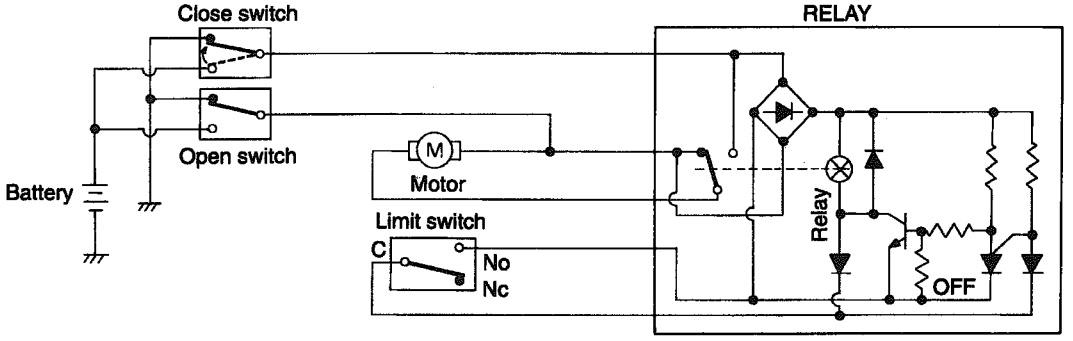
G5H0073

- The limit switch turns from ON to OFF (the P.U.T. turns ON), and the motor will stop.



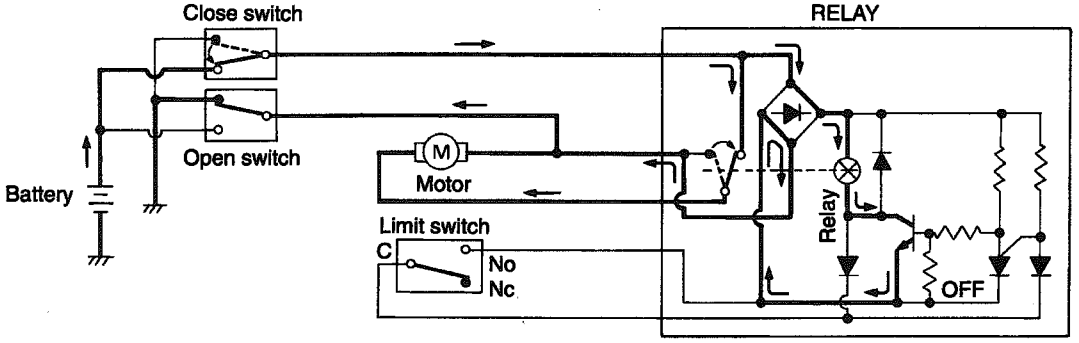
G5H0074

- When the "CLOSE" switch is released, the P.U.T. turns OFF, holding the circuit in a stand-by mode for ready operation.



G5H0075

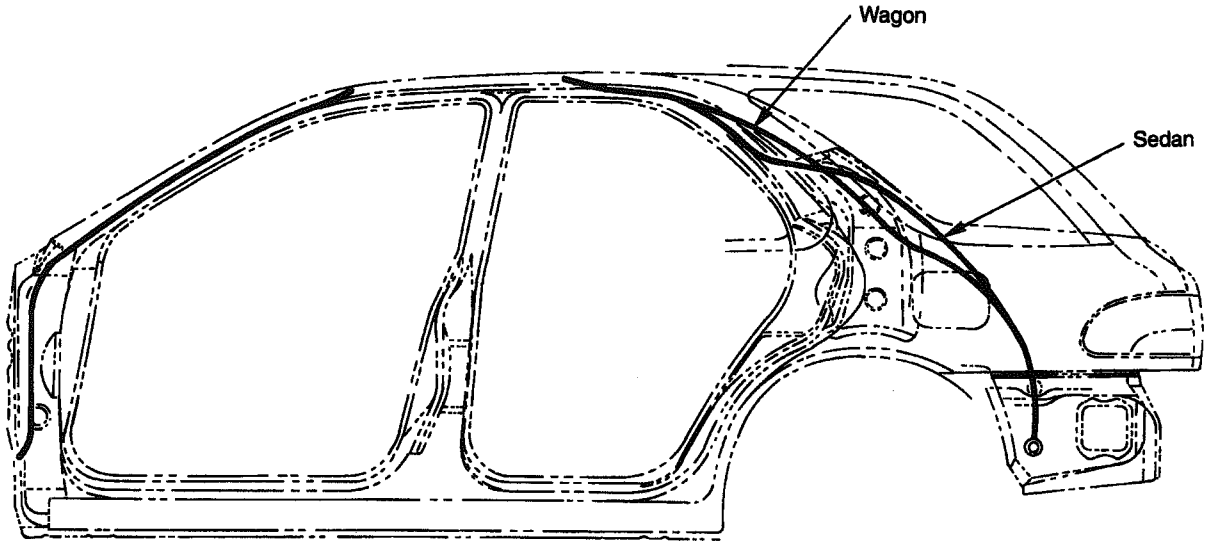
- When the "CLOSE" switch is pressed again, the transistor and relay turn ON. The motor will then rotate in the direction that closes the slide panel fully. (In this case, the slide panel does not stop at the tilt-up position.)



G5H0087

E: DRAIN TUBE LAYOUT

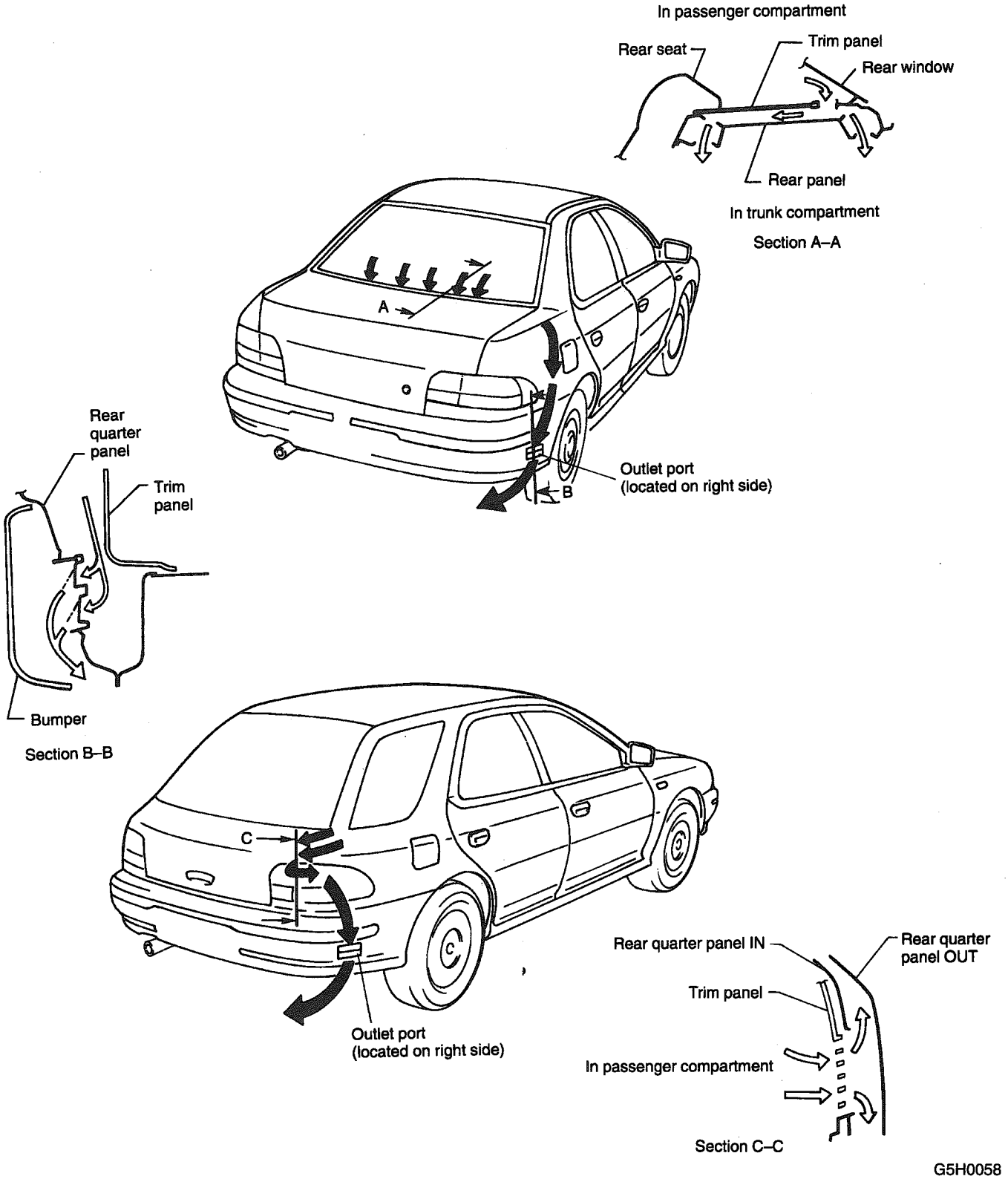
The front drain tube is routed to the inner side of the front wheel arch through the front pillar. The rear drain tube is routed to the back of the rear bumper through the side rail and rear pillar.



G5H0088

14. Ventilation

A: AIR OUTLET PORT

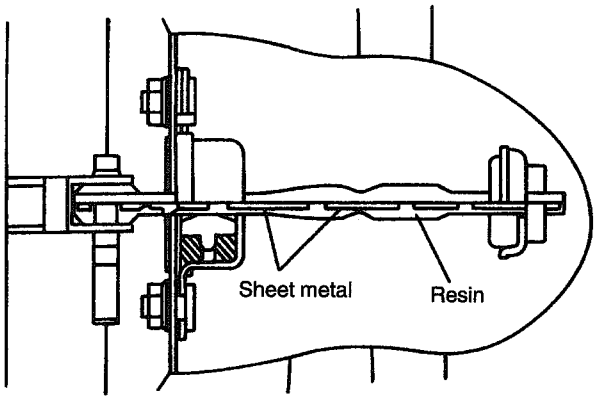


DOORS AND WINDOWS 5-2

1. Door

A: DOOR CHECKER

A resin molding type door checker is introduced (Front door).

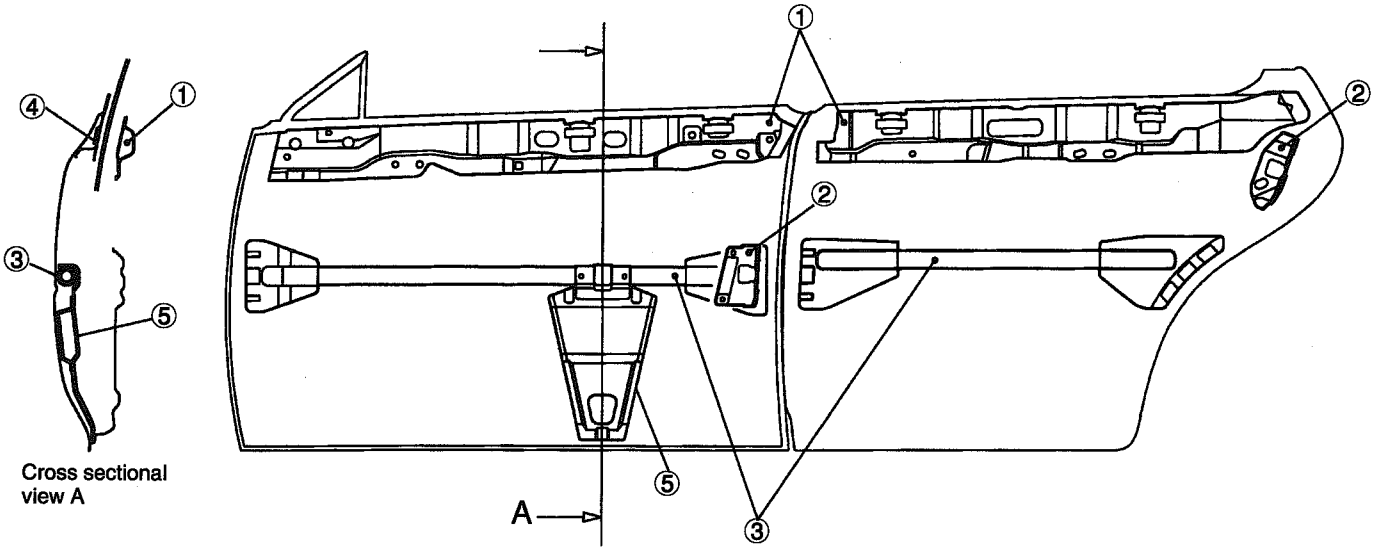


B5H0471A

B: DOOR CONSTRUCTION

All front and rear doors are fitted with a side door beam (front door is equipped with a pad), an inner upper reinforcement, an outer upper reinforcement and a reinforcement latch.

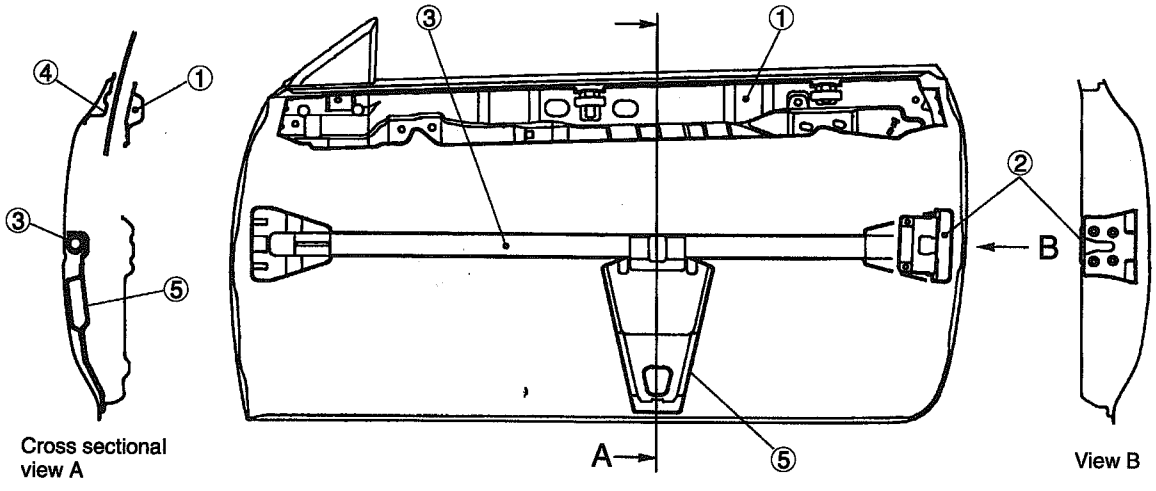
1. SEDAN AND WAGON MODEL



G5H0579

① Inner upper reinforcement
② Reinforcement latch
③ Side door beam
④ Outer upper reinforcement
⑤ Pad

2. COUPE MODEL

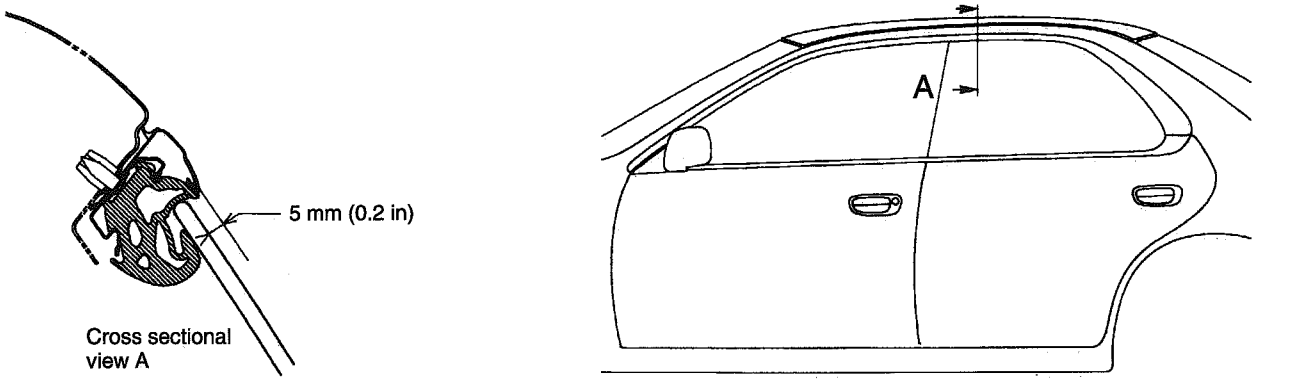


G5H0624A

① Inner upper reinforcement
② Reinforcement latch
③ Side door beam
④ Outer upper reinforcement
⑤ Pad

2. Window Glass

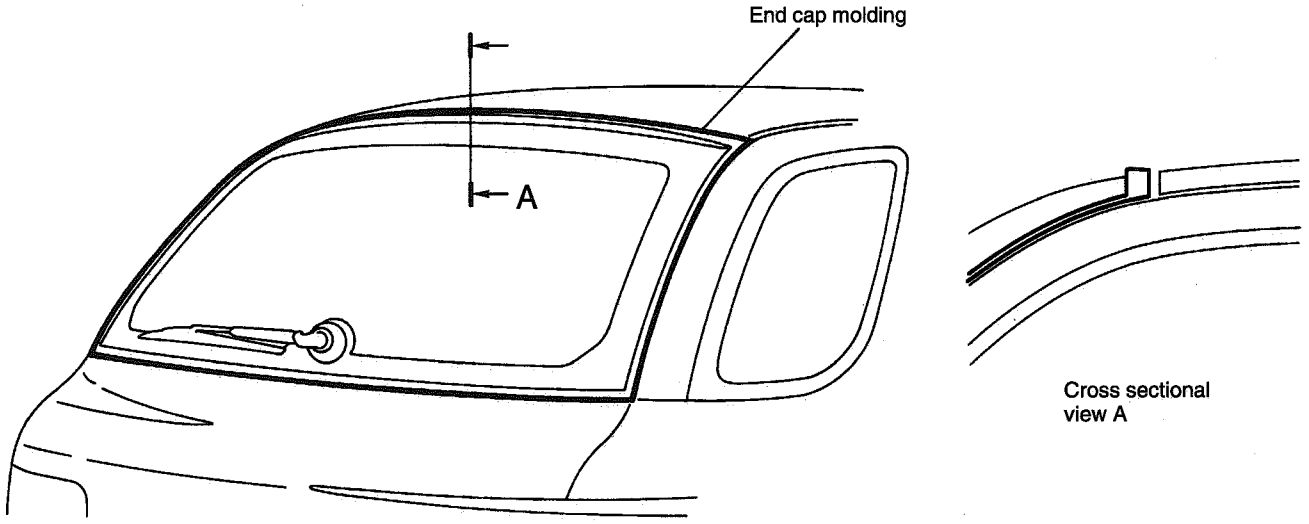
The window glass aligns with the body paneling at surface level difference of approximately 5 mm (0.2 in).



G5H0108

3. Rear Gate

The rear gate borders on the body paneling by the rear window glass.
The rear window glass has an end cap molding whose top section has a spoiler-like shape.



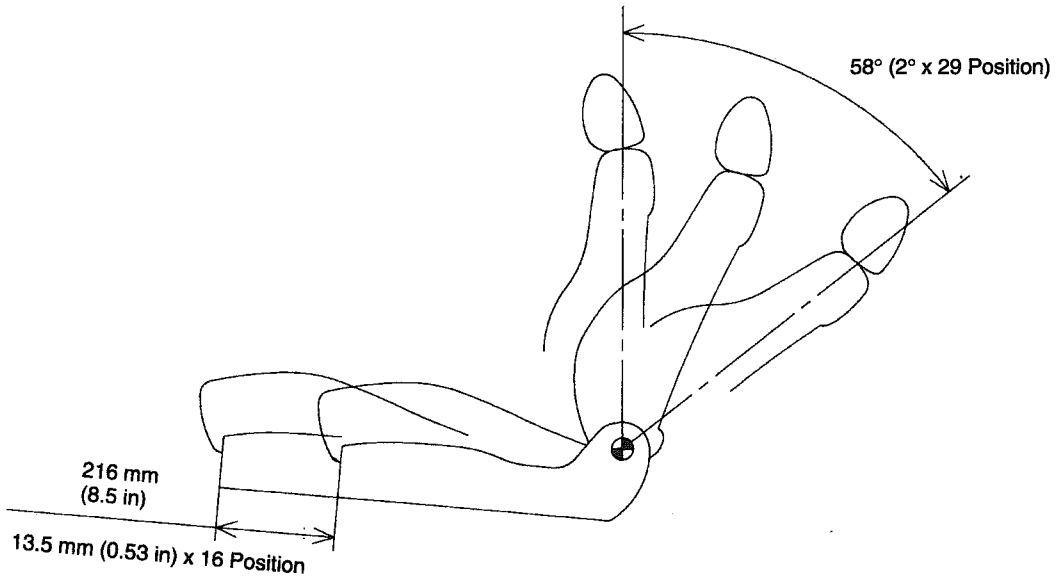
G5H0109

SEATS, SEAT BELTS AND INTERIOR 5-3

1. Front Seat

A: ADJUSTMENT

- The height of each headrest is adjustable to 4 positions.
- The angle of each backrest is adjustable to 29 positions at 2° steps.
- The front seat can be slid back and forth to one of 16 positions at 13.5 mm (0.53 in) steps.

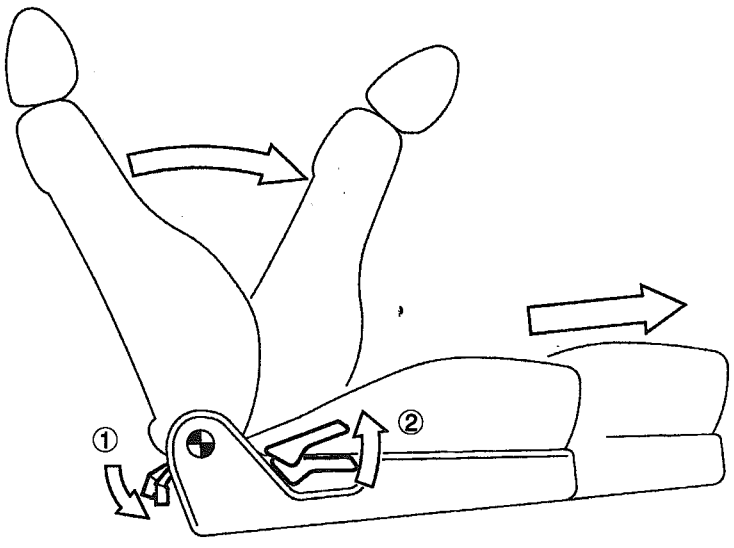


H5H0686A

B: WALK-IN SYSTEM

When getting in or out of rear seat, front passenger seat can be moved to the forward most position as follows:

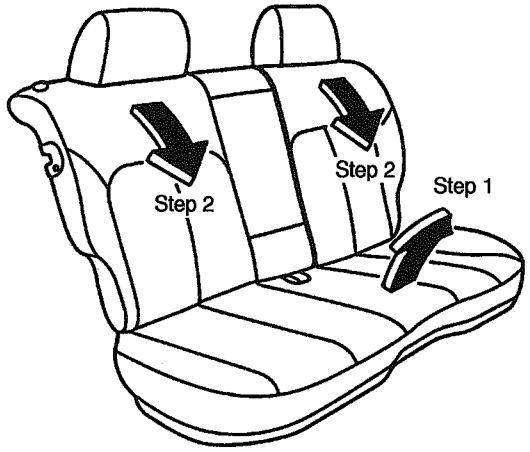
Depress pedal ① or lift reclining hinge lever ② to tilt backrest forward. Reclining hinge will then release slide rail lock so that seat moves forward.



G5H0625

2. REAR SEAT

- The wagon model is provided with a foldable seat.

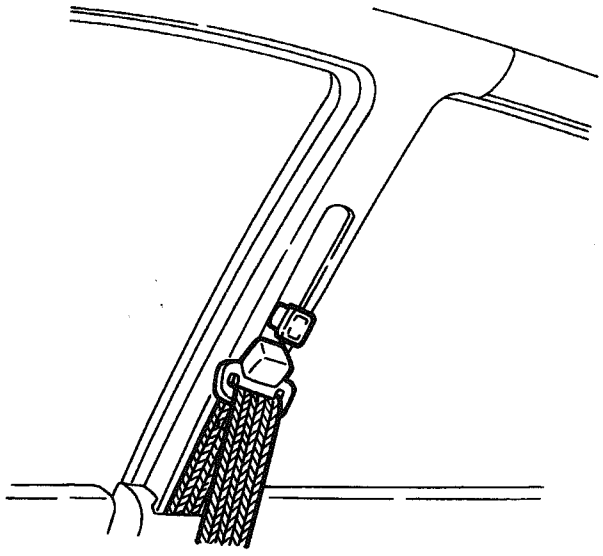


H5H0684A

3. Seat Belt

A: ADJUSTABLE SHOULDER ANCHOR

The front seat belt has a mechanism that allows the occupant to select the most appropriate shoulder anchor height from among the four positions [changeable within 90 mm (3.54 in) range]. The adjustment is made by moving the anchor up or down while keeping the anchor knob raised to bring the anchor to the desired position.

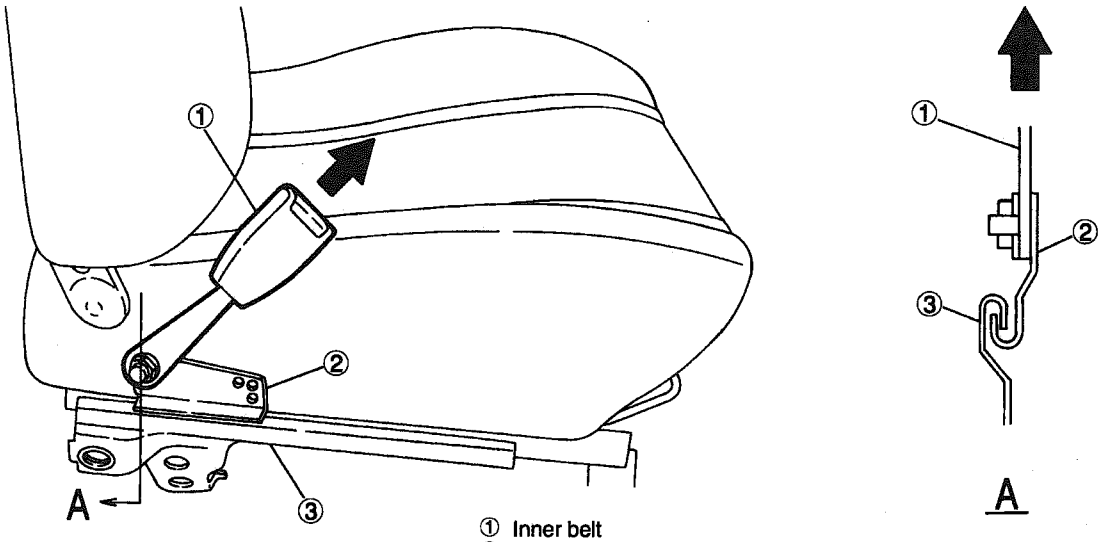


G5H0104

B: BELT IN SEAT

The front inner belt is now integral with the front seat. This keeps the relative positions of the occupant and the front inner belt always constant, irrespective of the adjustments of the front seat position.

When an impact is applied to the occupant in a collision, the inner belt is pulled together with the upper hook in the direction of the arrow to engage the upper hook with the lower hook. As a result, the impact load is transmitted to the vehicle body and dispersed.

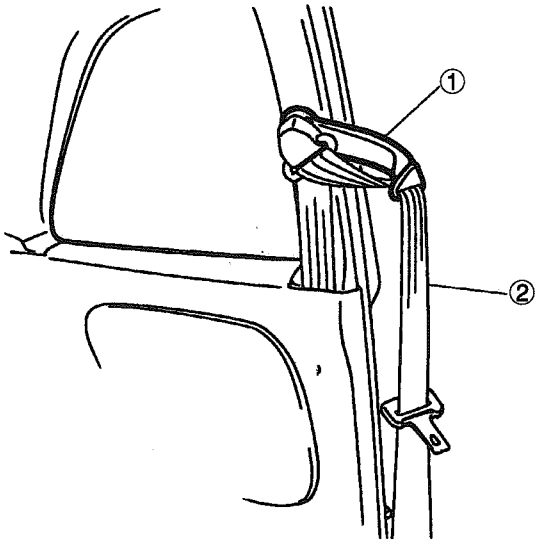


① Inner belt
② Upper hook
③ Lower hook

G5H0105

C: SEAT BELT GUIDE

A seat belt guide can be used to easily pull the webbing out by forward rotate arm when fastening the seat belt.

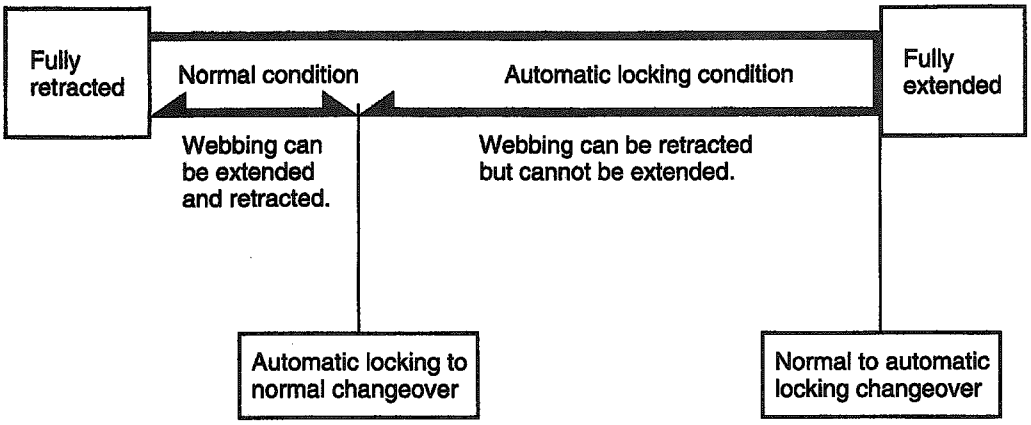


G5H0626A

① Arm
② Webbing

D: AUTOMATIC ELR

When the webbing of the front seat belt (passenger side) and rear seat belt are once drawn out completely, its retractor is changed to the automatic locking condition to securely install the child restraint system. In this condition, the webbing can be retracted but cannot be extended. When the belt is retracted to some extent, this condition is released.



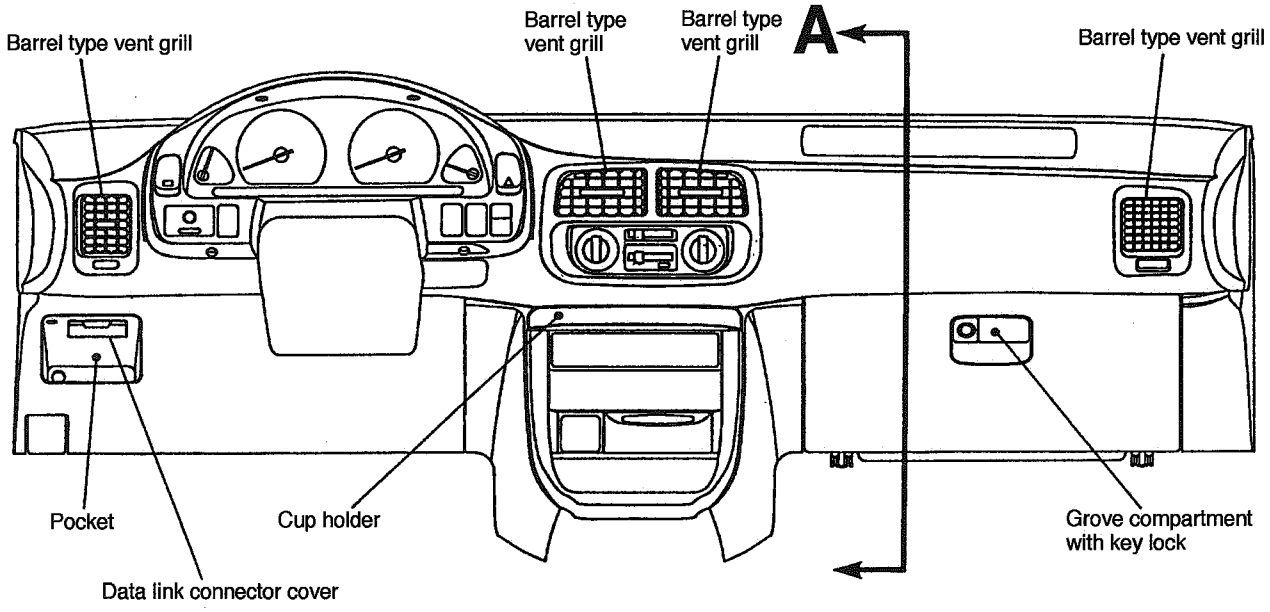
B5H0328

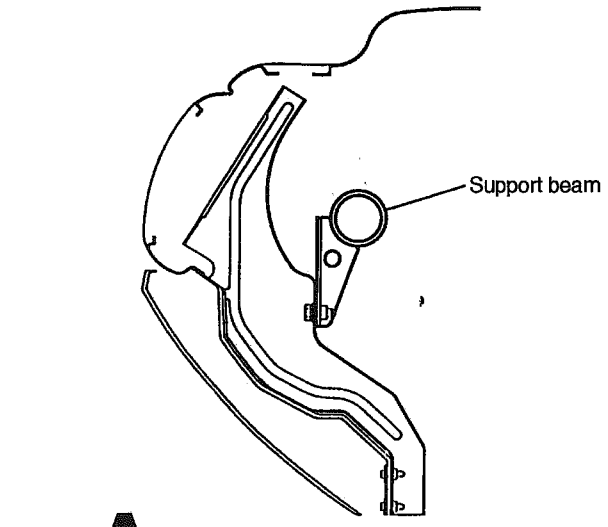
MEMO

INSTRUMENT PANEL 5-4

1. Instrument Panel

- A cup holder is equipped.
- A glove compartment with key lock is equipped.
- A pocket is equipped.
- Barrel type vent grills are adopted.
- A support beam connecting the left and right pillars is installed at the back of the instrument panel. The instrument panel is mounted on the support beam.
- A data link connector cover is equipped.



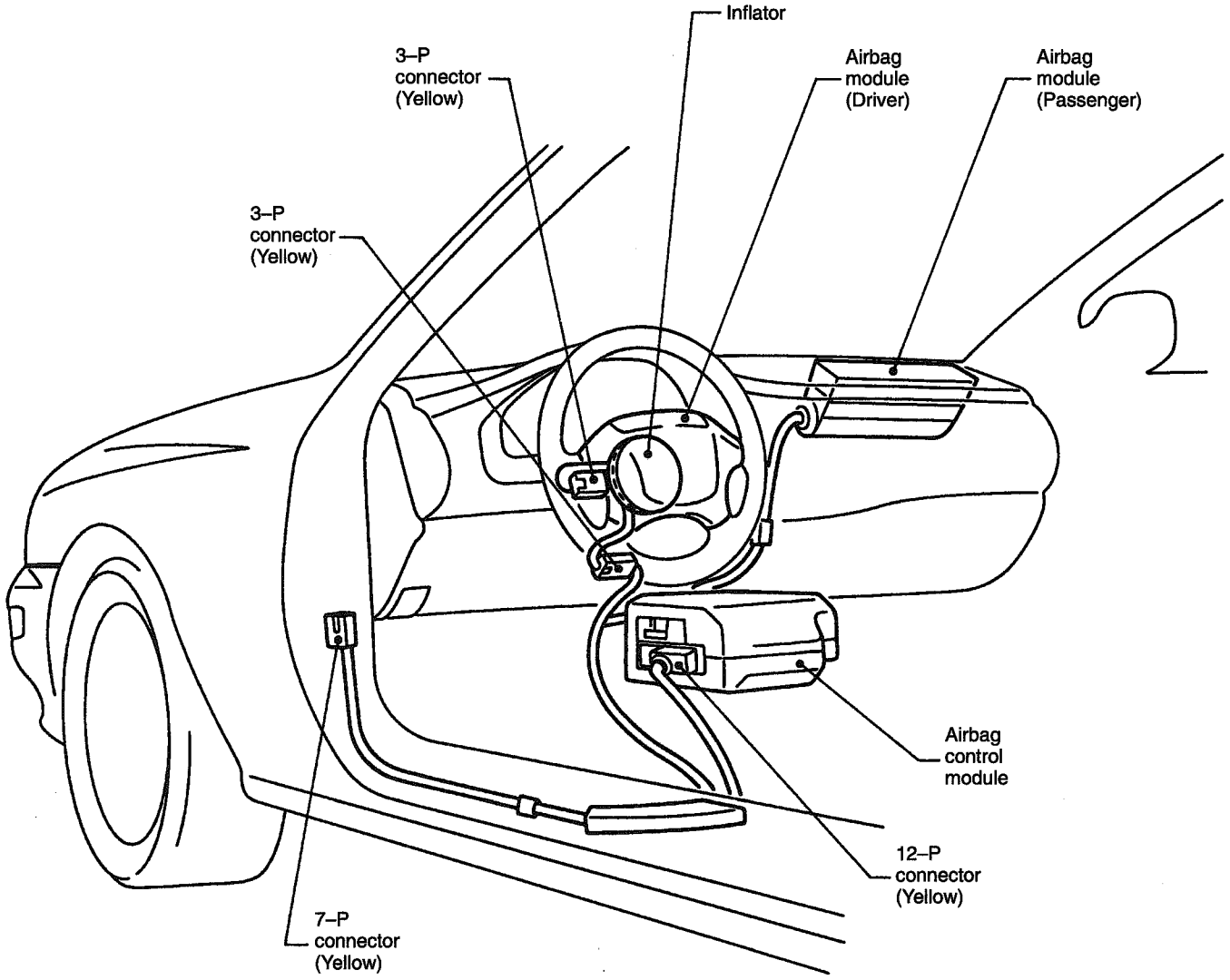


H5H0683A

SUPPLEMENTAL RESTRAINT SYSTEM 5-5

1. SRS Airbag System

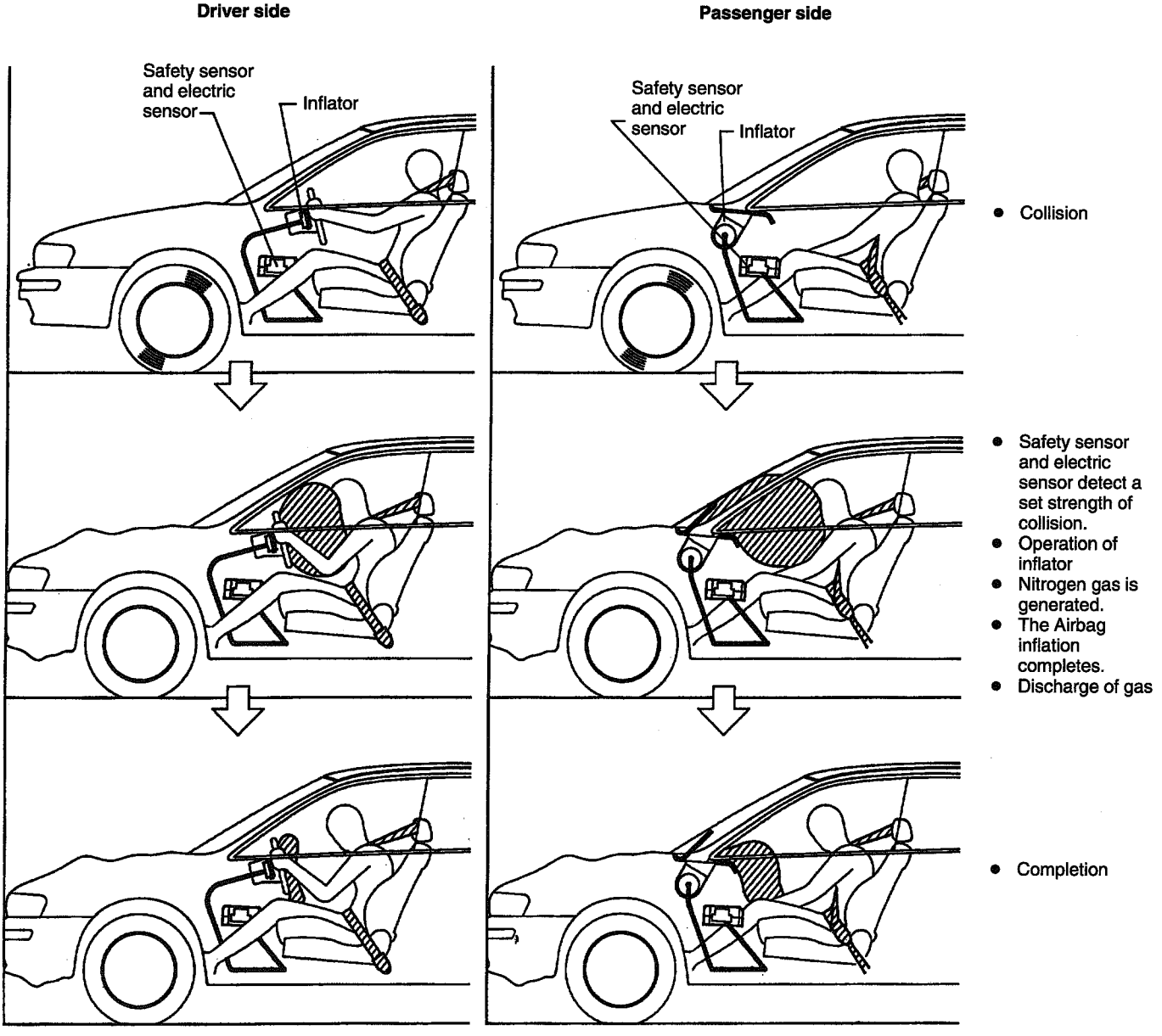
A: INSTALLATION



H5H0655A

B: FUNCTION

The SRS airbag is provided as an auxiliary driver and passenger front seat restraint system to be used in combination with the seat belt. When an impact greater than a set level is applied to the front of the vehicle, the sensor senses it and generates an electrical pulse to inflate the bag in the airbag module, thus preventing the upper bodies of the driver and passenger in the front seat from impacting the steering wheel, instrument panel and windshield.

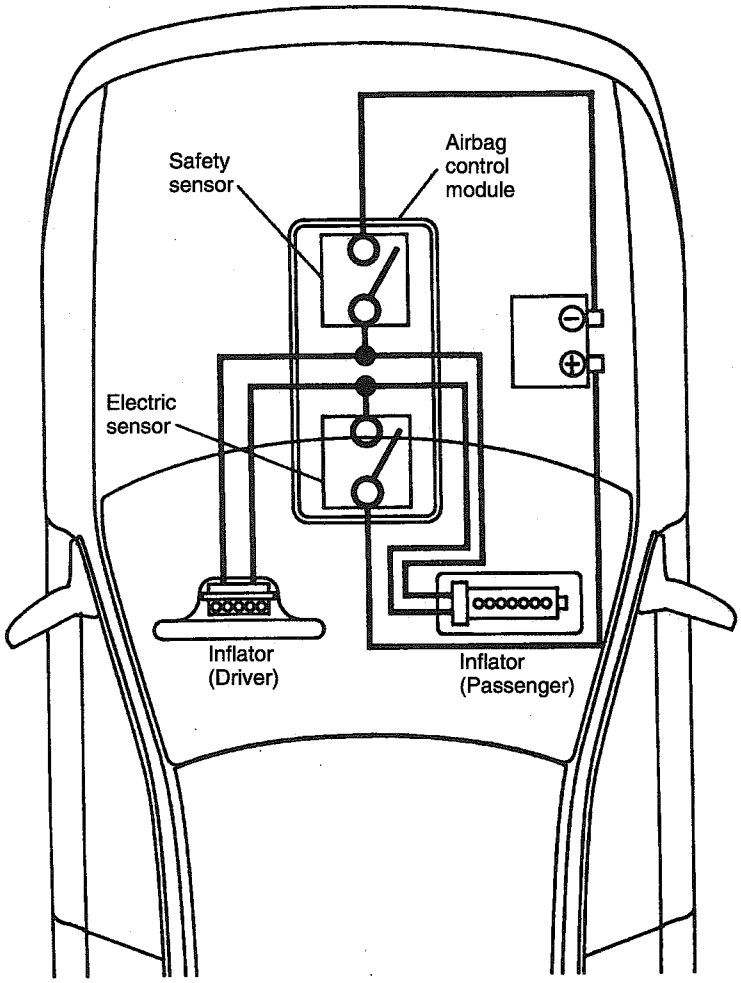


H5H0656A

2. Construction

A: GENERAL

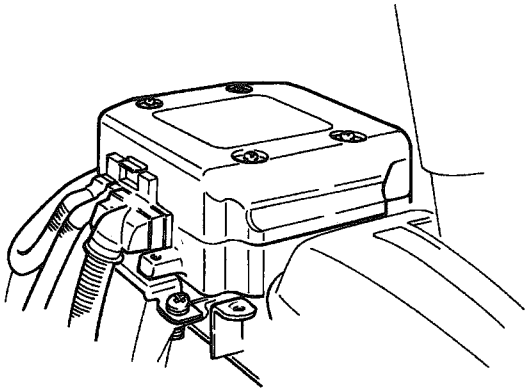
The SRS airbag consists of an airbag control module, electric sensor and safety sensor built into the control module, and airbag modules of driver and passenger containing an inflator and airbag. Electric sensor and safety sensor are connected in series, so that the airbag will inflate if electric sensor and safety sensor sense an impact at the same time.



H5H0657A

B: AIRBAG CONTROL MODULE

The airbag control module is installed ahead of the front floor tunnel. It detects the vehicle's deceleration by receiving electrical signals from the sensors and judges whether to fire the airbag. This control module has a built-in self-diagnosis function. If a trouble occurs inside the system, it lights up the airbag warning light in the combination meter. The trouble data is stored in the module. A back-up power supply is provided for possible damage to the battery during an accident, and a boosting circuit is built into the module in case of a battery voltage drop.



G5H0079

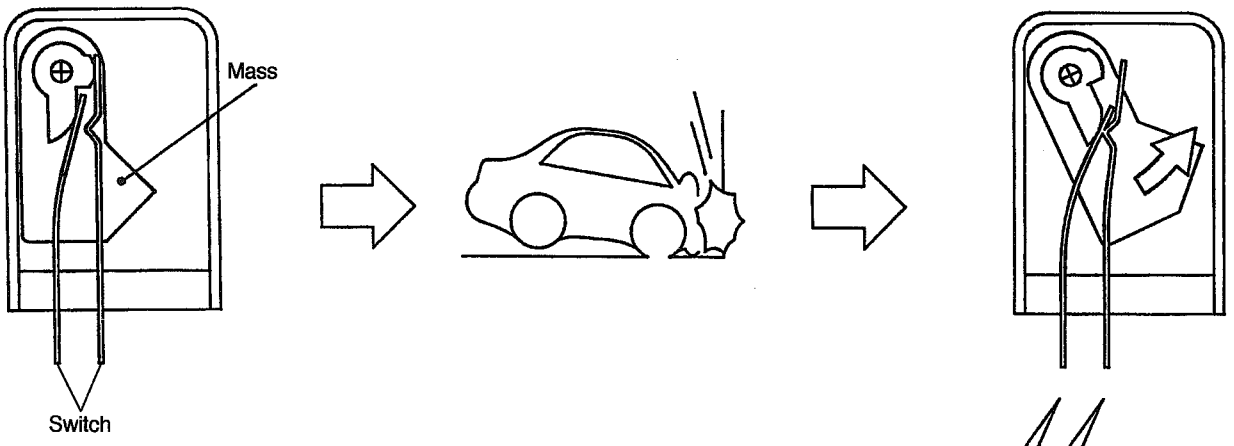
C: SAFETY SENSOR AND ELECTRIC SENSOR

Safety sensor and electric sensor are built into the airbag control module.

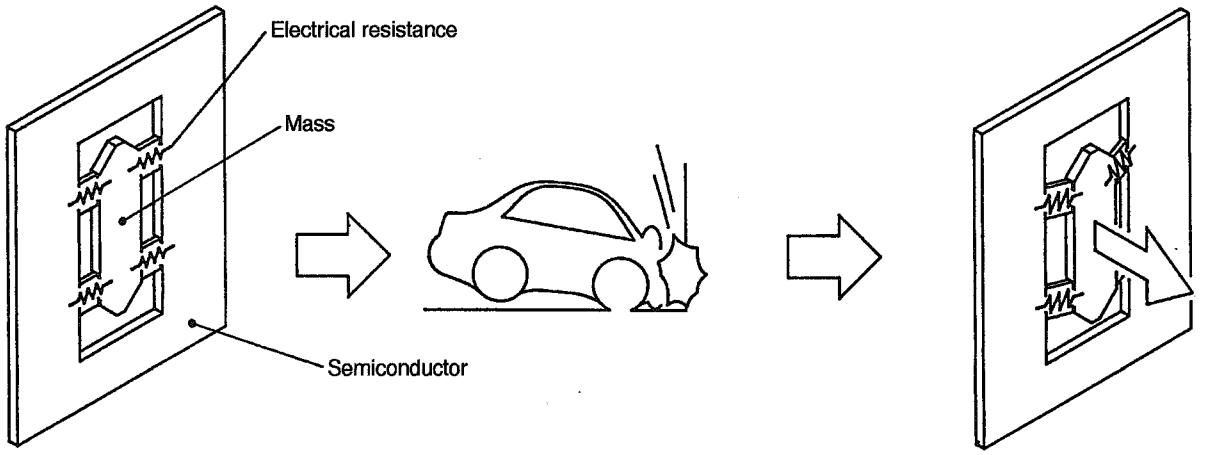
Safety sensor is the pendulum type sensor. If the sensor receives a frontal impact exceeding a certain limit, the mass in the sensor revolves forward to turn the switch ON.

Electric sensor consists of the semiconductor type sensor which senses the deceleration at collision by the change of the electrical resistance and the impact sensing circuit.

SAFETY SENSOR



ELECTRIC SENSOR

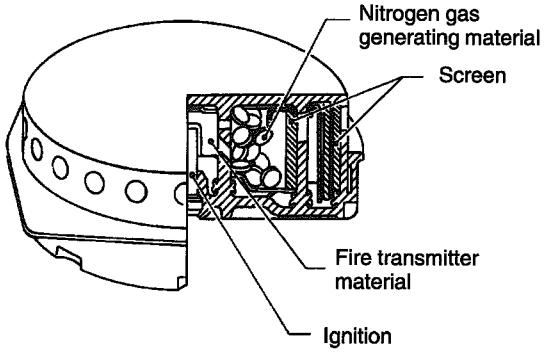


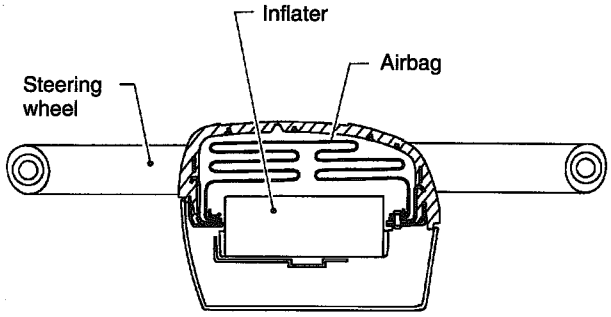
H5H0685A

D: AIRBAG MODULE

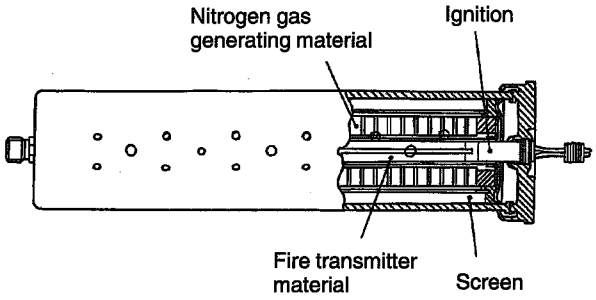
The driver's airbag module is located at the center of the steering wheel, and passenger's airbag module is located at upper side of instrument panel, and it each contains an airbag and inflater. If a collision occurs, the inflator produces a large volume of nitrogen gas inflating the nylon airbag in a very short time.

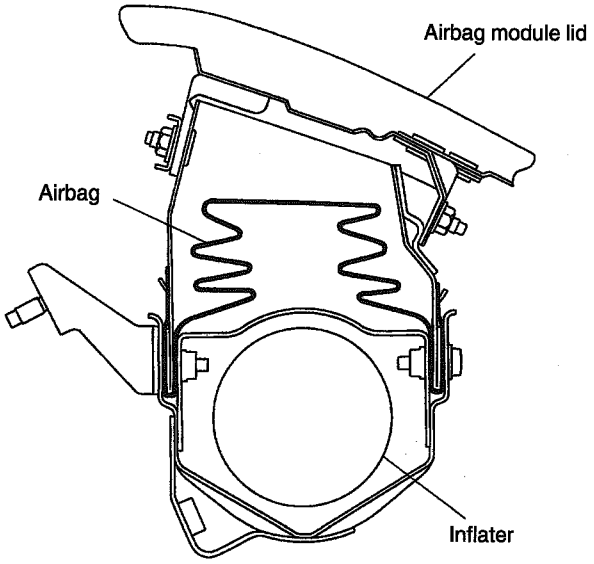
Driver side





Passenger side





G5H0585

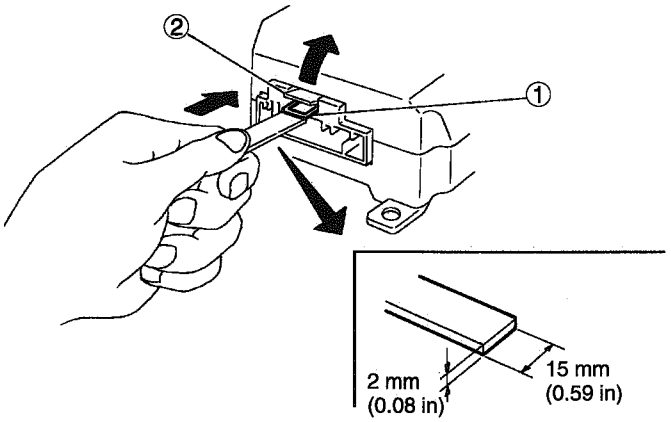
E: AIRBAG CONNECTOR

The SRS airbag adopts a connector which has a double lock mechanism and coupling error detection mechanism for enhanced reliability. If coupling is incomplete, the airbag warning light comes on in the combination meter.

1. CONNECTOR COUPLED TO AIRBAG CONTROL MODULE

To disconnect the connector, press wire ① of the control unit as illustrated below until the green lever ② tilts up. This unlocks the double lock, then you can pull off the connector while pressing tile connector lock.

To couple the connector, insert the three connectors until a "click" is heard, then push in the green lever ② to apply the double lock.

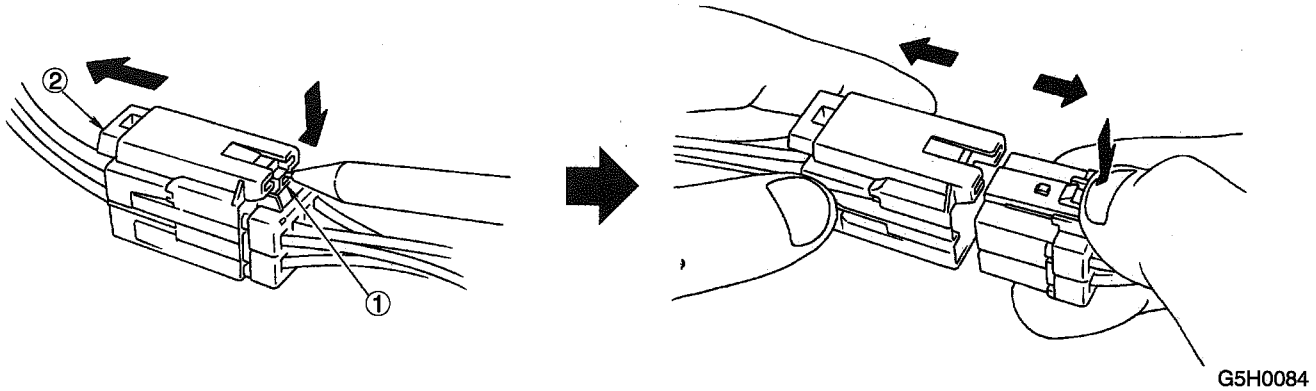


G5H0083

2. CONNECTOR BETWEEN HARNESSES

To disconnect the connector, press lever ① to pop green lever ② out, this unlocks the double lock system. Then separate the connector by pulling both sides while holding the connector sections and pressing in lever ①.

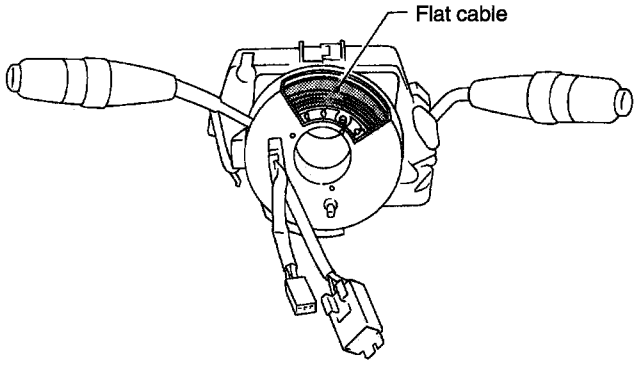
To couple the connector, insert both connectors until a "click" is heard, then push in the green lever ② until a "click" is heard; this applies the double lock.



G5H0084

F: STEERING ROLL CONNECTOR

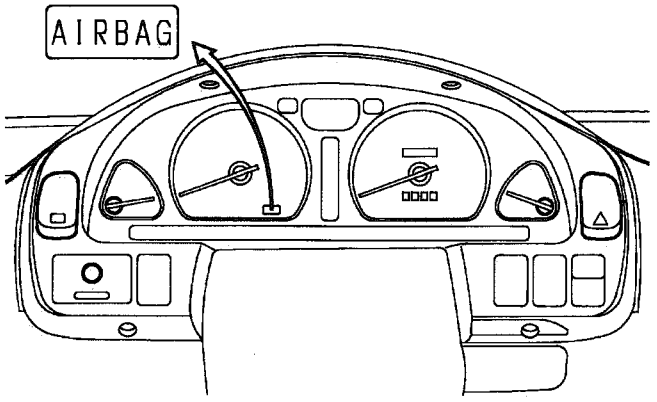
The steering roll connector is located between the steering column and steering wheel. A flat cable stored in a spiral form transmits the electrical signal from the airbag control module to the steering wheel from the body harness.



G5H0085

G: AIRBAG WARNING LIGHT

The airbag warning light is located inside the combination meter. It illuminates if a poor connection occurs, or if the airbag control module detects an abnormality, When the airbag system is normal, this light goes out about 7 seconds after turning the ignition switch ON.

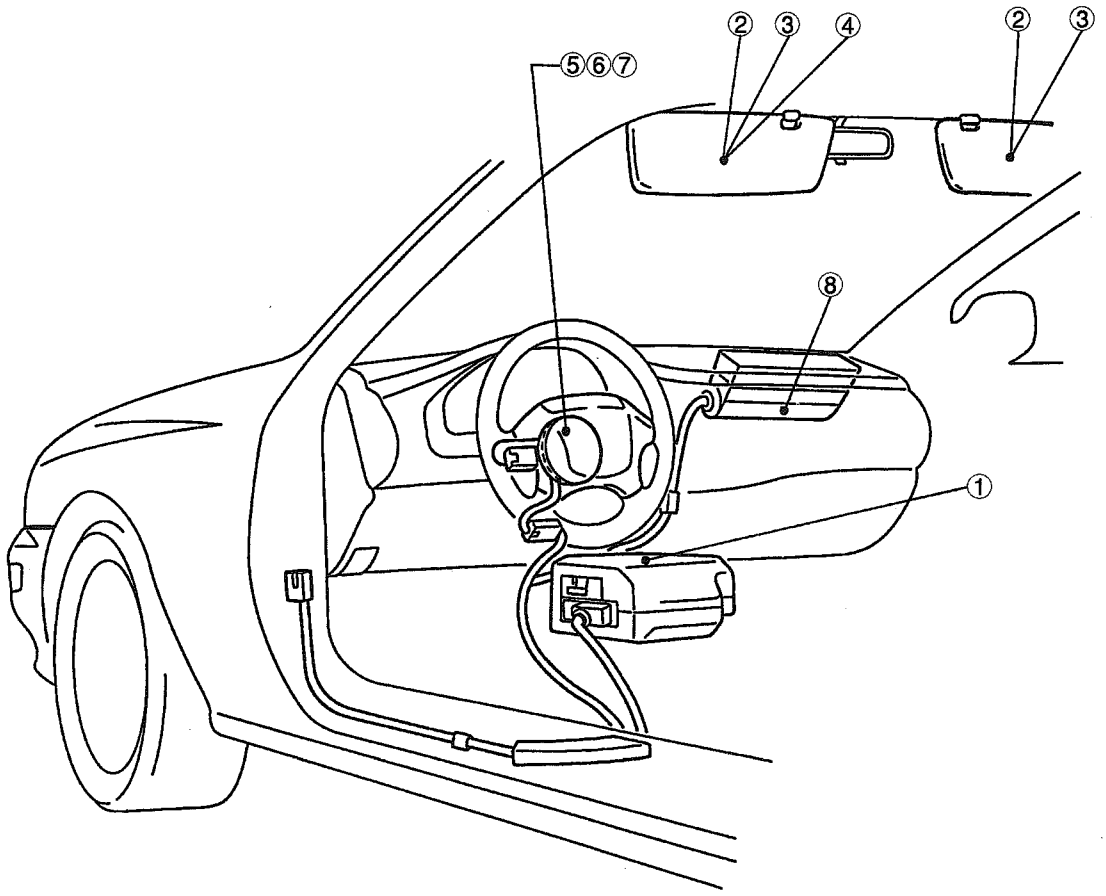


G5H0086

H: WIRE HARNESS

The wire harness of the SRS airbag is entirely covered with a yellow protective tube, and can easily be identified from harnesses of other systems.

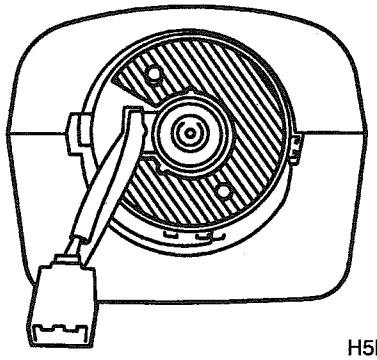
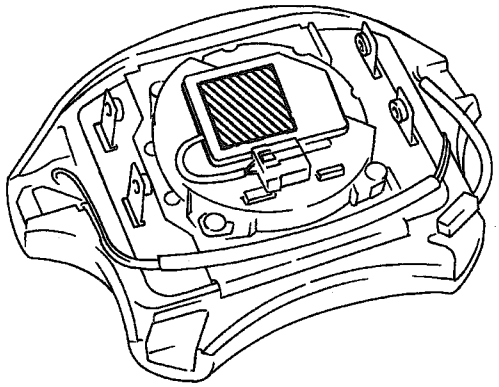
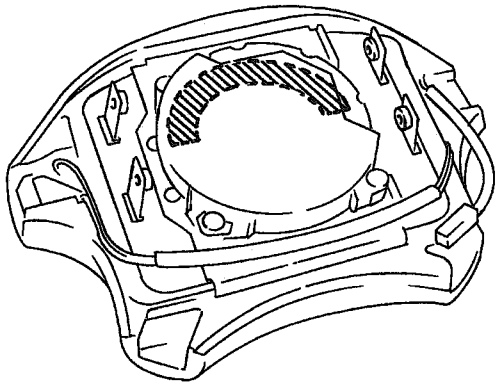
I: WARNING AND CAUTION LABELS

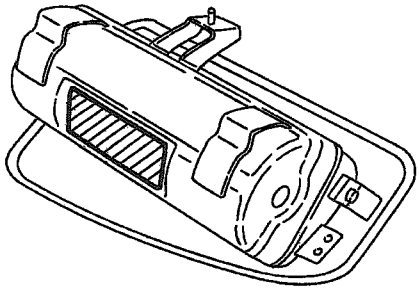


H5H0725A

①	SRS AIRBAG CONTROL UNIT CAUTION • READ SERVICE MANUAL • NO SERVICEABLE INSIDE • DO NOT DISASSEMBLE OR TAMPER • DO NOT DROP; KEEP DRY • STORE IN CLEAN DRY AREA	Précaution • lisez le manuel d'entretien • aucune pièce interne ne peut être remplacée ou réparée • ne démontez ou altérez pas cette unité de contrôle • n'échappez pas • emmagasinez dans un endroit sec	• 取り扱いは、サービスマニュアルを参照して下さい。 • 分解しないで下さい。 • 乾燥したクリーンな場所に保管して下さい。 • 落としたり濡らしたりしないで下さい。
②	**For USA** WARNING TO AVOID SERIOUS INJURY: For maximum safety protection in all types of crashes, you must always wear your safety belt. Do not install rearward-facing child seats in any front passenger seat position. Do not sit or lean unnecessarily close to the air bag. Do not place any objects over the air bag or between the air bag and yourself. See the owner's manual for further information and explanations. TEN YEARS AFTER THE DATE OF VEHICLE MANUFACTURE AS NOTED ON THE CERTIFICATION PLATE, THE SRS AIRBAG SYSTEM MUST BE INSPECTED BY A SUBARU DEALER. WARNING TO AVOID SERIOUS INJURY: For maximum safety protection in all types of crashes, you must always wear your safety belt. Do not install rearward-facing child seats in any front passenger seat position. Do not sit or lean unnecessarily close to the air bag. Do not place any objects over the air bag or between the air bag and yourself. See the owner's manual for further information and explanations.		

③	**For CANADA (with driver's and passenger's airbags)** WARNING TO AVOID SERIOUS INJURY: For maximum safety protection in all types of crashes, you must always wear your safety belt. Do not install rearward-facing child seats in any front passenger seat position. Do not sit or lean unnecessarily close to the air bag. Do not place any objects over the air bag or between the air bag and yourself. See the owner's manual for further information and explanations. TEN YEARS AFTER THE DATE OF VEHICLE MANUFACTURE AS NOTED ON THE CERTIFICATION PLATE, THE SRS AIRBAG SYSTEM MUST BE INSPECTED BY A SUBARU DEALER. AVERTISSEMENT POUR PROTÉGER DE BLESSURES GRAVES: Veillez à toujours attacher votre ceinture pour une sécurité maximale quel que soit l'accident. Ne pas installer un siège d'enfant faisant face vers l'arrière sur le siège avant. Ne pas s'asseoir ou se pencher à proximité du coussin gonflable. Ne placer aucun objet sur le coussin gonflable ou entre le coussin et vous. Consulter le manuel du propriétaire pour de plus amples informations ou explications. DIX ANS APRÈS LA DATE DE FABRICATION DU VÉHICULE, NOTEE SUR LA PLAQUE DE CERTIFICATION, LE SYSTÈME DE COUSSIN GONFLABLE (SRS) DOIT ÊTRE INSPECTÉ PAR UN CONCESSIONNAIRE SUBARU. WARNING TO AVOID SERIOUS INJURY: For maximum safety protection in all types of crashes, you must always wear your safety belt. Do not install rearward-facing child seats in any front passenger seat position. Do not sit or lean unnecessarily close to the air bag. Do not place any objects over the air bag or between the air bag and yourself. See the owner's manual for further information and explanations. AVERTISSEMENT POUR PROTÉGER DE BLESSURES GRAVES: Veillez à toujours attacher votre ceinture pour une sécurité maximale quel que soit l'accident. Ne pas installer un siège d'enfant faisant face vers l'arrière sur le siège avant. Ne pas s'asseoir ou se pencher à proximité du coussin gonflable. Ne placer aucun objet sur le coussin gonflable ou entre le coussin et vous. Consulter le manuel du propriétaire pour de plus amples informations ou explications.
④	**For CANADA (with driver's airbag)** WARNING TO AVOID SERIOUS INJURY: For maximum safety protection in all types of crashes, you must always wear your safety belt. Do not sit or lean unnecessarily close to the air bag. Do not place any objects over the air bag or between the air bag and yourself. See the owner's manual for further information and explanations. TEN YEARS AFTER THE DATE OF VEHICLE MANUFACTURE AS NOTED ON THE CERTIFICATION PLATE, THE SRS AIRBAG SYSTEM MUST BE INSPECTED BY A SUBARU DEALER. AVERTISSEMENT POUR PROTÉGER DE BLESSURES GRAVES: Veillez a toujours attacher votre ceinture pour une securite maximale quel que soit l'accident. Ne pas s'asseoir ou se pencher a proximite du coussin gonflable. Ne placer aucun objet sur le coussin gonflable ou entre le coussin et vous. Consulter le manuel du proprietaire pour de plus amples informations ou explications. DIX ANS APRÈS LA DATE DE FABRICATION DU VÉHICULE, NOTÉE SUR LA PLAQUE DE CERTIFICATION, LE SYSTÈME DE COUSSIN GONFLABLE (SRS) DOIT ÊTRE INSPECTÉ PAR UN CONCESSIONNAIRE SUBARU.

⑤	 H5H0660	CAUTION [BEFORE INSTALLING] 1. POINT FRONT WHEELS STRAIGHT AHEAD. 2. ROTATE 2.65 TURNS FROM RIGHT END STOP. 3. ALIGN MATCH-MARKS (CENTER MARKS: ▼ ▲). 4. READ SERVICE MANUAL.
⑥	 G5H0287	AIR BAG MODULE 警 告 この部品は分解、修理、他車への取り付けをしないで下さい。 取り扱い・交換・廃棄方法は整備解説書に従って下さい。 WARNING To prevent personal injury. Do not dismantle, repair or install in another vehicle. Service or dispose as directed in the service manual. ATTENTION Pour éviter tout risque de blessures corporelles: Ne pas démonter, réparer, installer dans un autre véhicule. L'entretenir ou le remplacer comme indique dans le manual d'entretien. ACHTUNG Zur Vermeidung von Verletzungen. Nicht zerlegen, reparieren oder in einem anderen Fahrzeug installieren. Wartung und Ausbau wie im Reparaturhandbuch beschrieben.
⑦	 G5H0288	AIRBAG GAS GENERATOR UT 12684 BAM . PT_1 . 0354 SAFETY NOTICE: THIS GAS GENERATOR IS FOR INSTALLATIONS ONLY IN AUTOMOBILES WHICH HAVE AIRBAG EQUIPPED OCCUPANT RESTRAINT SYSTEMS. MOUNTING AND DISMOUNTING OF THIS GAS GENERATOR MUST BE PERFORMED BY TRAINED PERSONNEL ONLY. WARNING: CONTENTS ARE POISONOUS AND EXTREMELY FLAMMABLE. DO NOT PROBE WITH ELECTRICAL DEVICES. UMGANG NUR DURCH GESCHULTES PERSONAL ERLAUBT. VERWENDUNG NUR IN INSASSENRÜCKHALTESYSTEMEN MIT LUFTSACK FÜR KRAFTFAHRZEUGE ERLAUBT. BEI AUSLÖSUNG KANN DIE NICHT MONTIERTE AIRBAG-EINHEIT ZUM GEFÄHRLICHEN WURFSTÜCK WERDEN. SUBARU DEUTSCHLAND GmbH DÜSSELDORF MORTON INTERNATIONAL, INC. OGDEM, USA DANGER ACHTUNG ATTENTION

⑧	 G5H0586	危険　有毒性、可燃性物質封入部品 DANGER: POISONOUS, FLAMMABLE MATERIAL ACHTUNG: GIFTIGES, LEICHT ENTZÜNDLICHES MATERIAL ATTENTION: MATÉRIAU TOXIQUE ET INFLAMMABLE • DO NOT USE ELECTRIC TESTING EQUIPMENTS AND OTHER ELECTRIC RELATED PRODUCTS. • DO NOT OVERHAUL THE SYSTEM AND AVOID STRONG IMPACT. • MAXIMUM SAFE TEMPERATURE FOR THE AIR BAG SYSTEM IS 200°F (93°C). • STORE THE SYSTEM WITH TOP SIDE UP. • REFER TO SERVICE MANUAL FOR HANDLING STORAGE AND DISPOSAL PROCEDURES. • KEINE ELEKTRISCHEN PRÜFGERÄTE ODER ÄHNLICHE INSTRUMENTE VERWENDEN. • NICHT VERSUCHEN, ZU ZERLEGEN ODER ZU REPARIEREN. VOR STÖBEN SCHÜTZEN. • LAGERTEMPERATUR DARF 93°C (200°F) NICHT ÜBERSCHREITEN. • MIT DEM DECKEL NACH OBEN LAGERN. • ZU BEDIENUNG, LAGERUNG UND BESEITIGUNG SIEHE WARTUNGSHANDBUCH. • NE PAS UTILISER DE TESTEUR ELECTRIQUE. • CE MODULE NE PEUT ÉTRE NI DÉMONTÉ NI RÉPARÉ. EVITER LES CHOCS. • NE JAMAIS ENTREPOSER SOUS UNE TEMPÉRATURE SUPÉRIEURE À 93°C (200°F). • LE MODULE DOIT TOUJOURS ÉTRE POSÉ AVEC LE COUVERCLE VERS LE HAUT. • CONCERNANT LE MODE D'EMPLOI, DE CONSERVATION ET DE REJET, VEUILLEZ VOUS RÉFÉRER À LA NOTICE D'UTILISATION. AIRBAG GAS GENERATOR UT12016 MORTON INTERNATIONAL. INC. OGDEN. UT. USA. BAM-PT$_1$-0437 EINFÜHRER: SUBARU DEUTSCHLAND GmbH. DÜSSELDORF. HERG. 96/97 UMGANG NUR DURCH GESCHULTES PERSONAL ERLAUBT. VERWENDUNG NUR IN INSASSENRÜCKHALTESYSTEMEN MIT LUFTSACK FÜR KRAFTFAHRZEUGE ERLAUBT. BEI AUSLÖSUNG KANN DIE NICHT MONTIERTE AIRBAG-EINHEIT ZUM GEFÄHRLICHEN WURFSTÜCK WERDEN. • 電気テスター等は使用しないこと。 • 分解、修理不可。衝撃を与えないこと。 • 高温（93℃以上）での保管禁止。 • リッド面を上にして保管すること。 • 取り扱い、保管、廃却方法は整備解説書を参照。

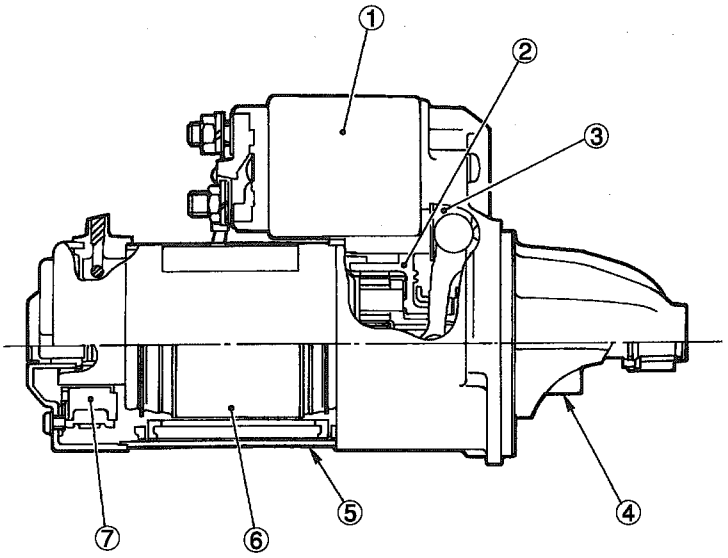
MEMO

ELECTRICAL SECTION

ENGINE ELECTRICAL SYSTEM 6-1

1. Starter

The starter is of reduction type. Its output is 1.0 kW on the MT model and 1.4 kW on the AT model.

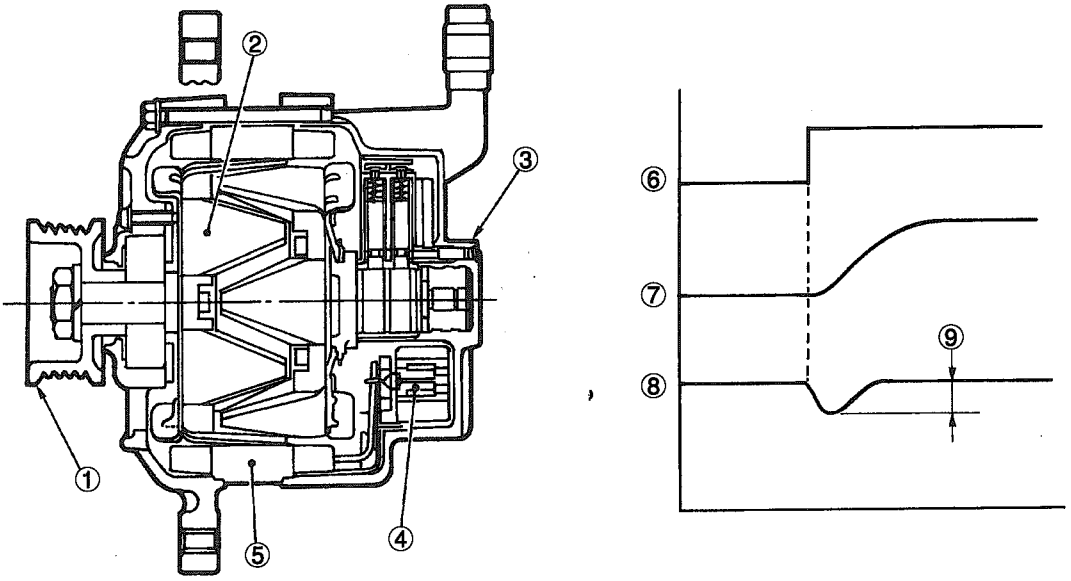


G6H0001

① Magnet switch
② Internal gear
③ Shift lever
④ Pinion
⑤ Yoke
⑥ Armature
⑦ Brush holder

2. Generator

The generator incorporates an IC regulator which features a "load response control". The load response control circuit function to gradually increase the generator output when an additional electric load such as headlights or blower fan is applied to the engine in the idling state. This prevents a sharp drop in engine idling speed and ensures an improved comfort while the engine is idling.

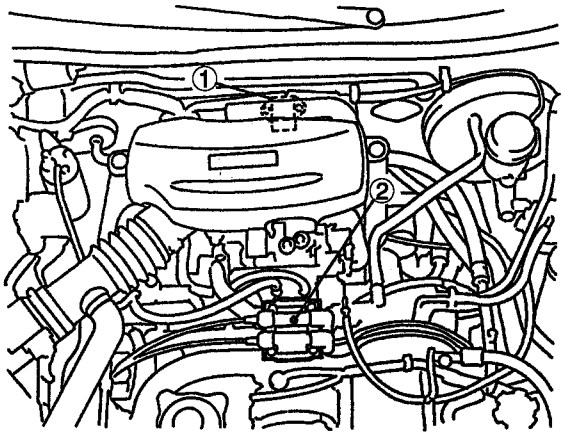


G6H0002

① Pulley
② Rotor
③ Rear cover
④ IC regulator
⑤ Stator coil
⑥ Electric load
⑦ Alternator output
⑧ Engine idle speed
⑨ Amplitude

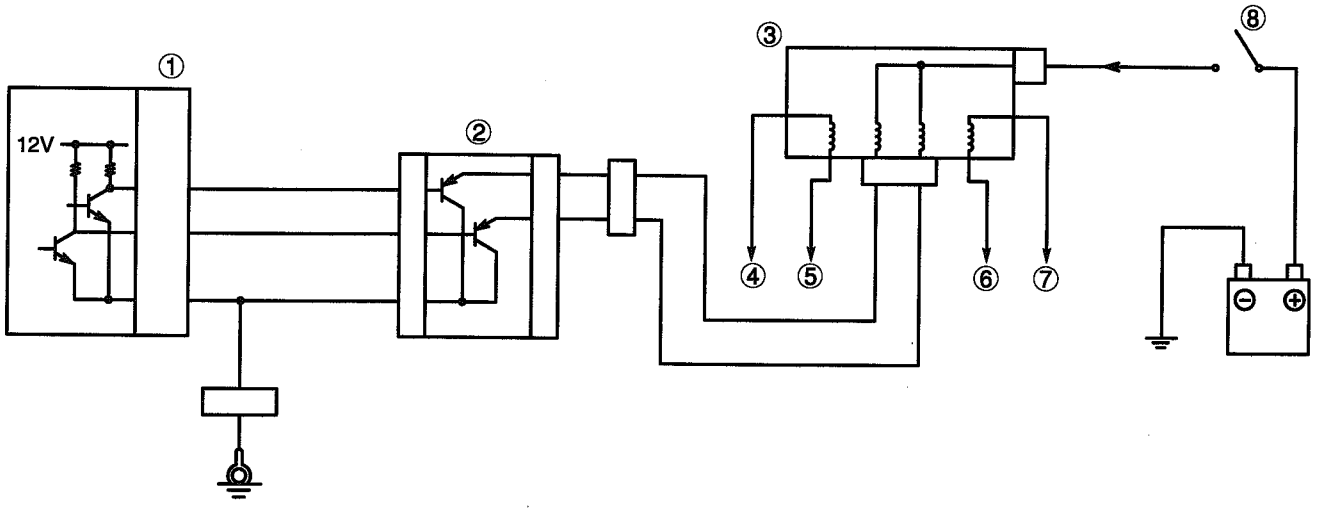
3. Ignition Coil and Igniter

The ignition system is of a 2-cylinder simultaneous ignition design. In response to the signal from the ECM, the igniter supplies another signal to the ignition coil to ignite a pair of cylinders #1 and #2 or #3 and #4 simultaneously.



H6H0401A

① Igniter
② Ignition coil



G6H0004

① ECM
② Igniter
③ Ignition coil
④ Spark plug #1
⑤ Spark plug #2
⑥ Spark plug #3
⑦ Spark plug #4
⑧ Ignition switch

MEMO

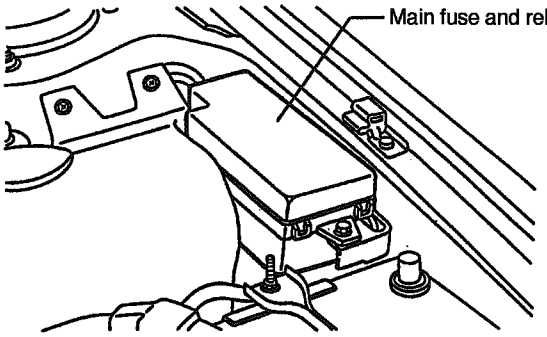
Page

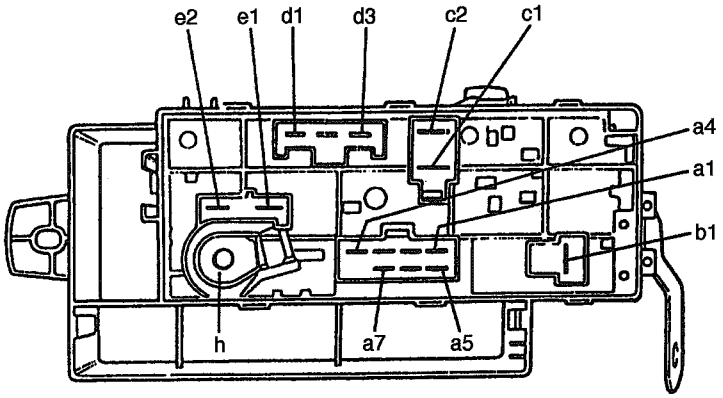
1. Fuse

A: MAIN FUSE AND RELAY BOX

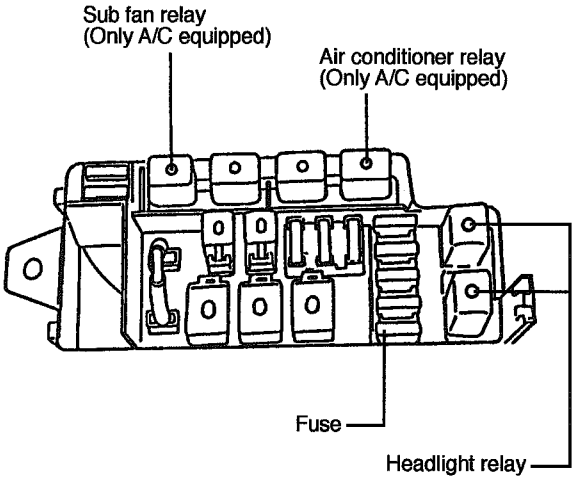
The main fuse and relay box is installed at the rear of the battery on left side of the engine compartment.

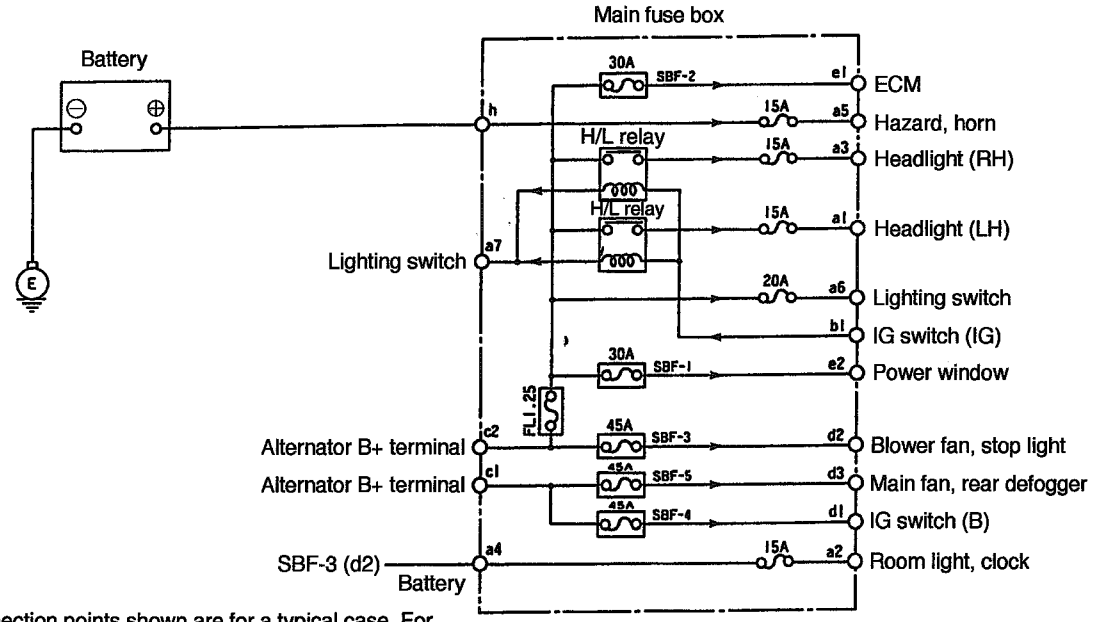
The fuses, relays and fusible links are installed in the box as described below.





Main fuse and relay box (back side)





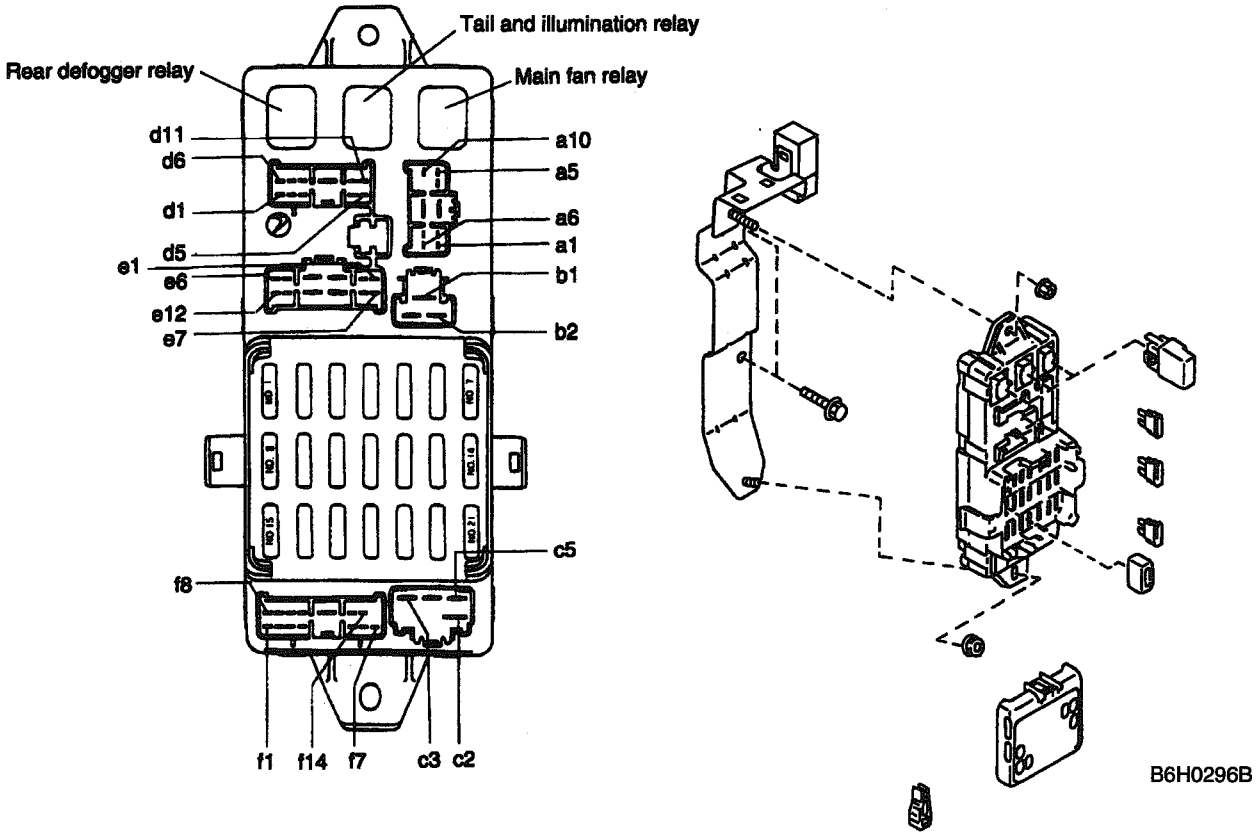
NOTE:

The distined connection points shown are for a typical case. For details, refer to the Wiring Diagram Manual.

H6H0415A

B: JOINT BOX

The joint box is installed under the instrument panel on driver's side.
The fuses are installed in the joint box as described below.



2. Ignition Switch

A: DESCRIPTION

The ignition key warning system is adopted.

- When driver opens the door with the ignition key in "LOCK" or "ACC" position, warning alarm sounds to warn the driver

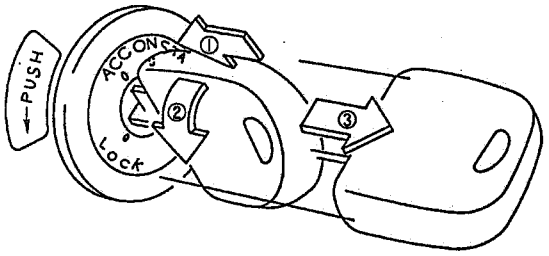
In manual transmission vehicle, two stage steering lock is adopted to improve safety in key operation.

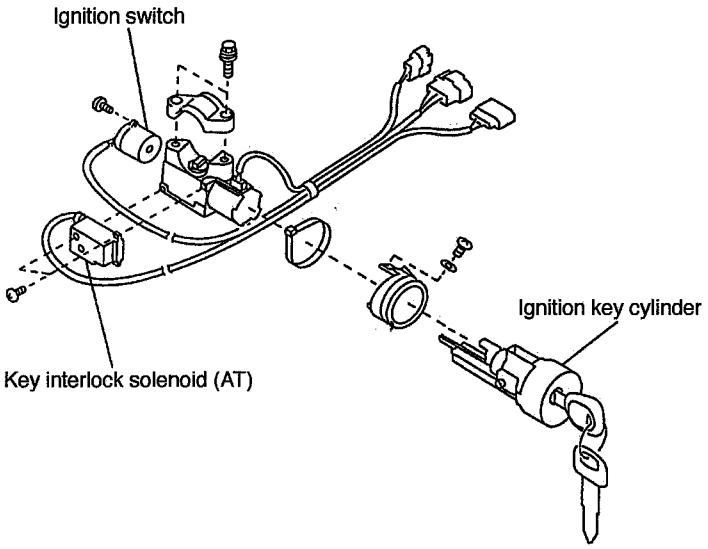
- When turning the ignition key from "ACC" to "LOCK" position, it is necessary to push the key into the key cylinder (arrow 1 in the illustration) and then turn the key to "LOCK" position (arrow 2).

Automatic transmission vehicles are equipped with a key interlock mechanism to prevent erroneous operation.

- Ignition key can be turned to "LOCK" position only when select lever is set to P position.

NOTE:
If the key cannot be turned to "LOCK" position although select lever is in P position (because of key interlock system failure), the key interlock system must be cancelled by key interlock release lever which is located at the lower side of the steering column.





H6H0416A

3. Front Wiper and Washer

A: DESCRIPTION

1. FRONT WIPER

1) The front wiper is of a tandem type featuring wide wiping area. The blade is installed to the arm by means of U-hook joint to improve serviceability.

2) The front wiper operates in three modes of speed; HI, LOW and INTERMITTENT.

The operation speed can be changed by turning the wiper switch incorporated in the combination switch.

3) The intermittent unit which controls the front wiper operation interval is installed behind the combination switch.

2. FRONT WASHER SYSTEM

1) The washer system consists of a washer tank, motor and a pair of nozzles.

2) The washer tank is installed at the front of the strut mount on the left side of the engine compartment.

3) The washer motor is installed directly at the lower position of the washer tank.

4) The washer nozzles are installed on the engine hood, and each nozzle has two injection ports.

3. SPECIFICATION

Washer Tank	Capacity			4.0 liters (4.2 US qt, 3.5 Imp qt)
Wiper Motor	Standard voltage			12 V
	No-load current			3.5 A or less
	Speed [at 2.0 N·m (20 kg-cm, 17 in-lb)]		HIGH	72–80 rpm
			LOW	47–50 rpm
	Locked rotor characteristics	Torque	HIGH	21.6 N·m (220 kg-cm, 1.6 ft-lb)
			LOW	27.5 N·m (280 kg-cm, 2.0 ft-lb)
		Current		29.5 A or less
Wiper Blade	Blade length	Driver's side		525 mm (20.67 in)
		Passenger's side		450 mm (17.72 in)

4. Rear Wiper and Washer (WAGON Only)

A: DESCRIPTION

1. REAR WIPER

1) The rear wiper has 180 degree wide wiping area.
2) The wiper link is installed to the wiper motor shaft through the rear window glass.
3) The wiper blade is attached to the arm by means of U-hook joint in the same way as the front wiper blade.

2. REAR WASHER SYSTEM

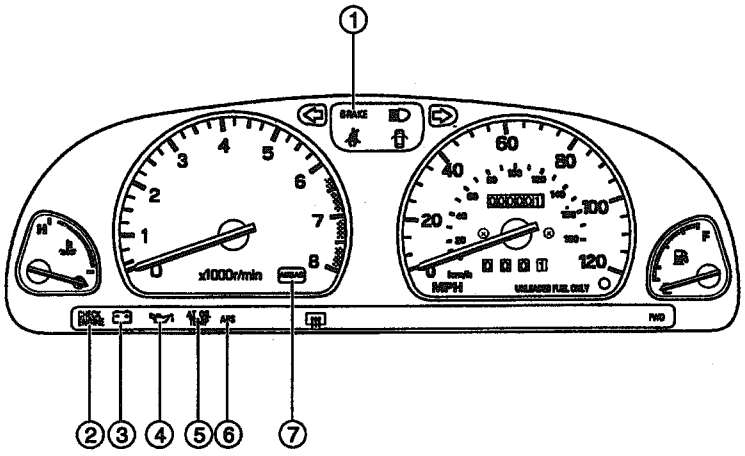
1) The washer tank of the rear washer system is shared with the front washer system.
2) The washer motor is installed at the bottom of the washer tank, adjacent to the front washer motor.
3) The washer nozzle is installed on the wiper shaft base.

3. SPECIFICATION

Wiper Motor	Standard voltage	12 V
	No-load current	1 A or less
	Speed [at 0.5 N·m (5 kg-cm, 4.3 in-lb)]	25 rpm or more
	Locked rotor current	12 A or less
Wiper Blade	Blade length	375 mm (14.76 in)

5. Combination Meter

A: WARNING AND INDICATOR LIGHT



H6H0417

① Brake fluid level warning/parking brake indicator light

This light illuminates when the fluid level in the brake reservoir tank lowers under specified level and/or when parking brake is applied.

② CHECK ENGINE warning light

This light illuminates when trouble occurs in MFI (Multiple point Fuel Injection) system.

③ Charge indicator light

This light illuminates when trouble occurs in charging system during engine is running.

④ Oil pressure warning light

This light illuminates when the engine oil pressure decreases below 14.7 kPa (0.15 kg/cm^2, 2.1 psi).

⑤ AT oil temperature warning light

This light illuminates when the ATF temperature exceeds 150 °C (302 °F).

⑥ ABS warning light

This light illuminates when trouble occurs in electrical components of ABS (Anti-lock Brake System).

⑦ AIR BAG system warning light

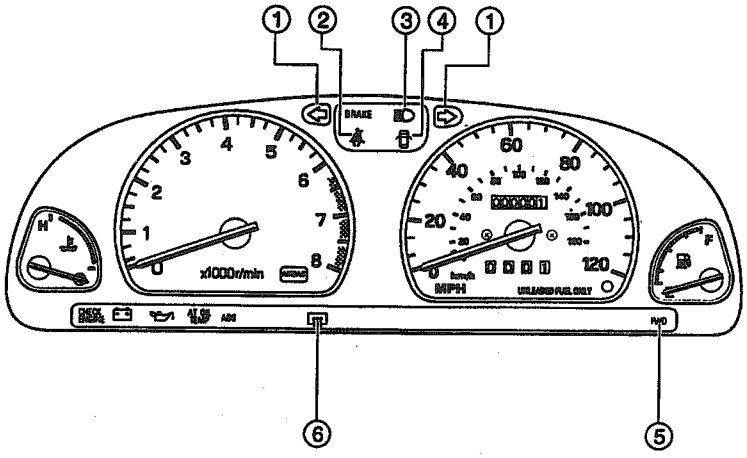
This light illuminates when trouble occurs in Airbag system.

According to ignition switch position, the warning and indicator lights will come on and/or go off under normal conditions as follows:

Warning/Indicator light	Ignition switch position			
	OFF/ACC	ON	ST	While engine is running
① Brake fluid level/parking brake	OFF	ON	ON	*1
② Malfunction indicator (CHECK ENGINE)	OFF	*2	ON	OFF
③ Charge	OFF	ON	ON	OFF
④ Oil pressure	OFF	ON	ON	OFF
⑤ AT oil temperature	OFF	ON	ON	*4
⑥ ABS	OFF	ON	ON	OFF
⑦ AIR BAG	OFF	*3	ON	OFF

*1: Light comes ON when parking brake is applied.
*2: Light comes ON before engine starts, and stay OFF after engine has stopped.
*3: Light comes ON for about seven seconds, and go out.
*4: Light comes ON for about two seconds, and go out.

B: TELLTALE (GRAPHIC MONITOR)



H6H0418

① Turn signal indicator light

This light blinks (and turn signal light flashes) when the turn signal switch is turned ON.

② Seat belt warning light

This light illuminates about 6 seconds after ignition switch turns ON if the drivers' seat belt is not fastened.

③ Headlight beam indicator light

This light illuminates when the headlight is in high-beam position.

④ Door open warning light

This light illuminates when one or more doors and/or rear gate are not fully closed.

⑤ FWD indicator light

This light illuminates when the center differential locks (with the fuse installed in the center differential locking circuit).

⑥ Rear defogger indicator light

This light illuminates when the rear defogger switch is turned ON.

According to ignition switch position, the telltales will come on and/or go off under normal conditions as follows:

Telltale light		Ignition switch position			
		OFF/ACC	ON	ST	While engine is running
① Turn signal		OFF	Blink	Blink	Blink
② Seat belt		OFF	*1	*1	*1
③ Headlight beam	• High beam	OFF	ON	ON	ON
	• Low beam	OFF	OFF	OFF	OFF
④ Door open	• Open	ON	ON	ON	ON
	• Shut	OFF	OFF	OFF	OFF
⑤ FWD	• FWD	OFF	ON	ON	ON
	• AWD	OFF	OFF	OFF	OFF
⑥ Rear defogger		OFF	ON *2	ON *2	ON *2

*1: Light illuminates about 6 seconds after ignition switch turns to ON if the drivers' seat belt is NOT fastened.

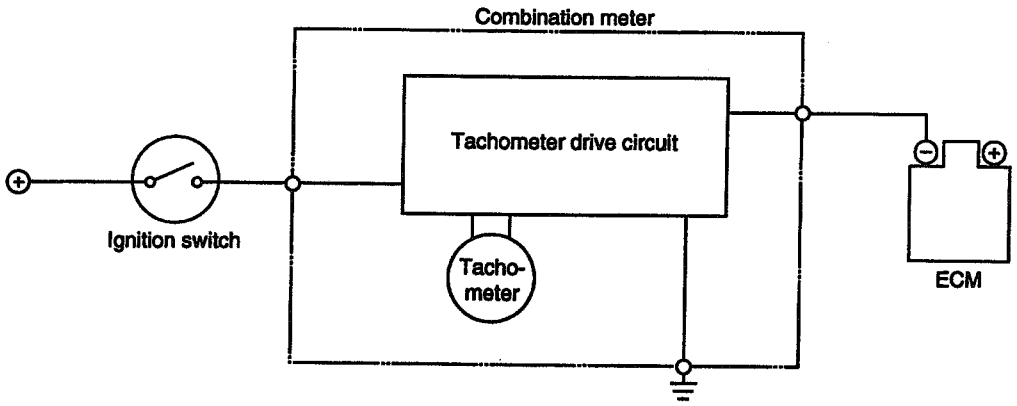
*2: When rear defogger switch turn to ON.

C: TACHOMETER

The tachometer drive circuit connects to engine revolution detecting circuit in engine control module.

When the engine revolution increases/decreases, the voltage of this circuit also increases/decreases, changing the magnetic force of tachometer drive coil.

Thus, the tachometer hand moves together with engine revolution change.



H6H0419

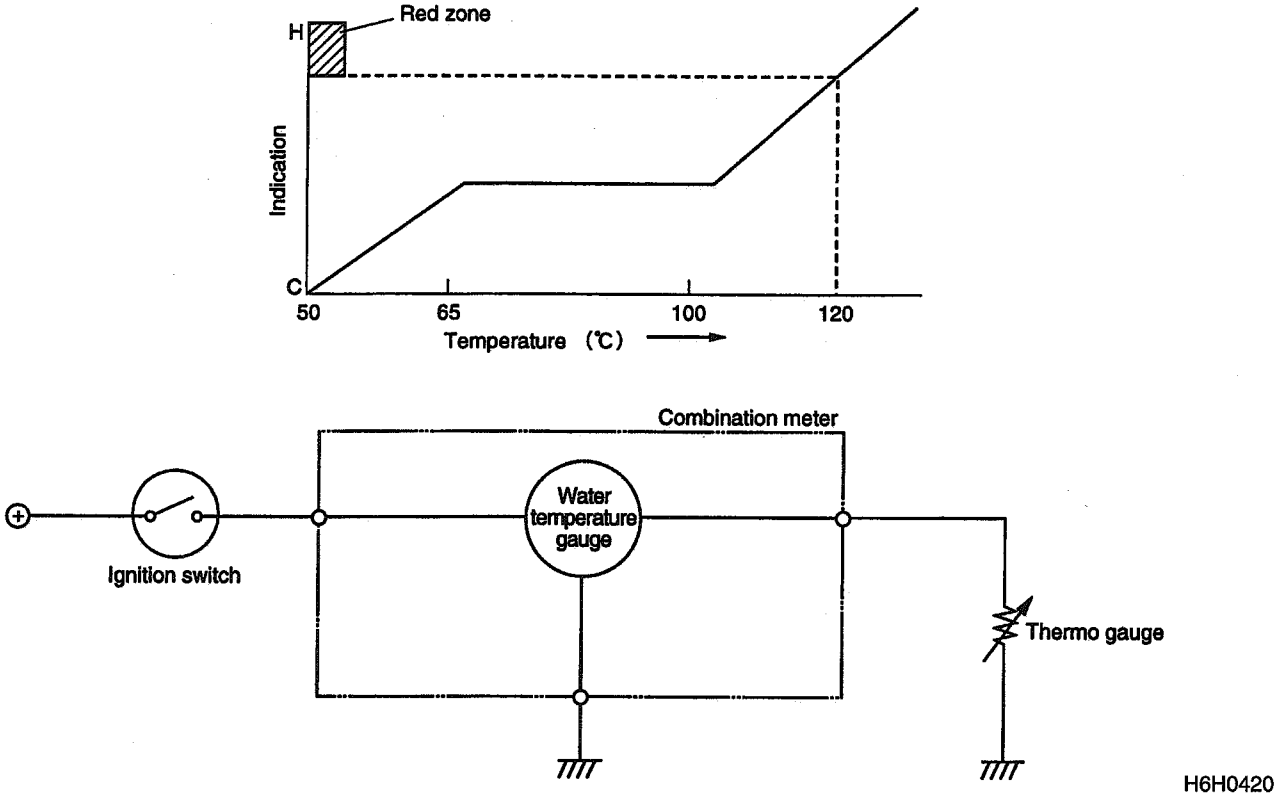
D: WATER TEMPERATURE GAUGE

The water temperature gauge is a cross-coil type.

The water temperature signal is input from thermo gauge installed on the engine.

The resistance of thermo gauge changes according to engine coolant temperature. Therefore, the current input to water temperature gauge also changes according to engine coolant temperature. Accordingly, gauge hand moves in proportion to the change in magnetic force of coil.

When the water temperature is at approx. 70 to 100 °C (158 to 212 °F)[normal operating temperature], the meter hand is stable in the middle of indication range as shown in the graph below.

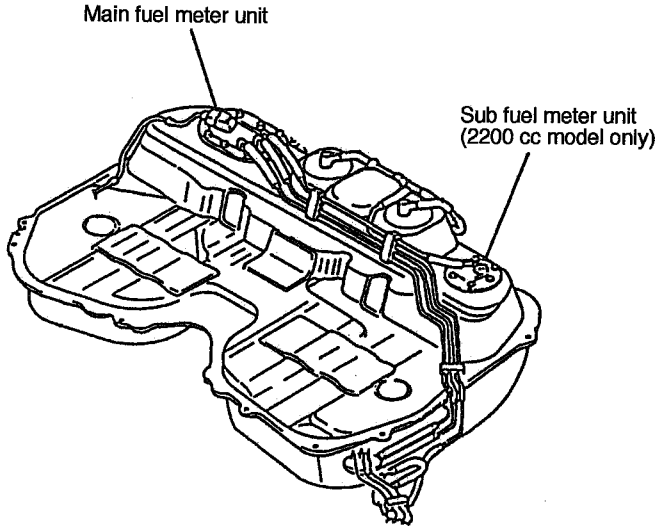


E: FUEL GAUGE

1. GENERAL

The fuel gauge is a resistance type and indicates the fuel level in the tank even when the ignition switch is in OFF position.

2200 cc model is equipped with two fuel meter units. Two fuel meter units are installed in the fuel tank, one each at the right and left side, because the fuel tank is divided into main and sub tank area.

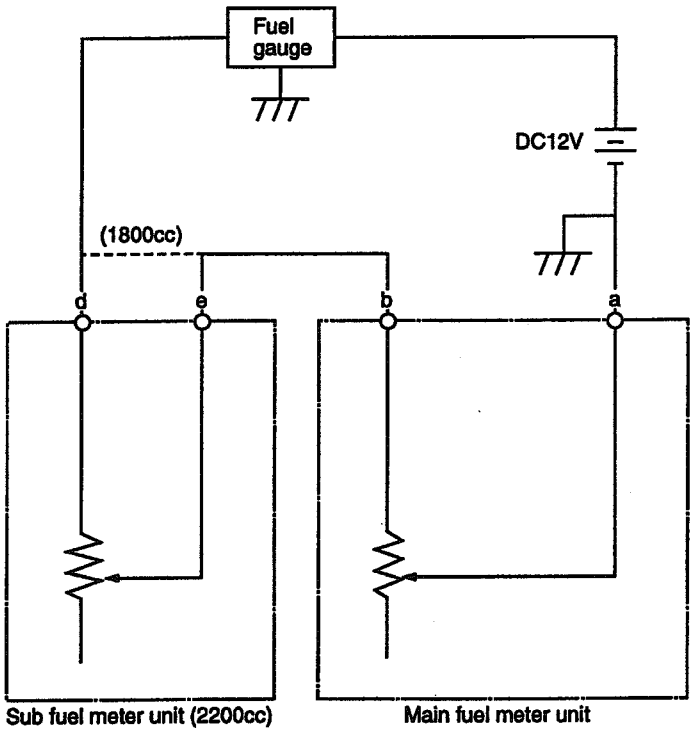


H6H0421A

2. SPECIFICATION

	Fuel amount	Resistance	
		1800 cc	2200 cc
Main unit	FULL	2–5 Ω	0.5–2.5 Ω
	1/2	45.5–51.5 Ω	25–29 Ω
	EMPTY	92–95 Ω	50–52 Ω
Sub unit (2200 cc model)	FULL	—	0.5–2.5 Ω
	1/2	—	19.5–23.5 Ω
	EMPTY	—	42–44 Ω

3. CIRCUIT DIAGRAM



H6H0422

6. Power Window

A: CONSTRUCTION

The power window system consists of regulator motor and switch (installed in each door), relay and circuit breaker unit.

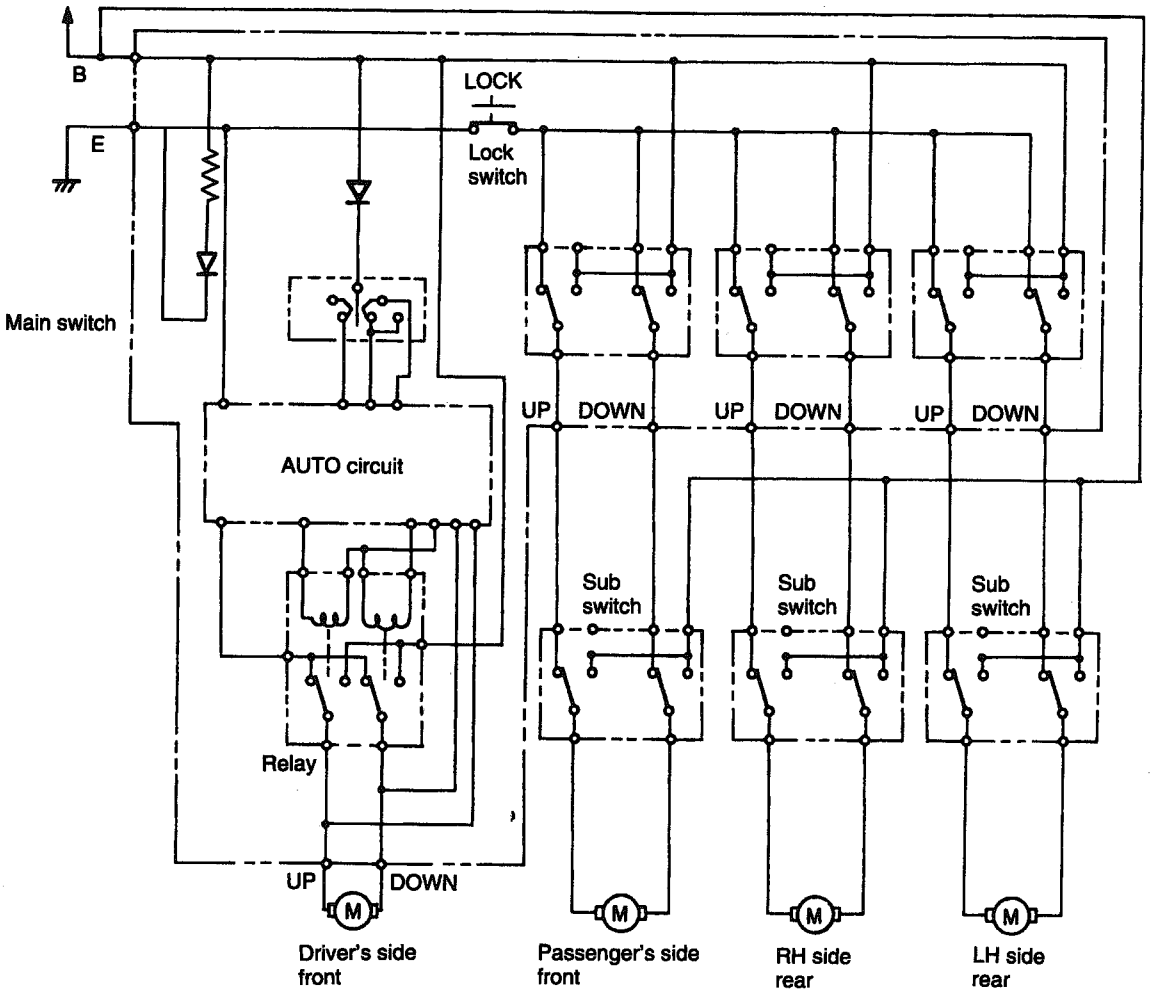
Each door window opens/closes by pushing down/pulling up the switch.

Only driver's door window switch has a 2-stage mechanism;

- When the switch is pushed down to "one click" position and held there, the window continue to lower until the switch is released.
- When the switch is pushed down fully, the window lowers to the end position automatically.

NOTE:
For the sake of safety, the power window system is designed to operate only when the ignition switch is in ON position.

B: CIRCUIT DIAGRAM



B6H0308

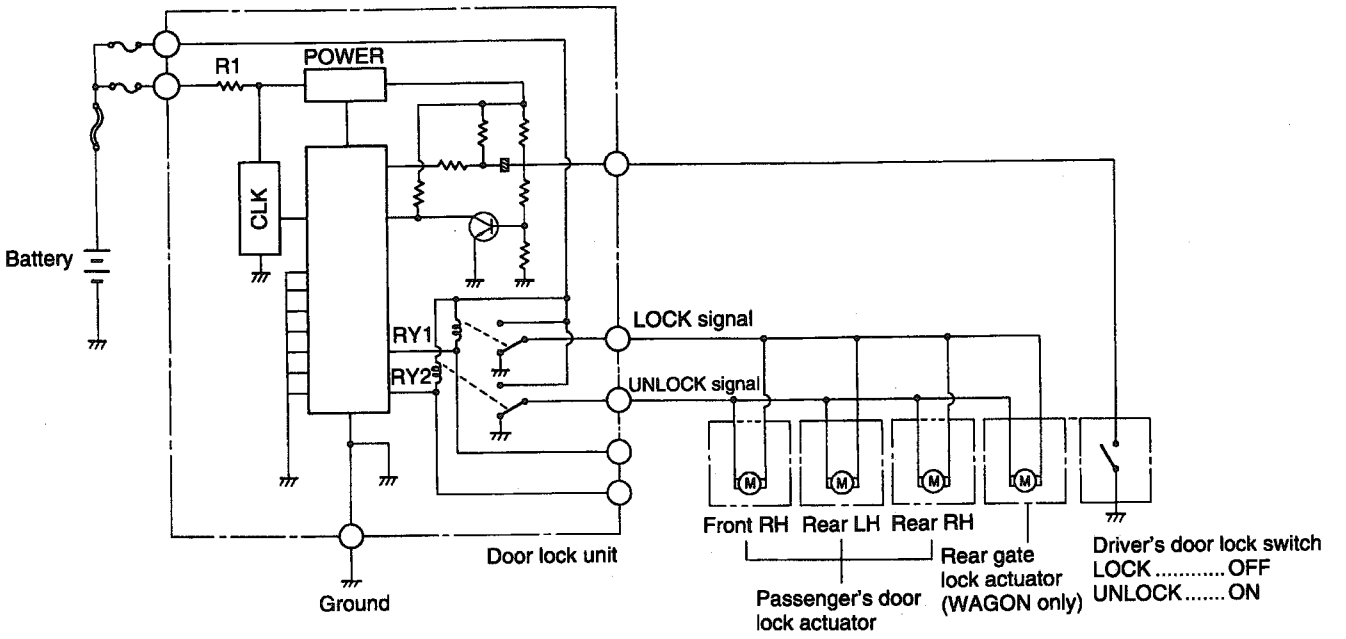
7. Power Door Lock

A: CONSTRUCTION

The power door lock system consists of driver's door lock switch, passenger's door lock actuator, rear door lock actuators, and rear gate lock actuator (WAGON).

When driver locks or releases the driver's door using the lock knob, the other doors and the rear gate (WAGON) are also locked or released automatically.

1. CIRCUIT DIAGRAM



B6H0309A

REPAIR SECTION

FOREWORD

This portion of the 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 both the fully qualified and the less-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.

FUJI HEAVY INDUSTRIES LTD.

1. Important Safety Notice

● Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.

● In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.

● It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if he used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use this Manual

● This Service Manual is divided into four volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

- GENERAL INFORMATION SECTION
- REPAIR SECTION
- DIAGNOSTICS SECTION
- WIRING DIAGRAM SECTION

● Each chapter in the manual is basically made of the following four types of areas.

S	SPECIFICATIONS AND SERVICE DATA
C	COMPONENT PARTS
W (X (Y	SERVICE PROCEDURE SERVICE PROCEDURE) SERVICE PROCEDURE)
K	DIAGNOSTICS

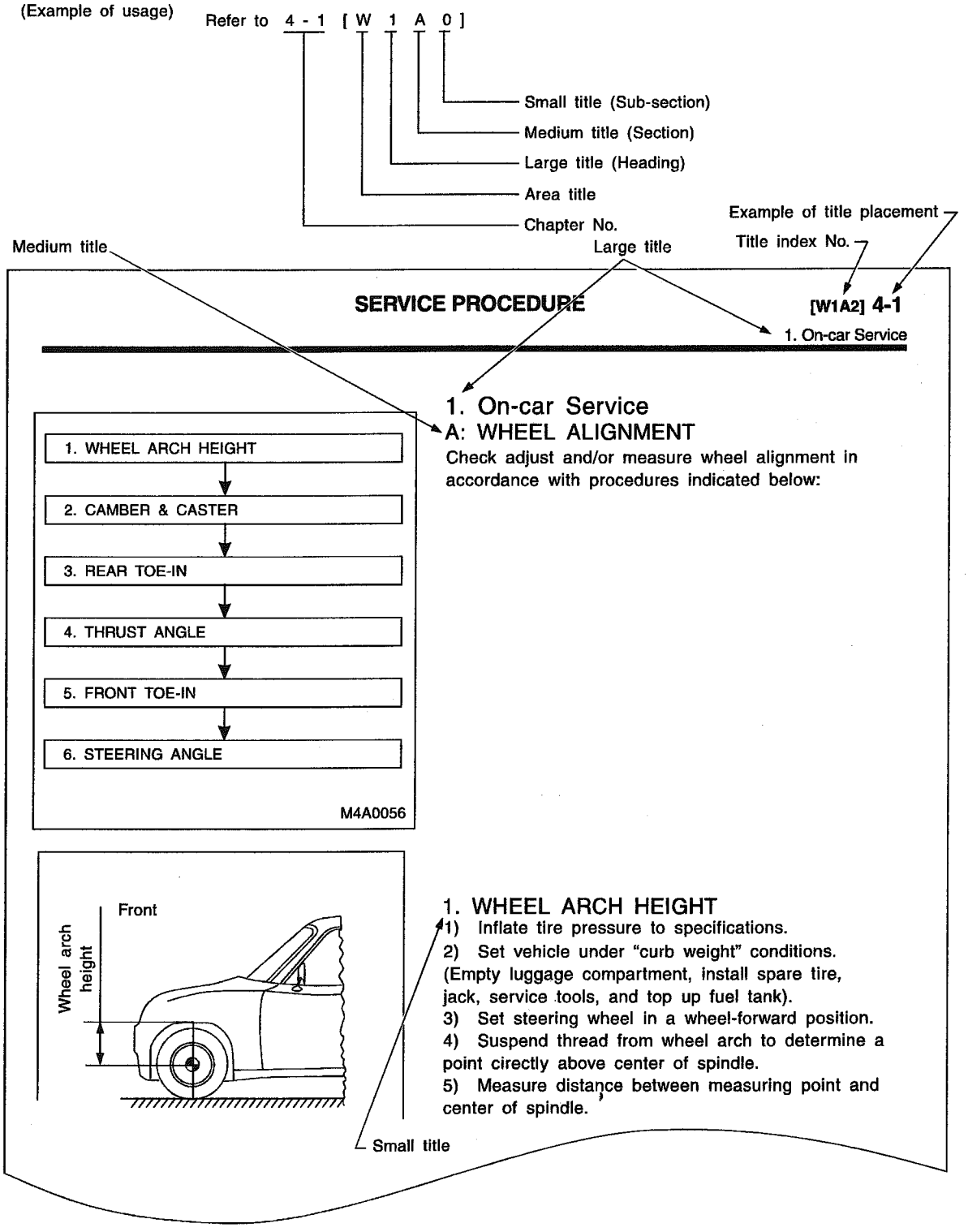
● The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

● Area title:	W SERVICE PROCEDURE (one of the four types of areas)
● Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
● Medium title (Section):	A: REMOVAL (to denote the type of work in principle)
● Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

FOREWORD

● The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.

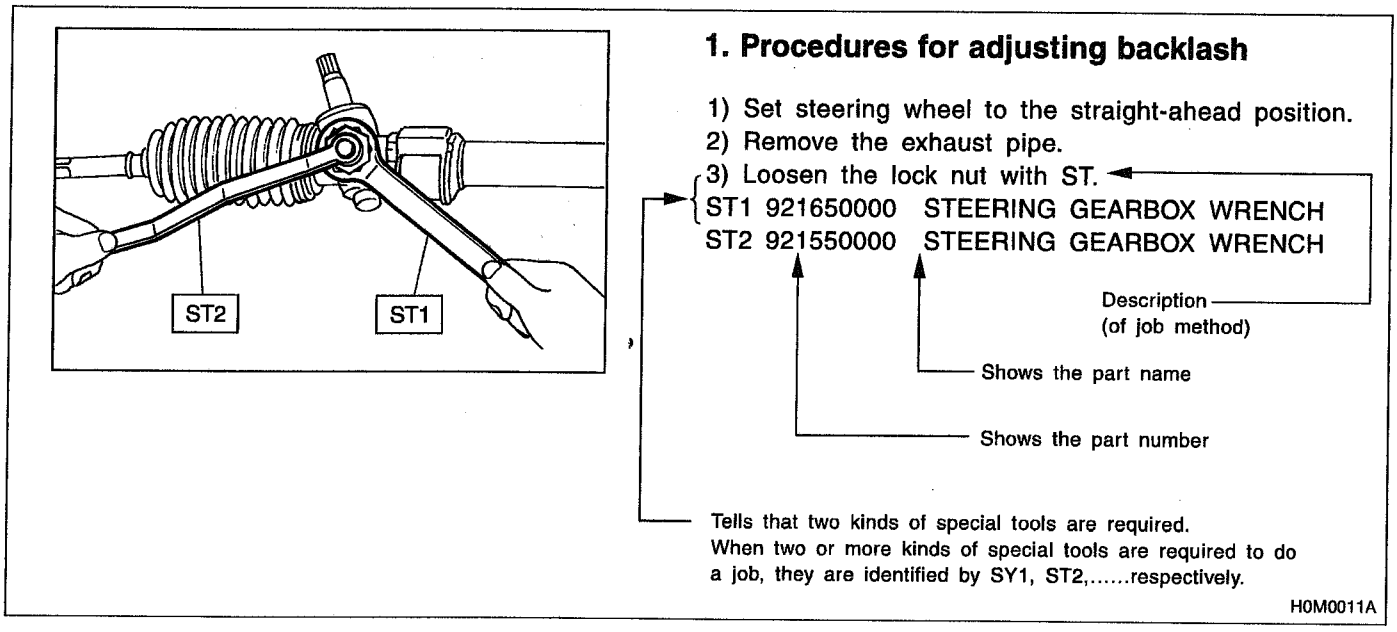


H0M0010

- In this manual, the following symbols are used.

*	Selective part
★	Replacement part
	Should be lubricated with oil.
	Should be lubricated with grease.
	Sealing point
T	Tightening torque

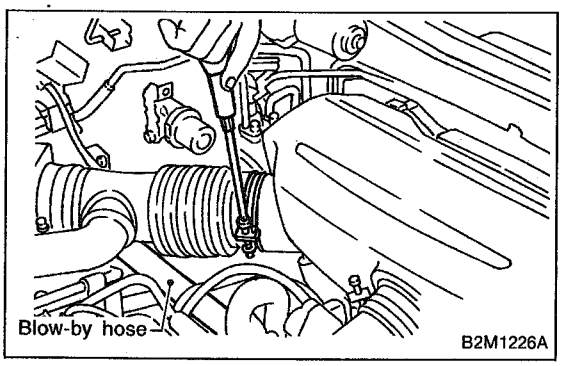
- **WARNING**, **CAUTION**, NOTE
  - **WARNING:** Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
  - **CAUTION:** Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
  - NOTE: Indicates the hints, knacks, etc. which make the maintenance job easier.
- SPECIAL TOOLS
  When any special tool is required to perform the job, it is identified by "ST" in the applicable illustration and its part number is shown in the manual.



3. Table of Contents

ENGINE SECTION

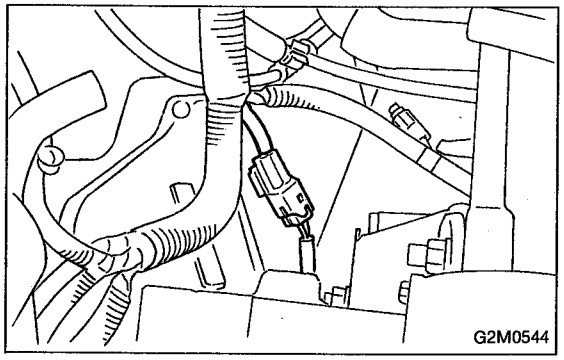
EMISSION CONTROL SYSTEM AND VACUUM FITTING 2-1



1. Front Catalytic Converter

A: REMOVAL

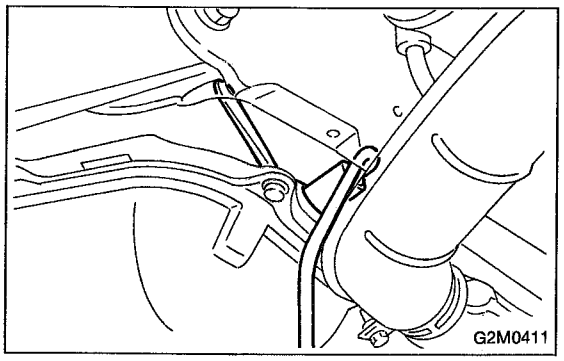
1) Remove air intake duct. <Ref. to 2-7 [W1A0].>



2) Disconnect front oxygen sensor connector.

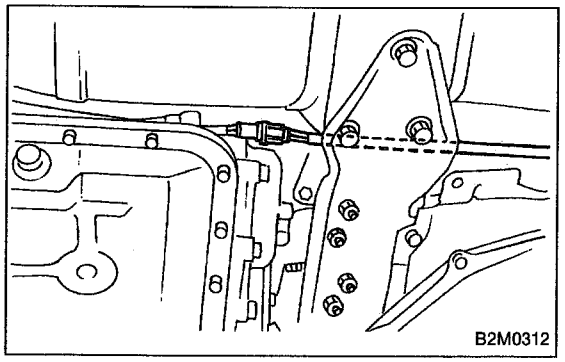
3) Lift-up the vehicle.
4) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

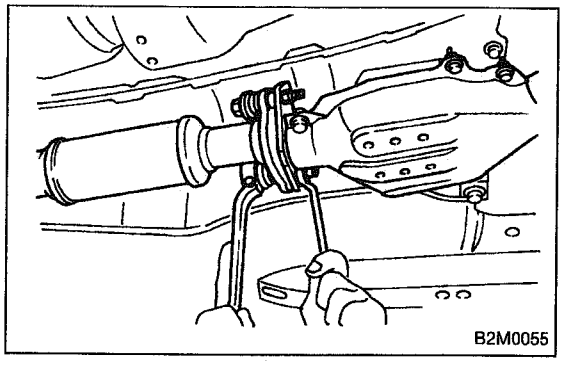


5) Remove front oxygen sensor.

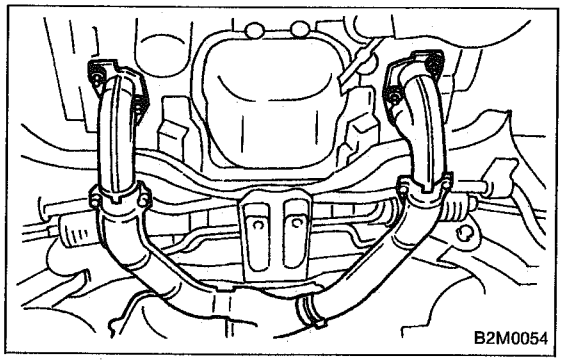
CAUTION:
When removing oxygen sensor, do not force oxygen sensor especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.



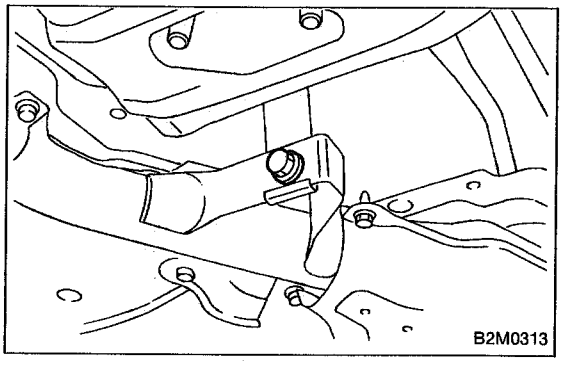
6) Disconnect rear oxygen sensor connector.


B2M0055

7) Separate center exhaust pipe from rear exhaust pipe.

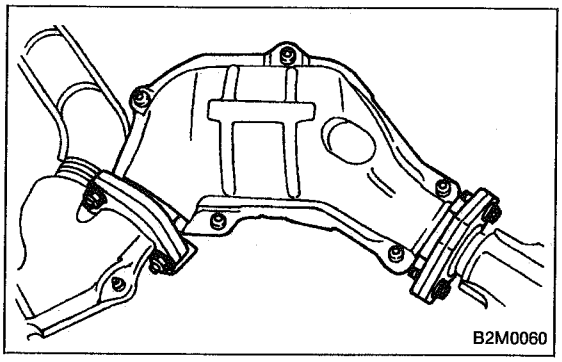

B2M0054

8) Remove bolts which hold front exhaust pipe onto cylinder heads.

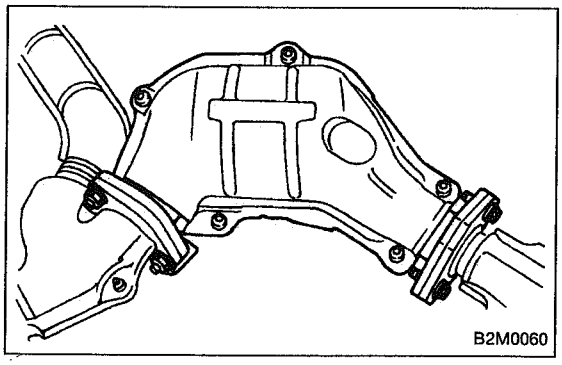

B2M0313

9) Remove front exhaust pipe and center exhaust pipe from hanger bracket.

CAUTION:
Be careful not to pull down front exhaust pipe and center exhaust pipe.


B2M0060

10) Separate front catalytic converter from front exhaust pipe and center exhaust pipe.

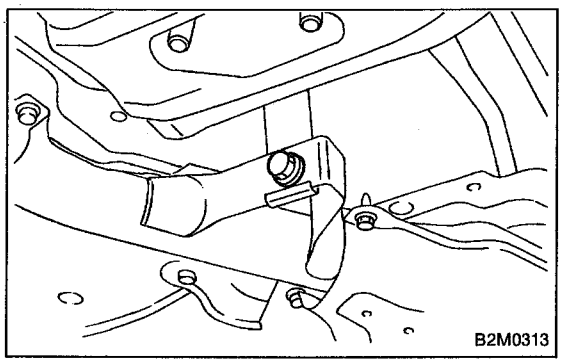

B2M0060

B: INSTALLATION

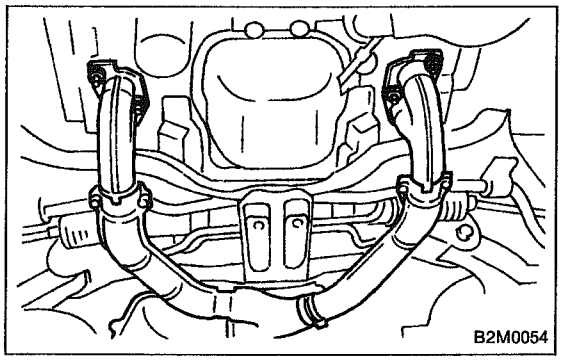
CAUTION:
Replace gaskets with new ones.

1) Install front catalytic converter to front exhaust pipe and center exhaust pipe.

Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)

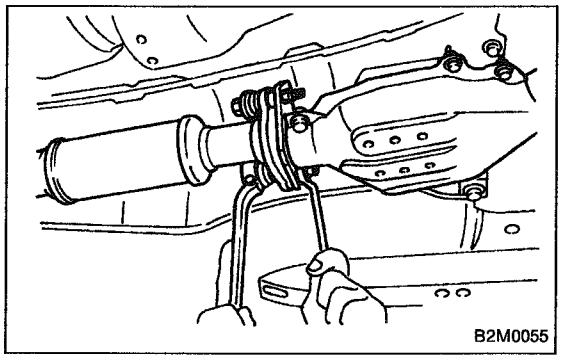


2) Install front exhaust pipe and center exhaust pipe. And temporarily tighten bolt which installs center exhaust pipe to hanger bracket.



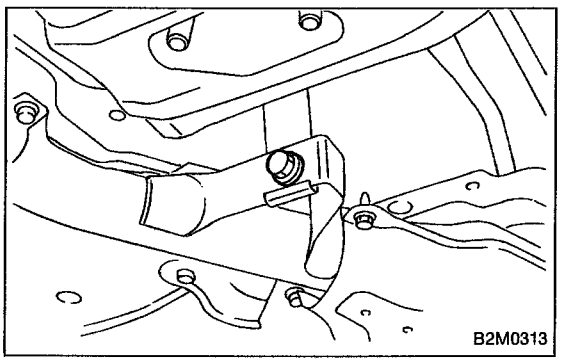
3) Tighten bolts which hold front exhaust pipe onto cylinder heads.

Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)



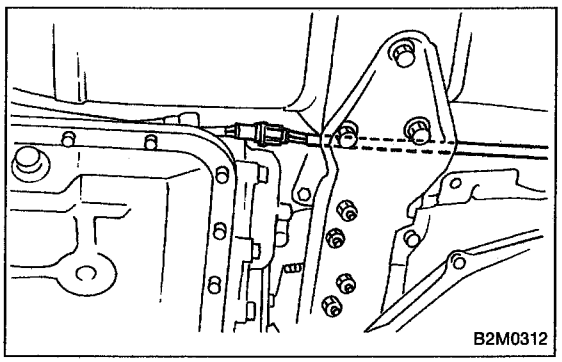
4) Install center exhaust pipe to rear exhaust pipe.

Tightening torque:
18 ± 5 N·m (1.8 ± 0.5 kg-m, 13.0 ± 3.6 ft-lb)

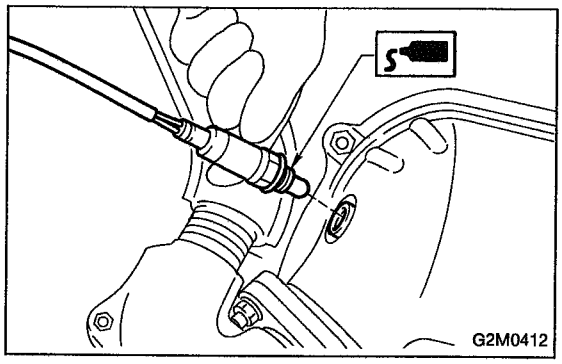


5) Tighten bolt which holds center exhaust pipe to hanger bracket.

Tightening torque:
35 ± 5 N·m (3.6 ± 0.5 kg-m, 26.0 ± 3.6 ft-lb)



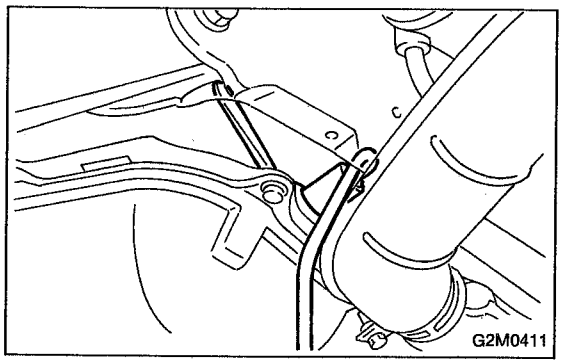
6) Connect rear oxygen sensor connector.



7) Before installing front oxygen sensor, apply anti-seize compound only to threaded portion of front oxygen sensor to make the next removal easier.

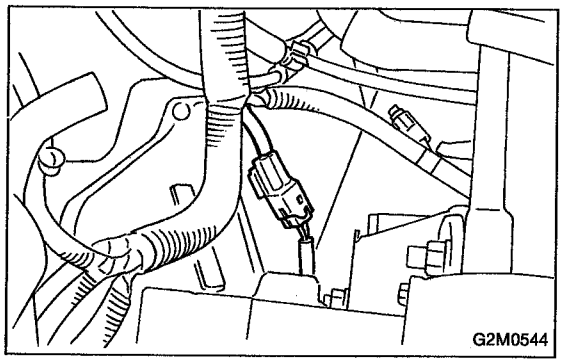
Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of front oxygen sensor.

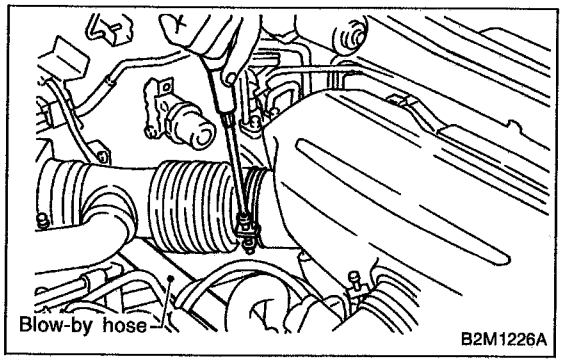


8) Install front oxygen sensor.

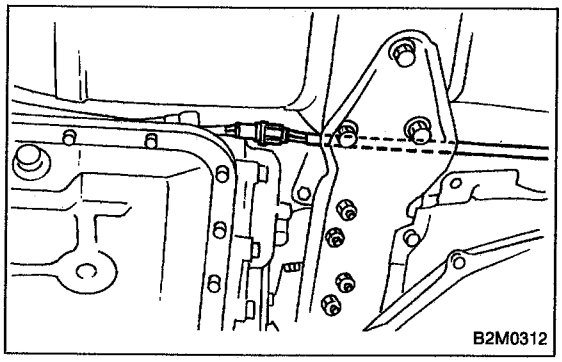
Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)



9) Lower the vehicle.
10) Connect front oxygen sensor connector.



11) Install air intake duct.



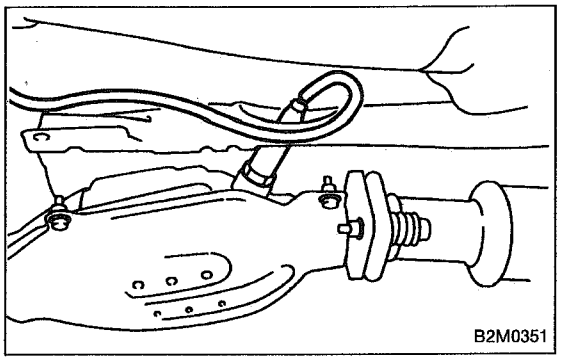
2. Rear Catalytic Converter

A: REMOVAL

1) Lift-up the vehicle.
2) Disconnect rear oxygen sensor connector.

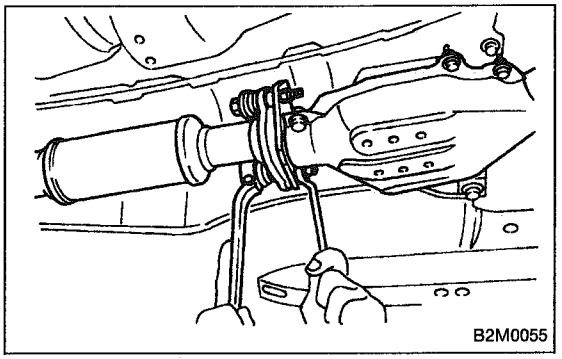
3) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

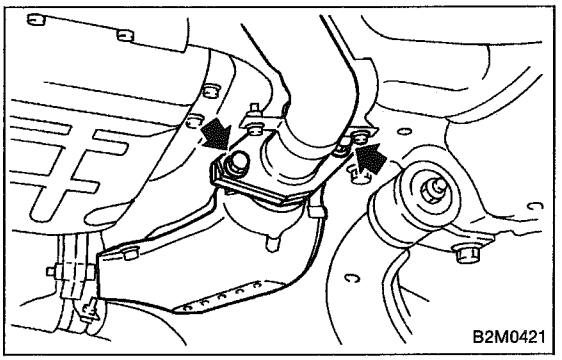

B2M0351

4) Remove rear oxygen sensor.

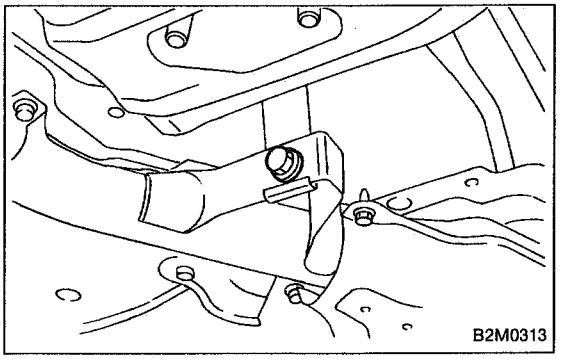
CAUTION:
When removing rear oxygen sensor, do not force rear oxygen sensor especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.


B2M0055

5) Separate center exhaust pipe and rear catalytic converter assembly from rear exhaust pipe.

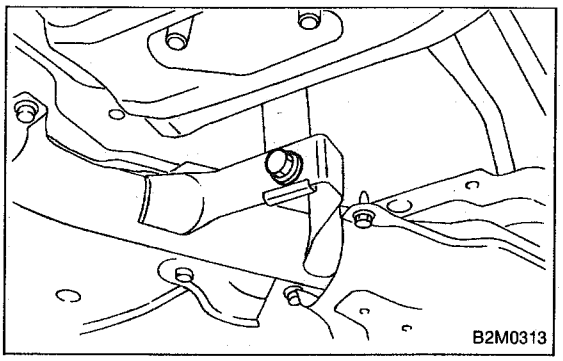

B2M0421

6) Separate center exhaust pipe and rear catalytic converter assembly from front catalytic converter.


B2M0313

7) Remove center exhaust pipe and rear catalytic converter assembly from hanger bracket.

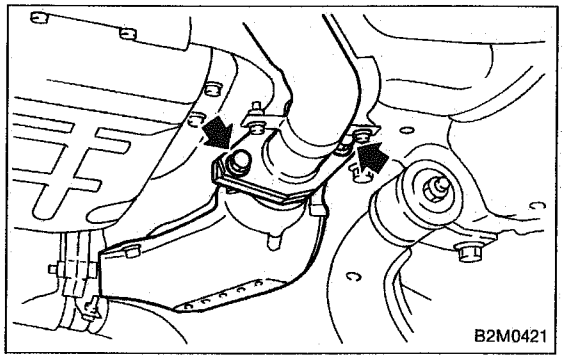
CAUTION:
- **Be careful not to pull down center exhaust pipe.**
- **After removing center exhaust pipe, do not apply excessive pulling force on front catalytic converter and front exhaust pipe.**



B: INSTALLATION

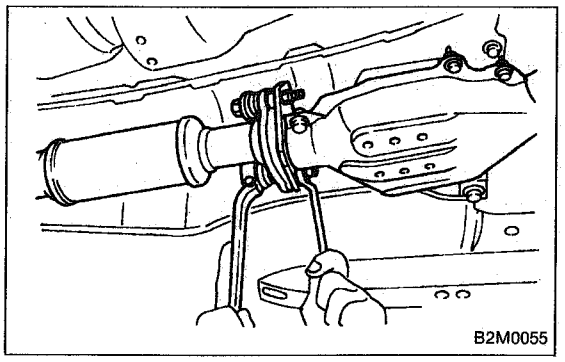
CAUTION:
Replace gaskets with new ones.

1) Install center exhaust pipe and rear catalytic converter assembly.
Temporarily tighten bolt which installs center exhaust pipe to hanger bracket.



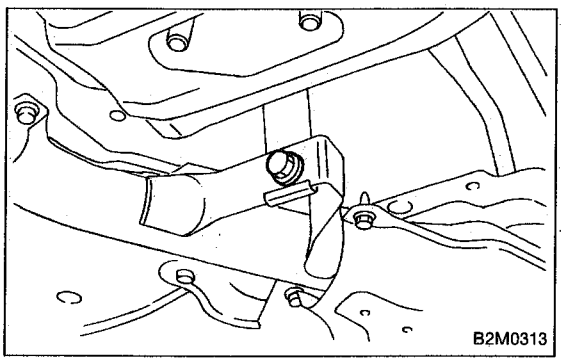
2) Install center exhaust pipe to front catalytic converter.

Tightening torque:
35 ± 5 N·m (3.6 ± 0.5 kg-m, 26.0 ± 3.6 ft-lb)



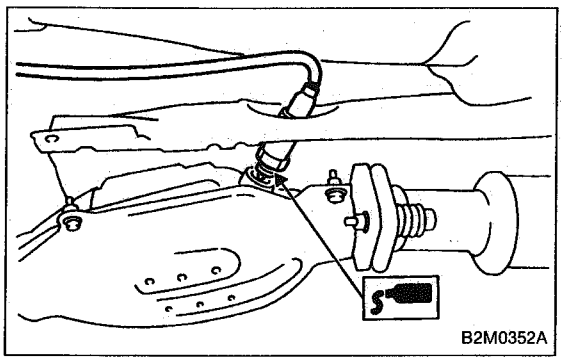
3) Install center exhaust pipe to rear exhaust pipe.

Tightening torque:
18 ± 5 N·m (1.8 ± 0.5 kg-m, 13.0 ± 3.6 ft-lb)



4) Tighten bolt which holds center exhaust pipe to hanger bracket.

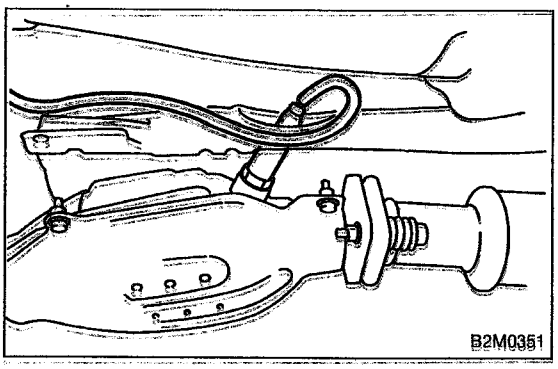
Tightening torque:
35 ± 5 N·m (3.6 ± 0.5 kg-m, 26.0 ± 3.6 ft-lb)



5) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion of rear oxygen sensor to make the next removal easier.

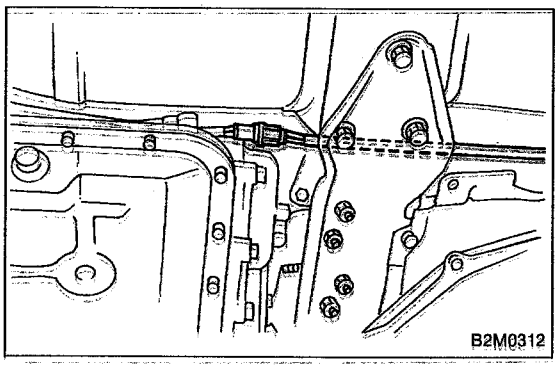
Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of rear oxygen sensor.

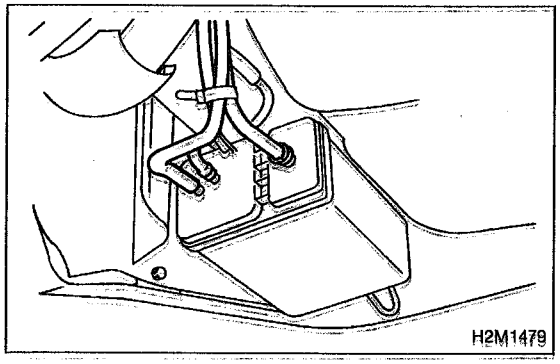


6) Install rear oxygen sensor.

Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)



7) Connect rear oxygen sensor connector.
8) Lower the vehicle.

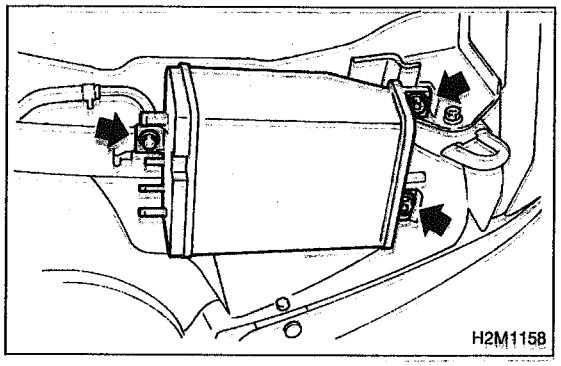


3. Canister

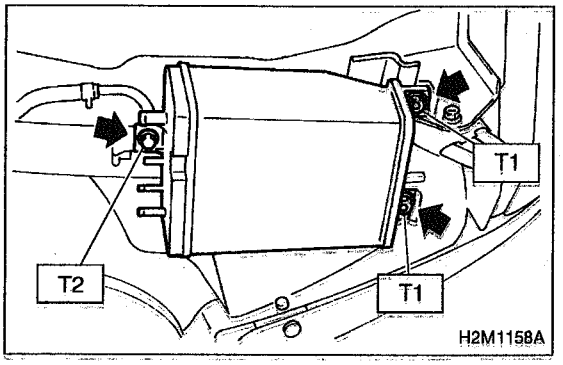
A: REMOVAL AND INSTALLATION

1. 1800 cc MODEL

1) Lift-up the vehicle.
2) Disconnect evaporation hoses from canister.

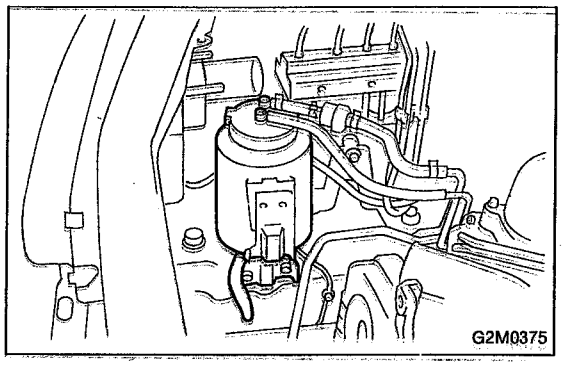


3) Remove canister from body.



4) Installation is in the reverse order of removal.

Tightening torque:
T1: 22.5 ± 7 N·m (2.3 ± 0.7 kg-m, 16.6 ± 5.1 ft-lb)
T2: 24.5 ± 7 N·m (2.5 ± 0.7 kg-m, 18.1 ± 5.1 ft-lb)

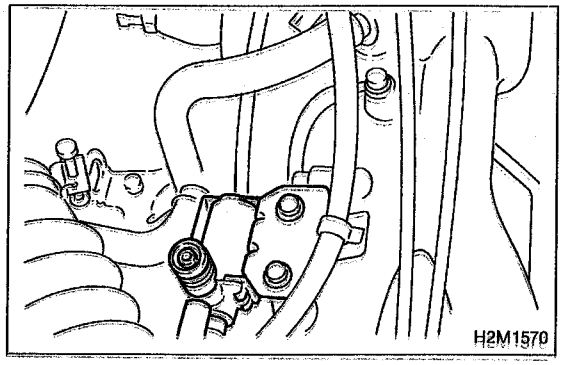


2. 2200 cc MODEL

1) Disconnect canister hoses from evaporation pipes.
2) Remove canister hose from body.
3) Remove canister from bracket.

4) Installation is in the reverse order of removal.

CAUTION:
Insert air vent hose of canister into the hole on body.

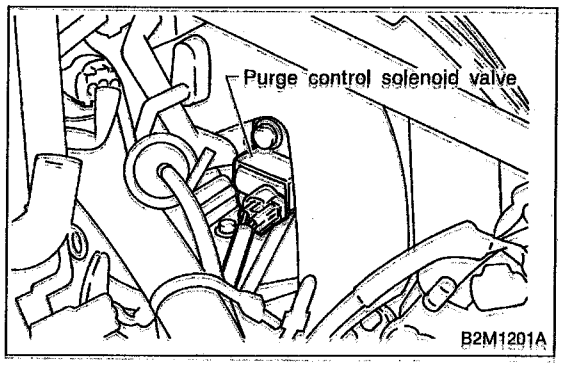


4. Purge Control Solenoid Valve

A: REMOVAL AND INSTALLATION

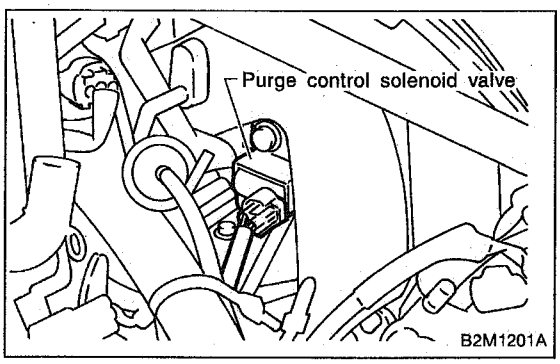
1. 1800 cc MODEL

1) Disconnect connector from FICD solenoid valve.
2) Remove bolts which installs FICD solenoid valve to intake manifold.



3) Disconnect connector from purge control solenoid valve.
4) Disconnect vacuum hoses from purge control solenoid valve.
5) Remove bolt which installs purge control solenoid valve to intake manifold.
6) Take out purge control solenoid valve.
7) Installation is in the reverse order of removal.

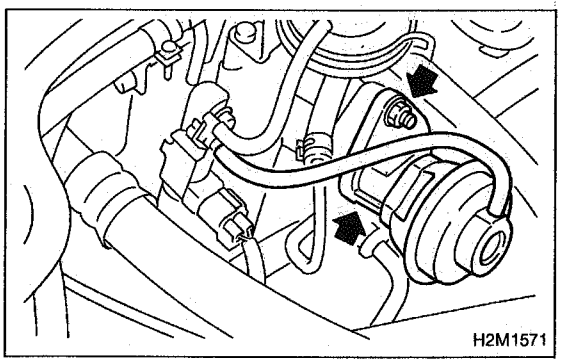
Tightening torque:
, ***16±1.5 N·m (1.6±0.15 kg-m, 11.6±1.1 ft-lb)***



2. 2200 cc MODEL

1) Disconnect connector from purge control solenoid valve.
2) Disconnect vacuum hoses from purge control solenoid valve.
3) Remove bolt which installs purge control solenoid valve to intake manifold.
4) Take out purge control solenoid valve.
5) Installation is in the reverse order of removal.

Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)



5. EGR Valve [AT Vehicles]

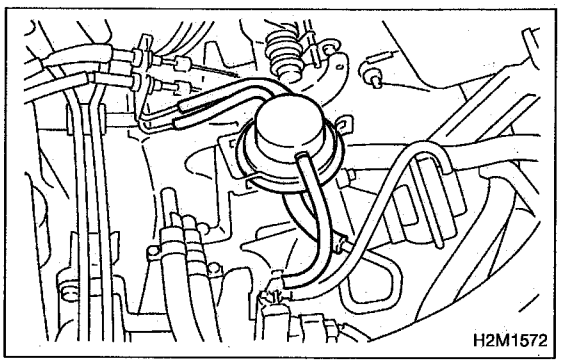
A: REMOVAL AND INSTALLATION

1) Disconnect vacuum hose from EGR valve.
2) Remove bolts which install EGR valve onto intake manifold.

3) Installation is in the reverse order of removal.

CAUTION:
Replace gasket with a new one.

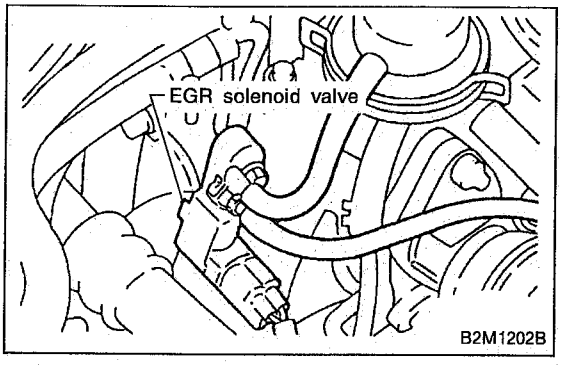
Tightening torque:
19 ± 1 N·m (1.9 ± 0.1 kg-m, 13.7 ± 0.7 ft-lb)



6. Back-Pressure Transducer (BPT) [AT Vehicles]

A: REMOVAL AND INSTALLATION

1) Disconnect vacuum hoses from BPT.
2) Remove BPT from bracket.
3) Installation is in the reverse order of removal.

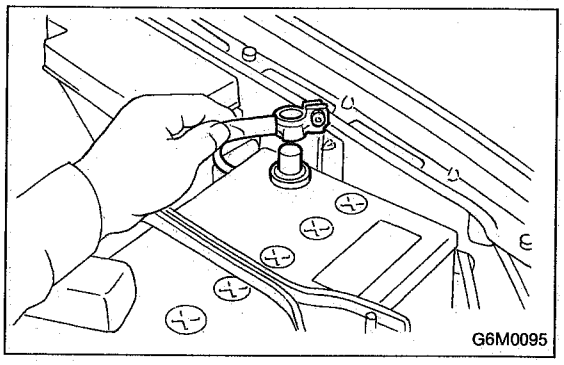


7. EGR Solenoid Valve [AT Vehicles]

A: REMOVAL AND INSTALLATION

1) Disconnect connector from EGR solenoid valve.
2) Disconnect vacuum hoses from EGR solenoid valve.
3) Remove bolt which installs EGR solenoid valve.
4) Take out EGR solenoid valve.
5) Installation is in the reverse order of removal.

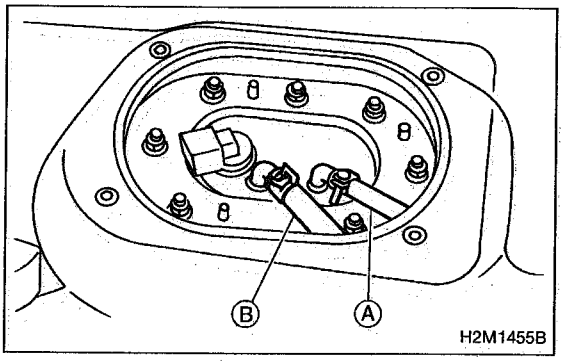
Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)



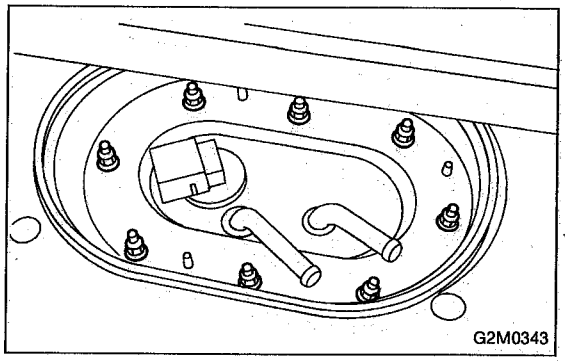
8. Fuel Temperature Sensor (1800 cc Model)

A: REMOVAL

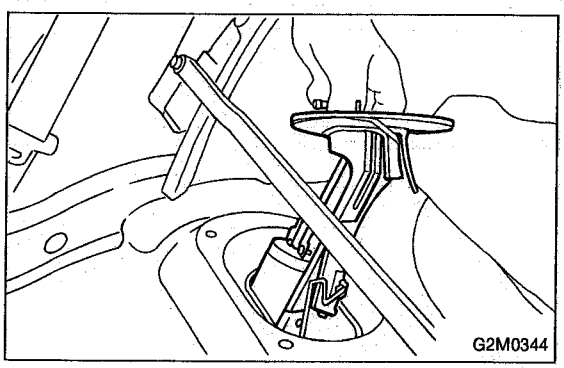
1) Disconnect battery ground cable.



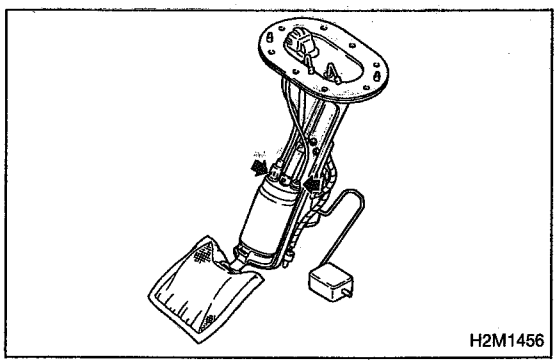
2) Release fuel pressure. <Ref. to 2-8 [W1B0].>
3) Disconnect fuel delivery hose Ⓐ and return hose Ⓑ.



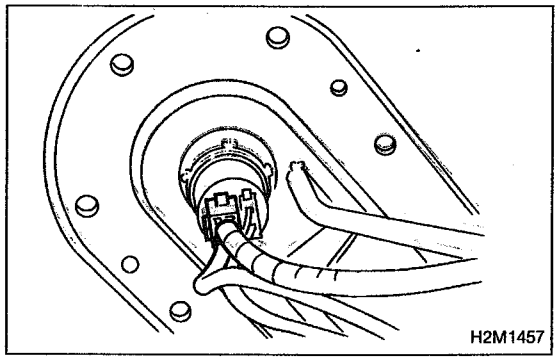
4) Remove nuts which install fuel pump assembly onto fuel tank.



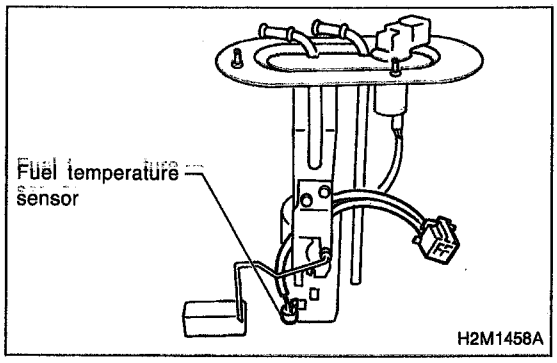
5) Take off fuel pump from fuel tank.


H2M1456

6) Remove two screws fixing terminals on fuel pump assembly.

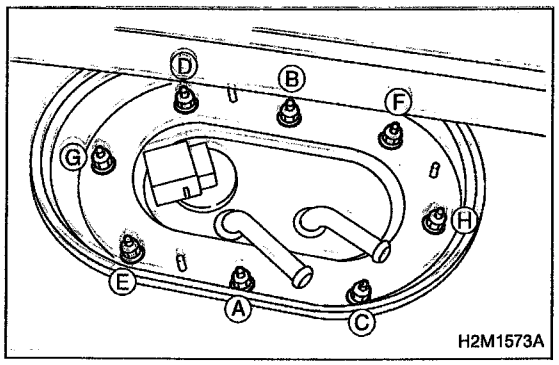

H2M1457

7) Disconnect connector from fuel pump.



H2M1458A

8) Remove fuel temperature sensor from fuel pump assembly.



H2M1573A

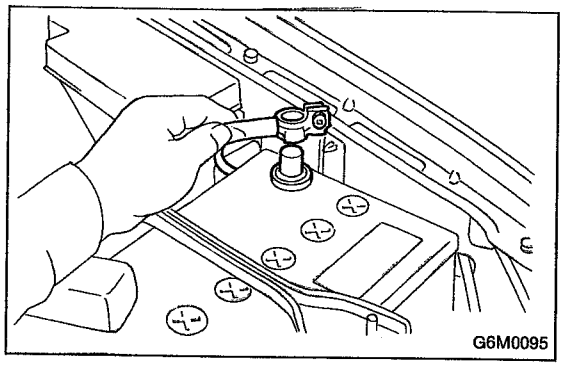
B: INSTALLATION

CAUTION:
Leave fuel filler cap open when tightening nuts, to prevent fuel from flowing out through fuel delivery and return pipes. Close fuel filler cap after tightening nuts.

Installation is in the reverse order of removal. Do the following:

- Always use new gaskets.
- Ensure sealing portion is free from fuel or foreign particles before installation.
- Tighten nuts in alphabetical sequence shown in Figure to specified torque.

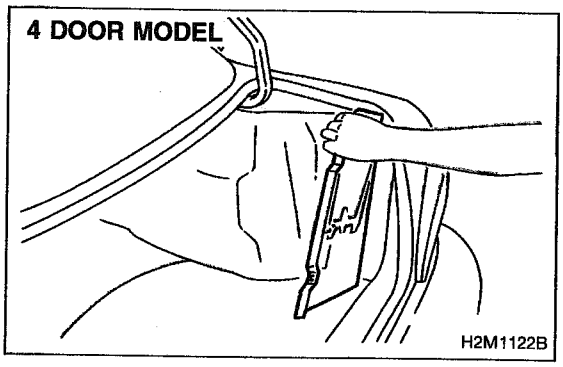
Tightening torque:
4.4 ± 1.5 N·m (0.45 ± 0.15 kg-m, 3.3 ± 1.1 ft-lb)


G6M0095

9. Fuel Tank Pressure Sensor (1800 cc Model)

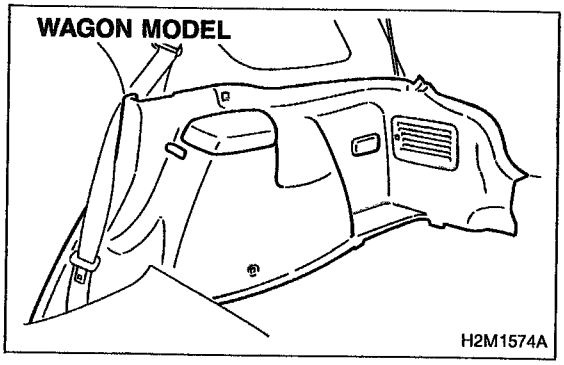
A: REMOVAL AND INSTALLATION

1) Disconnect battery ground cable.



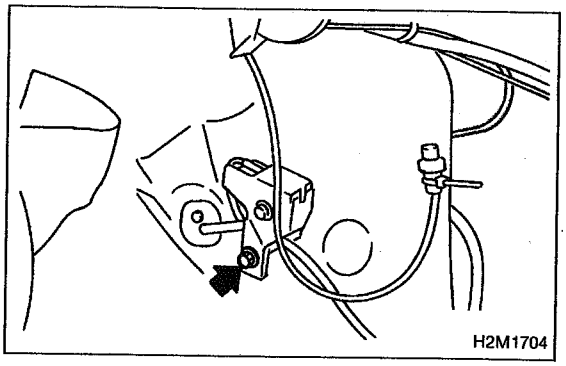
H2M1122B

2) Remove trims.
- 4 door model:
  Remove right trunk side trim.

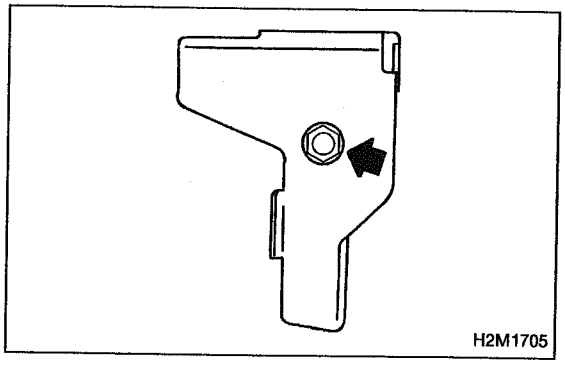


H2M1574A

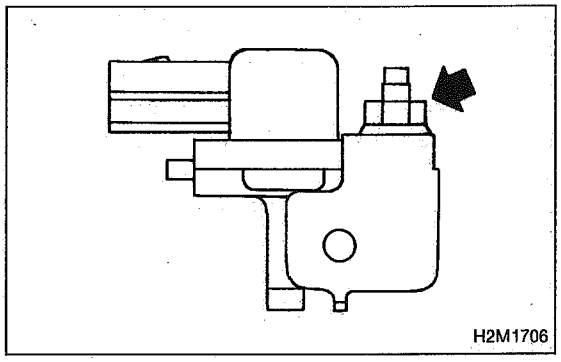
- Wagon model:
  Remove right rear quarter lower trim. <Ref. to 5-3 [W5A4].>


H2M1704

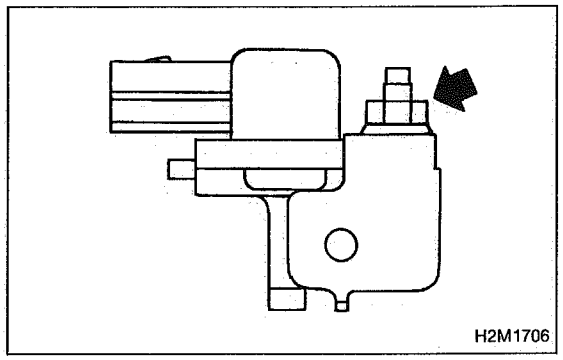
3) Remove bolts which install fuel tank pressure sensor bracket on body.
4) Disconnect hose from connection pipe.


H2M1705

5) Disconnect connector from fuel tank pressure sensor.
6) Remove fuel tank pressure sensor assembly from bracket.

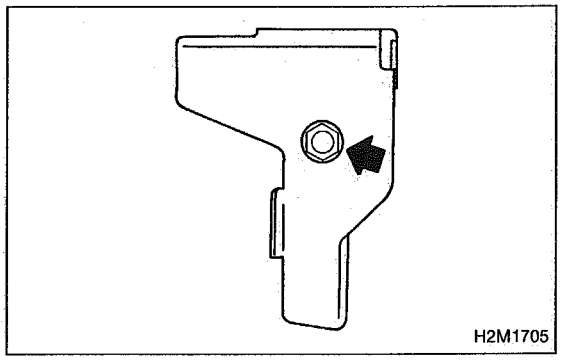

H2M1706

7) Remove fuel tank pressure sensor from bracket.


H2M1706

8) Installation is in the reverse order of removal.

Tightening torque:
7.35 ± 1.96 N·m (0.75 ± 0.20 kg-m, 5.4 ± 1.4 ft-lb)

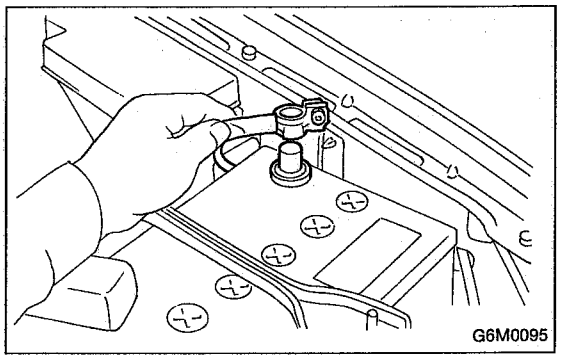

H2M1705

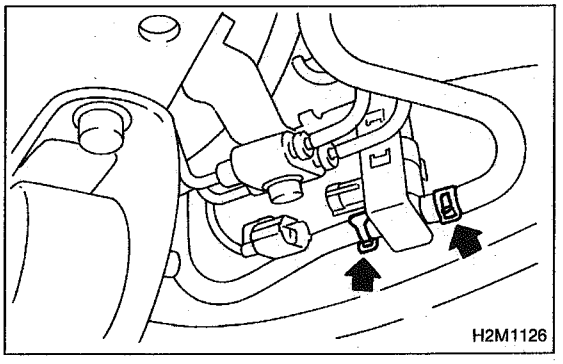
Tightening torque:
7.35 ± 1.96 N·m (0.75 ± 0.20 kg-m, 5.4 ± 1.4 ft-lb)

10. Pressure Control Solenoid Valve (1800 cc Model)

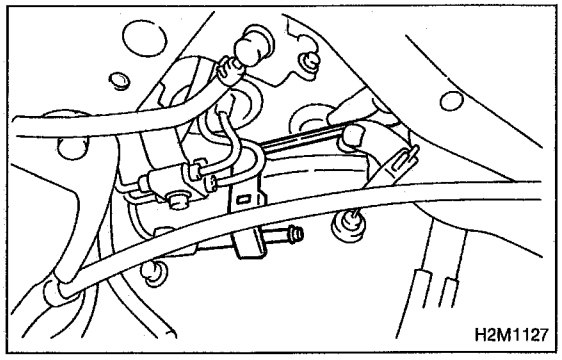
A: REMOVAL AND INSTALLATION

1) Disconnect battery ground cable.
2) Lift-up the vehicle.

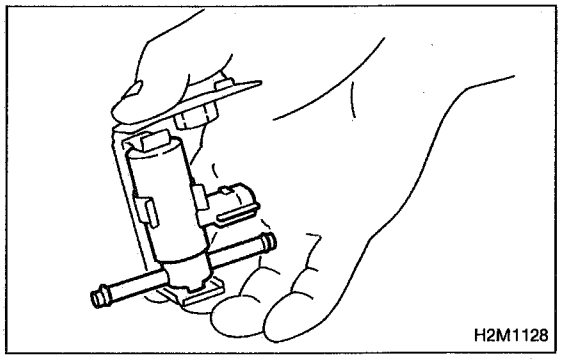

G6M0095


H2M1126

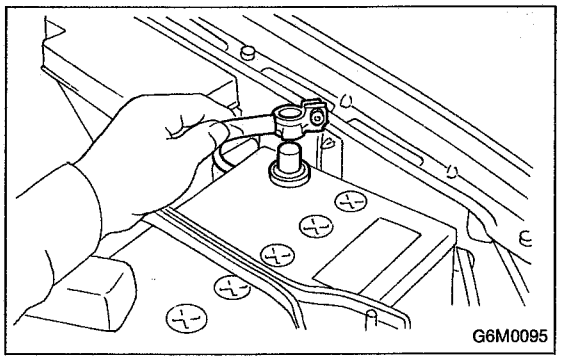
3) Disconnect evaporation hoses from pressure control valve.
4) Disconnect connector from pressure control valve.



5) Remove pressure control valve with bracket.



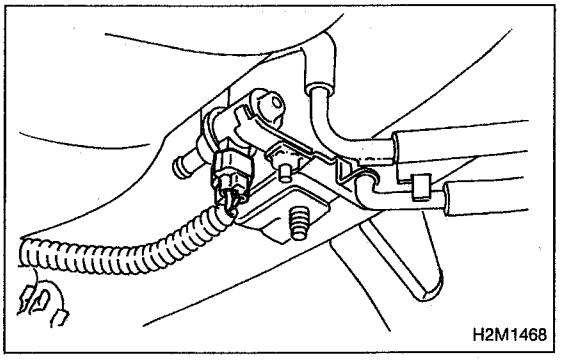
6) Remove pressure control valve from bracket.
7) Installation is in the reverse order of removal.



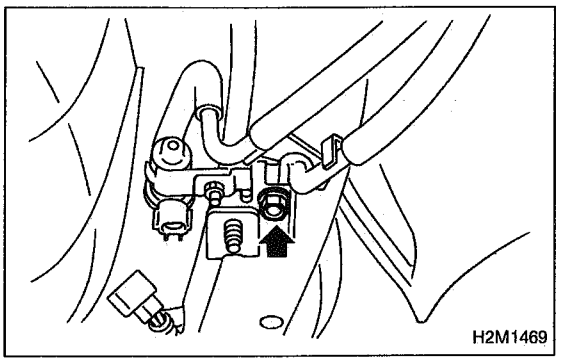
11. Vent Control Solenoid Valve (1800 cc Model)

A: REMOVAL

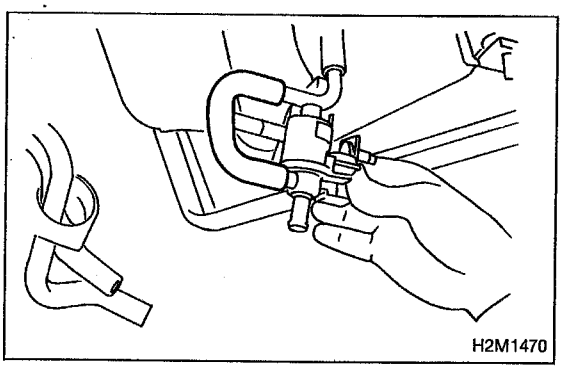
1) Disconnect battery ground cable.



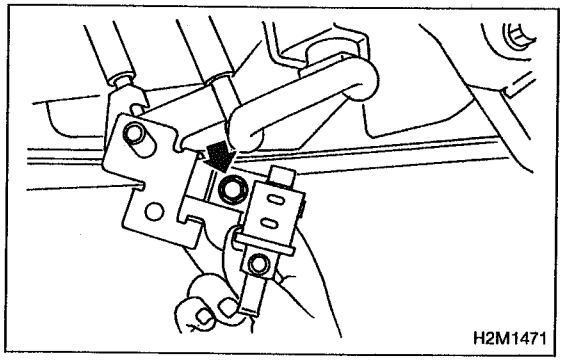
2) Lift-up the vehicle.
3) Remove canister. <Ref. to 2-1 [W3A1].>
4) Disconnect connector from vent control solenoid valve.



5) Remove one bolt fixing bracket on the body.

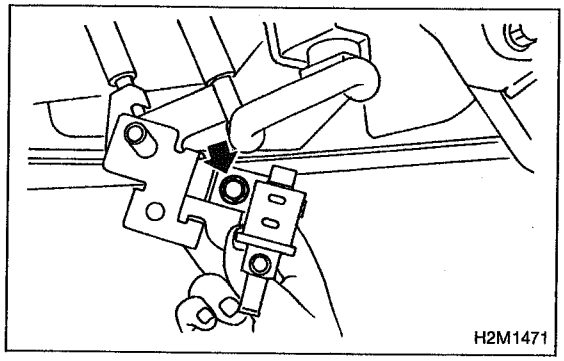


6) Remove one vacuum hose from vent control solenoid valve.

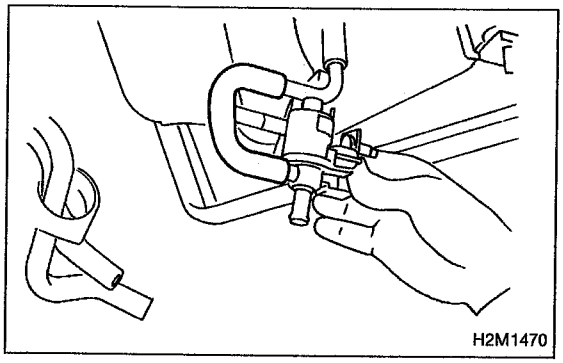


7) Remove one bolt fixing vent control solenoid valve on bracket.
8) Remove vent control solenoid valve.

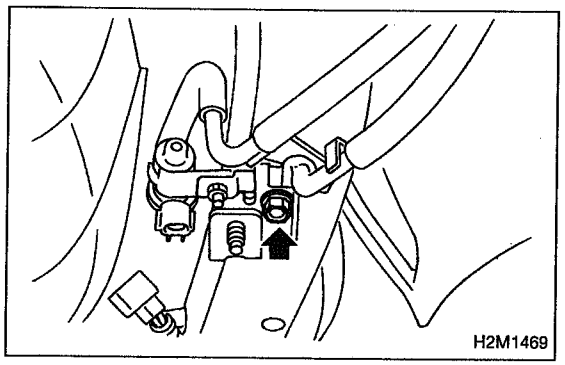
B: INSTALLATION



1) Install the bolt fixing vent control solenoid valve on bracket.

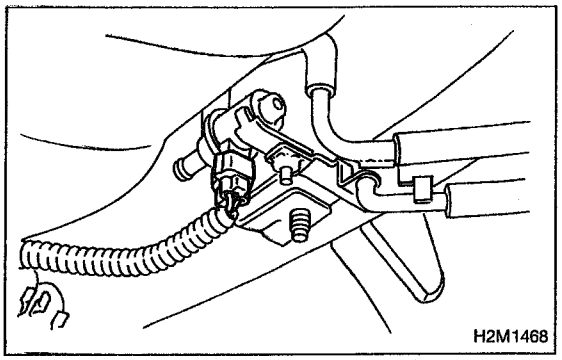


2) Install the vacuum hose to vent control solenoid valve.

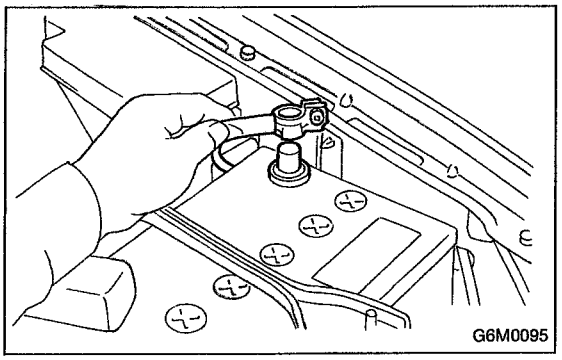


3) Install the bolt fixing bracket on the body.

Tightening torque:
25 ± 7 N·m (2.5 ± 0.7 kg-m, 18.1 ± 5.1 ft-lb)



4) Connect connector to vent control solenoid valve.
5) Install canister. <Ref. to 2-1 [W3A1].>
6) Lower the vehicle.

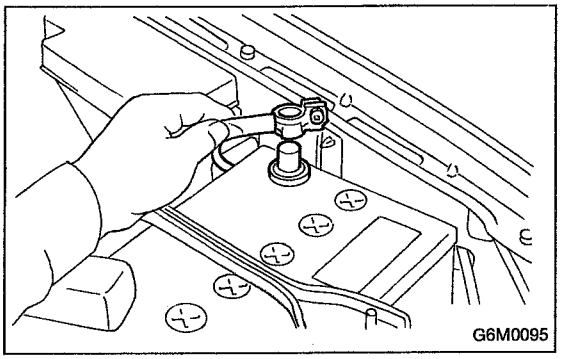


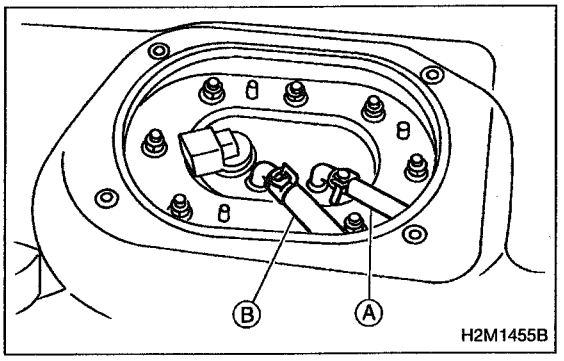
7) Connect battery ground cable.

12. Fuel Level Sensor (1800 cc Model)

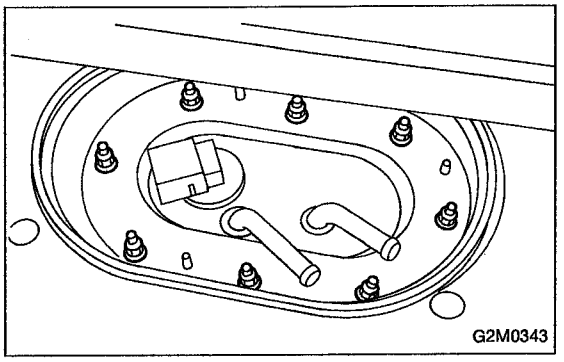
A: REMOVAL

1) Disconnect battery ground cable.

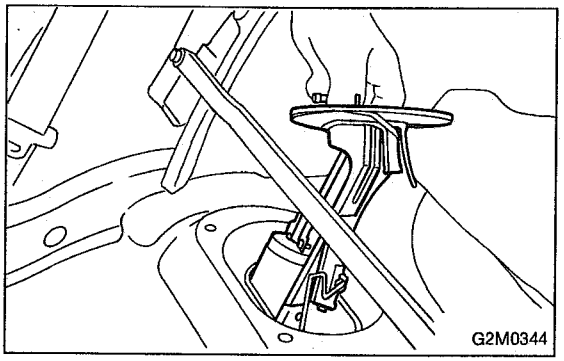




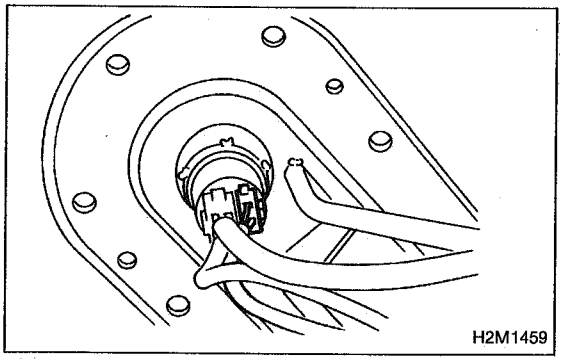
2) Release fuel pressure. <Ref. to 2-8 [W1B0].>
3) Disconnect fuel delivery hose Ⓐ and return hose Ⓑ.



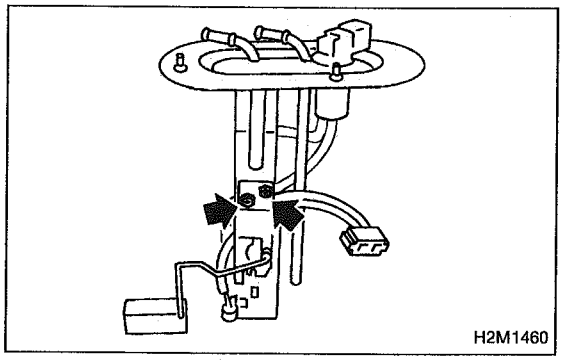
4) Remove nuts which install fuel pump assembly onto fuel tank.



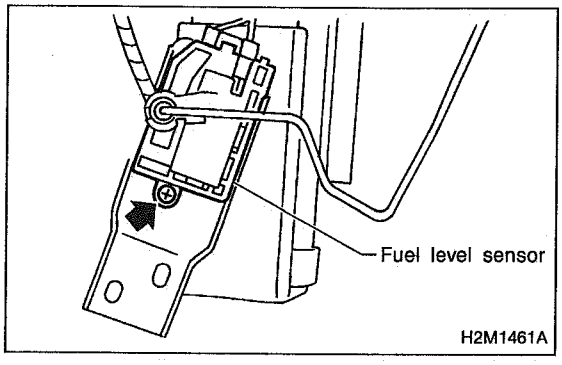
5) Take off fuel pump from fuel tank.



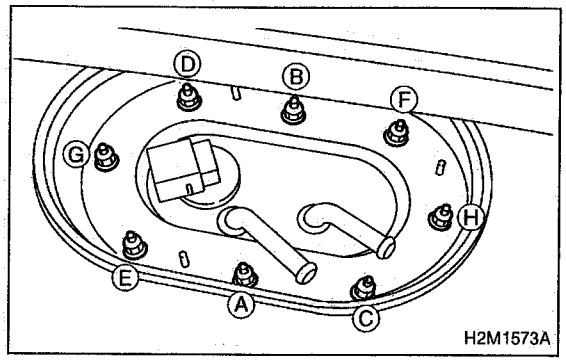
6) Disconnect connector from fuel pump.



7) Remove two screws fixing bracket on fuel pump assembly.



8) Remove one screw fixing fuel level sensor on bracket.
9) Remove fuel level sensor from fuel pump assembly.



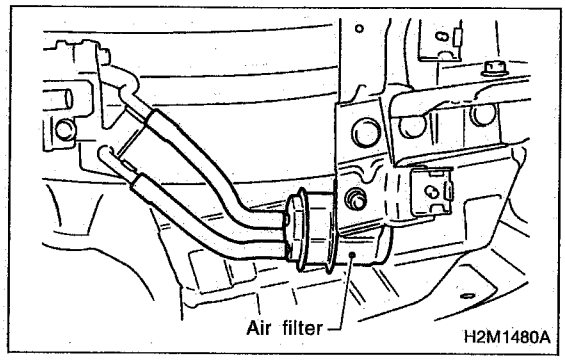
B: INSTALLATION

CAUTION:
Leave fuel filler cap open when tightening nuts, to prevent fuel from flowing out through fuel delivery and return pipes. Close fuel filler cap after tightening nuts.

Installation is in the reverse order of removal. Do the following:

- Always use new gaskets.
- Ensure sealing portion is free from fuel or foreign particles before installation.
- Tighten nuts in alphabetical sequence shown in Figure to specified torque.

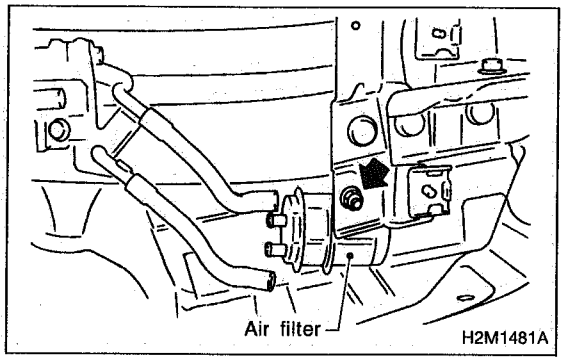
Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



13. Air Filter (1800 cc Model)

A: REMOVAL AND INSTALLATION

1) Remove canister. <Ref. to 2-1 [W3A1].>
2) Remove two hoses from air filter.



3) Remove flange nut from bracket.
4) Installation is in the reverse order of removal.

MEMO:

ON-CAR SERVICES 2-2

1. Foreword

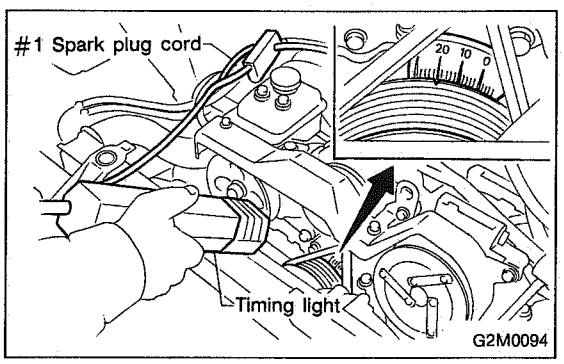
This chapter describes major inspection and service procedures for the engine mounted on the body. For procedures not found in this chapter, refer to the service procedure section in the applicable chapter.

2. Ignition Timing

A: MEASUREMENT

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) Warm-up the engine.



2) To check the ignition timing, connect a timing light to #1 cylinder spark plug cord, and illuminate the timing mark with the timing light.
3) Start the engine at idle speed and check the ignition timing.
If the timing is not correct, check the ignition control system. <Ref. to 2-7 [T8D0].>

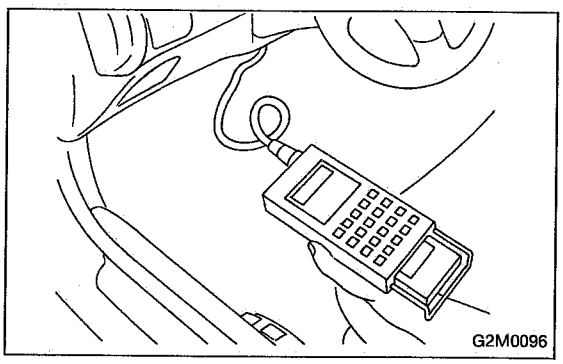
Ignition timing [BTDC/rpm]:
16° ± 8°/700 (1800 cc MT vehicles)
14° ± 8°/700 (2200 cc MT vehicles)
20° ± 8°/700 (2200 cc AT vehicles)

NOTE:
To improve stability, ignition timing while engine is idling is also controlled. For this reason specified ignition timing range is increased somewhat, to ±8°.

3. Engine Idle Speed

A: MEASUREMENT

1) Before checking idle speed, check the following:
   (1) Ensure that air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and that hoses are connected properly.
   (2) Ensure that malfunction indicator lamp (CHECK ENGINE light) does not illuminate.
2) Warm-up the engine.

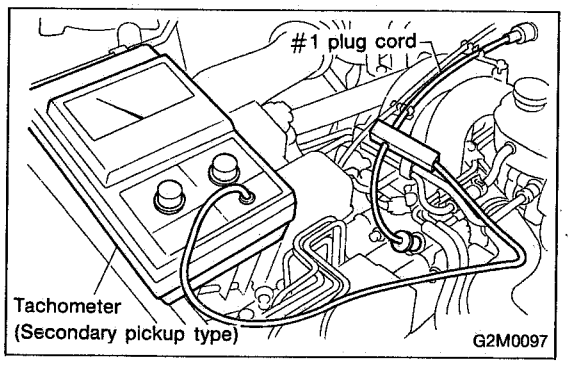


3) Connect Subaru Select Monitor or the OBD-II general scan tool to data link connector.

CAUTION:
When connecting Subaru Select Monitor, turn ignition switch to OFF.

4) Start the engine and measure engine speed.

NOTE:
Engine speed is indicated on Subaru Select Monitor by selecting "MODE F04".



NOTE:
- When using the OBD-II general scan tool, carefully read its operation manual.
- When Subaru Select Monitor is not used, attach the pickup sensor on tachometer (Secondary pickup type) to #1 spark plug cord.
- This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.

5) Check idle speed when unloaded (with headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF).

Idle speed [No load and gears in neutral (MT) or N or P (AT) position]:
700 ± 100 rpm

6) Check idle speed when loaded. (Turn air conditioning switch to "ON" and operate compressor for at least one minute before measurement.)

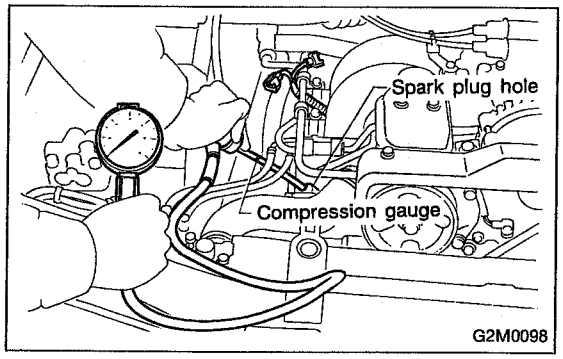
Idle speed [A/C switch "ON", no load and gears in neutral (MT) or N or P (AT) position]:
850 ± 100 rpm

CAUTION:
Never rotate idle adjusting screw, if idle speed is outside specifications, refer to General On-board Diagnosis Table under "2-7 On-Board Diagnostics II System".

4. Engine Compression

A: MEASUREMENT

1) After warming-up the engine, turn ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Remove all the spark plugs.
4) Disconnect connectors from fuel injectors.
5) Fully open throttle valve.
6) Check the starter motor for satisfactory performance and operation.



7) Hold the compression gauge tight against the spark plug hole.

CAUTION:
When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

8) Crank the engine by means of the starter motor, and read the maximum value on the gauge when the pointer is steady.

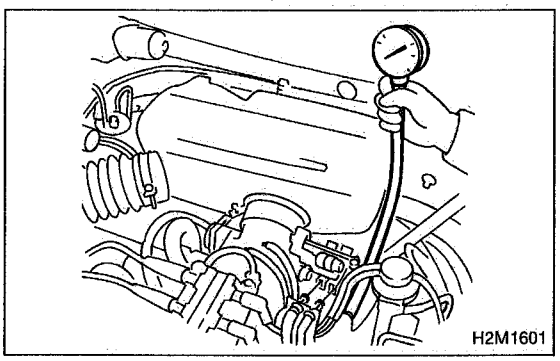
9) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (200 — 300 rpm and fully open throttle):
Standard: 1,079 — 1,275 kPa
(11.0 — 13.0 kg/cm^2, 156 — 185 psi)
Limit: 883 kPa (9.0 kg/cm^2, 128 psi)
Difference between cylinders: 196 kPa (2.0 kg/cm^2, 28 psi)

5. Intake Manifold Vacuum

A: MEASUREMENT

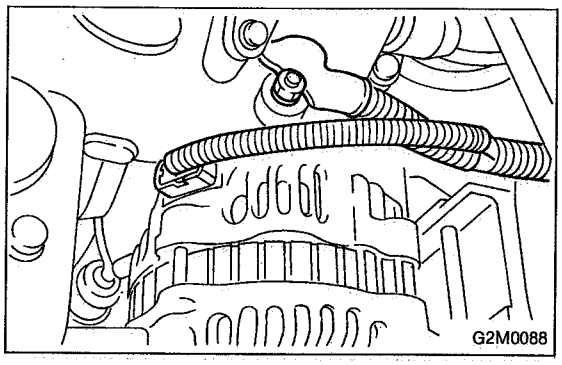
1) Warm-up the engine.
2) Disconnect the vacuum hose and install the vacuum gauge to the hose fitting on the manifold.



3) Keep the engine at the idle speed and read the vacuum gauge indication.
By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.

Vacuum pressure (at idling, A/C "OFF"):
1800 cc:
Less than – 66.7 kPa
(– 500 mmHg, – 19.69 inHg)
2200 cc:
Less than – 60.0 kPa
(– 450 mmHg, – 17.72 inHg)

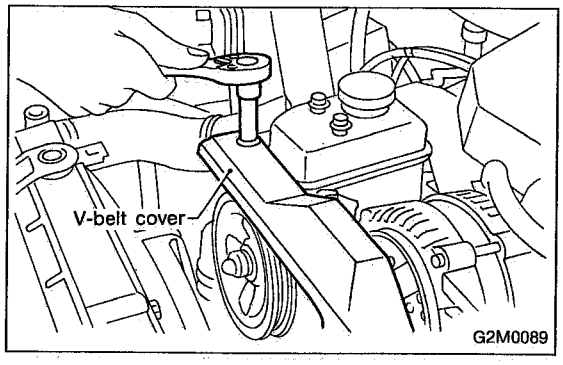
Diagnosis of engine condition by measurement of manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket/throttle chamber gasket or disconnection/damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valves
5. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment



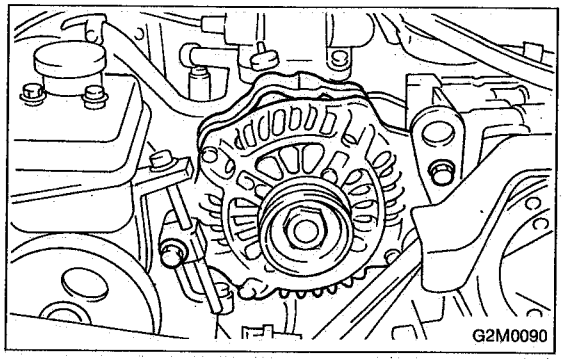
6. Engine Oil Pressure

A: MEASUREMENT

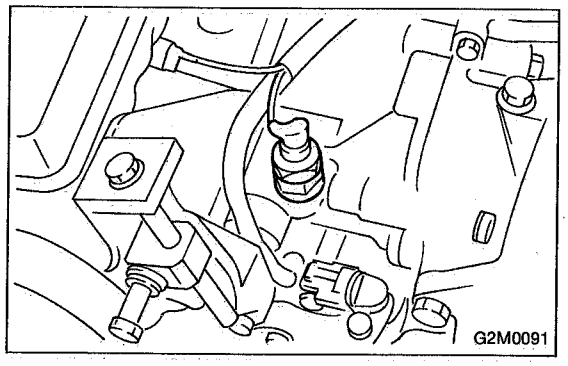
1) Remove generator from bracket.
   (1) Disconnect connector and terminal from generator.



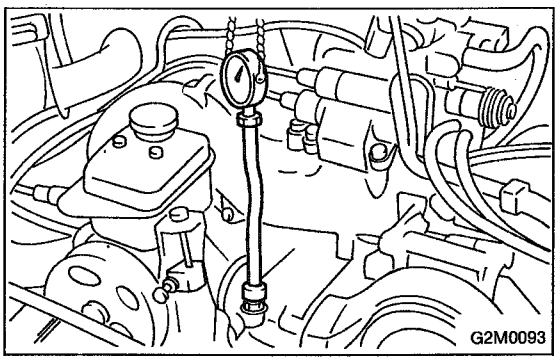
   (2) Remove V-belt cover.
   (3) Loosen lock bolt and slider bolt, and remove front side V-belt.



   (4) Remove lock bolt.
   (5) Remove bolts which install generator on bracket.



2) Disconnect connector from oil pressure switch.
3) Remove oil pressure switch from engine block.



4) Connect oil pressure gauge hose.
5) Start the engine, and measure oil pressure.

Oil pressure:
98 kPa (1.0 kg/cm^2,14 psi) or more at 600 rpm
294 kPa (3.0 kg/cm^2, 43 psi) or more at 5,000 rpm

CAUTION:
- **If oil pressure is out of specification, check oil pump, oil filter and lubrication line.**
<Ref. to 2-4 [W1A0].>
- **If oil pressure warning light is turned ON and oil pressure is in specification, replace oil pressure switch.**
<Ref. to 2-4 [W3A0].>

NOTE:
The specified data is based on an engine oil temperature of 80°C (176°F).

6) After measuring oil pressure, install oil pressure switch.

Tightening torque:
25 ± 3 N·m (2.5 ± 0.3 kg-m, 18.1 ± 2.2 ft-lb)

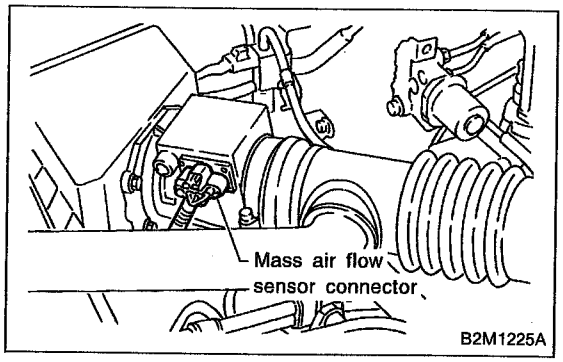
7) Install generator and V-belt in the reverse order of removal, and adjust the V-belt deflection.

7. Valve Clearance

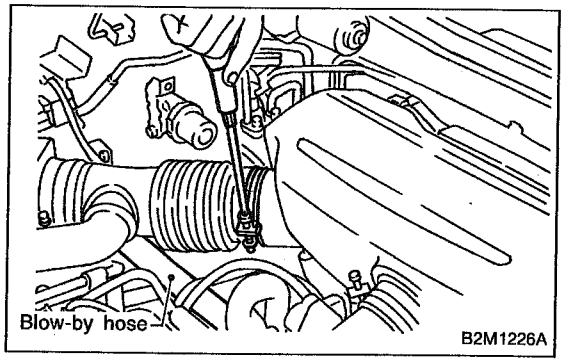
A: INSPECTION

CAUTION:
Inspection and adjustment of valve clearance should be performed while engine is cold.

1) Set the vehicle onto the lift.
2) Disconnect battery ground cable.
3) Remove timing belt cover (RH).



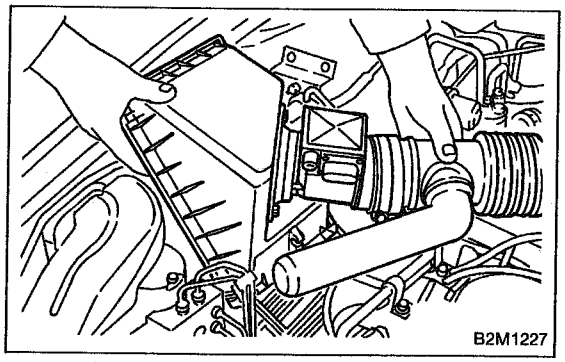
4) Remove rocker cover.
- When inspecting #1 and #3 cylinders;
  (1) Disconnect connector from mass air flow sensor.



(2) Loosen clamp which connects air intake duct to air intake chamber.
(3) Remove the two clips from air cleaner upper cover.

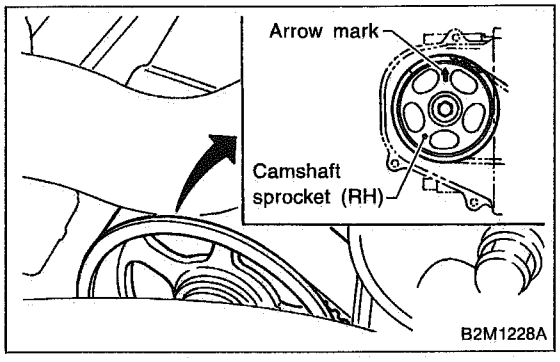
CAUTION:
Before installing air cleaner upper cover, align hole(s) with protruding portions of air cleaner lower case, then secure upper cover.

(4) Disconnect blow-by hose from air intake duct.



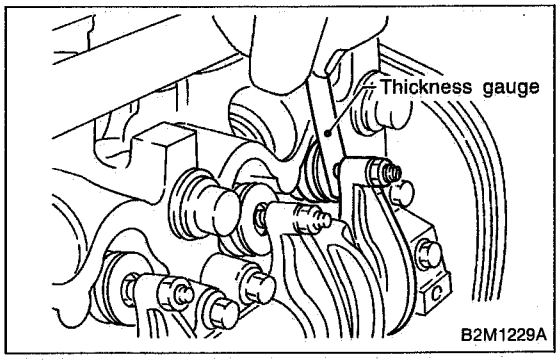
(5) Remove air intake duct and air cleaner upper cover as a unit.
(6) Remove air cleaner element.
(7) Disconnect spark plug cords from spark plugs (#1 and #3 cylinders).
(8) Remove under cover (RH).
(9) Place suitable container under the vehicle.
(10) Disconnect PCV hose from rocker cover (RH).
(11) Remove bolts, then remove rocker cover (RH).

- When inspecting #2 and #4 cylinders;
  (1) Disconnect battery cables, and then remove battery and battery carrier.
  (2) Disconnect washer motor connectors.
  (3) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.
  (4) Remove the two bolts which holds washer tank, then secure the tank away from working area.
  (5) Disconnect spark plug cords from spark plugs (#2 and #4 cylinders).
  (6) Remove under cover (LH).
  (7) Place suitable container under the vehicle.
  (8) Disconnect PCV hose from rocker cover (LH).
  (9) Remove bolts, then remove rocker cover (LH).



5) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

NOTE:
When arrow mark on camshaft sprocket (RH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.

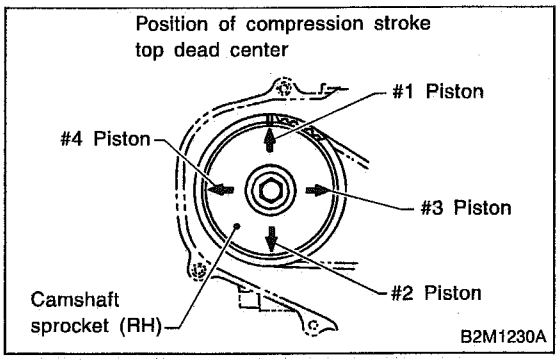


6) Measure #1 cylinder valve clearance by using thickness gauge.

CAUTION:
- **Insert the thickness gauge in as horizontal a direction as possible with respect to the valve stem end face.**
- **Measure exhaust valve clearances while lifting-up the vehicle.**

Valve clearance:
Intake: 0.20 ± 0.02 mm (0.0079 ± 0.0008 in)
Exhaust: 0.25 ± 0.02 mm (0.0098 ± 0.0008 in)

7) If necessary, adjust the valve clearance. <Ref. to 2-2 [07B1].>

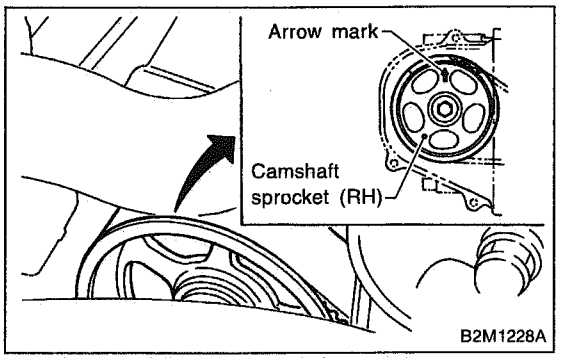


8) Similar to measurement procedures used for #1 cylinder, measure #2, #3 and #4 cylinder valve clearances.

NOTE:

- Be sure to set cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
- To set #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on right-hand camshaft sprocket facing up.

9) After inspection, install the related parts in the reverse order of removal.



B: ADJUSTMENT

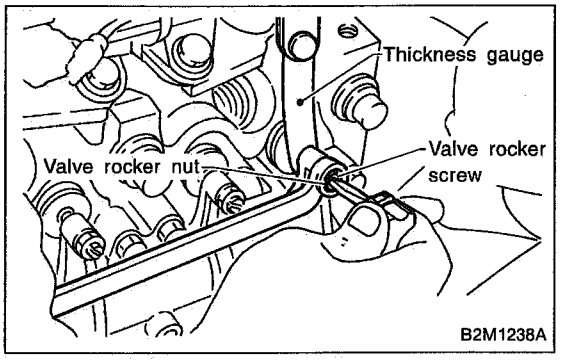
CAUTION:

Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

NOTE:

When arrow mark on camshaft sprocket (RH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



2) Adjust the #1 cylinder valve clearance.
   (1) Loosen the valve rocker nut and screw.
   (2) Place suitable thickness gauge.
   (3) While noting valve clearance, tighten valve rocker adjust screw.
   (4) When specified valve clearance is obtained, tighten valve rocker nut.

Tightening torque:
10 ± 1 N·m (1.0 ± 0.1 kg-m, 7.2 ± 0.7 ft-lb)

CAUTION:
• Insert the thickness gauge in as horizontal a direction as possible with respect to the valve stem end face.
• Adjust exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake: 0.20 ± 0.02 mm (0.0079 ± 0.0008 in)
Exhaust: 0.25 ± 0.02 mm (0.0098 ± 0.0008 in)

3) Ensure that valve clearances are within specifications.

4) Turn crankshaft two complete rotations until #1 cylinder piston is again set to top dead center on compression stroke.

5) Ensure that valve clearances are within specifications. If necessary, re-adjust valve clearances.

1. Specifications

Model			1800 cc	2200 cc
ENGINE	Type		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve arrangement		Belt driven, single over-head camshaft, 4-valve/cylinder	
	Bore x Stroke mm (in)		87.9 x 75.0 (3.461 x 2.953)	96.9 x 75.0 (3.815 x 2.953)
	Piston displacement cm^3 (cu in)		1,820 (111.06)	2,212 (135.0)
	Compression ratio		9.7	
	Compression pressure (at 200 — 300 rpm) kPa (kg/cm^2, psi)		1,079 — 1,275 (11.0 — 13.0, 156 — 185)	
	Number of piston rings		Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Opening	2° BTDC	4° BTDC
		Closing	54° ABDC	52° ABDC
	Exhaust valve timing	Opening	48° BBDC	48° BBDC
		Closing	8° ATDC	12° ATDC
	Valve clearance	Intake mm (in)	0.20±0.02 (0.0079±0.0008)	
		Exhaust mm (in)	0.25±0.02 (0.0098±0.0008)	
	Idling speed [At neutral position on MT, or "P" or "N" position on AT] rpm		700±100 (No load) 800±50 (A/C switch ON)	700±100 (No load) 850±50 (A/C switch ON)
	Firing order		1 → 3 → 2 → 4	
	Ignition timing BTDC/rpm		MT: 20°±2°/700	AT: 20°±8°/700 MT: 14°±8°/700

2. Service Data

Belt tensioner adjuster	Protrusion of adjuster rod					15.4 — 16.4 mm	(0.606 — 0.646 in)
Belt tensioner	Spacer O.D.					16 mm	(0.63 in)
	Tensioner bush I.D.					16.16 mm	(0.6362 in)
	Clearance between spacer and bush				STD	0.117 — 0.180 mm	(0.0046 — 0.0071 in)
					Limit	0.230 mm	(0.0091 in)
	Side clearance of spacer				STD	0.37 — 0.54 mm	(0.0146 — 0.0213 in)
					Limit	0.8 mm	(0.031 in)
Valve rocker arm	Clearance between shaft and arm				STD	0.020 — 0.054 mm	(0.0008 — 0.0021 in)
					Limit	0.10 mm	(0.0039 in)
Camshaft	Bend limit					0.025 mm	(0.0010 in)
	Thrust clearance				STD	0.030 — 0.260 mm	(0.0012 — 0.0102 in)
					Limit	0.35 mm	(0.0138 in)
	Cam lobe height			Intake	STD	32.244 — 32.344 mm	(1.2694 — 1.2734 in)
					Limit	32.094 mm	(1.2635 in)
				Exhaust	STD	31.964 — 32.064 mm	(1.2584 — 1.2624 in)
					Limit	31.814 mm	(1.2525 in)
	Camshaft journal O.D.	RH	Front	LH	Rear	31.935 — 31.950 mm	(1.2573 — 1.2579 in)
			Center		Center	37.435 — 37.450 mm	(1.4738 — 1.4744 in)
			Rear		Front	37.935 — 37.950 mm	(1.4935 — 1.4941 in)
	Camshaft journal hole I.D.	RH	Front	LH	Rear	32.005 — 32.025 mm	(1.2600 — 1.2608 in)
			Center		Center	37.505 — 37.525 mm	(1.4766 — 1.4774 in)
			Rear		Front	38.005 — 38.025 mm	(1.4963 — 1.4970 in)
	Oil clearance				STD	0.055 — 0.090 mm	(0.0022 — 0.0035 in)
					Limit	0.10 mm	(0.0039 in)
Cylinder head	Surface warpage limit					0.05 mm	(0.0020 in)
	Surface grinding limit					0.1 mm	(0.004 in)
	Standard height					98.3 mm	(3.870 in)
Valve set	Refacing angle					90°	
	Contacting width			Intake	STD	0.7 mm	(0.028 in)
					Limit	1.4 mm	(0.055 in)
				Exhaust	STD	1.4 mm	(0.055 in)
					Limit	1.8 mm	(0.071 in)
Valve guide	Inner diameter					6.000 — 6.012 mm	(0.2362 — 0.2367 in)
	Protrusion above head					17.5 — 18.0 mm	(0.689 — 0.709 in)
Valve	Head edge thickness			Intake	STD	1.0 mm	(0.039 in)
					Limit	0.8 mm	(0.031 in)
				Exhaust	STD	1.2 mm	(0.047 in)
					Limit	0.8 mm	(0.031 in)
	Stem diameter				Intake	5.950 — 5.965 mm	(0.2343 — 0.2348 in)
					Exhaust	5.945 — 5.960 mm	(0.2341 — 0.2346 in)
	Stem oil clearance			STD	Intake	0.035 — 0.062 mm	(0.0014 — 0.0024 in)
					Exhaust	0.040 — 0.067 mm	(0.0016 — 0.0026 in)
				Limit	—	0.15 mm	(0.0059 in)
	Overall length				Intake	101.0 mm	(3.976 in)
					Exhaust	101.2 mm	(3.984 in)

STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter

Valve spring	Free length				44.05 mm	(1.7342 in)
	Squareness				2.5°, 1.9 mm	(0.075 in)
	Tension/spring height				174.6 — 200.1 N (17.8 — 20.4 kg, 39.2 — 45.0 lb)/36.0 mm (1.417 in) 405.0 — 458.0 N (41.3 — 46.7 kg, 91.1— 103.0 lb)/28.2 mm (1.110 in)	
Cylinder block	Surface warpage limit (mating with cylinder head)				0.05 mm	(0.0020 in)
	Surface grinding limit				0.1 mm	(0.004 in)
	Cylinder bore	1800 cc	STD	A	87.905 — 87.915 mm	(3.4608 — 3.4612 in)
				B	87.895 — 87.905 mm	(3.4604 — 3.4608 in)
		2200 cc	STD	A	96.905 — 96.915 mm	(3.8151 — 3.8155 in)
				B	96.895 — 96.905 mm	(3.8148 — 3.8151 in)
	Taper			STD	0.015 mm	(0.0006 in)
				Limit	0.050 mm	(0.0020 in)
	Out-of-roundness			STD	0.010 mm	(0.0004 in)
				Limit	0.050 mm	(0.0020 in)
	Piston clearance			STD	0.010 — 0.030 mm	(0.0004 — 0.0012 in)
				Limit	0.050 mm	(0.0020 in)
	Enlarging (boring) limit				0.5 mm	(0.020 in)
Piston	Outer diameter	1800 cc	STD	A	87.885 — 87.895 mm	(3.4600 — 3.4604 in)
				B	87.875 — 87.885 mm	(3.4596 — 3.4600 in)
			0.25 mm (0.0098 in) OS		88.125 — 88.135 mm	(3.4695 — 3.4699 in)
			0.50 mm (0.0197 in) OS		88.375 — 88.385 mm	(3.4793 — 3.4797 in)
		2200 cc	STD	A	96.885 — 96.895 mm	(3.8144 — 3.8148 in)
				B	96.875 — 96.885 mm	(3.8140 — 3.8144 in)
			0.25 mm (0.0098 in) OS		97.115 — 97.145 mm	(3.8234 — 3.8246 in)
			0.50 mm (0.0197 in) OS		97.365 — 97.395 mm	(3.8333 — 3.8344 in)
Piston pin	Standard clearance between piston pin and hole in piston			STD	0.004 — 0.010 mm	(0.0002 — 0.0004 in)
				Limit	0.020 mm	(0.0008 in)
	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).	
Piston ring	Piston ring gap	Top ring		STD	0.20 — 0.35 mm	(0.0079 — 0.0138 in)
				Limit	1.0 mm	(0.039 in)
		Second ring		STD	0.20 — 0.50 mm	(0.0079 — 0.0197 in)
				Limit	1.0 mm	(0.039 in)
		Oil ring		STD	0.20 — 0.70 mm	(0.0079 — 0.0276 in)
				Limit	1.5 mm	(0.059 in)
	Clearance between piston ring and piston ring groove	Top ring		STD	0.040 — 0.080 mm	(0.0016 — 0.0031 in)
				Limit	0.15 mm	(0.0059 in)
		Second ring		STD	0.030 — 0.070 mm	(0.0012 — 0.0028 in)
				Limit	0.15 mm	(0.0059 in)

Connecting rod	Bend twist per 100 mm (3.94 in) in length	Limit	0.10 mm	(0.0039 in)
	Side clearance	STD	0.070 — 0.330 mm	(0.0028 — 0.0130 in)
		Limit	0.4 mm	(0.016 in)
Connecting rod bearing	Oil clearance	STD	0.015 — 0.045 mm	(0.0006 — 0.0018 in)
		Limit	0.05 mm	(0.0020 in)
	Thickness at center portion	STD	1.492 — 1.501 mm	(0.0587 — 0.0591 in)
		0.03 mm (0.0012 in) US	1.510 — 1.513 mm	(0.0594 — 0.0596 in)
		0.05 mm (0.0020 in) US	1.520 — 1.523 mm	(0.0598 — 0.0600 in)
		0.25 mm (0.0098 in) US	1.620 — 1.623 mm	(0.0638 — 0.0639 in)
Connecting rod bushing	Clearance between piston pin and bushing	STD	0 — 0.022 mm	(0 — 0.0009 in)
		Limit	0.030 mm	(0.0012 in)

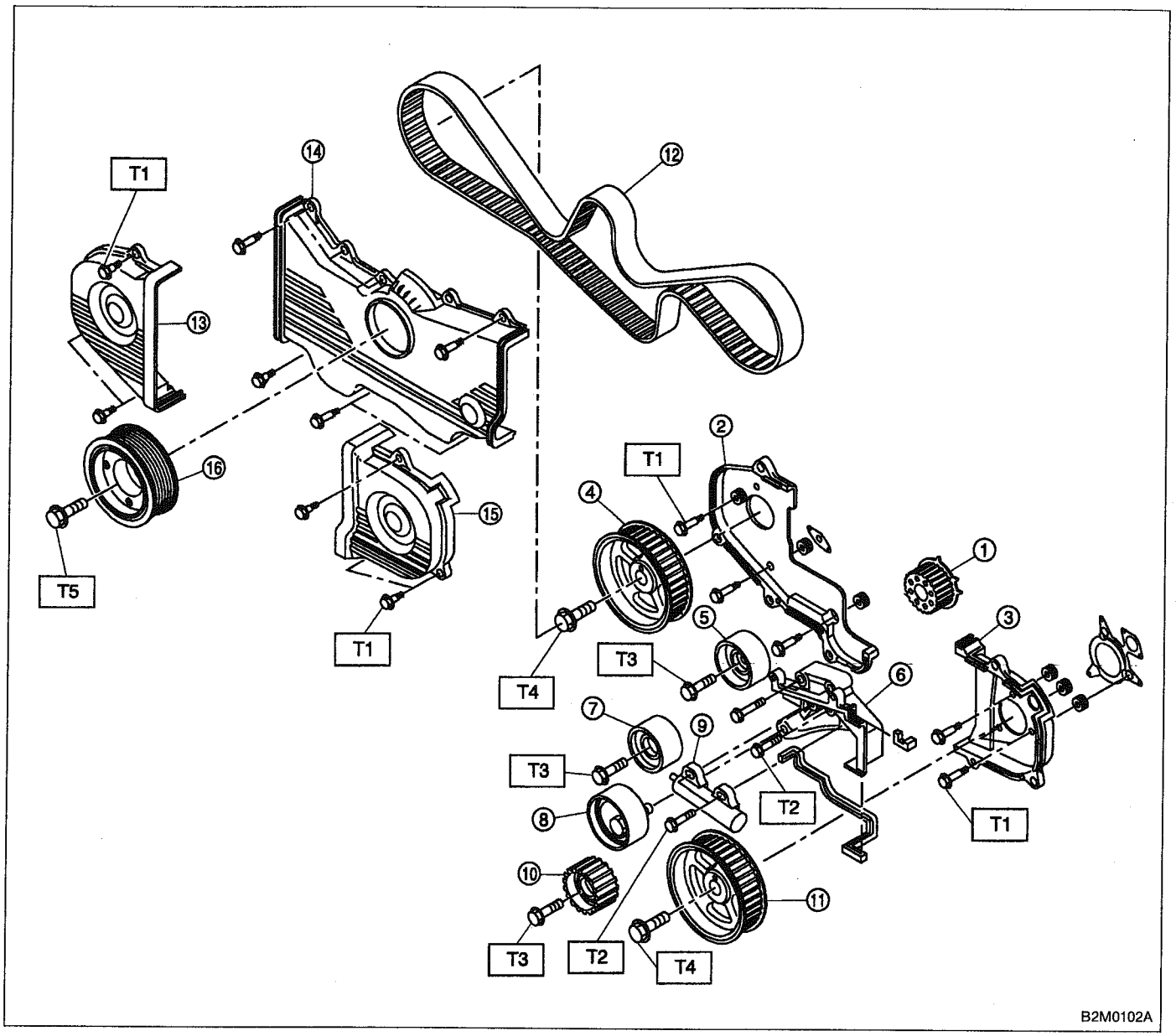
STD: Standard OS: Oversize US: Undersize

SPECIFICATIONS AND SERVICE DATA

Crankshaft	Bend limit			0.035 mm	(0.0014 in)
	Crankpin and crank journal	Out-of-roundness		0.030 mm (0.0012 in) or less	
		Grinding limit		0.250 mm	(0.0098 in)
	Crankpin outer diameter		STD	51.984 — 52.000 mm	(2.0466 — 2.0472 in)
			0.03 mm (0.0012 in) US	51.954 — 51.970 mm	(2.0454 — 2.0461 in)
			0.05 mm (0.0020 in) US	51.934 — 51.950 mm	(2.0446 — 2.0453 in)
			0.25 mm (0.0098 in) US	51.734 — 51.750 mm	(2.0368 — 2.0374 in)
	Crank journal outer diameter	#1, #5	STD	59.992 — 60.008 mm	(2.3619 — 2.3625 in)
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm	(2.3607— 2.3613 in)
			0.05 mm (0.0020 in) US	59.934 — 59.950 mm	(2.3596 — 2.3602 in)
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm	(2.3520 — 2.3527 in)
		#2, #3, #4	STD	59.992 — 60.008 mm	(2.3619 — 2.3625 in)
			0.03 mm (0.0012 in) US	59.954 — 59.970 mm	(2.3604 — 2.3610 in)
			0.05 mm (0.0020 in) US	59.934 — 59.950 mm	(2.3596 — 2.3602 in)
			0.25 mm (0.0098 in) US	59.734 — 59.750 mm	(2.3517 — 2.3524 in)
	Thrust clearance		STD	0.030 — 0.115 mm	(0.0012 — 0.0045 in)
			Limit	0.25 mm	(0.0098 in)
	Oil clearance	#1, #5	STD	0.003 — 0.030 mm	(0.0001 — 0.0012 in)
		#2, #3, #4	STD	0.010 — 0.033 mm	(0.0004 — 0.0013 in)
		#1, #3, #5	Limit	0.040 mm	(0.0016 in)
		#2, #4	Limit	0.035 mm	(0.0014 in)
Crankshaft bearing	Crankshaft bearing thickness	#1, #5	STD	1.998 — 2.011 mm	(0.0787 — 0.0792 in)
			0.03 mm (0.0012 in) US	2.017 — 2.020 mm	(0.0794 — 0.0795 in)
			0.05 mm (0.0020 in) US	2.027 — 2.030 mm	(0.0798 — 0.0799 in)
			0.25 mm (0.0098 in) US	2.127 — 2.130 mm	(0.0837 — 0.0839 in)
		#2, #3, #4	STD	2.000 — 2.013 mm	(0.0787 — 0.0793 in)
			0.03 mm (0.0012 in) US	2.019 — 2.022 mm	(0.0795 — 0.0796 in)
			0.05 mm (0.0020 in) US	2.029 — 2.032 mm	(0.0799 — 0.0800 in)
			0.25 mm (0.0098 in) US	2.129 — 2.132 mm	(0.0838 — 0.0839 in)

STD: Standard US: Undersize

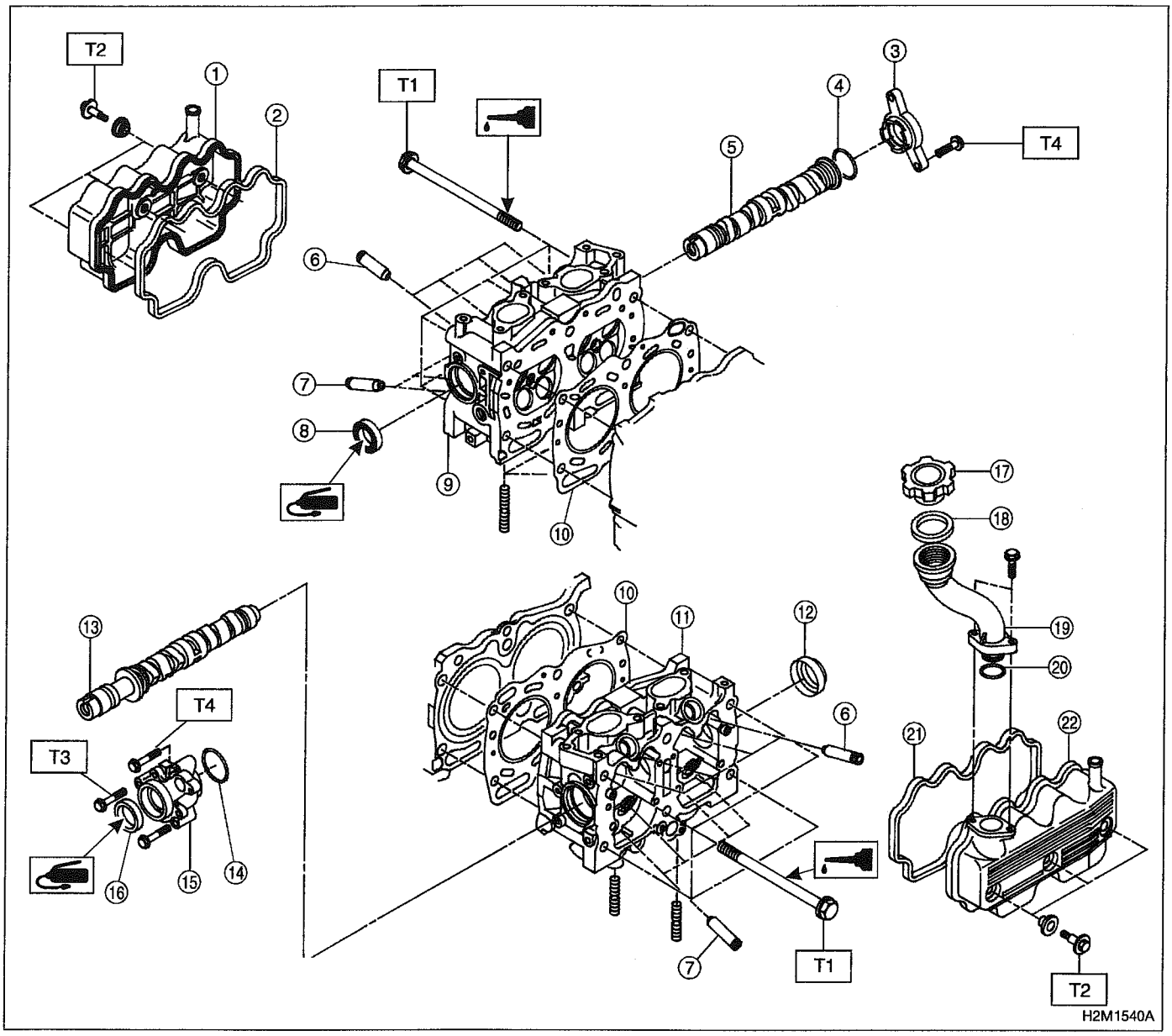
1. Timing Belt



① Crankshaft sprocket
② Belt cover No. 2 (RH)
③ Belt cover No. 2 (LH)
④ Camshaft sprocket No. 1
⑤ Belt idler (No. 1)
⑥ Tensioner bracket
⑦ Belt idler (No. 2)
⑧ Belt tensioner
⑨ Belt tensioner adjuster
⑩ Belt idler No. 2
⑪ Camshaft sprocket No. 2
⑫ Timing belt
⑬ Belt cover (RH)
⑭ Front belt cover
⑮ Belt cover (LH)
⑯ Crankshaft pulley

Tightening torque: N·m (kg-m, ft-lb)
T1: 5 ± 1 (0.5 ± 0.1, 3.6 ± 0.7)
T2: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T3: 39 ± 4 (4.0 ± 0.4, 28.9 ± 2.9)
T4: 78 ± 5 (8.0 ± 0.5, 57.9 ± 3.6)
T5: 127 ± 10 (13.0 ± 1.0, 94 ± 7)

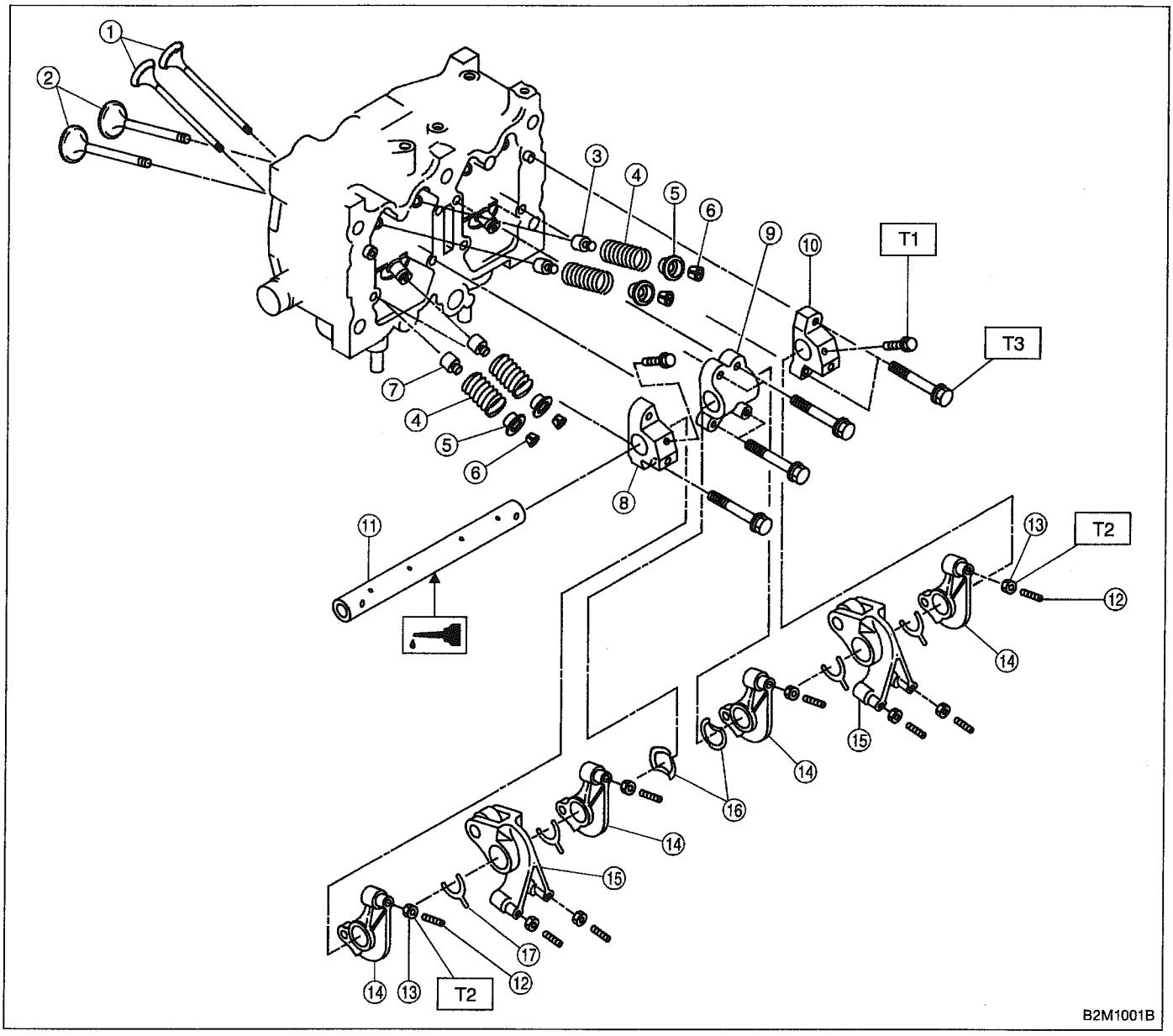
2. Cylinder Head and Camshaft



① Rocker cover (RH)
② Rocker cover gasket
③ Camshaft support (RH)
④ O-ring
⑤ Camshaft (RH)
⑥ Intake valve guide
⑦ Exhaust valve guide
⑧ Oil seal
⑨ Cylinder head (RH)
⑩ Cylinder head gasket
⑪ Cylinder head (LH)
⑫ Plug
⑬ Camshaft (LH)
⑭ O-ring
⑮ Camshaft support (LH)
⑯ Oil seal
⑰ Oil filler cap
⑱ Gasket
⑲ Oil filler pipe
⑳ O-ring
㉑ Rocker gasket
㉒ Rocker cover (LH)

Tightening torque: N·m (kg-m, ft-lb)
T1: <Ref. to 2-3 [W5E1].>
T2: 5±1 (0.5±0.1, 3.7±0.7)
T3: 10 (1.0, 7)
T4: 16 (1.6, 12)

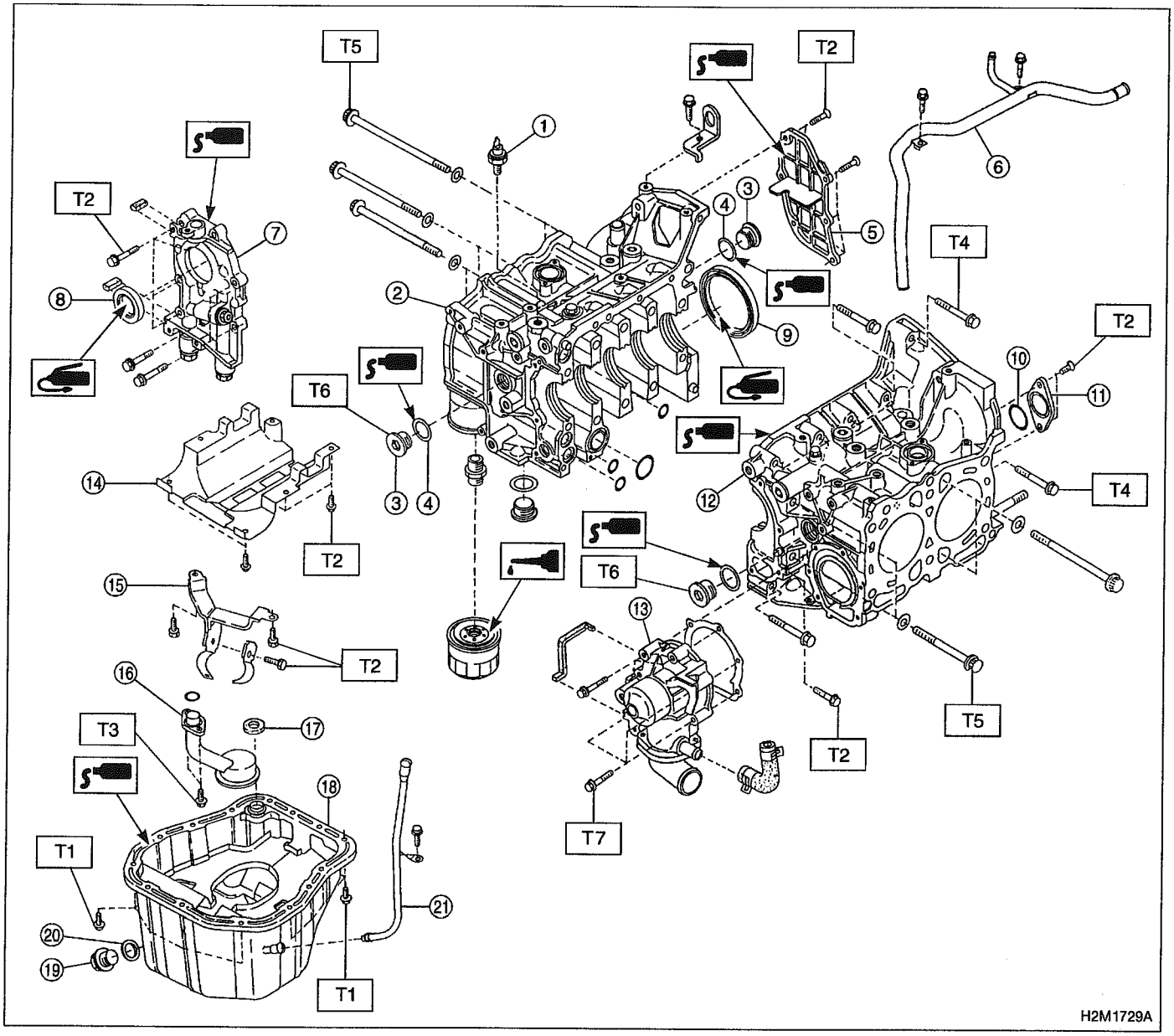
3. Cylinder Head and Valve Assembly



① Exhaust valve
② Intake valve
③ Intake valve oil seal
④ Valve spring
⑤ Retainer
⑥ Retainer key
⑦ Exhaust valve oil seal
⑧ Rocker shaft support
⑨ Rocker shaft support
⑩ Rocker shaft support
⑪ Rocker shaft
⑫ Valve rocker adjust screw
⑬ Valve rocker nut
⑭ Intake valve rocker arm
⑮ Exhaust valve rocker arm
⑯ Spring
⑰ Plate

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 10±1 (1.0±0.1, 7.2±0.7)
T3: 12±1 (1.2±0.1, 8.7±0.7)

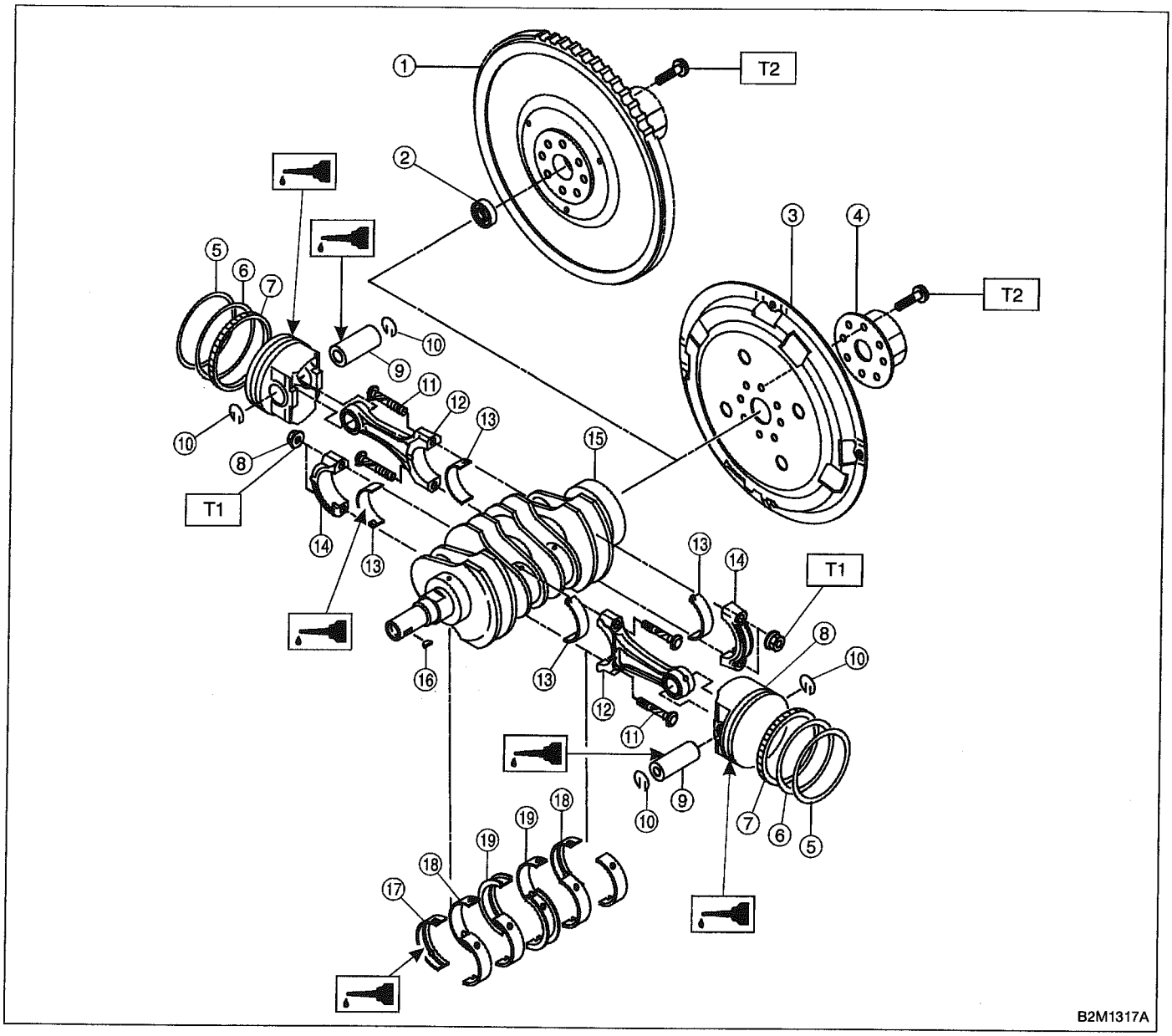
4. Cylinder Block



① Oil pressure switch
② Cylinder block (RH)
③ Service hole plug
④ Gasket
⑤ Oil separator cover
⑥ Water by-pass pipe
⑦ Oil pump
⑧ Front oil seal
⑨ Rear oil seal
⑩ O-ring
⑪ Service hole cover
⑫ Cylinder block (LH)
⑬ Water pump
⑭ Baffle plate
⑮ Oil strainer stay
⑯ Oil strainer
⑰ Gasket
⑱ Oil pan
⑲ Oil drain plug
⑳ Gasket
㉑ Oil filler pipe

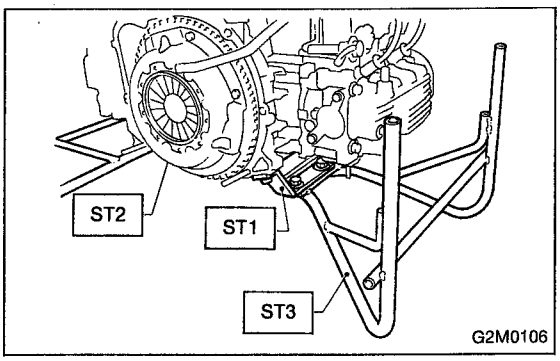
Tightening torque: N·m (kg-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7)
T4: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T5: 47 ± 3 (4.8 ± 0.3, 34.7 ± 2.2)
T6: 69 ± 7 (7.0 ± 0.7, 50.6 ± 5.1)
T7: First 12 ± 2 (1.2 ± 0.2, 8.7 ± 1.4)
Second 12 ± 2 (1.2 ± 0.2, 8.7 ± 1.4)

5. Crankshaft and Piston



① Flywheel (MT vehicles)
② Bell bearing (MT vehicles)
③ Drive plate (AT vehicles)
④ Reinforcement (AT vehicles)
⑤ Top ring
⑥ Second ring
⑦ Oil ring
⑧ Piston
⑨ Piston pin
⑩ Circlip
⑪ Connecting rod bolt
⑫ Connecting rod
⑬ Connecting rod bearing
⑭ Connecting rod cap
⑮ Crankshaft
⑯ Woodruff key
⑰ Crankshaft bearing #1, #5
⑱ Crankshaft bearing #2, #4
⑲ Crankshaft bearing #3

Tightening torque: N·m (kg-m, ft-lb)
T1: 44 ± 2 (4.5 ± 0.2, 32.5 ± 1.4)
T2: 72 ± 3 (7.3 ± 0.3, 52.8 ± 2.2)



1. General Precautions

1) Before disassembling engine, place it on ST3.

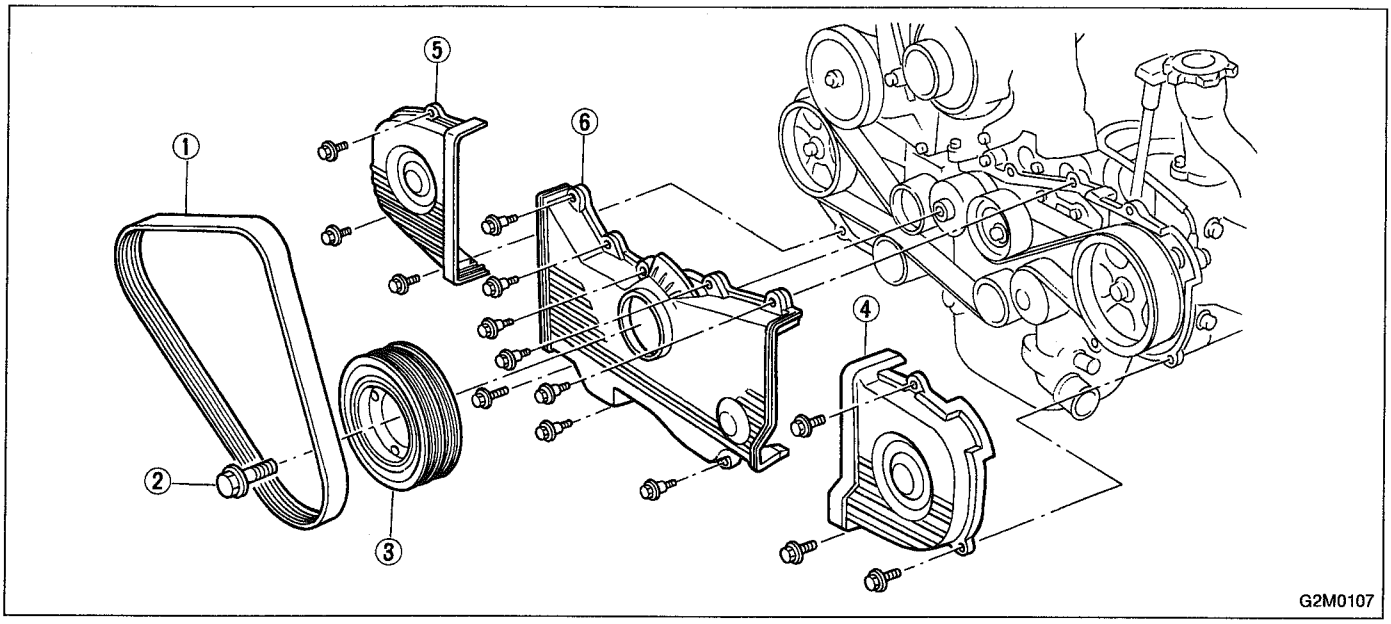
ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817000	ENGINE STAND

2) All parts should be thoroughly cleaned, paying special attention to the engine oil passages, pistons and bearings.
3) Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
4) Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
5) All removed parts, if to be reused, should be reinstalled in the original positions and directions.
6) Gaskets and lock washers must be replaced with new ones. Liquid gasket should be used where specified to prevent leakage.
7) Bolts, nuts and washers should be replaced with new ones as required.
8) Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.

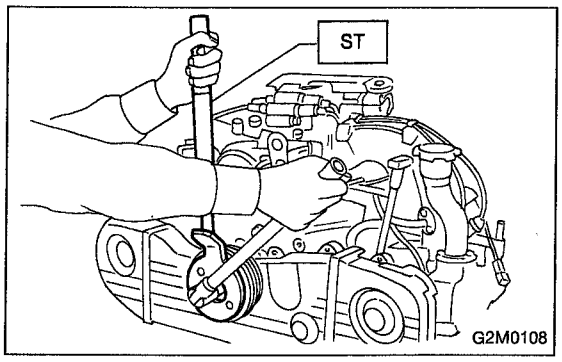
2. Timing Belt

A: REMOVAL

1. CRANKSHAFT PULLEY AND BELT COVER



① V-belt
② Crankshaft pulley bolt
③ Crankshaft pulley
④ Belt cover (LH)
⑤ Belt cover (RH)
⑥ Front belt cover

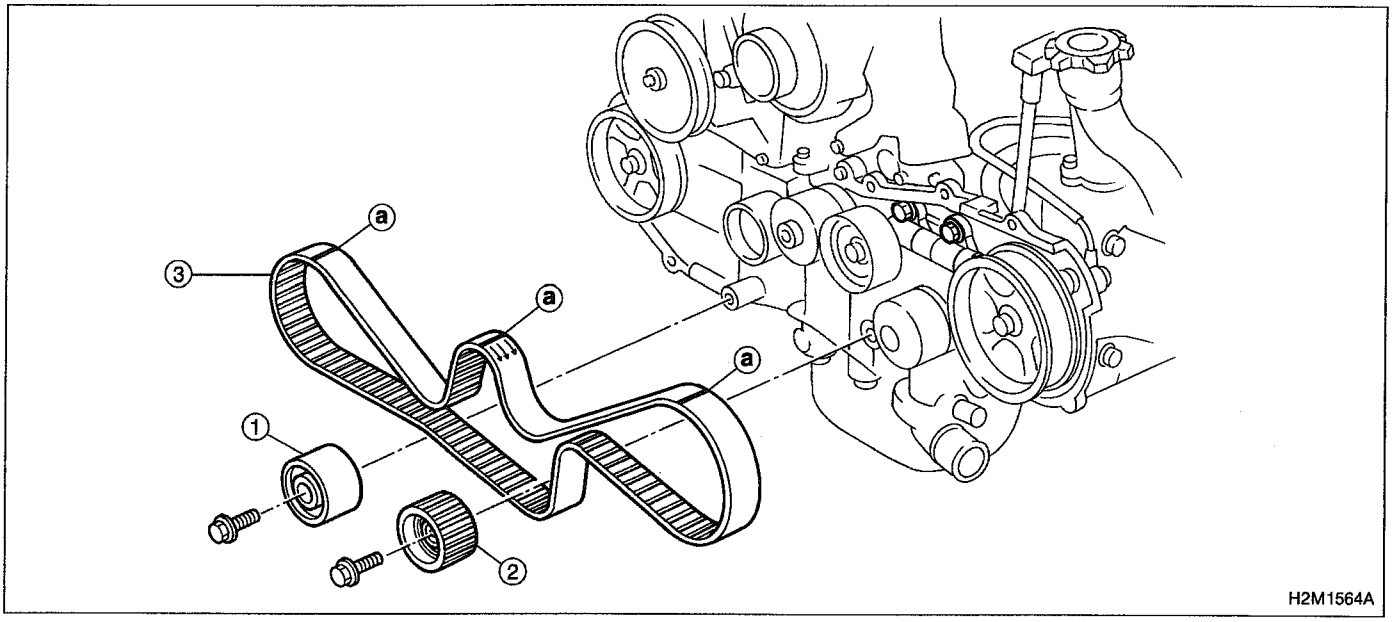


1) Remove V-belt and A/C belt tensioner.
2) Remove crankshaft pulley bolt. To lock crankshaft use ST.

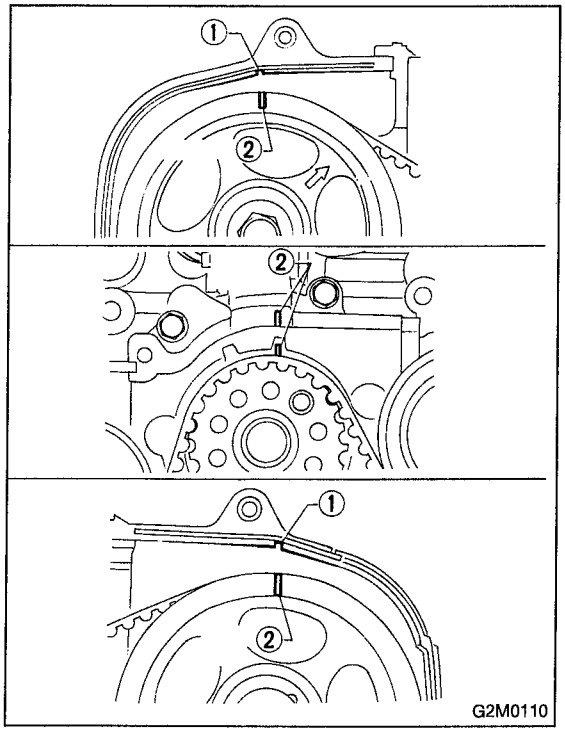
ST 499977000 CRANKSHAFT PULLEY WRENCH

3) Remove crankshaft pulley.
4) Remove belt cover (LH).
5) Remove belt cover (RH).
6) Remove front belt cover.

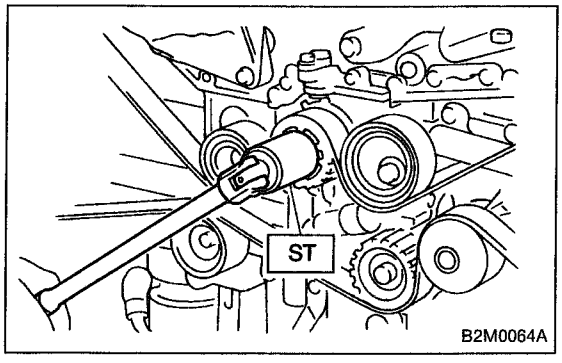
2. TIMING BELT



ⓐ Alignment mark
① Belt idler (No. 2)
② Belt idler No. 2
③ Timing belt

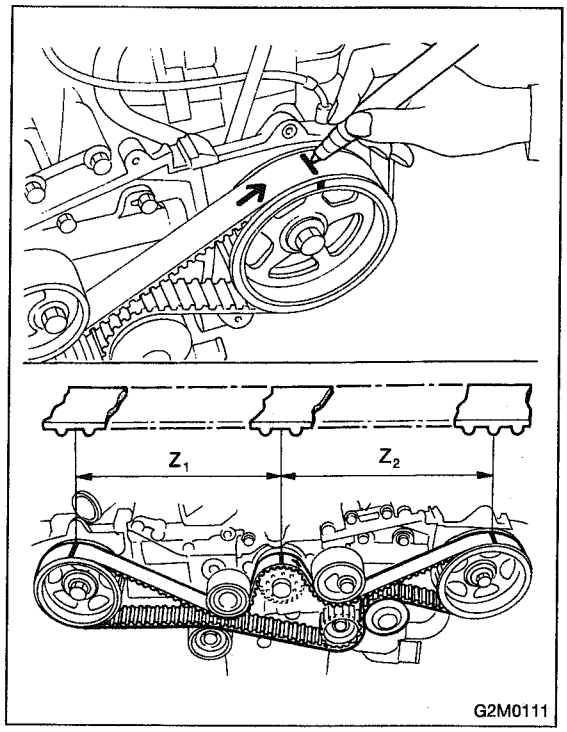


1) If alignment mark ② and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing timing belt as follows:



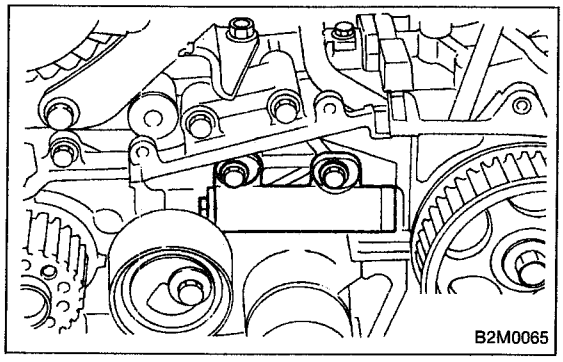
(1) Turn crankshaft, and align alignment marks ② on crankshaft sprocket, and left and right camshaft sprockets with notches ① of belt cover and cylinder block.

ST 499987500 CRANKSHAFT SOCKET



(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the sprockets.

Z_1: 44 tooth length
Z_2: 40.5 tooth length

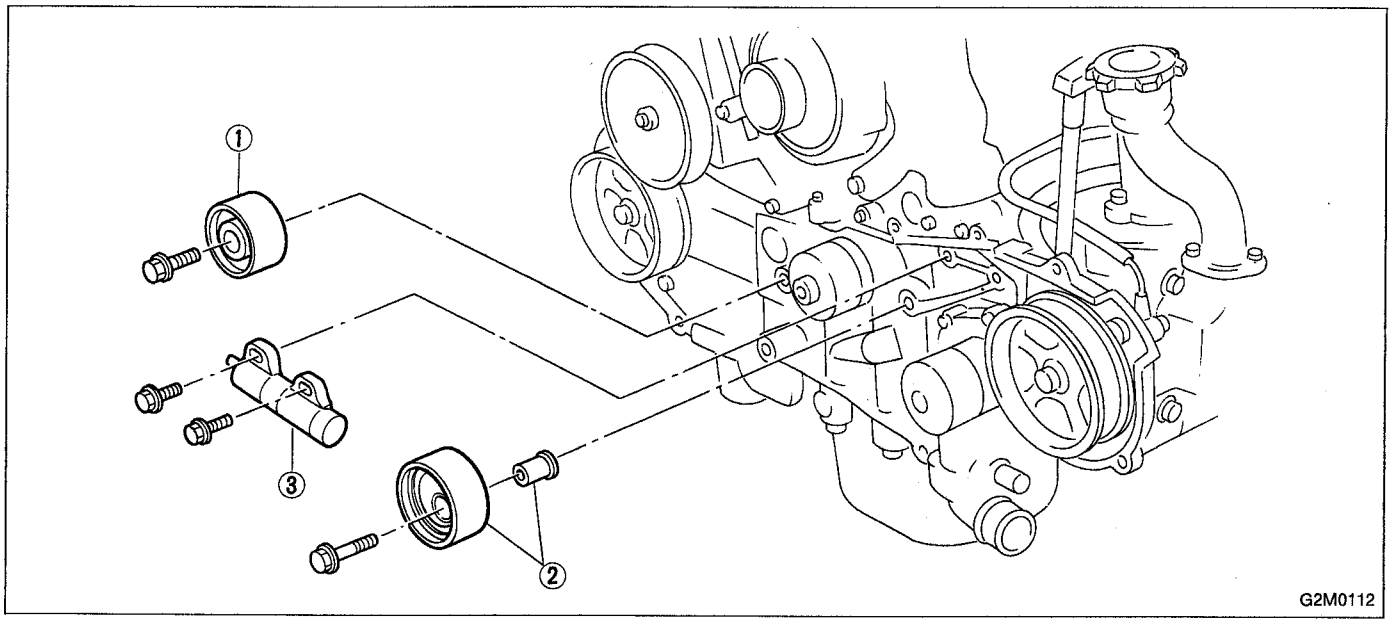


2) Loosen belt tensioner adjuster mounting bolts.

3) Remove belt idler (No. 2).

4) Remove belt idler No. 2.
5) Remove timing belt.

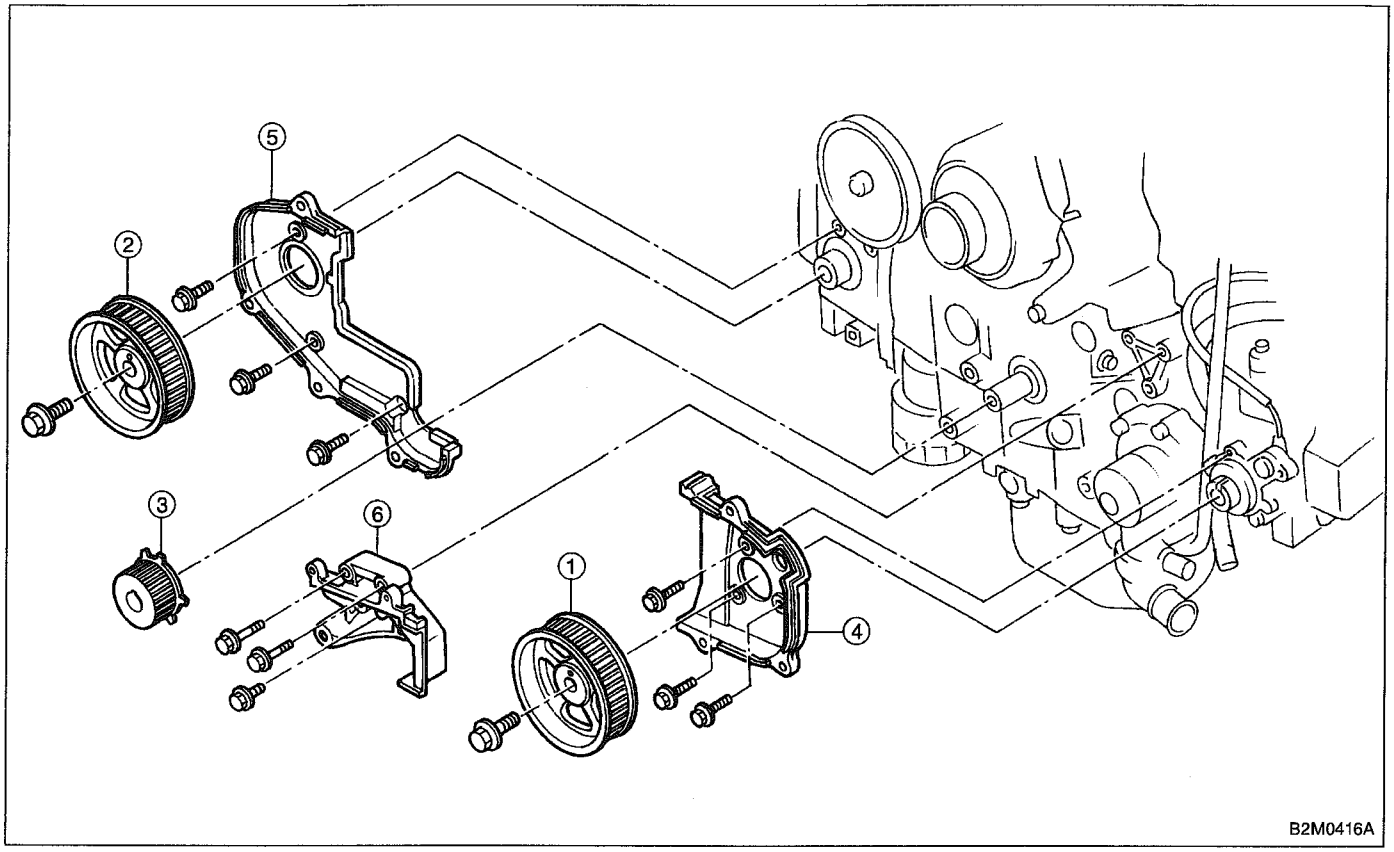
3. BELT TENSIONER AND IDLER



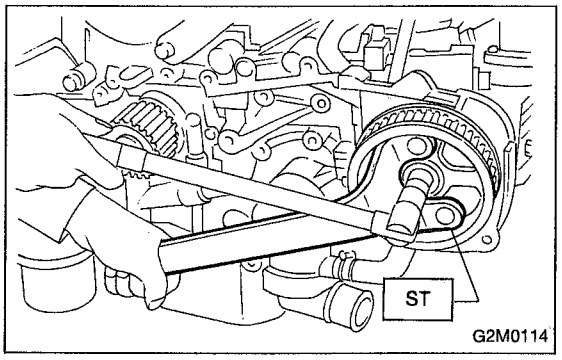
① Belt idler (No. 1)
② Belt tensioner ASSY
③ Belt tensioner adjuster

1) Remove belt idler (No. 1).
2) Remove belt tensioner assembly.
3) Remove belt tensioner adjuster.

4. SPROCKET



① Camshaft sprocket No. 2
② Camshaft sprocket No. 1
③ Crankshaft sprocket
④ Belt cover No. 2 (LH)
⑤ Belt cover No. 2 (RH)
⑥ Tensioner bracket



1) Remove camshaft sprocket No. 2.
2) Remove camshaft sprocket No. 1. To lock camshaft use ST.

ST 499207100 CAMSHAFT SPROCKET WRENCH

3) Remove crankshaft sprocket.
4) Remove belt cover No. 2 (LH).
5) Remove belt cover No. 2 (RH).

CAUTION:
Do not damage or lose the seal rubber when removing belt covers.

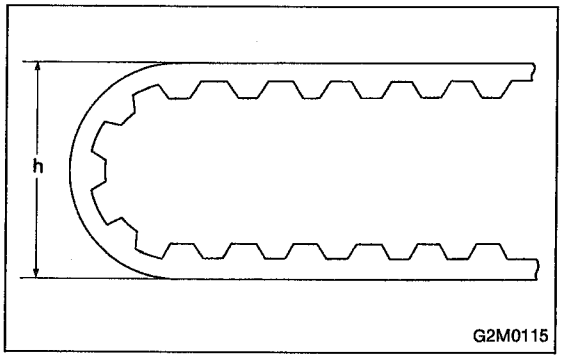
6) Remove tensioner bracket.

B: INSPECTION

1. TIMING BELT

1) Check timing belt teeth for breaks, cracks, and wear. If any fault is found, replace belt.
2) Check the condition of back side of belt; if any crack is found, replace belt.

CAUTION:
• Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.



• Do not bend the belt sharply.
Bending radius: h
60 mm (2.36 in) or more

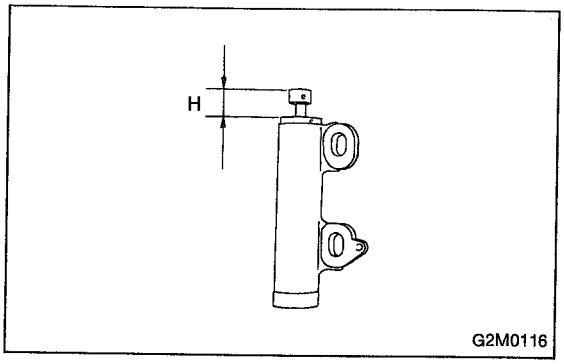
2. BELT TENSIONER ADJUSTER

1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace belt tensioner adjuster.

CAUTION:
Slight traces of oil at rod' oil seal does not indicate a problem.

2) While holding belt tensioner adjuster with both hands, push the rod section against floor or wall ensuring the rod section will react as follows:

(1) When applying a force of 147 N (15 kg, 33 lb), the rod section should not sink.
(2) When applying a force of 147 to 490 N (15 to 50 kg, 33 to 110 lb), the rod section should maintain a projectionally acting force and should not sink within 8.5 seconds.



3) Measure the extension of rod beyond the body. If it is not within specifications, replace with a new one.

Rod extension: H
15.4 — 16.4 mm (0.606 — 0.646 in)

3. BELT TENSIONER

1) Check mating surfaces of timing belt and contact point of belt tensioner adjuster rod for abnormal wear or scratches. Replace belt tensioner if faulty.
2) Check spacer and tensioner bushing for wear.
3) Check belt tensioner for smooth rotation. Replace if noise or excessive play is noted.
4) Check belt tensioner for grease leakage.

4. BELT IDLER

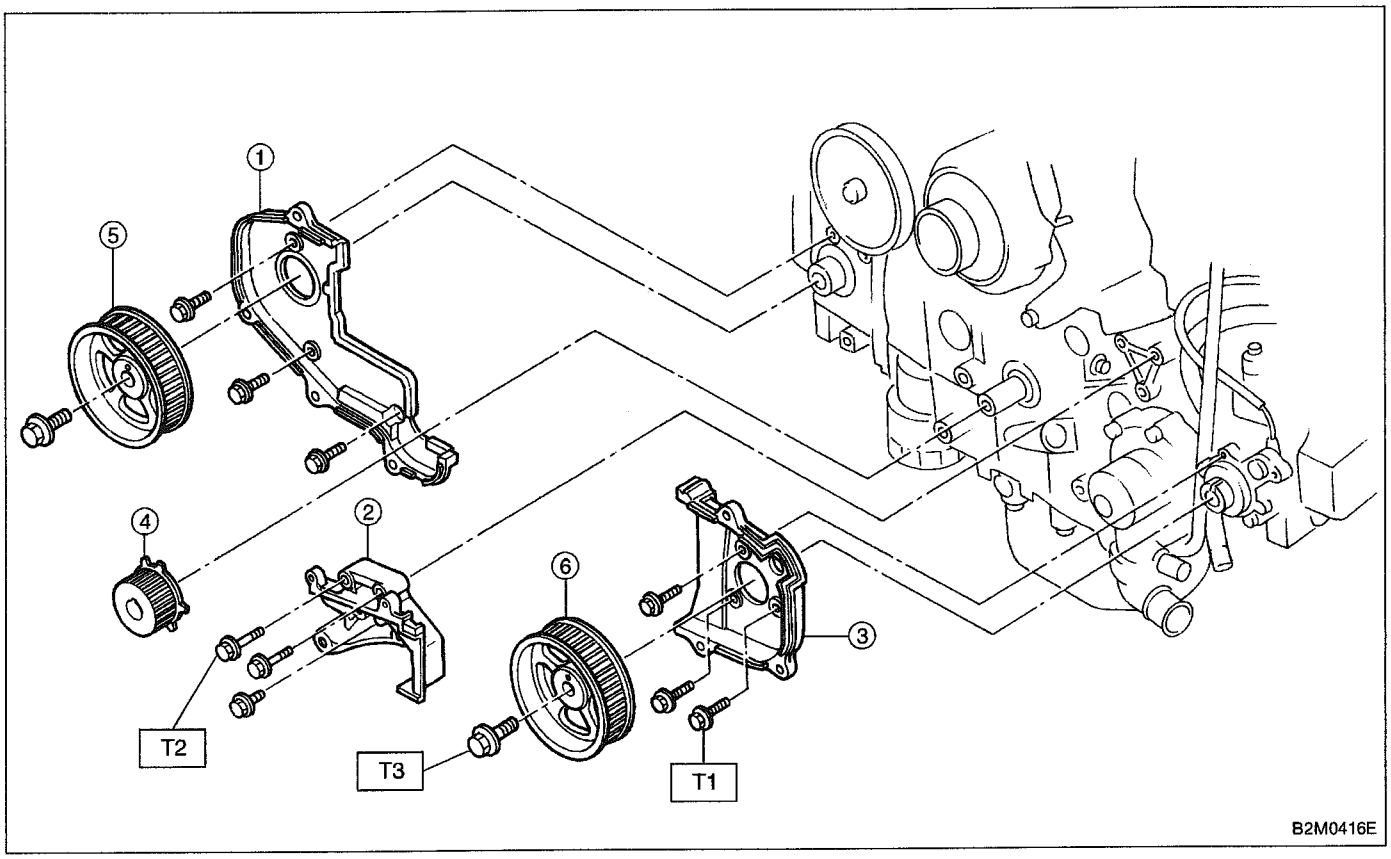
1) Check belt idler for smooth rotation. Replace if noise or excessive play is noted.
2) Check outer contacting surfaces of belt idler for abnormal wear and scratches.
3) Check belt idler for grease leakage.

5. CAMSHAFT AND CRANKSHAFT SPROCKET

1) Check sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between sprocket and key.
3) Check crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

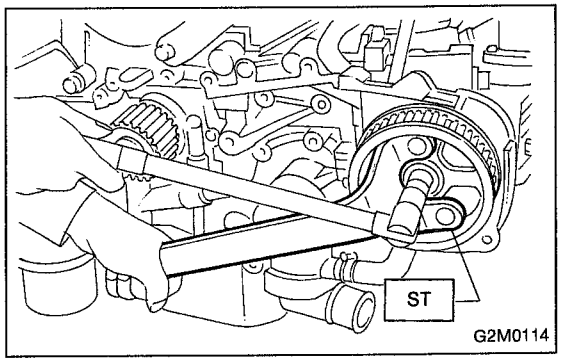
C: INSTALLATION

1. CAMSHAFT AND CRANKSHAFT SPROCKET



① Belt cover No. 2 (RH)
② Tensioner bracket
③ Belt cover No. 2 (LH)
④ Crankshaft pulley
⑤ Camshaft sprocket No. 1
⑥ Camshaft sprocket No. 2

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 25±2 (2.5±0.2, 18.1±1.4)
T3: 78±5 (8.0±0.5, 57.9±3.6)

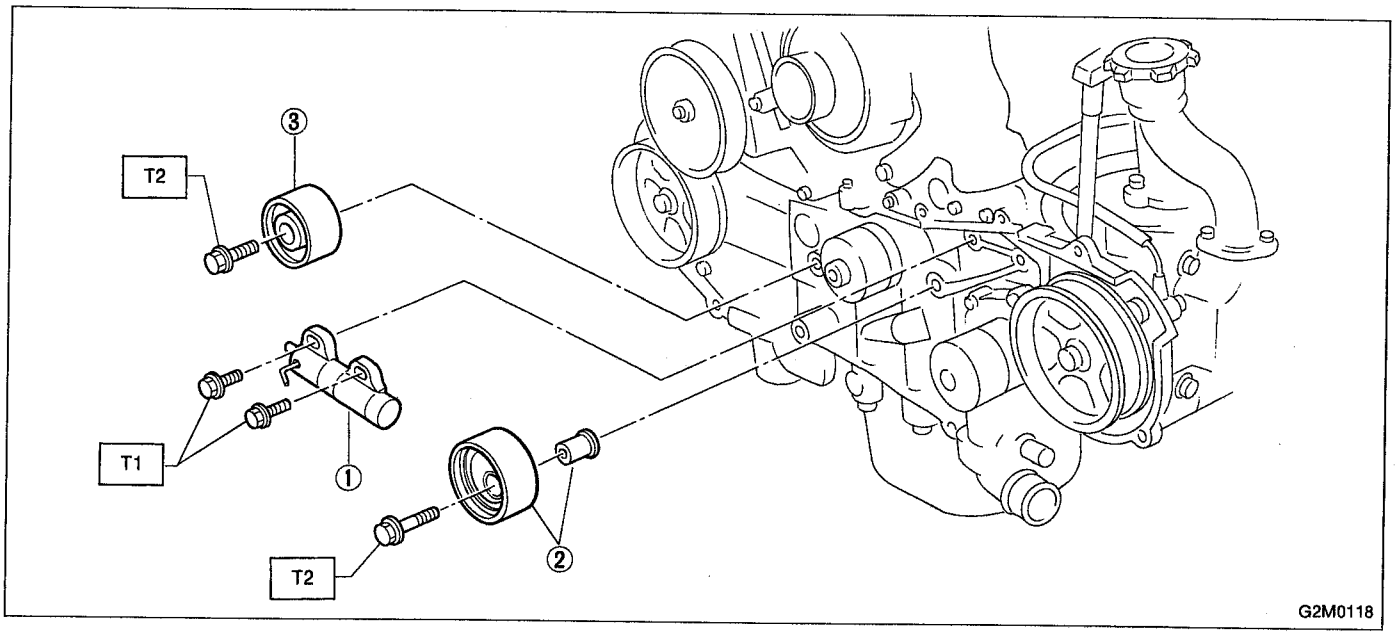


1) Install belt cover No. 2 (RH).
2) Install tensioner bracket.
3) Install belt cover No. 2 (LH).
4) Install crankshaft sprocket.
5) Install camshaft sprocket No. 1 and camshaft sprocket No. 2. To lock camshaft use ST.

ST 499207100 CAMSHAFT SPROCKET WRENCH

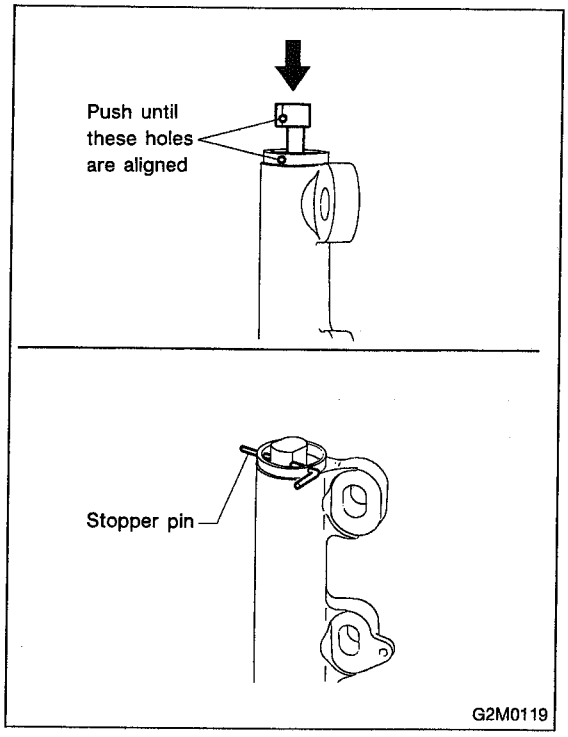
CAUTION:
Do not confuse left and right side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor camshaft position sensor.

2. BELT TENSIONER AND IDLER



① Belt tensioner adjuster
② Belt tesnioner ASSY
③ Belt idler (No. 1)

Tightening torque: N·m (kg-m, ft-lb)
T1: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T2: 39 ± 4 (4.0 ± 0.4, 28.9 ± 2.9)



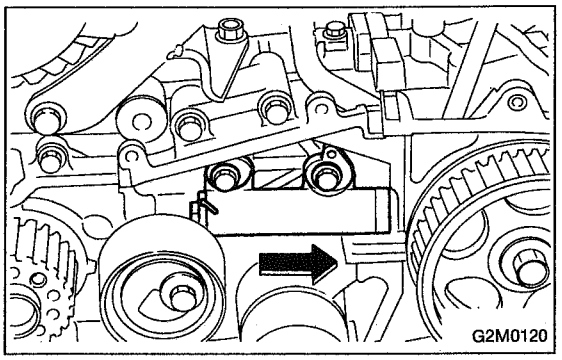
1) Installation of belt tensioner adjuster

(1) Insert stopper pin 1.5 mm (0.059 in) diameter into place while pushing adjuster rod into body using a press.

CAUTION:
- **Do not allow press pressure to exceed 9,807 N (1,000 kg, 2,205 lb).**
- **Do not release press pressure until stopper pin is completely inserted.**
- **Push belt tensioner adjuster rod vertically.**
- **Press-in the push adjuster rod gradually taking three minutes or more.**

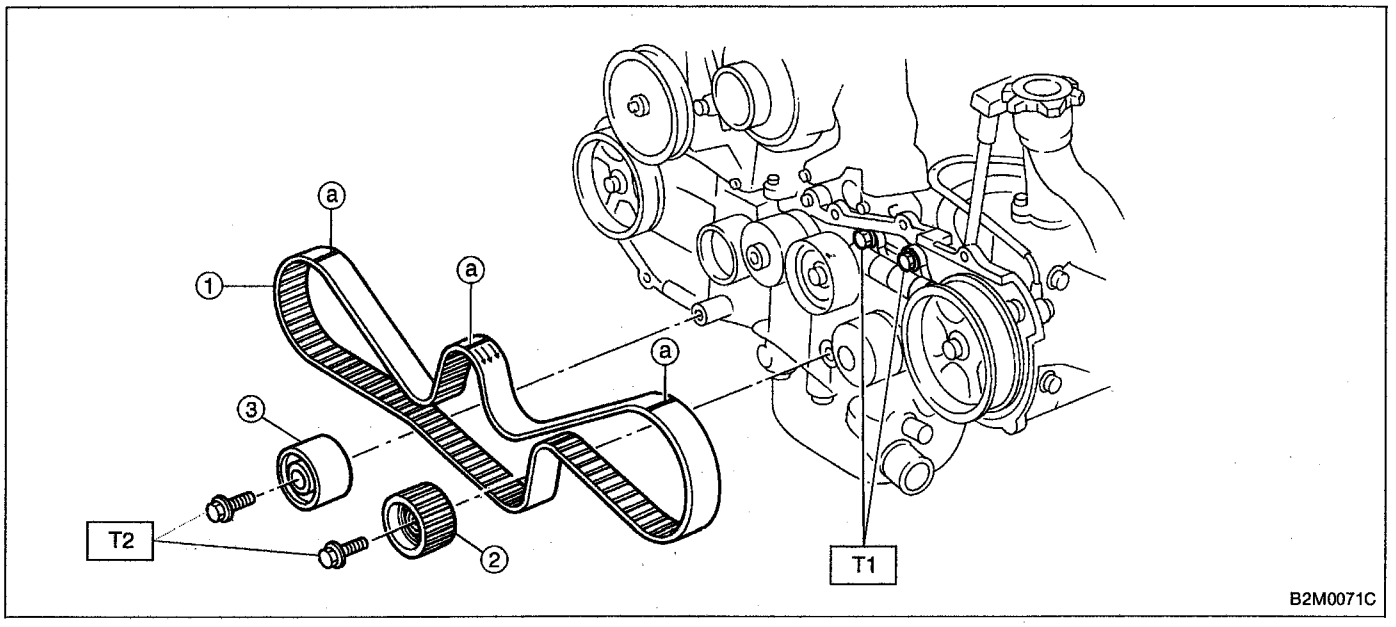
(2) Install belt tensioner adjuster to tensioner bracket.

2) Install belt tensioner assembly.
3) Install belt idler (No. 1).



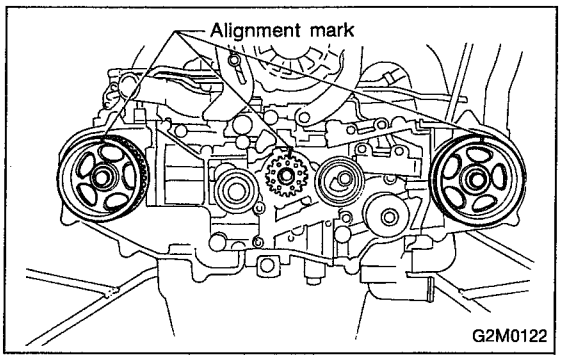
4) Temporarily tighten bolts while belt tensioner adjuster is pushed all the way to the right.

3. TIMING BELT



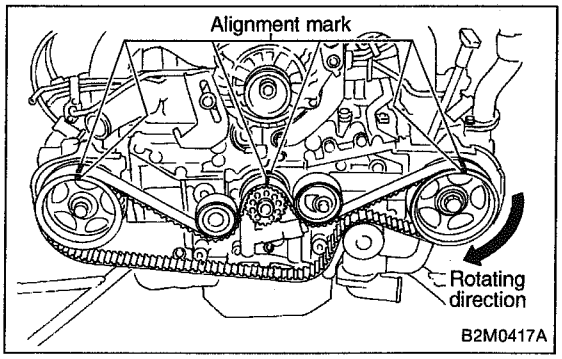
ⓐ Alignment mark
① Timing belt
② Belt idler No. 2
③ Belt idler (No. 2)

'Tightening torque: N·m (kg-m, ft-lb)
T1: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T2: 39 ± 4 (4.0 ± 0.4, 28.9 ± 2.9)



1) Installation of timing belt.
(1) Using ST, turn left and right camshaft sprockets so that their alignment marks come to top positions.

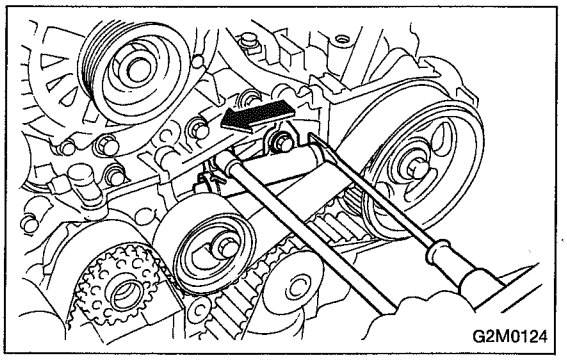
ST 499207100 CAMSHAFT SPROCKET WRENCH



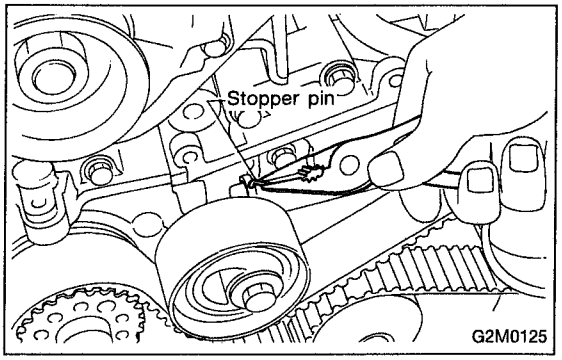
(2) While aligning alignment mark on timing belt with marks on sprockets, position timing belt properly.

CAUTION:
Ensure belt's rotating direction is correct.

2) Install belt idler No. 2.
3) Install belt idler (No. 2).

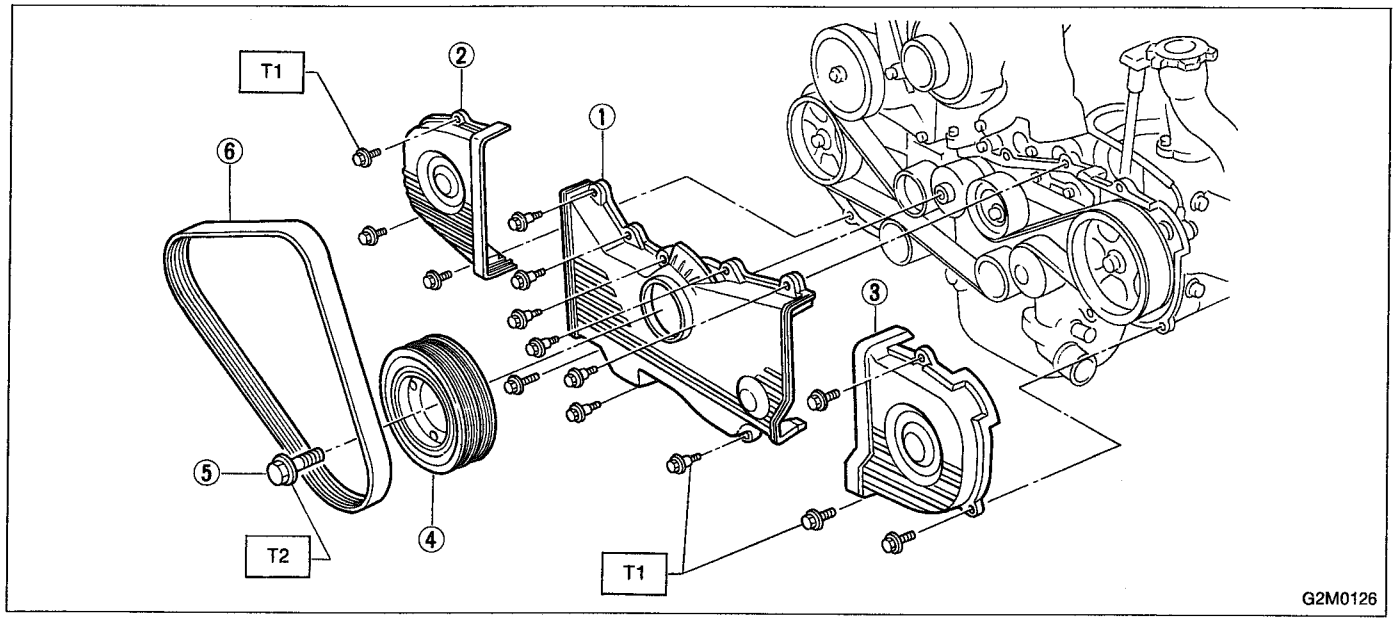


4) Loosen belt tensioner adjuster attaching bolts and move adjuster all the way to the left. Tighten the bolts.



5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove stopper pin from belt tensioner adjuster.

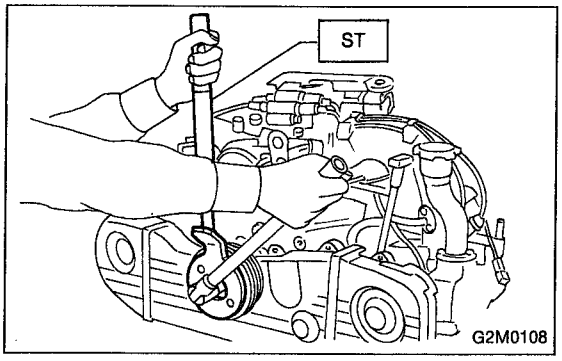
4. CRANKSHAFT PULLEY AND BELT COVER



① Front belt cover
② Belt cover (RH)
③ Belt cover (LH)
④ Crankshaft pulley
⑤ Crankshaft pulley bolt
⑥ V-belt

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 127±10 (13.0±1.0, 94±7)

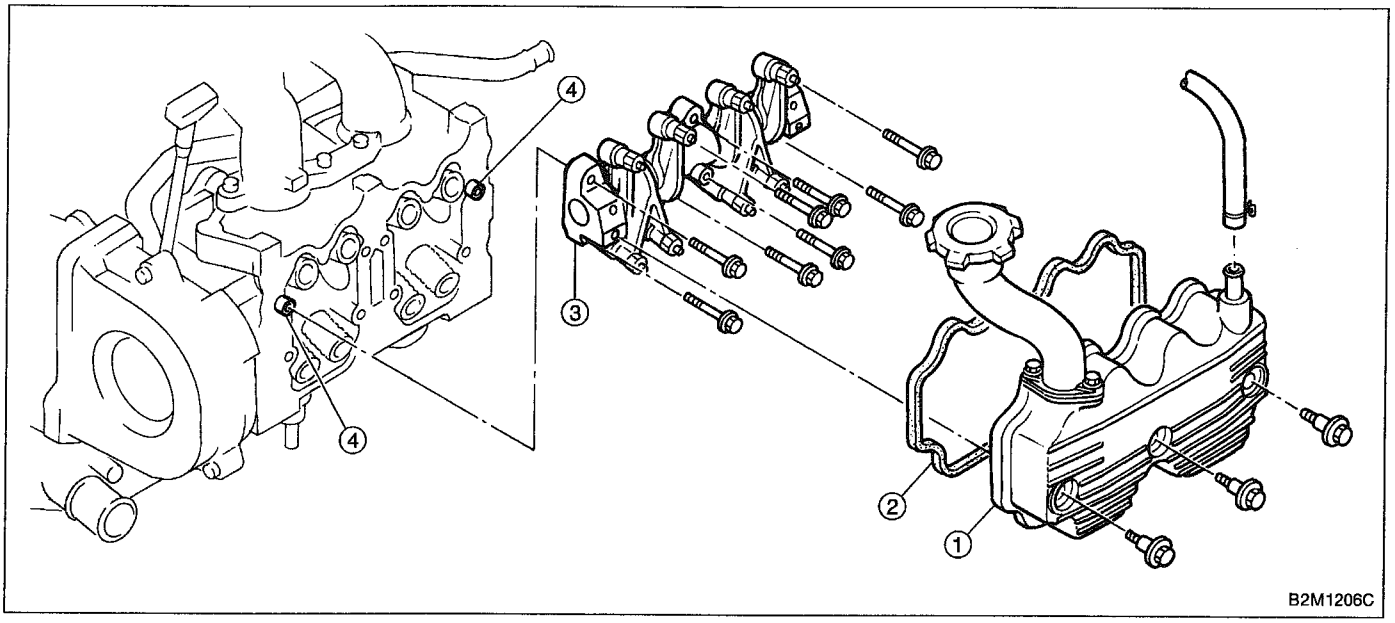
1) Install front belt cover.
2) Install belt cover (RH).
3) Install belt cover (LH).
4) Install crankshaft pulley.



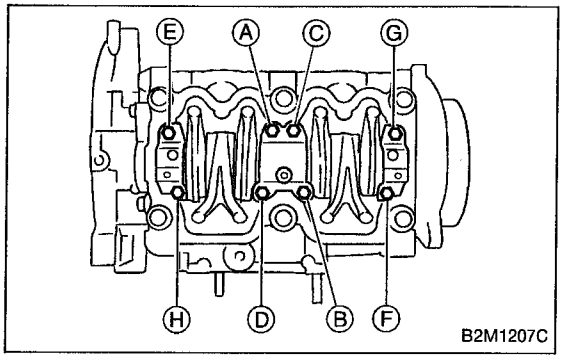
5) Install pulley bolt.
To lock crankshaft, use ST.
ST 499977000 CRANKSHAFT PULLEY WRENCH
6) Install V-belt.

3. Valve Rocker Assembly

A: REMOVAL



① Rocker cover
② Rocker cover gasket
③ Valve rocker ASSY
④ Knock pin

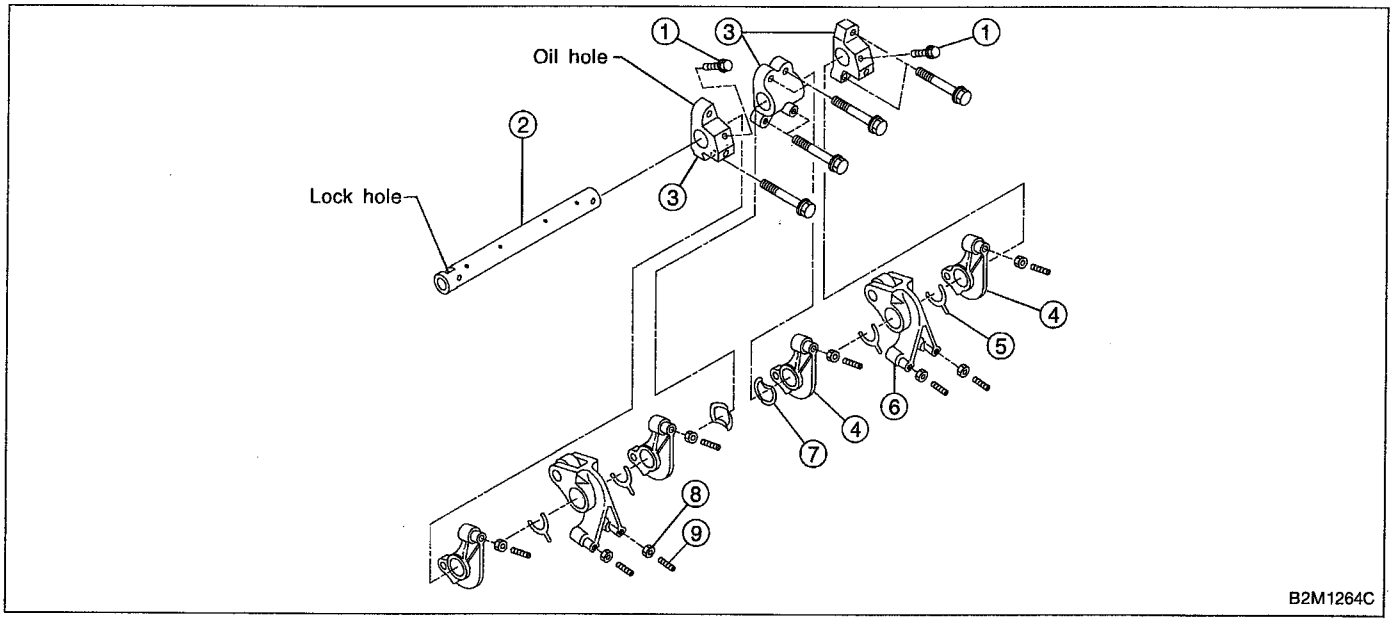


1) Disconnect PCV hose and remove rocker cover.
2) Removal of valve rocker assembly
   (1) Remove bolts Ⓐ through Ⓓ in alphabetical sequence.

CAUTION:
Leave two or three threads of bolt Ⓐ engaged to retain valve rocker assembly.

   (2) Equally loosen bolts Ⓔ through Ⓗ all the way, being careful that knock pin is not gouged.
   (3) Remove valve rocker assembly.

B: DISASSEMBLY



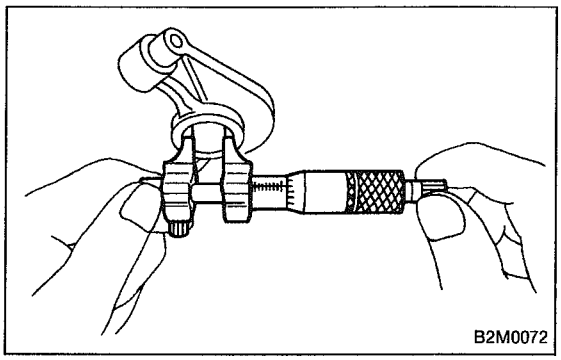
① Bolt
② Rocker shaft
③ Rocker shaft support
④ Intake valve rocker arm
⑤ Plate
⑥ Exhaust valve rocker arm
⑦ Spring
⑧ Valve rocker nut
⑨ Valve rocker adjust screw

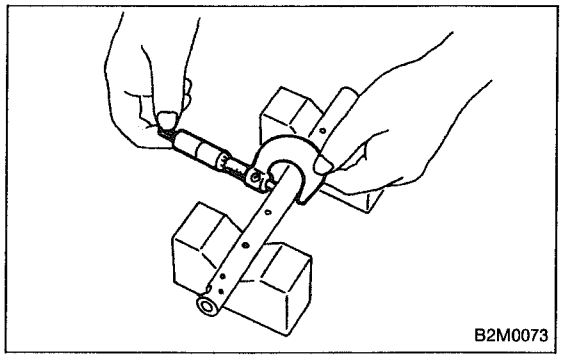
1) Remove bolts which secure rocker shaft.
2) Extract rocker shaft. Remove valve rocker arms, plates, springs and shaft supports from rocker shaft.

CAUTION:
Arrange all removed parts in order so that they can be installed in their original positions.

3) Loosen valve rocker nut, and then remove valve rocker adjust screw and nut from valve rocker arm.

CAUTION:
Do not remove valve rocker adjust screw and valve rocker nut unless necessary.


B2M0072


B2M0073

C: INSPECTION

1. VALVE ROCKER ARM

1) Measure inside diameter of valve rocker arm and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between arm and shaft:
Standard
0.020 — 0.054 mm (0.0008 — 0.0021 in)
Limit
0.10 mm (0.0039 in)

If oil clearance exceeds specifications, replace valve rocker arm or shaft.

NOTE:
Replace valve rocker arm or shaft, whichever shows greater amount of wear.

Rocker arm inside diameter:
22.020 — 22.041 mm (0.8669 — 0.8678 in)
Rocker shaft diameter:
21.987 — 22.000 mm (0.8656 — 0.8661 in)

2) Measure inside diameter of rocker shaft support and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between support and shaft:
Standard
0.005 — 0.039 mm (0.0002 — 0.0015 in)
Limit
0.05 mm (0.0020 in)

If oil clearance exceeds specifications, replace rocker shaft support or shaft.

NOTE:
Replace rocker shaft support or shaft, whichever shows greater amount of wear.

Rocker shaft support inside diameter:
22.005 — 22.026 mm (0.8663 — 0.8672 in)
Rocker shaft diameter:
21.987 — 22.000 mm (0.8656 — 0.8661 in)

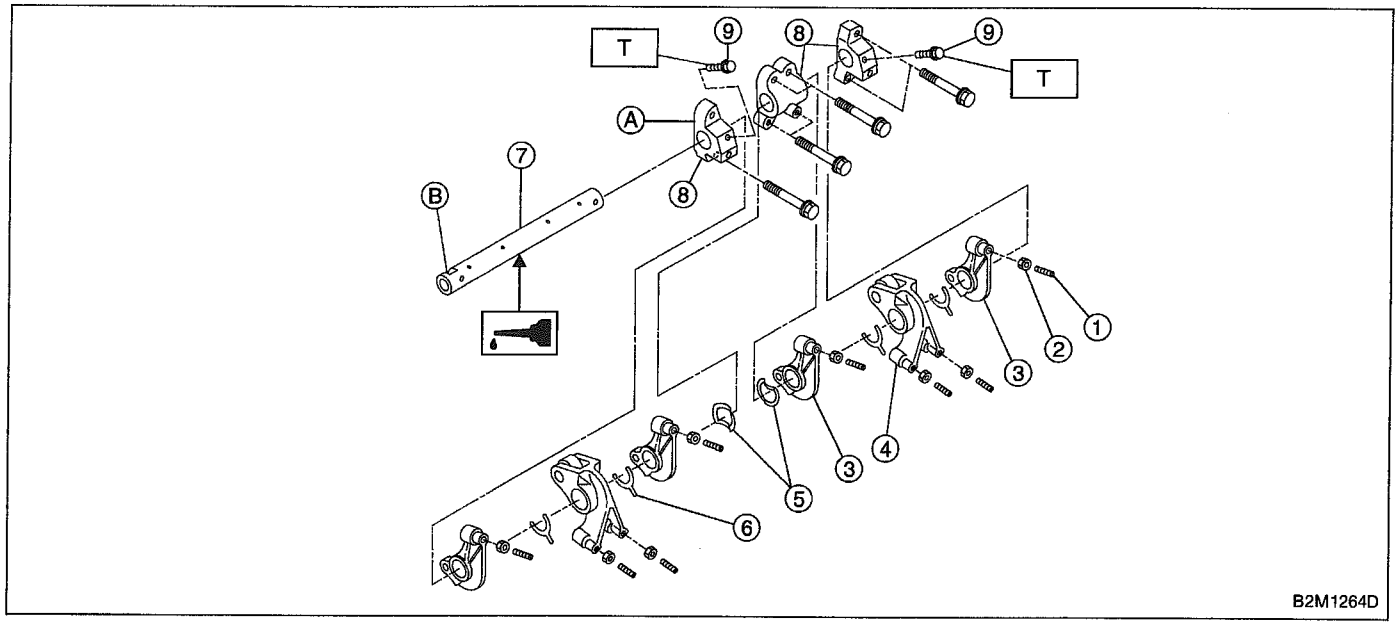
3) If cam or valve contact surface of valve rocker arm is worn or dented excessively, replace valve rocker arm.
4), Check that valve rocker arm roller rotates smoothly. If not, replace valve rocker arm.

2. VALVE ROCKER SHAFT

Visually check oil relief valve of shaft end for any of the following abnormalities.
- Breaks in check ball body
- Foreign particles caught in valve spring
- Oil leaks at check ball

CAUTION:
Repair or replace valve rocker shaft as necessary.

D: ASSEMBLY



① Valve rocker adjust screw
② Valve rocker nut
③ Intake valve rocker arm
④ Exhaust valve rocker arm
⑤ Spring
⑥ Plate
⑦ Rocker shaft
⑧ Rocker shaft support
⑨ Bolt
Ⓐ Oil hole
Ⓑ Lock hole

Tightening torque: N·m (kg-m, ft-lb)
T: 5±1 (0.5±0.1, 3.6±0.7)

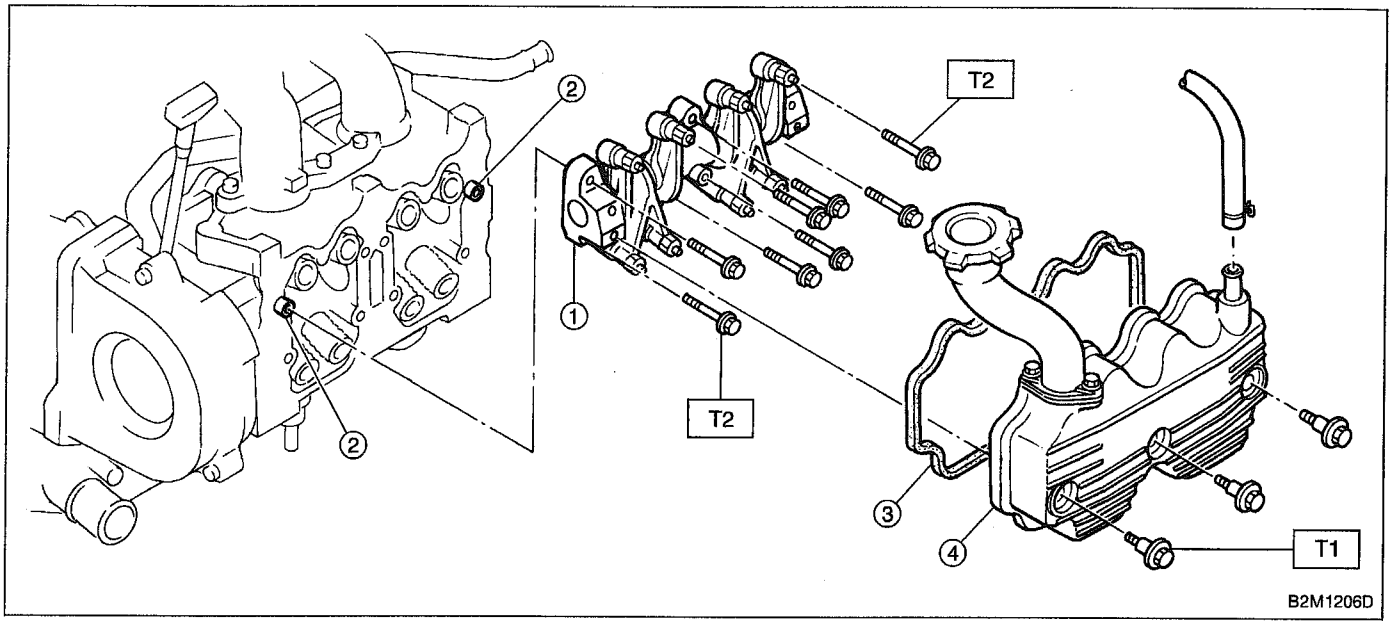
1) Install valve rocker adjust screw and valve rocker nut to valve rocker arm, and loosely tighten nut.

2) Arrange valve rocker arms, plates, springs and rocker shaft supports in assembly order and insert valve rocker shaft. Ensure that cutout portion of rocker shaft faces oil holes Ⓐ in rocker shaft supports.

CAUTION:
Valve rocker arms, rocker shaft and rocker shaft supports have identification marks. Ensure parts with same markings are properly assembled.

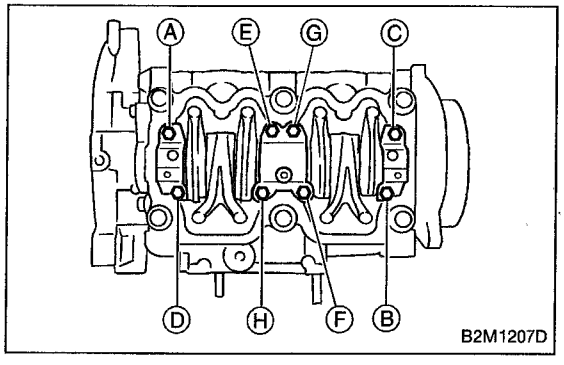
3) Install valve rocker shaft securing bolts while aligning shaft "lock" holes Ⓑ with bolts.

E: INSTALLATION



① Valve rocker ASSY
② Knock pin
③ Rocker cover gasket
④ Rocker cover

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 12±1 (1.2±0.1, 8.7±0.7)



1) Installation of valve rocker assembly
   (1) Temporarily tighten bolts Ⓐ through Ⓓ equally as shown in Figure.

CAUTION:
Do not allow valve rocker assembly to gouge knock pins.

   (2) Tighten bolts Ⓔ through Ⓗ to specified torque.
   (3) Tighten bolts Ⓐ through Ⓓ to specified torque.

Tightening torque:
12±1 N·m (1.2±0.1 kg-m, 8.7±0.7 ft-lb)

2) Adjust the valve clearances. <Ref. to 2-2 [07B1].>
3) Install rocker cover and connect PCV hose.

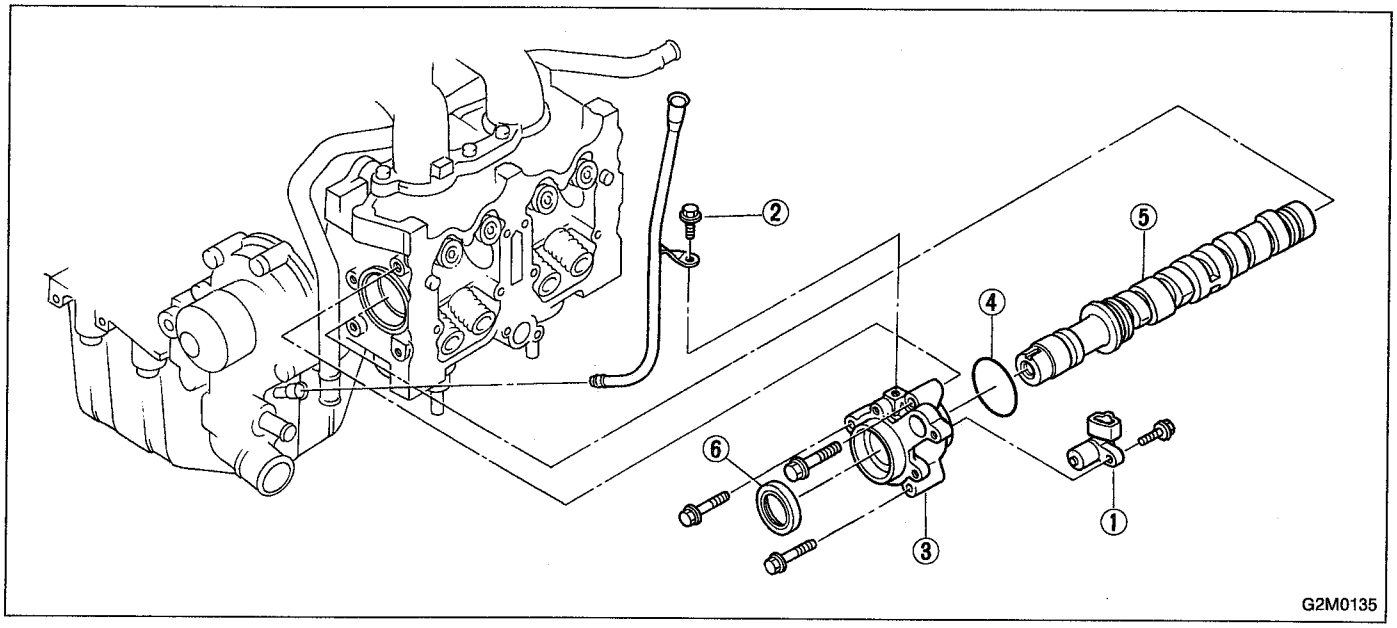
4. Camshaft

A: REMOVAL

1. RELATED PARTS

1) Remove timing belt, camshaft sprockets and related parts.
<Ref. to 2-3 [W2A0].>
2) Remove valve rocker assembly.
<Ref. to 2-3 [W3A0].>

2. CAMSHAFT (LH)



① Camshaft position sensor
② Bolt
③ Camshaft support (LH)
④ O-ring
⑤ Camshaft (LH)
⑥ Oil seal

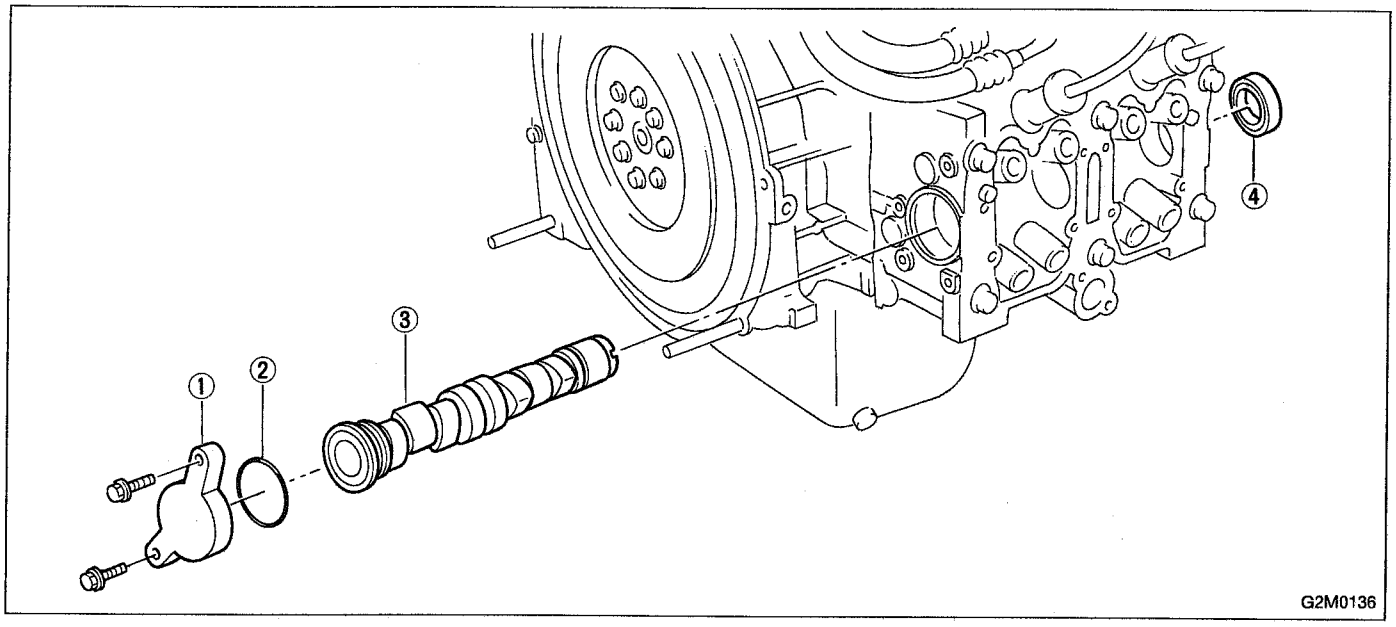
1) Remove camshaft position sensor.

CAUTION:
Do not damage the camshaft position sensor.

2) Remove oil level gauge guide attaching bolt.
3) Remove camshaft support (LH).
4) Remove O-ring.
5) Remove camshaft (LH).
6) Remove oil seal.

CAUTION:
- **Do not remove oil seal unless necessary.**
- **Do not scratch journal surface when removing oil seal.**

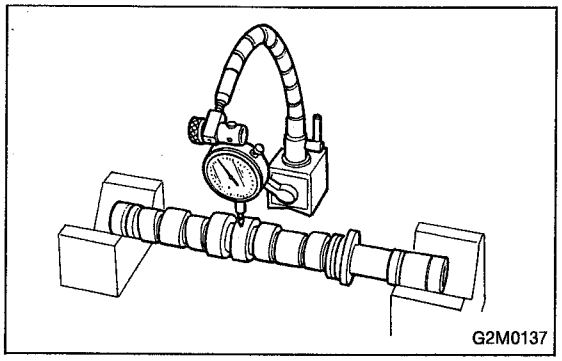
3. CAMSHAFT (RH)



① Camshaft support (RH)
② O-ring
③ Camshaft (RH)
④ Oil seal

1) Remove camshaft support (RH).
2) Remove O-ring.
3) Remove camshaft (RH).
4) Remove oil seal.

CAUTION:
- **Do not remove oil seal unless necessary.**
- **Do not scratch journal surface when removing oil seal.**


G2M0137

B: INSPECTION

1. CAMSHAFT

1) Measure the bend, and repair or replace if necessary.

Limit:

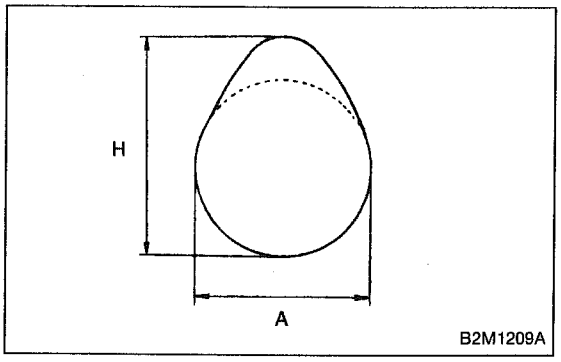
0.025 mm (0.0010 in)

2) Check journal for damage and wear. Replace if faulty.

3) Measure outside diameter of camshaft journal and inside diameter of cylinder head journal, and determine the difference between the two (= oil clearance). If oil clearance exceeds specifications, replace camshaft or cylinder head as necessary.

Unit: mm (in)

Item				
	Right-hand camshaft	Front	Center	Rear
	Left-hand camshaft	Rear	Center	Front
Clearance at journal	Standard	0.055 — 0.090 (0.0022 — 0.0035)		
	Limit	0.10 (0.0039)		
Camshaft journal O.D.		31.935 — 31.950 (1.2573 — 1.2579)	37.435 — 37.450 (1.4738 — 1.4744)	37.935 — 37.950 (1.4935 — 1.4941)
Journal hole I.D.		32.005 — 32.025 (1.2600 — 1.2608)	37.505 — 37.525 (1.4766 — 1.4774)	38.005 — 38.025 (1.4963 — 1.4970)



B2M1209A

4) Check cam face condition; remove minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

Cam height: H

Standard

IN: 32.244 — 32.344 mm (1.2694 — 1.2734 in)

EX: 31.964 — 32.064 mm (1.2584 — 1.2624 in)

Limit

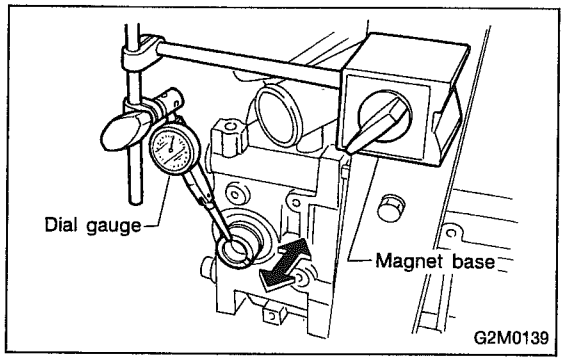
IN: 32.094 mm (1.2635 in)

EX: 31.814 mm (1.2525 in)

Cam base circle diameter A:

IN: 27.5 mm (1.083 in)

EX: 27.0 mm (1.063 in)



2. CAMSHAFT SUPPORT

Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace camshaft support.

Standard:

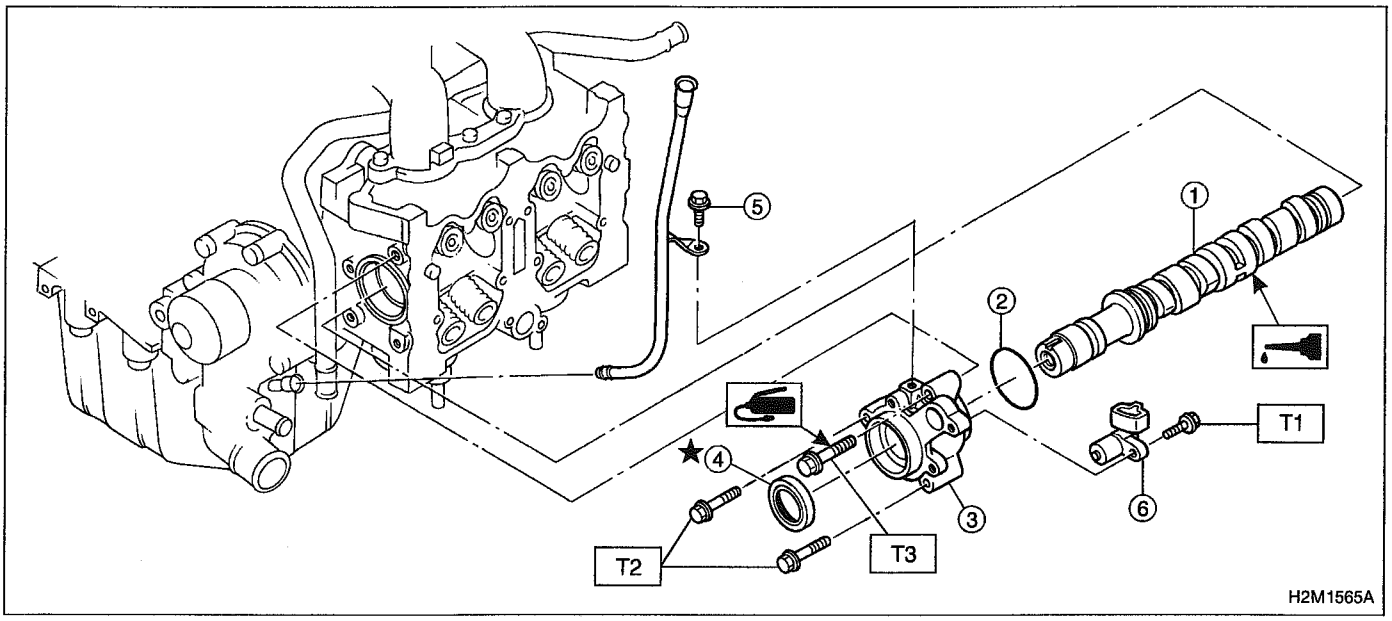
0.030 — 0.260 mm (0.0012 — 0.0102 in)

Limit:

0.35 mm (0.0138 in)

C: INSTALLATION

1. CAMSHAFT (LH)



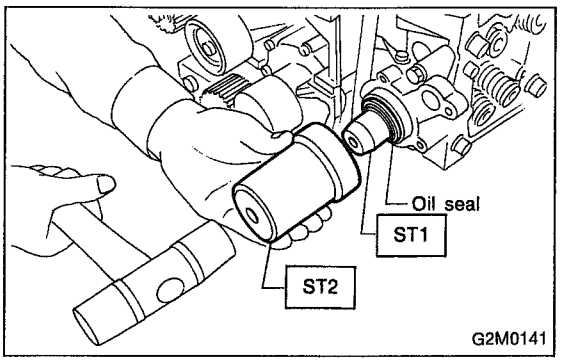
① Camshaft (LH)
② O-ring
③ Camshaft support (LH)
④ Oil seal
⑤ Bolt
★: Replacement part

Tightening torque: N·m (kg-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 10 (1.0, 7)
T3: 16 (1.6, 12)

1) Apply a coat of engine oil to camshaft journals and install camshaft (LH).
2) Apply a coat of engine oil or grease to O-ring.
3) Install O-ring to camshaft support (LH).

CAUTION:
Use a new O-ring.

4) Install camshaft support (LH).



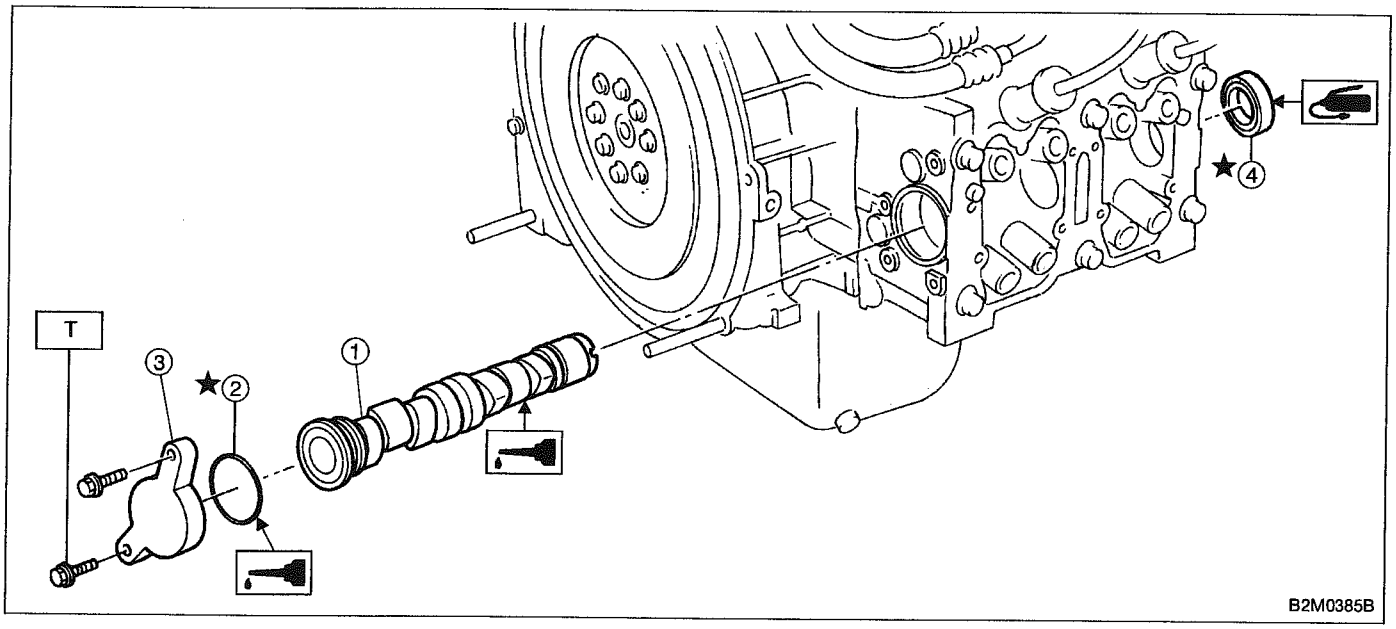
5) Apply a coat of grease to oil seal lips and install oil seal on camshaft support (LH) by using ST1 and ST2.

CAUTION:
Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE
ST2 499587100 OIL SEAL INSTALLER

6) Install oil level gauge guide bolt.
7) Install camshaft position sensor.

2. CAMSHAFT (RH)



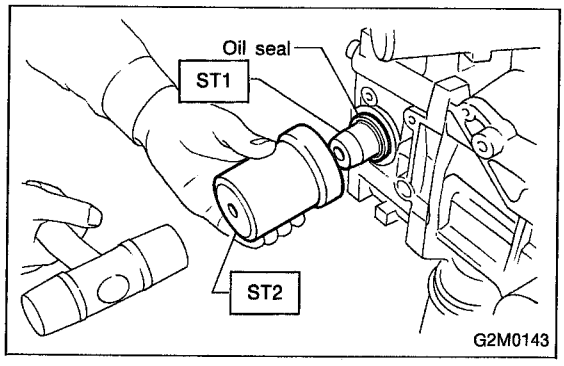
① Camshaft (RH)
② O-ring
③ Camshaft support (RH)
④ Oil seal
★: Replacement part

Tightening torque: N·m (kg-m, ft-lb)
T: 16 (1.6, 1.2)

1) Apply a coat of engine oil to camshaft journals and install camshaft (RH).
2) Apply a coat of engine oil or grease to O-ring.
3) Install O-ring to camshaft support (RH).

CAUTION:
Use a new O-ring.

4) Install camshaft support (RH).



5) Install oil seal by using ST1 and ST2.

CAUTION:
Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE
ST2 499587100 OIL SEAL INSTALLER

3. RELATED PARTS

1) Install valve rocker assembly.
<Ref. to 2-3 [W3E0].>
2) Install timing belt, camshaft sprockets and related parts. <Ref. to 2-3 [W2C0].>

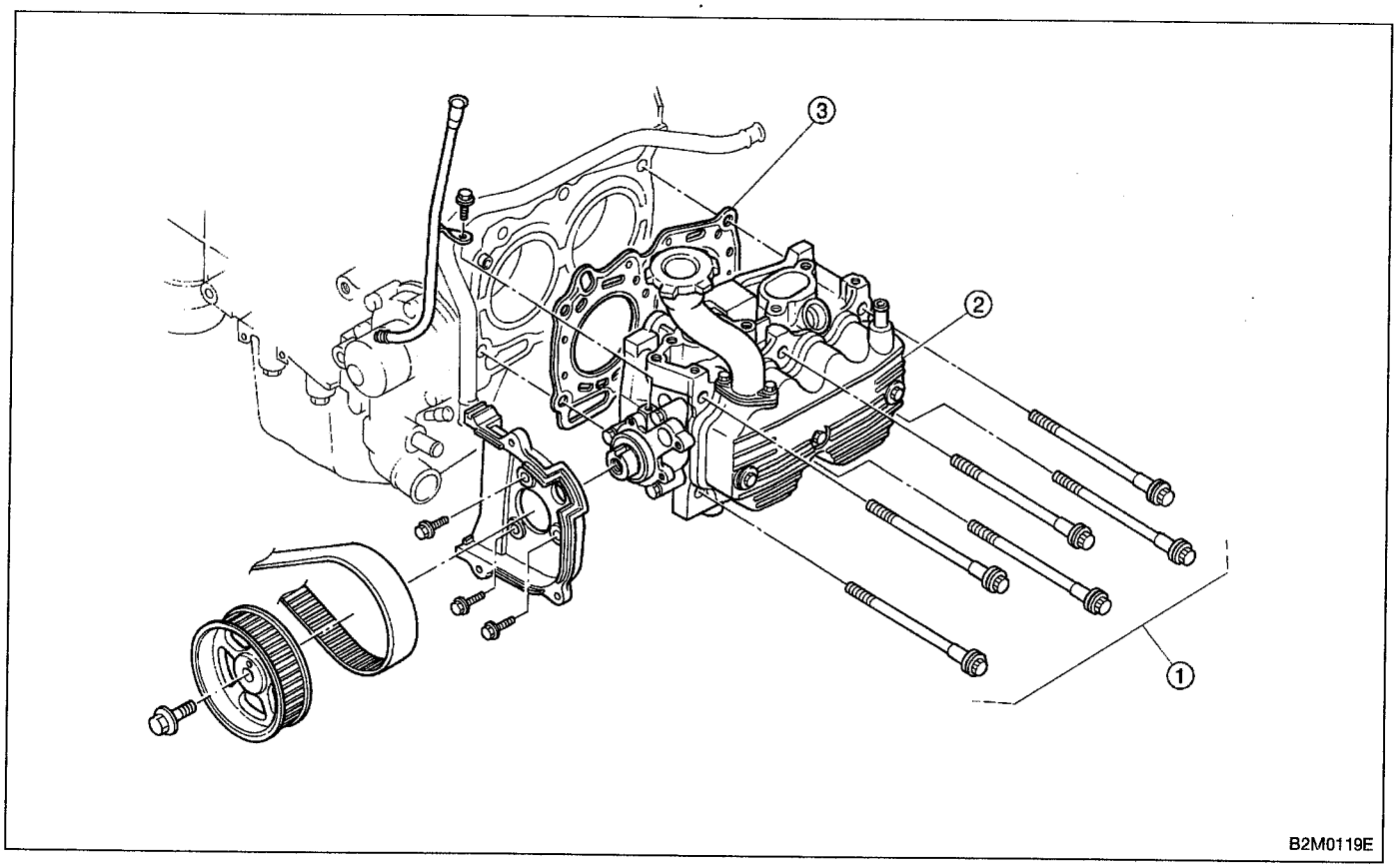
5. Cylinder Head

A: REMOVAL

1. RELATED PARTS

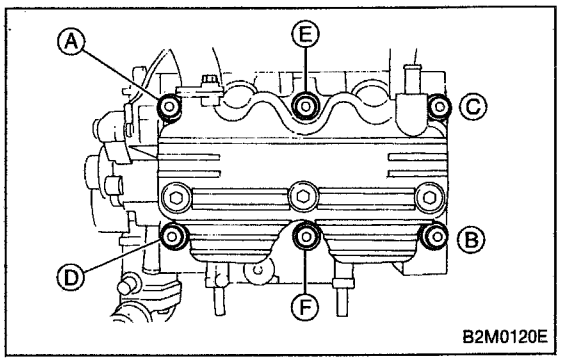
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Drain engine coolant. <Ref. to 2-5 [W1A0].>
3) Remove V-belt.
4) Remove alternator and bracket.
5) Disconnect spark plug cords.
6) Remove connector bracket attaching bolt.
7) Remove crankshaft position sensor and camshaft position sensor.
8) Disconnect oil pressure switch connector.
9) Disconnect blow-by hose.
10) Remove EGR pipe. (AT vehicles only)
11) Remove intake manifold and gasket. <Ref. to 2-7 [W4A0].>
12) Remove water pipe.

2. CYLINDER HEAD



① Cylinder head bolt
② Cylinder head
③ Cylinder head gasket

1) Remove timing belt, camshaft sprocket and related parts.
<Ref. to 2-3 [W2A0].>
2) Remove oil level gauge guide attaching bolt (left hand only) and oil level gauge guide.



3) Remove cylinder head bolts in alphabetical sequence shown in Figure.

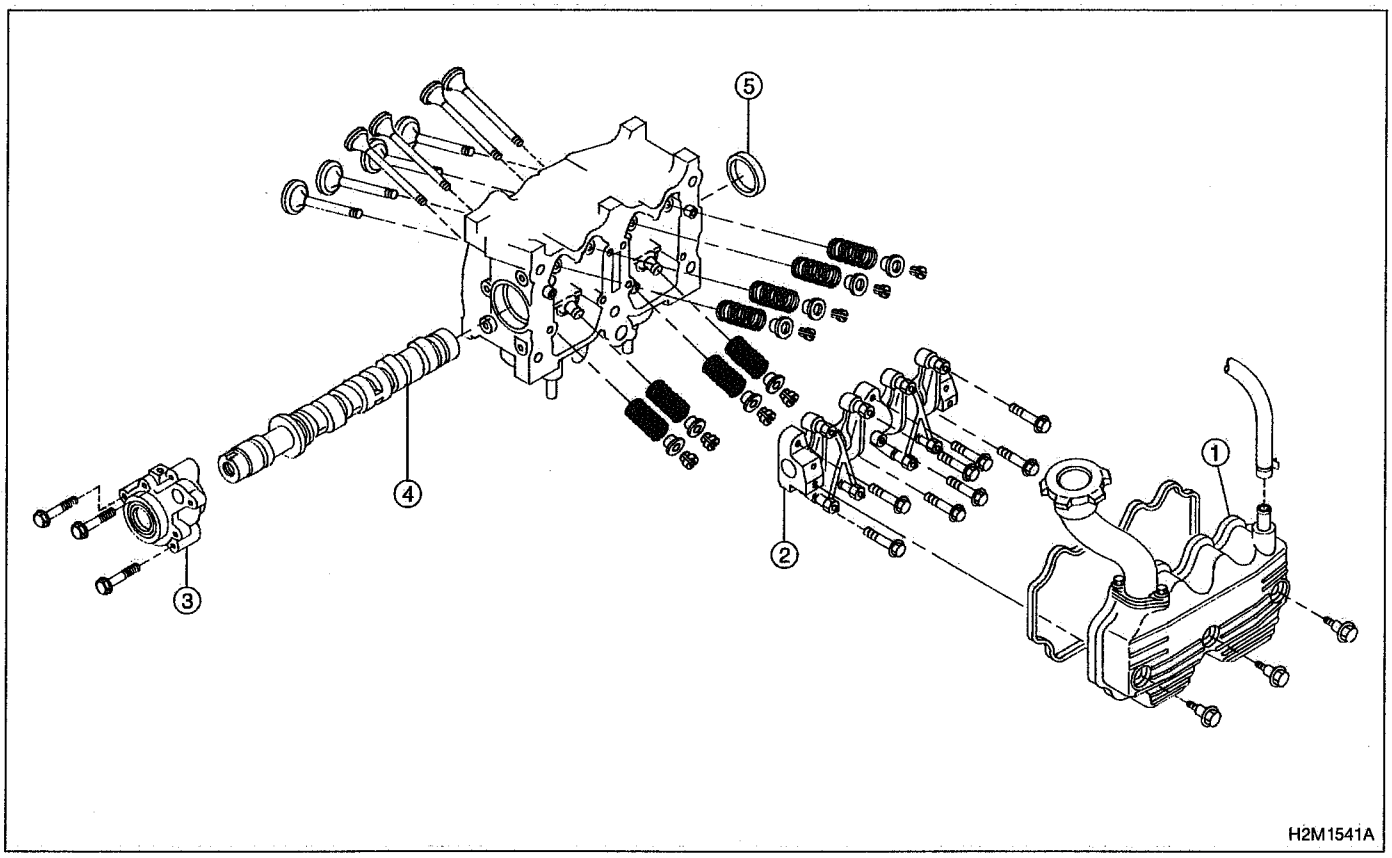
CAUTION:
Leave bolts Ⓐ and Ⓒ engaged by three or four threads to prevent cylinder head from falling.

4) While tapping cylinder head with a plastic hammer, separate it from cylinder block.
5) Remove bolts Ⓐ and Ⓒ to remove cylinder head.
6) Remove cylinder head gasket.

CAUTION:
Do not scratch the mating surface of cylinder head and cylinder block.

7) Similarly, remove right side cylinder head.

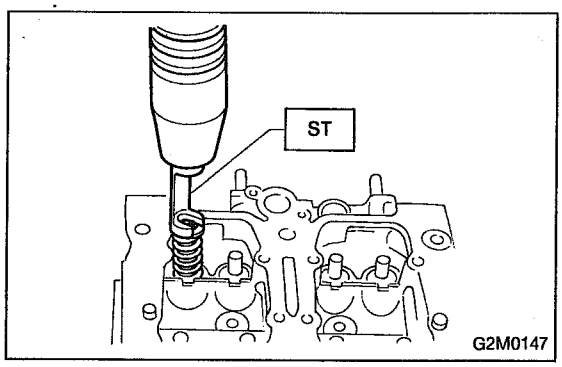
B: DISASSEMBLY



① Rocker cover
② Valve rocker ASSY
③ Camshaft support
④ Camshaft
⑤ Oil seal

1) Remove rocker cover.
2) Remove valve rocker assembly.
<Ref. to 2-3 [W3A0].>
3) Remove camshaft and support.
<Ref. to 2-3 [W4A0].>
4) Place cylinder head on ST.

ST 498267200 CYLINDER HEAD TABLE



5) Set ST on valve spring. Compress valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

ST 499718000 VALVE SPRING REMOVER

CAUTION:
- **Mark each valve to prevent confusion.**
- **Use extreme care not to damage the lips of the intake valve oil seals and exhaust valve oil seals.**

6) Removal of plug (cylinder head LH).

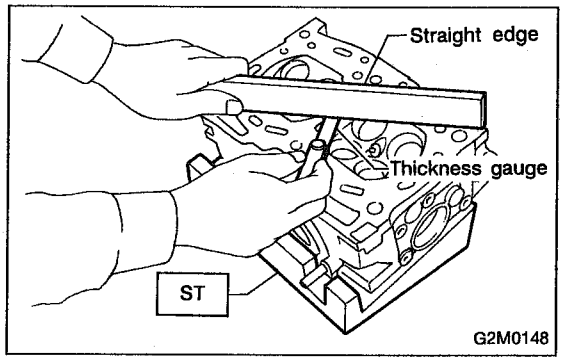
CAUTION:
Do not remove plug unless necessary.

C: INSPECTION

1. CYLINDER HEAD

1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect important areas by means of red lead check.
Also make sure that gasket installing surface shows no trace of gas and water leaks.
2) Place cylinder head on ST.

ST 498267200 CYLINDER HEAD TABLE



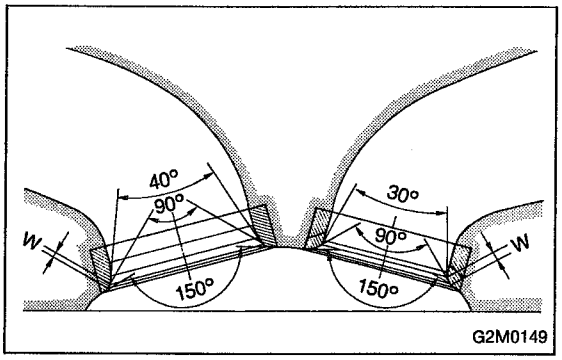
3) Measure the warping of the cylinder head surface that mates with crankcase by using a straight edge and thickness gauge.
If the warping exceeds 0.05 mm (0.0020 in), regrind the surface with a surface grinder.

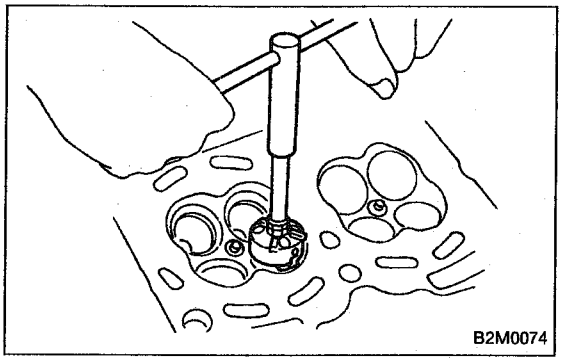
Warping limit:
0.05 mm (0.0020 in)

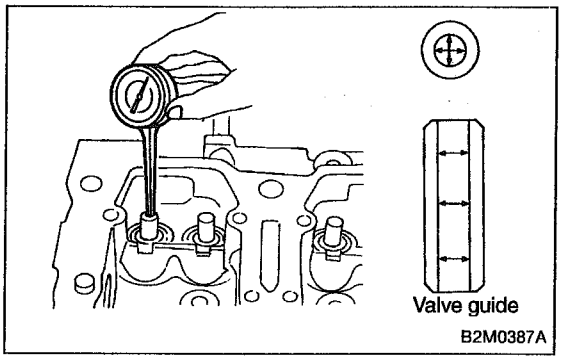
Grinding limit:
0.1 mm (0.004 in)

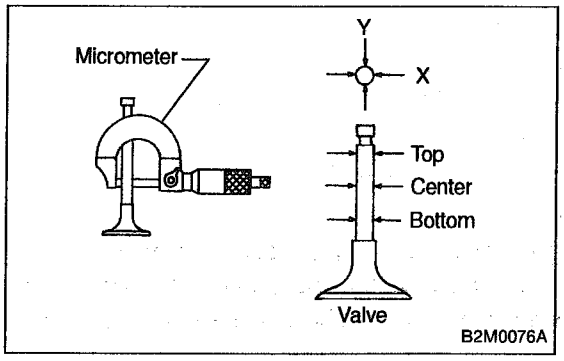
Standard height of cylinder head:
98.3 mm (3.870 in)

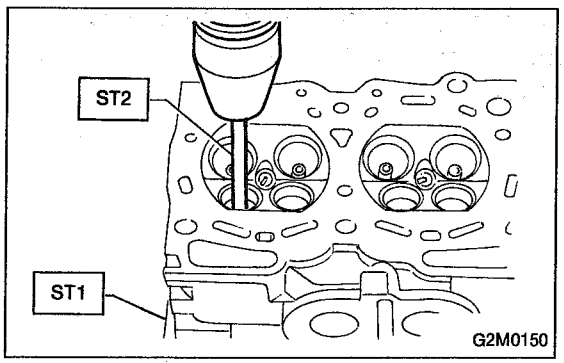
CAUTION:
Uneven torque for the cylinder head bolts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.











2. VALVE SEAT

Inspect intake and exhaust valve seats, and correct the contact surfaces with valve seat cutter if they are defective or when valve guides are replaced.

Valve seat width: W

Intake

Standard

0.7 mm (0.028 in)

Limit

1.4 mm (0.055 in)

Exhaust

Standard

1.4 mm (0.055 in)

Limit

1.8 mm (0.071 in)

3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

Clearance between the valve guide and valve stem:

Standard

Intake

0.035 — 0.062 mm (0.0014 — 0.0024 in)

Exhaust

0.040 — 0.067 mm (0.0016 — 0.0026 in)

Limit

0.15 mm (0.0059 in)

Valve guide inner diameters:

6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameter:

Intake

5.950 — 5.965 mm (0.2343 — 0.2348 in)

Exhaust

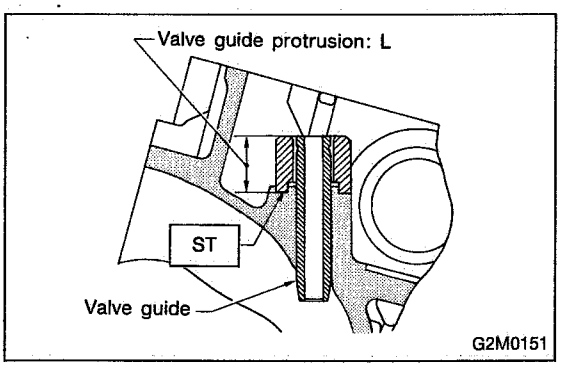
5.945 — 5.960 mm (0.2341 — 0.2346 in)

2) If the clearance between valve guide and stem exceeds the specification, replace guide as follows:

(1) Place cylinder head on ST1 with the combustion chamber upward so that valve guides enter the holes in ST1.

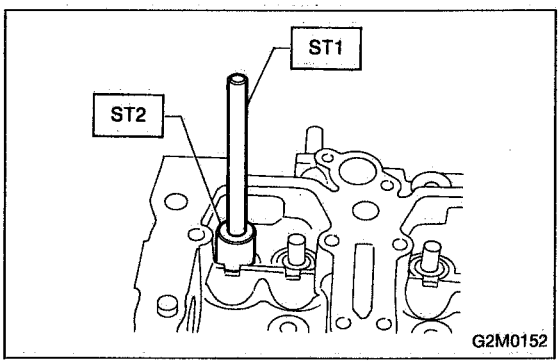
(2) Insert ST2 into valve guide and press it down to remove valve guide.

ST1	498267200	CYLINDER HEAD TABLE
ST2	499767200	VALVE GUIDE REMOVER



(3) Turn cylinder head upside down and place ST as shown in the Figure.

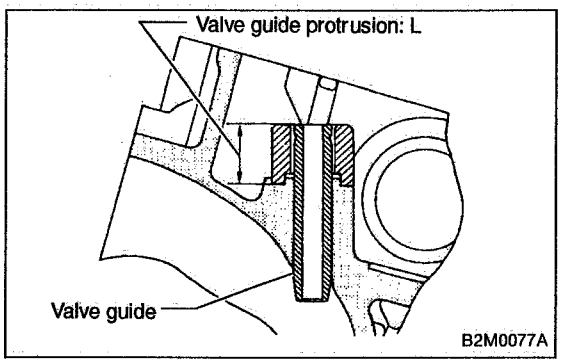
ST 499767000 VALVE GUIDE ADJUSTER



(4) Before installing new oversize valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.

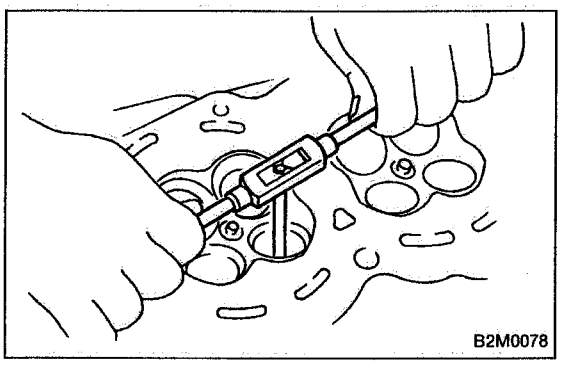
(5) Put new valve guide, coated with sufficient oil, in cylinder, and insert ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
ST2 499767000 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

Valve guide protrusion: L
17.5 — 18.0 mm (0.689 — 0.709 in)

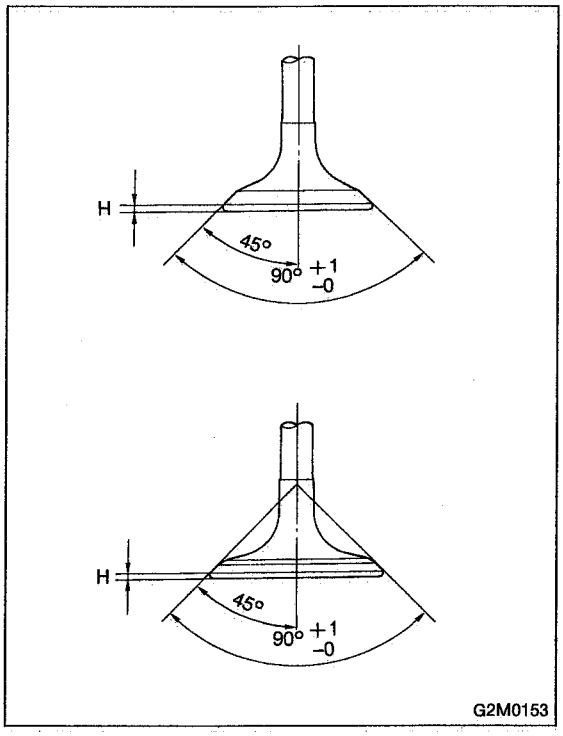


(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise. After reaming, clean valve guide to remove chips.

ST 499767400 VALVE GUIDE REAMER

CAUTION:
- **Apply engine oil to the reamer when reaming.**
- **If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.**
- **If the inner surface of the valve guide becomes lustrous and the reamer does not chips, use a new reamer or remedy the reamer.**

(8) Recheck the contact condition between valve and valve seat after replacing valve guide.



4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if "H" is less than the specified limit.

H:

Intake

Standard

1.0 mm (0.039 in)

Limit

0.8 mm (0.031 in)

Exhaust

Standard

1.2 mm (0.047 in)

Limit

0.8 mm (0.031 in)

Valve overall length:

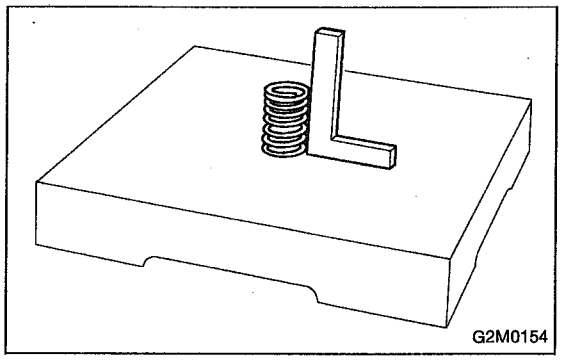
Intake

101.0 mm (3.976 in)

Exhaust

101.2 mm (3.984 in)

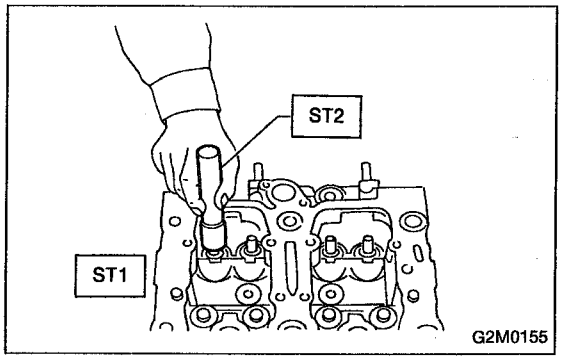
2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. Also refer to "2. VALVE SEAT" at this time <Ref. to 2-3 [W5C2].>. Install a new intake valve oil seal after lapping.



5. VALVE SPRINGS

1) Check valve springs for damage, free length, and tension. Replace valve spring if it is not to the specifications presented below.
2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top using a try square.

Free length	44.05 mm (1.7342 in)
Squareness	2.5°, 1.9 mm (0.075 in)
Tension/spring height	174.6 — 200.1 N (17.8 — 20.4 kg, 39.2 — 45.0 lb)/ 36.0 mm (1.417 in)
	405.0 — 458.0 N (41.3 — 46.7 kg, 91.1 — 103.0 lb)/ 28.2 mm (1.110 in)



6. INTAKE AND EXHAUST VALVE OIL SEAL

Replace oil seal with new one, if lip is damaged or spring out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced.

1) Place cylinder head on ST1.
2) Press in oil seal to the specified dimension indicated in the Figure by using ST2.

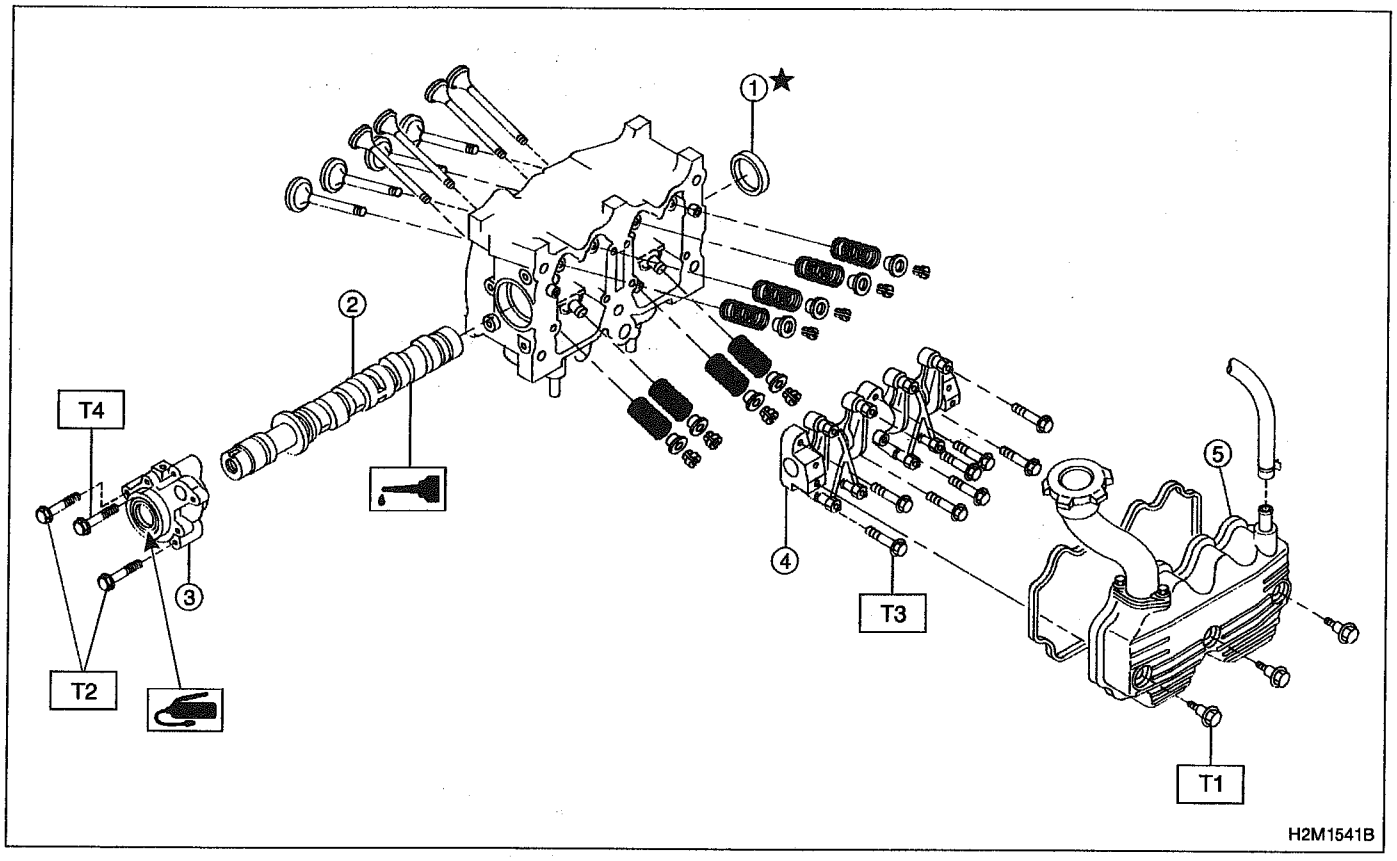
ST1 498267200 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

CAUTION:
- **Apply engine oil to oil seal before force-fitting.**
- **When press-fitting oil seal, do not use a hammer or strike into position.**
- **Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in color.**

Color of rubber part:
Intake [Black]
Exhaust [Brown]

Color of spring part:
Intake [Silver]
Exhaust [Silver]

D: ASSEMBLY



① Oil seal
② Camshaft
③ Camshaft support
④ Valve rocker ASSY
⑤ Rocker cover
★: Replacement part

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 10 (1.0, 7)
T3: 12±1 (1.2±0.1, 8.7±0.7)
T4: 16 (1.6, 12)

1) Install plug (cylinder head LH) by using ST.

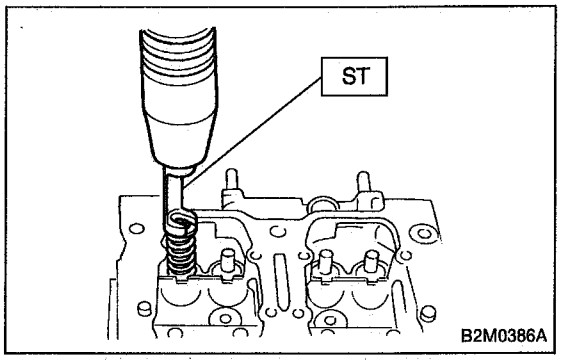
ST 499587100 OIL SEAL INSTALLER

2) Installation of valve spring and valve
   (1) Place cylinder head on ST.

ST 498267200 CYLINDER HEAD TABLE

   (2) Coat stem of each valve with engine oil and insert valve into valve guide.

CAUTION:
When inserting valve into valve guide, use special care not to damage the oil seal lip.



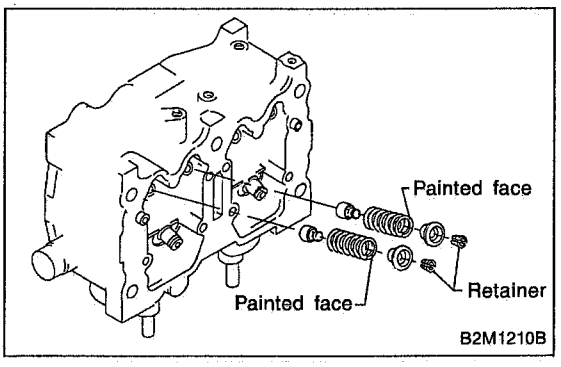
(3) Install valve spring and retainer.

CAUTION:
Be sure to install the valve springs with their painted facing towards the valve spring retainer.

(4) Set ST on valve spring.

ST 499718000 VALVE SPRING REMOVER

(5) Compress valve spring and fit valve spring retainer key.

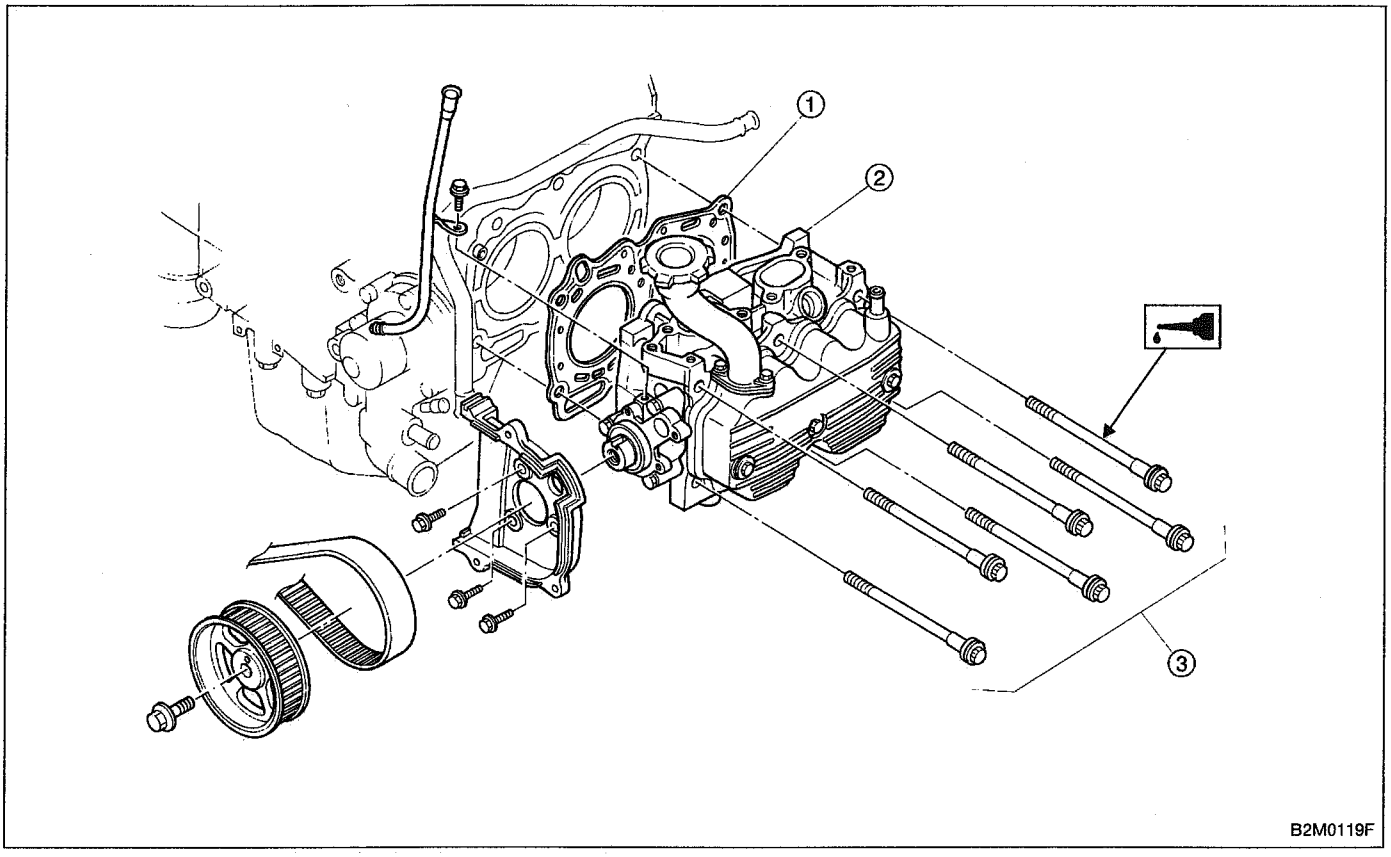


(6) After installing, tap valve spring retainers lightly with wooden hammer for better seating.

3) Install camshaft and support.
<Ref. to 2-3 [W4C0].>
4) Install valve rocker assembly.
<Ref. to 2-3 [W3E0].>
5) Install rocker cover.

E: INSTALLATION

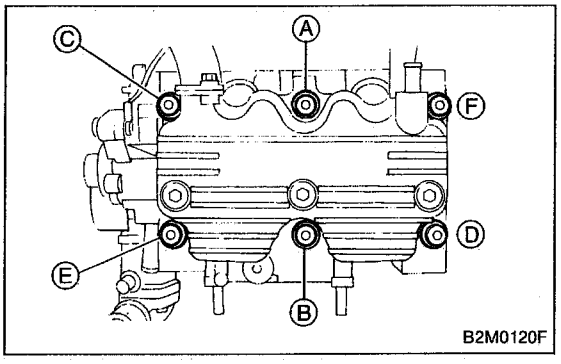
1. CYLINDER HEAD



① Cylinder head gasket
② Cylinder head
③ Cylinder head bolt

1) Install cylinder head and gaskets on cylinder block.

CAUTION:
Use new cylinder head gaskets.



2), Tighten cylinder head bolts.

(1) Apply a coat of engine oil to washers and bolt threads.
(2) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb) in alphabetical sequence.
Then tighten all bolts to 69 N·m (7.0 kg-m, 51 ft-lb) in alphabetical sequence.
(3) Back off all bolts by 180° first; back them off by 180° again.
(4) Tighten bolts Ⓐ and Ⓑ to 34 N·m (3.5 kg-m, 25 ft-lb).

(5) Tighten bolts Ⓒ, Ⓓ, Ⓔ and Ⓕ to 15 N m (1.5 kg-m, 11 ft-lb).
(6) Tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:
Do not tighten bolts more than 90°.

(7) Further tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:
Ensure that the total "re-tightening angle" [in the former two steps] does not exceed 180°.

3) Install oil level gauge guide attaching bolt (left hand only).
4) Install timing belt, camshaft sprocket and related parts. <Ref. to 2-3 [W2C0].>

2. RELATED PARTS

CAUTION:
Use dry compressed air to remove foreign particles before installing each solenoid valve and sensor.

1) Install water pipe.
2) Install intake manifold. <Ref. to 2-7 [W4D0].>
3) Connect blow-by hose.
4) Install EGR pipe. (AT vehicles only)
5) Connect oil pressure switch connector.
6) Install crankshaft position sensor and camshaft position sensor.
7) Install connector bracket attaching bolt.
8) Connect spark plug cords.
9) Install alternator and bracket.
10) Install V-belt.
11) Remove engine stand.

6. Cylinder Block

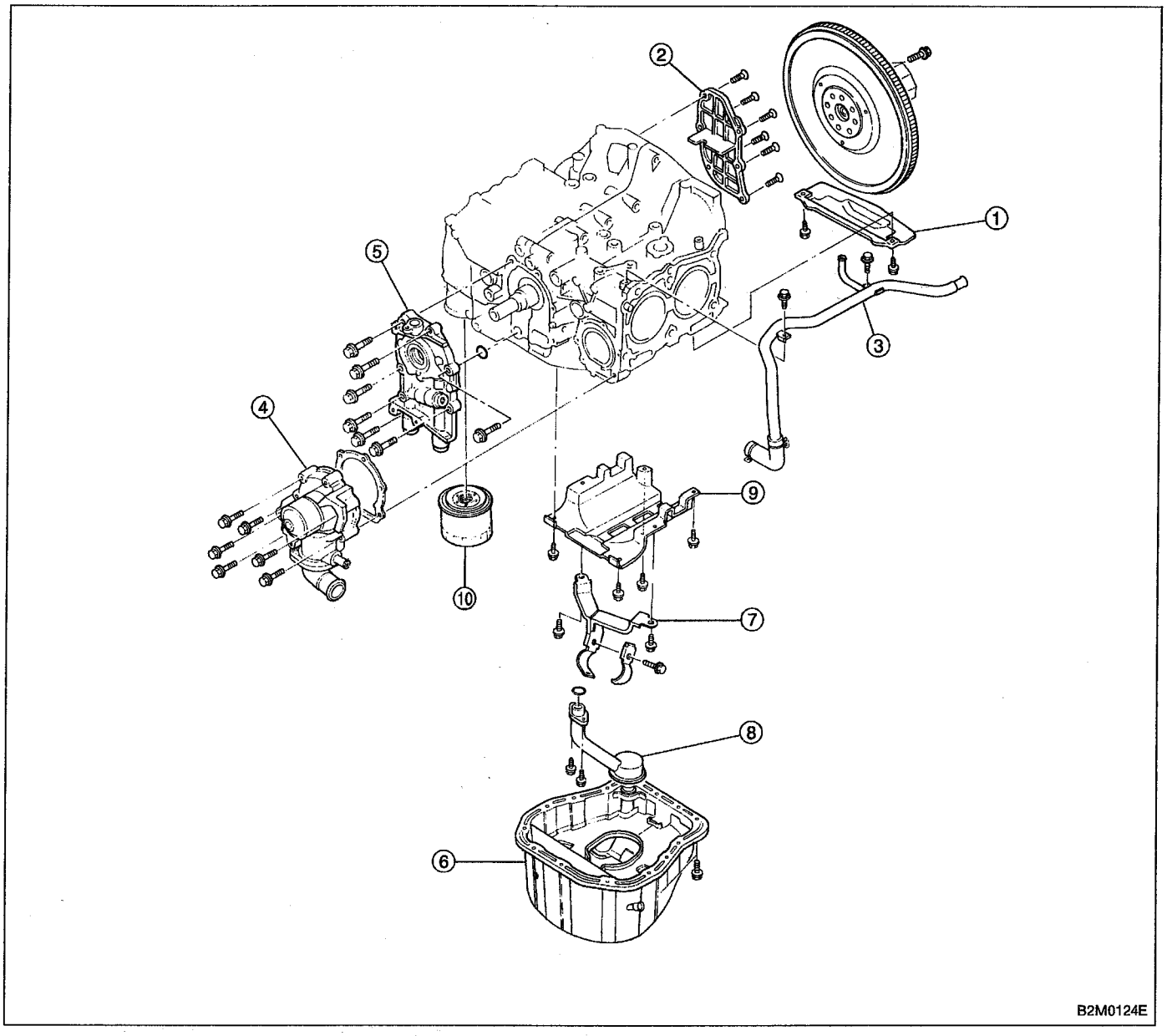
A: REMOVAL

1. RELATED PARTS

1) Remove timing belt, camshaft sprocket and related parts.
<Ref. to 2-3 [W2A0].>

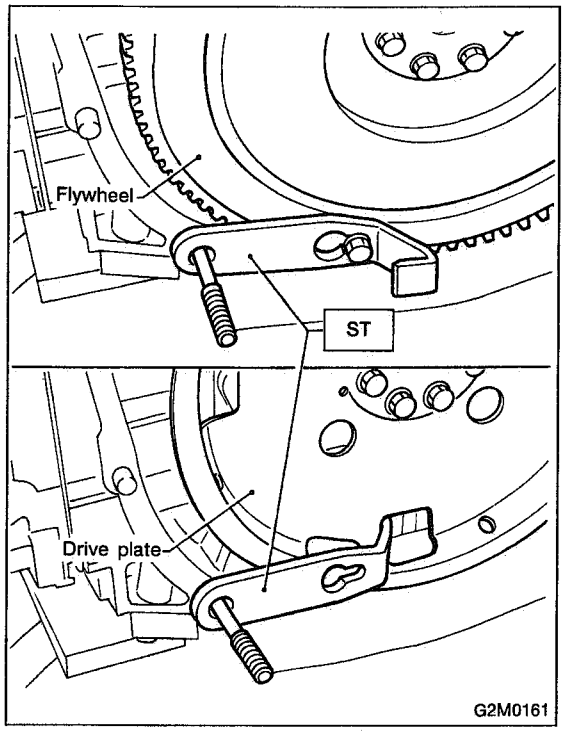
2) Remove intake manifold and cylinder head.
<Ref. to 2-3 [W5A0].>

2. OIL PUMP AND WATER PUMP



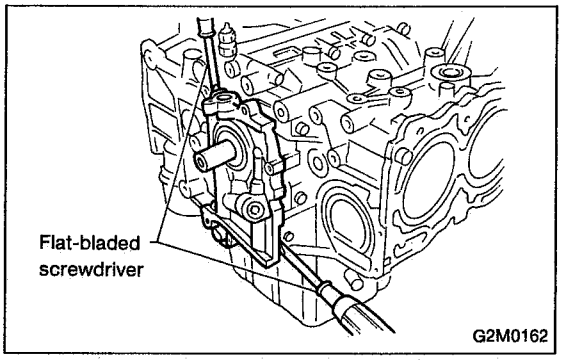
① Clutch housing cover (MT vehicles)
② Oil separator cover
③ Water by-pass pipe
④ Water pump
⑤ Oil pump
⑥ Oil pan
⑦ Oil strainer stay
⑧ Oil strainer
⑨ Baffle plate
⑩ Oil filter

1) Remove clutch housing cover. (MT vehicles only)



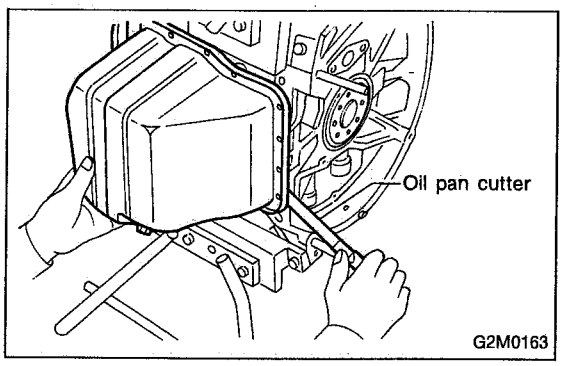
2) Remove flywheel or drive plate.
To lock crankshaft use ST.
ST 498497100 CRANKSHAFT STOPPER

3) Remove oil separator cover.
4) Remove water pipe and water by-pass pipe.
5) Remove water pump.



6) Remove oil pump from cylinder block.
Use a flat-bladed screwdriver as shown in Figure when removing oil pump.

CAUTION:
Be careful not to scratch the mating surface of cylinder block and oil pump.



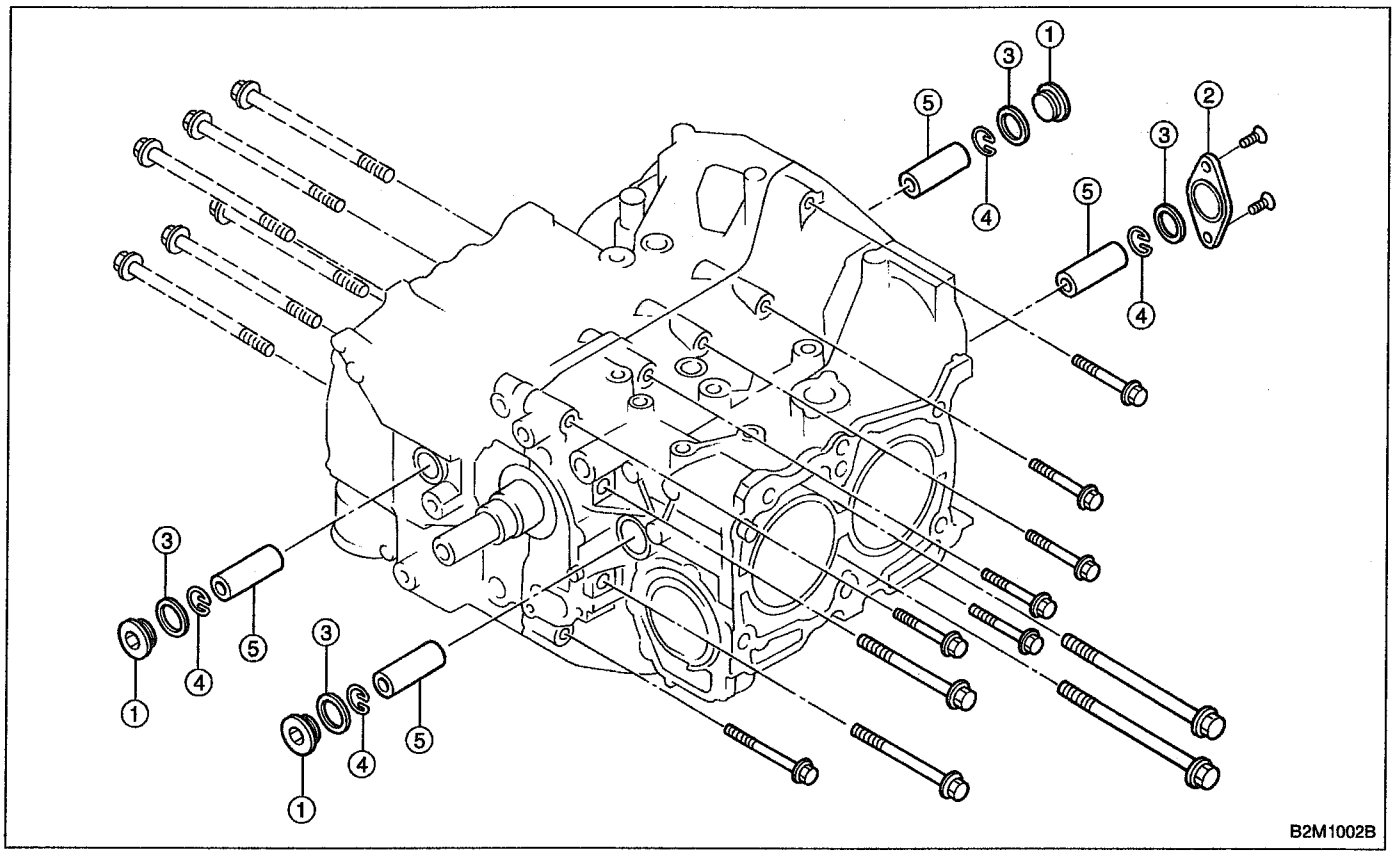
7) Removal of oil pan.
   (1) Turn cylinder block with #2 and #4 piston sides facing upward.
   (2) Remove bolts which secure oil pan to cylinder block.
   (3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance and remove oil pan.

CAUTION:
Do not use a screwdriver or similar tool in place of oil-pan cutter blade.

8) Remove oil strainer stay.
9) Remove oil strainer.
10) Remove baffle plate.
11) Remove oil filter.

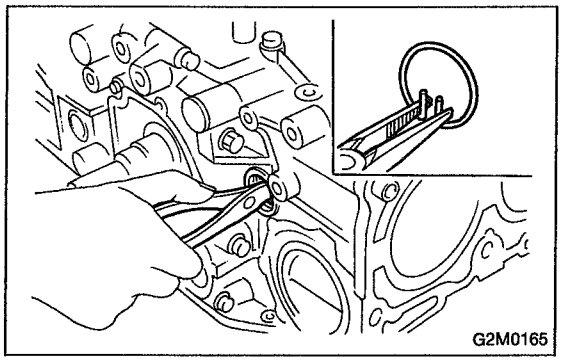
B: DISASSEMBLY

1. PISTON PIN AND CYLINDER BLOCK CONNECTING BOLT

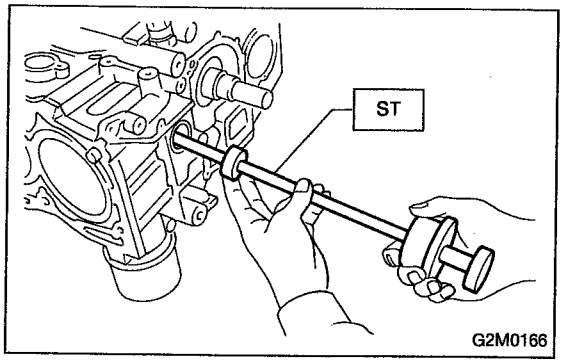


① Service hole plug
② Service hole cover
③ Gasket
④ Circlip
⑤ Piston pin

1) Remove service hole cover and service hole plugs using hexagon wrench (14 mm).



2) Rotate crankshaft to bring #1 and #2 pistons to BDC position, then remove piston circlip through service hole of #1 and #2 cylinders.



3) Draw out piston pin from #1 and #2 pistons by using ST.

ST 499097500 PISTON PIN REMOVER

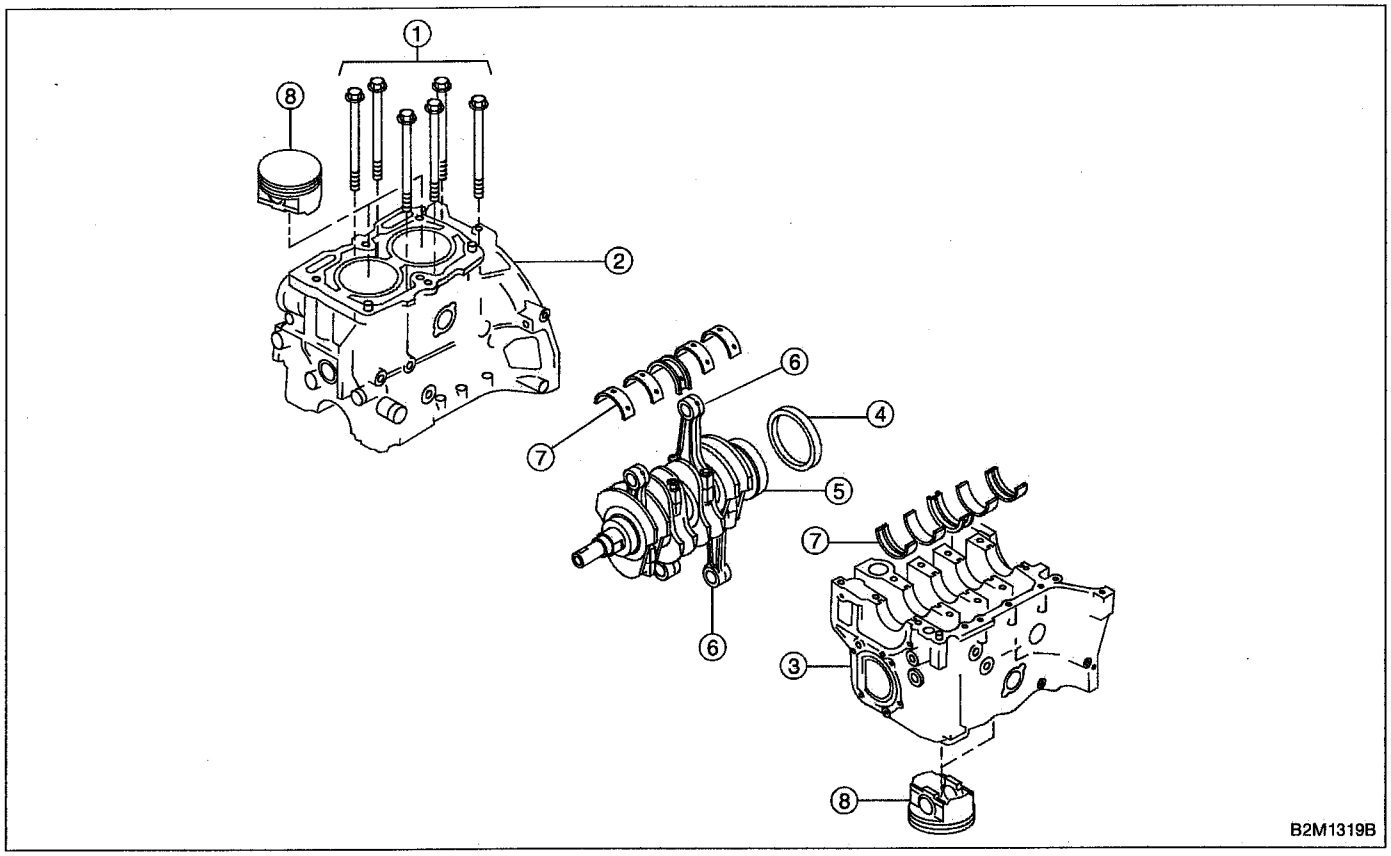
CAUTION:
Be careful not to confuse original combination of piston, piston pin and cylinder.

4) Similarly remove piston pins from #3 and #4 pistons by using ST.

ST 499097500 PISTON PIN REMOVER

5) Remove bolts which connect cylinder block on the side of #2 and #4 cylinders.
6) Back off bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.

2. CYLINDER BLOCK



① Bolt
② Cylinder block (RH)
③ Cylinder block (LH)
④ Rear oil seal
⑤ Crankshaft
⑥ Connecting rod
⑦ Crankshaft bearing
⑧ Piston

1) Set up cylinder block so that #1 and #3 cylinders are on the upper side, then remove cylinder block connecting bolts.
2) Separate left-hand and right-hand cylinder blocks.

CAUTION:
When separating cylinder block, do not allow the connecting rod to fall and damage the cylinder block.

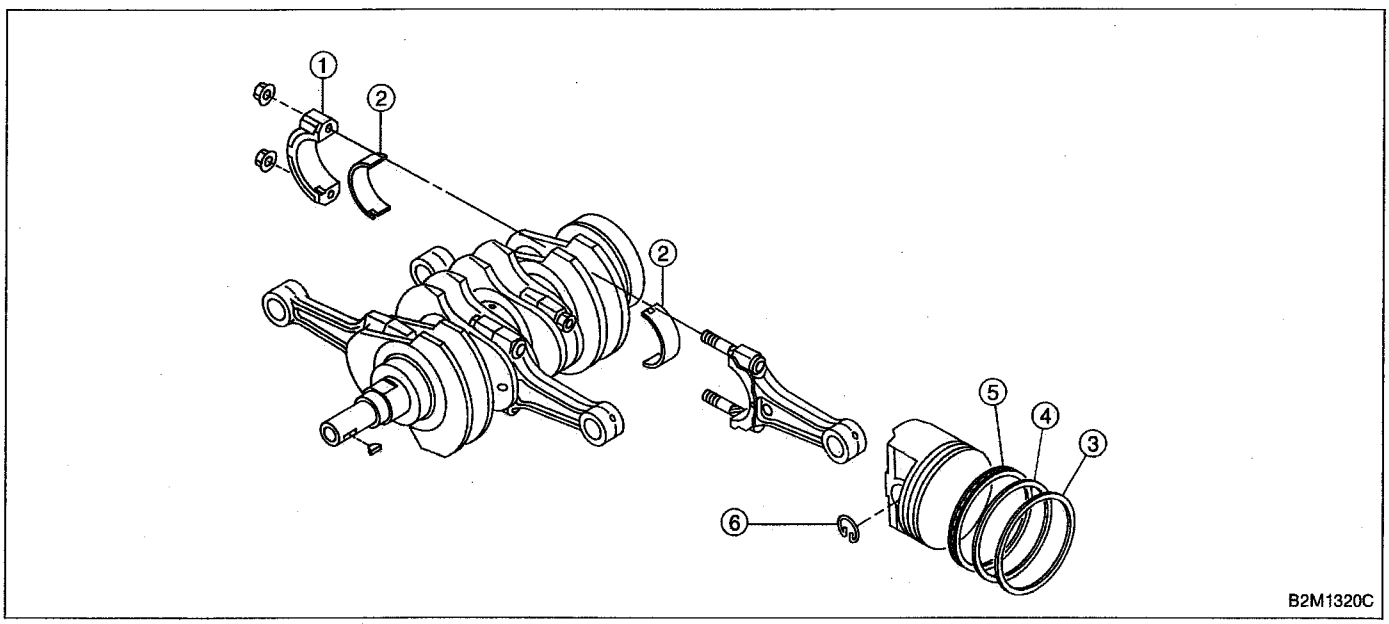
3) Remove rear oil seal.
4) Remove crankshaft together with connecting rod.
5) Remove crankshaft bearings from cylinder block using hammer handle.

CAUTION:
Do not confuse combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

6) Draw out each piston from cylinder block using wooden bar or hammer handle.

CAUTION:
Do not confuse combination of piston and cylinder.

3. CRANKSHAFT AND PISTON



① Connecting rod cap
② Connecting rod bearing
③ Top ring
④ Second ring
⑤ Oil ring
⑥ Circlip

1) Remove connecting rod cap.
2) Remove connecting rod bearing.

CAUTION:
Arrange removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

3) Remove piston top and second rings using the piston ring expander.
4) Remove the oil ring by hand.

CAUTION:
Arrange the removed piston rings in good order to prevent confusion.

5) Remove circlip.

C: INSPECTION

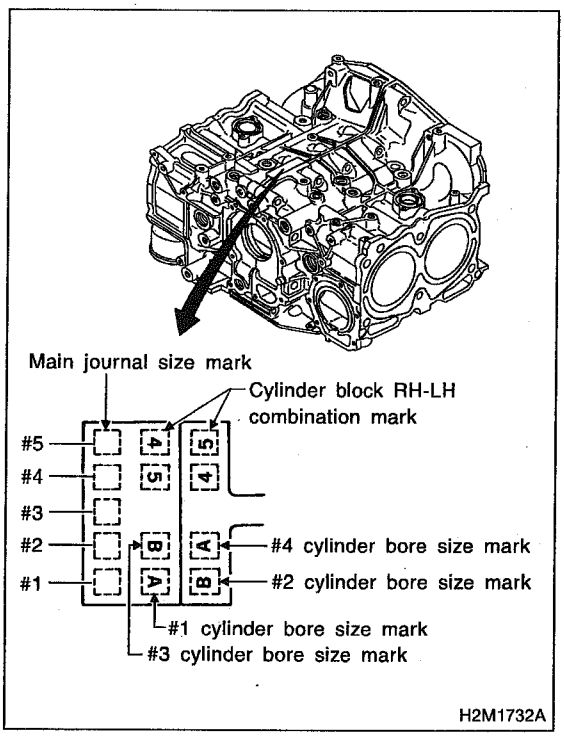
1. CYLINDER BLOCK

1) Check for cracks and damage visually. Especially, inspect important parts by means of red lead check.
2) Check the oil passages for clogging.
3) Inspect crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.05 mm (0.0020 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder block:
201.0 mm (7.91 in)

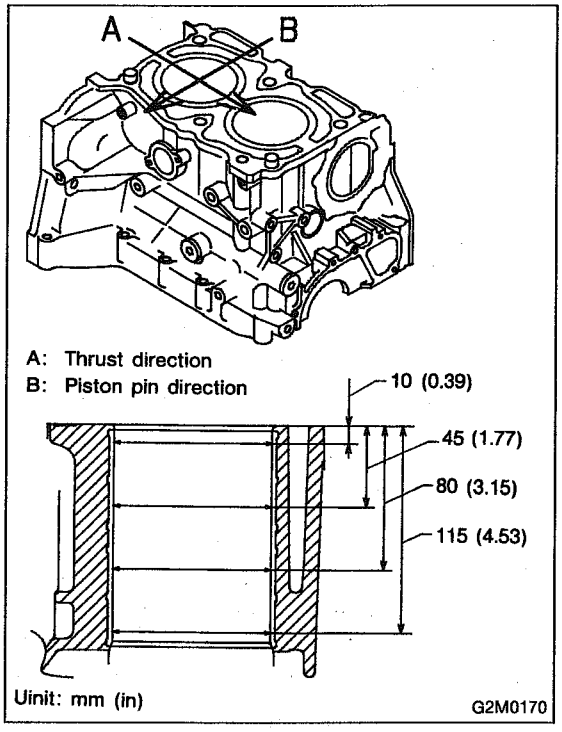


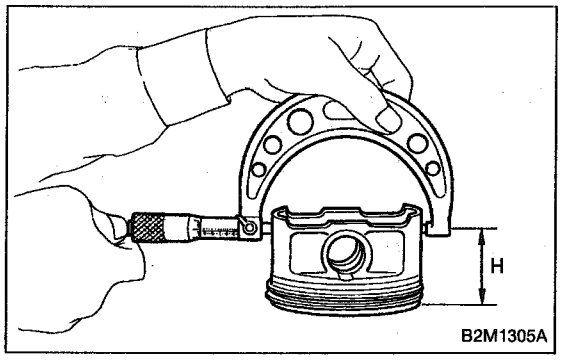
2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the cylinder block's front upper surface.

NOTE:
Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as a guideline in selecting a standard piston.

Standard diameter:
1800 cc:
A: 87.905 — 87.915 mm (3.4608 — 3.4612 in)
B: 87.895 — 87.905 mm (3.4604 — 3.4608 in)
2200 cc:
A: 96.905 — 96.915 mm (3.8151 — 3.8155 in)
B: 96.895 — 96.905 mm (3.8148 — 3.8151 in)





2) How to measure the inner diameter of each cylinder
Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights shown in the Figure, using a cylinder bore gauge.

CAUTION:
Measurement should be performed at a temperature 20°C (68°F).

- ***Taper:***
  Standard
  0.015 mm (0.0006 in)
  Limit
  0.050 mm (0.0020 in)
- ***Out-of-roundness:***
  Standard
  0.010 mm (0.0004 in)
  Limit
  0.050 mm (0.0020 in)

3) When piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

4) How to measure the outer diameter of each piston
Measure the outer diameter of each piston at the height shown in the Figure. (Thrust direction)

CAUTION:
Measurement should be performed at a temperature of 20°C (68°F).

- ***Piston grade point H:***
  40.0 mm (1.575 in)
- ***Piston outer diameter:***
  - ***1800 cc:***
  Standard
  A: 87.885 — 87.895 mm (3.4600 — 3.4604 in)
  B: 87.875 — 87.885 mm (3.4596 — 3.4600 in)
  0.25 mm (0.0098 in) oversize
  88.125 — 88.135 mm (3.4695 — 3.4699 in)
  0.50 mm (0.0197 in) oversize
  88.375 — 88.385 mm (3.4793 — 3.4797 in)
  - ***2200 cc:***
  Standard
  A: 96.885 — 96.895 mm (3.8144 — 3.8148 in)
  B: 96.875 — 96.885 mm (3.8140 — 3.8144 in)
  0.25 mm (0.0098 in) oversize
  97.115 — 97.145 mm (3.8234 — 3.8246 in)
  0.50 mm (0.0197 in) oversize
  97.365 — 97.395 mm (3.8333 — 3.8344 in)

5) Calculate the clearance between cylinder and piston.

CAUTION:
Measurement should be performed at a temperature of 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):
Standard
0.010 — 0.030 mm (0.0004 — 0.0012 in)
Limit
0.050 mm (0.0020 in)

6) Boring and honing

(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, rebore it to use an oversize piston.

CAUTION:
When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the crankcase.

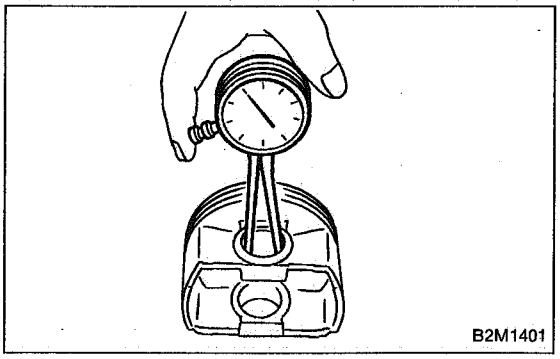
CAUTION:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

Limit of cylinder enlarging (boring):
0.5 mm (0.020 in)

3. PISTON AND PISTON PIN

1) Check pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.

2) Measure the piston-to-cylinder clearance at each cylinder as instructed in "2. CYLINDER AND PISTON". <Ref. to 2-3 [W6C2].> If any of the clearances is not to specification, replace the piston or bore the cylinder to use an oversize piston.


B2M1401

3) Make sure that piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

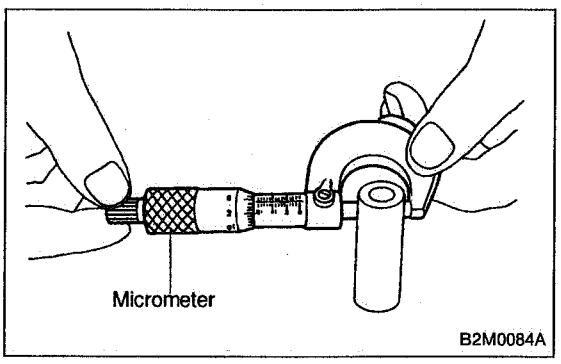
Standard clearance between piston pin and hole in piston:

Standard

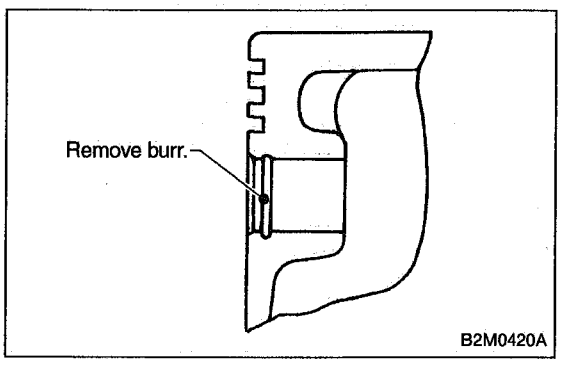
0.004 — 0.010 mm (0.0002 — 0.0004 in)

Limit

0.020 mm (0.0008 in)



B2M0084A

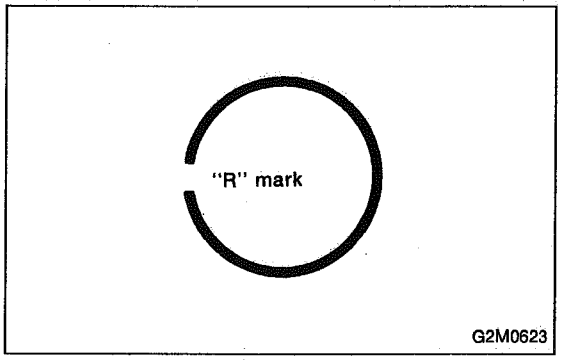


B2M0420A

4) Check circlip installation groove on the piston for burr. If necessary, remove burr from the groove so that piston pin can lightly move.

5) Check piston pin circlip for distortion, cracks and wear.

4. PISTON RING

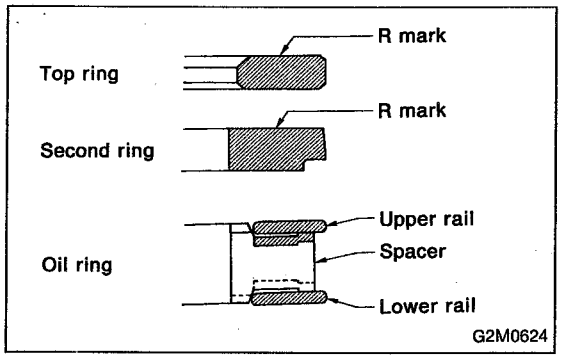


G2M0623

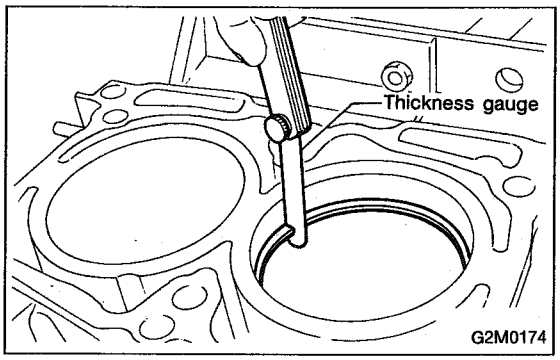
1) If piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace piston ring with a new one of the same size as the piston.

CAUTION:

• "R" is marked on the end of the top and second rings. When installing the rings to the piston, face this mark upward.

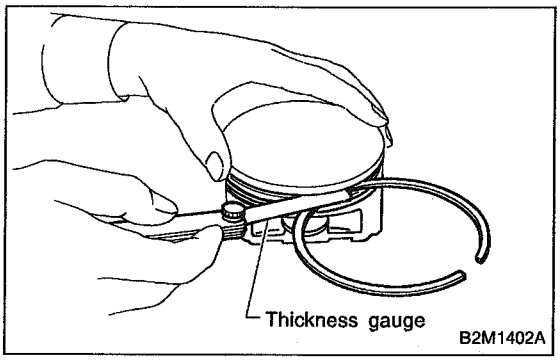


● The oil ring is a combined ring consisting of two rails and a spacer in between. When installing, be careful to assemble correctly.



2) Squarely place piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

Item		Unit: mm (in)	
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.20 — 0.50 (0.0079 — 0.0197)	1.0 (0.039)
	Oil ring rail	0.20 — 0.70 (0.0079 — 0.0276)	1.5 (0.059)



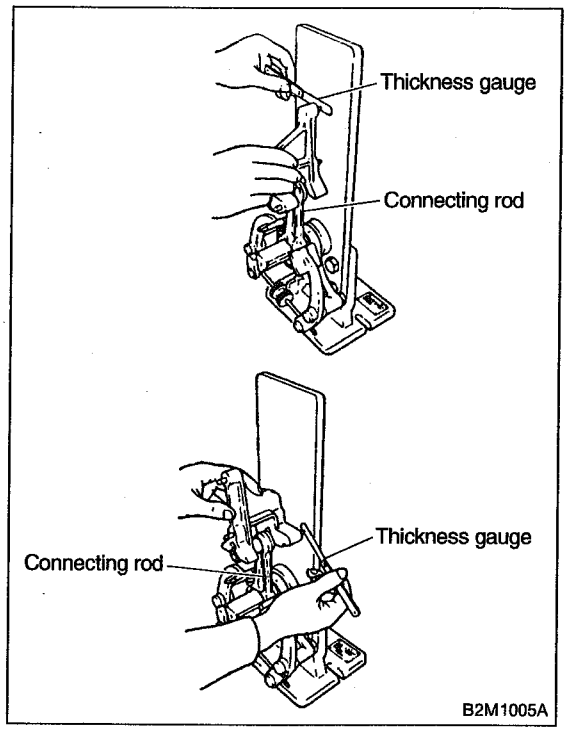
3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

CAUTION:
Before measuring the clearance, clean the piston ring groove and piston ring.

Item		Unit: mm (in)	
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)

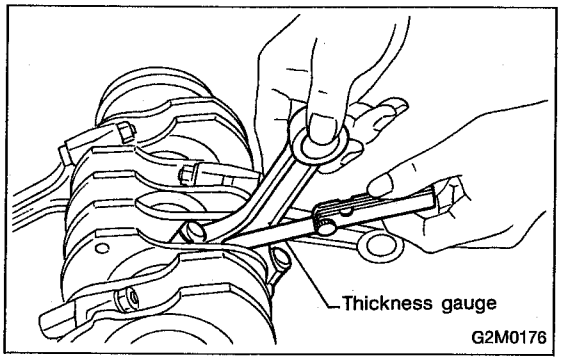
5. CONNECTING ROD

1) Replace connecting rod, if the large or small end thrust surface is damaged.



2) Check for bend or twist using a connecting rod aligner. Replace connecting rod if the bend or twist exceeds the limit.

Limit of bend or twist per 100 mm (3.94 in) in length:
0.10 mm (0.0039 in)



3) Install connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). Replace connecting rod if the side clearance exceeds the specified limit.

Connecting rod side clearance:
Standard
0.070 — 0.330 mm (0.0028 — 0.0130 in)
Limit
0.4 mm (0.016 in)

4) Inspect connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

5) Measure the oil clearance on individual connecting rod bearings by means of plastigauge. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary.

Connecting rod oil clearance:

Standard

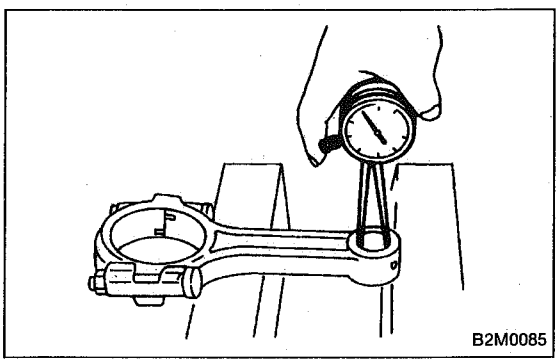
0.015 — 0.045 mm (0.0006 — 0.0018 in)

Limit

0.05 mm (0.0020 in)

Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.492 — 1.501 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.510 — 1.513 (0.0594 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.520 — 1.523 (0.0598 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.620 — 1.623 (0.0638 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)


B2M0085

6) Inspect bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

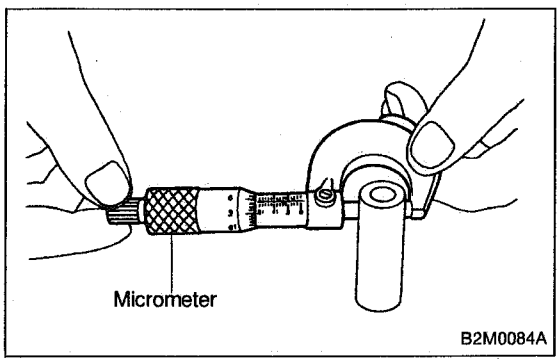
Clearance between piston pin and bushing:

Standard

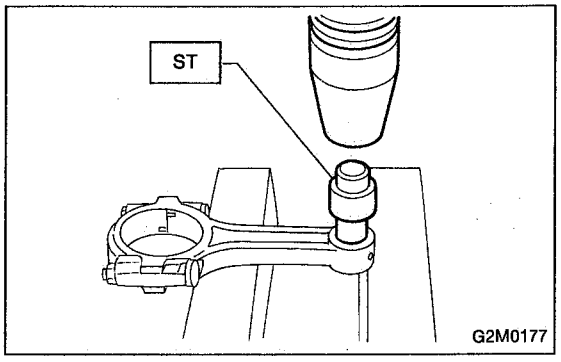
0 — 0.022 mm (0 — 0.0009 in)

Limit

0.030 mm (0.0012 in)



B2M0084A



G2M0177

7) Replacement procedure is as follows.

(1) Remove bushing from connecting rod with ST and press.

(2) Press bushing with ST after applying oil on the periphery of bushing.

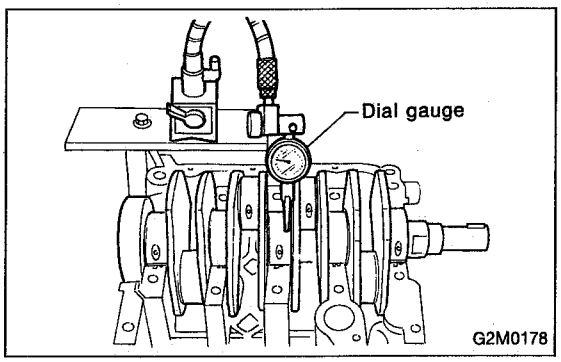
ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER

(3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.

(4) After completion of reaming, clean bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

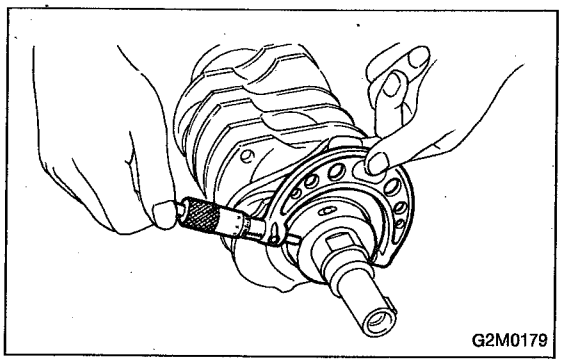
1) Clean crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.



2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

CAUTION:
If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position crankshaft on these bearings and measure crankshaft bend using a dial gauge.

Crankshaft bend limit:
0.035 mm (0.0014 in)


G2M0179

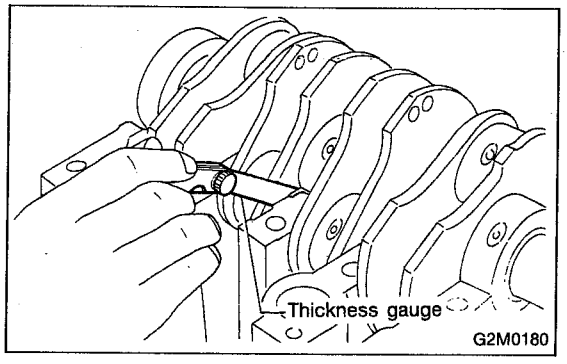
3) Inspect the crank journal and crank pin for wear. If not to specifications, replace bearing with an undersize one, and replace or recondition crankshaft as necessary. When grinding crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

Crank pin and crank journal:
Out-of-roundness
0.030 mm (0.0012 in) or less
Taper limit
0.07 mm (0.0028 in)
Grinding limit
0.25 mm (0.0098 in)

Unit: mm (in)

		Crank journal diameter		Crank pin diameter
		#1, #5	#2, #3, #4	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.492 — 1.501 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.954 — 59.970 (2.3604 — 2.3610)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.510 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) undersize	Journal O.D.	59.934 — 59.950 (2.3596 — 2.3602)	59.934 — 59.950 (2.3596 — 2.3602)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.520 — 1.523 (0.0598 — 0.0600)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.734 — 59.750 (2.3517 — 2.3524)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.620 — 1.623 (0.0638 — 0.0639)

O.D. ... Outer Diameter



G2M0180

4) Measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace bearing.

Crankshaft thrust clearance:
Standard
0.030 — 0.115 mm (0.0012 — 0.0045 in)
Limit
0.25 mm (0.0098 in)

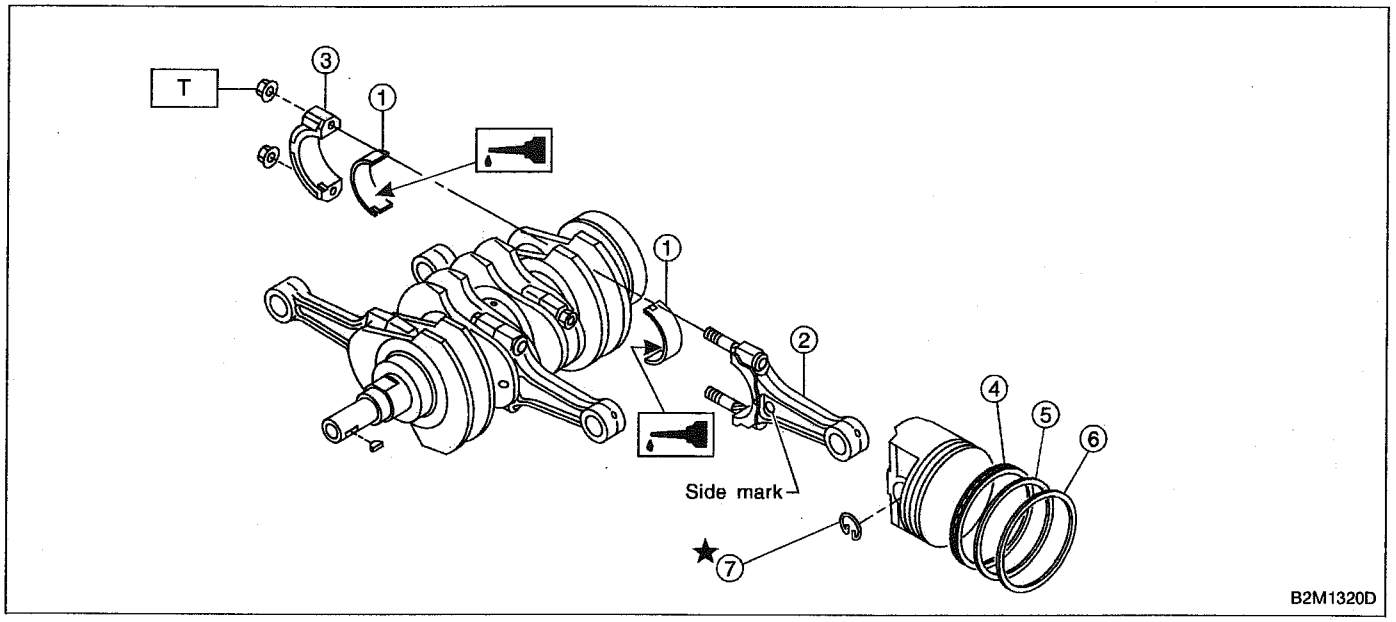
5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting, and wear.
6) Measure the oil clearance on each crankshaft bearing by means of plastigauge. If the measurement is not within the specification, replace defective bearing with an undersize one, and replace or recondition crankshaft as necessary.

Unit: mm (in)

Crankshaft oil clearance		
Standard	#1, #5	0.003 — 0.030 (0.0001 — 0.0012)
	#2, #3, #4	0.010 — 0.033 (0.0004 — 0.0013)
Limit	#1, #3, #5	0.040 (0.0016)
	#2, #4	0.035 (0.0014)

D: ASSEMBLY

1. CRANKSHAFT AND PISTON



① Connecting rod bearing
② Connecting rod
③ Connecting rod cap
④ Oil ring
⑤ Second ring
⑥ Top ring
⑦ Circlip
★: Replacement part

Tightening torque: N·m (kg-m, ft-lb)
T: 44±2 (4.5±0.2, 32.5±1.4)

1) Install connecting rod bearings on connecting rods and connecting rod caps.

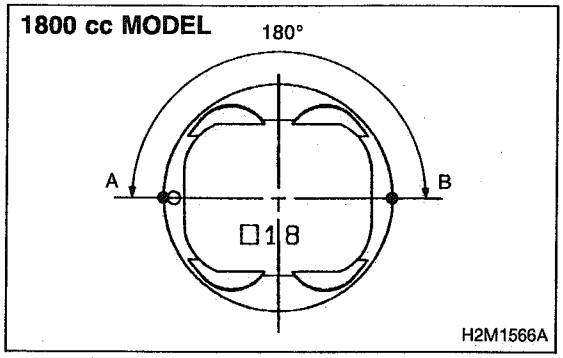
CAUTION:
Apply oil to the surfaces of the connecting rod bearings.

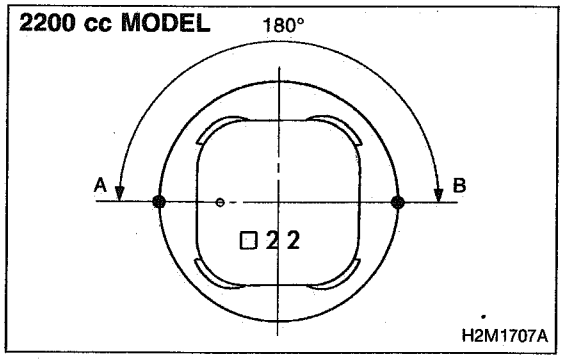
2) Install connecting rod on crankshaft.

CAUTION:
Position each connecting rod with the side marked facing forward.

3) Install connecting rod cap with connecting rod nut. Ensure the arrow on connecting rod cap faces the front during installation.

CAUTION:
- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.**
- **When tightening the connecting rod nuts, apply oil on the threads.**



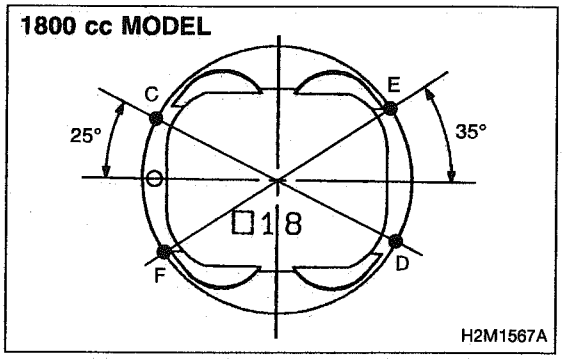


4) Installation of piston rings and oil ring

(1) Install oil ring spacer, upper rail and lower rail in this order by hand. Then install second ring and top ring with a piston ring expander.

(2) Position the top ring gap at A or B in the Figure.

(3) Position the second ring gap at 180° on the reverse side for the top ring gap.



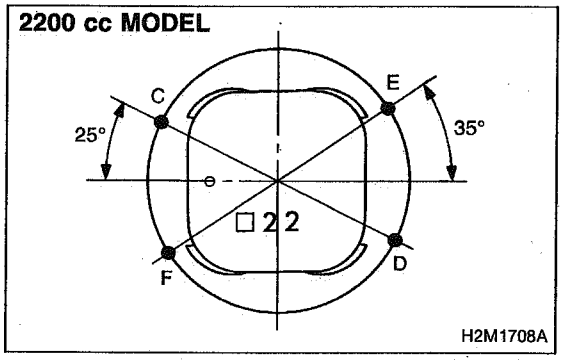
(4) Position the upper rail gap at C or D in the Figure.

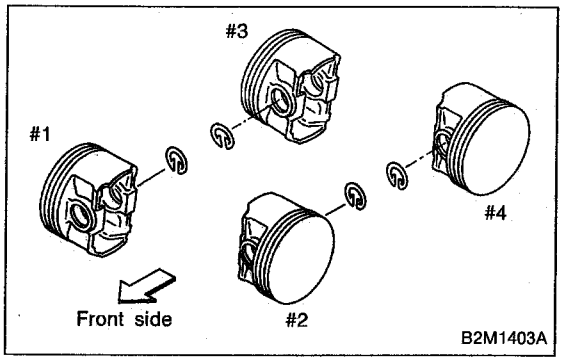
(5) Position the expander gap at 180° of the reverse side for the upper rail gap.

(6) Position the lower rail gap at E or F in the Figure.

CAUTION:

- **Ensure ring gaps do not face the same direction.**
- **Ensure ring gaps are not within the piston skirt area.**





5) Install circlip.

Install circlips in piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

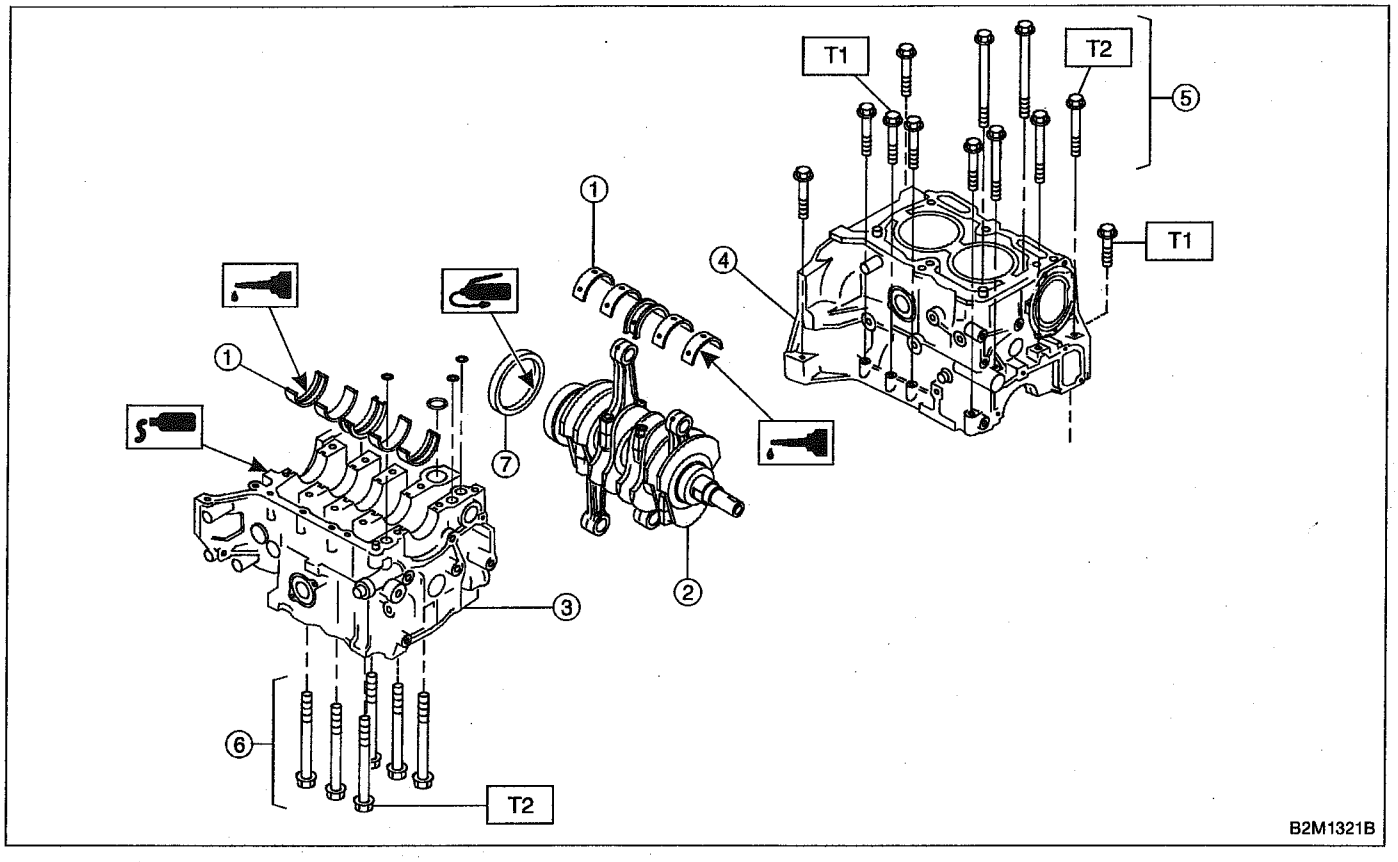
CAUTION:

Use new circlips.

NOTE:

Piston front mark "○" facer toward front of engine.

2. CYLINDER BLOCK



① Crankshaft bearing
② Crankshaft ASSY
③ Cylinder block (LH)
④ Cylinder block (RH)
⑤ Bolt
⑥ Bolt
⑦ Rear oil seal

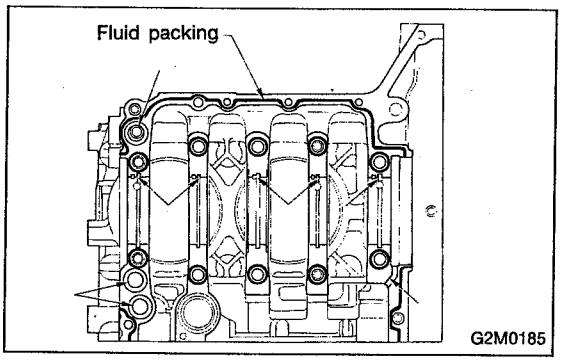
Tightening torque: N·m (kg-m, ft-lb)
T1: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T2: 47 ± 3 (4.8 ± 0.3, 34.7 ± 2.2)

1) Install ST to cylinder block, then install crankshaft bearings.

ST 499817000 ENGINE STAND

CAUTION:
Remove oil the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

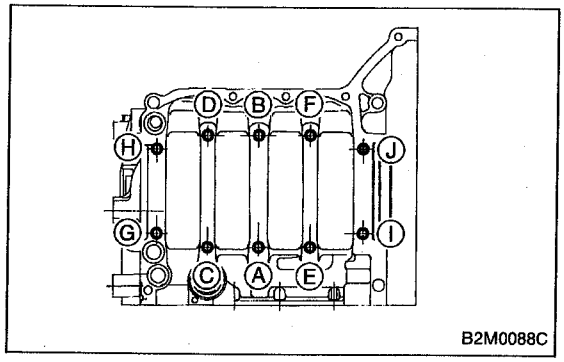
2) Position crankshaft on the cylinder block (LH).



3) Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

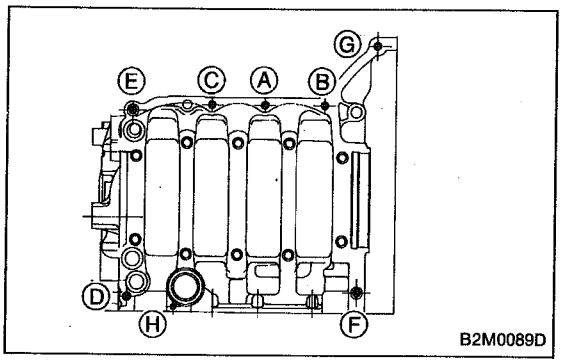
Fluid packing:
THREE BOND 1215 or equivalent

CAUTION:
Do not allow fluid packing to jut into O-ring grooves, oil passages, bearing grooves, etc.



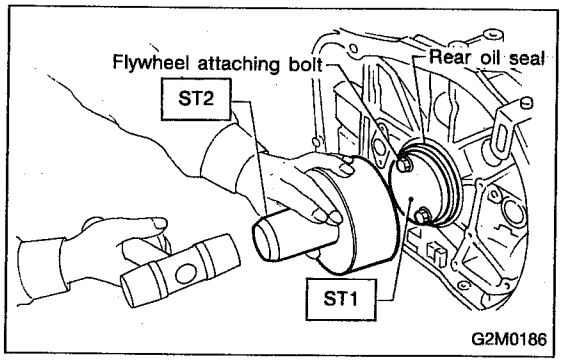
4) Temporarily tighten 10 mm cylinder block connecting bolts in alphabetical order shown in Figure.
5) Tighten 10 mm cylinder block connecting bolts in numerical order.

Tightening torque:
47 ± 3 N·m (4.8 ± 0.3 kg-m, 34.7 ± 2.2 ft-lb)



6) Tighten 8 mm and 6 mm cylinder block connecting bolts in alphabetical order shown in Figure.

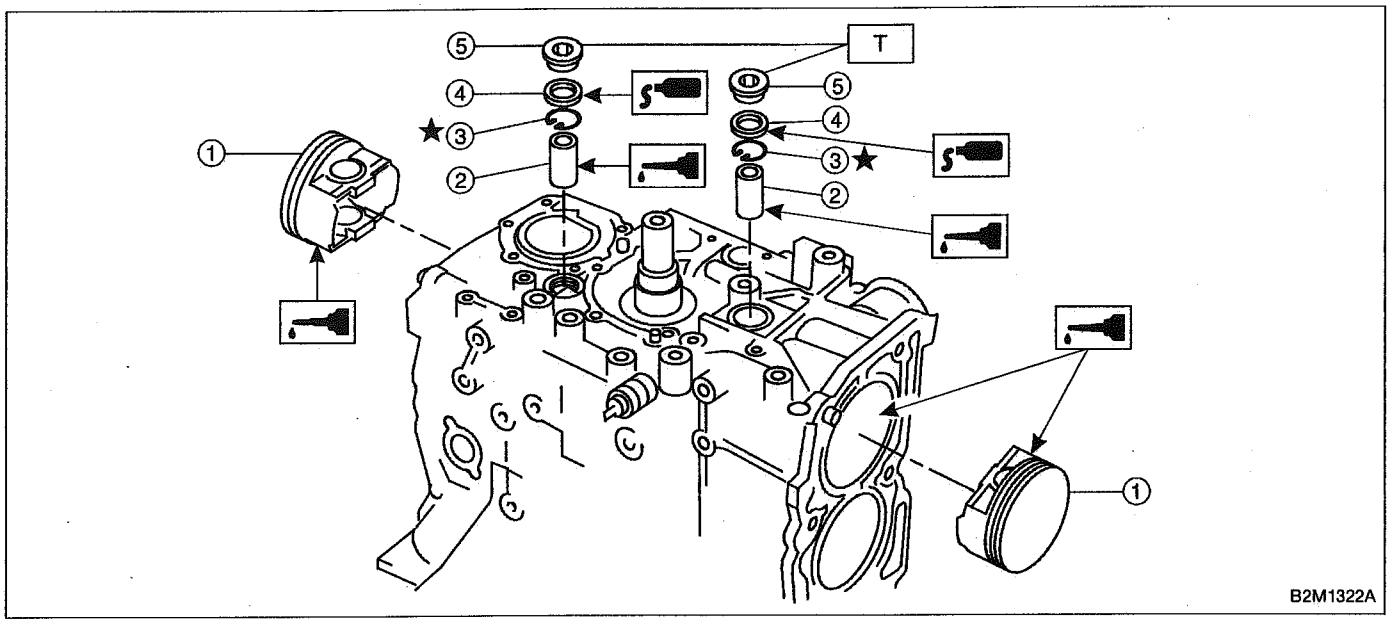
Tightening torque:
Ⓐ — Ⓖ: 25 ± 2 N·m
(2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)
Ⓗ: 6.4 N·m (0.65 kg-m, 4.7 ft-lb)



7) Install rear oil seal by using ST1 and ST2.

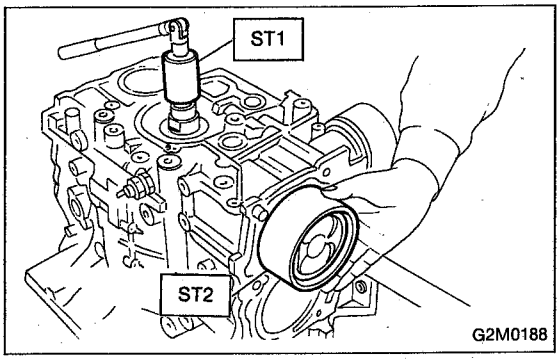
ST1	499597100	OIL SEAL GUIDE
ST2	499587200	OIL SEAL INSTALLER

3. PISTON AND PISTON PIN (#1 AND #2)



① Piston
② Piston pin
③ Circlip
④ Gasket
⑤ Service hole plug
★: Replacement part

Tightening torque: N·m (kg-m, ft-lb)
T: 69±7 (7.0±0.7, 50.6±5.1)

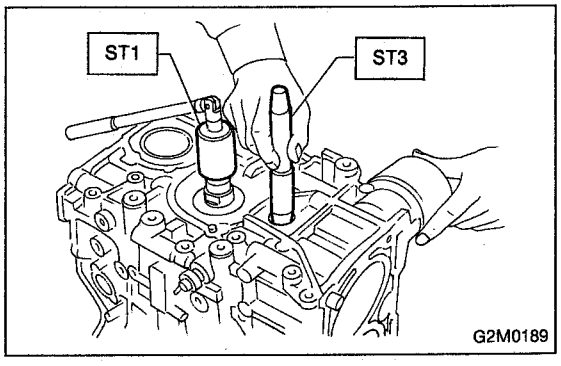


1) Installing piston
(1) Turn cylinder block so that #1 and #2 cylinders face upward.
(2) Using ST1, turn crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to pistons and cylinders and insert pistons in their cylinders by using ST2.

ST2 498747000 PISTON GUIDE (1800 cc)
498747100 PISTON GUIDE (2200 cc)

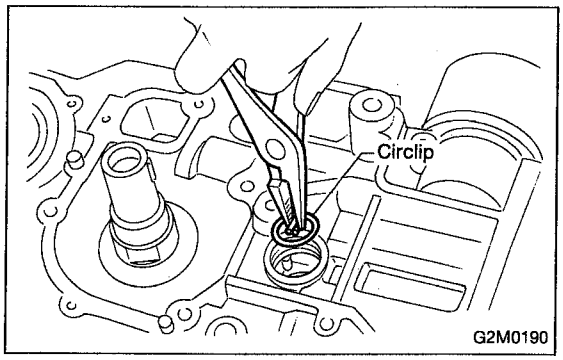


2) Installing piston pin
(1) Insert ST3 into service hole to align piston pin hole with connecting rod small end.

CAUTION:
Apply a coat of engine oil to ST3 before insertion.

ST3 499017100 PISTON PIN GUIDE

(2) Apply a coat of engine oil to piston pin and insert piston pin into piston and connecting rod through service hole.



(3) Install circlip.

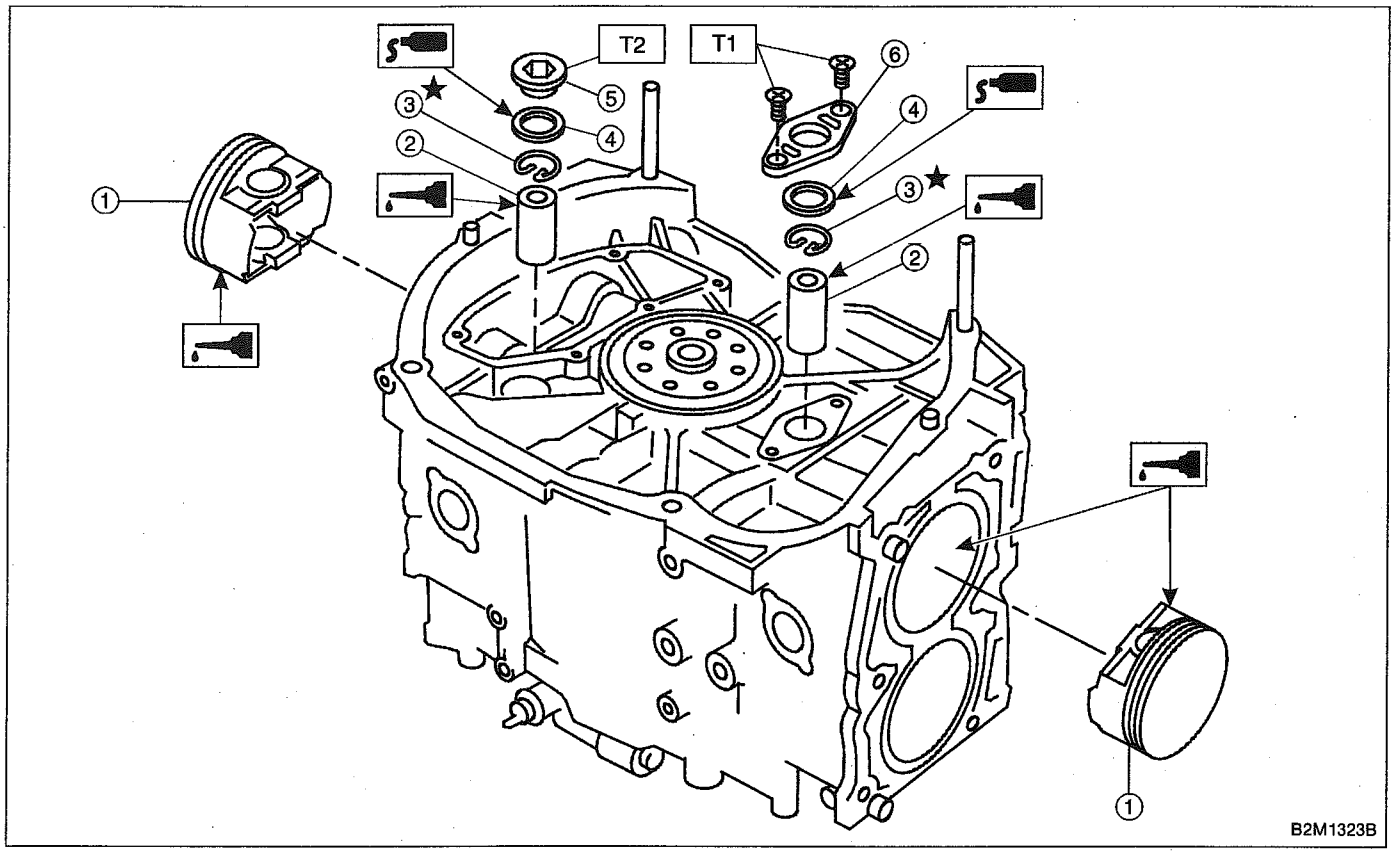
CAUTION:
Use new circlips.

(4) Install service hole plug and gasket.

CAUTION:
Use a new gasket and apply a coat of fluid packing to it before installation.

Fluid packing:
THREE BOND 1215 or equivalent

4. PISTON AND PISTON PIN (#3 AND #4)



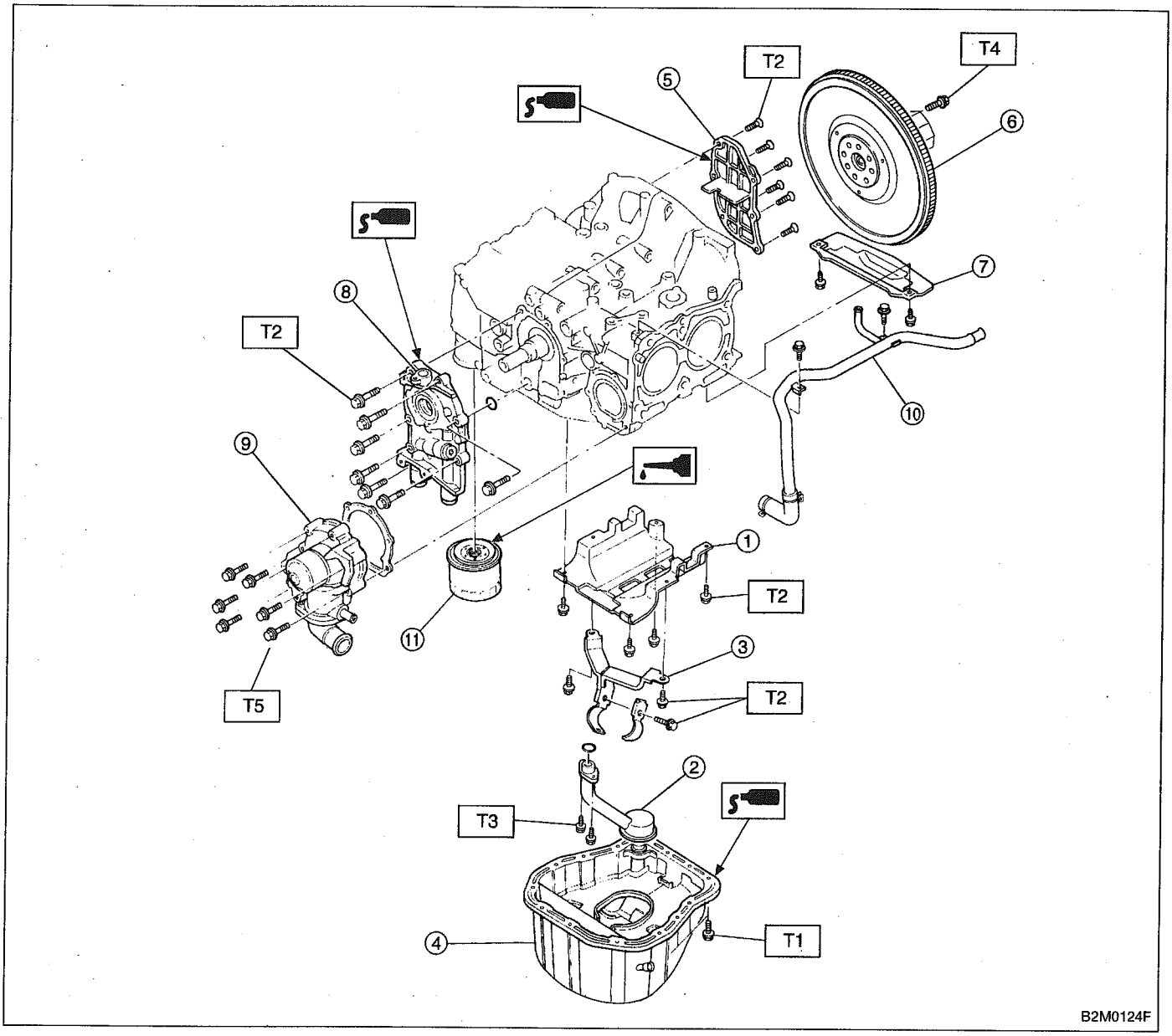
① Piston
② Piston pin
③ Circlip
④ Gasket
⑤ Service hole plug
⑥ Service hole cover
★: Replacement part

Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 69±7 (7.0±0.7, 50.6±5.1)

Turn cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install pistons and piston pins.

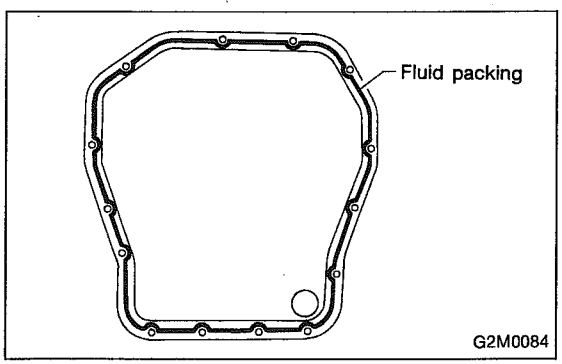
E: INSTALLATION

1. OIL PUMP AND WATER PUMP



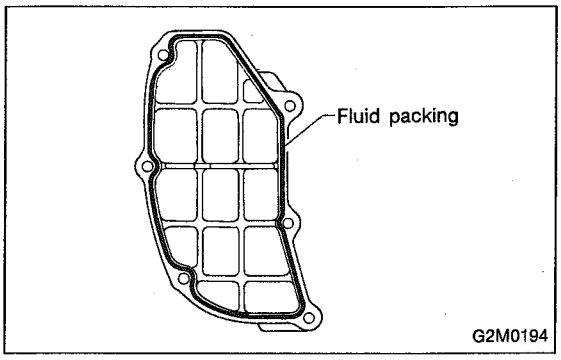
① Baffle plate
② Oil strainer
③ Oil strainer stay
④ Oil pan
⑤ Oil separator cover
⑥ Flywheel (MT vehicles)/ Drive plate (AT vehicles)
⑦ Clutch housing (MT vehicles)
⑧ Oil pump
⑨ Water pump
⑩ Water by-pass pipe
⑪ Oil filter

Tightening torque: N·m (kg-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7)
T4: 72 ± 3 (7.3 ± 0.3, 52.8 ± 2.2)
T5: First 12 ± 2 (1.2 ± 0.2, 8.7 ± 1.4)
Second 12 ± 2 (1.2 ± 0.2, 8.7 ± 1.4)



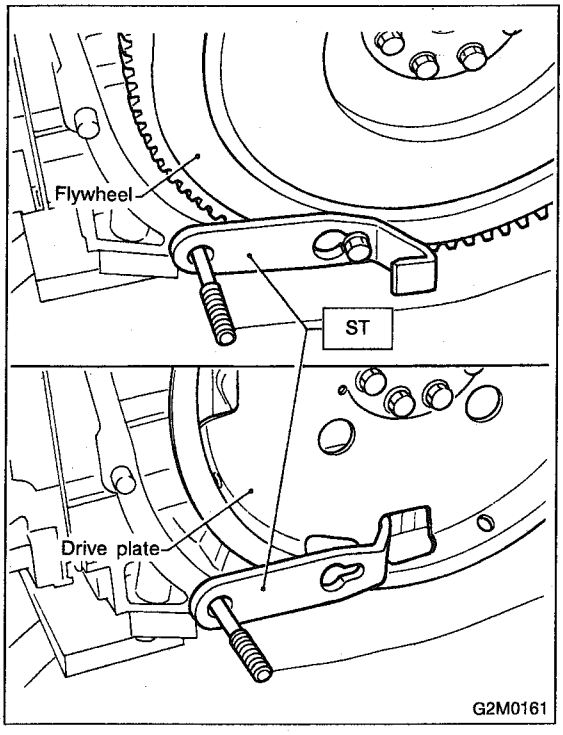
1) Install baffle plate.
2) Install oil strainer and O-ring
3) Install oil strainer stay.
4) Apply fluid packing to matching surfaces and install oil pan.

Fluid packing:
THREE BOND 1215 or equivalent

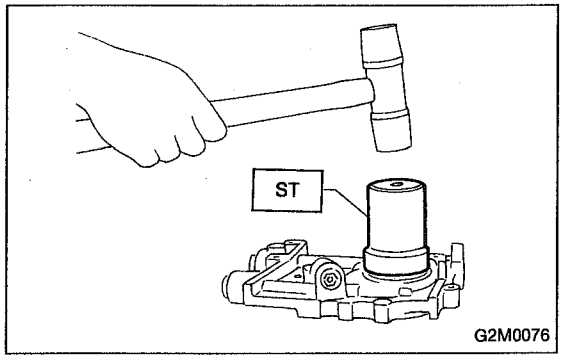


5) Apply fluid packing to matching surfaces and install oil separator cover.

Fluid packing:
THREE BOND 1215 or equivalent

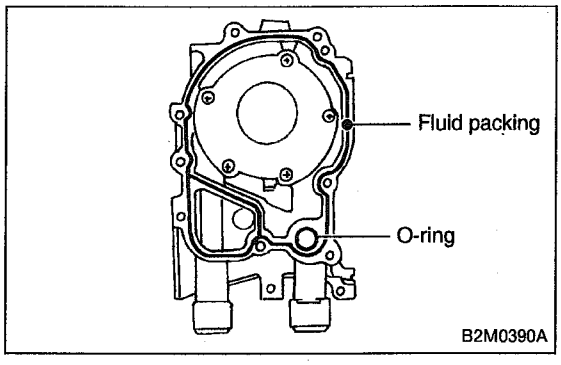


6) Install flywheel or drive plate.
To lock crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER
7) Install housing cover.



8) Installation of oil pump.
(1) Discard front oil seal after removal. Replace with a new one by using ST.

ST 499587100 OIL SEAL INSTALLER

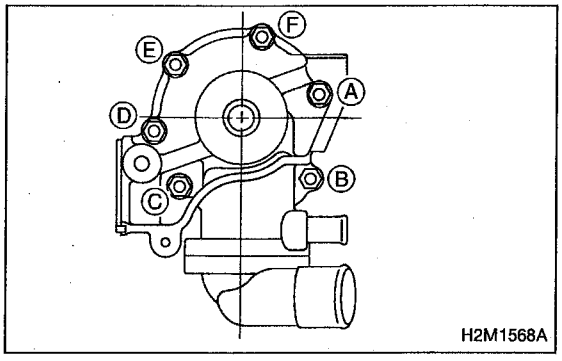


(2) Apply fluid packing to matching surface of oil pump.

Fluid packing:
THREE BOND 1215 or equivalent

(3) Install oil pump on cylinder block. Be careful not to damage oil seal during installation.

CAUTION:
● Do not forget to install O-ring and seal when installing oil pump.
● Align flat surface of oil pump's inner rotor with crankshaft before installation.



9) Install water pump and gasket.

CAUTION:
● Be sure to use a new gasket.
● When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in Figure.

10) Install water pipe.
11) Install oil filter.

2. RELATED PARTS

1) Install cylinder head and intake manifold.
<Ref. to 2-3 [W5E0].>
2) Install timing belt, camshaft sprocket and related parts.
<Ref. to 2-3 [W2C0].>

1. Engine Trouble in General

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
1. Engine will not start.			
1) Starter does not turn.	• Starter	• Defective battery-to-starter harness	B
		• Defective starter switch	C
		• Defective inhibitor switch or neutral switch	C
		• Defective starter	B
	• Battery	• Poor terminal connection	A
		• Run-down battery	A
		• Defective charging system	B
	• Friction	• Seizure of crankshaft and connecting rod bearing	C
		• Seized camshaft	C
		• Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	• Starter	• Defective starter	C
	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Fuel line	• Defective fuel pump and relay	A
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
3) Initial combustion occurs.	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
	• Fuel line	• Defective fuel pump and relay	C
		• Clogged fuel line	C
		• Lack of/or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened or cracked intake duct	B
		• Loosened or cracked PCV hose	C
		• Loosened or cracked vacuum hose	C
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Dirty air cleaner element	C
	• Fuel line	• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
2. Rough idle and engine stall	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	A
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	C
		• Loosened oil filler cap	B
		• Dirty air cleaner element	C
	• Fuel line	• Defective fuel pump and relay	C
		• Clogged fuel line	C
		• Lack of/or insufficient fuel	B
	• Belt	• Defective timing	C
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
		• Defective rocker cover gasket	C
	• Cooling system	• Overheating	C
	• Others	• Malfunction of evaporative emission control system	A
		• Stuck or damaged throttle valve	B
		• Accelerator cable out of adjustment	C

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	B
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	B
		• Loosened oil filler cap	B
		• Dirty air cleaner element	A
	• Fuel line	• Defective fuel pump and relay	B
		• Clogged fuel line	B
		• Lack of/or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
	• Cooling system	• Overheating	C
		• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	A

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4. Surging	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	A
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	B
		• Loosened oil filler cap	B
		• Dirty air cleaner element	B
	• Fuel line	• Defective fuel pump and relay	B
		• Clogged fuel line	B
		• Lack of/or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	C
5. Engine does not return to idle.	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened or cracked vacuum hose	A
	• Others	• Stuck or damaged throttle valve	A
		• Accelerator cable out of adjustment	B
6. Dieseling (Run-on)	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Cooling system	• Overheating	B
	• Others	• Accelerator cable out of adjustment	B

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
7. After burning in exhaust system	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened or cracked intake duct	C
		• Loosened or cracked PCV hose	C
		• Loosened or cracked vacuum hose	B
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	C
8. Knocking	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Loosened oil filler cap	B
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Incorrect valve timing	B
	• Cooling system	• Overheating	A
9. Excessive engine oil consumption	• Intake system	• Loosened or cracked PCV hose	A
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Compression	• Defective valve stem	A
		• Worn or stuck piston rings, cylinder and piston	A
	• Lubrication system	• Loosened oil pump attaching bolts and defective gasket	B
		• Defective oil filter seal	B
		• defective crankshaft oil seal	B
		• Defective rocker cover gasket	B
		• Loosened oil drain plug or defective gasket	B
		• Loosened oil pan fitting bolts or defective oil pan	B
10. Excessive fuel consumption	• Fuel injection system (Ref. to 2-7 On-Board Diagnostics II System)		A
	• Intake system	• Dirty air cleaner element	A
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken spring	C
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	B
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• Accelerator cable out of adjustment	B

2. Engine Noise

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective. • Incorrect valve clearance • Worn valve rocker • Worn camshaft • Broken valve spring
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft main bearing • Worn connecting rod bearing (big end)
	Oil pressure is normal.	• Loose flywheel mounting bolts • Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload.	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong spark plug • Improper gasoline
Clank when engine speed is medium (1,000 to 2,000 rpm).	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	• Worn crankshaft main bearing • Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm.	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	• Worn cylinder liner and piston ring • Broken or stuck piston ring • Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	• Worn camshaft journal bore in crankcase
Squeaky sound	—	• Insufficient generator lubrication
Rubbing sound	—	• Defective generator brush and rotor contact
Gear scream when starting engine	—	• Defective ignition starter switch • Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	• Loose drive belt • Defective water pump shaft
Hissing sound	—	• Loss of compression • Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	• Loose timing belt • Belt contacting case/adjacent part
Valve tappet noise	—	• Incorrect valve clearance

NOTE*:
• When disconnecting fuel injector connector, Malfunction Indicator Light (CHECK ENGINE light) illuminates and trouble code is stored in ECM memory.
• Therefore, carry out the CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].> after connecting fuel injector connector.

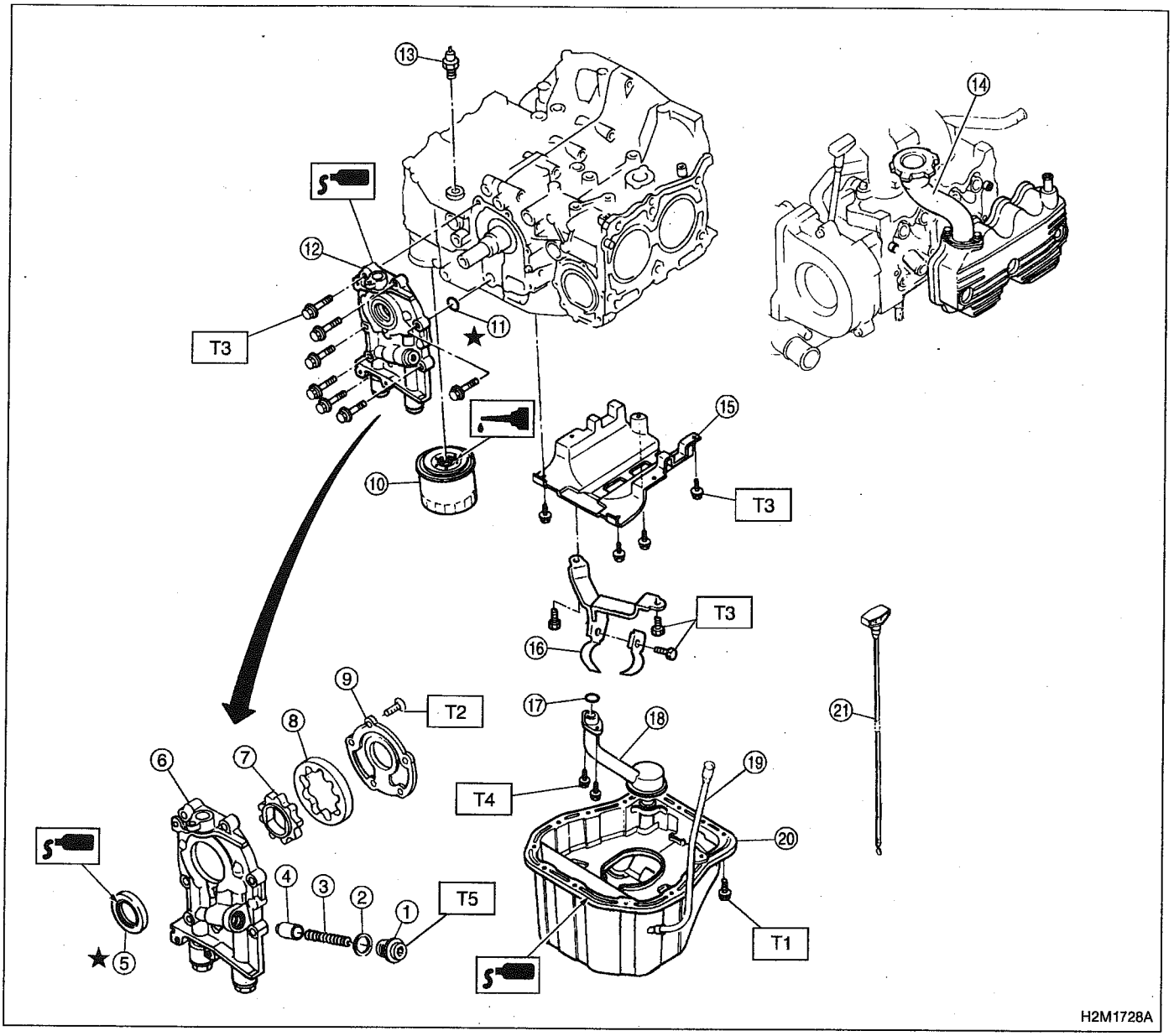
MEMO:

ENGINE LUBRICATION SYSTEM 2-4

1. Specifications

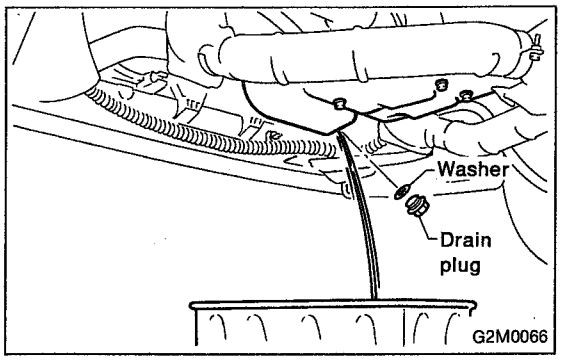
Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth		Inner rotor		9
			Outer rotor		10
	Outer rotor diameter x thickness				78 x 9 mm (3.07 x 0.35 in)
	Tip clearance between inner and outer rotor			STANDARD	0.04 — 0.14 mm (0.0016 — 0.0055 in)
				LIMIT	0.18 mm (0.0071 in)
	Side clearance between inner rotor and pump case			STANDARD	0.02 — 0.07 mm (0.0008 — 0.0028 in)
				LIMIT	0.15 mm (0.0059 in)
	Case clearance between outer rotor and pump case			STANDARD	0.10 — 0.175 mm (0.0039 — 0.0069 in)
				LIMIT	0.20 mm (0.0079 in)
	Capacity at 80°C (176°F)	600 rpm	Discharge	- pressure	98 kPa (1.0 kg/cm^2, 14 psi) or more
				- quantity	4.2 ℓ (4.4 US qt, 3.7 Imp qt)/min.
		5,000 rpm	Discharge	- pressure	294 kPa (3.0 kg/cm^2, 43 psi) or more
				- quantity	42.0 ℓ (11.10 US gal, 9.24 Imp gal)/min.
	Relief valve operation pressure				490 kPa (5.0 kg/cm^2, 71 psi)
Oil filter	Type				Full-flow filter type
	Filtration area				1,000 cm^2 (155 sq in)
	By-pass valve opening pressure				156 kPa (1.6 kg/cm^2, 23 psi)
	Outer diameter x width				80 x 70 mm (3.15 x 2.76 in)
	Oil filter to engine thread size				M 20 x 1.5
Relief valve (on rocker shaft) operation pressure					69 kPa (0.7 kg/cm^2, 10 psi)
Oil pressure switch	Type				Immersed contact point type
	Working voltage — wattage				12 V — 3.4 W or less
	Warning light activation pressure				14.7 kPa (0.15 kg/cm^2, 2.1 psi)
	Proof pressure				More than 981 kPa (10 kg/cm^2, 142 psi)
Oil capacity (at replacement)					4.0 ℓ (4.2 US qt, 3.5 Imp qt)

1. Lubrication System



① Plug
② Washer
③ Relief valve spring
④ Relief valve
⑤ Oil seal
⑥ Oil pump case
⑦ Inner rotor
⑧ Outer rotor
⑨ Oil pump cover
⑩ Oil filter
⑪ O-ring
⑫ Oil pump ASSY
⑬ Oil pressure switch
⑭ Oil filler duct
⑮ Baffle plate
⑯ Oil strainer stay
⑰ O-ring
⑱ Oil strainer
⑲ Oil level gauge guide
⑳ Oil pan
㉑ Oil level gauge

Tightening torque: N·m (kg-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 5 — 6 (0.5 — 0.6, 3.6 — 4.3)
T3: 6.4 (0.65, 4.7)
T4: 9.8 (1.0, 7.0)
T5: 40.7 — 47.6 (4.15 — 4.85, 30.0 — 35.1)

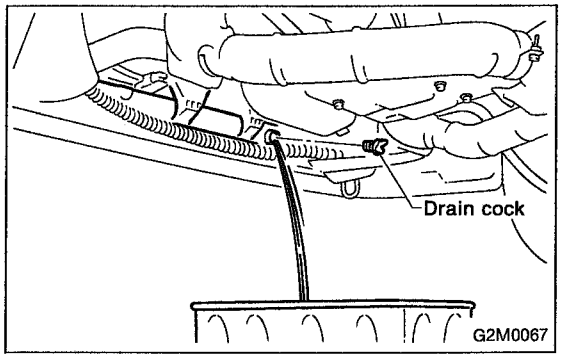


1. Oil Pump

A: REMOVAL

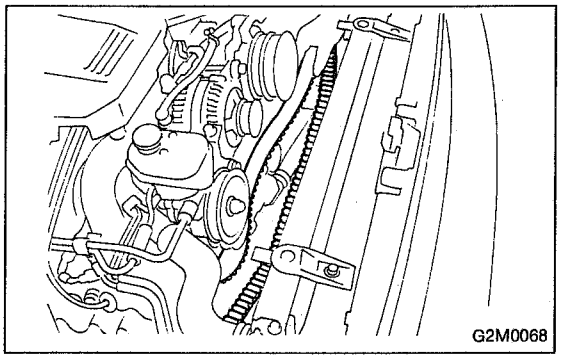
1) Drain engine oil.

Set container under the vehicle, and remove drain plug from oil pan.

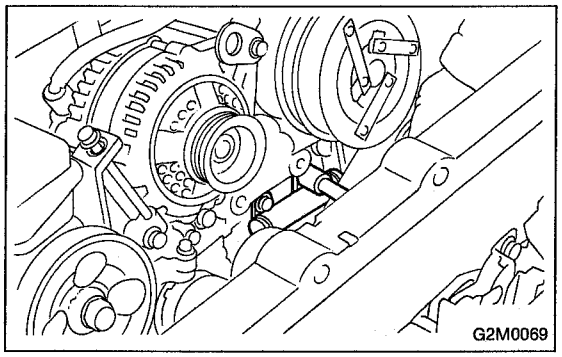


2) Drain coolant.

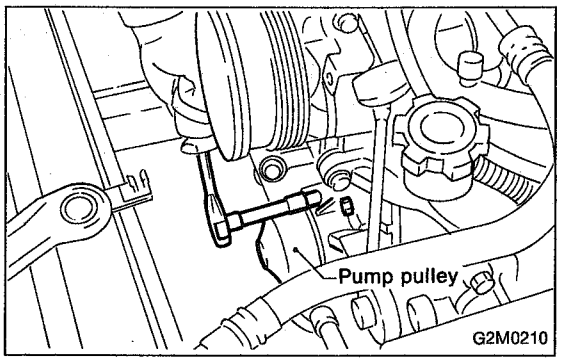
Set container under the vehicle, and remove drain cock from radiator.



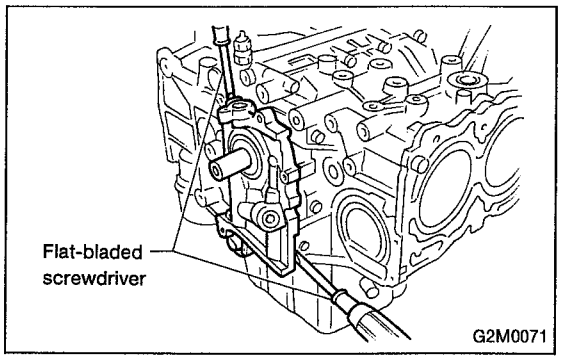
3) Remove belt covers, timing belt and related parts. <Ref. to 1-5 [W2A0].>



4) Remove belt tensioner bracket.

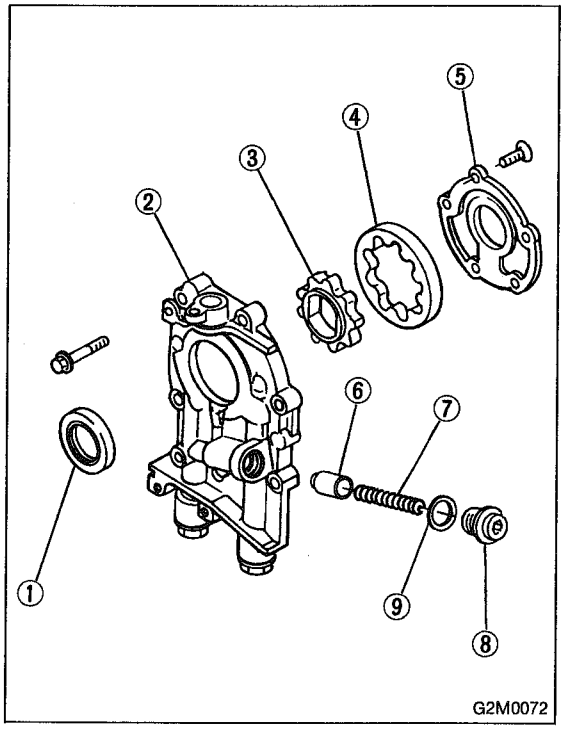


5) Remove left-hand camshaft sprocket and left-hand belt cover No. 2.
6) Remove water pump.



7) Remove oil pump by using flat-bladed screwdriver.

CAUTION:
Be careful not to scratch mating surfaces of cylinder block and oil pump.

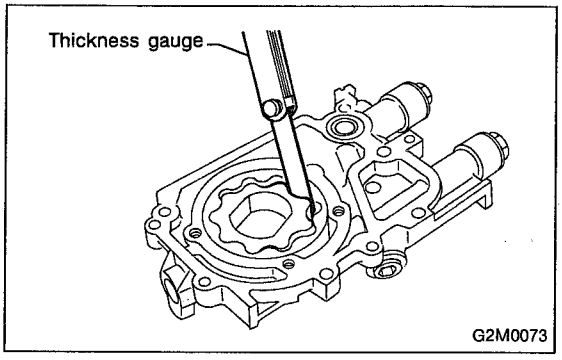


B: DISASSEMBLY

Remove screws which secure oil pump cover and disassemble oil pump.
Inscribe alignment marks on inner and outer rotors so that they can be replaced in their original positions during reassembly.

CAUTION:
Before removing relief valve, loosen plug when removing oil pump from cylinder block.

① Oil seal
② Pump case
③ Inner rotor
④ Outer rotor
⑤ Pump cover
⑥ Relief valve
⑦ Relief spring
⑧ Plug
⑨ Washer

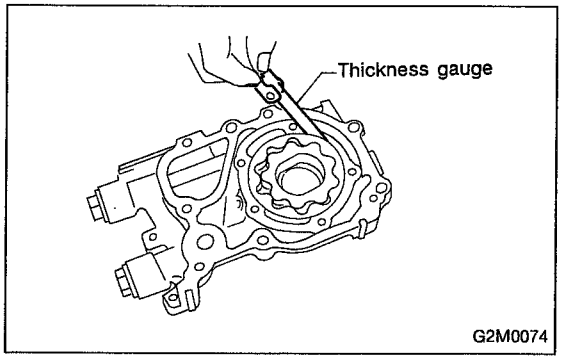


C: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds the limit, replace rotors as a matched set.

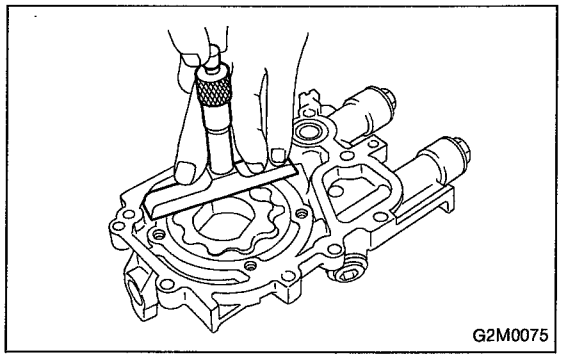
Tip clearance:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)
Limit
0.18 mm (0.0071 in)



2. CASE CLEARANCE

Measure the clearance between the outer rotor and the cylinder block rotor housing. If the clearance exceeds the limit, replace the rotor.

Case clearance:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)
Limit
0.20 mm (0.0079 in)


G2M0075

3. SIDE CLEARANCE

Measure clearance between oil pump inner rotor and pump cover. If the clearance exceeds the limit, replace rotor or pump body.

Side clearance:
Standard
0.02 — 0.07 mm (0.0008 — 0.0028 in)
Limit
0.15 mm (0.0059 in)

4. OIL RELIEF VALVE

Check the valve for fitting condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

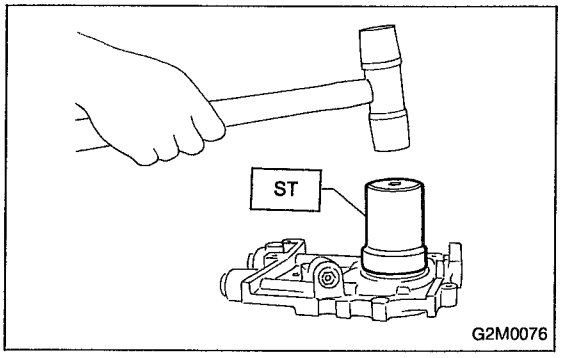
Relief valve spring:
Free length; 71.8 mm (2.827 in)
Installed length; 54.7 mm (2.154 in)
Load when installed; 77.08 N (7.86 kg, 17.33 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.



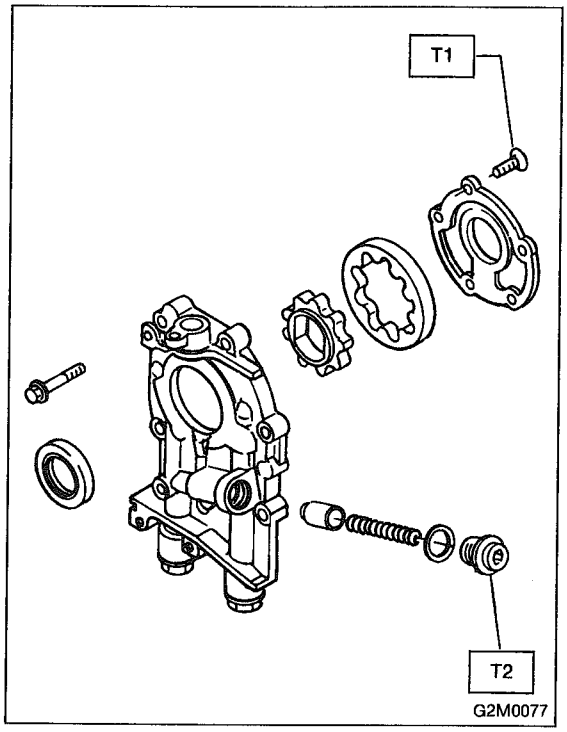
G2M0076

D: ASSEMBLY

1) Install front oil seal by using ST.

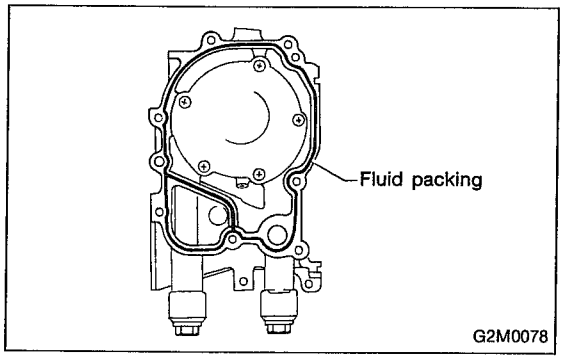
ST 499587100 OIL SEAL INSTALLER

CAUTION:
Use a new oil seal.



2) Install inner and outer rotors in their original positions.
3) Install oil relief valve and relief spring.
4) Install oil pump cover.

Tightening torque:
T1: 5 — 6 N·m (0.5 — 0.6 kg-m, 3.6 — 4.3 ft-lb)
T2: 40.7 — 47.6 N·m
(4.15 — 4.85 kg-m, 30.0 — 35.1 ft-lb)



E: INSTALLATION

Installation is in the reverse order of removal.

Observe the following:

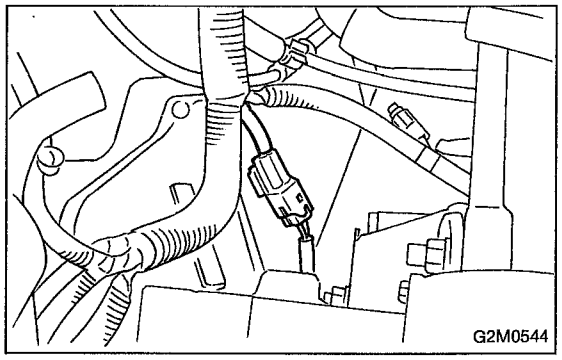
1) Apply fluid packing to matching surfaces of oil pump.

Fluid packing:
THREE BOND 1215 or equivalent

2) Replace O-ring with a new one.
3) Be careful not to scratch oil seal when installing oil pump on cylinder block.

CAUTION:
Apply fluid packing to oil pressure switch threads before installation.

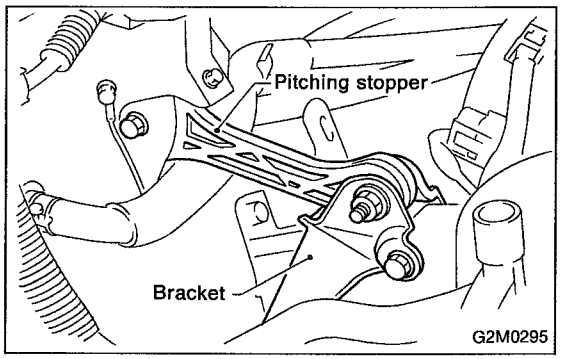
Fluid packing:
THREE BOND 1215 or equivalent



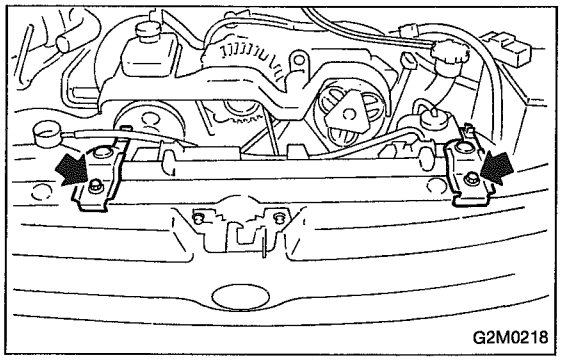
2. Oil Pan and Oil Strainer

A: REMOVAL

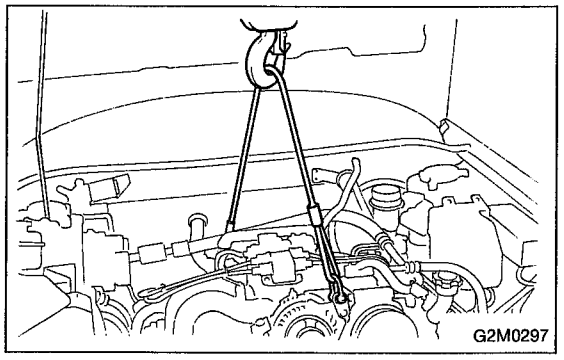
1) Remove front wheels.
2) Remove air intake duct and air intake chamber.
3) Disconnect connector from front oxygen sensor.



4) Remove pitching stopper.

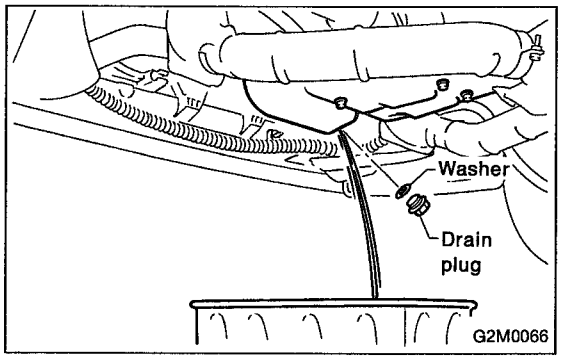


5) Remove radiator upper brackets.



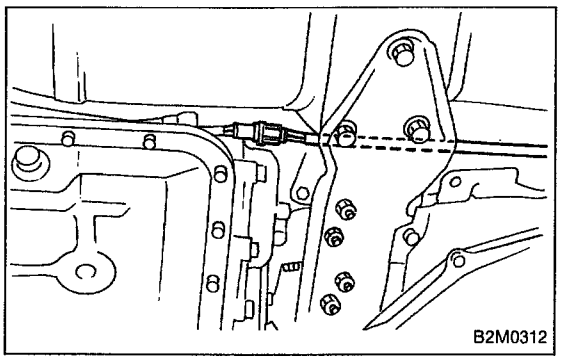
6) Support engine with a lifting device and wire ropes.
7) Lift-up the vehicle.

CAUTION:
At this time, raise up wire ropes.

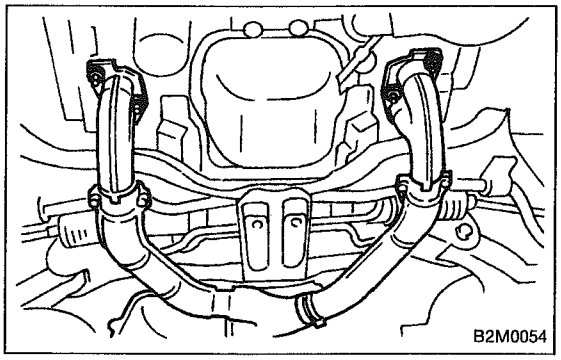


8) Drain engine oil.

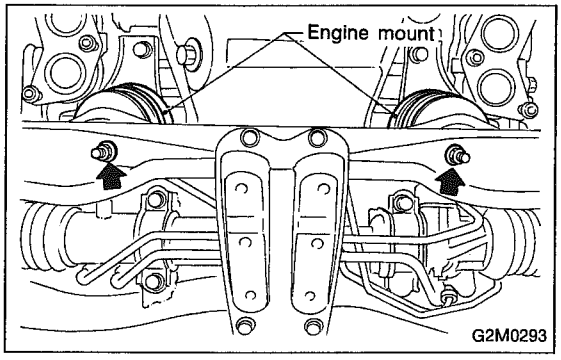
Set container under the vehicle, and remove drain plug from oil pan.



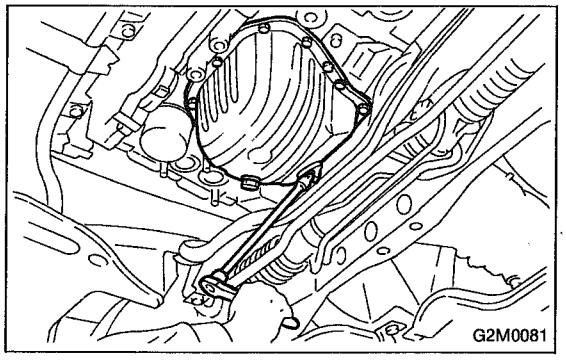
9) Disconnect connector from rear oxygen sensor.



10) Remove front exhaust pipe.
(1) Separate front catalytic converter from center exhaust pipe.
(2) Remove front exhaust pipe from engine.
(3) Remove bolt which installs front exhaust pipe on bracket.

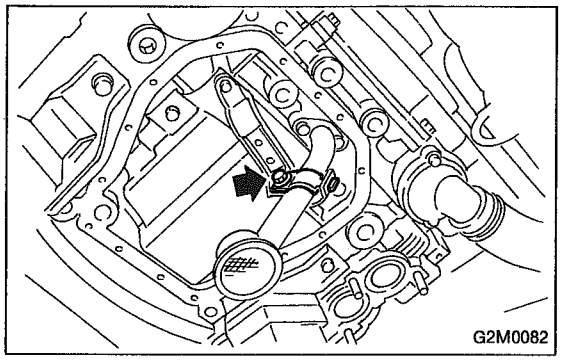


11) Remove nuts which install front cushion rubber onto front crossmember.

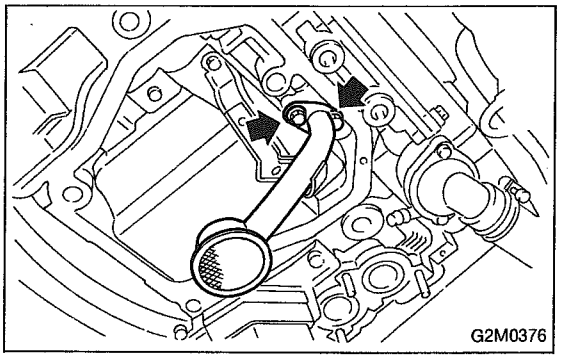


12) Remove bolts which install oil pan on cylinder block while raising up engine.
13) Insert oil pan cutter blade between cylinder block-to-oil pan clearance.

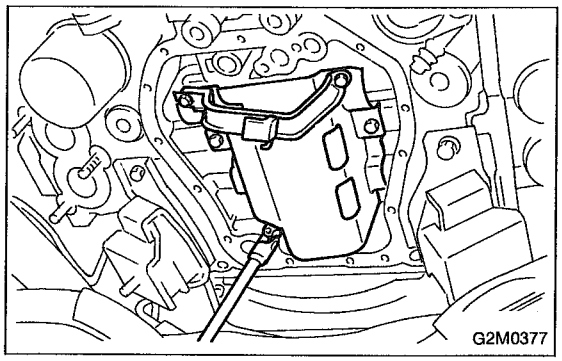
CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.



14) Separate oil strainer from oil strainer stay.



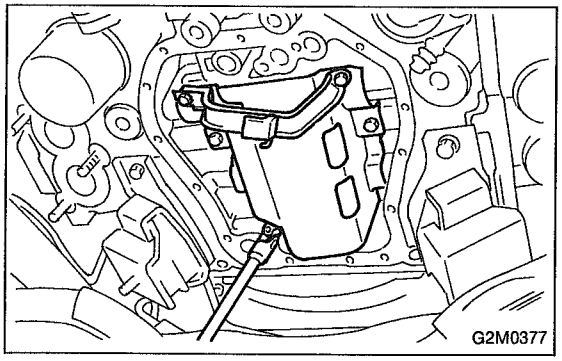
15) Remove oil strainer.



16) Remove baffle plate and oil strainer stay.

B: INSPECTION

By visual check make sure oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

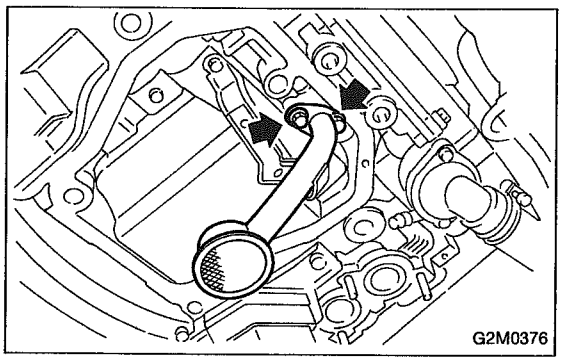


C: INSTALLATION

CAUTION:
Before installing oil pan, clean sealant from oil and engine block.

1) Install baffle plate and oil strainer stay.

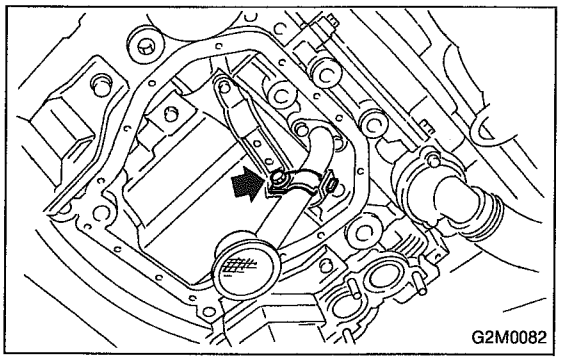
Tightening torque:
6.4 N·m (0.65 kg-m, 4.7 ft-lb)



2) Install oil strainer onto baffle plate.

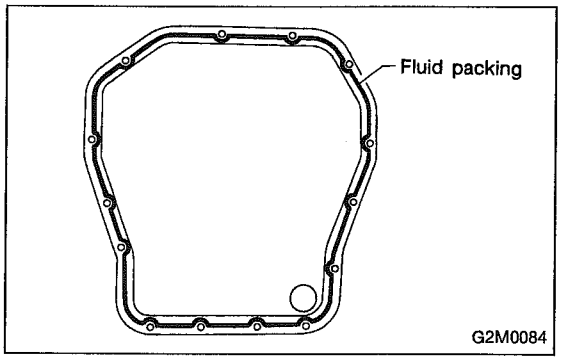
CAUTION:
Replace O-ring with a new one.

Tightening torque:
9.8 N·m (1.0 kg-m, 7 ft-lb)



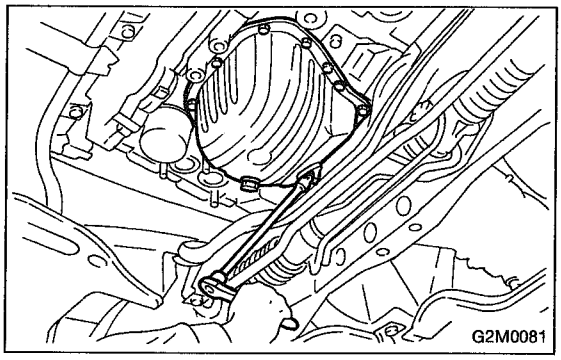
3) Hold oil strainer to oil strainer stay.

Tightening torque:
9.8 N·m (1.0 kg-m, 7 ft-lb)



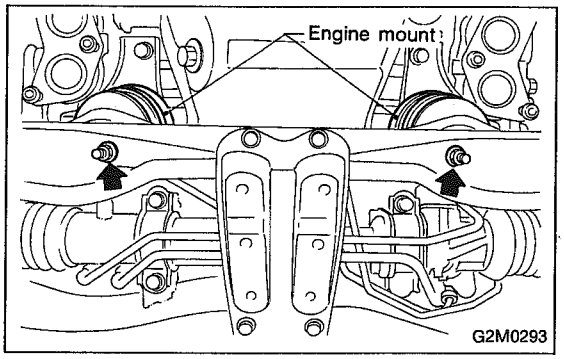
4) Apply fluid packing to mating surfaces and install oil pan.

Fluid packing:
THREE BOND 1215 or equivalent



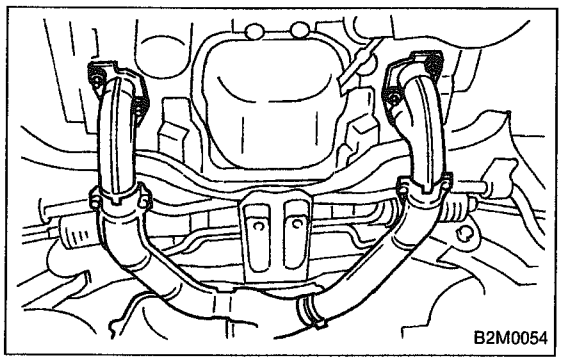
5) Tighten bolts which install oil pan onto engine block.

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



6) Lower engine onto front crossmember.
7) Tighten nuts which install front cushion rubber onto front crossmember.

Tightening torque:
69 ± 15 N·m (7.0 ± 1.5 kg-m, 51 ± 11 ft-lb)

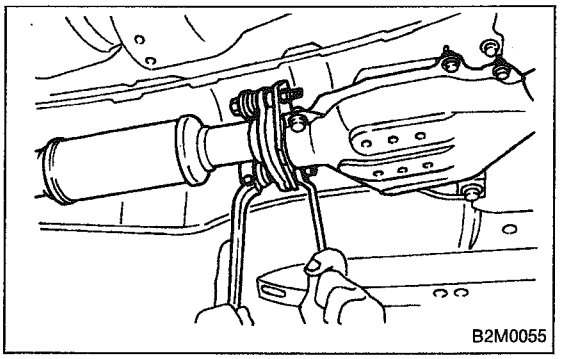


8) Install front exhaust pipe.

CAUTION:
Always use the new gaskets.

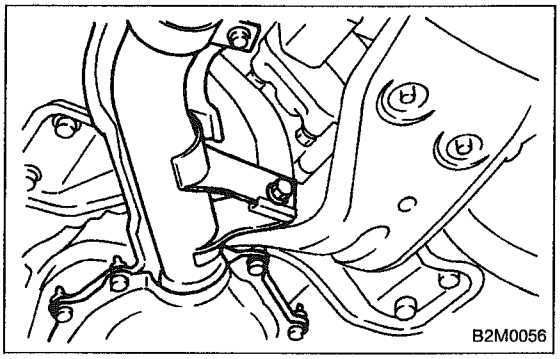
(1) Place front exhaust pipe on bracket.
(2) Tighten nuts which install front exhaust pipe on engine.

Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)



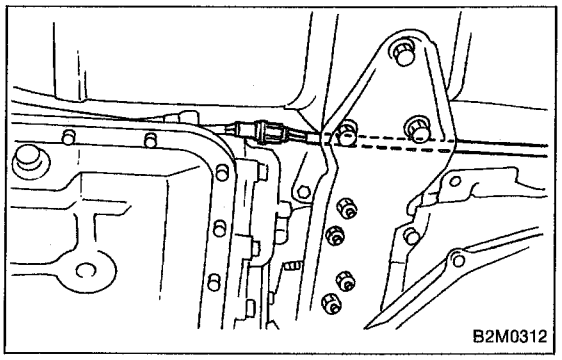
(3) Tighten nuts which install front catalytic converter to center exhaust pipe.

Tightening torque:
35 ± 5 N·m (3.6 ± 0.5 kg-m, 26.0 ± 3.6 ft-lb)

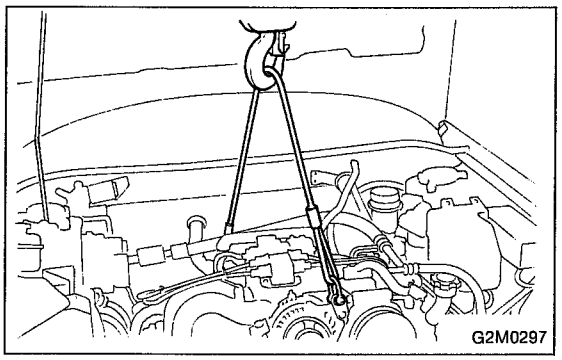


(4) Tighten bolt which installs front exhaust pipe on bracket.

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



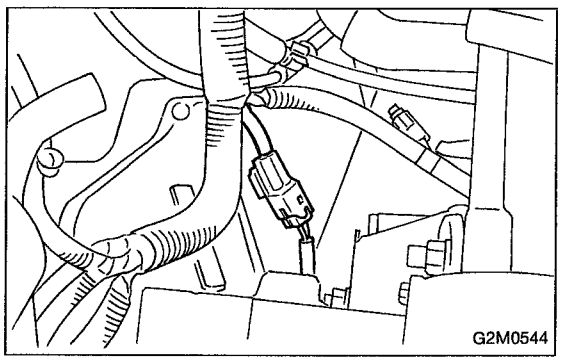
9) Connect connector to rear oxygen sensor.



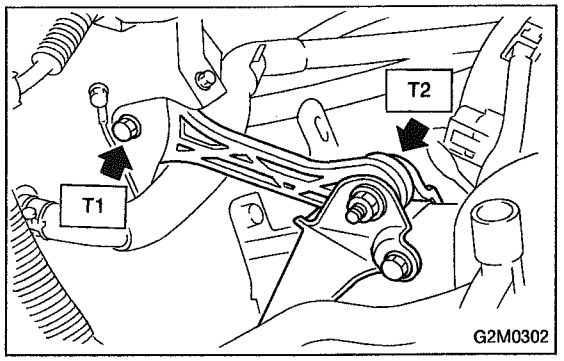
10) Lower the vehicle.

CAUTION:
At this time, lower lifting device and release steel cables.

11) Remove lifting device and steel cables.

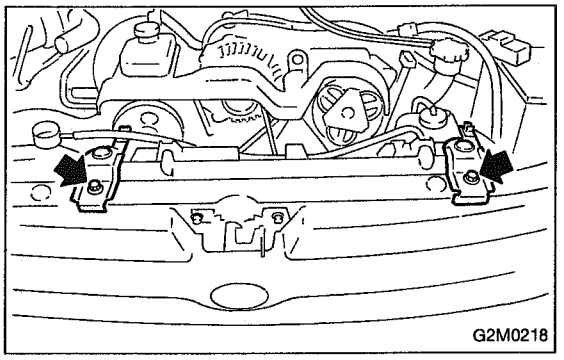


12) Connect connector to front oxygen sensor.



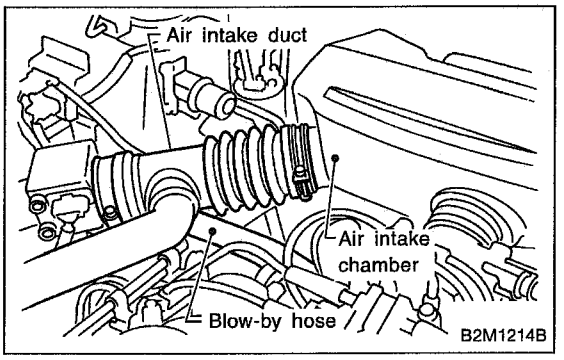
13) Install pitching stopper.

Tightening torque:
T1: 49 ± 5 N·m (5.0 ± 0.5 kg-m, 36.2 ± 3.6 ft-lb)
T2: 57 ± 10 N·m (5.8 ± 1.0 kg-m, 42 ± 7 ft-lb)



14) Install radiator upper brackets.

Tightening torque:
18 ± 5 N·m (1.8 ± 0.5 kg-m, 13 ± 4 ft-lb)

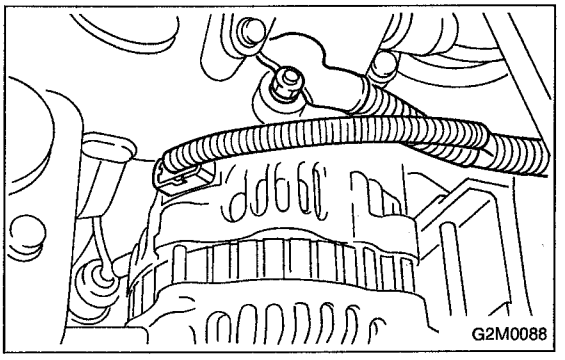


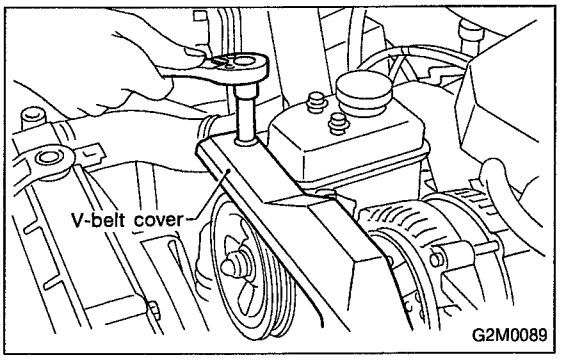
15) Install air intake duct and air intake chamber.

3. Oil Pressure Switch

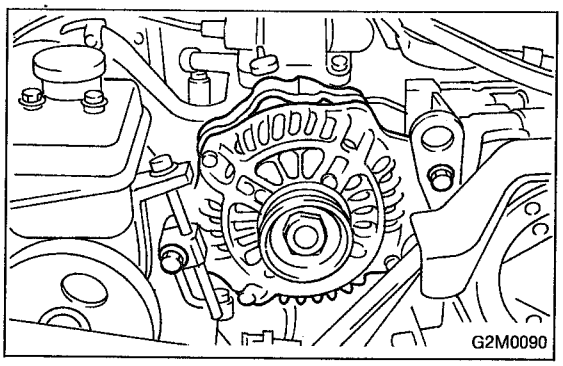
A: REMOVAL

1) Remove alternator from bracket.
   (1) Disconnect connector and terminal from generator.

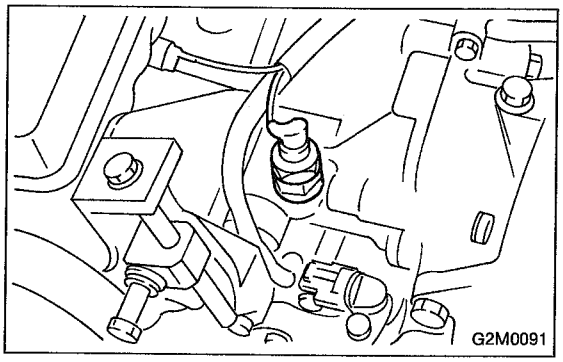




   (2) Remove V-belt cover.
   (3) Loosen lock bolt and slider bolt, and remove front side V-belt.

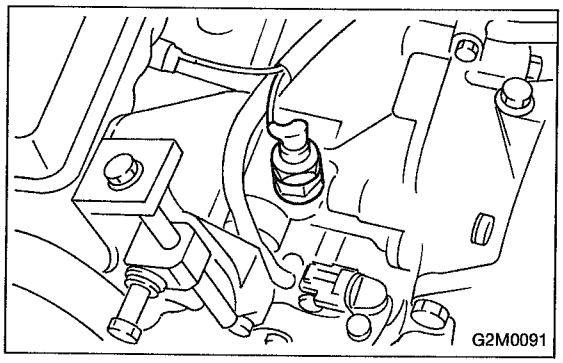


(4) Remove bolts which install generator on bracket.



2) Disconnect terminal from oil pressure switch.
3) Remove oil pressure switch.

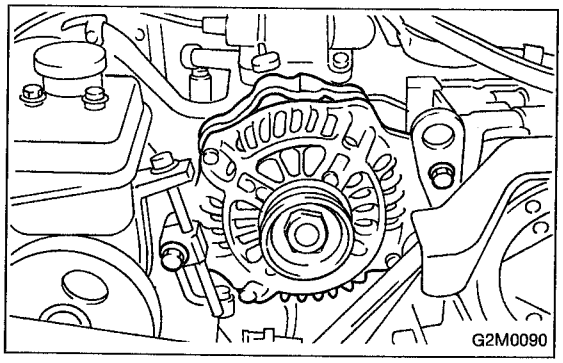
B: INSTALLATION



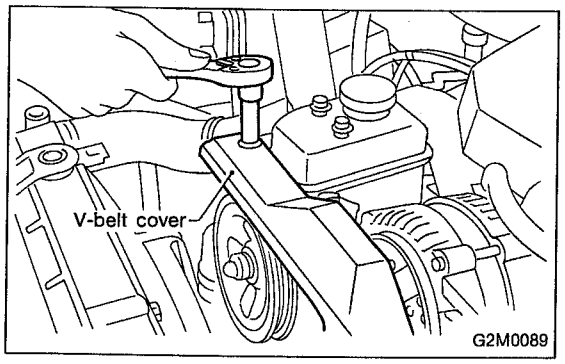
1) Install oil pressure switch onto engine block.

Tightening torque:
25 ± 3 N·m (2.5 ± 0.3 kg-m, 18.1 ± 2.2 ft-lb)

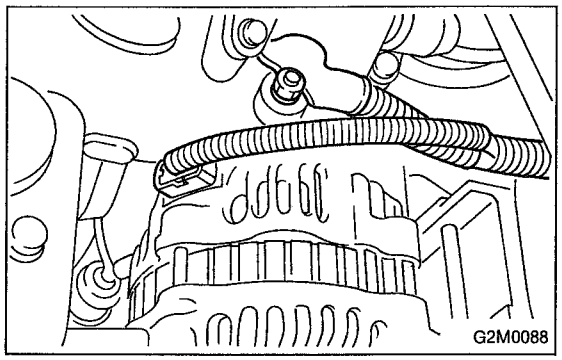
2) Connect terminal of oil pressure switch.



3) Install generator on bracket and temporary tighten installing bolts.



4) Install front side V-belt and adjust it.
<Ref. to 1-5 [01B0].>
5) Install V-belt cover.



6) Connect connector and terminal to generator.

1. Engine Lubrication System Trouble in General

Before troubleshooting, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogged oil filter	Replace.
		Malfunction of oil by-pass valve of oil filter	Clean or replace.
		Malfunction of oil relief valve of oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil	Replenish.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not go on.	1) Burn-out bulb		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact at terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed in 1.—2)

ENGINE COOLING SYSTEM 2-5

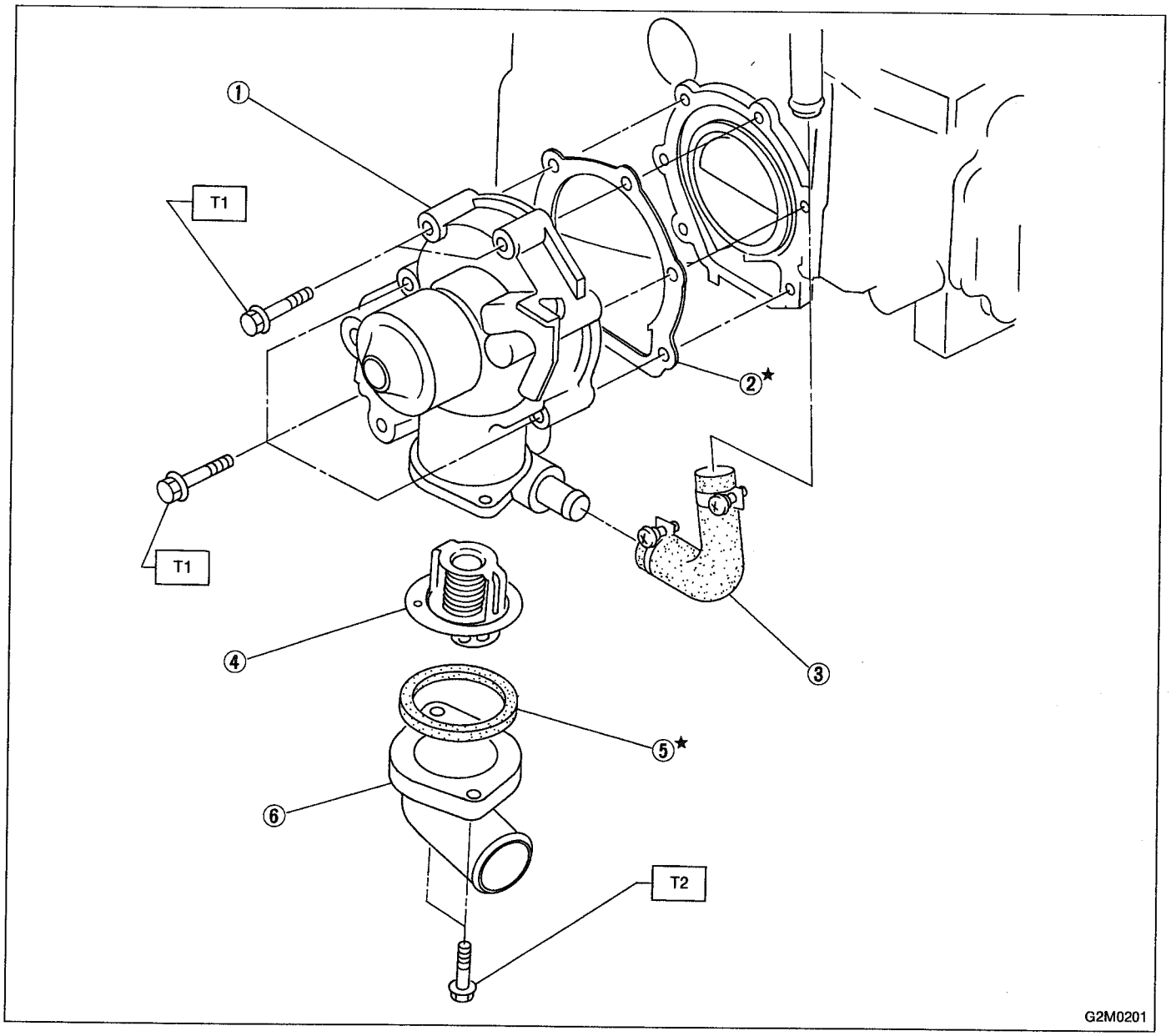
1. Specifications

Cooling system			Electric fan + Forced engine coolant circulation system
Total engine coolant capacity ℓ (US qt, Imp qt)		1800 cc	6.2 (6.6, 5.5)
		2200 cc	5.8 (6.1, 5.1)
Water pump	Type		Centrifugal impeller type
	Discharge performance I	Discharge	20 ℓ (5.3 US gal, 4.4 Imp gal)/min.
		Pump speed—total engine coolant head	760 rpm — 0.3 mAq (1.0 ftAq)
		Engine coolant temperature	85°C (185°F)
	Discharge performance II	Discharge	100 ℓ (26.4 US gal, 22.0 Imp gal)/min.
		Pump speed—total engine coolant head	3,000 rpm — 5.0 mAq (16.4 ftAq)
		Engine coolant temperature	85°C (185°F)
	Discharge performance III	Discharge	200 ℓ (52.8 US gal, 44.0 Imp gal)/min.
		Pump speed—total engine coolant head	6,000 rpm — 23.0 mAq (75.5 ftAq)
		Engine coolant temperature	85°C (185°F)
	Impeller diameter		76 mm (2.99 in)
	Number of impeller vanes		8
	Pump pulley diameter		60 mm (2.36 in)
Thermostat	Type		Wax pellet type
	Starts to open		76 — 80°C (169 — 176°F)
	Fully opened		91°C (196°F)
	Valve lift		9.0 mm (0.354 in) or more
	Valve bore		35 mm (1.38 in)
Radiator fan	Motor		90 W
	Fan diameter x Blade		320 mm (12.60 in) x 5
Radiator	Type		Down flow, pressure type
	Core dimensions		691 x 340 x 16 mm (27.20 x 13.39 x 0.63 in)
	Pressure range in which cap valve is open		Above: 88 ± 10 kPa (0.9 ± 0.1 kg/cm^2, 12.8 ± 1.4 psi) Below: – 4.9 to – 9.8 kPa (– 0.05 to – 0.1 kg/cm^2, – 0.7 to – 1.4 psi)
	Fins		Corrugated fin type
Reservoir tank	Capacity		0.5 ℓ (0.5 US qt, 0.4 Imp qt)

2. Service Data

Water pump	Clearance between impeller and case	Standard Limit	0.5 — 0.7 mm (0.020 — 0.028 in) 1.0 mm (0.039 in)
	"Thrust" runout of impeller end		0.5 mm (0.020 in)

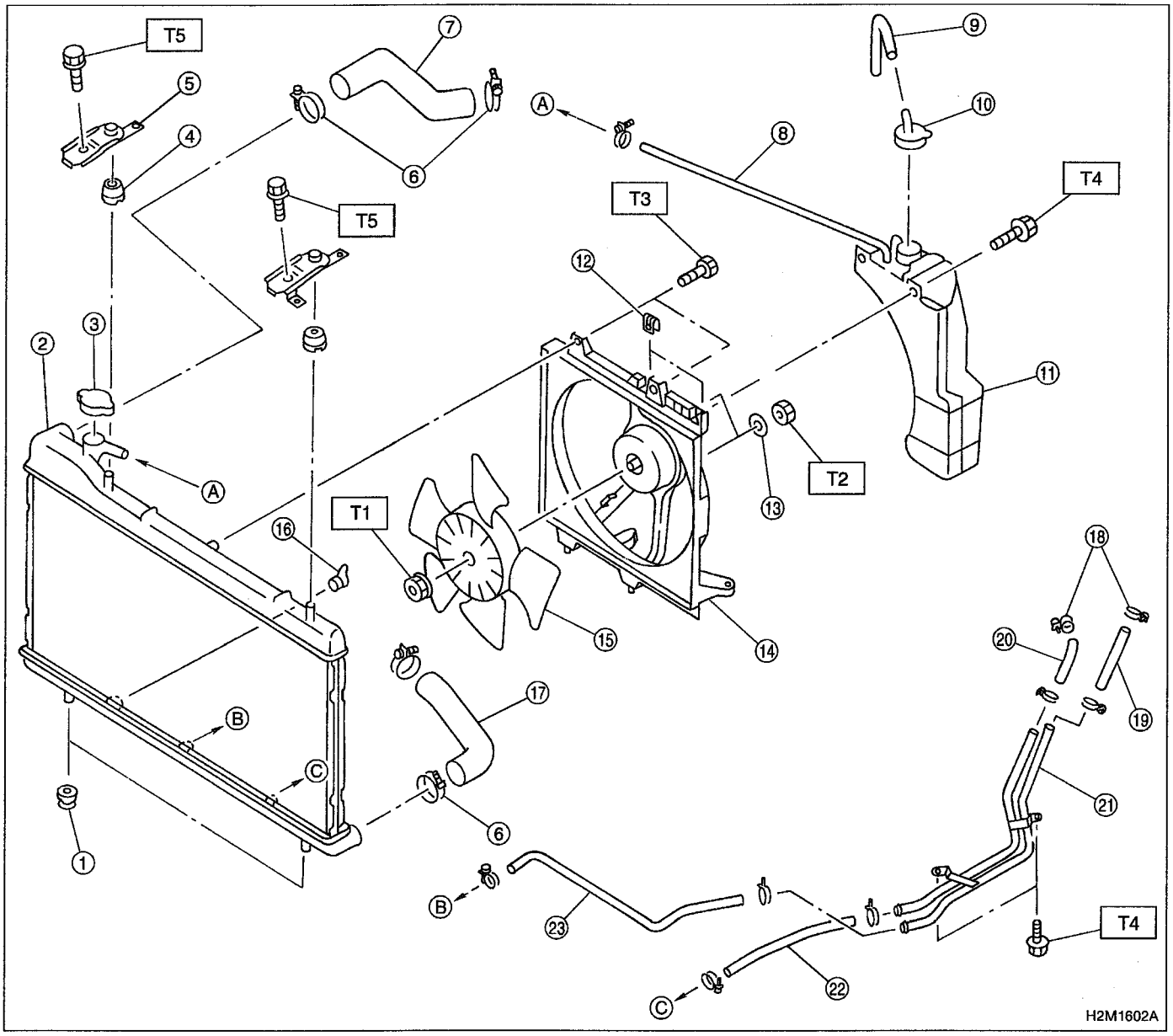
1. Water Pump



① Water pump ASSY
② Gasket
③ Heater hose
④ Thermostat
⑤ Gasket
⑥ Thermostat case

Tightening torque: N·m (kg-m, ft-lb)
T1: First 10^{+4}_{-0} ($1.0^{+0.4}_{-0}$, $7.2^{+2.9}_{-0}$)
Second 10^{+4}_{-0} ($1.0^{+0.4}_{-0}$, $7.2^{+2.9}_{-0}$)
T2: 6.4 ± 0.5 (0.65 ± 0.05, 4.7 ± 0.4)

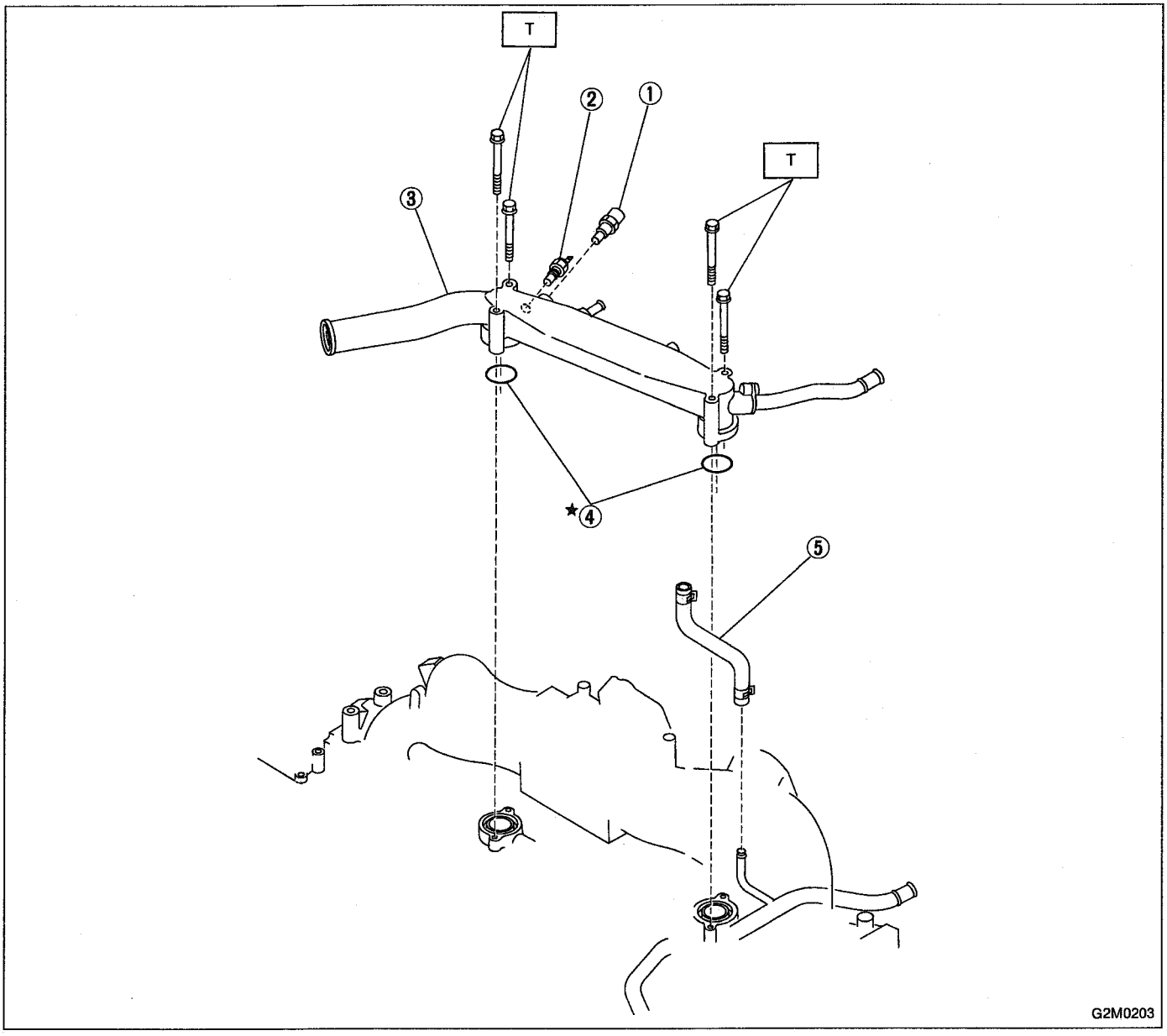
2. Radiator and Radiator Fan



① Radiator lower cushion
② Radiator
③ Radiator cap
④ Radiator upper cushion
⑤ Radiator upper bracket
⑥ Clamp
⑦ Radiator inlet hose
⑧ Over flow hose
⑨ Air vent hose
⑩ Engine coolant reservoir tank cap
⑪ Engine coolant reservoir tank
⑫ Clip
⑬ Washer
⑭ Radiator main fan motor ASSY
⑮ Radiator main fan
⑯ Radiator drain plug
⑰ Radiator outlet hose
⑱ ATF hose clamp
⑲ ATF inlet hose A
⑳ ATF outlet hose A
㉑ ATF pipe
㉒ ATF outlet hose B
㉓ ATF inlet hose B

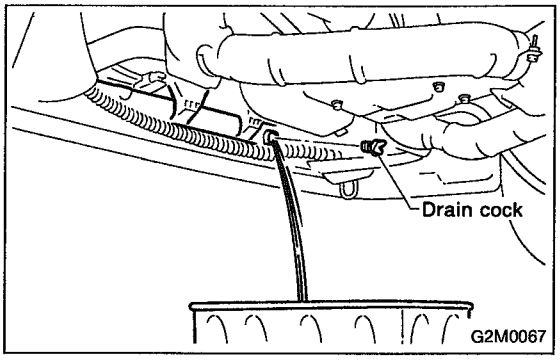
Tightening torque: N·m (kg-m, ft-lb)
T1: 2.0±0.5 (0.2±0.05, 1.4±0.4)
T2: 3.4±0.5 (0.35±0.05, 2.5±0.4)
T3: 3.9±1.0 (0.4±0.1, 2.9±0.7)
T4: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T5: 18±5 (1.8±0.5, 13.0±3.6)

3. Water Pipe



① Engine coolant temperature sensor
② Engine coolant temperature gauge
③ Water pipe
④ O-ring
⑤ By-pass hose

Tightening torque: N·m (kg-m, ft-lb)
T: 6.4±0.5 (0.65±0.05, 4.7±0.4)



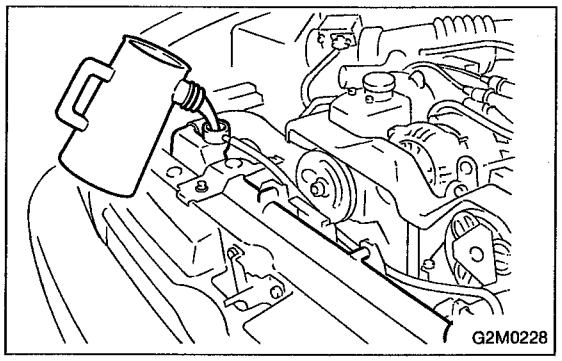
1. On-Car Service

A: DRAINING OF ENGINE COOLANT

1) Lift-up the vehicle.

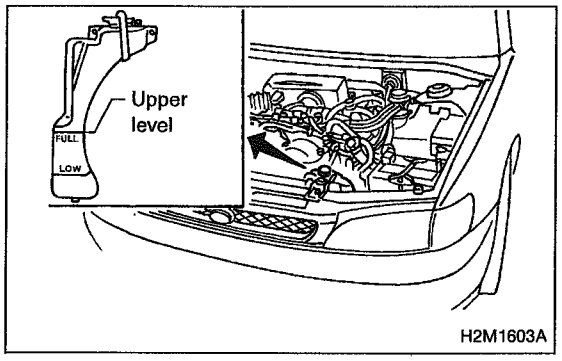
2) Loosen drain cock to drain engine coolant into container.

NOTE:
Remove radiator cap so that engine coolant will drain faster.



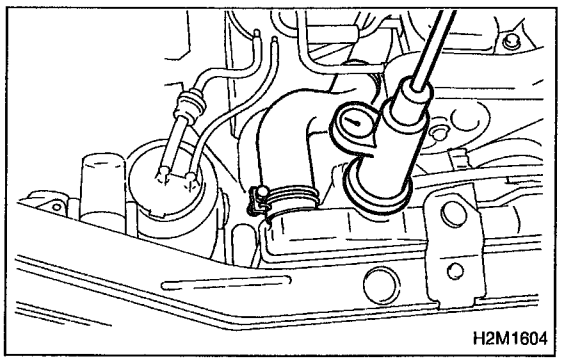
B: FILLING OF ENGINE COOLANT

1) Fill engine coolant into radiator up to filler neck position.



2) Fill engine coolant into reservoir tank up to upper level.

3) Attach radiator cap and reservoir tank cap properly.
4) Warm-up engine completely for more than five minutes at 2,000 to 3,000 rpm.
5) Stop engine and wait until temperature drops to a safe level.
6) If engine coolant level drops in radiator, add engine coolant to filler neck position.
7) If engine coolant level drops from upper level of reservoir tank, add engine coolant to upper level.
8) Attach radiator cap and reservoir tank cap properly.


H2M1604

C: CHECKING OF COOLING SYSTEM

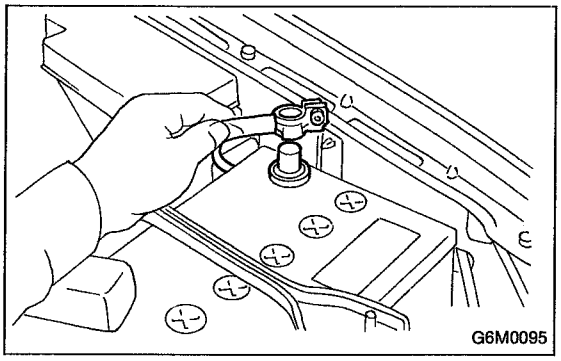
1) Remove radiator cap, top off radiator, and attach tester to radiator in place of cap.
2) Apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) to radiator to check if:
   (1) Engine coolant leaks at/around radiator.
   (2) Engine coolant leaks at/around hoses or connections.

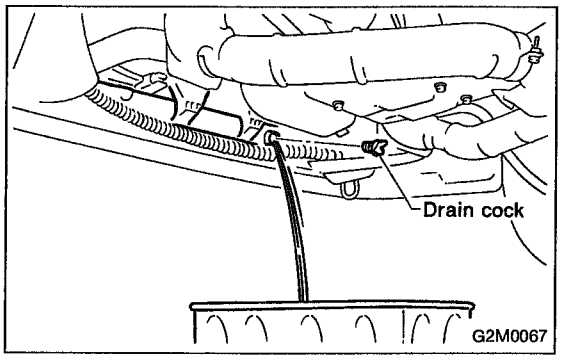
CAUTION:
- **Engine should be off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful to prevent engine coolant from spurting out when removing tester.**
- **Be careful also not to deform filler neck of radiator when installing or removing tester.**

2. Water Pump

A: REMOVAL AND INSTALLATION

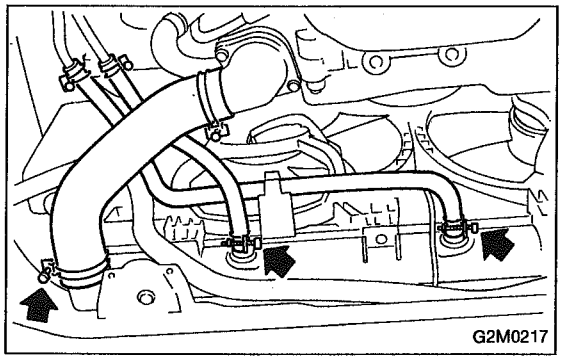
1) Open front hood.
2) Disconnect ground cable from the battery.


G6M0095

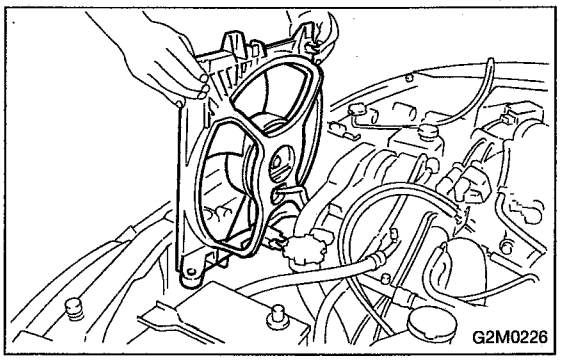


G2M0067

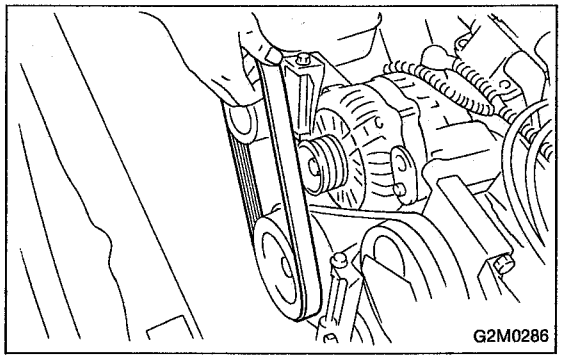
3) Drain engine coolant completely.
NOTE:
Set container under the vehicle, and remove drain cock from radiator.


G2M0217

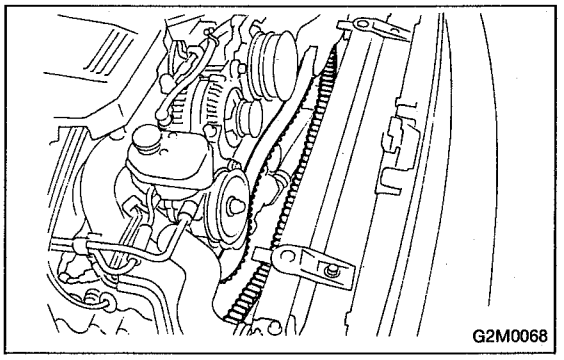
4) Disconnect radiator outlet hose from water pump.



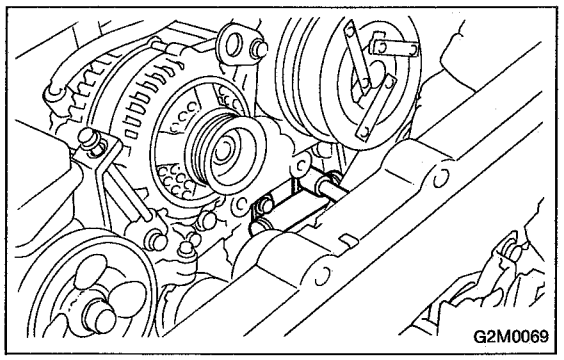
5) Remove radiator fan motor assembly.
<Ref. to 2-5 [W6A0].>



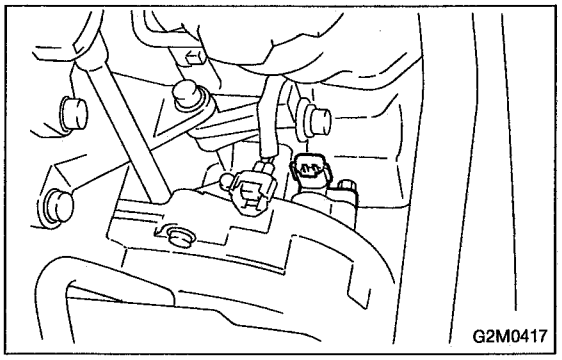
6) Remove V-belt(s).
<Ref. to 1-5 [02B0].>



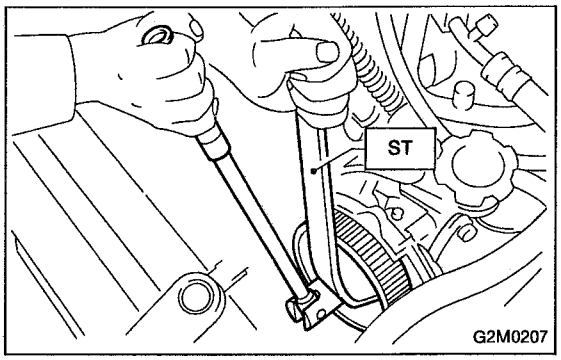
7) Remove timing belt.
<Ref. to 1-5 [03A0].>



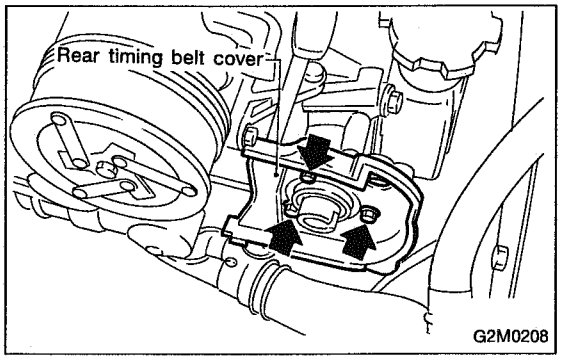
8) Remove belt tension adjuster.



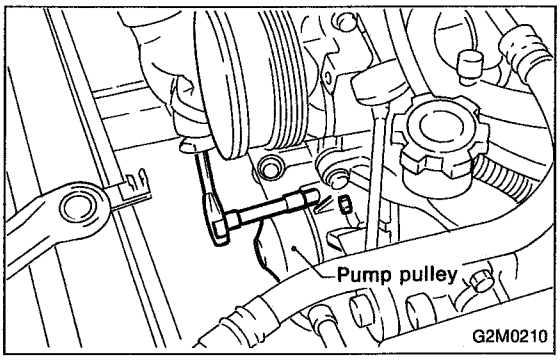
9) Remove camshaft position sensor.



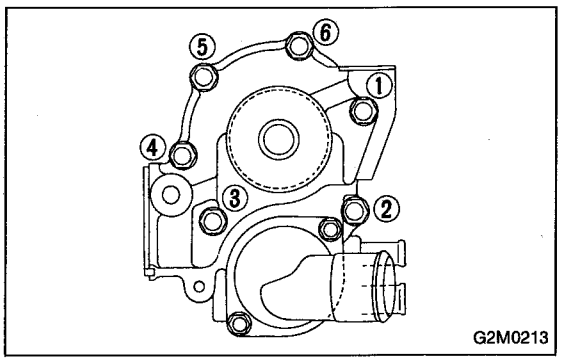
10) Remove left-hand camshaft sprocket by using ST.
ST 499207100 CAMSHAFT SPROCKET WRENCH



11) Remove left-hand belt cover No. 2.



12) Remove tensioner bracket.
13) Disconnect heater hose from water pump.
14) Remove water pump.



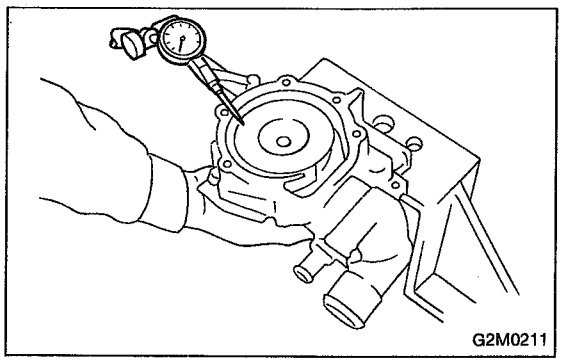
15) Installation is in the reverse order of removal.

CAUTION:
- **Replace gasket with a new one.**
- **When installing water pump, tighten bolts in two stages in numerical sequence as shown in figure.**

Tightening torque:
10^{+4}_{-0} N·m ($1.0^{+0.4}_{-0}$ kg-m, $7.2^{+2.9}_{-0}$ ft-lb)

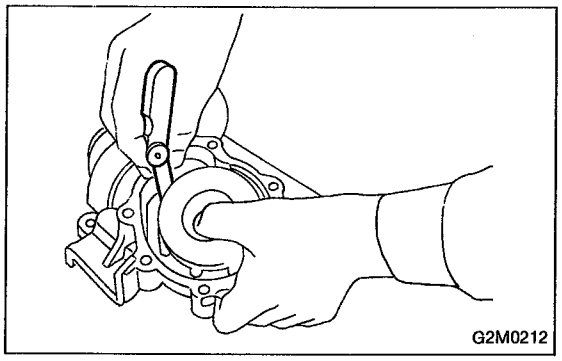
B: INSPECTION

1) Check water pump bearing for smooth rotation.
2) Check water pump pulley for abnormalities.



3) Using a dial gauge, measure impeller runout in thrust direction while rotating the pulley.

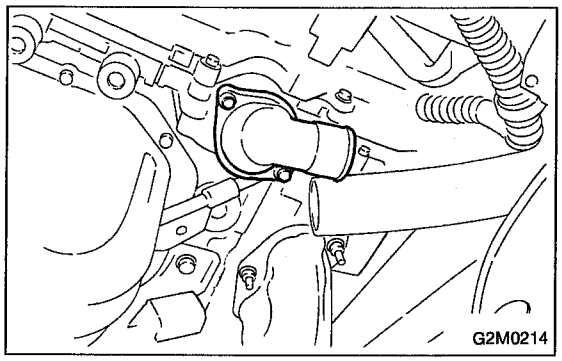
"Thrust" runout limit:
0.5 mm (0.020 in)



4) Check clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 0.7 mm (0.020 — 0.028 in)
Limit
1.0 mm (0.039 in)

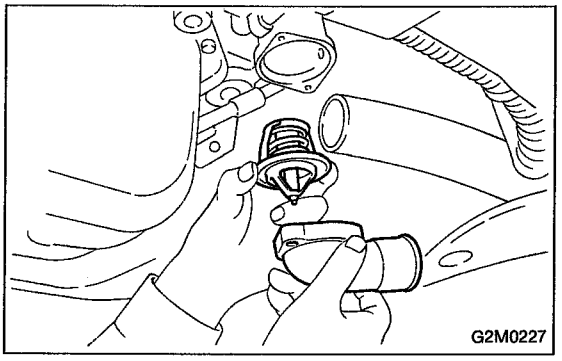
5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace water pump assembly.



3. Thermostat

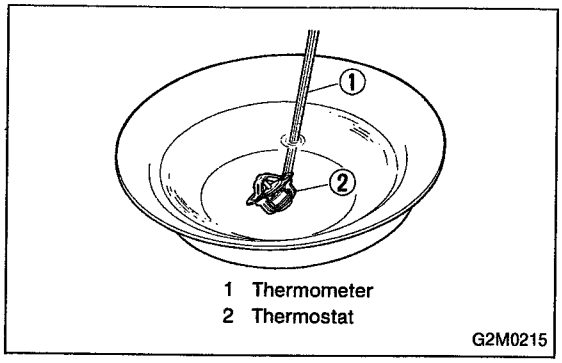
A: REMOVAL AND INSTALLATION

1) Drain engine coolant:
Set container under the vehicle, and remove drain cock from radiator.
2) Disconnect radiator outlet hose from thermostat cover.
3) Remove thermostat cover and gasket, and pull out the thermostat.



4) Install the thermostat in the intake manifold, and install the thermostat cover together with a gasket.

CAUTION:
- **When reinstalling the thermostat, use a new gasket.**
- **The thermostat must be installed with the jiggle pin upward.**
- **In this time, set the jiggle pin of thermostat for front side.**

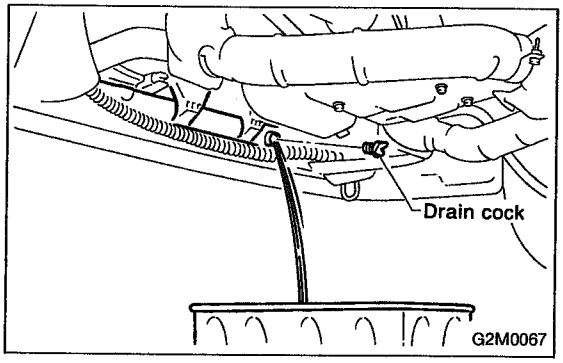


B: INSPECTION

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.
Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measurement should be to the specification.

Starts to open:
76.0 — 80.0°C (169 — 176°F)

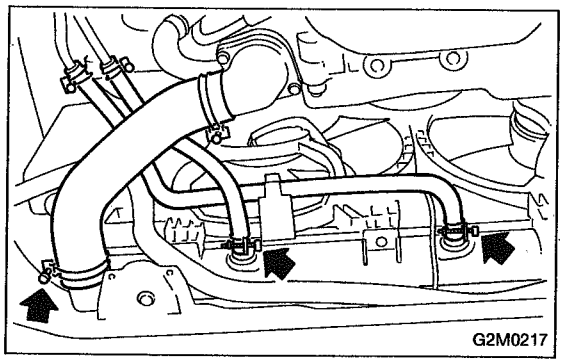
Fully opens:
91°C (196°F)



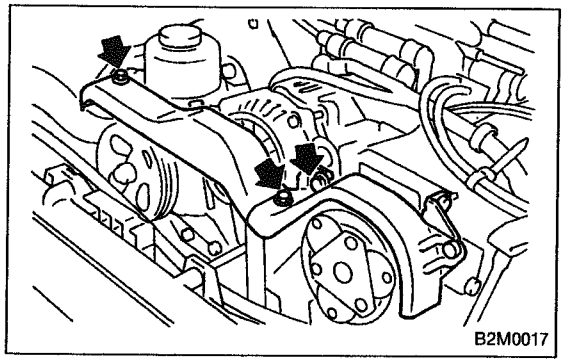
4. Radiator

A: REMOVAL

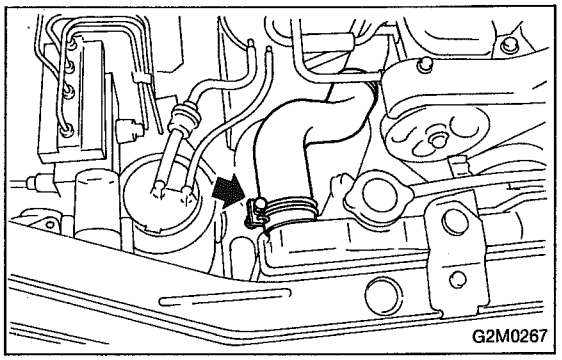
1) Disconnect battery cables and remove battery from body.
2) Drain engine coolant:
Set container under the vehicle, and remove drain cock from radiator.



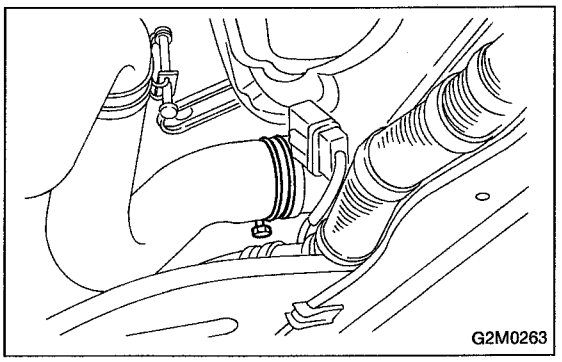
3) Disconnect radiator outlet hose from thermostat cover.
4) Disconnect ATF cooler hoses from radiator. (AT model)



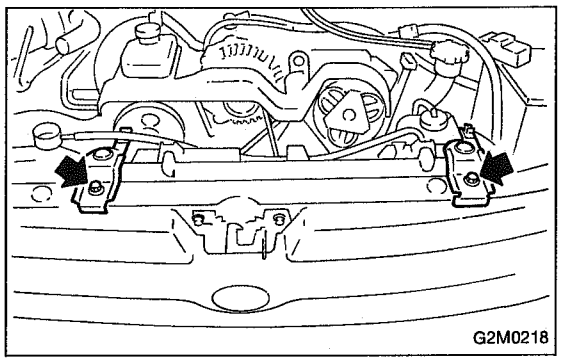
5) Remove V-belt cover.



6) Disconnect inlet hose from radiator.



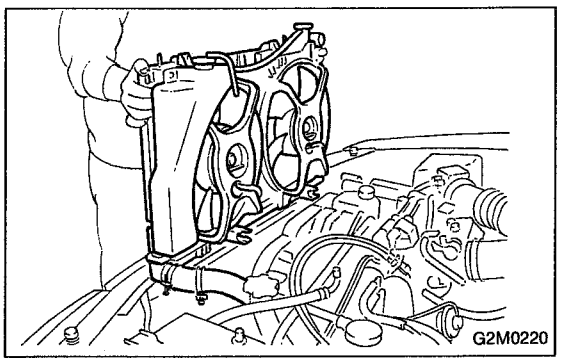
7) Disconnect connectors of radiator main fan and sub fan motor.



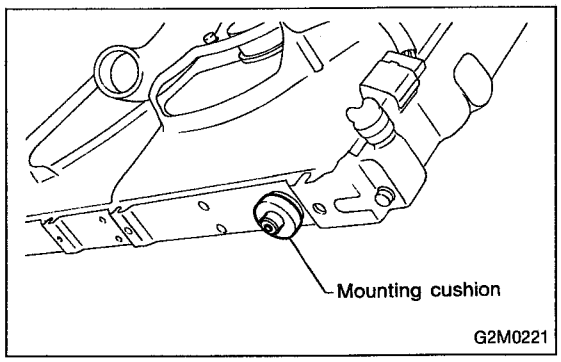
8) Remove radiator upper brackets.

NOTE:
Place left upper radiator bracket between grille and body.

9) While slightly lifting radiator, slide it to left.

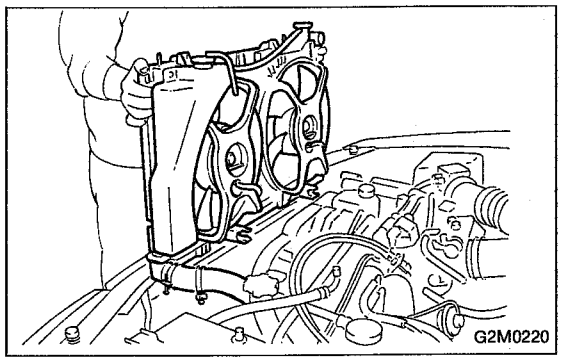


10) Lift radiator up and away from vehicle.

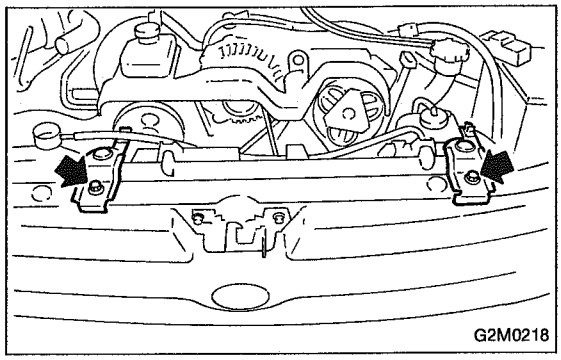


B: INSTALLATION

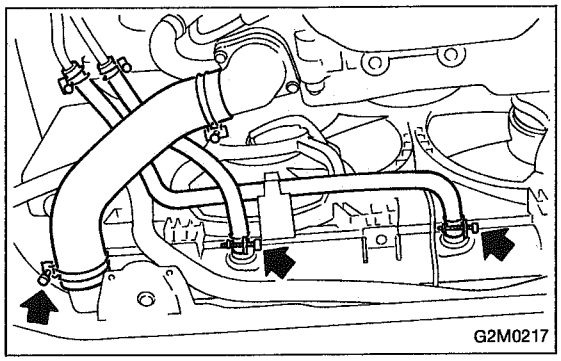
1) Attach radiator mounting cushions to pins on the lower side of radiator.



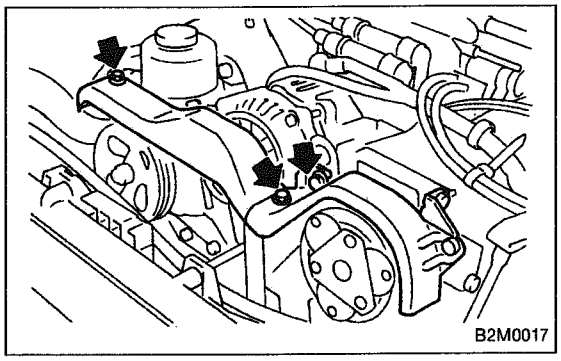
2) Fit cushions on lower side of radiator, into holes on body side and install radiator.



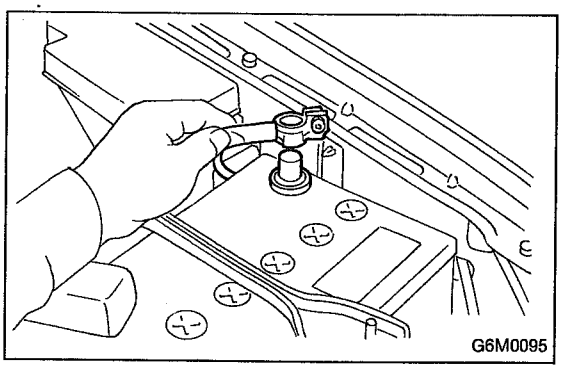
3) Install radiator brackets and tighten bolts.
4) Connect radiator main fan motor and sub fan motor connectors.



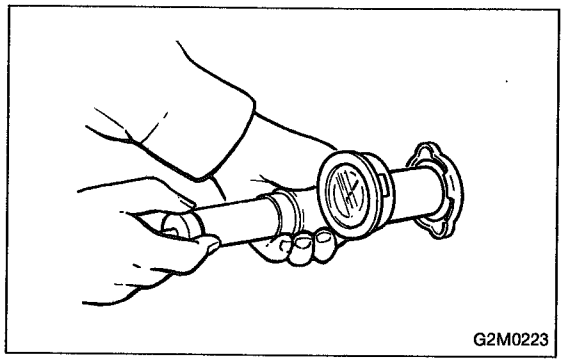
5) Connect radiator inlet and outlet hoses.
6) Connect ATF cooler hoses. (AT model)



7) Install V-belt cover.


G6M0095

8) Connect ground cable to battery terminal.


G2M0223

5. Radiator Cap

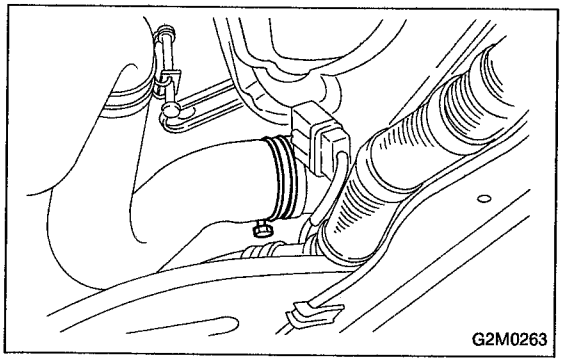
A: INSPECTION

1) Attach radiator cap to tester.
2) Increase pressure until tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds.

Standard pressure:
78 — 98 kPa (0.8 — 1.0 kg/cm^2, 11 — 14 psi)

Service limit pressure:
69 kPa (0.7 kg/cm^2, 10 psi)

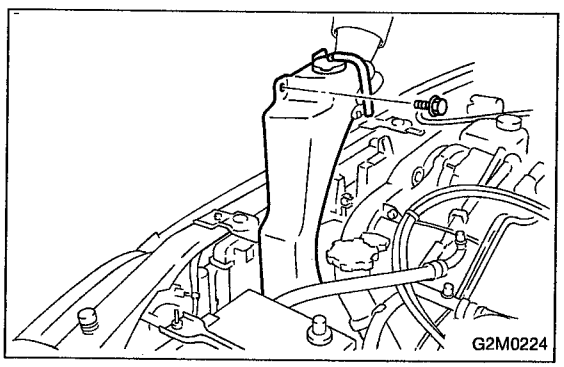
CAUTION:
Be sure to remove foreign matter and rust from the cap in advance; otherwise, results of pressure test will be incorrect.


G2M0263

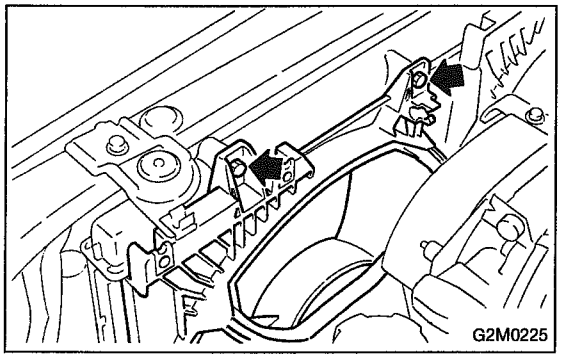
6. Radiator Fan and Fan Motor

A: REMOVAL AND INSTALLATION

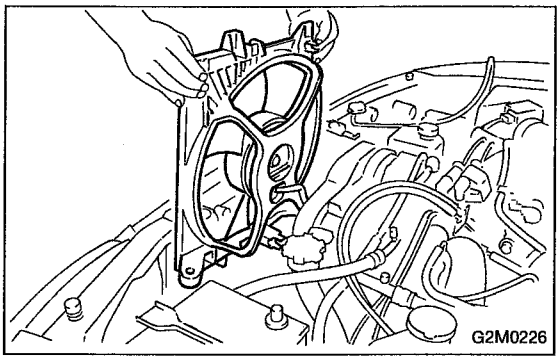
1) Disconnect ground cable from battery terminal.
2) Disconnect connector of fan motor.


G2M0224

3) Remove reservoir tank.



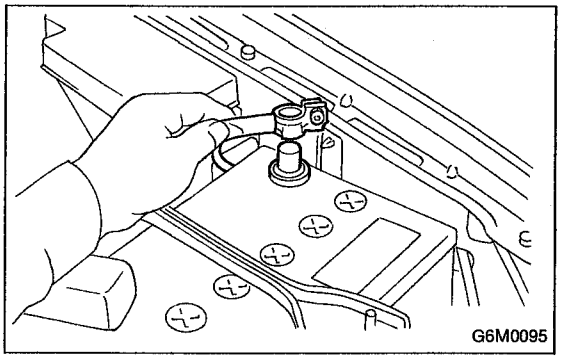
4) Remove two bolts holding shroud to radiator upper side.



5) Remove radiator fan motor assembly.
6) Remove fan motor from shroud.

7) Installation is in the reverse order of removal procedures.

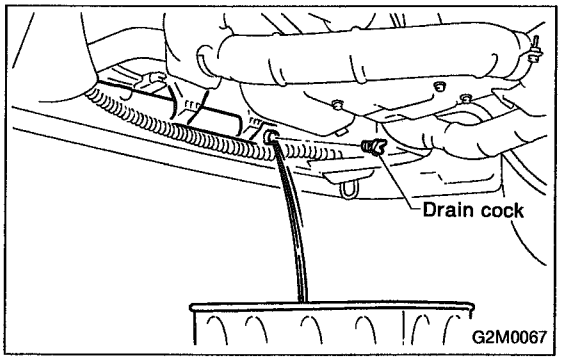
NOTE:
- Before installing radiator fan motor, apply a coat of sealant to threads and tighten nuts.
- Make sure radiator fan does not come into contact with shroud when installed.
- After installation, make sure there is no unusual noise or vibration when fan is rotated.



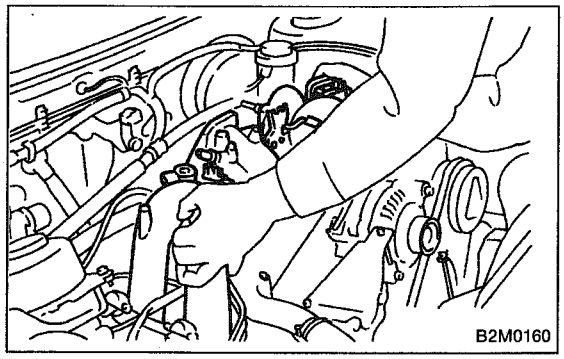
7. Water Pipe

A: REMOVAL

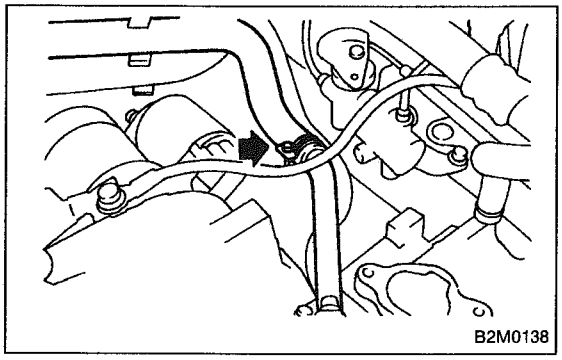
1) Release fuel pressure.
<Ref. to 2-8 [W1B0].>
2) Disconnect ground cable from the battery.



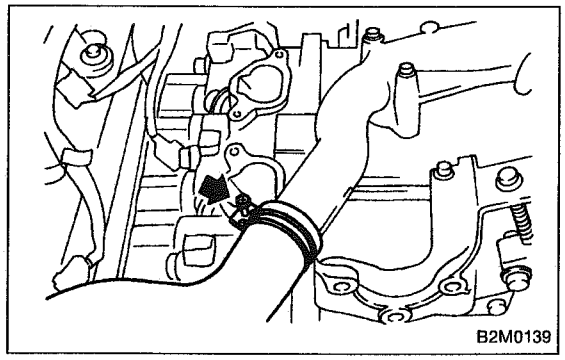
3) Drain engine coolant completely.
<Ref. to 2-5 [W1A0].>



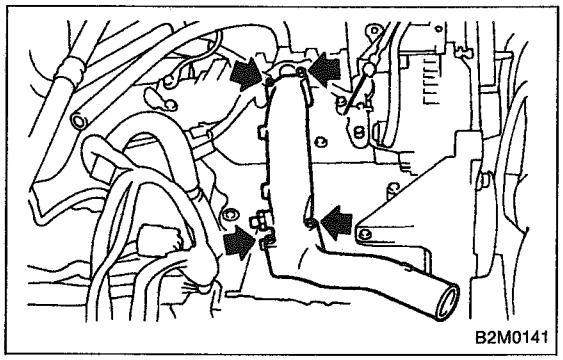
4) Remove intake manifold.
<Ref. to 2-7 [W4A0].>



5) Disconnect heater inlet hose.



6) Disconnect radiator inlet hose from water pipe.



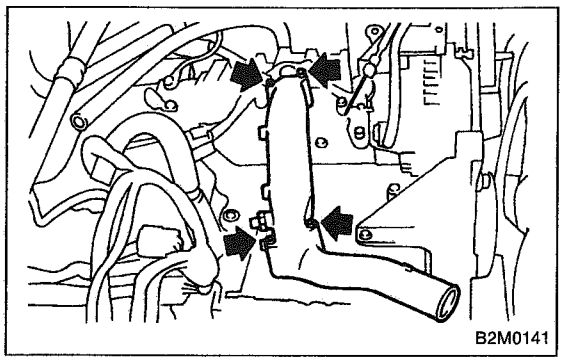
7) Remove bolts which install water pipe on cylinder block.

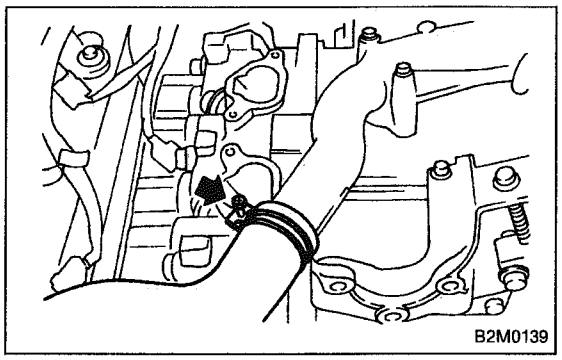
B: INSTALLATION

1) Install water pipe on cylinder block.

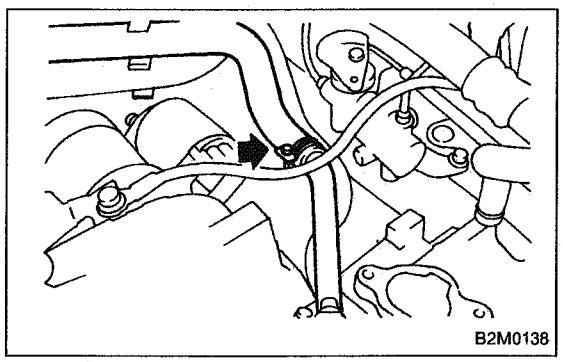
Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)

CAUTION:
Use a new O-ring.

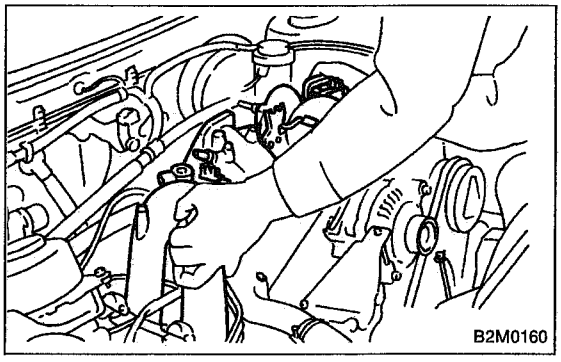




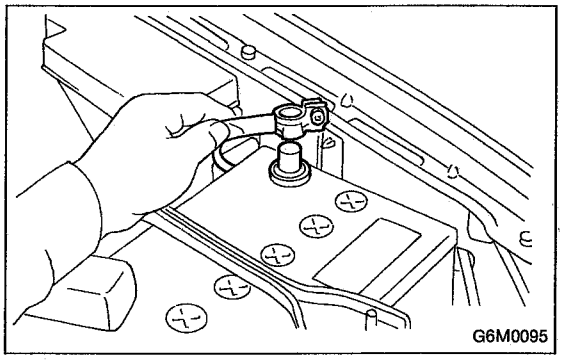
2) Connect radiator inlet hose.



3) Connect heater inlet hose.



4) Install intake manifold.
<Ref. to 2-7 [W4D0].>



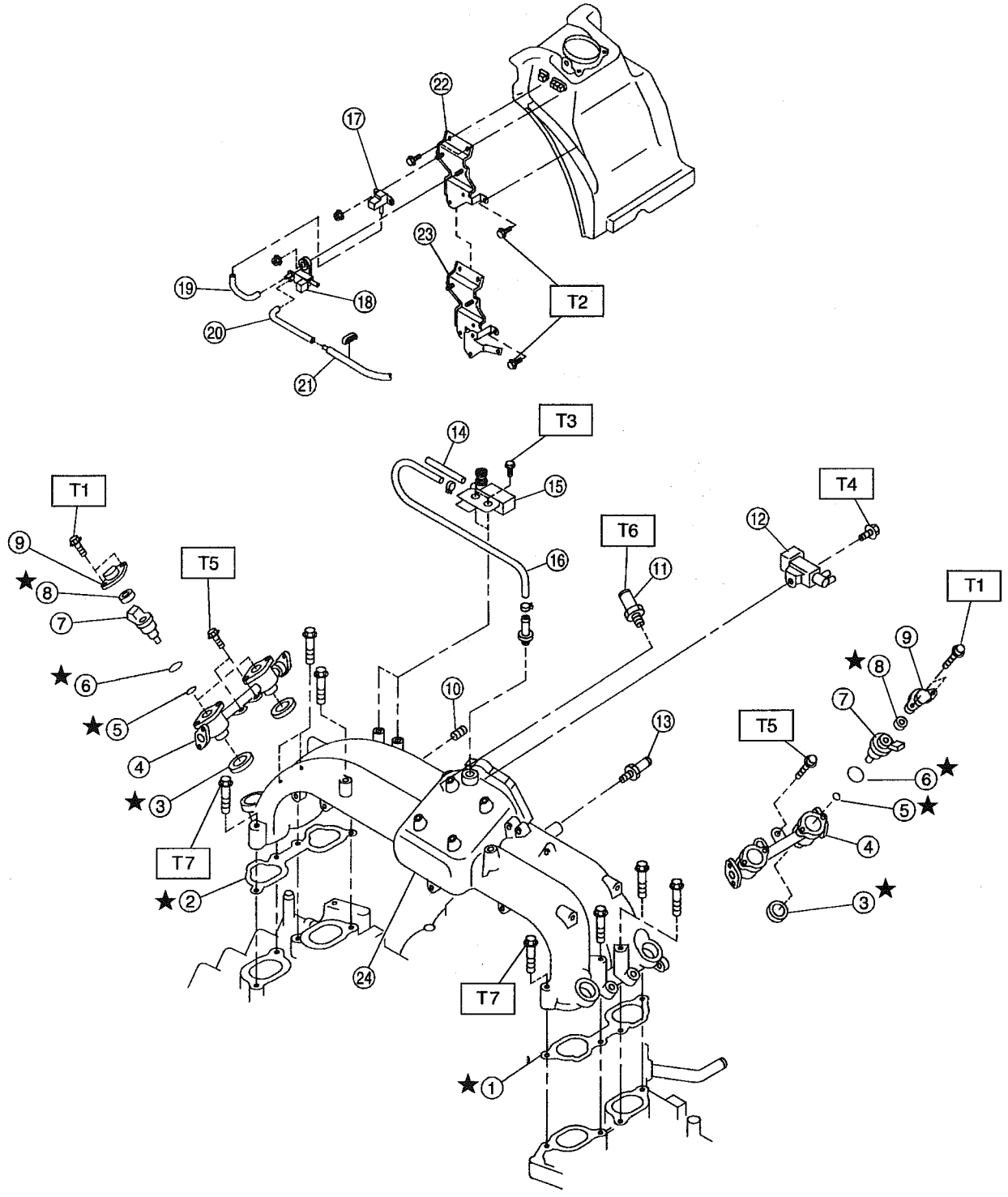
5) Connect ground cable to battery terminal.

1. Engine Cooling System Trouble in General

Trouble	Possible cause	Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on drive belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair ignition control system. <Ref. to 2-7b [T8D0].>
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair fuel injection system. <Ref. to 2-7b [T10S0].>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
	n. Dragging brake	Adjust.
	o. Improper transmission oil	Replace.
	p. Defective thermostat	Replace.
	q. Malfunction of electric fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Over-cooling	a. Atmospheric temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks.	a. Loosened or damaged connecting units on hoses	Repair or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Repair or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace gasket.
	e. Damaged or cracked cylinder head and crankcase	Repair or replace.
	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

1. Intake Manifold

A: 1800 cc MODEL



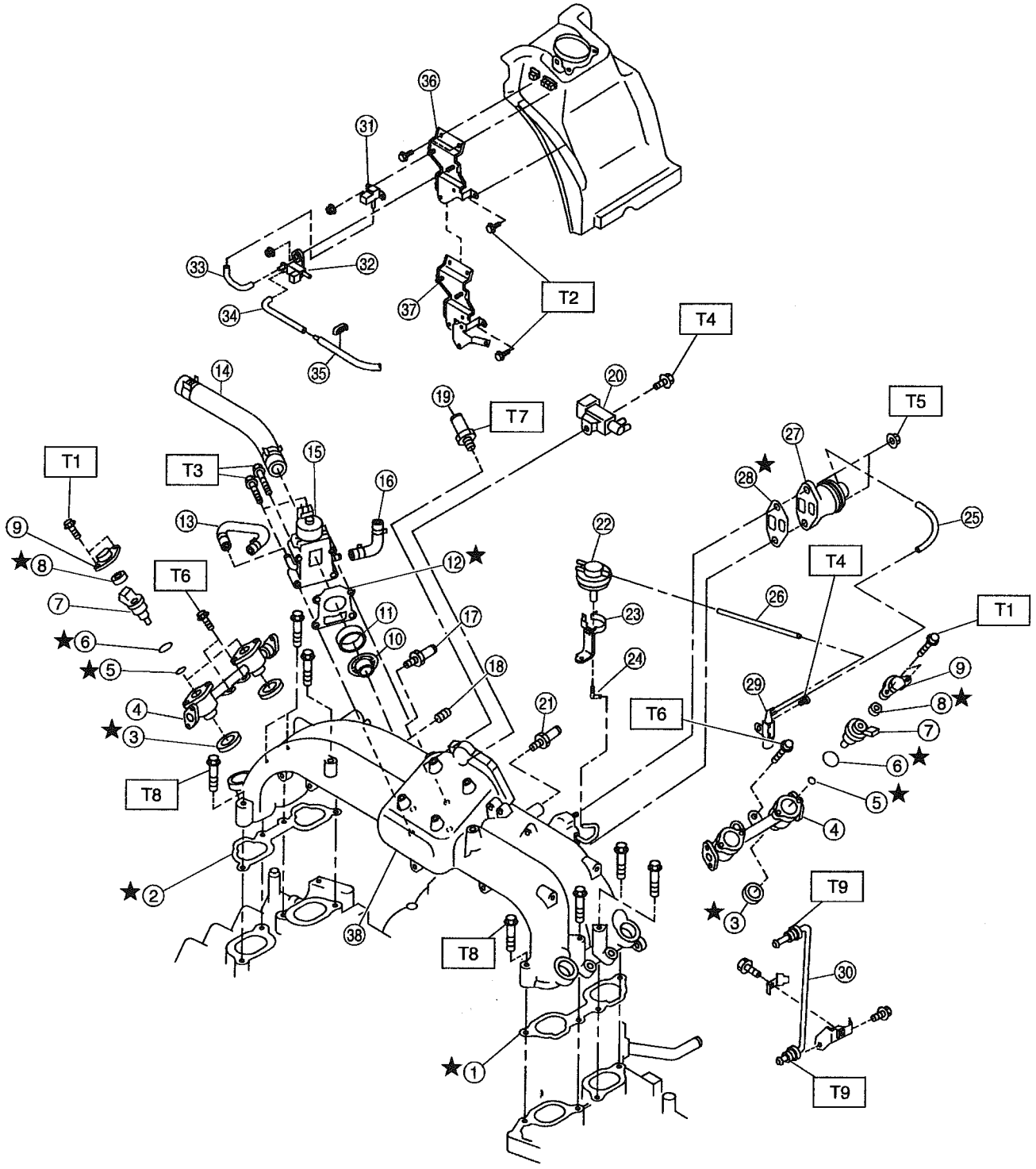
H2M1576A

① Intake manifold gasket LH
② Intake manifold gasket RH
③ Fuel injector pipe insulator
④ Fuel injector pipe
⑤ O-ring A
⑥ O-ring B
⑦ Fuel injector
⑧ Insulator
⑨ Fuel injector cap
⑩ Plug
⑪ PCV valve
⑫ Purge control solenoid valve
⑬ Nipple
⑭ FICD solenoid valve hose A (With A/C model)
⑮ FICD solenoid valve (With A/C model)
⑯ FICD solenoid valve hose B (With A/C model)
⑰ Pressure sensor
⑱ Pressure sources switching solenoid valve
⑲ Vacuum hose A
⑳ Vacuum hose B
㉑ Vacuum hose C
㉒ Bracket (Except Canada spec. vehicles)
㉓ Bracket (For Canada spec. vehicles)
㉔ Intake manifold

Tightening torque: N·m (kg-m, ft-lb)
T1: 3.4±0.5 (0.35±0.05, 2.5±0.4)
T2: 4.9±0.5 (0.5±0.05, 3.6±0.4)
T3: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T4: 16±1.5 (1.6±0.15, 11.6±1.1)
T5: 19±2 (1.9±0.2, 13.7±1.4)
T6: 23±3 (2.3±0.3, 16.6±2.2)
T7: 25±2 (2.5±0.2, 18.1±1.4)

COMPONENT PARTS

B: 2200 cc MODEL

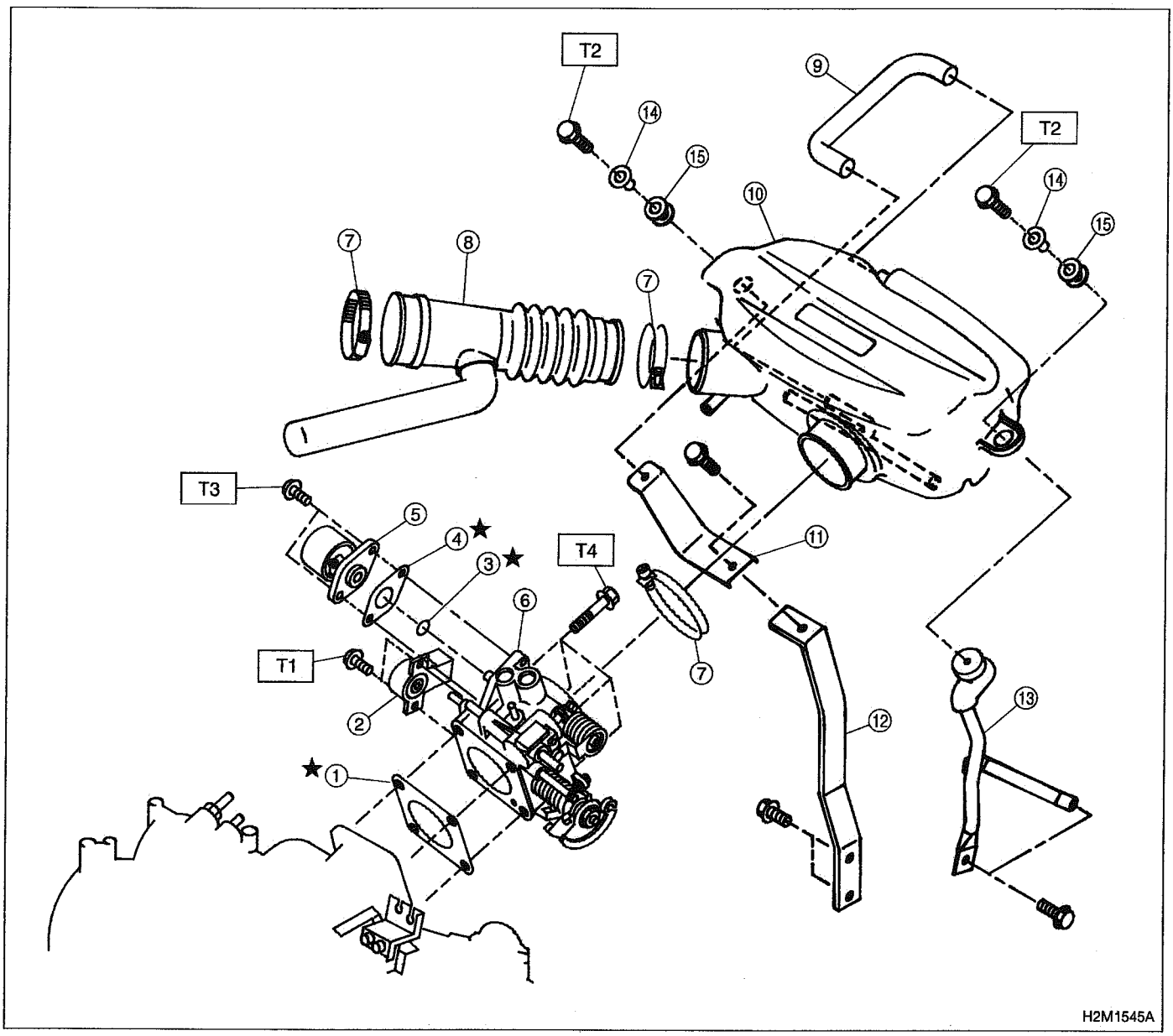


① Intake manifold gasket LH
② Intake manifold gasket RH
③ Fuel injector pipe insulator
④ Fuel injector pipe
⑤ O-ring A
⑥ O-ring B
⑦ Fuel injector
⑧ Insulator
⑨ Fuel injector cap
⑩ Plate
⑪ Sealing
⑫ Gasket
⑬ Engine coolant hose B
⑭ Air by-pass hose
⑮ Idle air control solenoid valve
⑯ Engine coolant hose A
⑰ Nipple (AT vehicles)
⑱ Plug
⑲ PCV valve
⑳ Purge control solenoid valve
㉑ Nipple
㉒ BPT (AT vehicles)
㉓ BPT holder bracket (AT vehicles)
㉔ Back pressure hose (AT vehicles)
㉕ EGR vacuum hose A (AT vehicles)
㉖ EGR vacuum hose B (AT vehicles)
㉗ EGR valve (AT vehicles)
㉘ Gasket (AT vehicles)
㉙ EGR solenoid valve (AT vehicles)
㉚ EGR pipe (AT vehicles)
㉛ Pressure sensor
㉜ Pressure sources switching solenoid valve
㉝ Vacuum hose A
㉞ Vacuum hose B
㉟ Vacuum hose C
㊱ Bracket (Except Canada spec. vehicles)
㊲ Bracket (For Canada spec. vehicles)
㊳ Intake manifold

Tightening torque: N·m (kg-m, ft-lb)
T1: 3.4±0.5 (0.35±0.05, 2.5±0.4)
T2: 4.9±0.5 (0.5±0.05, 3.6±0.4)
T3: 6.4±0.5 (0.65±0.05, 4.7±0.4)
T4: 16±1.5 (1.6±0.15, 11.6±1.1)
T5: 19±1.5 (1.9±0.15, 13.7±1.1)
T6: 19±2 (1.9±0.2, 13.7±1.4)
T7: 23±3 (2.3±0.3, 16.6±2.2)
T8: 25±2 (2.5±0.2, 18.1±1.4)
T9: 34±2 (3.5±0.2, 25.3±1.4)

2. Air Intake System

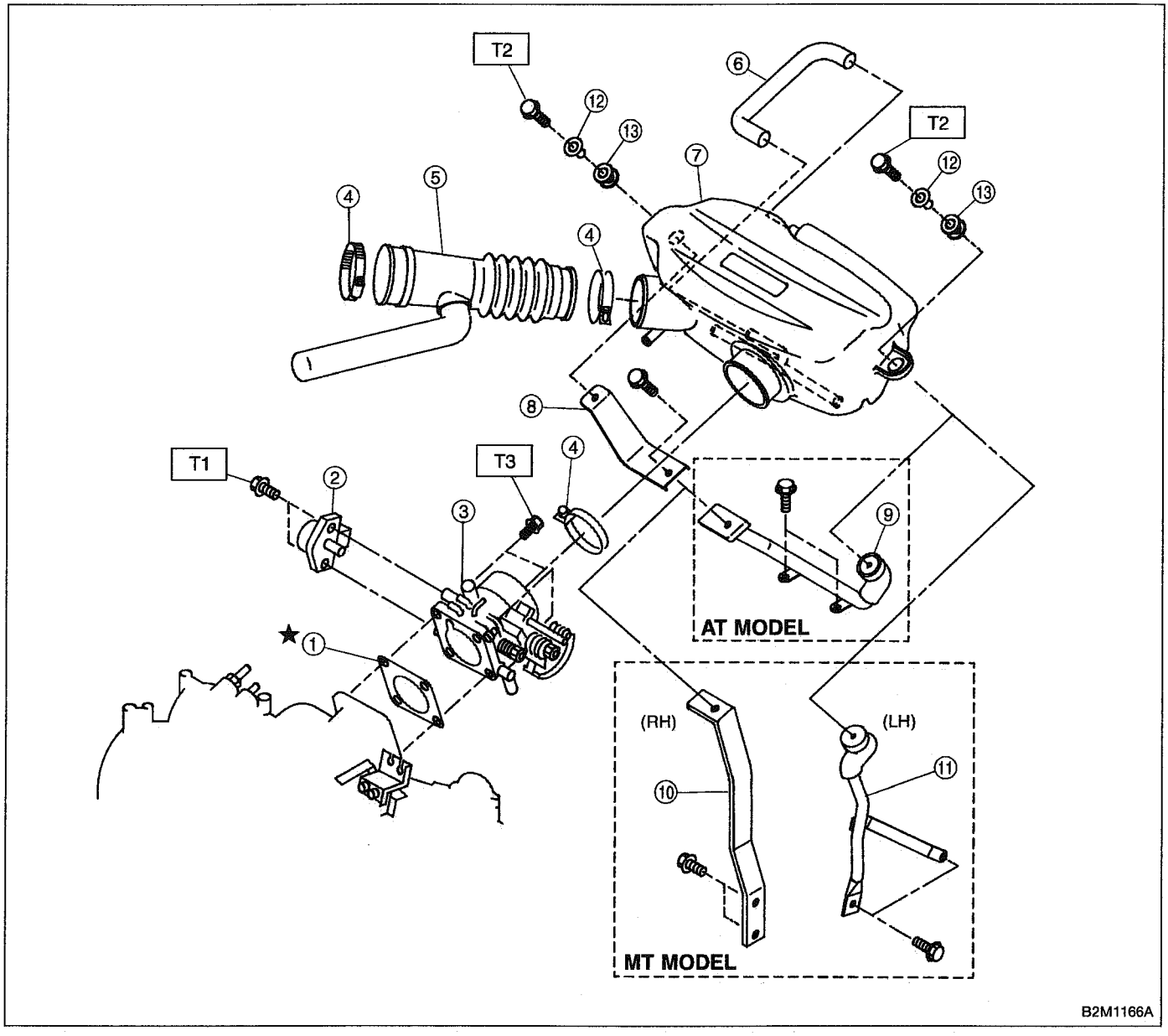
A: 1800 cc MODEL



① Gasket
② Throttle position sensor
③ O-ring
④ Gasket
⑤ Idle air control solenoid valve
⑥ Throttle body
⑦ Clamp
⑧ Air intake duct
⑨ By-pass hose
⑩ Air intake chamber
⑪ Stay A
⑫ Stay C (MT vehicles)
⑬ Stay D (MT vehicles)
⑭ Spacer
⑮ Bush

Tightening torque: N·m (kg-m, ft-lb)
T1: 2.2±0.2 (0.22±0.02, 1.6±0.1)
T2: 4.9±0.5 (0.5±0.05, 3.6±0.4)
T3: 6.0±0.8 (0.61±0.08, 4.4±0.6)
T4: 22±2 (2.2±0.2, 15.9±1.4)

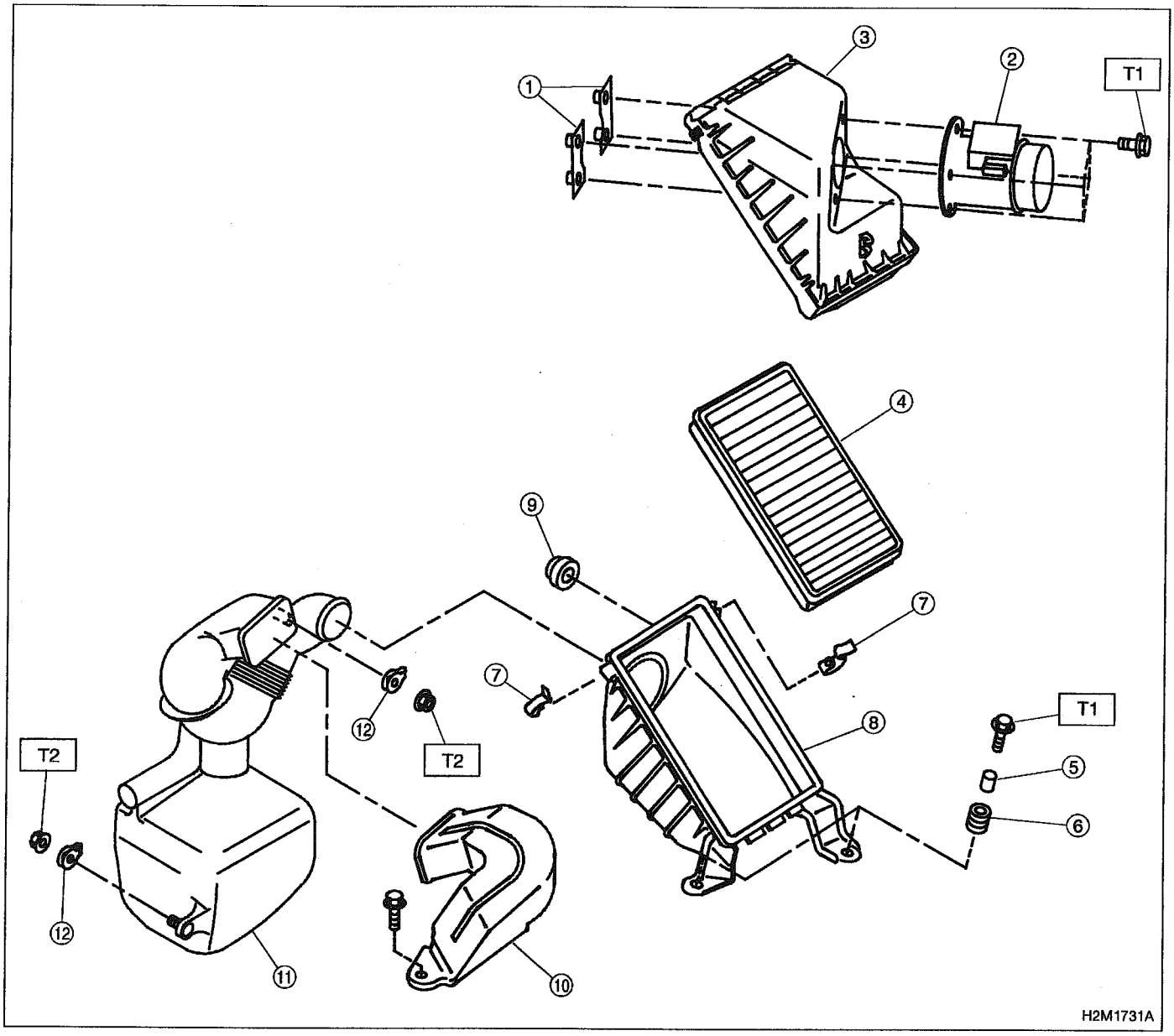
B: 2200 cc MODEL



① Gasket
② Throttle position sensor
③ Throttle body
④ Clamp
⑤ Air intake duct
⑥ By-pass hose
⑦ Air intake chamber
⑧ Stay A
⑨ Stay B (AT model)
⑩ Stay C (MT model)
⑪ Stay D (MT model)
⑫ Spacer
⑬ Bush

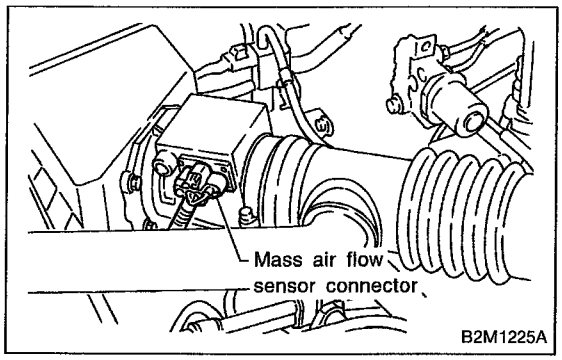
Tightening torque: N·m (kg-m, ft-lb)
T1: 2.2±0.2 (0.22±0.02, 1.6±0.1)
T2: 4.9±0.5 (0.5±0.05, 3.6±0.4)
T3: 22±2 (2.2±0.2, 15.9±1.4)

3. Air Cleaner



① Mass air flow sensor bracket
② Mass air flow sensor ASSY
③ Air cleaner upper cover
④ Air cleaner element
⑤ Spacer
⑥ Bush
⑦ Clip
⑧ Air cleaner case
⑨ Cushion rubber
⑩ Air intake duct
⑪ Resonator chamber ASSY
⑫ Clip

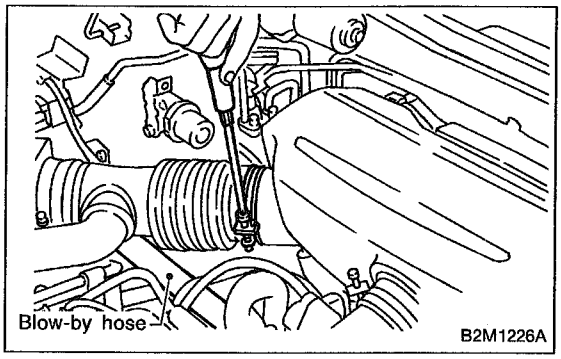
Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4 ± 2.0 (0.75 ± 0.2, 5.4 ± 1.4)
T2: 33 ± 10 (3.4 ± 1.0, 25 ± 7)



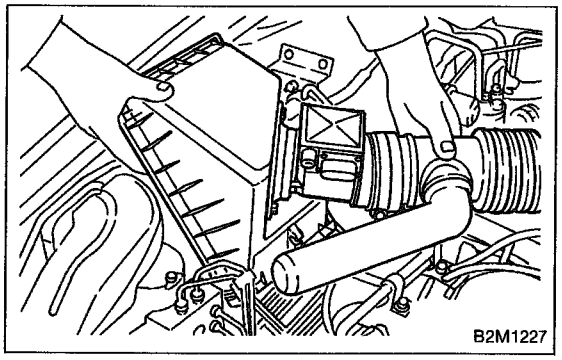
1. Air Cleaner and Air Intake Duct

A: REMOVAL AND INSTALLATION

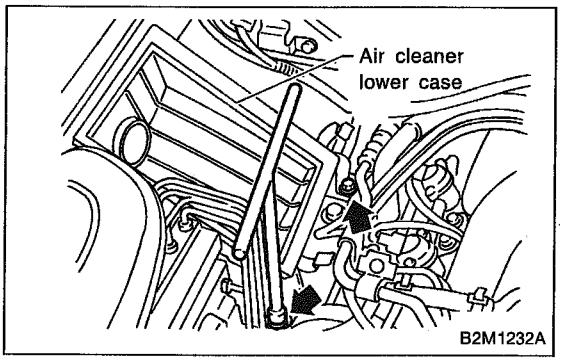
1) Disconnect connector from mass air flow sensor.



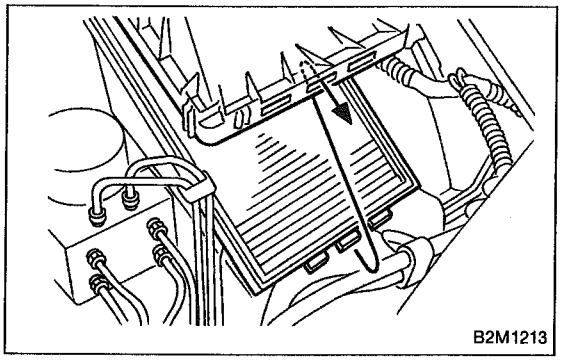
2) Loosen clamp which connects air intake duct to air intake chamber.
3) Remove two clips of air cleaner upper cover.
4) Disconnect blow-by hose from air intake duct.



5) Remove air intake duct and air cleaner upper cover as a unit.
6) Remove air cleaner element.

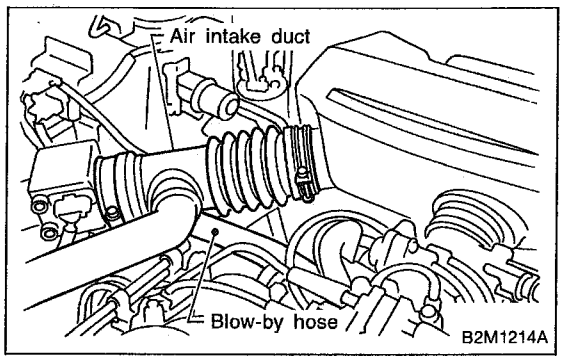


7) Remove air cleaner lower case.



8) Installation is in the reverse order of removal.

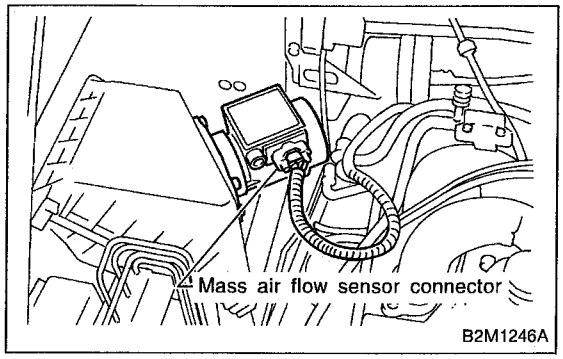
CAUTION:
Before installing air cleaner upper cover, align holes with protruding portions of air cleaner lower case, then secure upper cover to lower case.



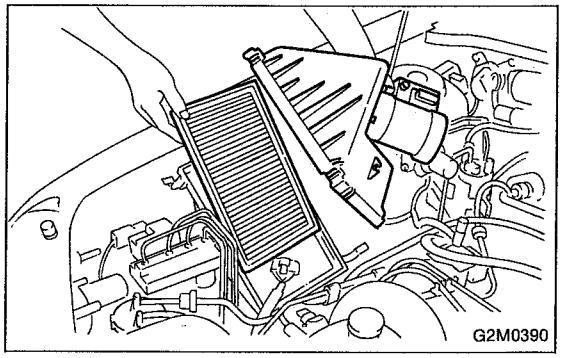
2. Mass Air Flow Sensor

A: REMOVAL AND INSTALLATION

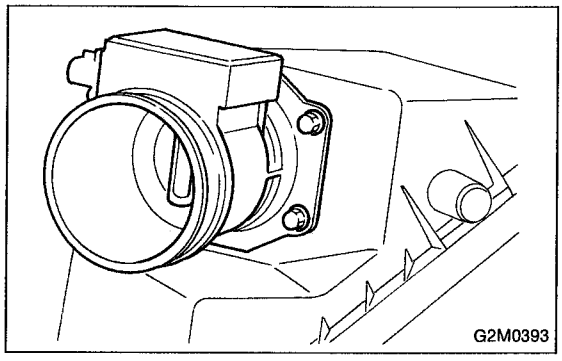
1) Loosen clamps which connect air intake duct to air intake chamber and mass air flow sensor.
2) Disconnect blow-by hose from air intake duct.
3) Remove air intake duct.



4) Disconnect connector from mass air flow sensor.



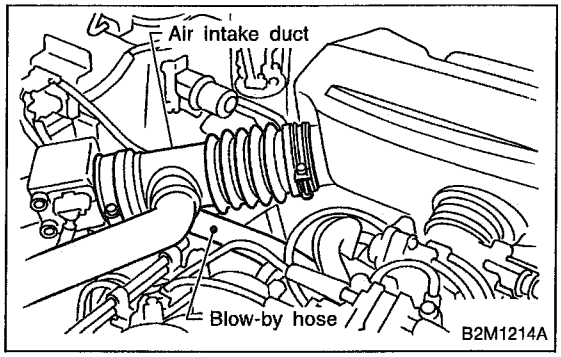
5) Remove two clips, then remove air cleaner upper cover.



6) Remove mass air flow sensor from air cleaner upper cover.
7) Installation is in the reverse order of removal.

Tightening torque:
7.4 ± 2.0 N·m (0.75 ± 0.2 kg-m, 5.4 ± 1.4 ft-lb)

CAUTION:
Before installing air cleaner upper cover, align holes with protruding portions of air cleaner lower case, then secure upper cover to lower case.

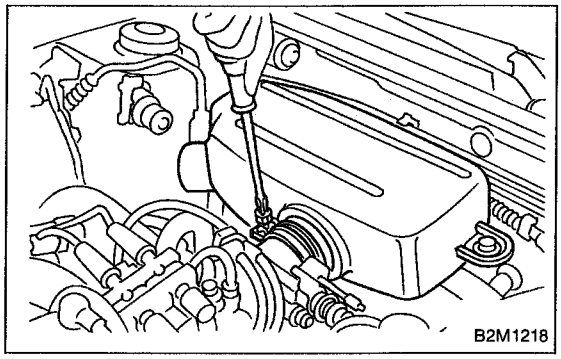


3. Throttle Body

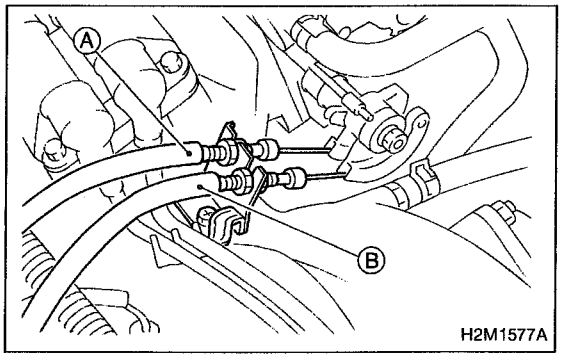
A: REMOVAL AND INSTALLATION

1. 1800 cc MODEL

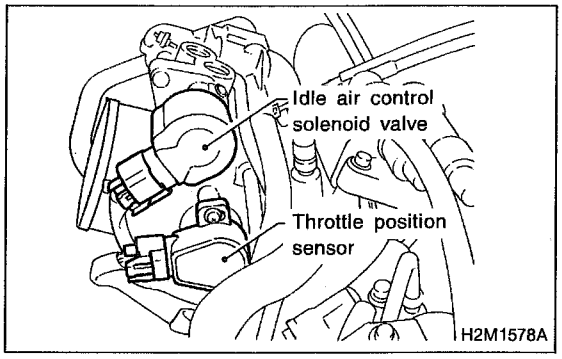
1) Loosen clamps which connect air intake duct to air intake chamber and mass air flow sensor.
2) Disconnect blow-by hose from air intake duct.
3) Remove air intake duct.



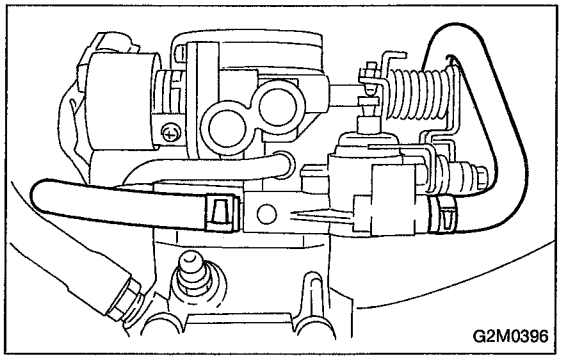
4) Loosen clamp which connects air intake chamber to throttle body.
5) Disconnect air hoses, and remove air intake chamber.



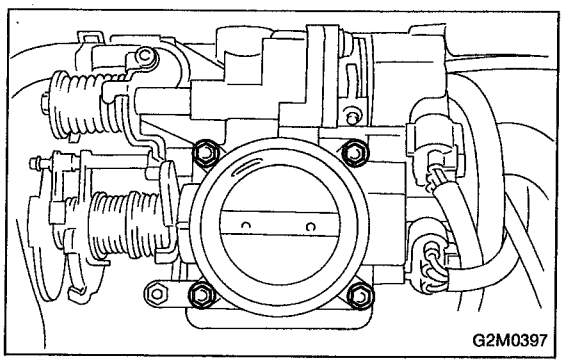
6) Disconnect accelerator cable Ⓐ.
7) Disconnect cruise control cable Ⓑ. (With cruise control model)



8) Disconnect connectors from idle air control solenoid valve and throttle position sensor.



9) Disconnect water hoses from throttle body.


G2M0397

10) Remove bolts which install throttle body to intake manifold.

11) Installation is in the reverse order of removal.

CAUTION:

- **Always use a new gasket.**
- **Before installing air cleaner upper cover, align holes with protruding portions of air cleaner lower case, then secure upper cover to lower case.**

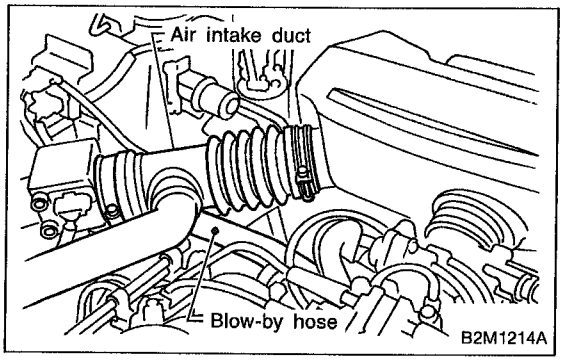
Tightening torque:

Throttle body:

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

Air intake chamber:

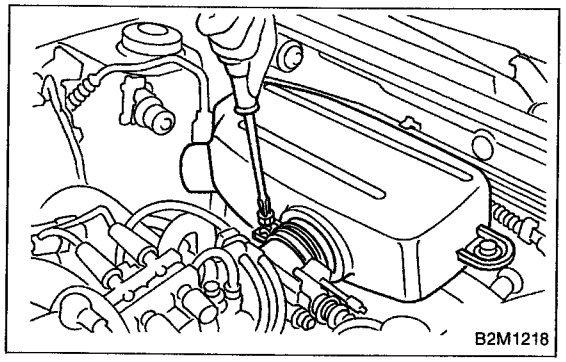
4.9 ± 0.5 N·m (0.5 ± 0.05 kg-m, 3.6 ± 0.4 ft-lb)



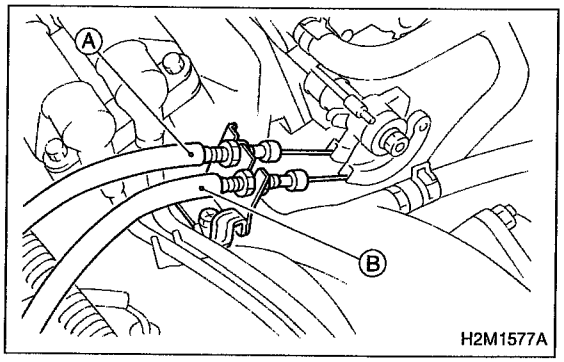
B2M1214A

2. 2200 cc MODEL

1) Loosen clamps which connect air intake duct to air intake chamber and mass air flow sensor.
2) Disconnect blow-by hose from air intake duct.
3) Remove air intake duct.

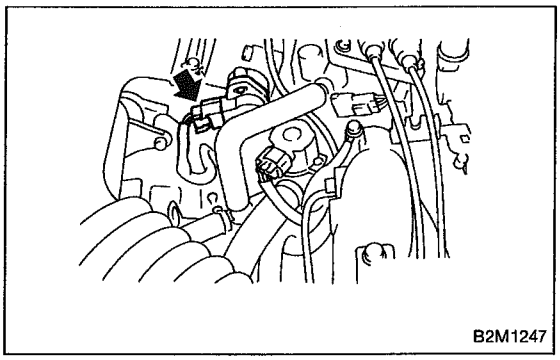

B2M1218

4) Loosen clamp which connects air intake chamber to throttle body.
5) Disconnect air hoses, and remove air intake chamber.

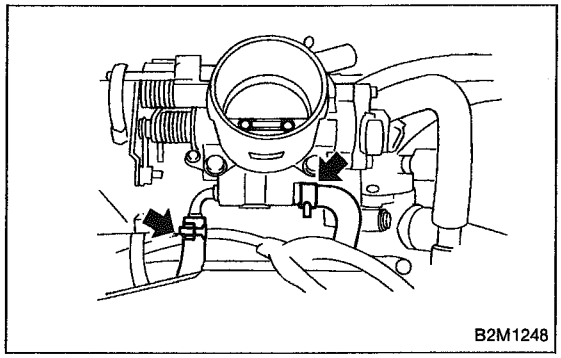


H2M1577A

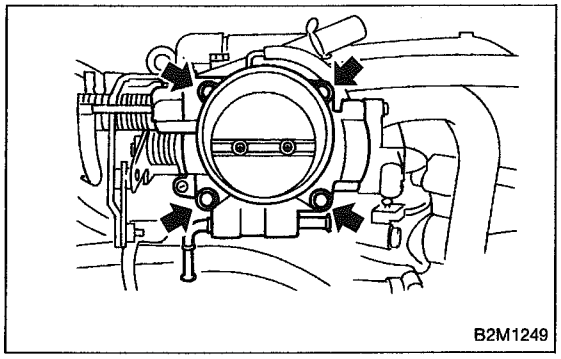
6) Disconnect accelerator cable Ⓐ.
7) Disconnect cruise control cable Ⓑ. (With cruise control model)


B2M1247

8) Disconnect connector from throttle position sensor.


B2M1248

9) Disconnect engine coolant hoses from throttle body.

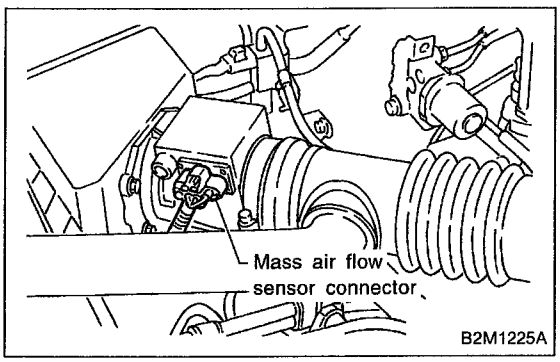

B2M1249

10) Remove bolts which install throttle body to intake manifold.

11) Installation is in the reverse order of removal.

CAUTION:
- **Always use a new gasket.**
- **Before installing air cleaner upper cover, align holes with protruding portions of air cleaner lower case, then secure upper cover to lower case.**

Tightening torque:
Throttle body:
22 ± 2 N·m (2.2 ± 0.2 kg-m, 15.9 ± 1.4 ft-lb)
Air intake chamber:
4.9 ± 0.5 N·m (0.5 ± 0.05 kg-m, 3.6 ± 0.4 ft-lb)



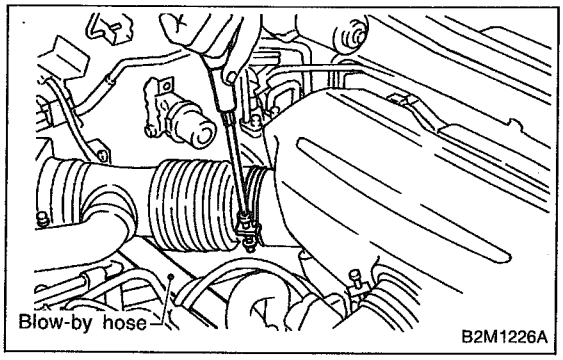
B2M1225A

4. Intake Manifold

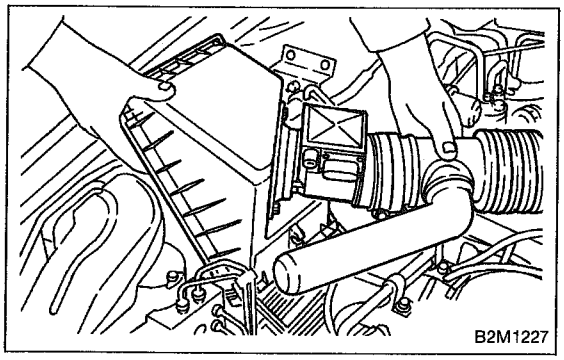
A: REMOVAL

1. 1800 cc MODEL

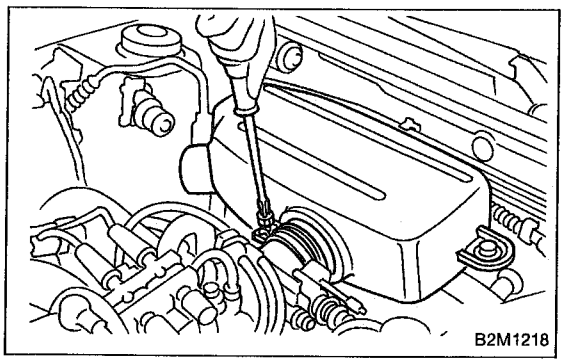
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Disconnect connector from mass air flow sensor.



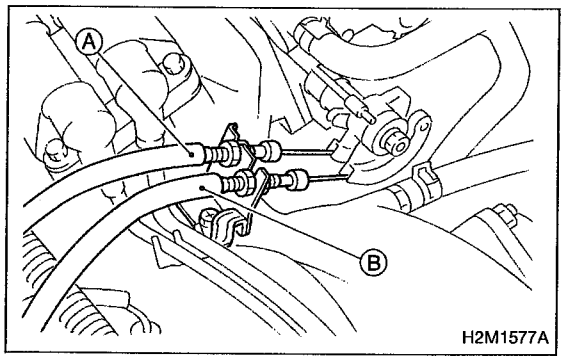
3) Loosen clamp which connects air intake duct to air intake chamber.
4) Remove two clips of air cleaner upper cover.
5) Disconnect blow-by hose from air intake duct.



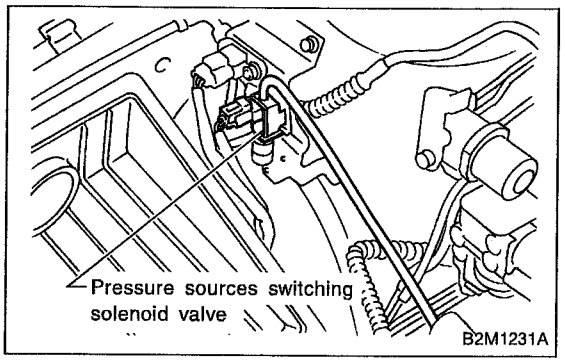
6) Remove air intake duct and air cleaner upper cover as a unit.
7) Remove air cleaner element.



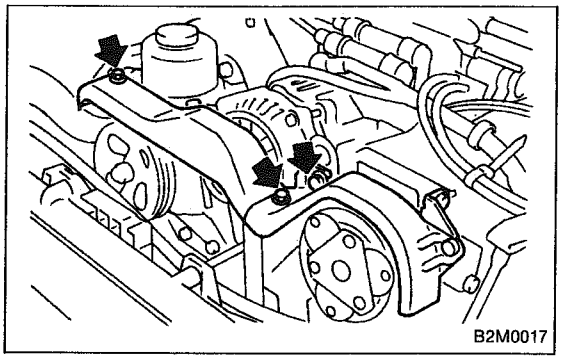
8) Loosen clamp which connects air intake chamber to throttle body.
9) Disconnect air hoses, and remove air intake chamber.



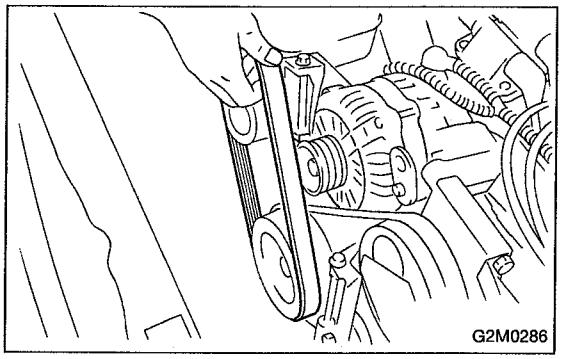
10) Disconnect accelerator cable Ⓐ.
11) Disconnect cruise control cable Ⓑ. (With cruise control model)



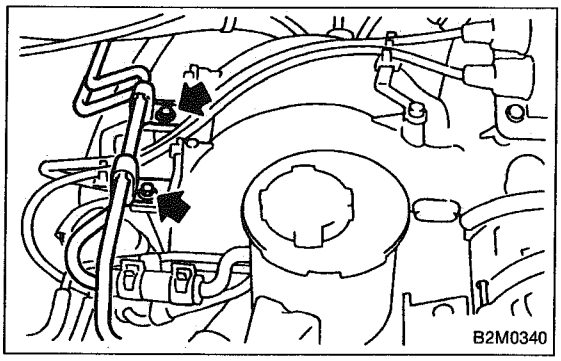
12) Disconnect vacuum hoses from pressure sources switching solenoid valve.



13) Remove power steering pump from bracket.
(1) Remove V-belt cover.

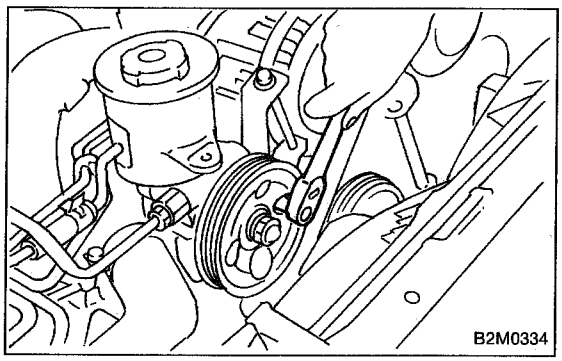


(2) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.

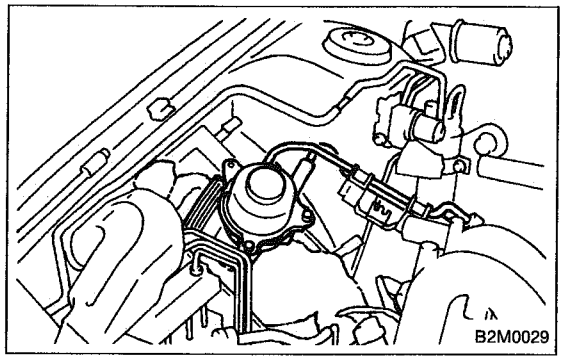


(3) Remove bolts which secure power steering pipe brackets to intake manifold.

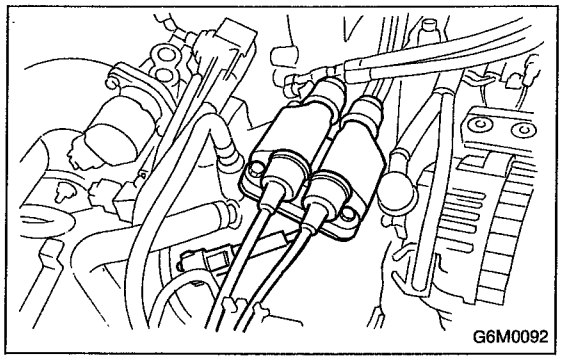
NOTE:
Do not disconnect power steering hose.



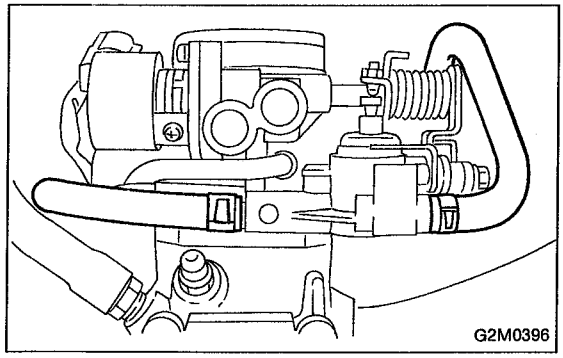
(4) Remove bolts which install power steering pump to bracket.



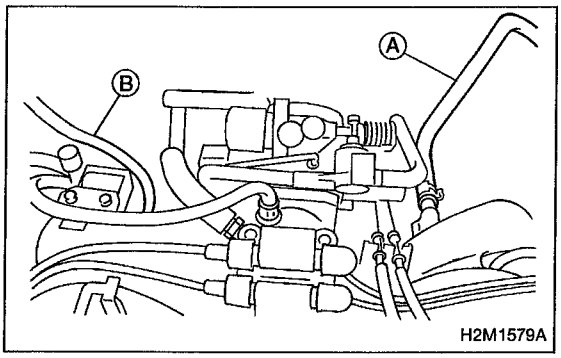
(5) Place power steering pump on the right side wheel apron.


G6M0092

14) Disconnect spark plug cords from ignition coil.
15) Disconnect connector from ignition coil.

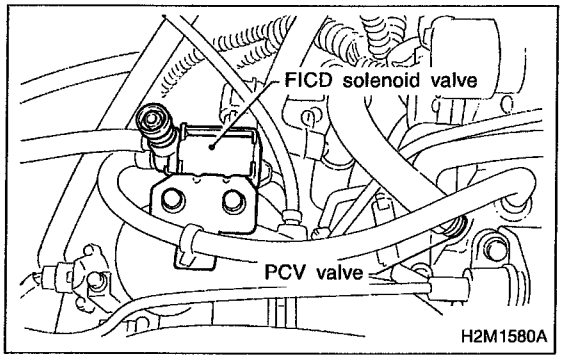

G2M0396

16) Disconnect water hose from throttle body.



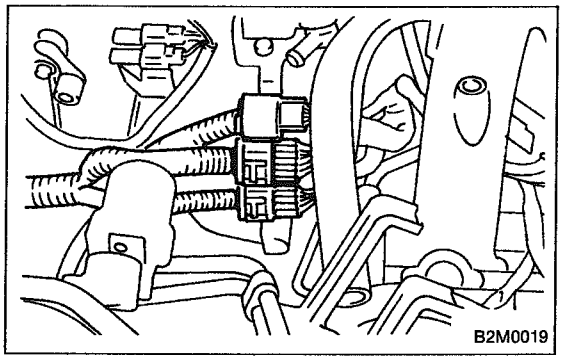
H2M1579A

17) Disconnect brake booster hose Ⓐ.
18) Disconnect cruise control vacuum hose Ⓑ. (With cruise control)

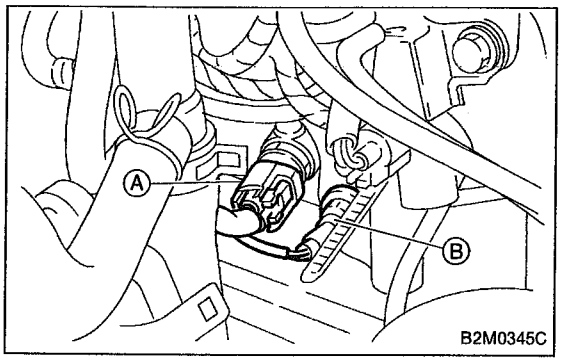


H2M1580A

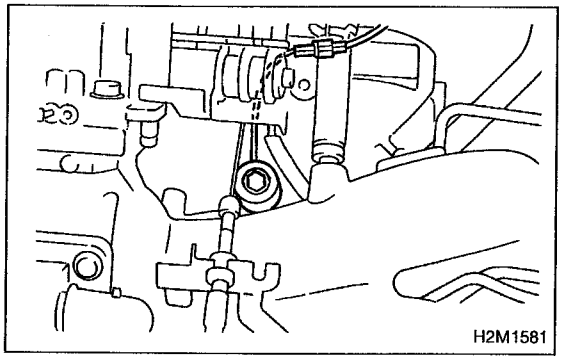
19) Disconnect air by-pass hose from FICD solenoid valve. (With A/C)
20) Disconnect emission hose from PCV valve.


B2M0019

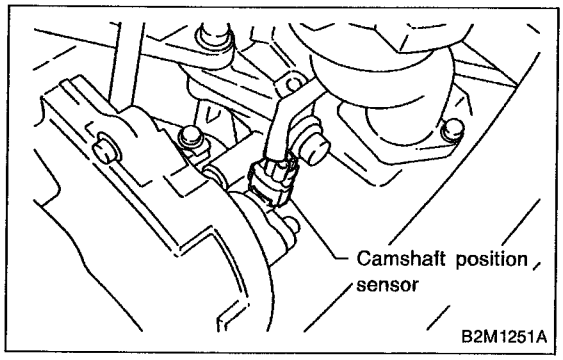
21) Disconnect engine harness connectors from bulkhead harness connectors, and remove engine harness connectors from bracket.



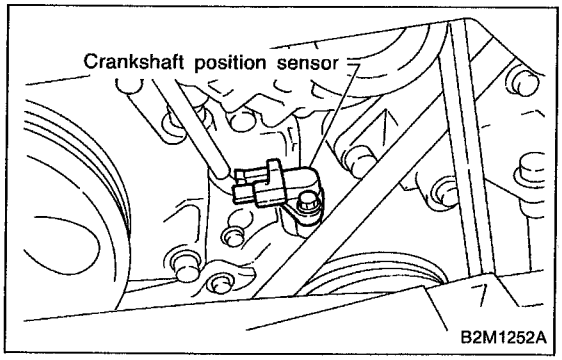
22) Disconnect connectors from engine coolant temperature sensor Ⓐ and thermometer Ⓑ.



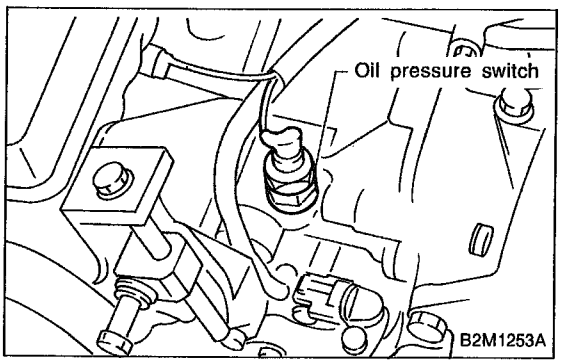
23) Disconnect knock sensor connector.



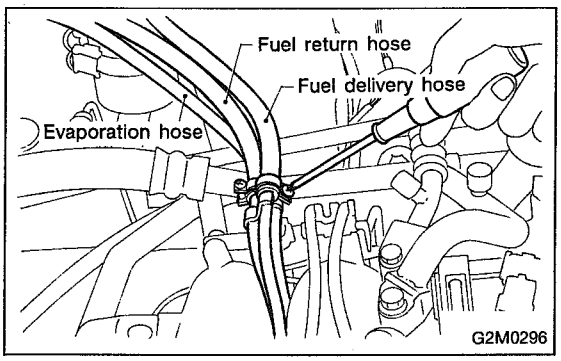
24) Disconnect connector from camshaft position sensor.



25) Disconnect connector from crankshaft position sensor.

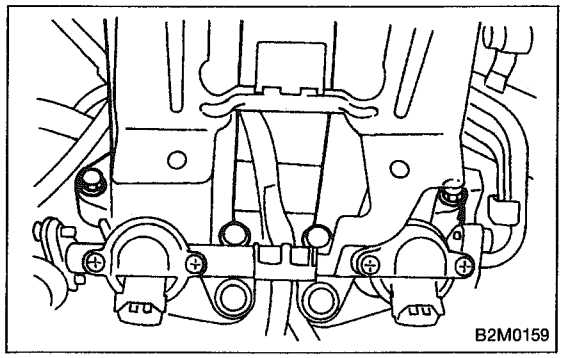


26) Disconnect connector from oil pressure switch.

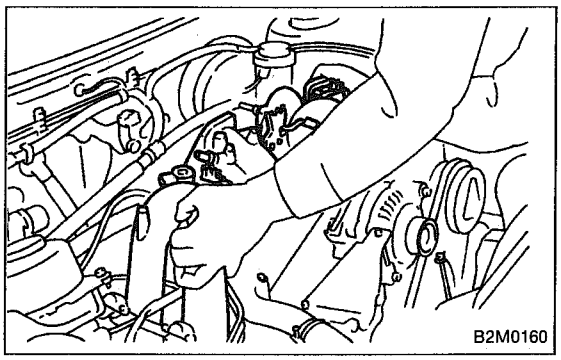


27) Disconnect fuel hoses from fuel pipes.

WARNING:
Catch fuel from hoses in a container.



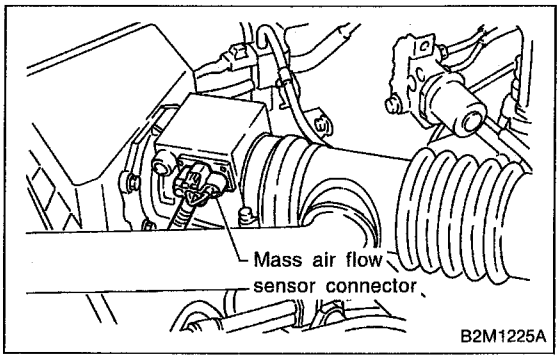
28) Remove bolts which hold intake manifold onto cylinder heads.

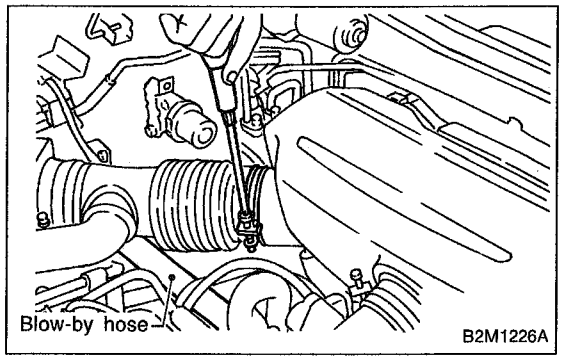


29) Remove intake manifold.

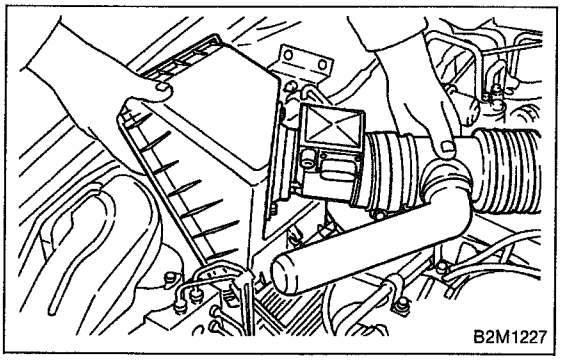
2. 2200 cc MODEL

1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Disconnect connector from mass air flow sensor.

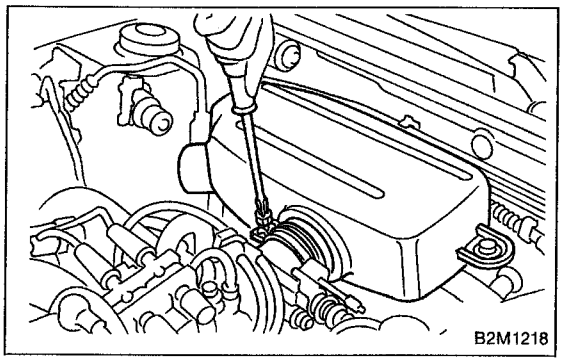




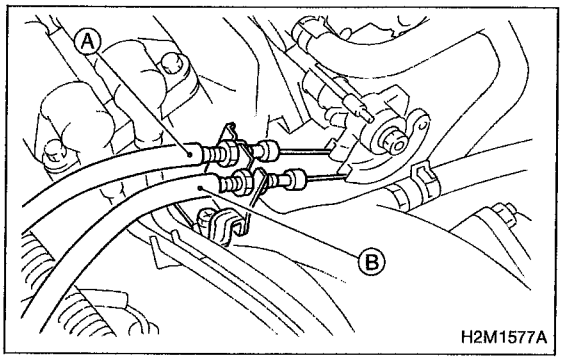
3) Loosen clamp which connects air intake duct to air intake chamber.
4) Remove two clips of air cleaner upper cover.
5) Disconnect blow-by hose from air intake duct.



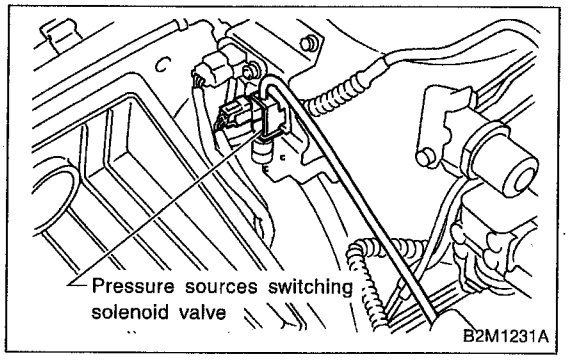
6) Remove air intake duct and air cleaner upper cover as a unit.
7) Remove air cleaner element.



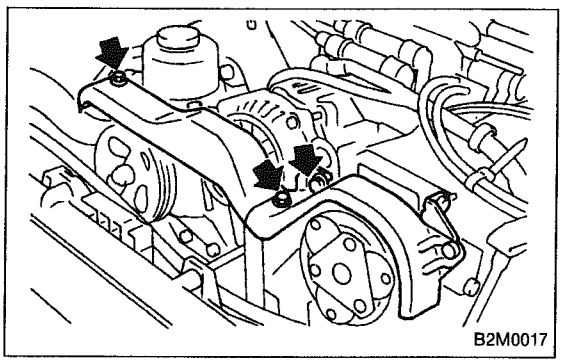
8) Loosen clamp which connects air intake chamber to throttle body.
9) Disconnect air hoses, and remove air intake chamber.



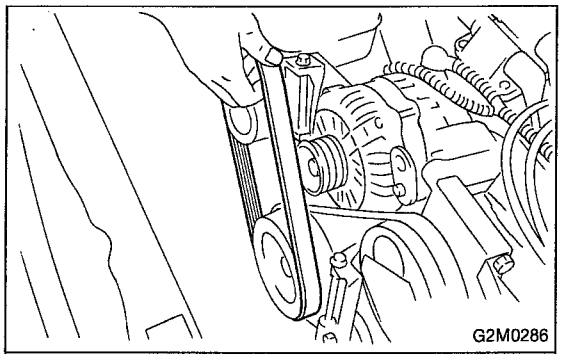
10) Disconnect accelerator cable Ⓐ.
11) Disconnect cruise control cable Ⓑ. (With cruise control model)



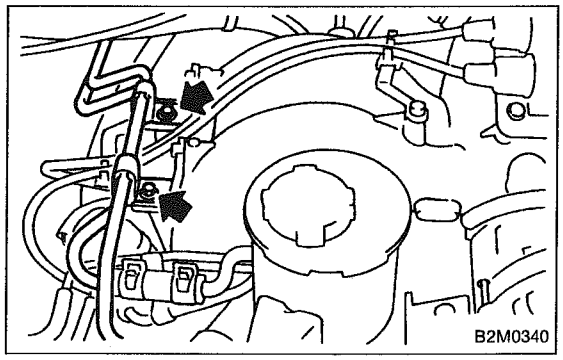
12) Disconnect vacuum hoses from pressure sources switching solenoid valve.



13) Remove power steering pump from bracket.
(1) Remove V-belt cover.

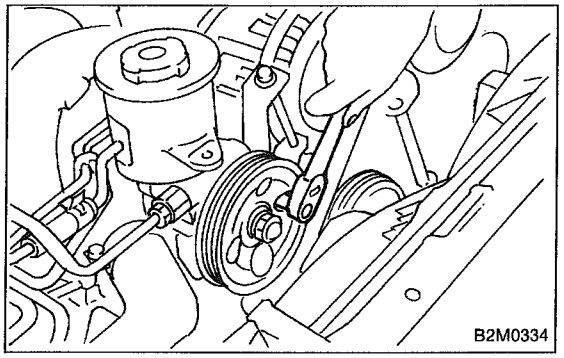


(2) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.

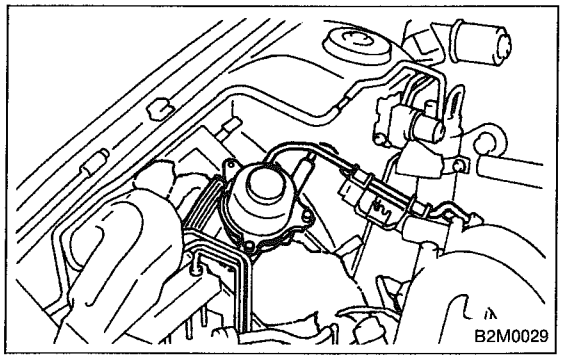


(3) Remove bolts which secure power steering pipe brackets to intake manifold.

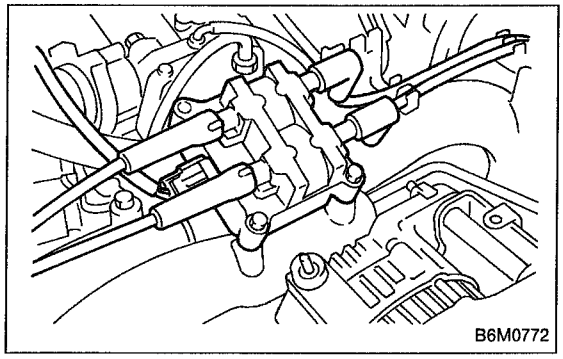
NOTE:
Do not disconnect power steering hose.



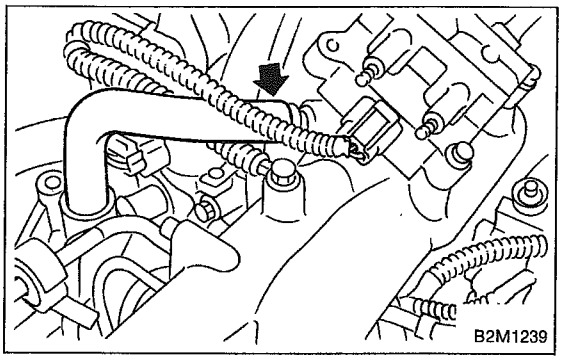
(4) Remove bolts which install power steering pump to bracket.



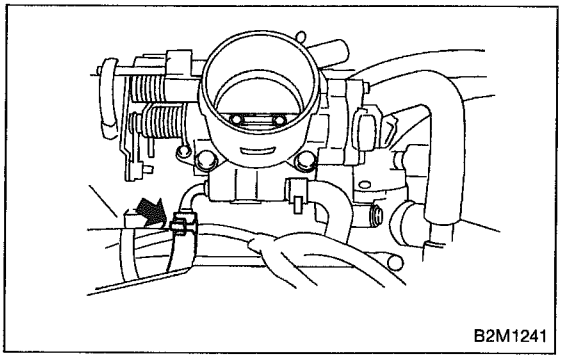
(5) Place power steering pump on the right side wheel apron.



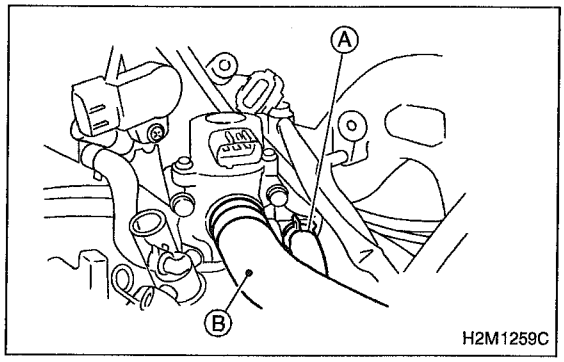
14) Disconnect spark plug cords from ignition coil.



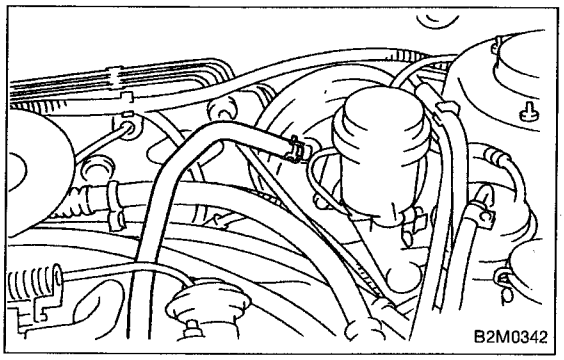
15) Disconnect PCV hose from intake manifold.



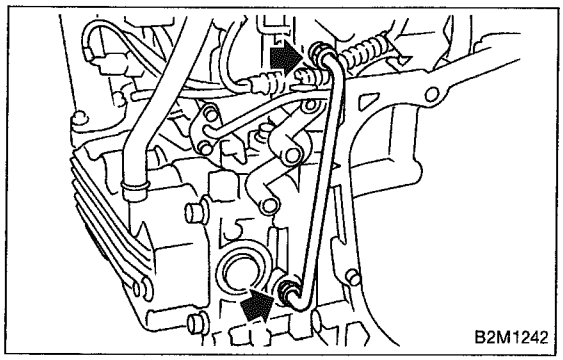
16) Disconnect engine coolant hose from throttle body.



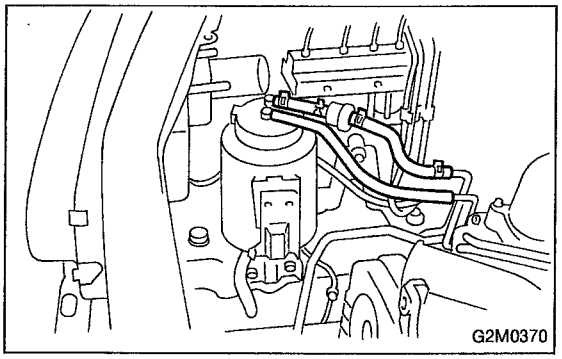
17) Disconnect engine coolant hose Ⓐ from idle air control solenoid valve.
18) Disconnect air by-pass hose Ⓑ from idle air control solenoid valve.



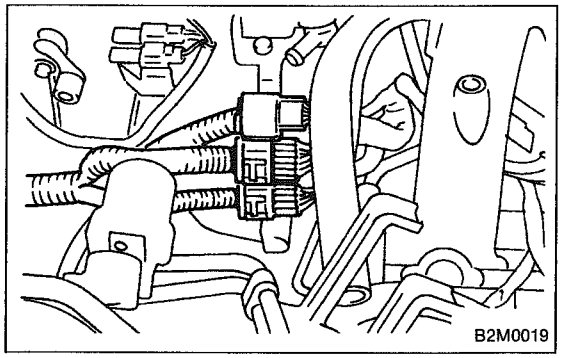
19) Disconnect brake booster hose.



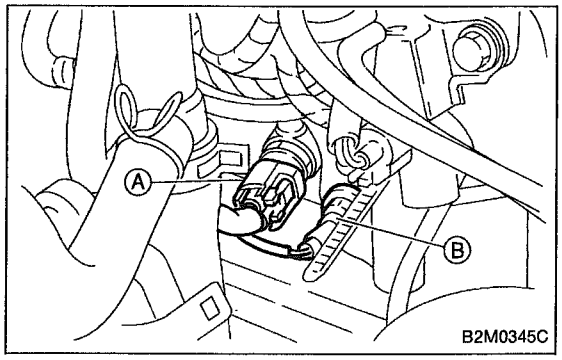
20) Remove EGR pipe. (AT vehicles)



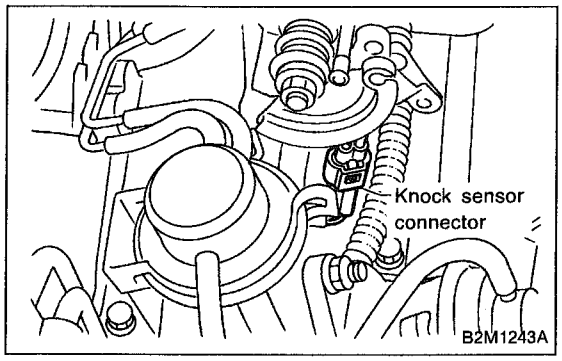
21) Disconnect canister hoses from pipes.



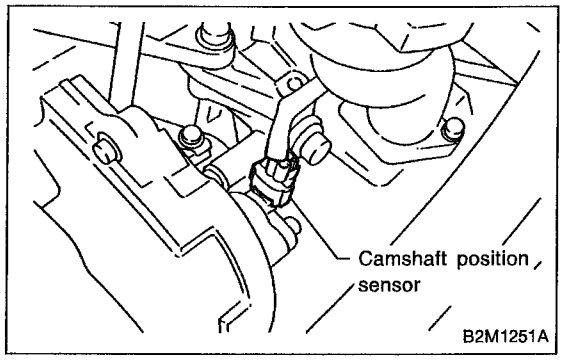
22) Disconnect engine harness connectors from bulkhead harness connectors, and remove engine harness connectors from bracket.



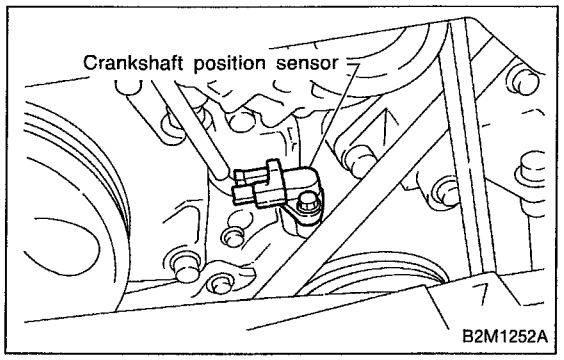
23) Disconnect connectors from engine coolant temperature sensor Ⓐ and thermometer Ⓑ.



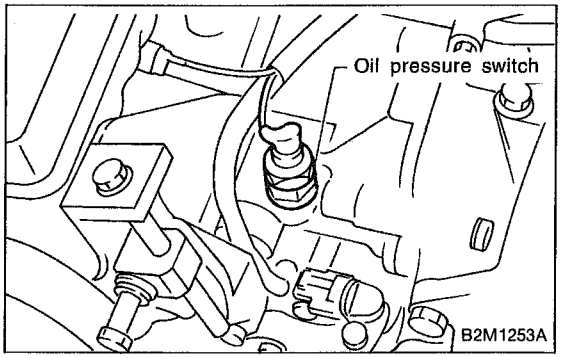
24) Disconnect knock sensor connector.



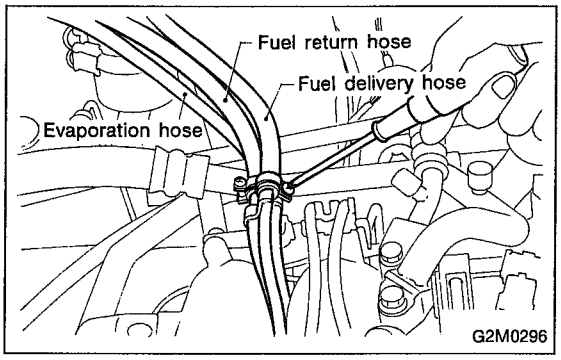
25) Disconnect connector from camshaft position sensor.



26) Disconnect connector from crankshaft position sensor.

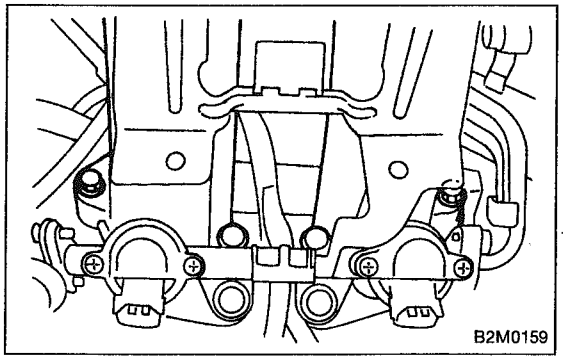


27) Disconnect connector from oil pressure switch.

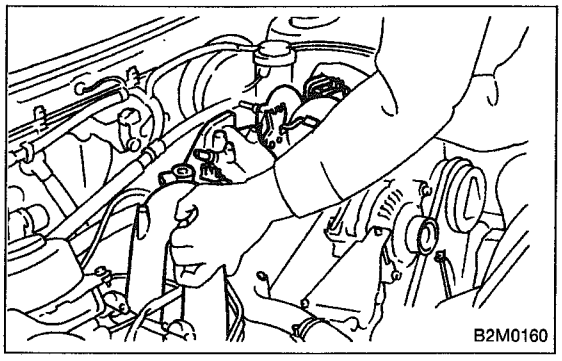


28) Disconnect fuel hoses from fuel pipes.

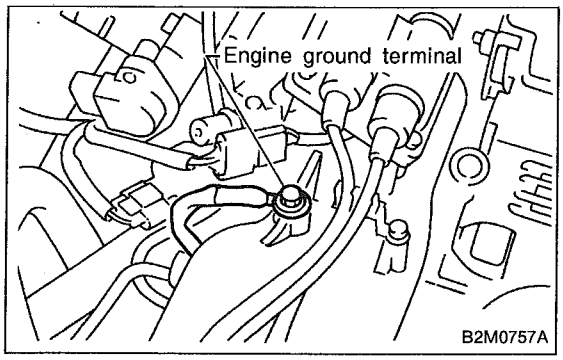
WARNING:
Catch fuel from hoses in a container.



29) Remove bolts which hold intake manifold onto cylinder heads.



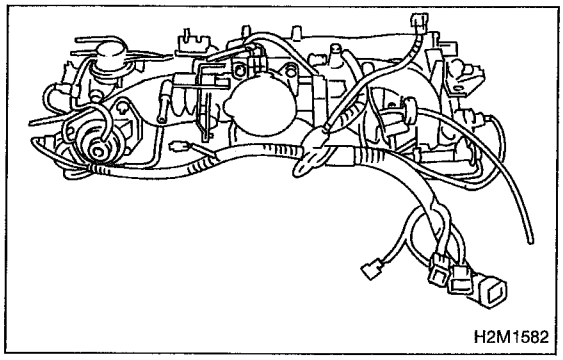
30) Remove intake manifold.



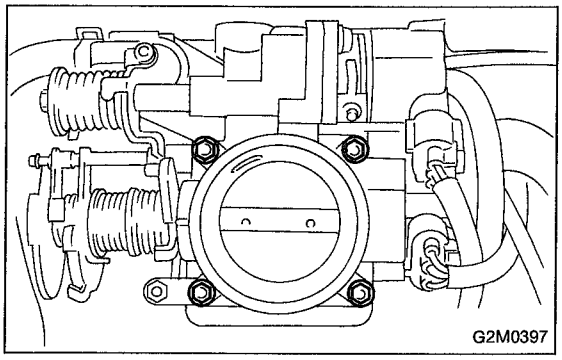
B: DISASSEMBLY

1. 1800 cc MODEL

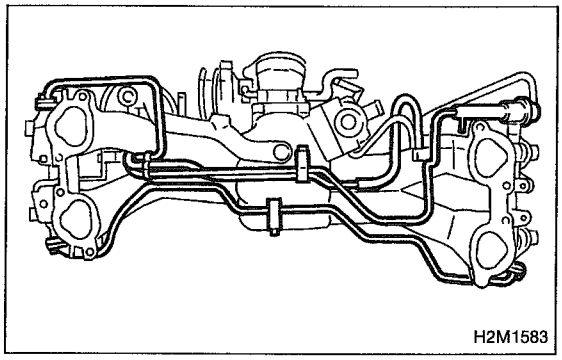
1) Disconnect engine ground terminal from intake manifold.



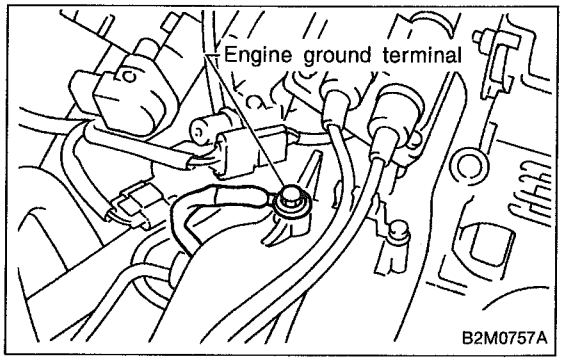
2) Disconnect connectors from throttle position sensor, ignition coil, fuel injectors, idle air control solenoid valve, purge control solenoid valve and FICD solenoid valve.
3) Remove engine harness from intake manifold.



4) Remove throttle body from intake manifold.

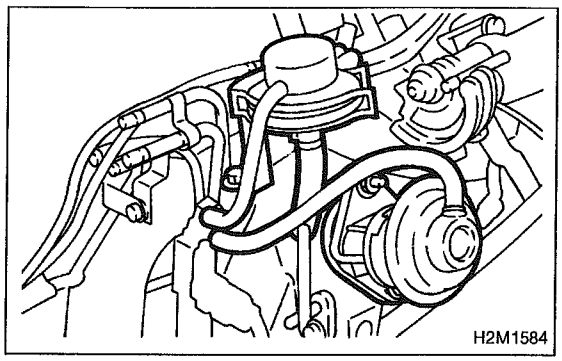


5) Remove fuel pipes, etc. from intake manifold.

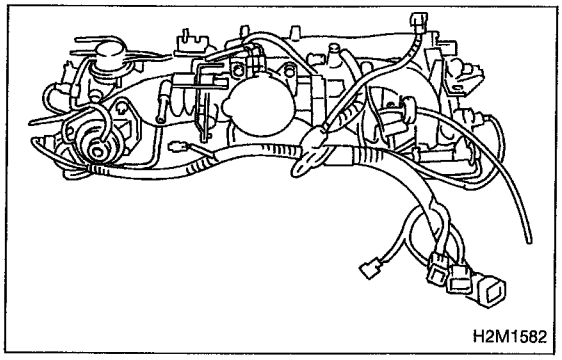


2. 2200 cc MODEL

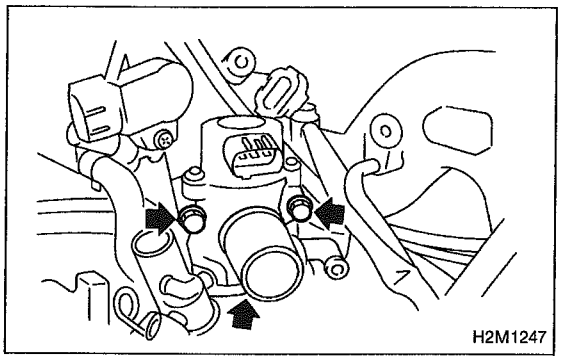
1) Disconnect engine ground terminal from intake manifold.



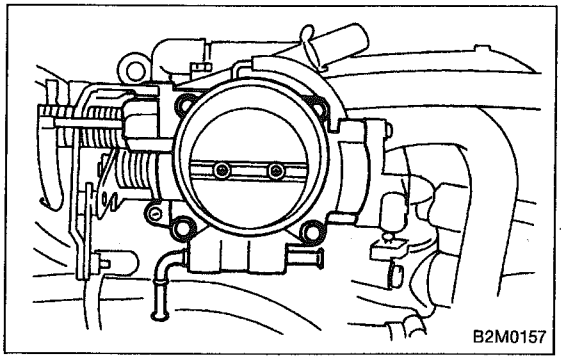
2) Disconnect EGR vacuum hose from EGR valve. (AT vehicles)
3) Disconnect back pressure hose from pipe. (AT vehicles)
4) Disconnect BPT hoses from EGR solenoid valve and intake manifold. (AT vehicles)
5) Remove BPT with BTP holder bracket. (AT vehicles)
6) Remove EGR valve. (AT vehicles)



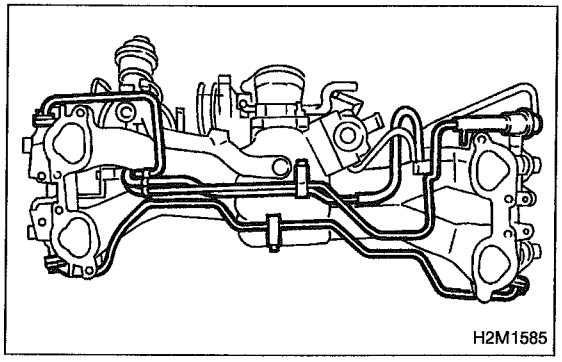
7) Disconnect connectors from throttle position sensor, ignition coil, fuel injectors, idle air control solenoid valve, purge control solenoid valve and EGR solenoid valve. (AT vehicles)
8) Remove engine harness from intake manifold.



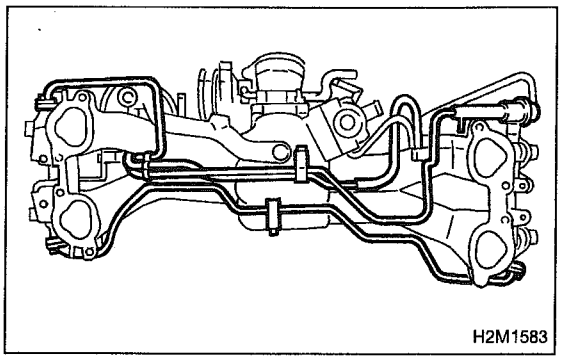
9) Remove idle air control solenoid valve from intake manifold.



10) Remove throttle body from intake manifold.



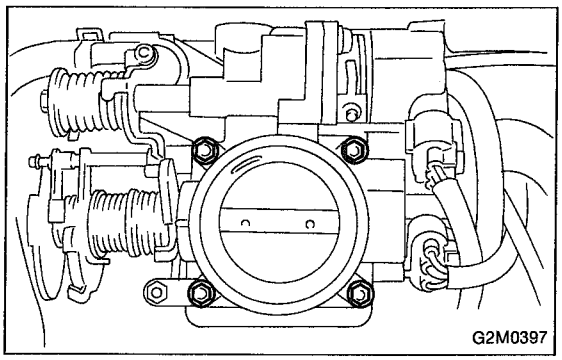
11) Remove fuel pipes, etc. from intake manifold.
12) Remove EGR solenoid valve (AT vehicles) and purge control solenoid valve.


H2M1583

C: ASSEMBLY

1. 1800 cc MODEL

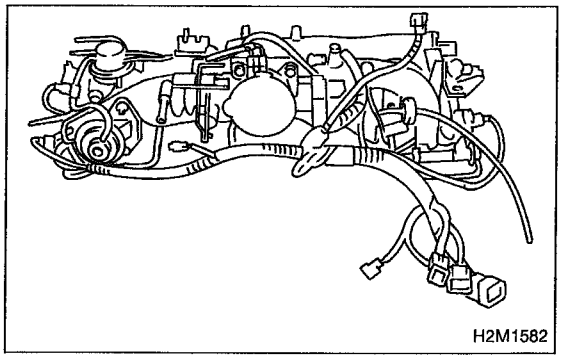
1) Install EGR solenoid valve (AT vehicles) and purge control solenoid valve.
2) Assemble fuel pipes, etc. to intake manifold.


G2M0397

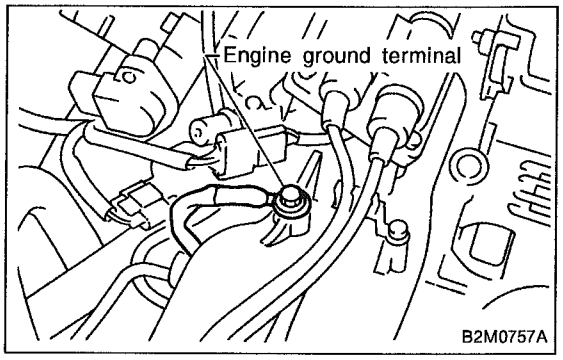
3) Assemble throttle body to intake manifold.

CAUTION:
Replace gasket with a new one.

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


H2M1582

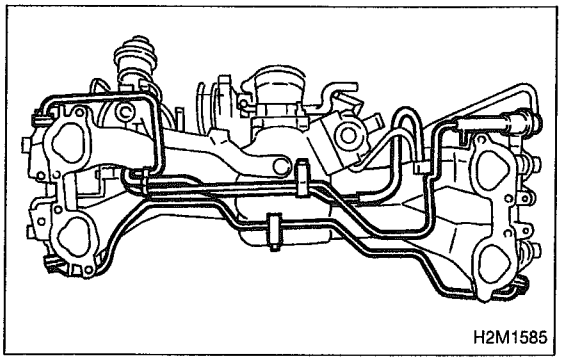
4) Install engine harness onto intake manifold.
5) Connect connectors to throttle position sensor, ignition coil, fuel injectors, idle air control solenoid valve, purge control solenoid valve and solenoid valve.



B2M0757A

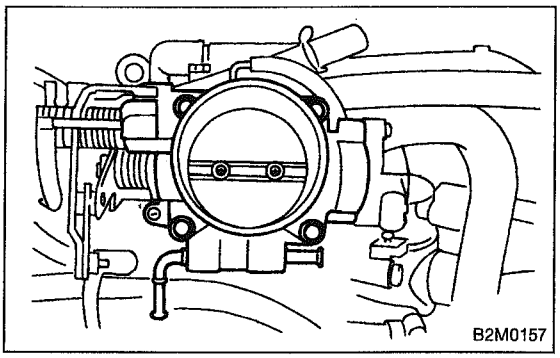
6) Connect engine ground terminal to intake manifold.

Tightening torque:
19 ± 1.5 N·m (1.9 ± 0.15 kg-m, 13.7 ± 1.1 ft-lb)


H2M1585

2. 2200 cc MODEL

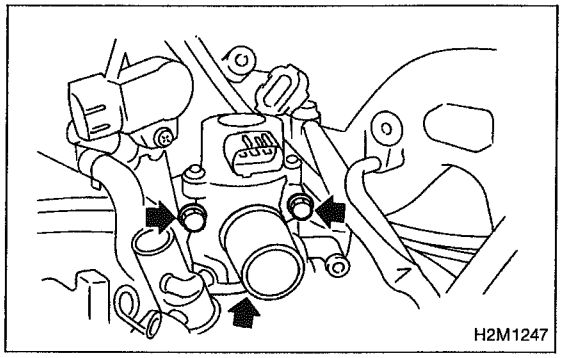
1) Install EGR solenoid valve (AT vehicles) and purge control solenoid valve.
2) Assemble fuel pipes, etc. to intake manifold.



3) Assemble throttle body to intake manifold.

CAUTION:
Replace gasket with a new one.

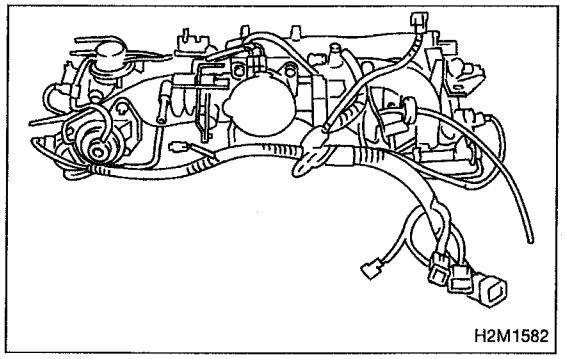
Tightening torque:
22 ± 2 N·m (2.2 ± 0.2 kg-m, 15.9 ± 1.4 ft-lb)



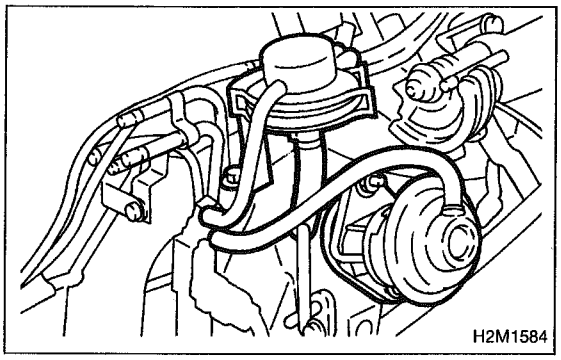
4) Install idle air control solenoid valve to intake manifold.

CAUTION:
Replace gasket with a new one.

Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)



5) Install engine harness onto intake manifold.
6) Connect connectors to throttle position sensor, ignition coil, fuel injectors, idle air control solenoid valve, purge control solenoid valve and EGR solenoid valve. (AT vehicles)

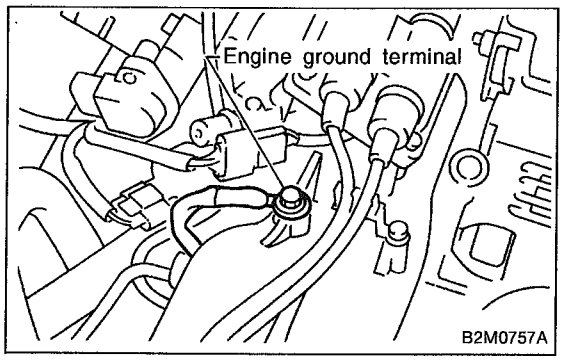


7) Install EGR valve. (AT vehicles)

CAUTION:
Replace gasket with a new one.

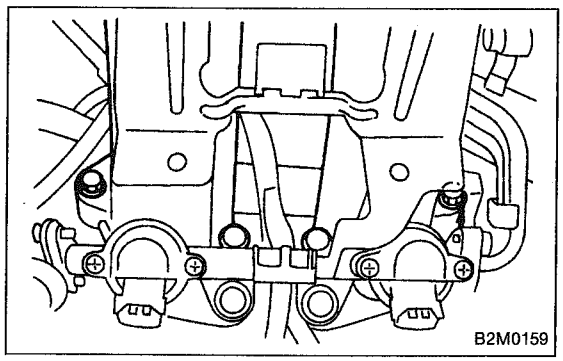
Tightening torque:
19 ± 1.5 N·m (1.9 ± 0.15 kg-m, 13.7 ± 1.1 ft-lb)

8) Install BPT with BPT holder bracket. (AT vehicles)
9) Connect BPT hoses from EGR solenoid valve and intake manifold. (AT vehicles)
10) Connect back pressure hose from pipe. (AT vehicles)
11)' Connect EGR vacuum hose from EGR vale. (AT vehicles)



12) Connect engine ground terminal to intake manifold.

Tightening torque:
19 ± 1.5 N·m (1.9 ± 0.15 kg-m, 13.7 ± 1.1 ft-lb)



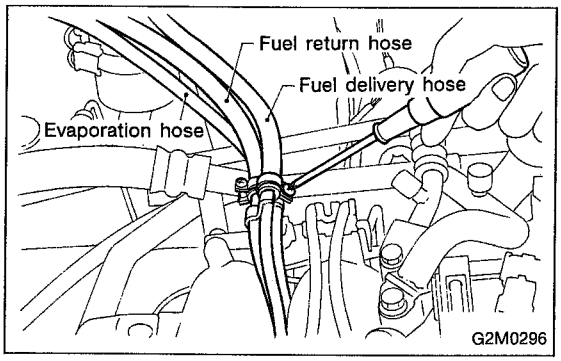
D: INSTALLATION

1. 1800 cc MODEL

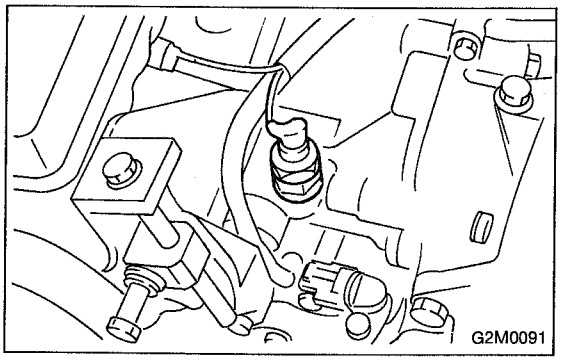
1) Install intake manifold onto cylinder heads.

CAUTION:
Always use new gaskets.

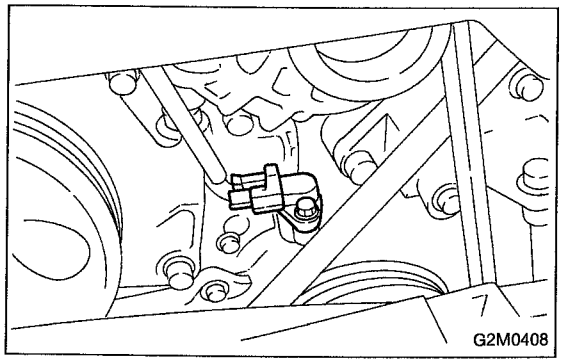
Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)



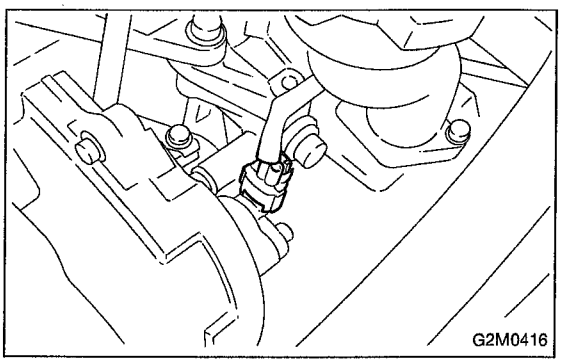
2) Connect fuel hoses.



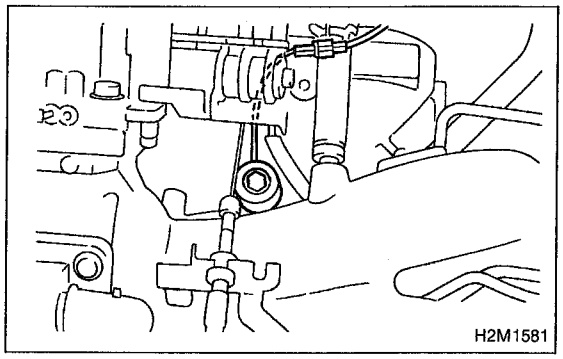
3) Connect connector to oil pressure switch.



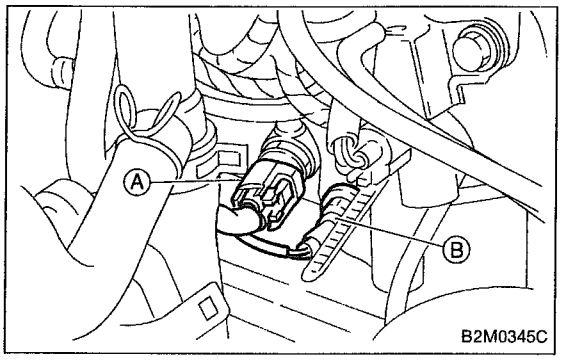
4) Connect connector to crankshaft position sensor.



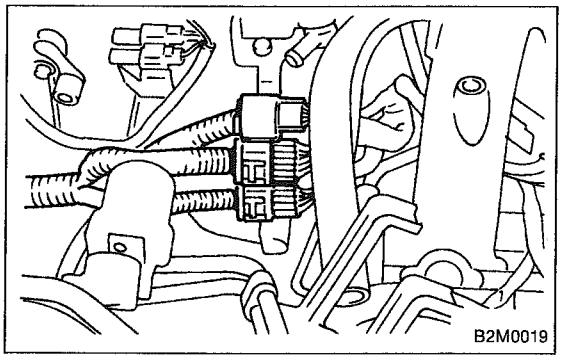
5) Connect connector to camshaft position sensor.



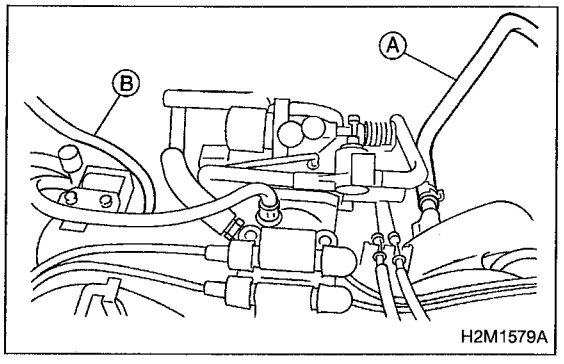
6) Connect connector to knock sensor.



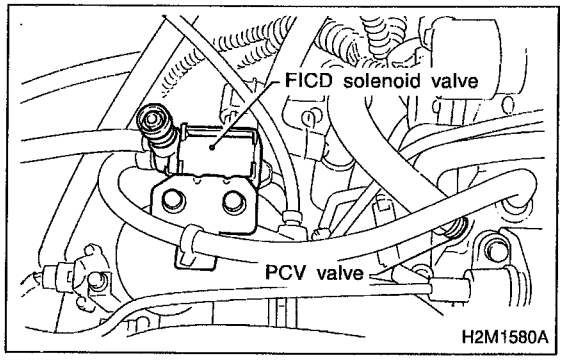
7) Connect connectors to engine coolant temperature sensor Ⓐ and thermometer Ⓑ.



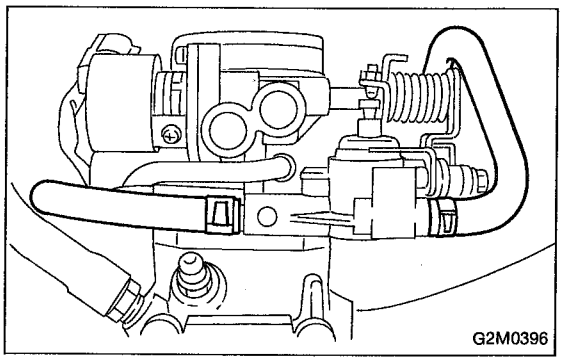
8) Connect engine harness connector to bulkhead harness connectors.



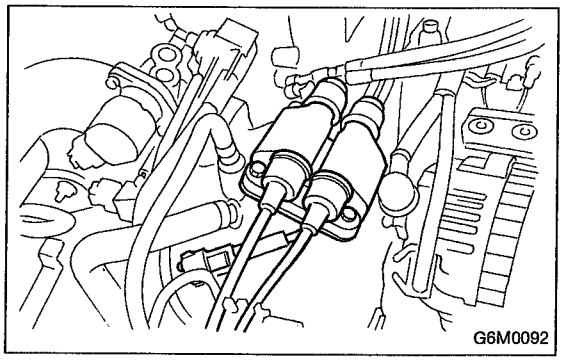
9) Connect cruise control vacuum hose Ⓑ. (With cruise control)
10) Connect brake booster vacuum hose Ⓐ.



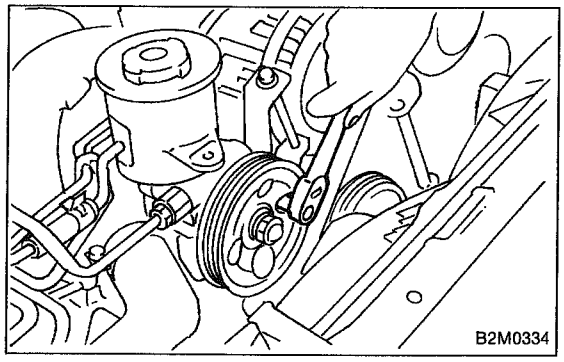
11) Connect air by-pass hose to FICD solenoid valve. (With A/C)
12) Connect emission hose to PCV valve.



13) Connect engine coolant hoses to throttle body.

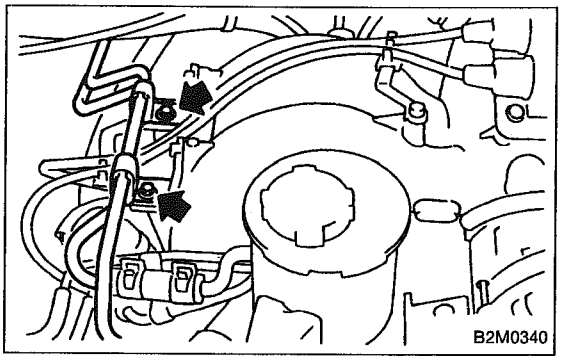


14) Connect spark plug cords to ignition coil.
15) Connect connector to ignition coil.

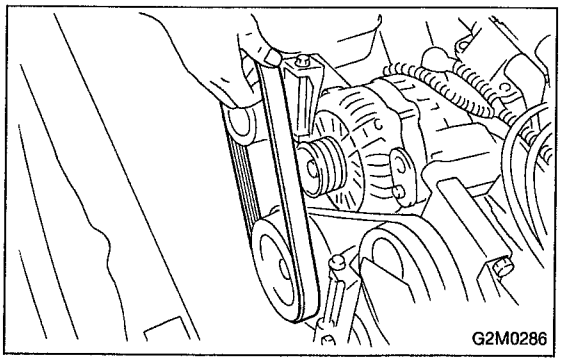


16) Install power steering pump on bracket.
(1) Install power steering pump on bracket, and tighten bolts.

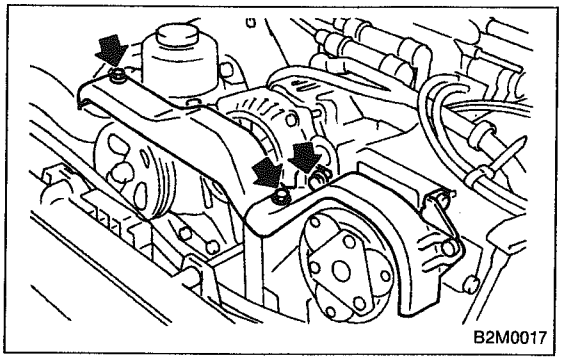
Tightening torque:
20.1 ± 2.5 N·m (2.05 ± 0.25 kg-m, 14.8 ± 1.8 ft-lb)



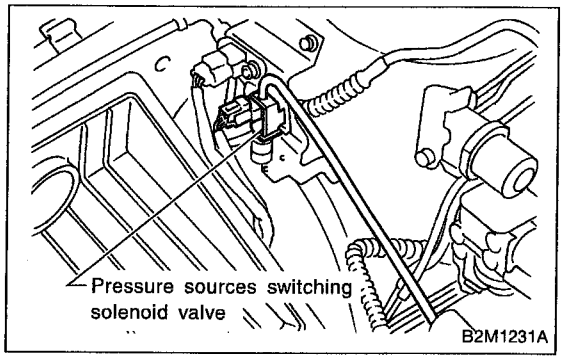
(2) Install power steering pipe brackets on right side intake manifold.



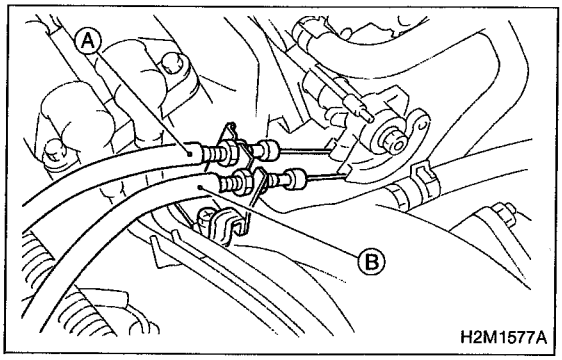
(3) Install power steering pump drive V-belt.
(4) Adjust V-belt. <Ref. to 1-5 [01A0].>



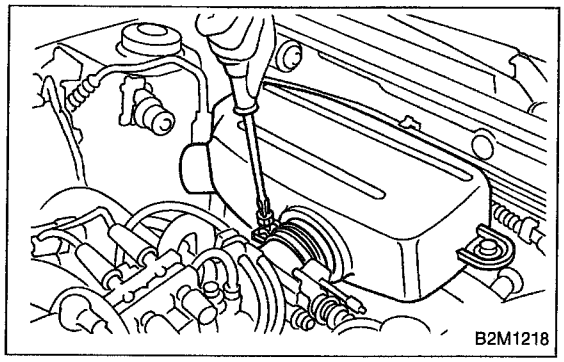
(5) Install V-belt cover.



17) Connect vacuum hoses to pressure sources switching solenoid valve.

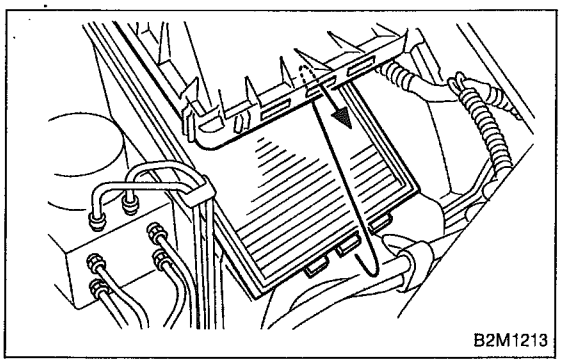


18) Connect accelerator cable Ⓐ.
19) Connect cruise control cable Ⓑ. (With cruise control model)



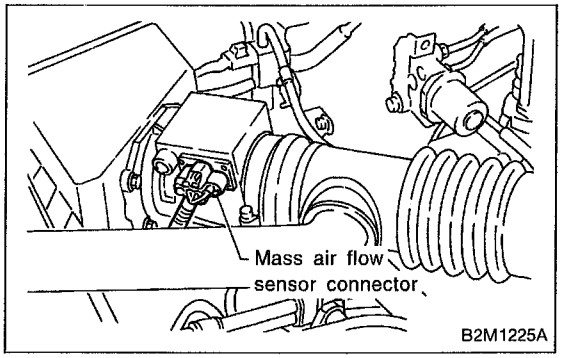
20) Install air intake chamber and connect air hoses.

Tightening torque:
4.9 ± 0.5 N·m (0.5 ± 0.05 kg-m, 3.6 ± 0.4 ft-lb)

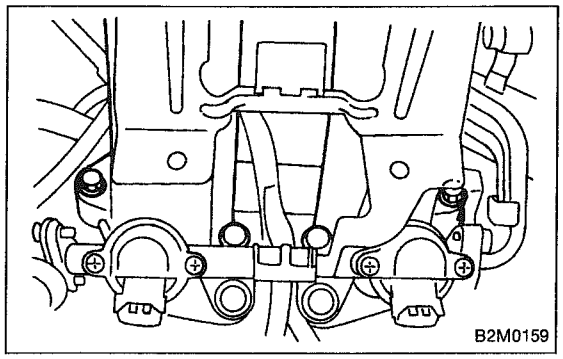


21) Install air cleaner element.
22) Install air cleaner upper cover and air intake duct as a unit.

CAUTION:
Before installing air cleaner upper cover, align holes with protruding portions of air cleaner lower case, then secure upper cover to lower case.



23) Connect connector to mass air flow sensor.

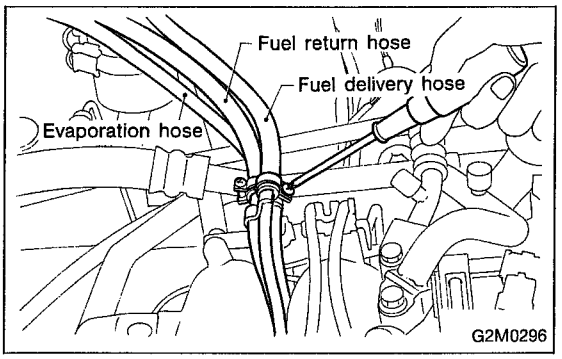


2. 2200 cc MODEL

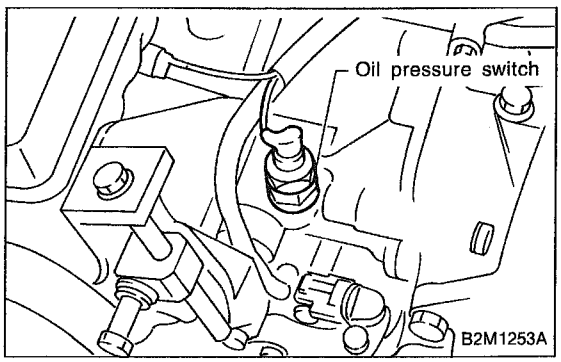
1) Install intake manifold onto cylinder heads.

CAUTION:
Always use new gaskets.

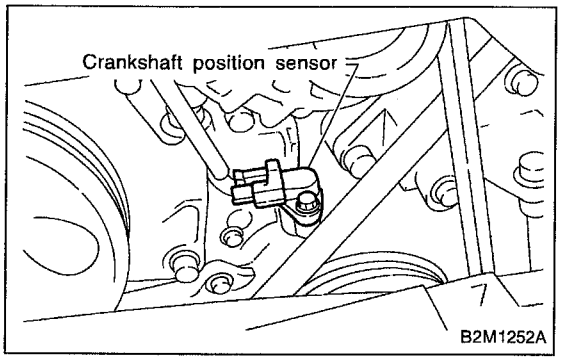
Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)



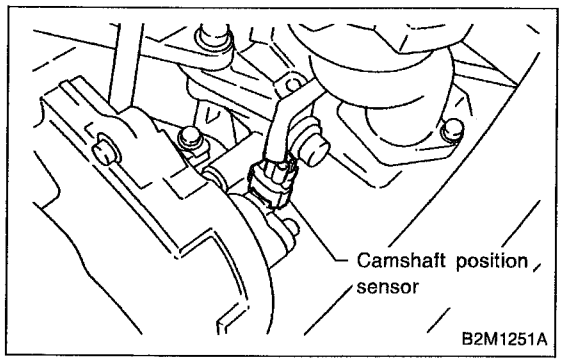
2) Connect fuel hoses.



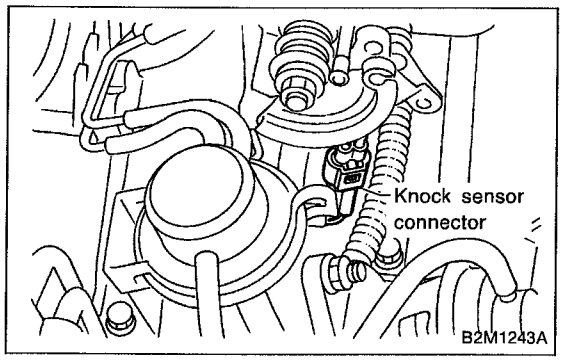
3) Connect connector to oil pressure switch.



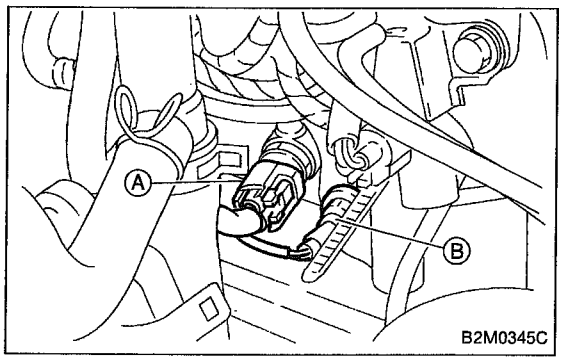
4) Connect connector to crankshaft position sensor.



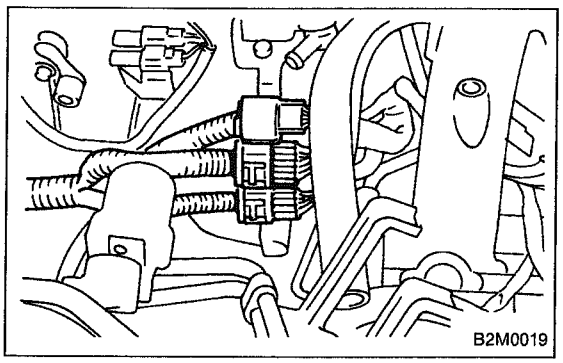
5) Connect connector to camshaft position sensor.



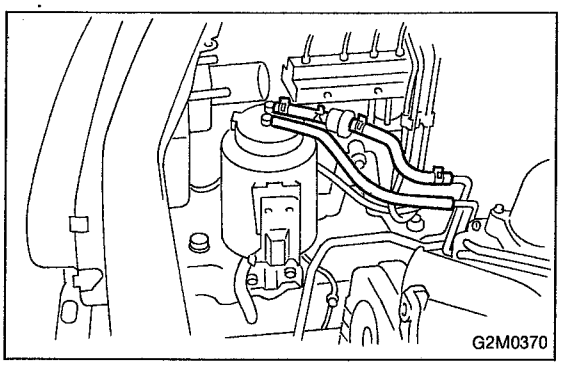
6) Connect knock sensor connector.



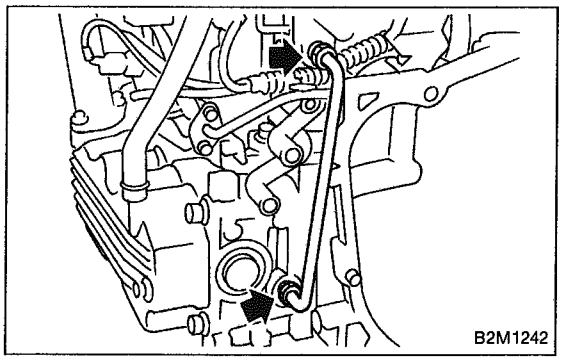
7) Connect connectors to engine coolant temperature sensor Ⓐ and thermometer Ⓑ.



8) Install engine harness connectors to bracket, and connect engine harness connectors to bulkhead connectors.

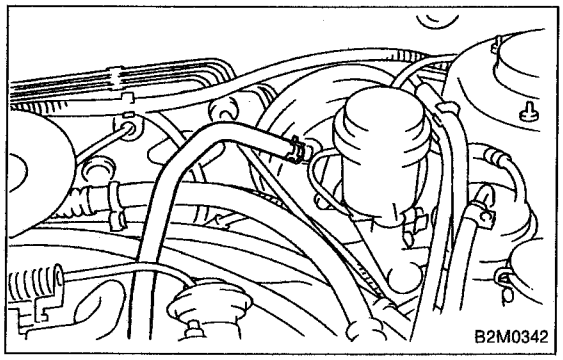


9) Connect canister hoses.

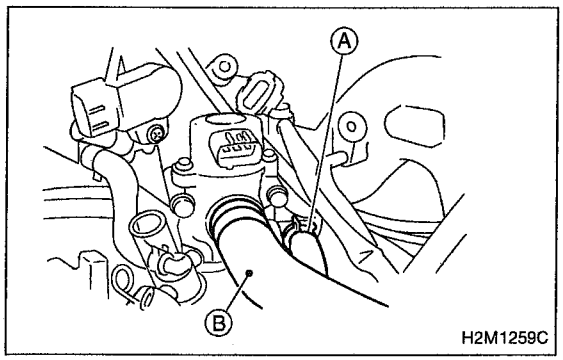


10) Install EGR pipe. (AT vehicles)

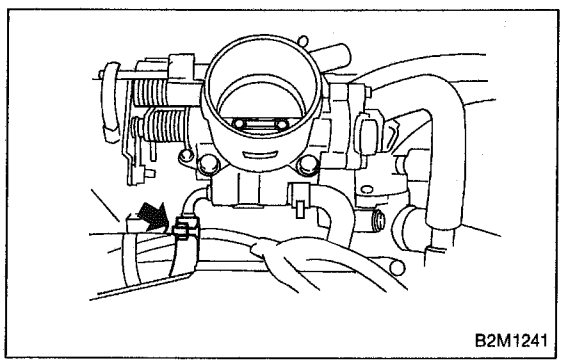
Tightening torque:
34 ± 2 N·m (3.5 ± 0.2 kg-m, 25.3 ± 1.4 ft-lb)



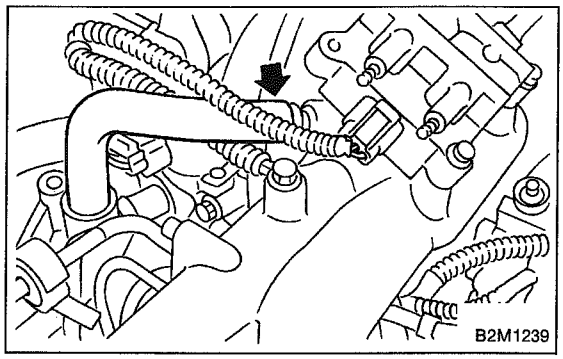
11) Connect brake booster hose.



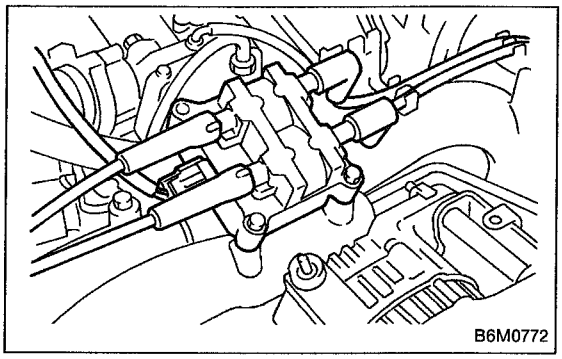
12) Connect engine coolant hose Ⓐ to idle air control solenoid valve.
13) Connect air by-pass hose Ⓑ to idle air control solenoid valve.



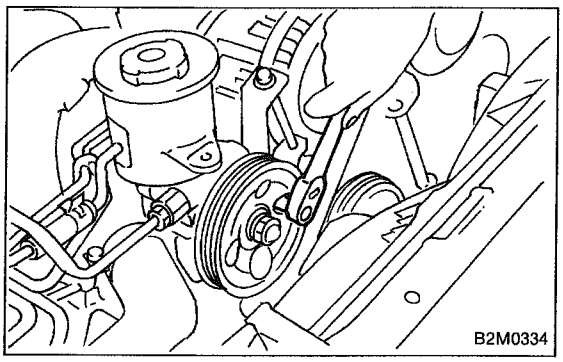
14) Connect engine coolant hose to throttle body.



15) Connect PCV hose to intake manifold.

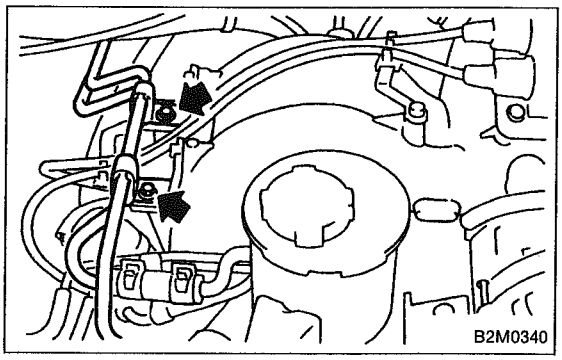


16) Connect spark plug cords to ignition coil.

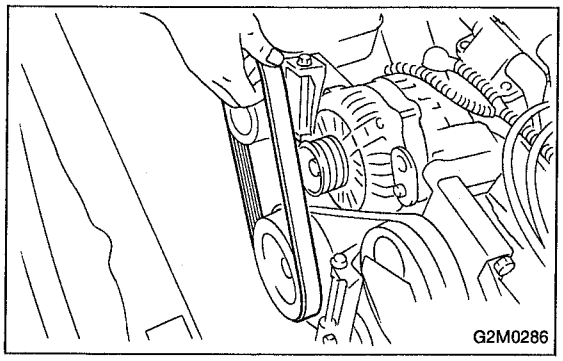


17) Install power steering pump on bracket.
(1) Install power steering pump on bracket, and tighten bolts.

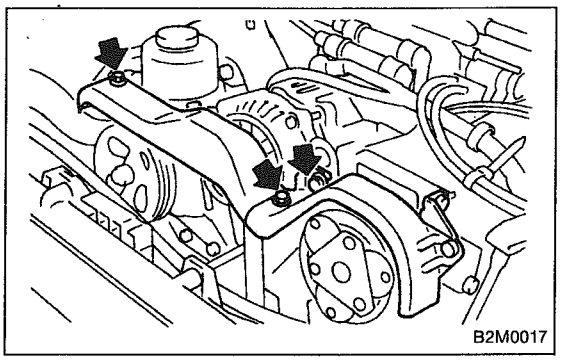
Tightening torque:
20.1 ± 2.5 N·m (2.05 ± 0.25 kg-m, 14.8 ± 1.8 ft-lb)



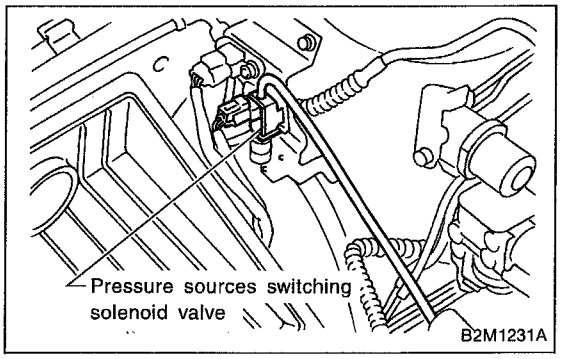
(2) Install power steering pipe brackets on right side intake manifold.



(3) Install power steering pump drive V-belt.
(4) Adjust V-belt. <Ref. to 1-5 [01A0].>

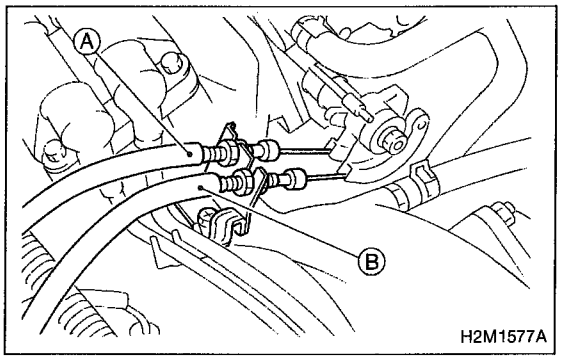

B2M0017

(5) Install V-belt cover.



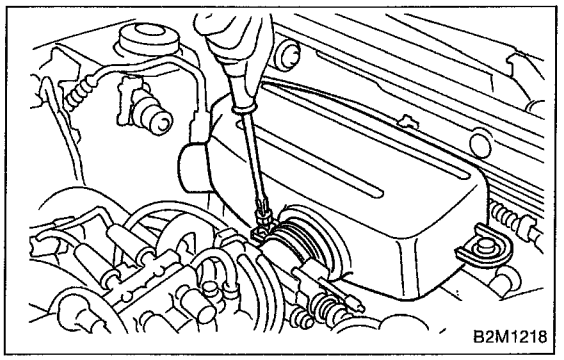
B2M1231A

18) Connect vacuum hoses to pressure sources switching solenoid valve.



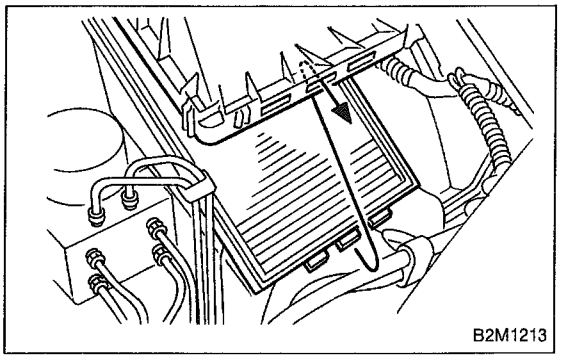
H2M1577A

19) Connect accelerator cable Ⓐ.
20) Connect cruise control cable Ⓑ. (With cruise control model)


B2M1218

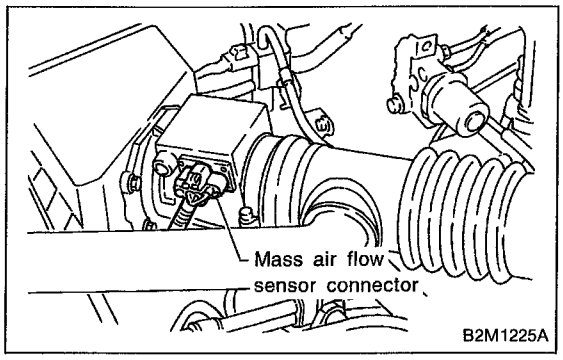
21) Install air intake chamber and connect air hoses.

Tightening torque:
4.9 ± 0.5 N·m (0.5 ± 0.05 kg-m, 3.6 ± 0.4 ft-lb)

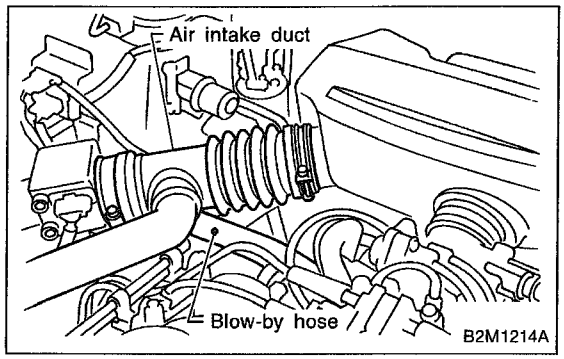

B2M1213

22) Install air cleaner element.
23) Install air cleaner upper cover and air intake duct as a unit.

CAUTION:
Before installing air cleaner upper cover, align holes with protruding portions of air cleaner lower case, then secure upper cover to lower case.



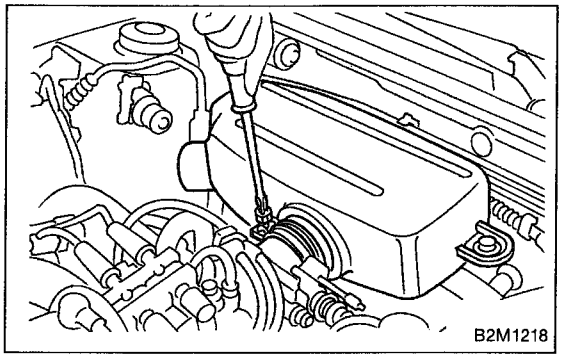
24) Connect connector to mass air flow sensor.



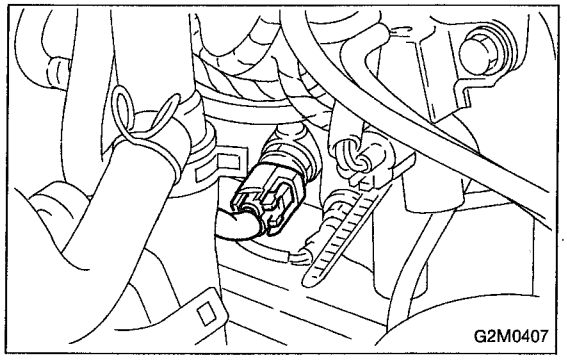
5. Engine Coolant Temperature Sensor

A: REMOVAL AND INSTALLATION

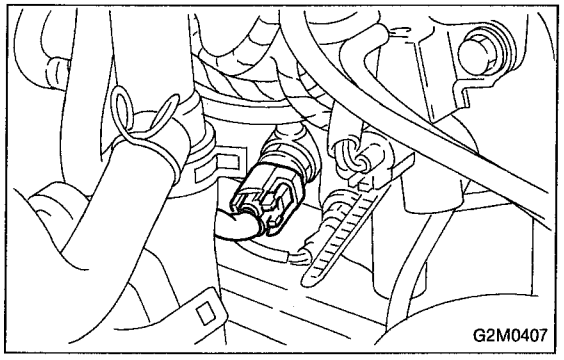
1) Loosen clamps which connect air intake duct to air intake chamber and mass air flow sensor.
2) Disconnect blow-by hose from air intake duct.
3) Remove air intake duct.



4) Loosen clamp which connects air intake chamber to throttle body.
5) Disconnect air hoses, and remove air intake chamber.

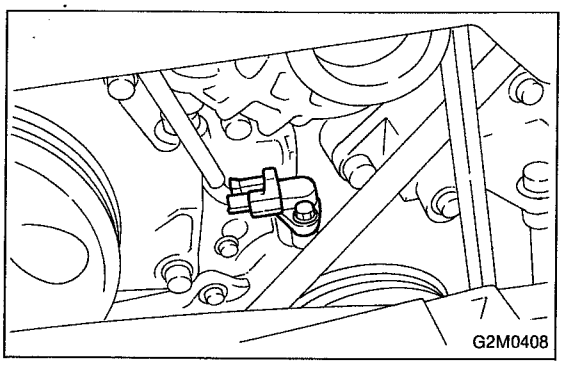


6) Disconnect connector from engine coolant temperature sensor.
7) Remove engine coolant temperature sensor.



8) Installation is in the reverse order of removal.

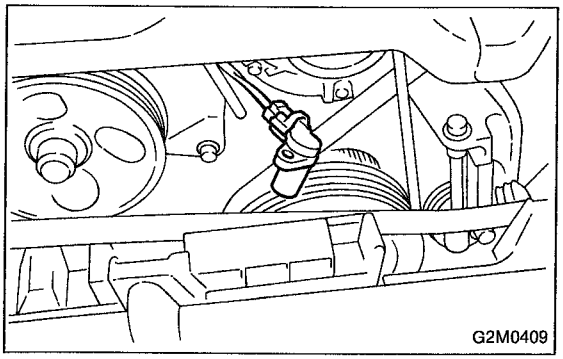
Tightening torque:
25 ± 3 N·m (2.5 ± 0.3 kg-m, 18.1 ± 2.2 ft-lb)



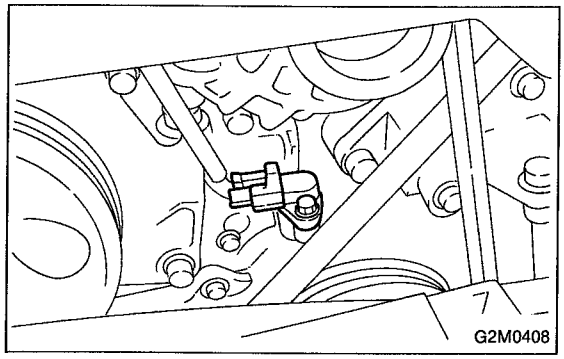
6. Crankshaft Position Sensor

A: REMOVAL AND INSTALLATION

1) Remove bolt which install crankshaft position sensor to cylinder block.

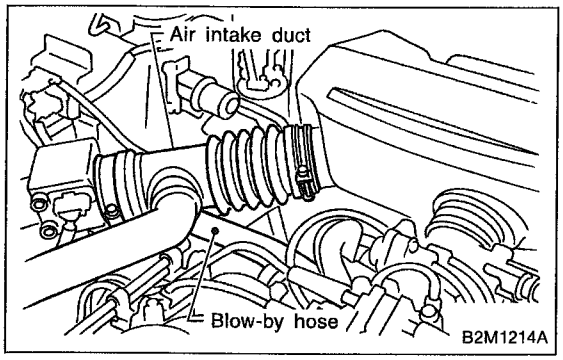


2) Remove crankshaft position sensor, and disconnect connector from it.



3) Installation is in the reverse order of removal.

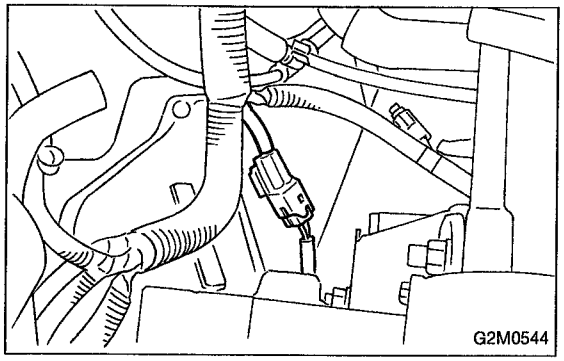
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)



7. Front Oxygen Sensor

A: REMOVAL

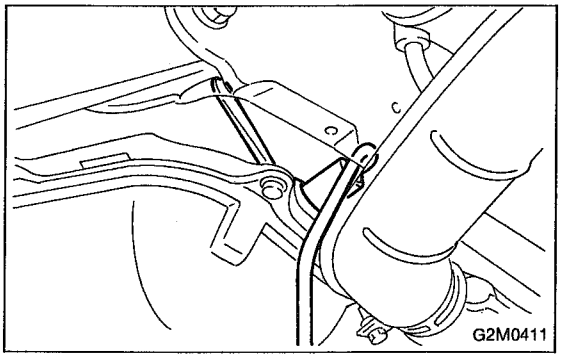
1) Loosen clamps which connect air intake duct to air intake chamber and mass air flow sensor.
2) Disconnect blow-by hose from air intake duct.
3) Remove air intake duct.



4) Disconnect connector from front oxygen sensor.

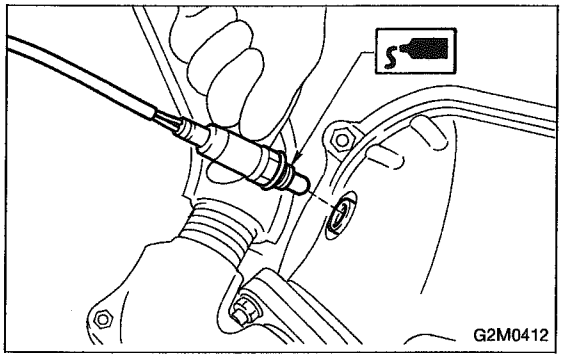
5) Lift-up the vehicle.
6) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)



7) Remove front oxygen sensor.

CAUTION:
When removing oxygen sensor, do not force oxygen sensor especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.

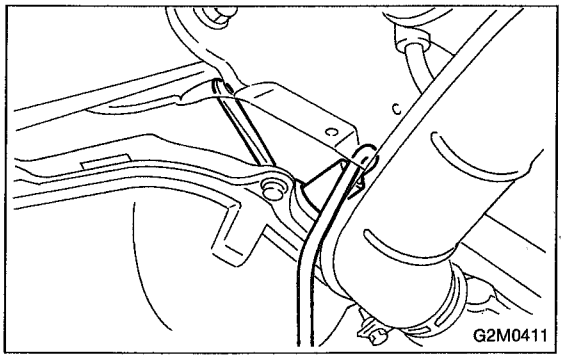


B: INSTALLATION

1) Before installing front oxygen sensor, apply anti-seize compound only to threaded portion of front oxygen sensor to make the next removal easier.

Anti-seize compound:
SS-30 by JET LUBE

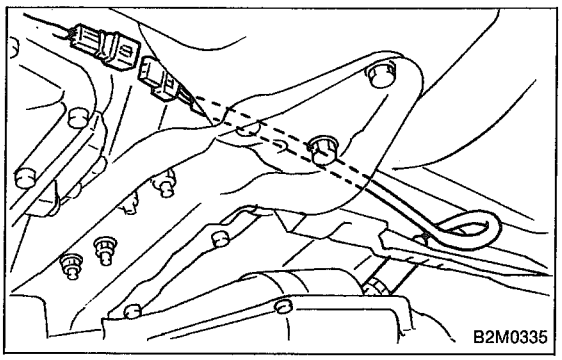
CAUTION:
Never apply anti-seize compound to protector of front oxygen sensor.



2) Install front oxygen sensor.

Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)

3) Lower the vehicle.
4) Connect connector of front oxygen sensor.
5) Install air intake duct.


B2M0335

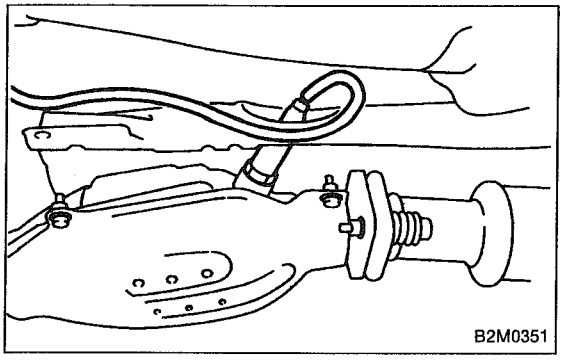
8. Rear Oxygen Sensor

A: REMOVAL

1) Lift-up the vehicle.
2) Disconnect connector from rear oxygen sensor.

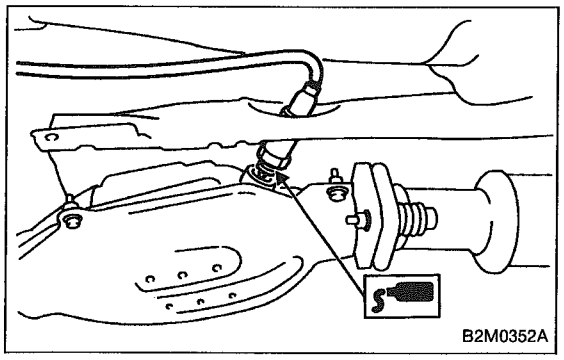
3) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)


B2M0351

4) Remove rear oxygen sensor.

CAUTION:
When removing rear oxygen sensor, do not force rear oxygen sensor especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.

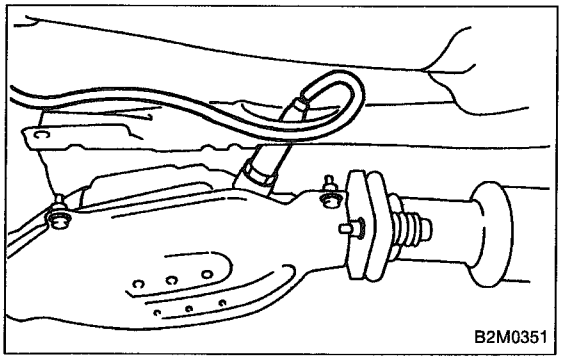

B2M0352A

B: INSTALLATION

1) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion of rear oxygen sensor to make the next removal easier.

Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of rear oxygen sensor.

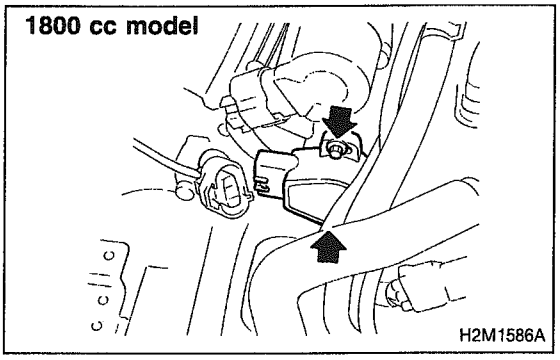

B2M0351

2) Install rear oxygen sensor.

Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)

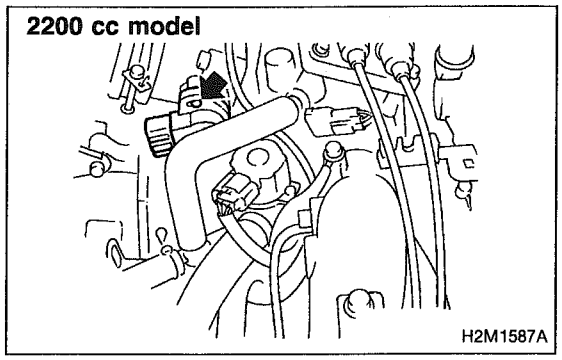
3) Connect connector of rear oxygen sensor.
4) Lower the vehicle.

1800 cc model



H2M1586A

2200 cc model



H2M1587A

9. Throttle Position Sensor

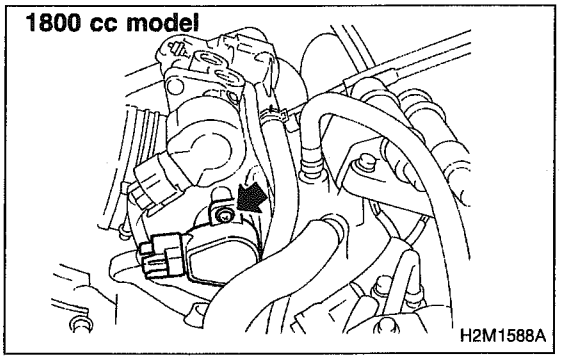
A: REMOVAL AND INSTALLATION

1) Disconnect connector from throttle position sensor.
2) Remove throttle position sensor holding screws, and remove it.
3) Installation is in the reverse order of removal.

Tightening torque:
2.2 ± 0.2 N·m (0.22 ± 0.02 kg-m, 1.6 ± 0.1 ft-lb)

CAUTION:
When installing throttle position sensor, adjust to the specified data.

1800 cc model

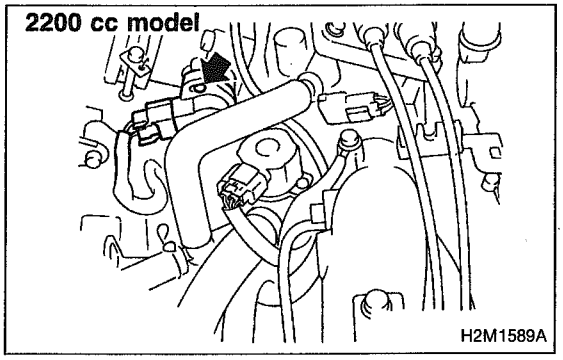


H2M1588A

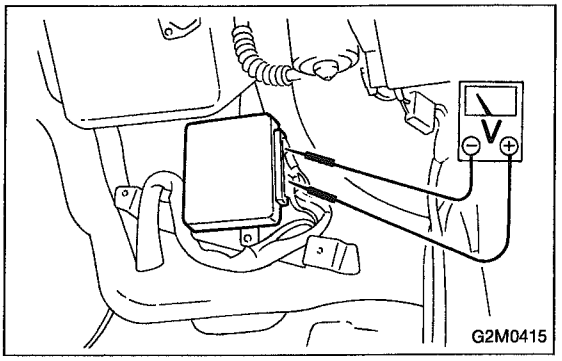
B: ADJUSTMENT

1) Turn ignition switch to OFF.
2) Loosen throttle position sensor holding screws.

2200 cc model



H2M1589A

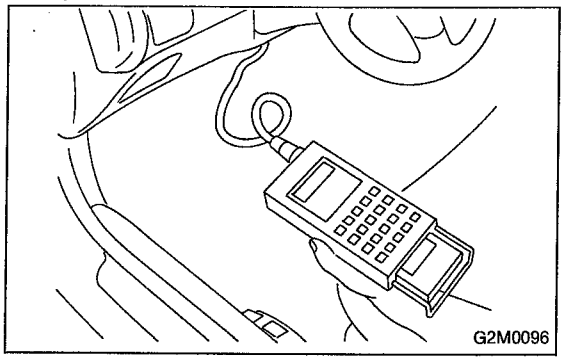


G2M0415

3) When using voltage meter;
   (1) Take out ECM.
   (2) Turn ignition switch to ON.
   (3) Adjust throttle position sensor to specified voltage between ECM connector terminal.

Connector & terminal / Specified voltage
(B84) No. 6 — No. 20 / 0.45 — 0.55 V
[Fully closed.]

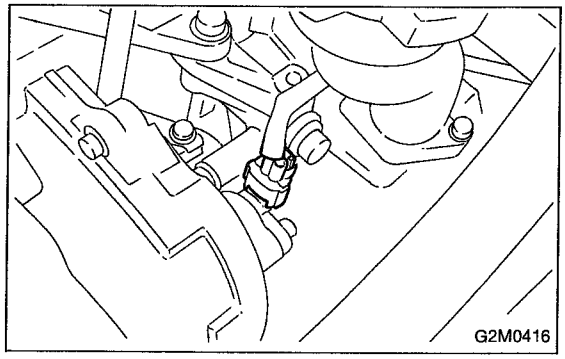
   (4) Tighten throttle position sensor holding screws.


G2M0096

4) When using the Select Monitor;
   (1) Attach Select Monitor.
   (2) Turn ignition switch to ON.
   (3) Select mode "F07".
   (4) Adjust throttle position sensor to specified data.

Condition / Specified data
Throttle fully closed. / 0.50 V

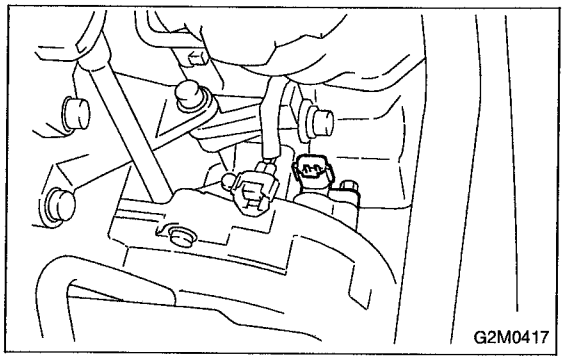
   (5) Tighten throttle position sensor holding screws.


G2M0416

10. Camshaft Position Sensor

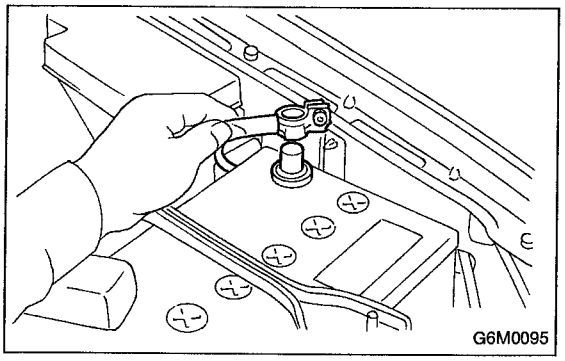
A: REMOVAL AND INSTALLATION

1) Disconnect connector from camshaft position sensor.


G2M0417

2) Remove camshaft position sensor from camshaft support LH.
3) Installation is in the reverse order of removal.

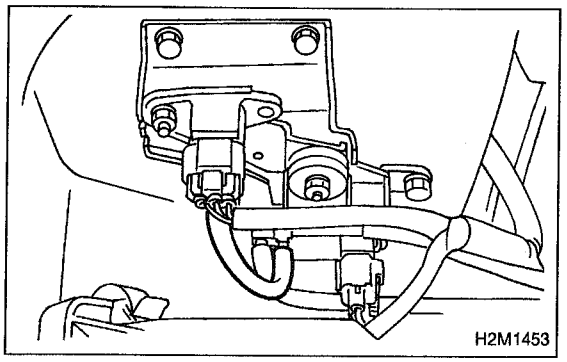
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)


G6M0095

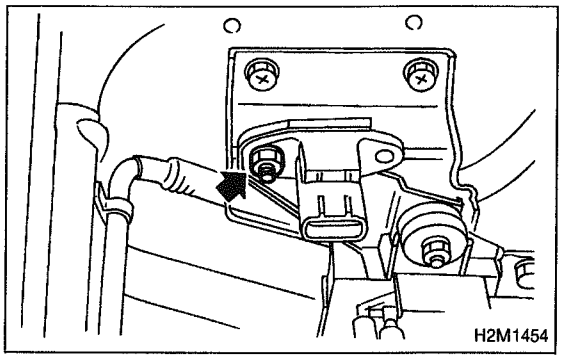
11. Pressure Sensor

A: REMOVAL AND INSTALLATION

1) Disconnect battery ground cable.

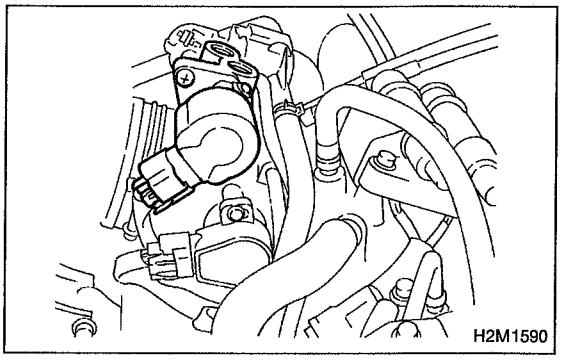

H2M1453

2) Disconnect connector from pressure sensor.
3) Disconnect hose from pressure sensor.



4) Remove pressure sensor from bracket.
5) Installation is in the reverse order of removal.

Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)

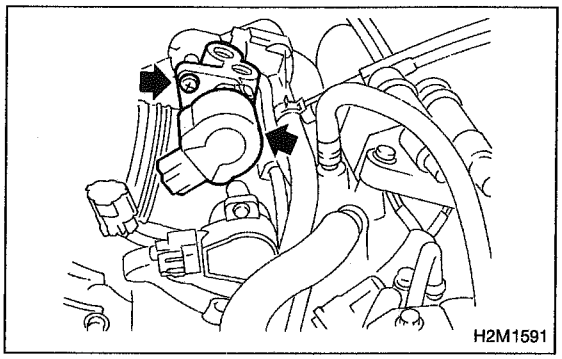


12. Idle Air Control Solenoid Valve

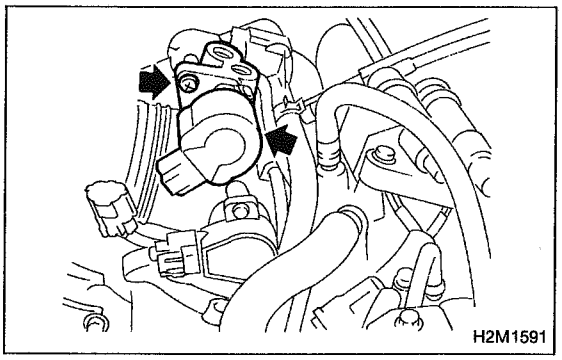
A: REMOVAL AND INSTALLATION

1. 1800 cc MODEL

1) Disconnect connector from idle air control solenoid valve.



2) Remove idle air control solenoid valve from throttle body.

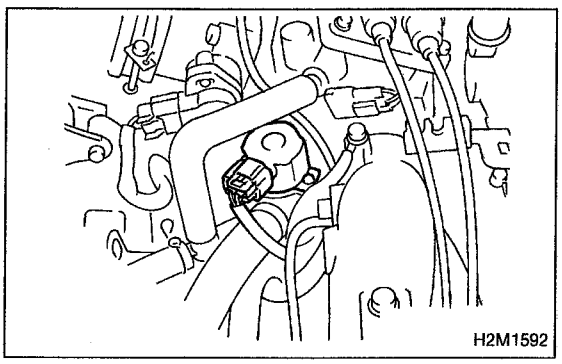


3) Installation is in the reverse order of removal.

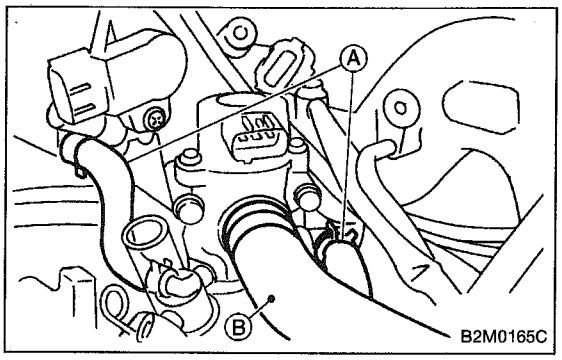
CAUTION:
Replace gasket with a new one.

Tightening torque:
6.0 ± 0.8 N·m (0.61 ± 0.08 kg-m, 4.4 ± 0.6 ft-lb)

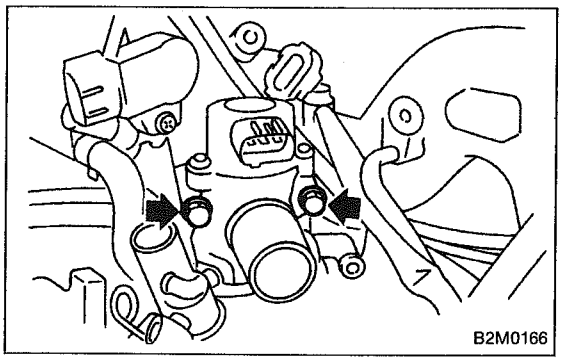
2. 2200 cc MODEL



1) Disconnect connector from idle air control solenoid valve.



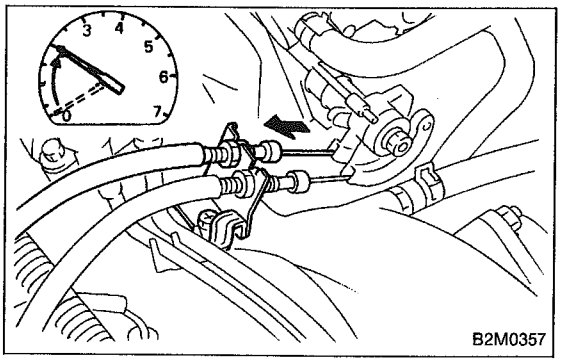
2) Disconnect engine coolant hoses Ⓐ from idle air control solenoid valve.
3) Disconnect air by-pass hose Ⓑ from idle air control solenoid valve.



4) Remove idle air control solenoid valve from throttle body.
5) Installation is in the reverse order of removal.

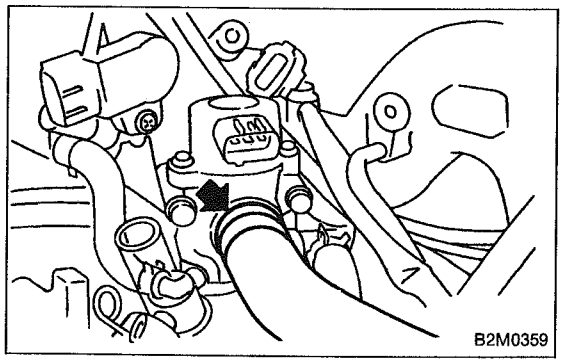
CAUTION:
Replace gasket with a new one.

Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)

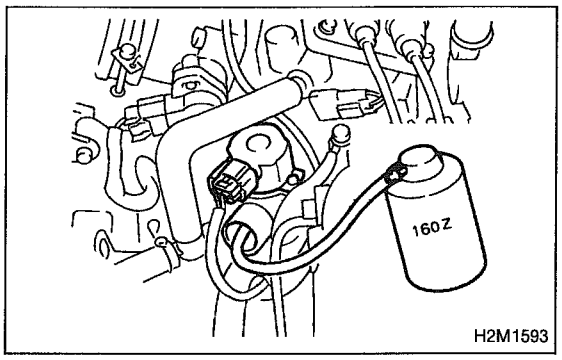


B: CLEANING (2200 cc MODEL)

1) Start and warm-up the engine until radiator fan operates.
2) Hold throttle valve so that engine speed is at 2,000 rpm.



3) Disconnect by-pass hose from idle air control solenoid valve.



4) Slowly pour one can (16 oz) of cleaner into by-pass air hole.

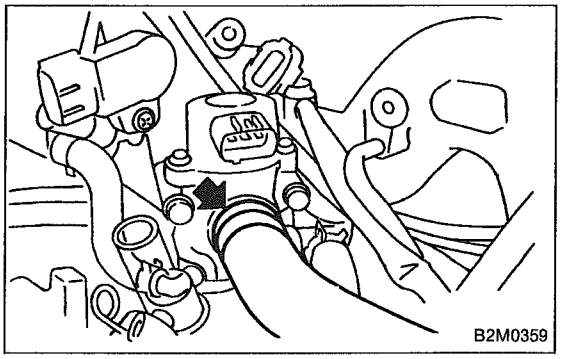
Cleaner:

- ***Part No. 1050002 GM Top Engine Cleaner***
- ***Part No. X66-A AC Delco Carburetor Tune-up Conditioner***

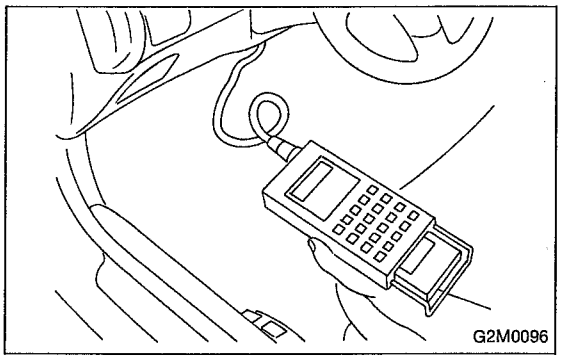
5) Leave the engine running for five minutes.

NOTE:
White smoke comes out of the muffler until the cleaner is used up.

6) Stop the engine.



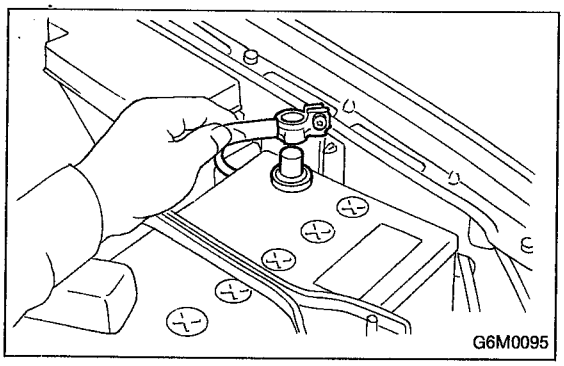
7) Release the throttle valve.
8) Connect by-pass hose to idle air control solenoid valve.



9) Check duty ratio of idle air control solenoid valve with Subaru Select Monitor.

(1) Connect Subaru Select Monitor to the data link connector.
(2) Start the engine and turn Subaru Select Monitor switch to ON.
(3) Select mode "F12".
(4) Make sure duty ratio on radiator fan and electric load is OFF.

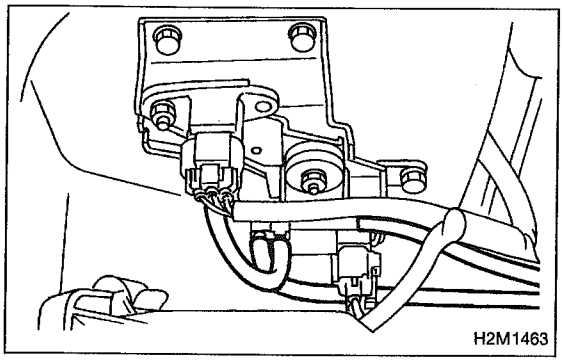
Specified data: 25 — 40%


G6M0095

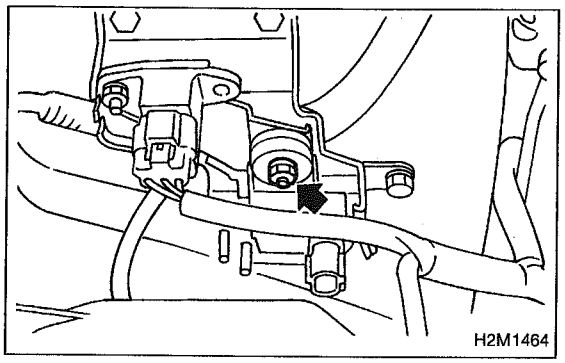
13. Pressure Sources Switching Solenoid Valve

A: REMOVAL AND INSTALLATION

1) Disconnect battery ground cable.

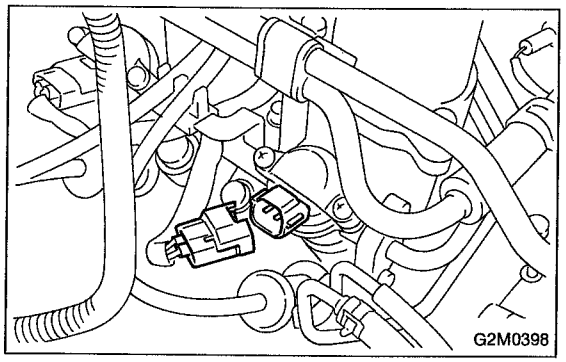

H2M1463

2) Disconnect connector from pressure sources switching solenoid valve.
3) Disconnect hoses from pressure sources switching solenoid valve.


H2M1464

4) Remove pressure sources switching solenoid valve from bracket.
5) Installation is in the reverse order of removal.

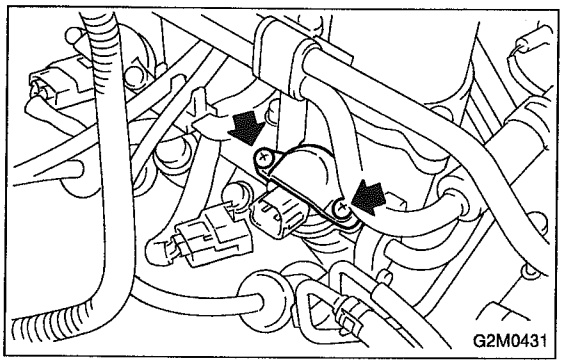
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)


G2M0398

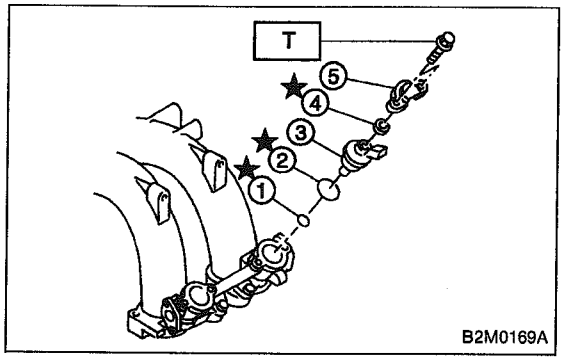
14. Fuel Injector

A: REMOVAL AND INSTALLATION

1) Release fuel pressure.
<Ref. to 2-8 [W1B0].>
2) Disconnect connector from fuel injector.


G2M0431

3) Remove fuel injector from fuel pipe assembly.

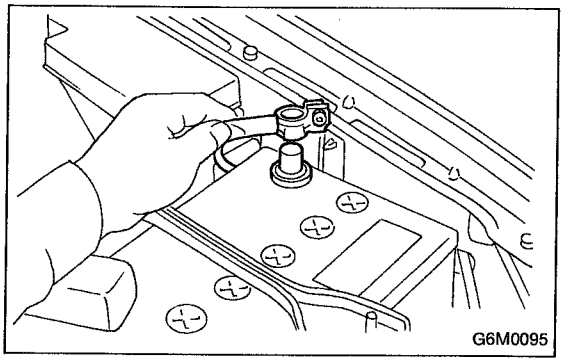


4) Installation is in the reverse order of removal.

CAUTION:
Replace O-rings and insulator.

Tightening torque:
T: 3.4 ± 0.5 N·m (0.35 ± 0.05 kg-m, 2.5 ± 0.4 ft-lb)

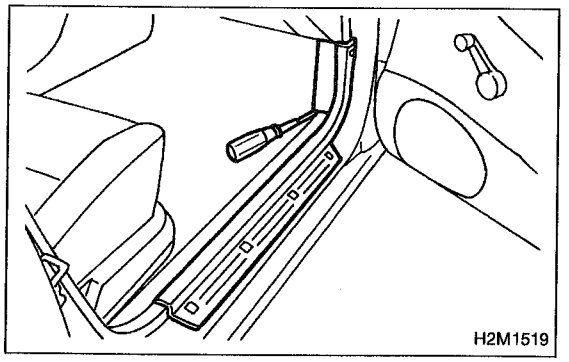
① O-ring B
② O-ring A
③ Fuel injector
④ Insulator
⑤ Fuel injector cup
★: Replacement part



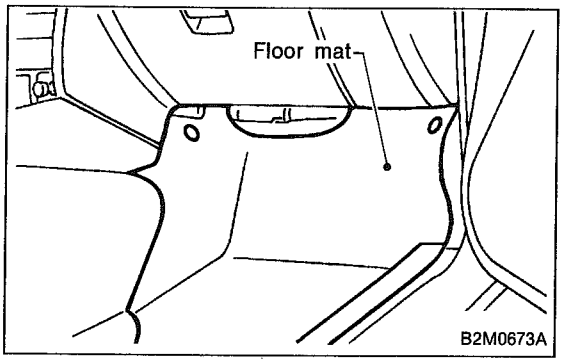
15. Engine Control Module

A: REMOVAL AND INSTALLATION

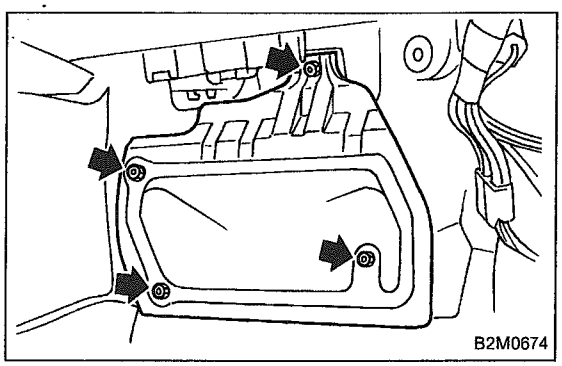
1) Disconnect battery ground cable.



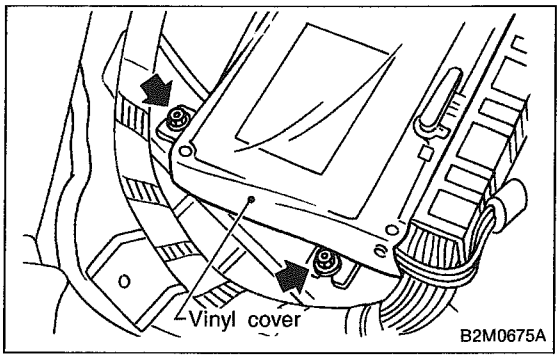
2) Remove front pillar lower trim.



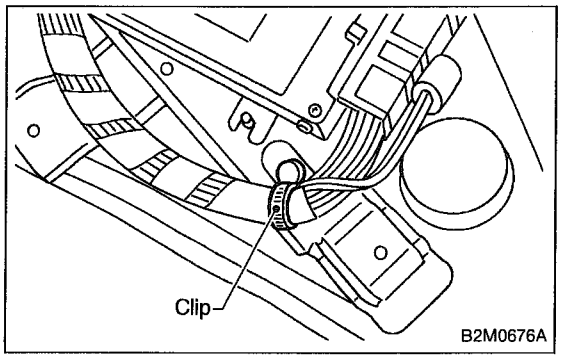
3) Detach floor mat of front passenger seat.



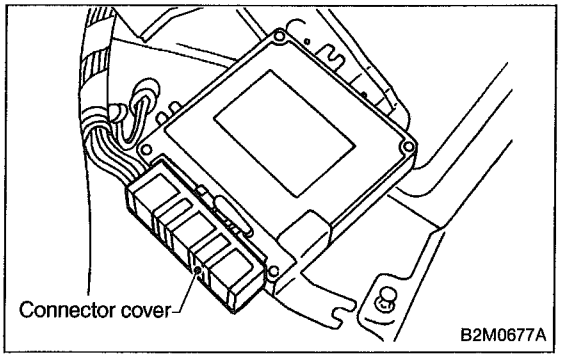
4) Remove protect cover.



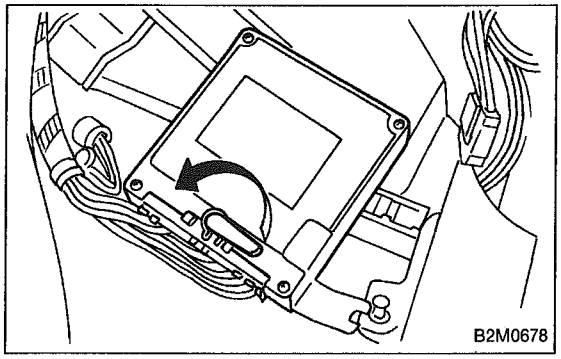
5) Remove vinyl cover and nuts which attach ECM to bracket.



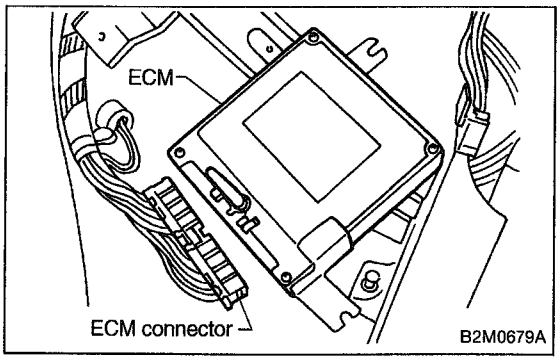
6) Detach clip from bracket.



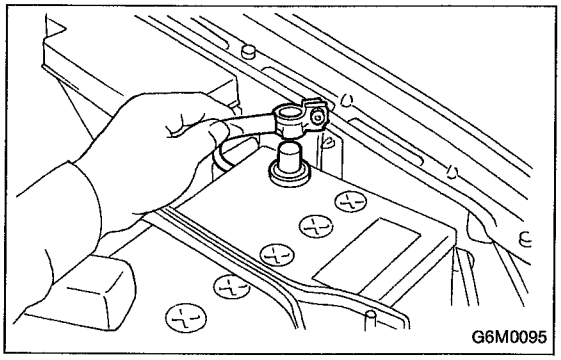
7) Remove connector cover.



8) Disconnect ECM connector.



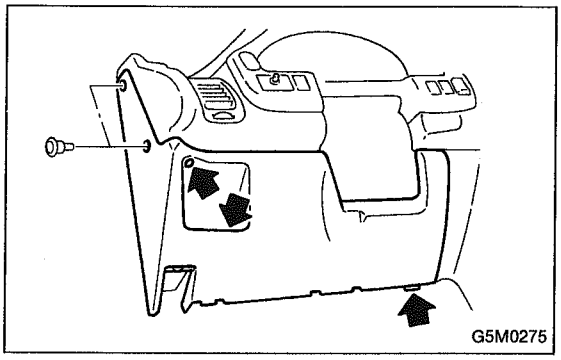
9) Take out ECM.
10) Installation is in the reverse order of removal.



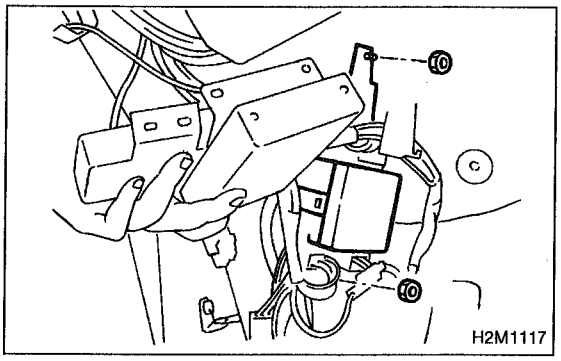
16. Main Relay

A: REMOVAL AND INSTALLATION

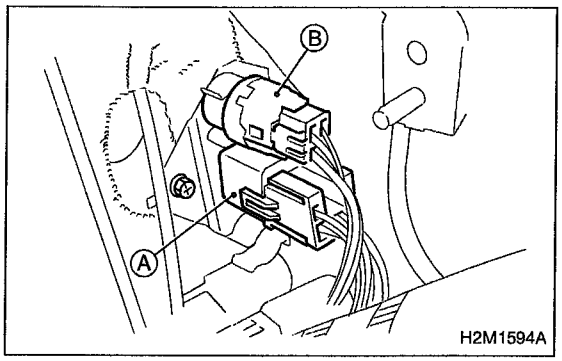
1) Disconnect battery ground cable.



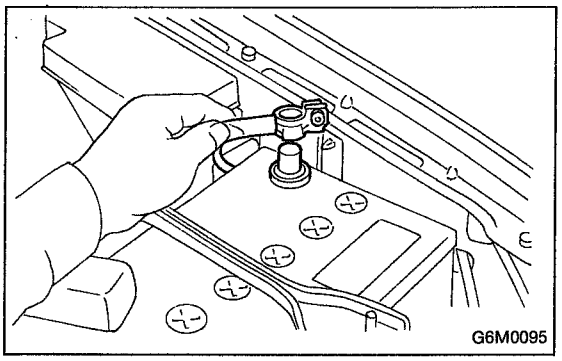
2) Remove lower cover and then disconnect connectors.
3) Remove the front pillar lower trim.



4) Remove fuse and relay box from bracket.
5) Disconnect connector from horn relay.
6) Remove all relays with bracket from body.
7) Remove fuse box mounting nuts.
8) Lower fuse box.
9) Remove fuse box mounting bracket.



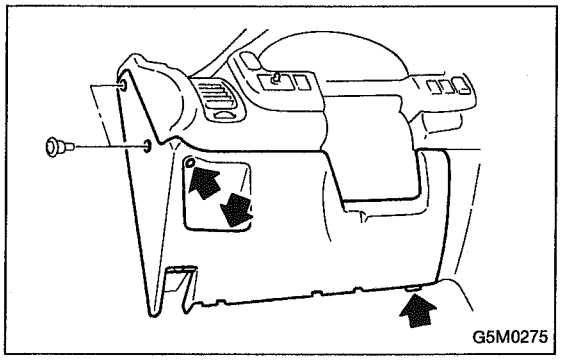
10) Remove bolt which retains bracket of main relay Ⓐ and fuel pump relay Ⓑ.
11) Disconnect connector from main relay.
12) Installation is in the reverse order of removal.


G6M0095

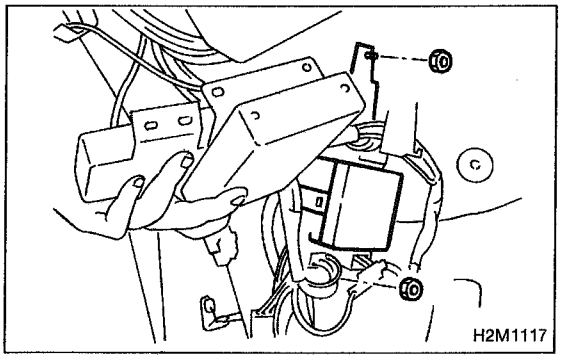
17. Fuel Pump Relay

A: REMOVAL AND INSTALLATION

1) Disconnect battery ground cable.

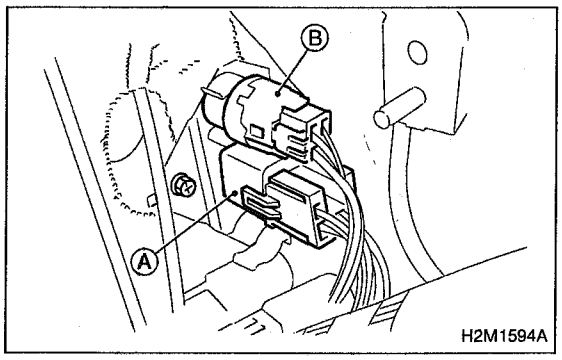

G5M0275

2) Remove lower cover and then disconnect connectors.
3) Remove the front pillar lower trim.



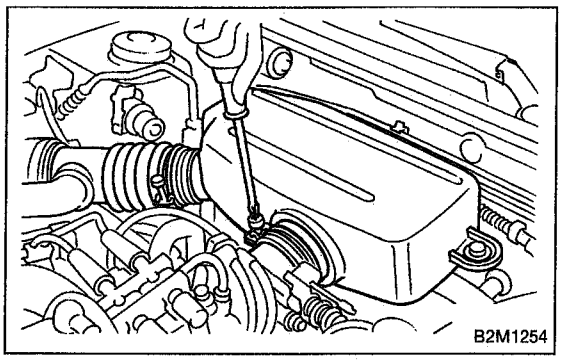
H2M1117

4) Remove fuse and relay box from bracket.
5) Disconnect connector from horn relay.
6) Remove all relays with bracket from body.
7) Remove fuse box mounting nuts.
8) Lower fuse box.
9) Remove fuse box mounting bracket.



H2M1594A

10) Remove fuel pump relay from main relay and fuel pump relay mounting bracket.
11) Disconnect connector from fuel pump relay.
12) Installation is in the reverse order of removal.



18. Air Intake Chamber

A: REMOVAL AND INSTALLATION

1) Loosen clamps which connect air intake chamber to throttle body and air intake duct.
2) Disconnect air hoses from air intake chamber.
3) Remove bolts which secure air intake chamber to stays.
4) Remove air intake chamber.
5) Installation is in the reverse order of removal.

Tightening torque:
4.9 ± 0.5 N·m (0.5 ± 0.05 kg-m, 3.6 ± 0.4 ft-lb)

MEMO:

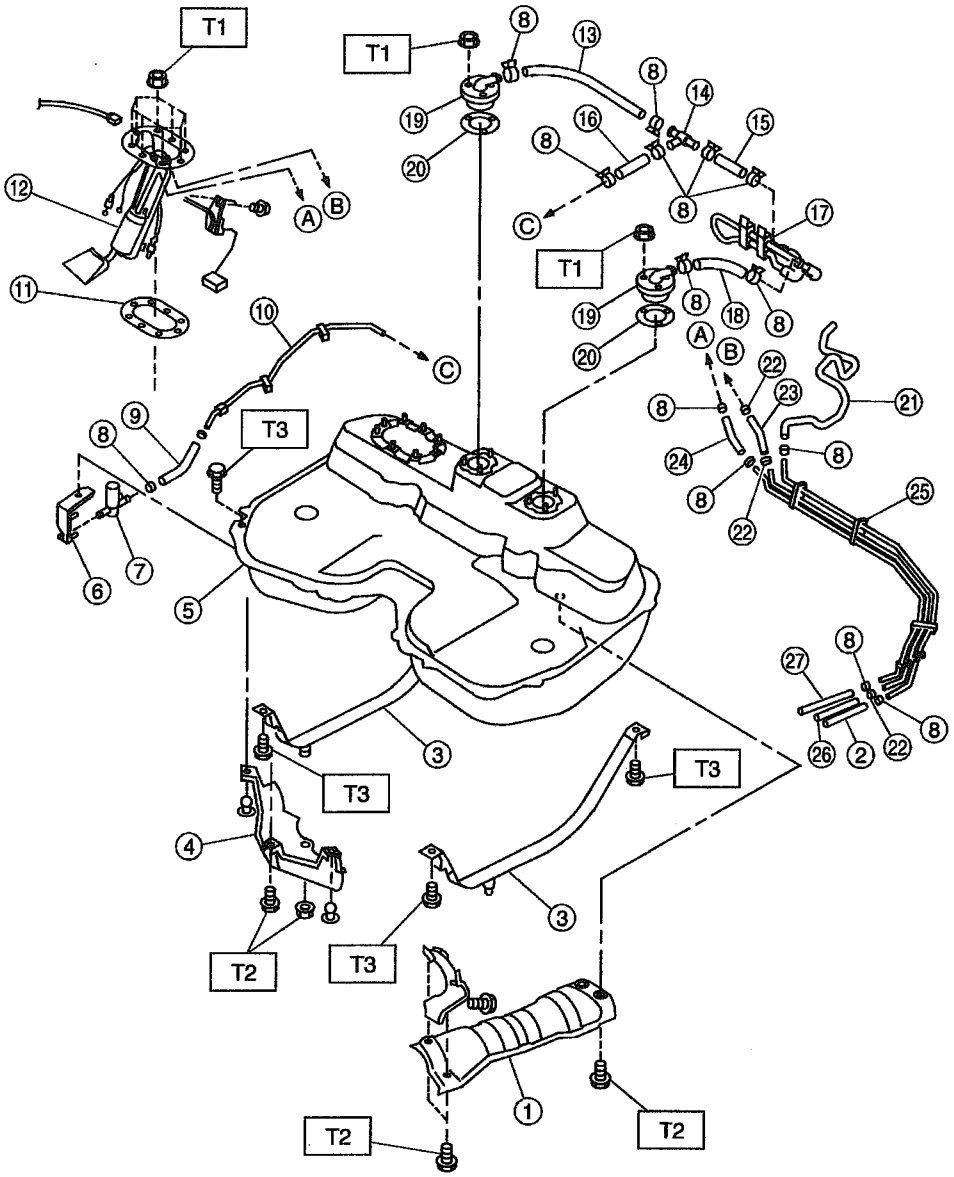
1. Specifications

Model		1800 cc	2200 cc
Fuel tank	Capacity	50 ℓ (13.2 US gal, 11.0 Imp gal)	60 ℓ (15.9 US gal, 13.2 Imp gal)
	Location	Under rear seat	
Fuel pump	Type	Impeller	
	Discharge pressure	250.1 kPa (2.55 kg/cm^2, 36.3 psi)	
	Discharge flow	More than 80 ℓ (21.1 US gal, 17.6 Imp gal)/h [12 V at 250.1 kPa (2.55 kg/cm^2, 36.3 psi)]	
Fuel filter		Cartridge type	

MEMO:

1. Fuel Tank

A: 1800 cc MODEL

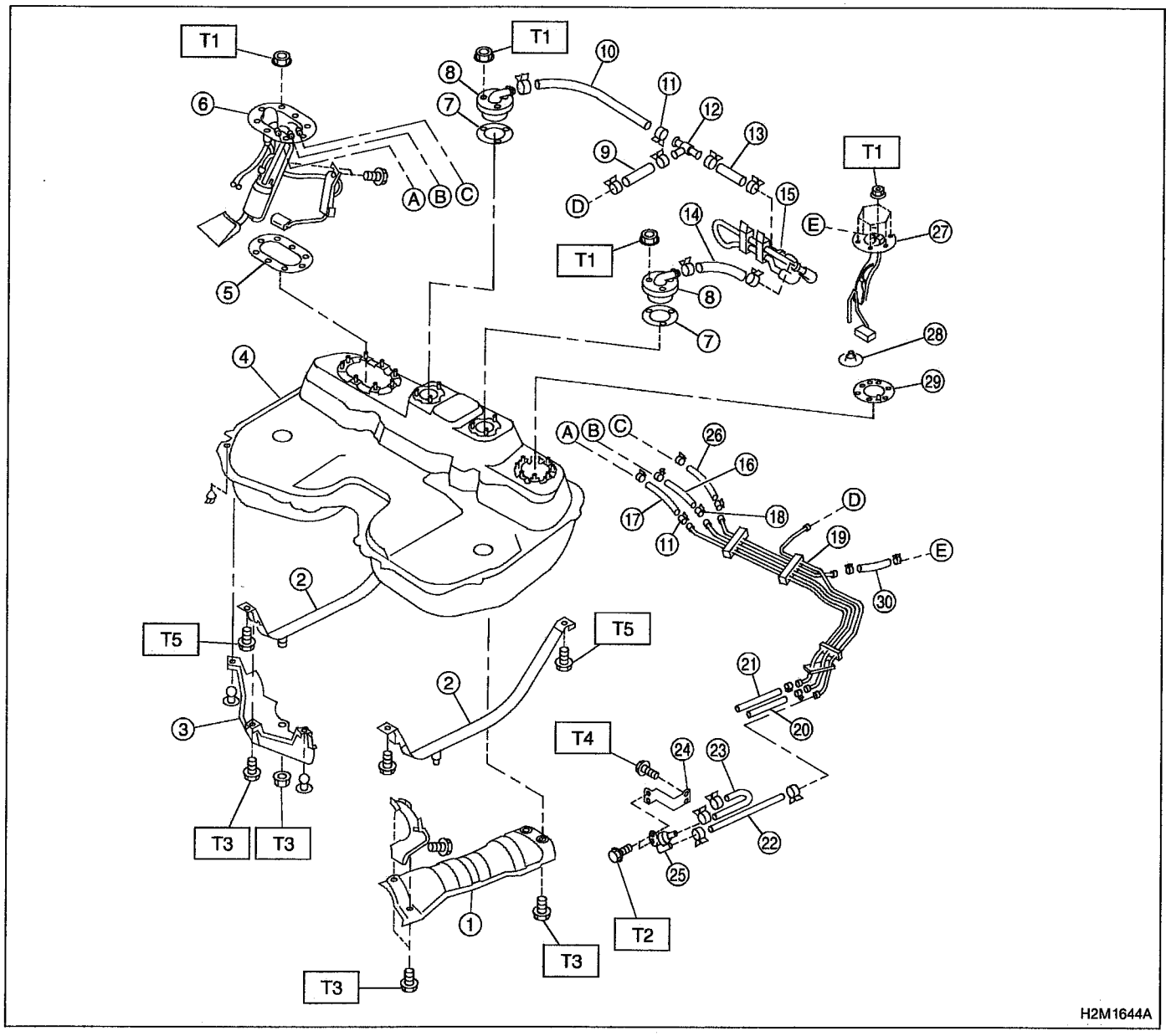


H2M1542A

① Heat sealed cover
② Evaporation hose E
③ Fuel tank band
④ Protector
⑤ Fuel tank
⑥ Pressure control solenoid valve bracket
⑦ Pressure control solenoid valve
⑧ Clip
⑨ Evaporation hose G
⑩ Evaporation pipe A
⑪ Fuel pump gasket
⑫ Fuel pump ASSY
⑬ Evaporation hose F
⑭ Joint pipe
⑮ Evaporation hose B
⑯ Evaporation hose A
⑰ Evaporation pipe ASSY
⑱ Evaporation hose D
⑲ Fuel cut valve
⑳ Fuel cut valve gasket
㉑ Evaporation hose C
㉒ Clamp
㉓ Fuel delivery hose A
㉔ Fuel return hose A
㉕ Fuel pipe ASSY
㉖ Fuel delivery hose B
㉗ Fuel return hose B

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4±1.5 (0.45±0.15, 3.3±1.1)
T2: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T3: 33±10 (3.4±1.0, 25±7)

B: 2200 cc MODEL



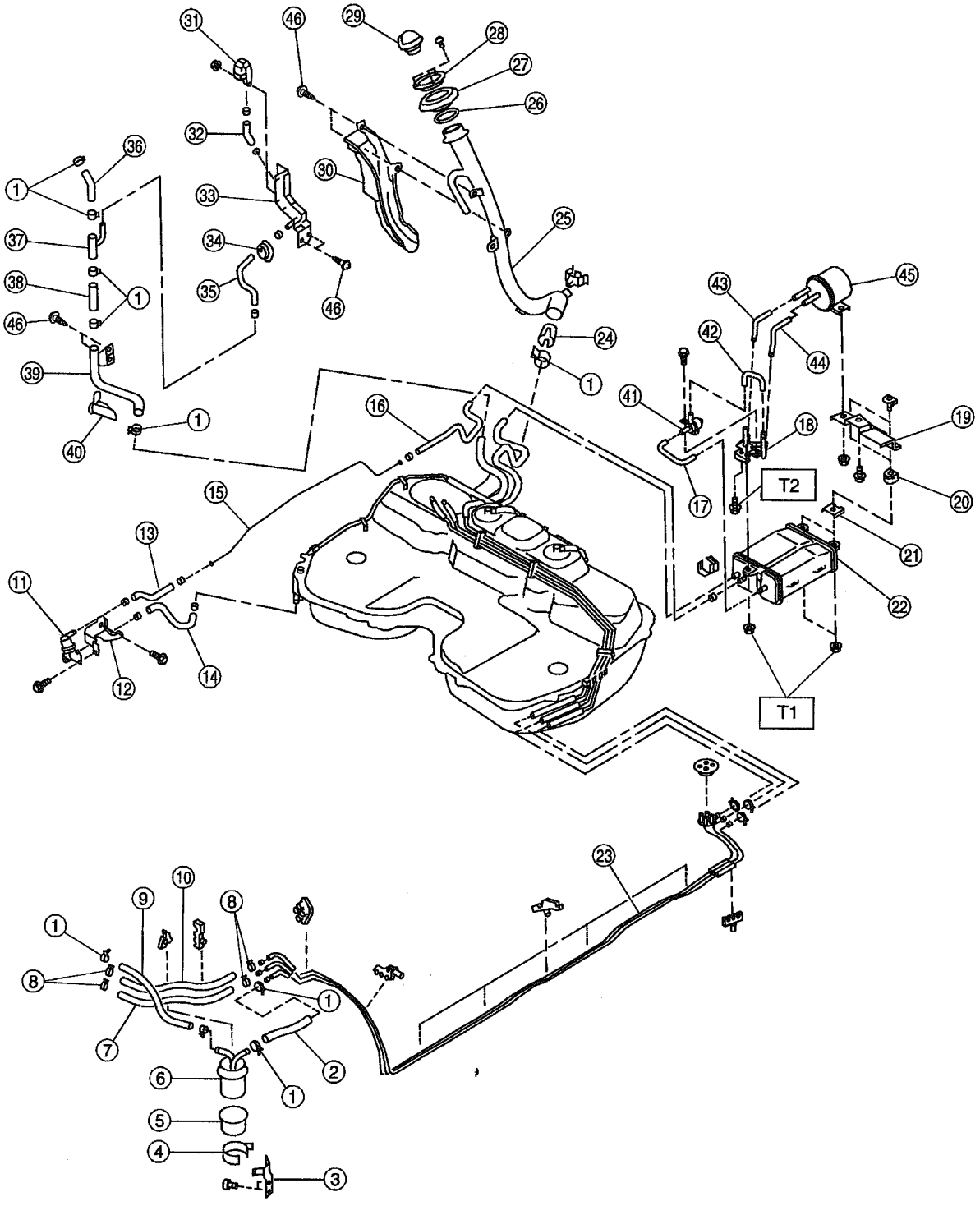
① Heat sealed cover
② Fuel tank band
③ Protector
④ Fuel tank
⑤ Fuel pump gasket
⑥ Fuel pump ASSY
⑦ Fuel cut valve gasket
⑧ Fuel cut valve
⑨ Evaporation hose C
⑩ Evaporation hose A
⑪ Clip
⑫ Joint pipe
⑬ Evaporation hose B
⑭ Evaporation hose D
⑮ Evaporation pipe ASSY
⑯ Fuel delivery hose A
⑰ Fuel return hose A
⑱ Clamp
⑲ Fuel pipe ASSY
⑳ Fuel delivery hose B
㉑ Fuel return hose B
㉒ Evaporation hose E
㉓ Evaporation hose F
㉔ Roll cover valve bracket
㉕ Roll over valve
㉖ Jet pump hose A
㉗ Fuel sub meter unit
㉘ Jet pump filter
㉙ Gasket
㉚ Jet pump hose B

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4±1.5 (0.45±0.15, 3.3±1.1)
T2: 6.5±1.5 (0.66±0.15, 4.8±1.1)
T3: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T4: 18±5 (1.8±0.5, 13.0±3.6)
T5: 33±10 (3.4±1.0, 25±7)

MEMO:

2. Fuel Line

A: 1800 cc MODEL

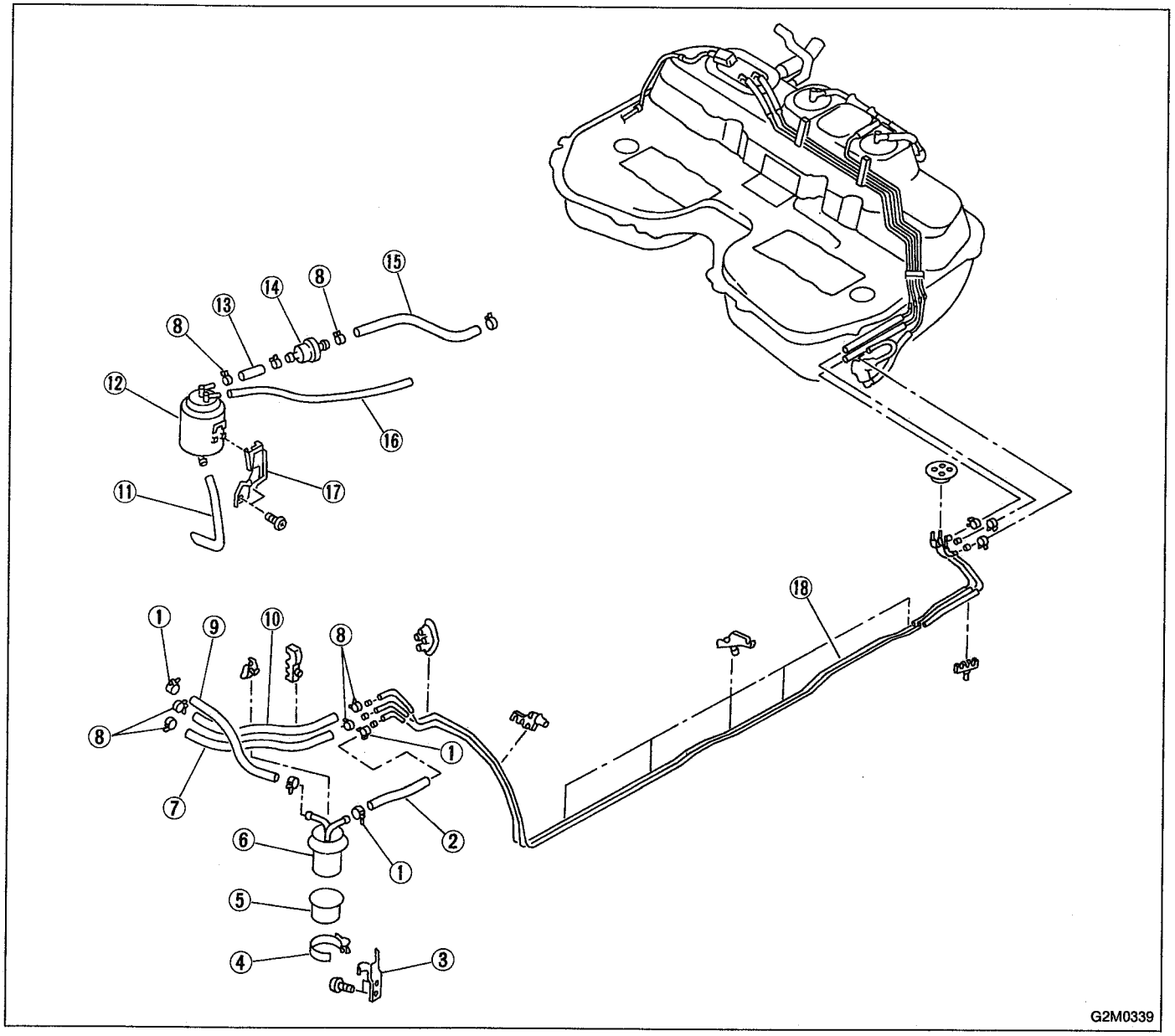


① Clamp
② Fuel delivery hose A
③ Fuel filter bracket
④ Fuel filter holder
⑤ Fuel filter cup
⑥ Fuel filter
⑦ Evaporation hose
⑧ Clip
⑨ Fuel delivery hose B
⑩ Fuel return hose
⑪ Roll over valve
⑫ Roll over valve bracket
⑬ Evaporation hose H
⑭ Evaporation hose I
⑮ Evaporation pipe B
⑯ Canister hose A
⑰ Canister hose B
⑱ Canister holder
⑲ Canister upper bracket
⑳ Cushion rubber
㉑ Canister lower bracket
㉒ Canister
㉓ Fuel pipe ASSY
㉔ Fuel filler valve
㉕ Fuel filler pipe
㉖ Packing
㉗ Ring A
㉘ Ring B
㉙ Fuel filler cap
㉚ Fuel filler pipe protector
㉛ Fuel tank pressure sensor
㉜ Fuel tank pressure sensor hose A
㉝ Fuel tank pressure sensor bracket
㉞ Grommet
㉟ Fuel tank pressure sensor hose B
㊱ Air ventilator hose A
㊲ Air ventilator pipe A
㊳ Air ventilator hose B
㊴ Air ventilator pipe B
㊵ Air ventilator pipe protector
㊶ Vent control solenoid valve
㊷ Vent control solenoid valve hose
㊸ Air filter hose A
㊹ Air filter hose B
㊺ Air filter
㊻ Tapping screw

Tightening torque: N·m (kg-m, ft-lb)
T1: 23±7 (2.3±0.7, 17±5.1)
T2: 25±7 (2.5±0.7, 18±5.1)

COMPONENT PARTS

B: 2200 cc MODEL



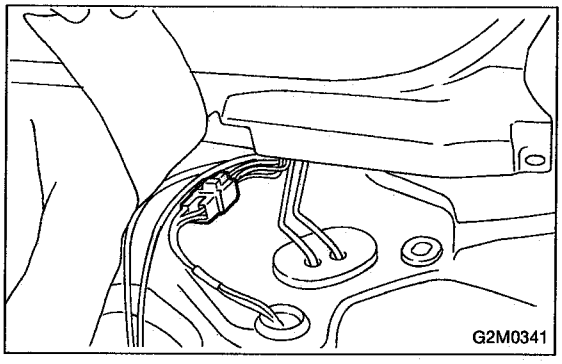
① Clamp
② Fuel delivery hose A
③ Fuel filter bracket
④ Fuel filter holder
⑤ Fuel filter cup
⑥ Fuel filter
⑦ Evaporation hose
⑧ Clip
⑨ Fuel delivery hose B
⑩ Fuel return hose
⑪ Air vent hose
⑫ Canister
⑬ Canister hose A
⑭ Two-way valve
⑮ Canister hose B
⑯ Canister hose C
⑰ Canister bracket
⑱ Fuel pipe ASSY

1. On-Car Services

A: PRECAUTIONS

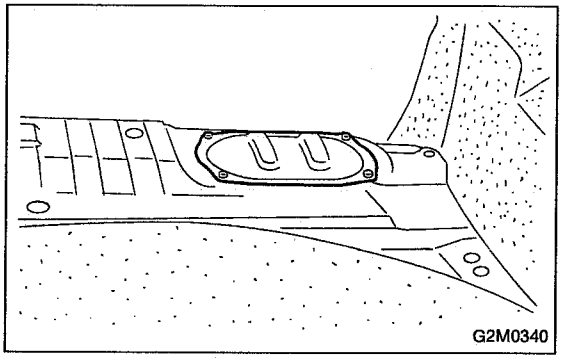
WARNING:

- **Place "No fire" signs near the working area.**
- **Disconnect ground terminal from battery.**
- **Be careful not to spill fuel on the floor.**



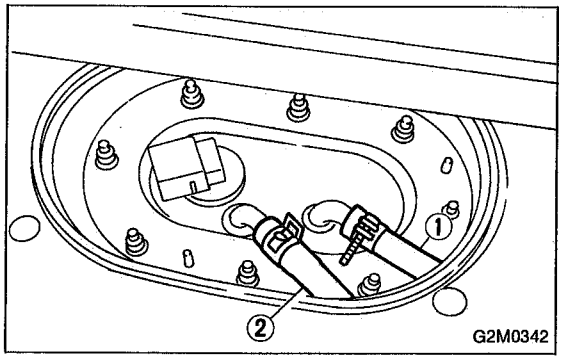
B: RELEASING OF FUEL PRESSURE

1) Remove rear seat, and turn up floor mat.
2) Disconnect connector from fuel tank.
3) Start the engine, and run it until it stalls.
4) After the engine stalls, crank it for five more seconds.
5) Turn ignition switch OFF.

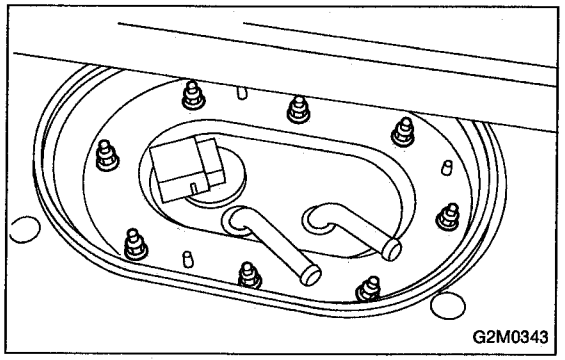


C: DRAINING OF FUEL

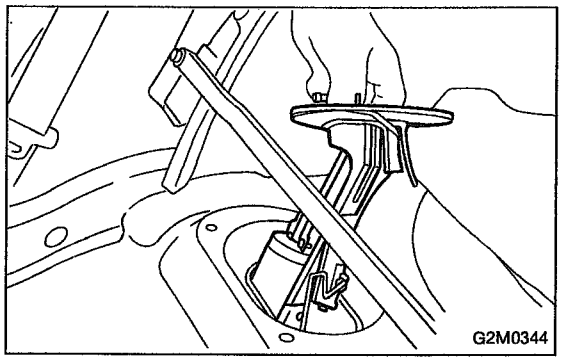
1) Remove rear seat and seat back.
2) Remove access hole lid.
3) Disconnect connector from fuel pump.
4) Release fuel pressure. <Ref. to 2-8 [W1B0].>



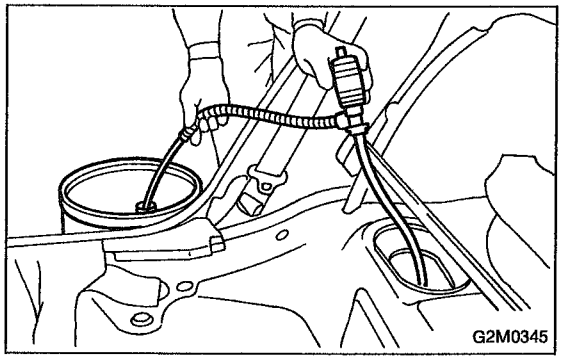
5) Disconnect fuel delivery hose ① and return hose ②.



6) Remove nuts which install fuel pump assembly onto fuel tank.

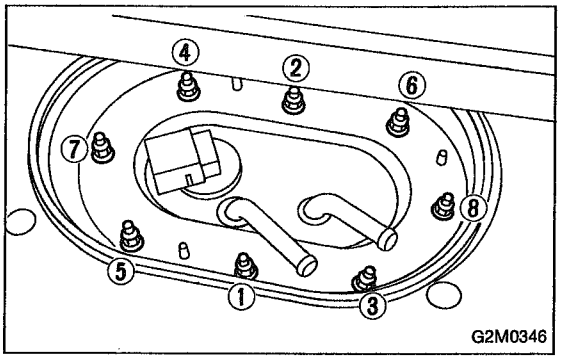


7) Take off fuel pump from fuel tank.



8) Drain fuel from fuel tank by using a hand pump.

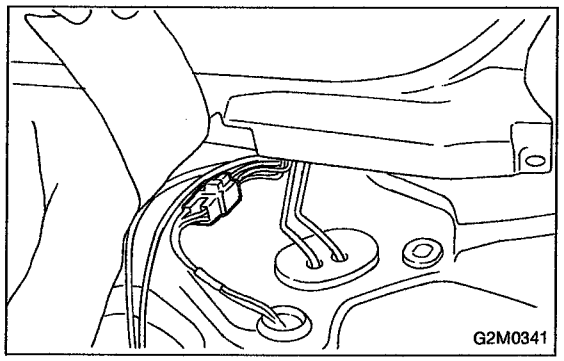
WARNING:
Do not use a motor pump when draining fuel.



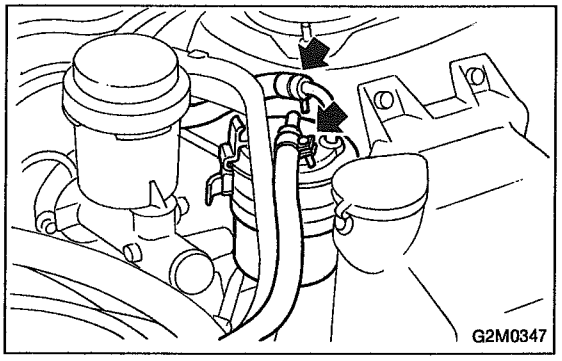
9) After draining fuel, reinstall fuel pump.
Tighten nuts in numerical sequence shown in Figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)

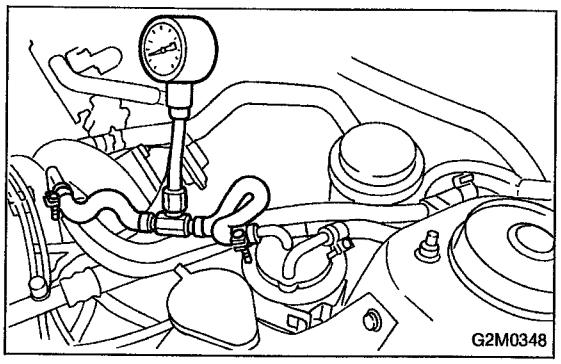
D: MEASUREMENT OF FUEL PRESSURE



1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Connect connector to fuel tank.



3) Disconnect fuel delivery hose from fuel filter, and connect fuel pressure gauge.



4) Start the engine.
5) Measure fuel pressure while disconnecting pressure regulator vacuum hose from collector chamber.

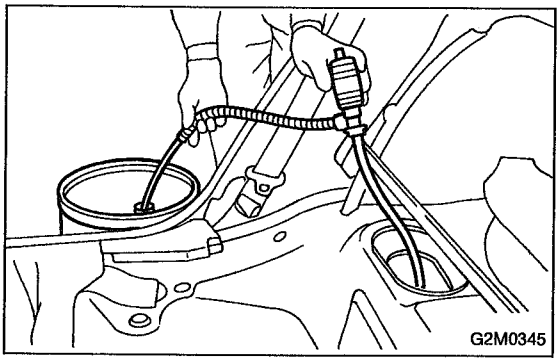
Fuel pressure:
235 — 265 kPa (2.4 — 2.7 kg/cm², 34 — 38 psi)

6) After connecting pressure regulator vacuum hose, measure fuel pressure.

Fuel pressure:
177 — 206 kPa (1.8 — 2.1 kg/cm², 26 — 30 psi)

WARNING:
Before removing fuel pressure gauge, release fuel pressure.

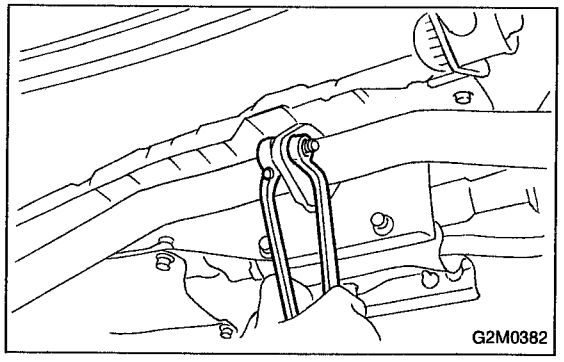
NOTE:
If out of specification as measured at step 6), check or replace pressure regulator and pressure regulator vacuum hose.



2. Fuel Tank

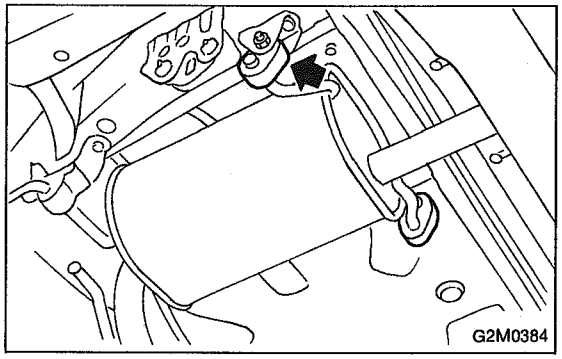
A: REMOVAL

1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Drain fuel from fuel tank. <Ref. to 2-8 [W1C0].>



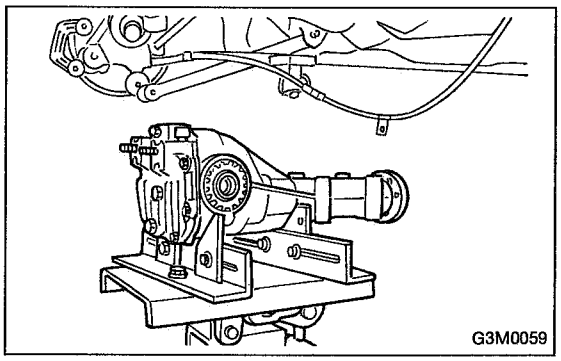
3) Remove rear exhaust pipe.
   (1) Lift-up the vehicle.
   (2) Separate rear exhaust pipe from front catalyst converter.
   (3) Separate rear exhaust pipe from muffler.
   (4) Remove hook from rubber cushion, and remove exhaust pipe.

NOTE:
To facilitate the removal of parts, apply a coat of SUBARU CRC5-56 (004301003)
<Ref. to 2-9 [W2A0].>

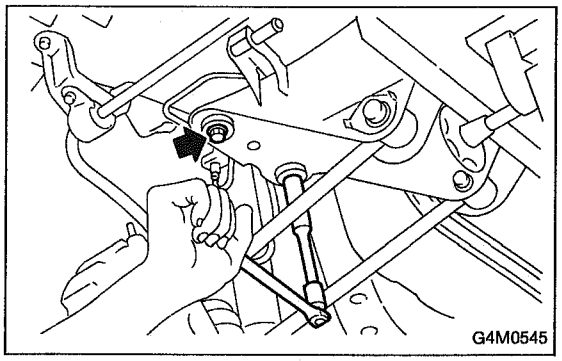


4) Remove muffler assembly.

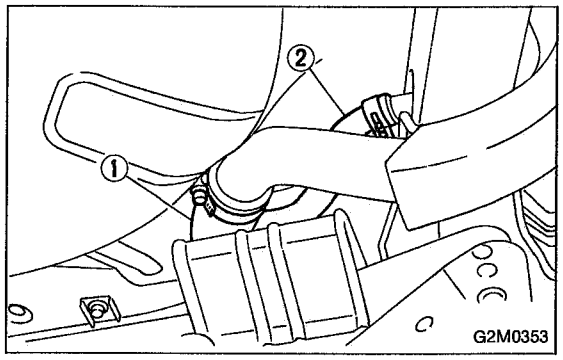
NOTE:
To facilitate the removal of parts, apply a coat of SUBARU CRC5-56 (004301003)
<Ref. to 2-9 [W3A0].>



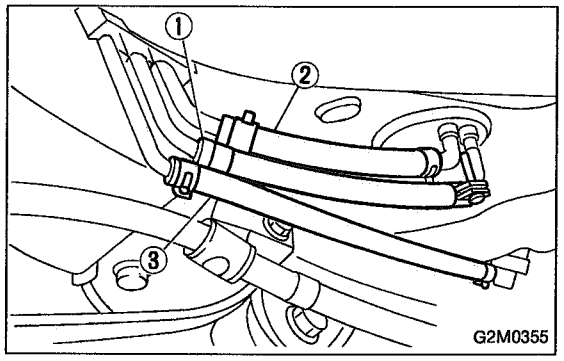
5) Remove rear differential assembly.
(1) Remove rear axle shafts from rear differential assembly.
(2) Remove rear differential front cover.
(3) Remove propeller shaft.
(4) Remove lower differential bracket.
(5) Set transmission jack under rear differential.
(6) Remove bolts which install rear differential onto transmission jack.
<Ref. to 3-4 [W2B0].>



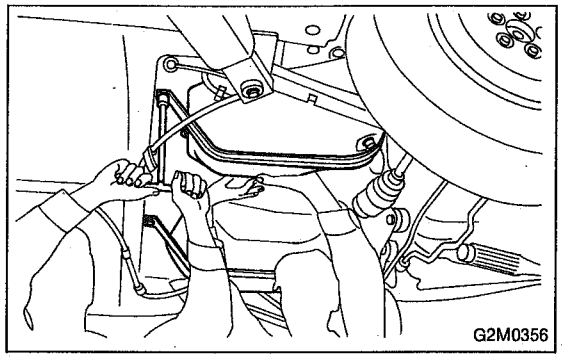
6) Remove rear crossmember.
<Ref. to 4-1 [W11A0].>



7) Loosen clamp, and disconnect fuel filler hose from pipe.
8) Loosen clamp, and disconnect air vent hose from air vent pipe.
① Fuel filler hose
② Air vent hose



9) Loosen clip and clamps, and disconnect fuel delivery hose ①, return hose ② and evaporation hose ③.

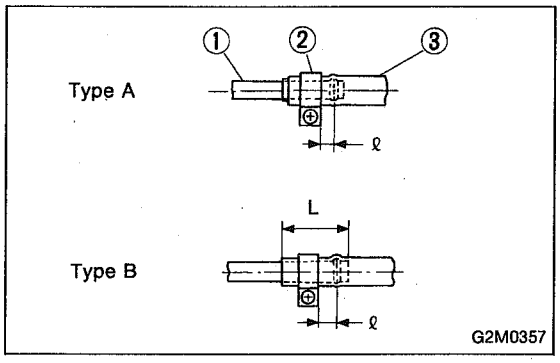


10) While holding fuel tank, remove bolts from bands and dismount fuel tank.

WARNING:
A helper is required to perform step 10).

B: INSTALLATION

Installation is in the reverse order of removal. Observe the following:
1) When installing fuel tank, have a helper hold fuel tank while installing bands.
2) Before tightening band mounting bolts, connect fuel system hoses.



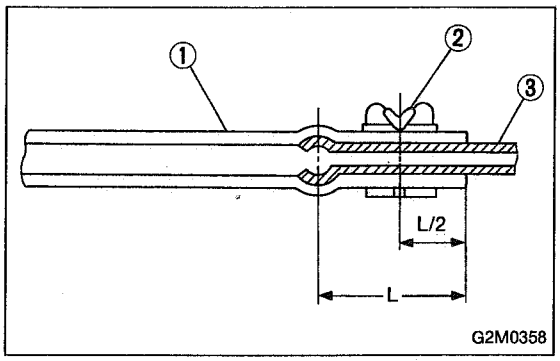
3) Install hose and hold down clips at positions indicated in Figure.

Tightening torque:
12.5 ± 2.5 N·m (1.27 ± 0.25 kg-m, 9.2 ± 1.8 ft-lb)

Type A: When fitting length is specified.
Type B: When fitting length is not specified.

① Fitting
② Clamp
③ Hose

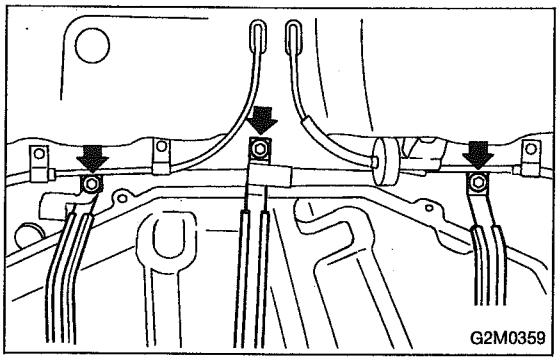
ℓ : 2.5 ± 1.5 mm (0.098 ± 0.059 in)
L: 22.5 ± 2.5 mm (0.886 ± 0.059 in)



① Hose
② Clip
③ Pipe

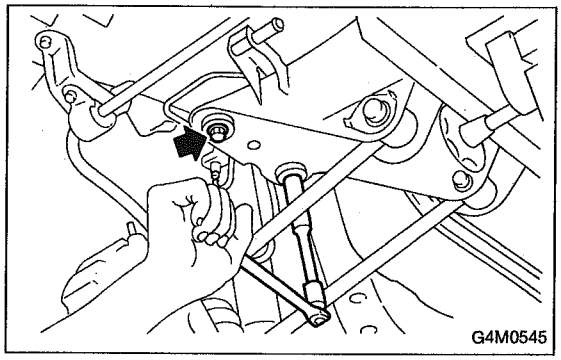
Fuel return hose:
L = 22.5 ± 2.5 mm (0.098 ± 0.059 in)

Evaporation hose:
L = 17.5 ± 2.5 mm (0.689 ± 0.098 in)

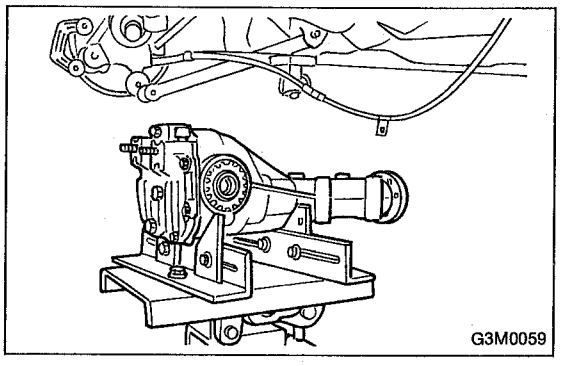


4) Tighten band mounting bolts.

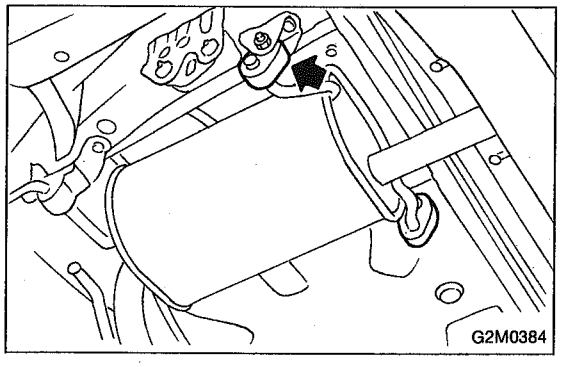
Tightening torque:
23.5 ± 0.5 N·m (2.40 ± 0.05 kg-m, 17.4 ± 0.4 ft-lb)



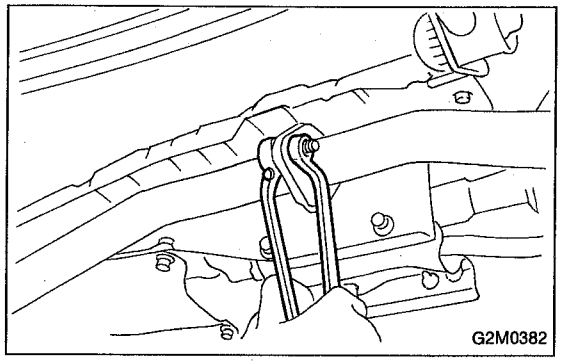
5) Install rear crossmember. <Ref. to 4-1 [W11C0].>



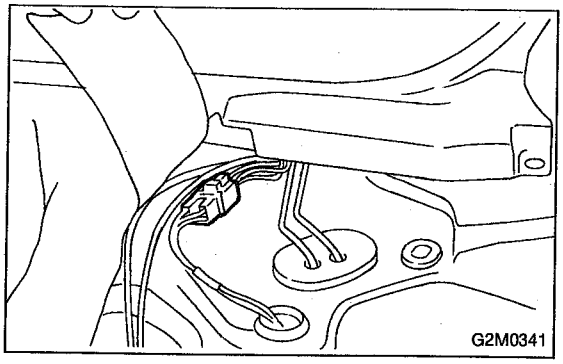
6) Install rear differential assembly. <Ref. to 3-4 [W2F0].>



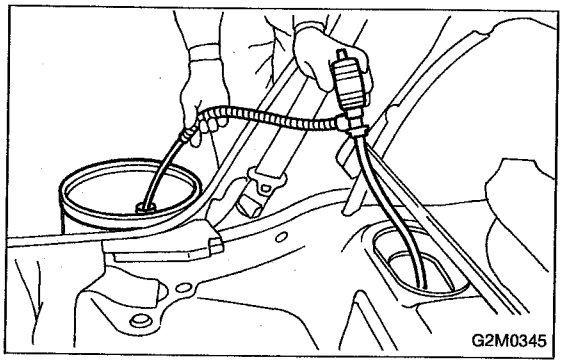
7) Install muffler assembly.



8) Install heat sealed cover.
9) Install rear exhaust pipe.



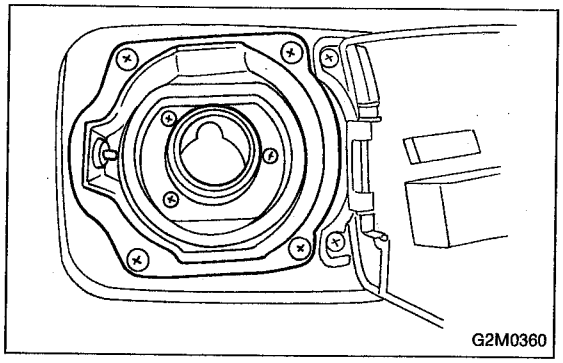
10) Lower the vehicle, and connect connector to fuel pump.
11) Install access hole lid.
12) Install rear seat back and rear seat.



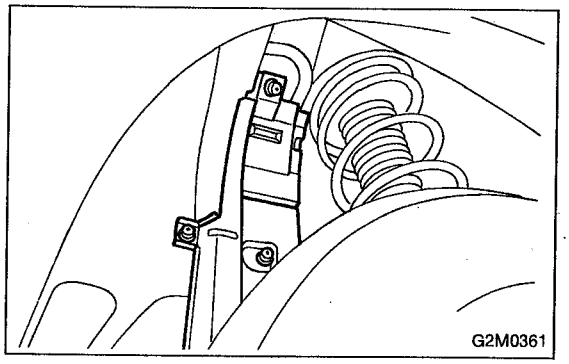
3. Fuel Filler Pipe

A: REMOVAL

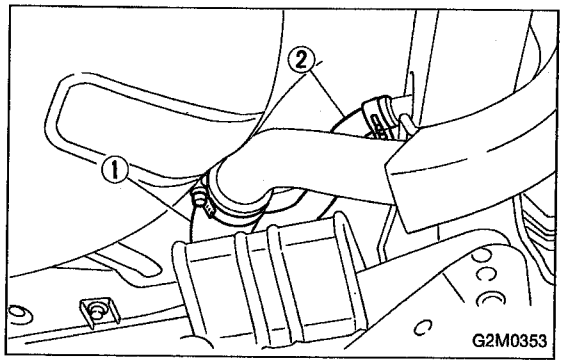
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Drain fuel from fuel tank. <Ref. to 2-8 [W1C0].>



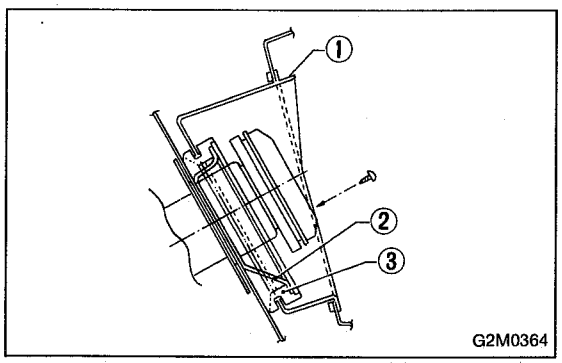
3) Remove right rear wheel.
4) Open fuel filler flap and remove filler cap.
5) Remove screws holding packing in place.



6) Lift-up the vehicle.
7) Remove fuel filler pipe protector.



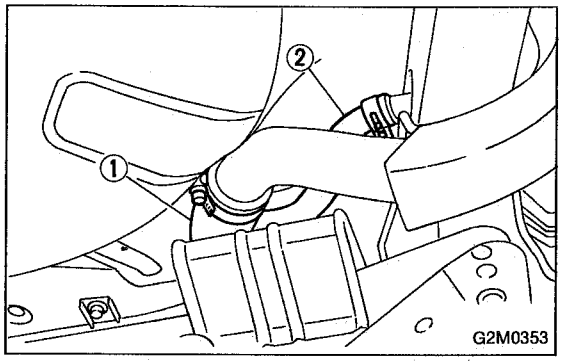
8) Remove clip, and separate air vent hose from pipe.
9) Loosen clamp, and separate fuel filler hose from pipe.
① Fuel filler hose
② Air vent hose
10) Remove fuel filler pipe to under side of the vehicle.



B: INSTALLATION

1) Hold fuel filler flap open.
2) Set fuel saucer ① with rubber packing ③, and insert fuel filler pipe into hole from the inner side of apron.
3) Align holes in fuel filler pipe neck and set cup ②, and tighten screws.

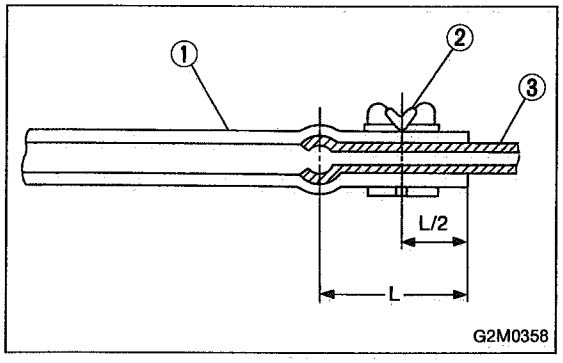
NOTE:
If edges of rubber packing are folded toward the inside, straighten it with a screwdriver.



4) Insert fuel filler hose approximately 25 to 30 mm (0.98 to 1.18 in) over the lower end of fuel filler pipe and tighten clamp.

① Fuel filler hose
② Air vent hose

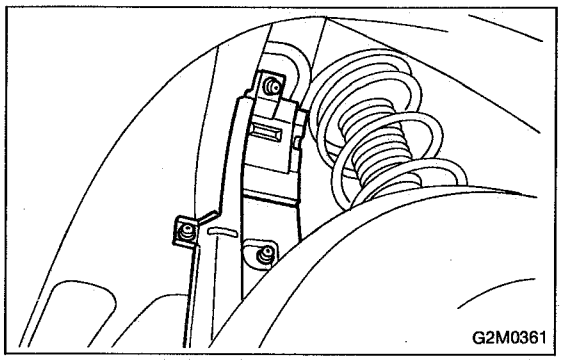
CAUTION:
Do not allow clips to touch air vent hose and rear suspension crossmember.



5) Insert air vent hose approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of air vent pipe and hold clip.

① Hose
② Clip
③ Pipe

L = 27.5 ± 2.5 mm (1.083 ± 0.098 in)

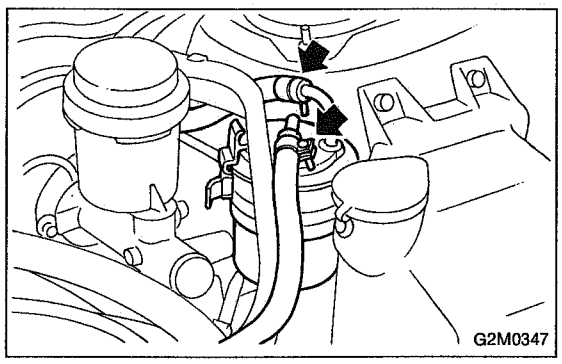


6) Install fuel filler pipe protector.
7) Install right rear wheel.

4. Fuel Filter

A: REMOVAL

1) Release fuel pressure. <Ref. to 2-8 [W1B0].>



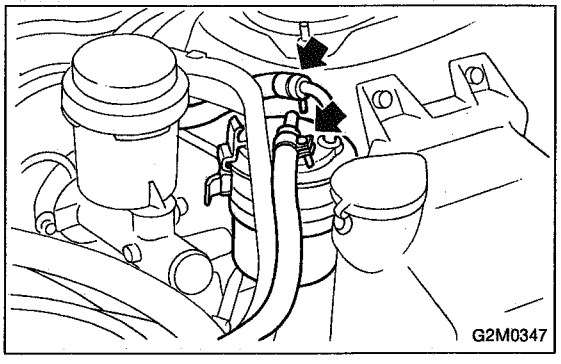
2) Disconnect fuel hoses from fuel filter.
3) Remove filter from holder.

B: INSPECTION

1) Check the inside of fuel filter for dirt and water sediment.
2) If it is clogged, or if replacement interval has been reached, replace it.
3) If water is found in it, shake and expel the water from inlet port.

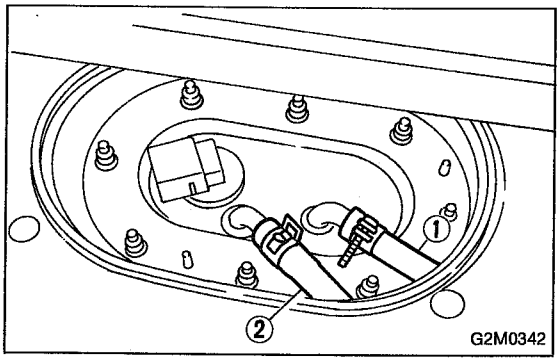
C: INSTALLATION

CAUTION:
- **If fuel hoses are damaged at the connecting portion, replace it with a new one.**
- **If clamps are badly damaged, replace with new ones.**



1) Installation is in the reverse order of removal.
2) Tighten hose clamp screws.

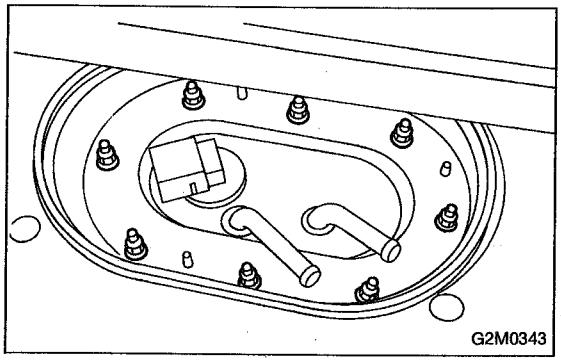
Tightening torque:
12.5 ± 2.5 N·m (1.27 ± 0.25 kg-m, 9.2 ± 1.8 ft-lb)



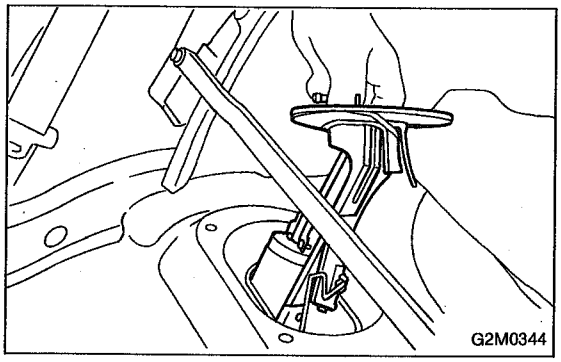
5. Fuel Pump

A: REMOVAL

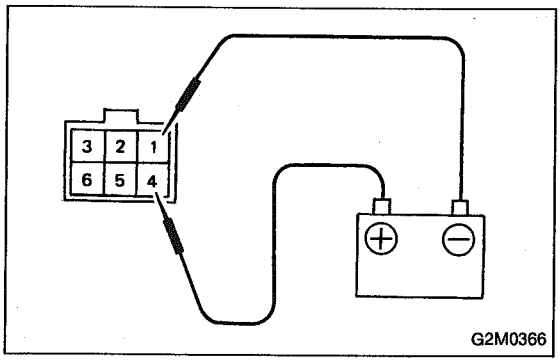
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Disconnect fuel delivery hose ① and return hose ②.



3) Remove nuts which install fuel pump onto fuel tank.



4) Take off fuel pump from fuel tank.

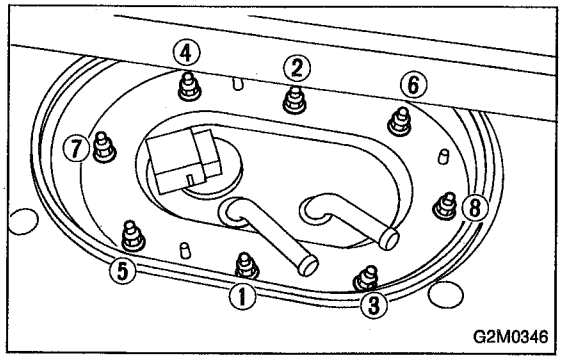


B: INSPECTION

Connect lead harness to connector terminal of fuel pump, and apply a 12 V power supply to check whether the pump operate.

WARNING:

- **Wipe off the fuel completely.**
- **Keep battery as far apart from fuel pump as possible.**
- **Be sure to turn the 12 V supply ON and OFF on the battery side.**
- **Do not run fuel pump for a long time under non-load condition.**

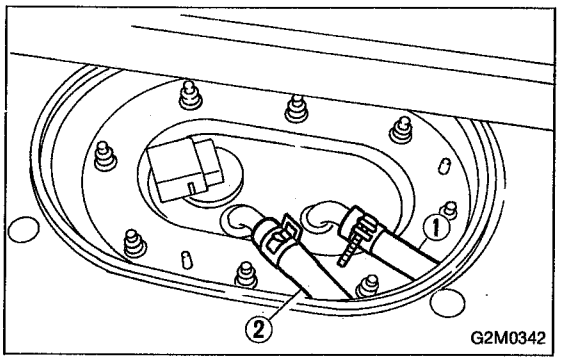


C: INSTALLATION

Installation is in the reverse order of removal. Observe the following:

(1) Always use new gaskets.
(2) Ensure sealing portion is free from fuel or foreign particles before installation.
(3) Tighten nuts in numerical sequence shown in Figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)

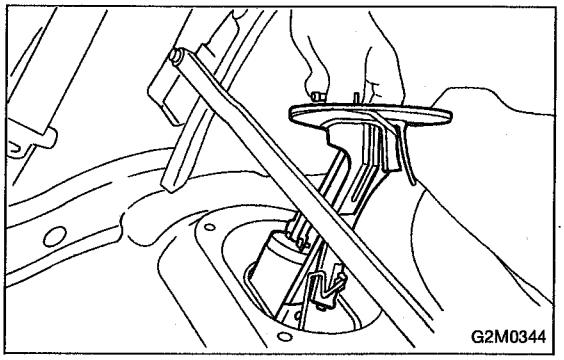


6. Fuel Meter Unit

A: REMOVAL

NOTE:
Fuel meter unit is built in fuel pump assembly.

1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Disconnect fuel delivery hose ① and return hose ②.

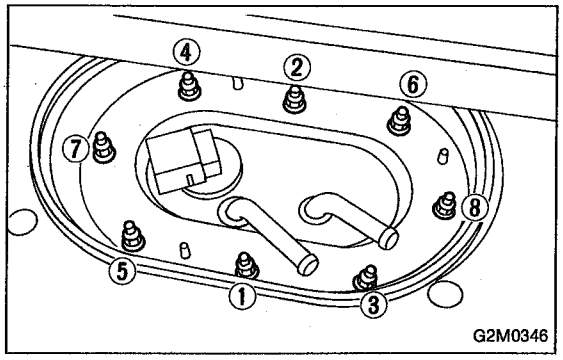


3) Remove nuts which install fuel pump onto fuel tank.
4) Take off fuel pump assembly.

B: INSTALLATION

Installation is in the reverse order of removal. <Ref. to 2-8 [W5C0].>
Tighten nuts in numerical sequence shown in Figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)

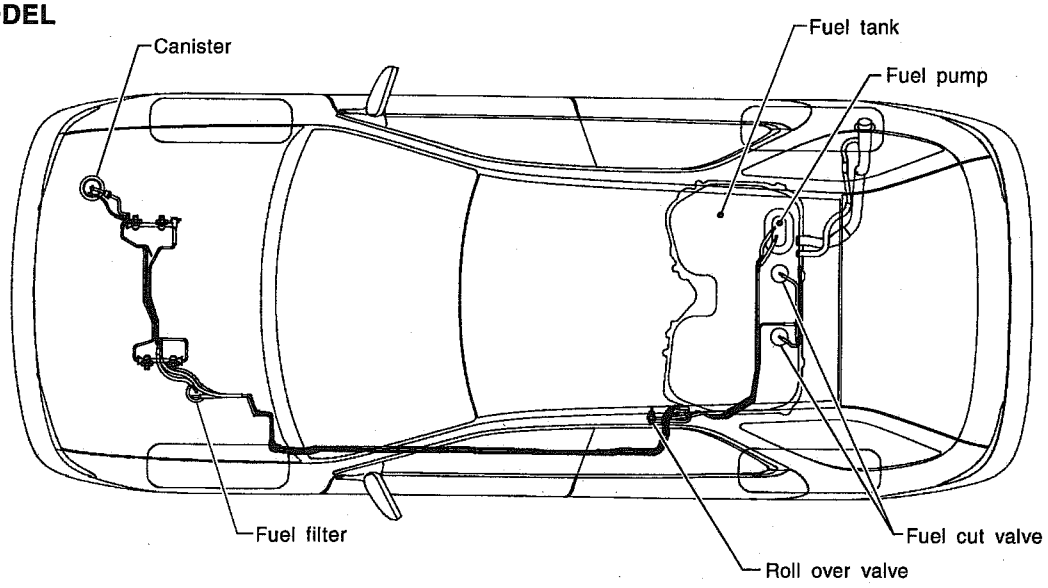


7. Fuel Delivery, Return and Evaporation Lines

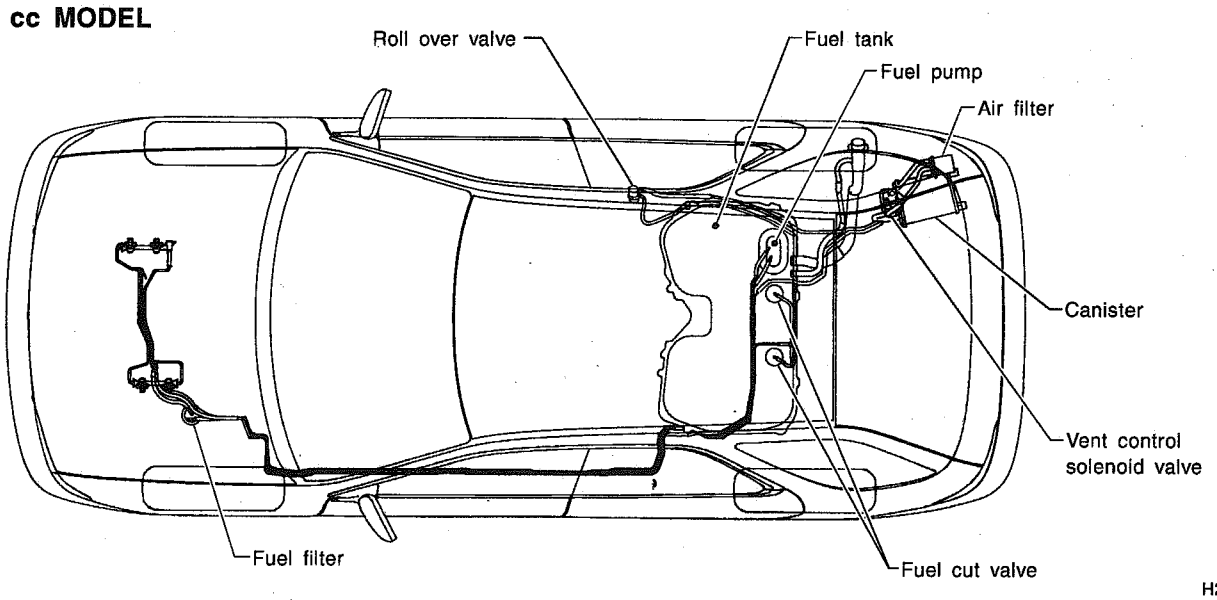
A: REMOVAL

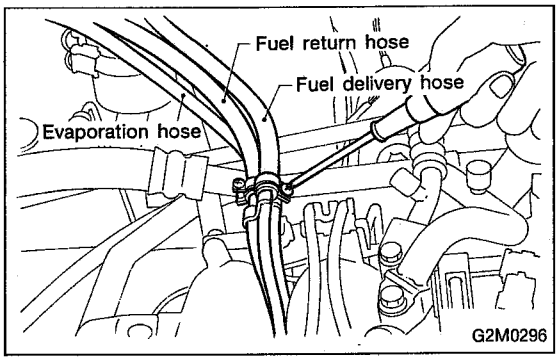
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Remove inner trim, insulator and rear seat. <Ref. to 5-3 [W2A0].>
3) Remove fuel delivery pipes and hoses, fuel return pipes and hoses, and evaporation pipes and hoses.

2200 cc MODEL

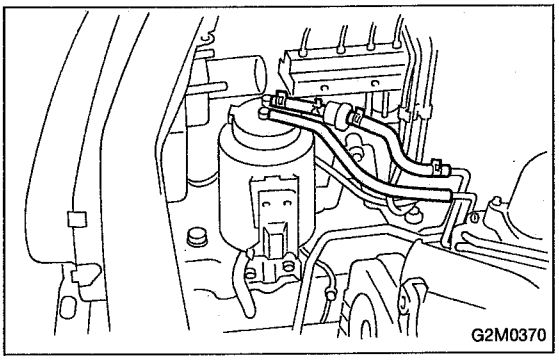


1800 cc MODEL

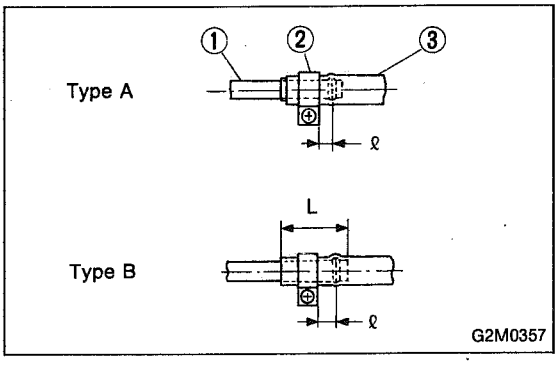




4) In engine compartment, detach fuel delivery hoses, return hoses and evaporation hose.



5) In engine compartment, detach canister hoses from canister. (2200 cc model)



B: INSTALLATION

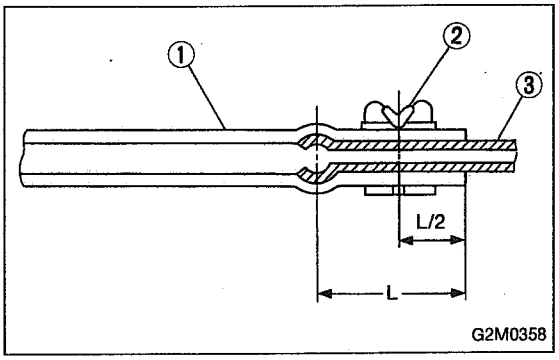
Installation is in the reverse order of removal.

1) Connect fuel delivery hose to pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When fitting length is specified.
Type B: When fitting length is not specified.

① Fitting
② Clamp
③ Hose

ℓ : 2.5 ± 1.5 mm (0.098 ± 0.059 in)
L: 22.5 ± 2.5 mm (0.886 ± 0.098 in)

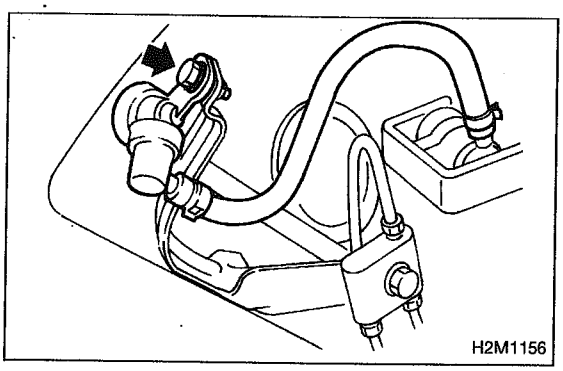


2) Connect evaporation hose to pipe by approx. 15 mm (0.59 in) from hose end.

① Hose
② Clip
③ Pipe

L = 17.5 ± 2.5 mm (0.689 ± 0.098 in)

CAUTION:
Be sure to inspect hoses and their connections for any leakage of fuel.

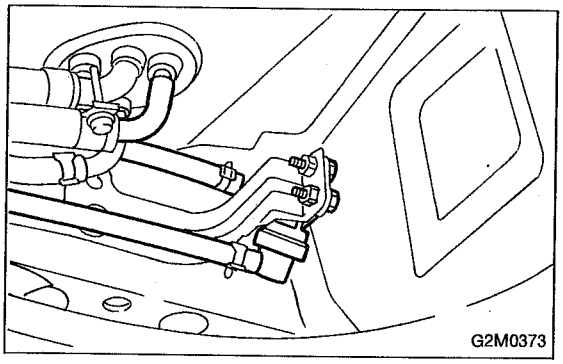


8. Roll Over Valve

A: REMOVAL

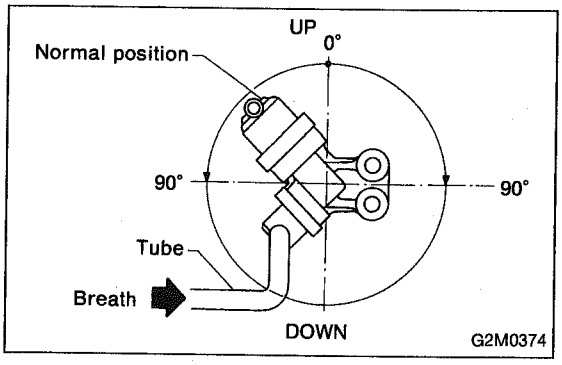
1. 1800 cc MODEL

1) Lift-up the vehicle.
2) Remove roll over valve from bracket.
3) Disconnect hoses from roll over valve.



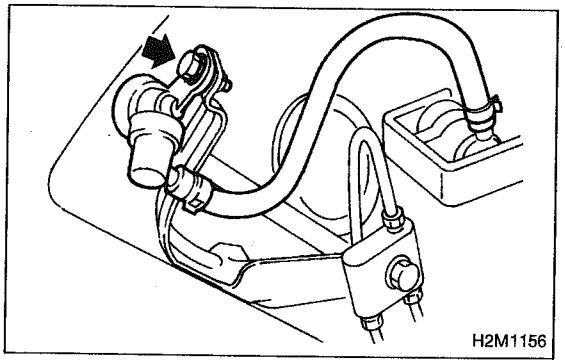
2. 2200 cc MODEL

1) Lift-up the vehicle.
2) Remove with bracket roll over valve.
3) Disconnect hoses from roll over valve, and remove it from bracket.



B: INSPECTION

1) Connect hoses to roll over valve as shown in Figure.
2) While blowing through open end of hose, tilt valve at least 90° left and right from normal position.
3) Ensure that there is no air flow when hose is tilted greater than 90°.



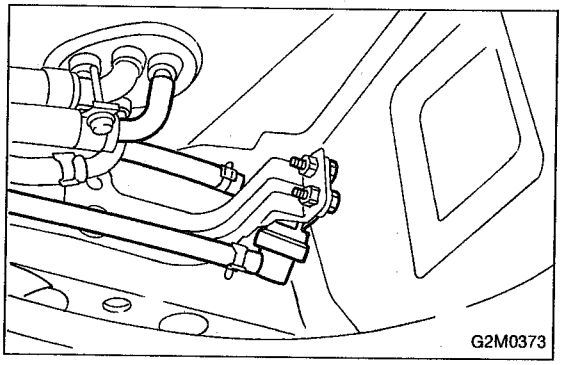
C: INSTALLATION

1. 1800 cc MODEL

Installation is in the reverse order of removal.

CAUTION:

- **Do not install top side of valve down.**
- **Before installing bracket on body, securely fit concave part of bracket to hole in body.**

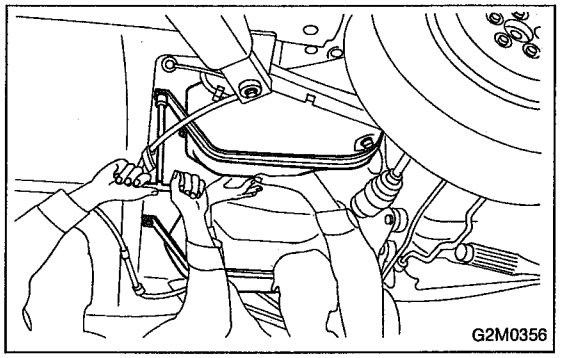


2. 2200 cc MODEL

Installation is in the reverse order of removal.

CAUTION:

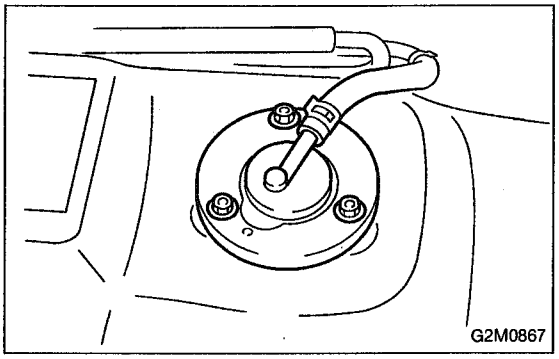
- **Do not install top side of valve down.**
- **Before installing bracket on body, securely fit concave part of bracket to hole in body.**



9. Fuel Cut Valve

A: REMOVAL AND INSTALLATION

1) Remove fuel tank. <Ref. to 2-8 [W2A0].>



2) Disconnect evaporation hose from fuel cut valve.
3) Remove fuel cut valve.
4) Installation is in the reverse order of removal procedure.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)

1. Fuel System Trouble in General

Trouble and possible cause		Corrective action
1. Insufficient fuel supply to the injector		
1)	Fuel pump will not operate.	
	○ Defective terminal contact.	Inspect connections, especially ground, and tighten securely.
	○ Trouble in electromagnetic or electronic circuit parts.	Replace fuel pump.
2)	Lowering of fuel pump function.	Replace fuel pump.
3)	Clogged dust or water in the fuel filter.	Replace fuel filter, clean or replace fuel tank.
4)	Clogged or bent fuel pipe or hose.	Clean, correct or replace fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent breather tube or pipe.	Clean, correct or replace air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator.	Replace.
2. Leakage or blow out fuel		
1)	Loosened joints of the fuel pipe.	Retightening.
2)	Cracked fuel pipe, hose and fuel tank.	Replace.
3)	Defective welding part on the fuel tank.	Replace.
4)	Defective drain packing of the fuel tank.	Replace.
5)	Clogged or bent air breather tube or air vent tube.	Clean, correct or replace air breather tube or air vent tube.
3. Gasoline smell inside of compartment		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retightening.
2)	Defective packing air tightness on the fuel saucer.	Correct or replace packing.
3)	Cracked fuel separator.	Replace separator.
4)	Inoperable fuel pump modulator or circuit.	Replace.
4. Defective fuel meter indicator		
1)	Defective operation of fuel meter unit.	Replace.
2)	Defective operation of fuel meter.	Replace.
5. Noise		
1)	Large operation noise or vibration of fuel pump.	Replace.

NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. To prevent water condensation:

1) Top off the fuel tank or drain the fuel completely.
2) Drain water condensation from the fuel filter.

- Refilling the fuel tank.

1) Refill the fuel tank while there is still some fuel left in the tank.

- Protecting the fuel system against freezing and water condensation.

1) Cold areas

In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use an anti-freeze solution in the cooling system. Refueling will also complement the effect of anti-freeze solution each time the fuel level drops to about one-half.

After the winter season, drain water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under Affected areas below.

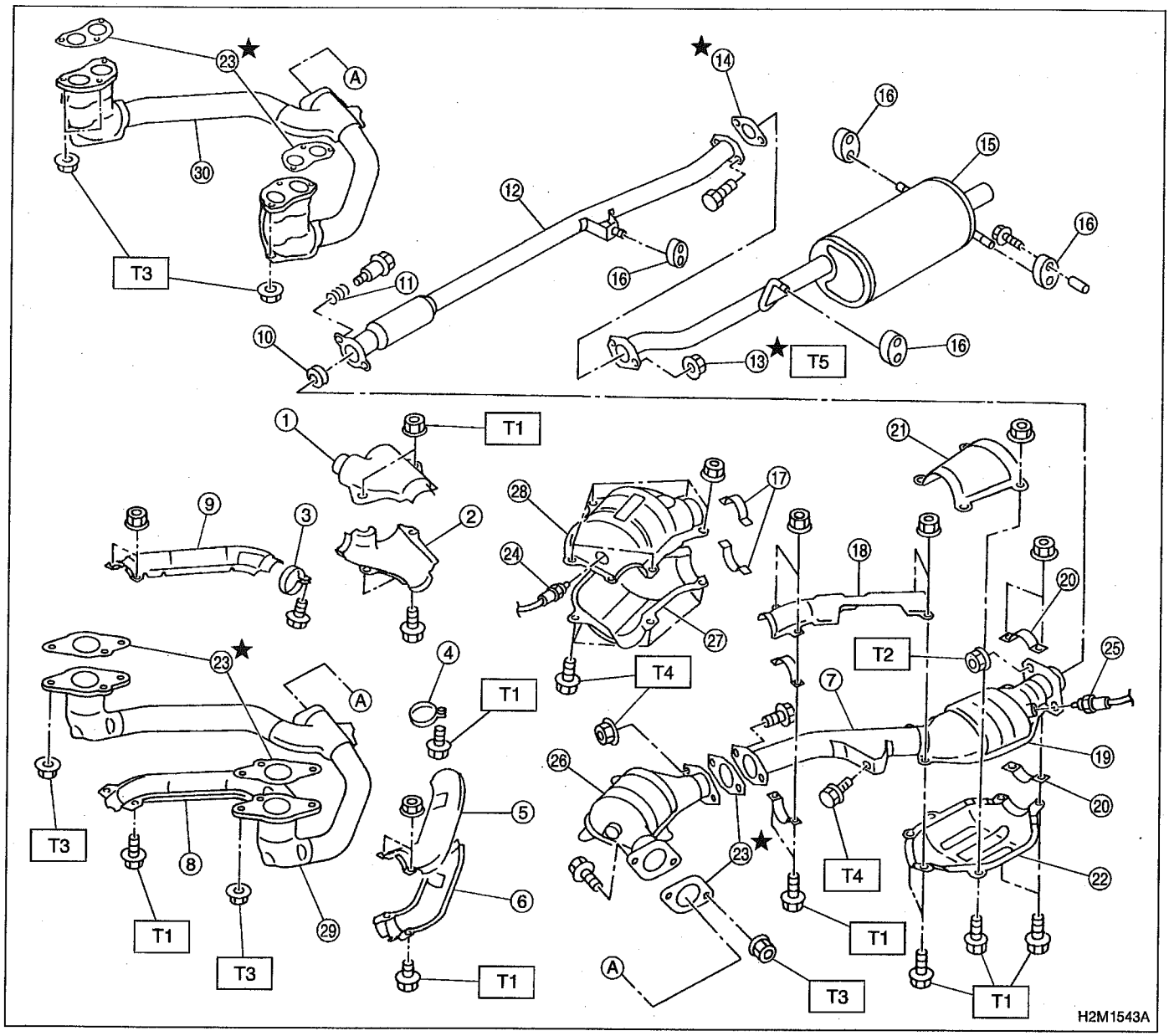
2) Affected areas

When water condensation is notched in the fuel filter, drain water from both the fuel filter and fuel tank or use a water removing agent (or anti-freeze solution) in the fuel tank.

- Observe the instructions, notes, etc., indicated on the label affixed to the anti-freeze solution (water removing agent) container before use.

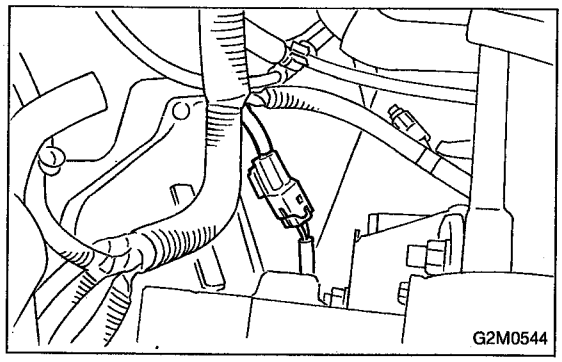
EXHAUST SYSTEM 2-9

1. Exhaust System



① Upper front exhaust pipe cover CTR
② Lower front exhaust pipe cover CTR
③ Band RH
④ Band LH
⑤ Upper front exhaust pipe cover LH
⑥ Lower front exhaust pipe cover LH
⑦ Center exhaust pipe
⑧ Lower front exhaust pipe cover RH
⑨ Upper front exhaust pipe cover RH
⑩ Gasket
⑪ Spring
⑫ Rear exhaust pipe
⑬ Self-locking nut
⑭ Gasket
⑮ Muffler
⑯ Cushion rubber
⑰ Clamp
⑱ Upper center exhaust pipe cover
⑲ Rear catalytic converter
⑳ Clamp B
㉑ Upper rear catalytic converter cover
㉒ Lower rear catalytic converter cover
㉓ Gasket
㉔ Front oxygen sensor
㉕ Rear oxygen sensor
㉖ Front catalytic converter
㉗ Lower front catalytic converter cover
㉘ Upper front catalytic converter cover
㉙ Front exhaust pipe (2200 cc)
㉚ Front exhaust pipe (1800 cc)

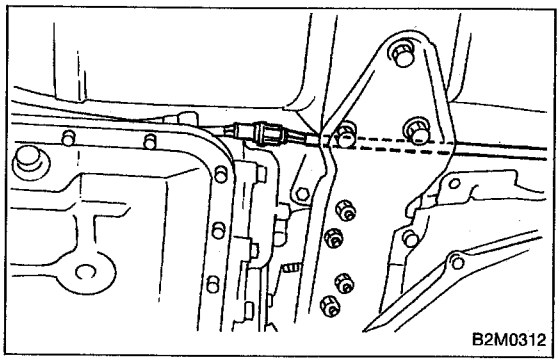
Tightening torque: N·m (kg-m, ft-lb)
T1: 13 ± 3 (1.3 ± 0.3, 9.4 ± 2.2)
T2: 18 ± 5 (1.8 ± 0.5, 13.0 ± 3.6)
T3: 30 ± 5 (3.1 ± 0.5, 22.4 ± 3.6)
T4: 35 ± 5 (3.6 ± 0.5, 26.0 ± 3.6)
T5: 48 ± 5 (4.9 ± 0.5, 35.4 ± 3.6)



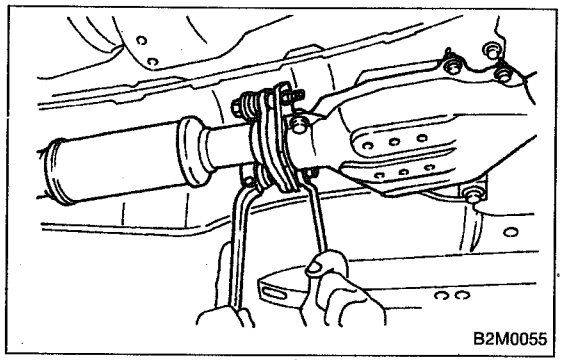
1. Front Exhaust Pipe and Center Exhaust Pipe

A: REMOVAL

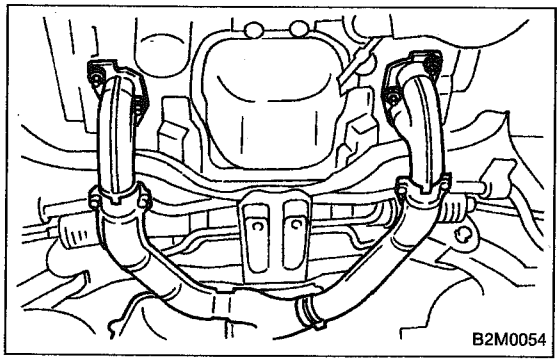
1) Disconnect front oxygen sensor connector.



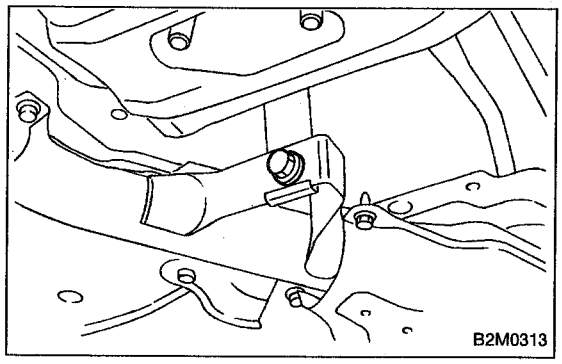
2) Lift-up the vehicle.
3) Disconnect rear oxygen sensor connector.



4) Separate center exhaust pipe from rear exhaust pipe.

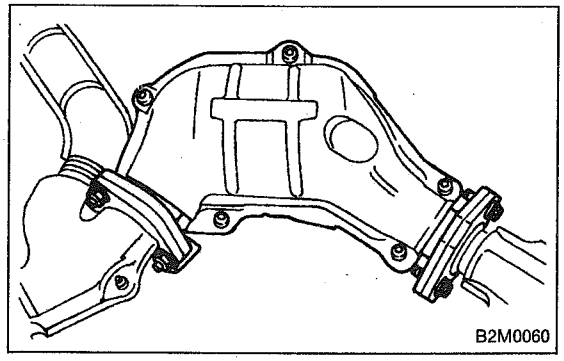


5) Remove bolts which hold front exhaust pipe onto cylinder heads.

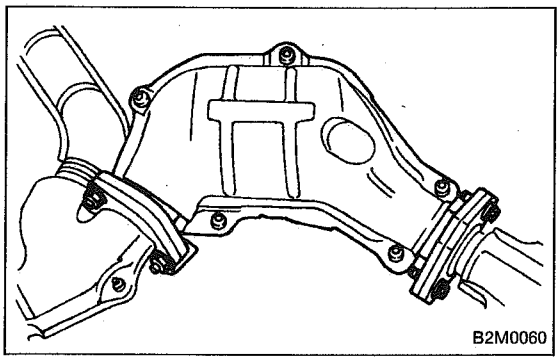


6) Remove front exhaust pipe and center exhaust pipe from hanger bracket.

CAUTION:
Be careful not to pull down front exhaust pipe and center exhaust pipe.


B2M0060

7) Separate front exhaust pipe from front catalytic converter.

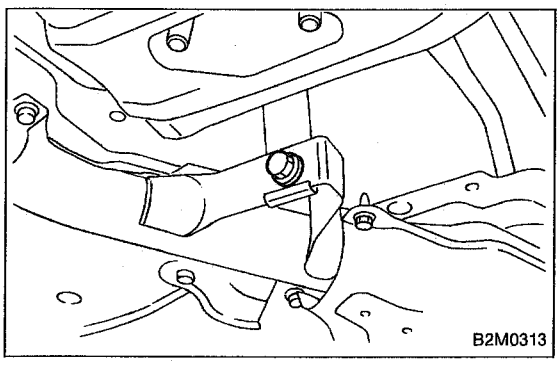

B2M0060

B: INSTALLATION

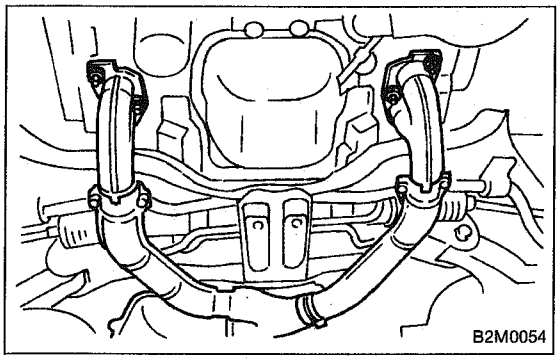
CAUTION:
Replace gaskets with new ones.

1) Install front catalytic converter to front exhaust pipe.

Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)

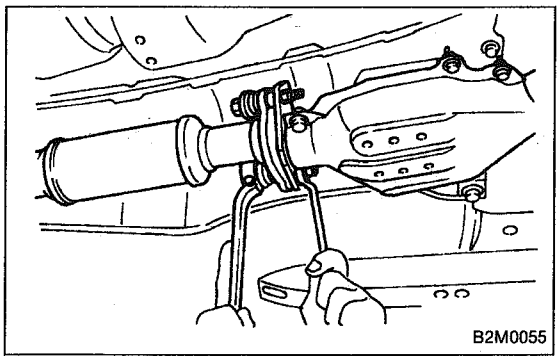

B2M0313

2) Install front exhaust pipe and center exhaust pipe. And temporarily tighten bolt which installs center exhaust pipe to hanger bracket.


B2M0054

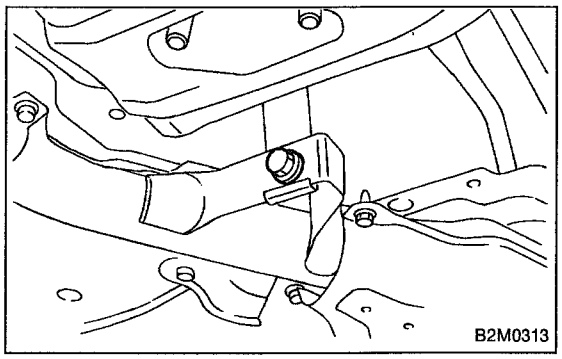
3) Tighten bolts which hold front exhaust pipe onto cylinder heads.

Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)


B2M0055

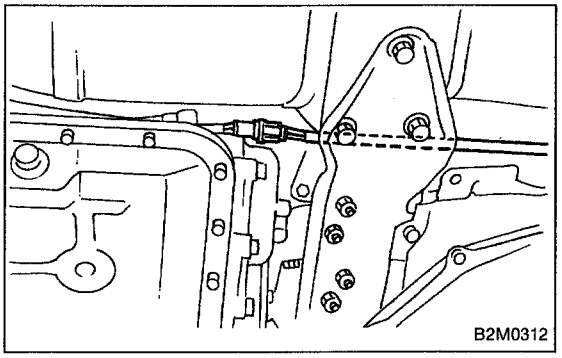
4) Install center exhaust pipe to rear exhaust pipe.

Tightening torque:
18 ± 5 N·m (1.8 ± 0.5 kg-m, 13.0 ± 3.6 ft-lb)

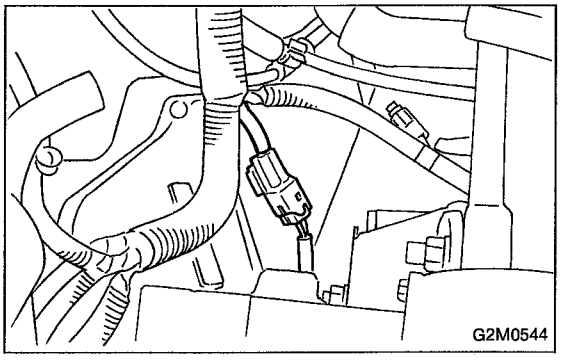


5) Tighten bolt which holds center exhaust pipe to hanger bracket.

Tightening torque:
35 ± 5 N·m (3.6 ± 0.5 kg-m, 26.0 ± 3.6 ft-lb)



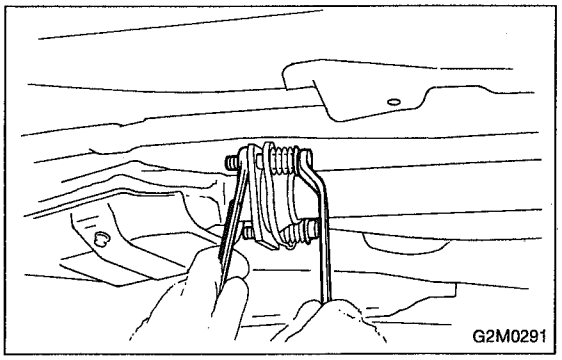
6) Connect rear oxygen sensor connector.



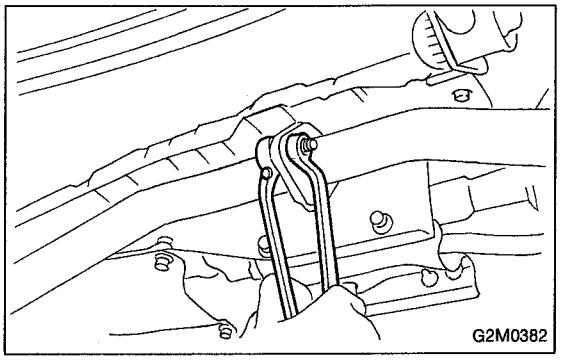
7) Lower the vehicle.
8) Connect front oxygen sensor connector.

2. Rear Exhaust Pipe

A: REMOVAL

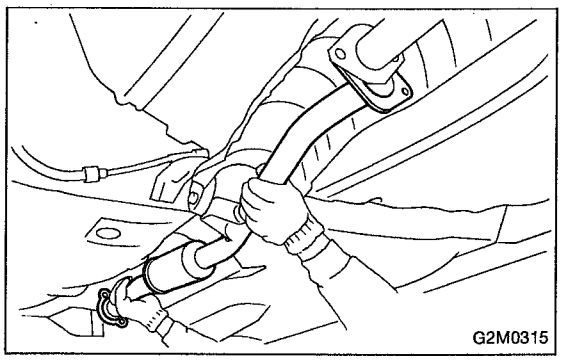


1) Separate rear exhaust pipe from front catalytic converter.



2) Separate rear exhaust pipe from muffler.

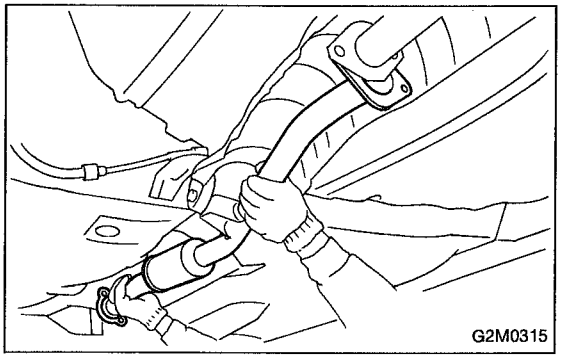
CAUTION:
Be careful not to pull down front exhaust pipe and front catalytic converter.



3) Remove rear exhaust pipe bracket from rubber cushion.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to pipe bracket in advance.

SUBARU CRC (Part No. 004301003)



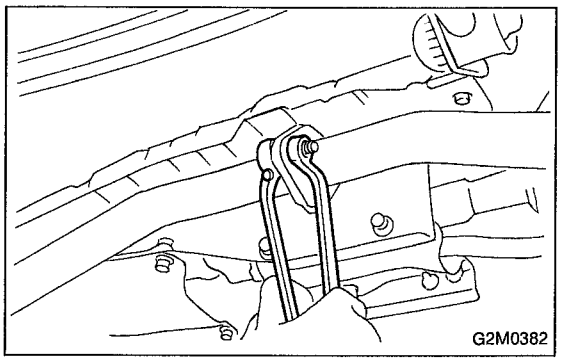
B: INSTALLATION

CAUTION:
Replace gaskets with new ones.

1) Install rear exhaust pipe bracket to rubber cushion.

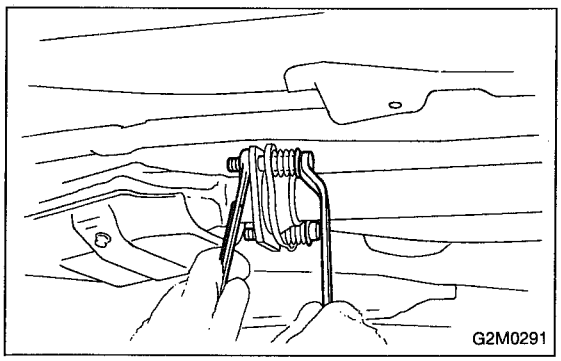
NOTE:
To facilitate installation, apply a coat of SUBARU CRC to mating area of rubber cushion in advance.

SUBARU CRC (Part No. 004301003)



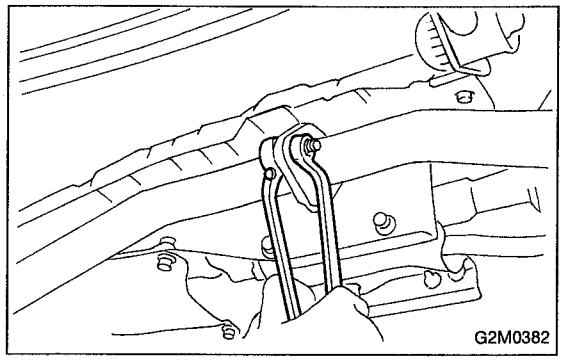
2) Install rear exhaust pipe to muffler.

Tightening torque:
48 ± 5 N·m (4.9 ± 0.5 kg-m, 35.4 ± 3.6 ft-lb)



3) Install rear exhaust pipe to front catalytic converter.

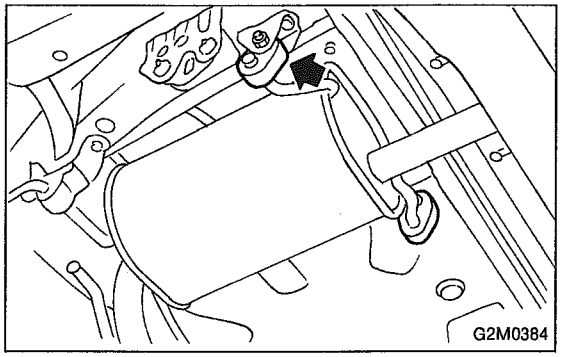
Tightening torque:
18 ± 5 N·m (1.8 ± 0.5 kg-m, 13.0 ± 3.6 ft-lb)



3. Muffler

A: REMOVAL AND INSTALLATION

1) Separate muffler from rear exhaust pipe.

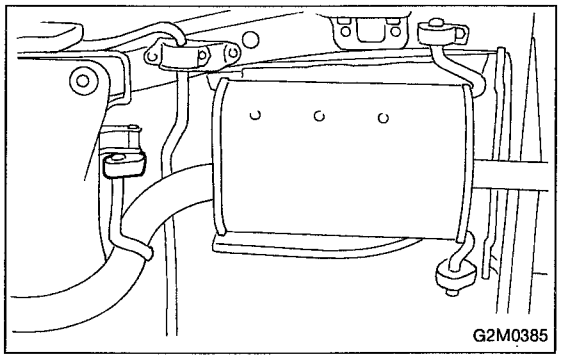


2) Remove left and right rubber cushions.

CAUTION:
Be careful not to pull down front exhaust pipe and front catalytic converter.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to mating area of rubber cushions in advance.

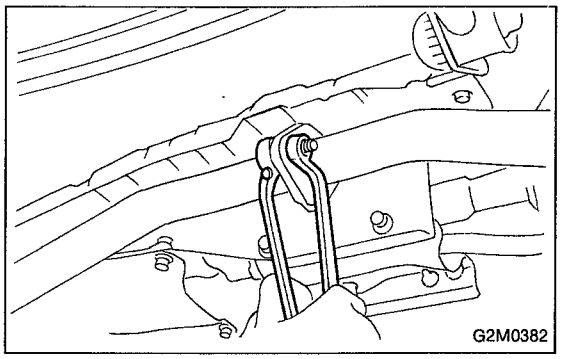
SUBARU CRC (Part No. 004301003)



3) Remove front rubber cushion, and detach muffler assembly.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to mating area of rubber cushion in advance.

SUBARU CRC (Part No. 004301003)



4) Installation is in the reverse order of removal.

CAUTION:
Replace gasket with a new one.

Tightening torque:
48 ± 5 N·m (4.9 ± 0.5 kg-m, 35.4 ± 3.6 ft-lb)

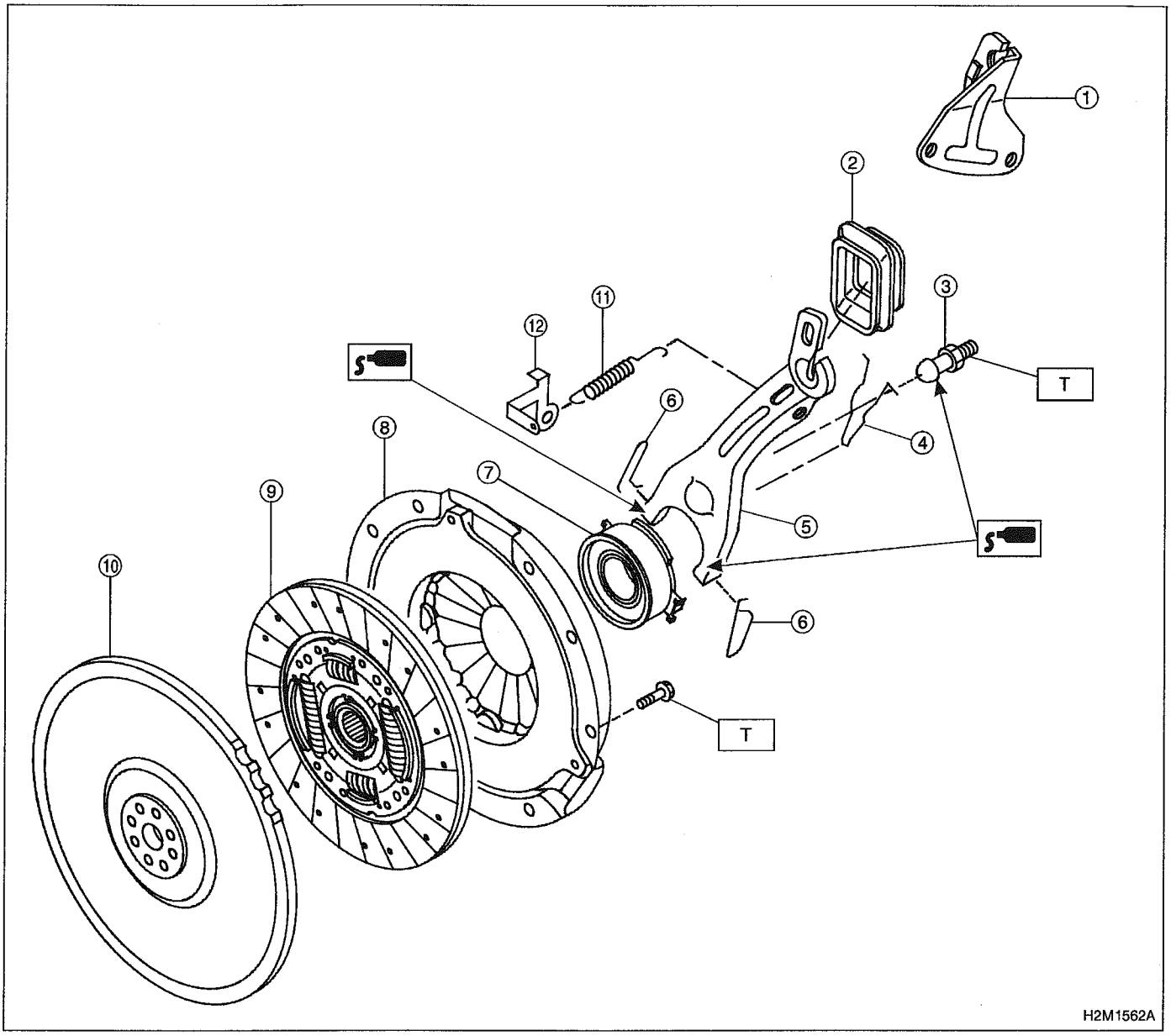
MEMO:

1. Specifications

			1800 cc	2200 cc
Clutch cover	Diaphragm set load kg (lb)		450 (992)	
Clutch disc	Facing material		Woven	
	O.D. x I.D. x thickness mm (in)		225 x 150 x 3.5 (8.86 x 5.91 x 0.138)	
	Spline O.D. mm (in) (No. of teeth)		25.2 (0.992) (24)	
	Depth of rivet head mm (in)	Standard	1.3 — 1.9 (0.051 — 0.075)	
		Limit of sinking	0.3 (0.012)	
	Limit for runout mm (in)		1.0 (0.039) at R = 107 (4.21)	
Clutch release lever ratio			3.0	
Release lever	Stroke mm (in)		24 — 26 (0.94 — 1.02)	
	Play at release lever center mm (in)		3 — 4 (0.12 — 0.16)	
Release bearing			Grease-packed self-aligning	
Clutch pedal	Full stroke mm (in)		140 — 145 (5.51 — 5.71)	

O.D.; Outer Diameter I.D.; Inner Diameter

1. Clutch System



① Clutch cable bracket
② Clutch release lever sealing
③ Pivot
④ Retainer spring
⑤ Clutch release lever
⑥ Clip
⑦ Clutch release bearing
⑧ Clutch cover
⑨ Clutch disc
⑩ Flywheel
⑪ Return spring
⑫ Clutch return spring bracket

Tightening torque: N·m (kg-m, ft-lb)
T: 15.7 ± 1.5 (1.6 ± 0.15, 11.6 ± 1.1)

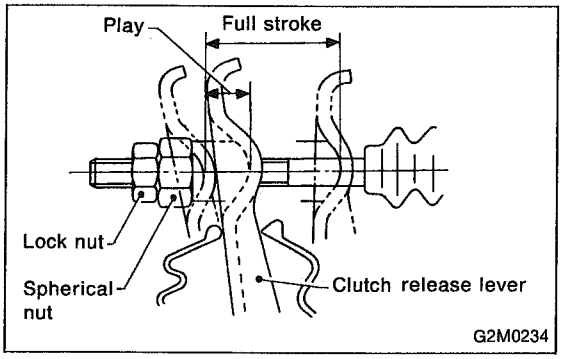
1. General

A: PRECAUTION

1. MECHANICAL APPLICATION TYPE

When servicing clutch system, pay attention to the following items.

1) Check the routing of clutch cable for smoothness.
2) Excessive tightness or looseness of clutch cable have a bad influence upon the cable durability.
3) Apply grease sufficiently to the connecting portion of clutch pedal.
4) Apply grease sufficiently to the release lever portion.
5) Position clutch cable through the center of toe board hole and route it smoothly. Adjustment is done by moving the outer cable.
6) Make sure not to let the clutch chatter when starting forward or rearward. If clutch chattering occurs, readjust so that the bend of clutch outer cable becomes flatter.



2. On-Car Service

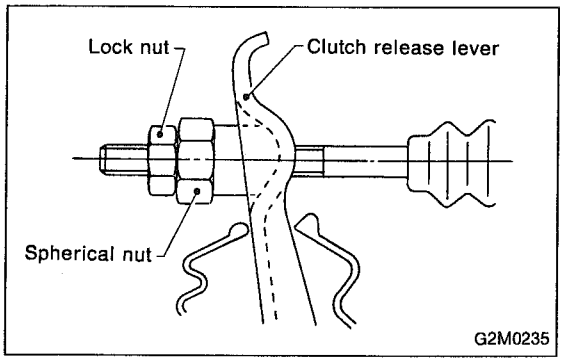
A: ADJUSTMENT

1. MECHANICAL APPLICATION TYPE

1) Remove release lever return spring from lever.
2) Adjust spherical nut so that the play is within the specified value at the lever end (center of spherical nut).

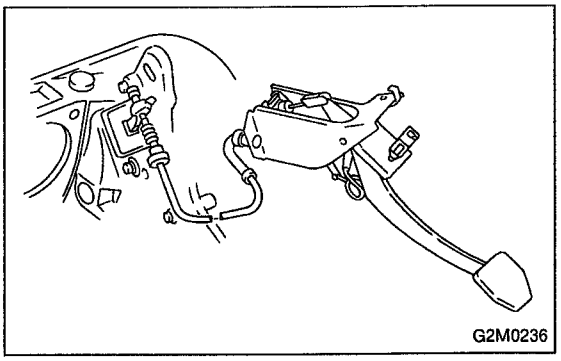
CAUTION:
Take care not to twist the cable during adjustment

Play: 3 — 4 mm (0.12 — 0.16 in)
Full stroke: 24 — 26 mm (0.94 — 1.02 in)

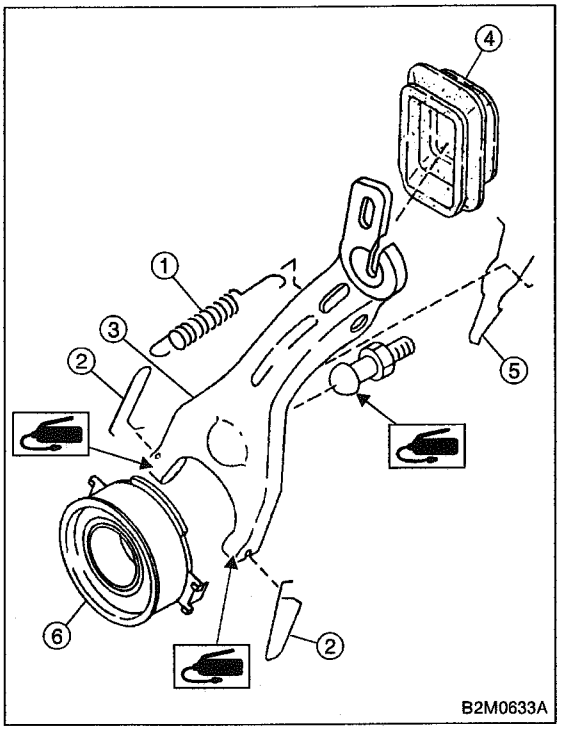


3) Upon completion of adjustment, securely lock spherical nut with lock nut.
Install return spring on lever.

NOTE:
Hook the long hook side of the return spring with the lever.



4) Depress clutch pedal to assure there is no abnormality in the clutch system.



3. Release Bearing and Lever

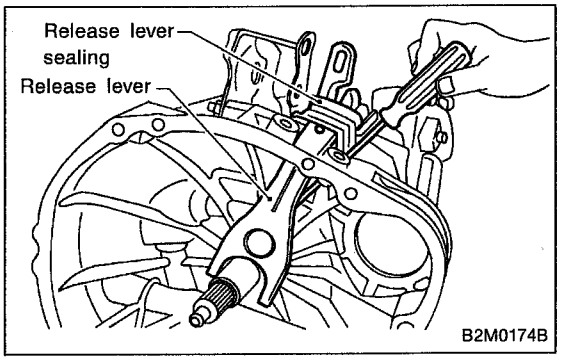
A: REMOVAL

1. MECHANICAL APPLICATION TYPE

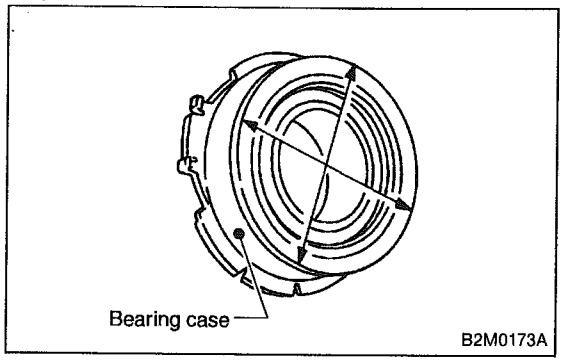
1) Remove release lever return spring ①.
2) Remove the two clips ② from clutch release lever ③ and remove release bearing ⑥.

CAUTION:
Be careful not to deform clips.

3) Remove release lever seal ④.



4) Remove release lever retainer spring from release lever pivot with a screwdriver by accessing it through clutch housing release lever hole. Then remove release lever.



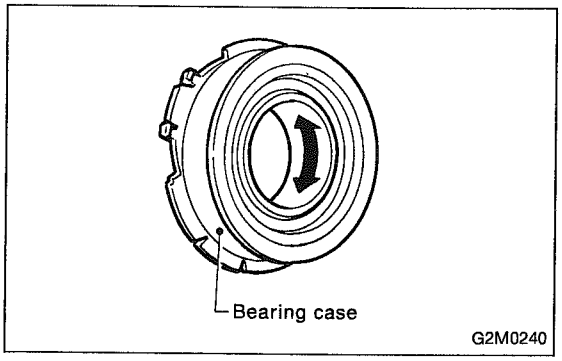
B: INSPECTION

1. RELEASE BEARING

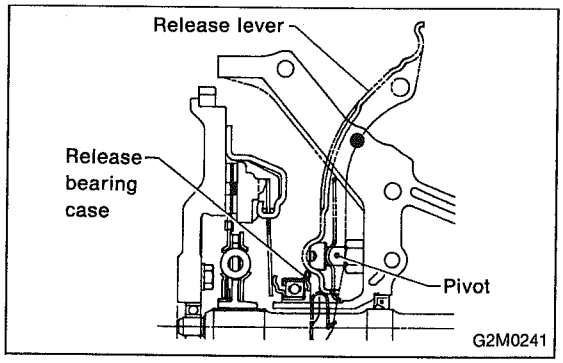
CAUTION:
Since this bearing is grease sealed and is of a nonlubrication type, do not wash with gasoline or any solvent when servicing the clutch.

1) Check the bearing for smooth movement by applying force in the radial direction.

Radial direction stroke:
Approx.
1.4 mm (0.055 in)



2) Check the bearing for smooth rotation by applying pressure in the thrust direction.
3) Check wear and damage of bearing case surface contacting with lever.



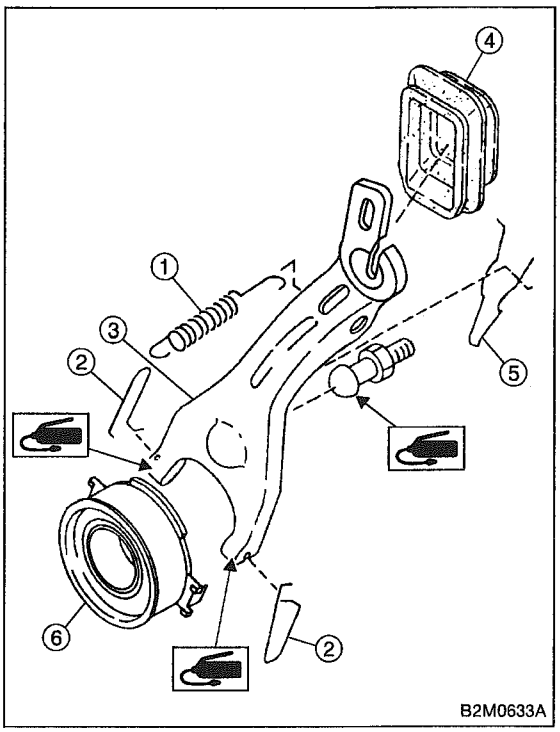
2. RELEASE LEVER

Check lever pivot portion and the point of contact with release bearing case for wear.

C: INSTALLATION

1. MECHANICAL APPLICATION TYPE

CAUTION:
Before or during assembling, lubricate the following points with a light coat of grease.
- **Inner groove of release bearing**
- **Contact surface of lever and pivot**
- **Contact surface of lever and bearing**
- **Transmission main shaft spline (Use grease containing molybdenum disulphide.)**

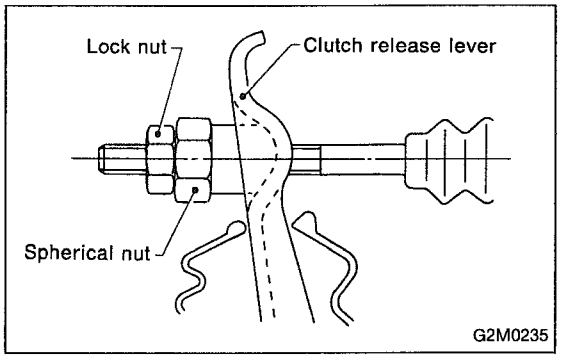


1) While pushing release lever ③ to pivot and twisting it to both sides, fit retainer spring ⑤ onto the constricted portion of pivot.

NOTE:
Confirm that retainer spring is securely fitted by observing it through the main case hole.

2) Install release bearing ⑥ and fasten it with two clips ②.

3) Install release lever seal ④.

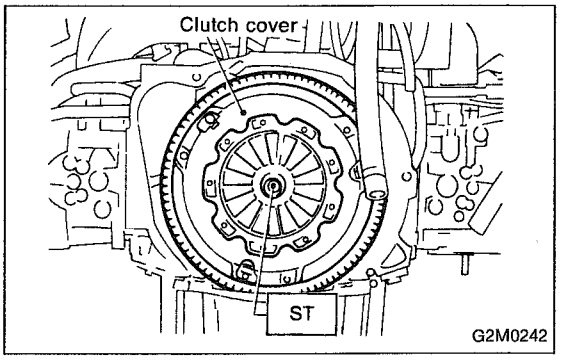


4) After remounting engine and transmission on body, make adjustment of the clutch release lever end play.

CAUTION:
Take care not to twist the cable during adjustment.

5) Install release lever return spring.

NOTE:
Hook up the return spring to right side hole of the release lever.



4. Clutch Disc and Cover

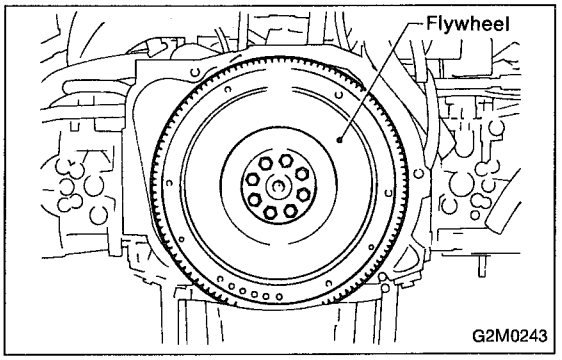
A: REMOVAL

1) Install ST on flywheel.

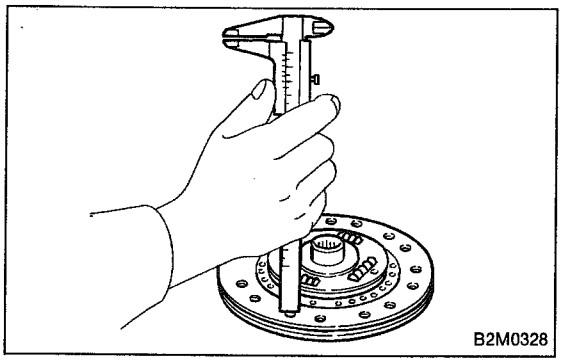
ST 498497100 CRANKSHAFT STOPPER

2) Remove clutch cover and clutch disc.

CAUTION:
- **Take care not to allow oil on the clutch disc facing.**
- **Do not disassemble either clutch cover or clutch disc.**



3) Remove flywheel.


B2M0328

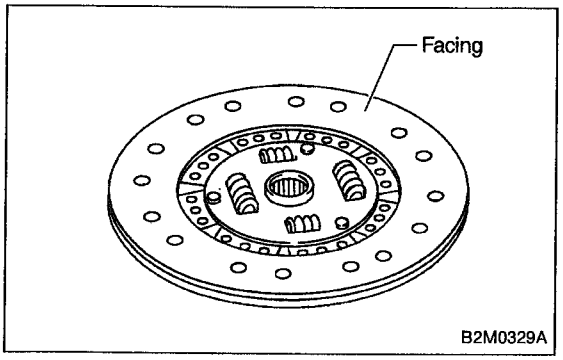
B: INSPECTION

1. CLUTCH DISC

1) Facing wear
Measure the depth of rivet head from the surface of facing. Replace if facings are worn locally or worn down to less than the specified value.

Depth of rivet head:
Standard value
1.3 — 1.9 mm (0.051 — 0.075 in)
Limit of sinking
0.3 mm (0.012 in)

CAUTION:
Do not wash clutch disc with any cleaning fluid.



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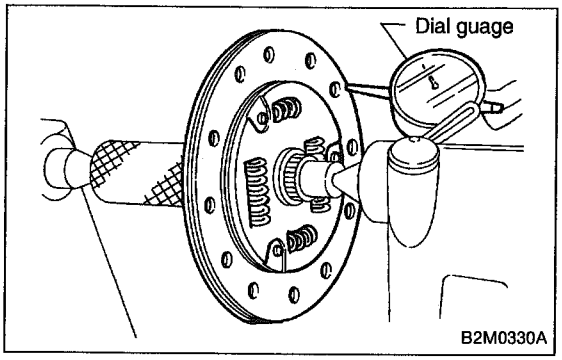
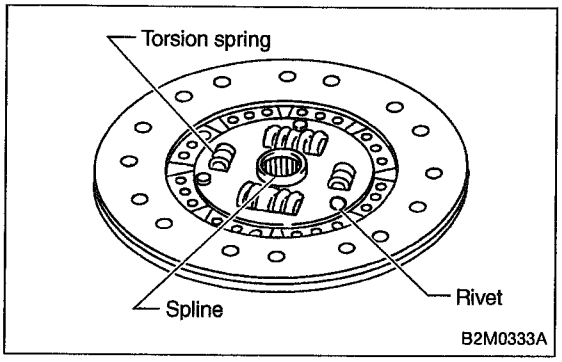
2) Hardened facing
Correct by using emery paper or replace.
3) Oil soakage on facing
Replace clutch disc and inspect transmission front oil seal, transmission case mating surface, engine rear oil seal and other points for oil leakage.



B2M0330A

4) Deflection on facing
If deflection exceeds the specified value at the outer circumference of facing, repair or replace.

Limit for deflection:
1.0 mm (0.039 in) at R = 107 mm (4.21 in)



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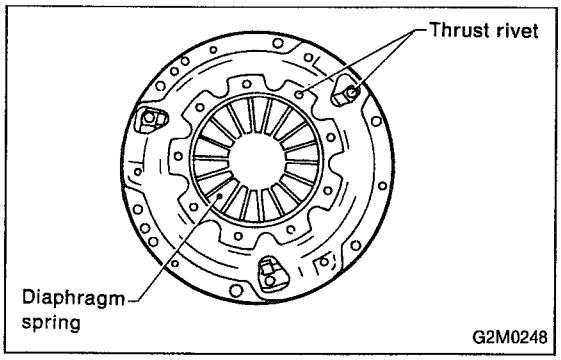
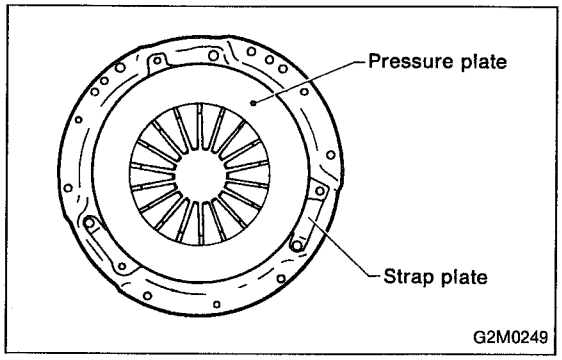
5) Worn spline, loose rivets and torsion spring failure
Replace defective parts.



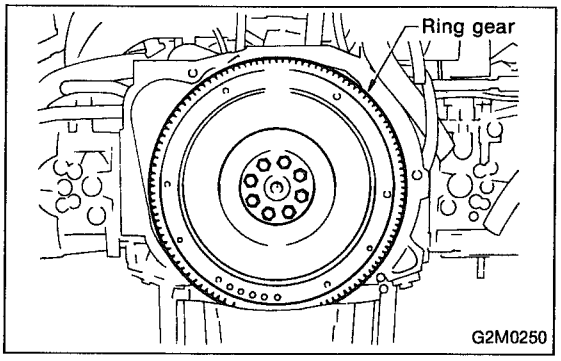
2. CLUTCH COVER

Visually check for the following items without disassembling, and replace or repair if defective.

1) Loose thrust rivet.
2) Damaged or worn bearing contact area at center of diaphragm spring.



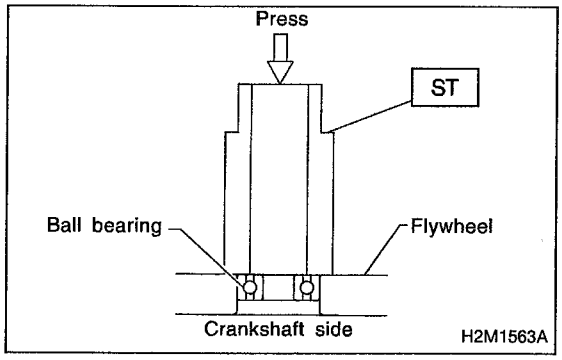
3) Damaged or worn disc contact surface of pressure plate.
4) Loose strap plate setting bolt.
5) Worn diaphragm sliding surface.



3. FLYWHEEL

CAUTION:
Since this bearing is grease sealed and is of a nonlubrication type, do not wash with gasoline or any solvent.

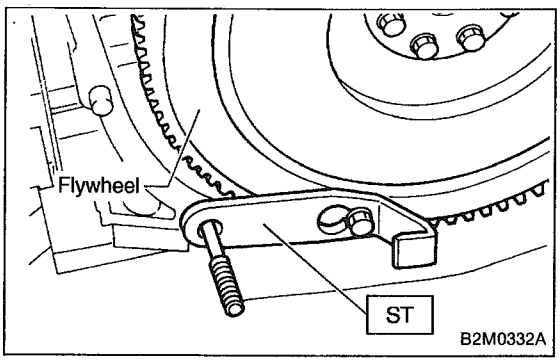
1) Damage of facing and ring gear
If defective, replace flywheel.



2) Smoothness of rotation
Rotate ball bearing applying pressure in thrust direction.
If noise or excessive play is noted, replace ball bearing as follows:

(1) Drive out ball bearing from flywheel.
(2) Press bearing into flywheel until bearing end surface is flush with clutch disc contact surface of flywheel. Do not press inner race.

ST 899754112 SNAP RING PRESS



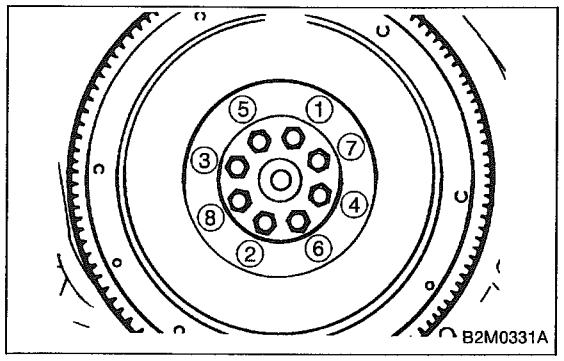
C: INSTALLATION

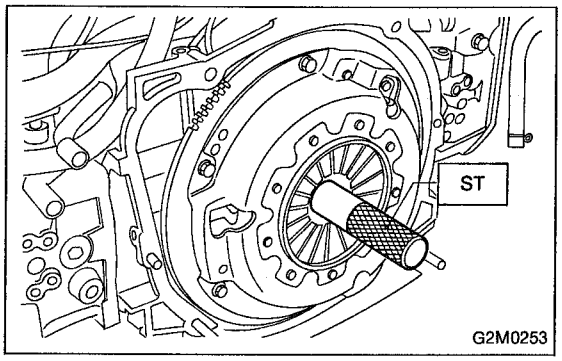
1) Install flywheel.
2) Install ST, and tighten the flywheel attaching bolts to the specified torque.

ST 498497100 CRANKSHAFT STOPPER

Tightening torque:
72 ± 3 N·m (7.3 ± 0.3 kg-m, 52.8 ± 2.2 ft-lb)

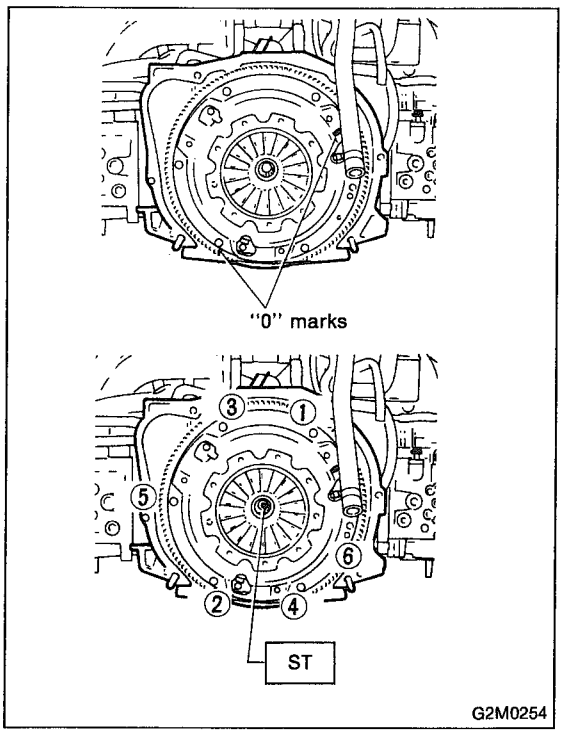
NOTE:
Tighten flywheel installing bolts gradually. Each bolt should be tightened to the specified torque in a crisscross fashion.





3) Insert ST into the clutch disc and install them on the flywheel by inserting the ST end into the pilot bearing.

ST 499747100 CLUTCH DISC GUIDE



4) Install clutch cover on flywheel and tighten bolts to the specified torque.

NOTE:
- When installing the clutch cover on the flywheel, position the clutch cover so that there is a gap of 120° or more between "0" marks on the flywheel and clutch cover. ("0" marks indicate the directions of residual unbalance.)
- Note the front and rear of the clutch disc when installing.
- Tighten clutch cover installing bolts gradually. Each bolt should be tightened to the specified torque in a crisscross fashion.

Tightening torque:
15.7 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)

5) Remove ST.

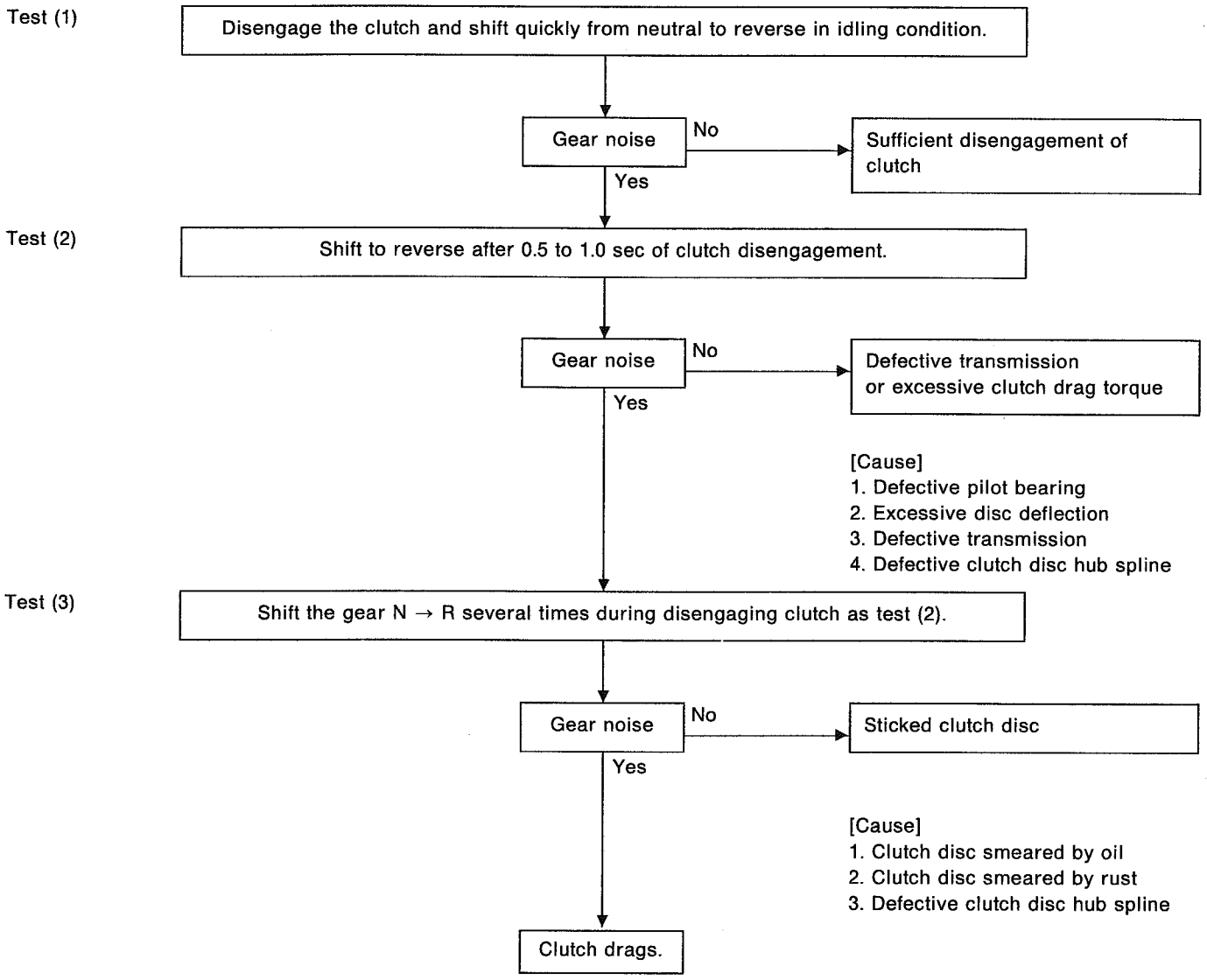
ST 499747100 CLUTCH DISC GUIDE

1. Clutch Trouble in General

Condition	Possible cause and testing	Corrective action
1. Clutch slippage	It is hard to perceive clutch slippage in the early stage, but pay attention to the following symptoms.	
	(a) Engine revs up when shifting. (b) High speed driving is impossible; especially rapid acceleration impossible and vehicle speed does not increase in proportion to an increase in engine speed. (c) Power falls, particularly when ascending a slope, and there is a smell of burning of the clutch facing. • Method of testing: Put the vehicle in stationary condition with parking brake fully applied. Disengage the clutch and shift the transmission gear into the first. Gradually allow the clutch to engage while gradually increasing the engine speed. The clutch function is satisfactory if the engine stalls. However, the clutch is slipping if the vehicle does not start off and the engine does not stall.	
	(a) No clutch pedal play	Readjust.
	(b) No release lever end play	Readjust.
	(c) Clutch facing smeared by oil	Replace.
	(d) Worn clutch facing	Replace.
	(e) Deteriorated diaphragm spring	Replace.
	(f) Distorted pressure plate or flywheel	Correct or replace.
	(g) Defective release bearing holder	Correct or replace.
	(h) Defective pedal and cable system	Correct or replace.
2. Clutch drags.	As a symptom of this trouble, a harsh scratching noise develops and control becomes quite difficult when shifting gears. The symptom becomes more apparent when shifting into the first gear. However, because much trouble of this sort is due to defective synchronization mechanism, carry out the test as described after. • Method of testing: Refer to DIAGNOSTIC DIAGRAM on page after.	
	It may be judged as insufficient disengagement of clutch if any noise occurs during this test.	
	(a) Excessive clutch pedal play	Readjust.
	(b) Excessive clutch release lever play	Readjust.
	(c) Worn or rusty clutch disc hub spline	Replace clutch disc.
	(d) Excessive deflection of clutch disc facing	Correct or replace.
	(e) Seized crankshaft pilot needle bearing	Replace.
	(f) Malfunction of pedal and cable system	Correct or replace.
	(g) Cracked clutch disc facing	Replace.
	(h) Sticked clutch disc (smeared by oil or water)	Replace.
3. Clutch chatters.	Clutch chattering is an unpleasant vibration to the whole body when the vehicle is just started with clutch partially engaged.	
	(a) Improper clutch cable routing	Correct.
	(b) Adhesion of oil on the facing	Replace clutch disc.
	(c) Weak or broken torsion spring	Replace clutch disc.
	(d) Defective facing contact or excessive disc	Replace clutch disc defection.
	(e) Warped pressure plate or flywheel	Correct or replace.
	(f) Loose disc rivets	Replace clutch disc.
	(g) Loose engine mounting	Retighten or replace mounting.
	(h) Improper adjustment of pitching stopper	Adjustment.

Condition	Possible cause and testing	Corrective action
4. Noisy clutch	Examine whether the noise is generated when the clutch is disengaged, engaged, or partially engaged.	
	(a) Broken, worn or unlubricated release bearing	Replace release bearing.
	(b) Insufficient lubrication of pilot bearing	Apply grease.
	(c) Loose clutch disc hub	Replace clutch disc.
	(d) Loose torsion spring retainer	Replace clutch disc.
	(e) Deteriorated or broken torsion spring	Replace clutch disc.
5. Clutch grabs.	When starting the vehicle with the clutch partially engaged, the clutch engages suddenly and the vehicle jumps instead of making a smooth start.	
	(a) Grease or oil on facing	Replace clutch disc.
	(b) Deteriorated cushioning spring	Replace clutch disc.
	(c) Worn or rusted spline of clutch disc or main	Take off rust, apply grease or replace clutch shaft disc or mainshaft.
	(d) Deteriorated or broken torsion spring	Replace clutch disc.
	(e) Loose engine mounting	Retighten or replace mounting.
	(f) Deteriorated diaphragm spring	Replace.

A: DIAGNOSTIC DIAGRAM OF CLUTCH DRAG

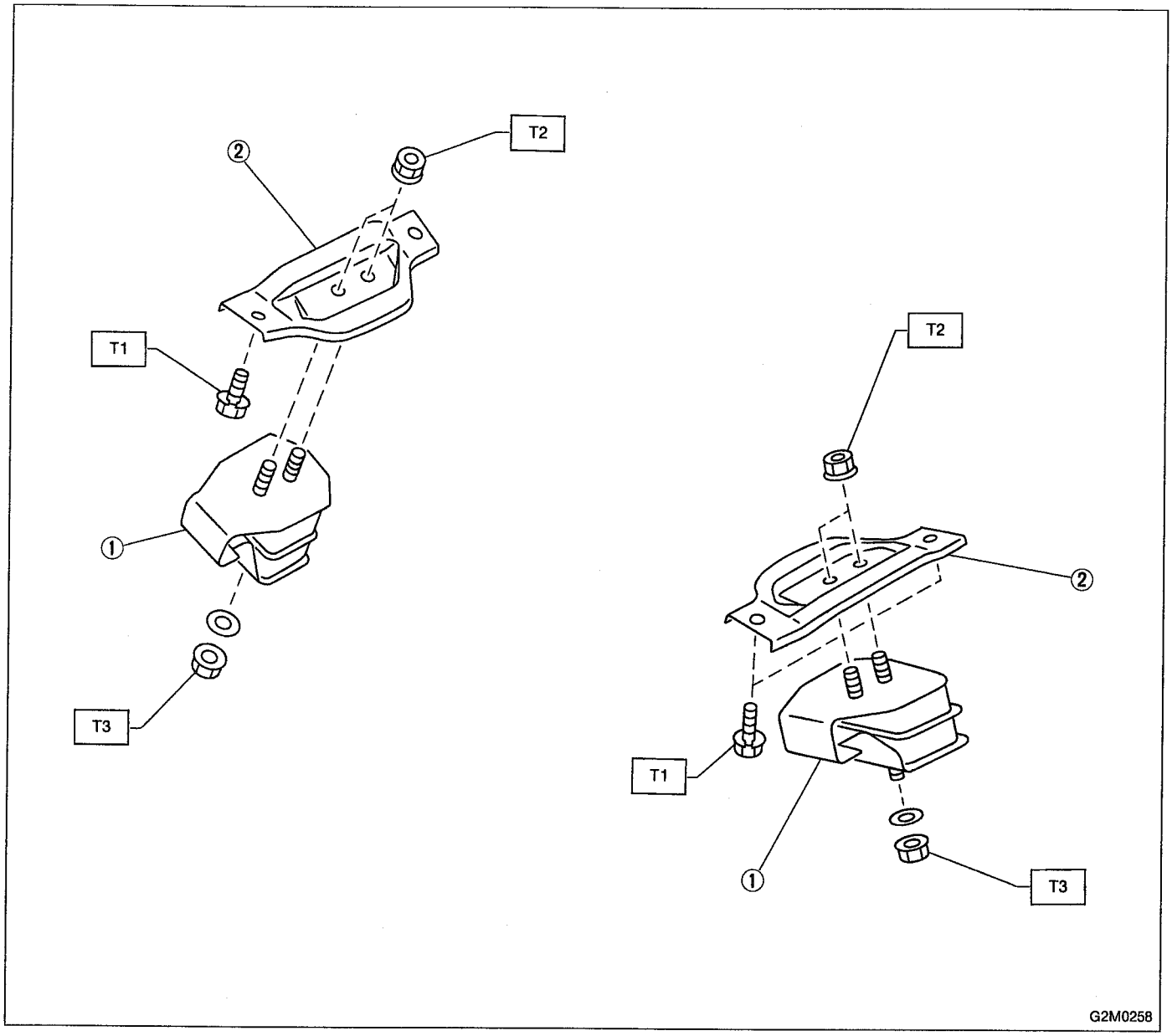


[Cause]
1. Cracked clutch disc facing
2. Damaged or worn clutch cover
3. Malfunction of clutch release system
4. Insufficient clutch release amount
5. Excessive clutch pedal play

MEMO:

ENGINE AND TRANSMISSION MOUNTING SYSTEM 2-11

1. Engine Mounting

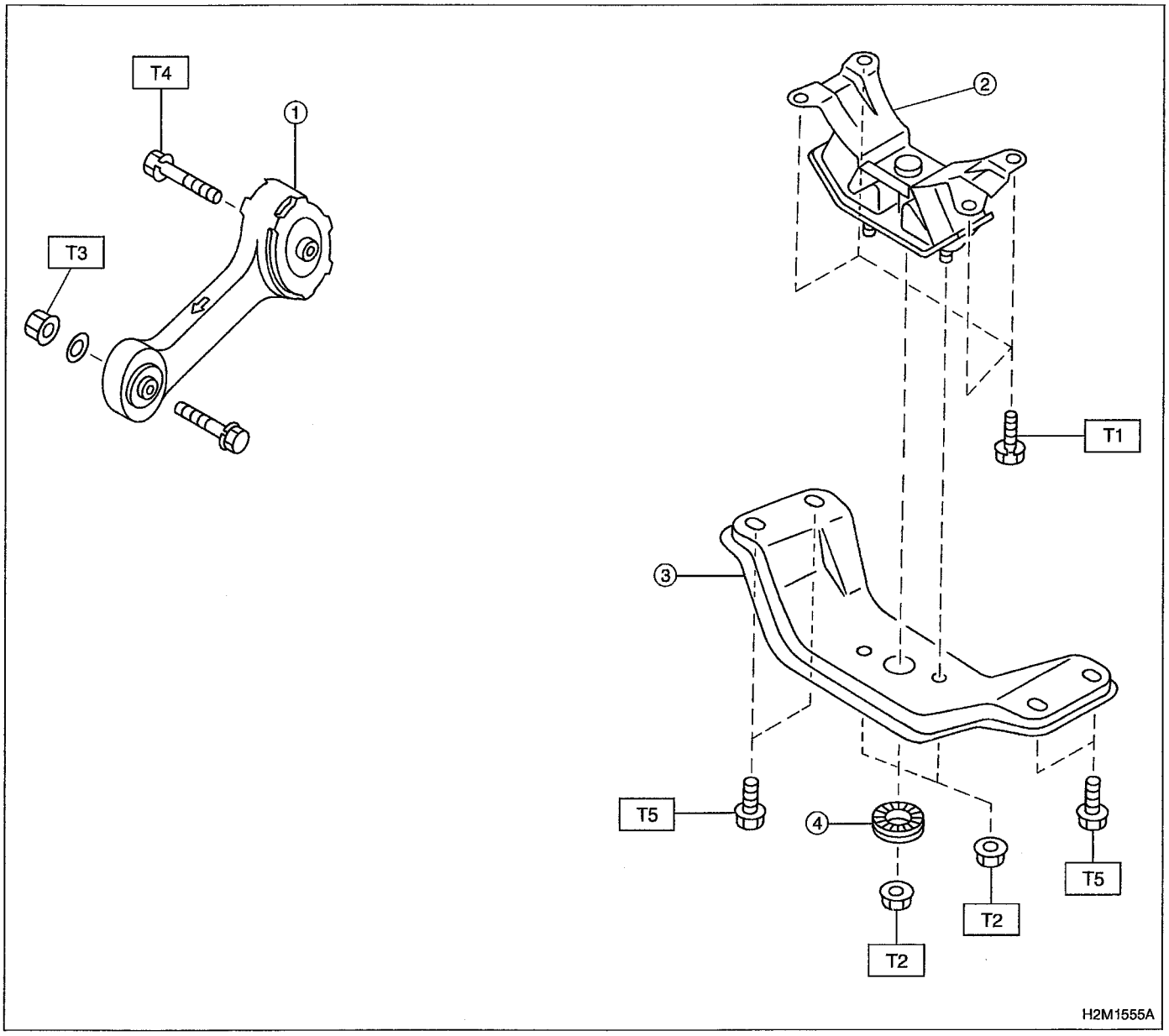


① Front cushion rubber
② Front engine mounting bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 26 ± 7 (2.7 ± 0.7, 19.5 ± 5.1)
T2: 41 ± 10 (4.2 ± 1.0, 30 ± 7)
T3: 69 ± 15 (7.0 ± 1.5, 51 ± 11)

2. Transmission Mounting

A: MT MODEL

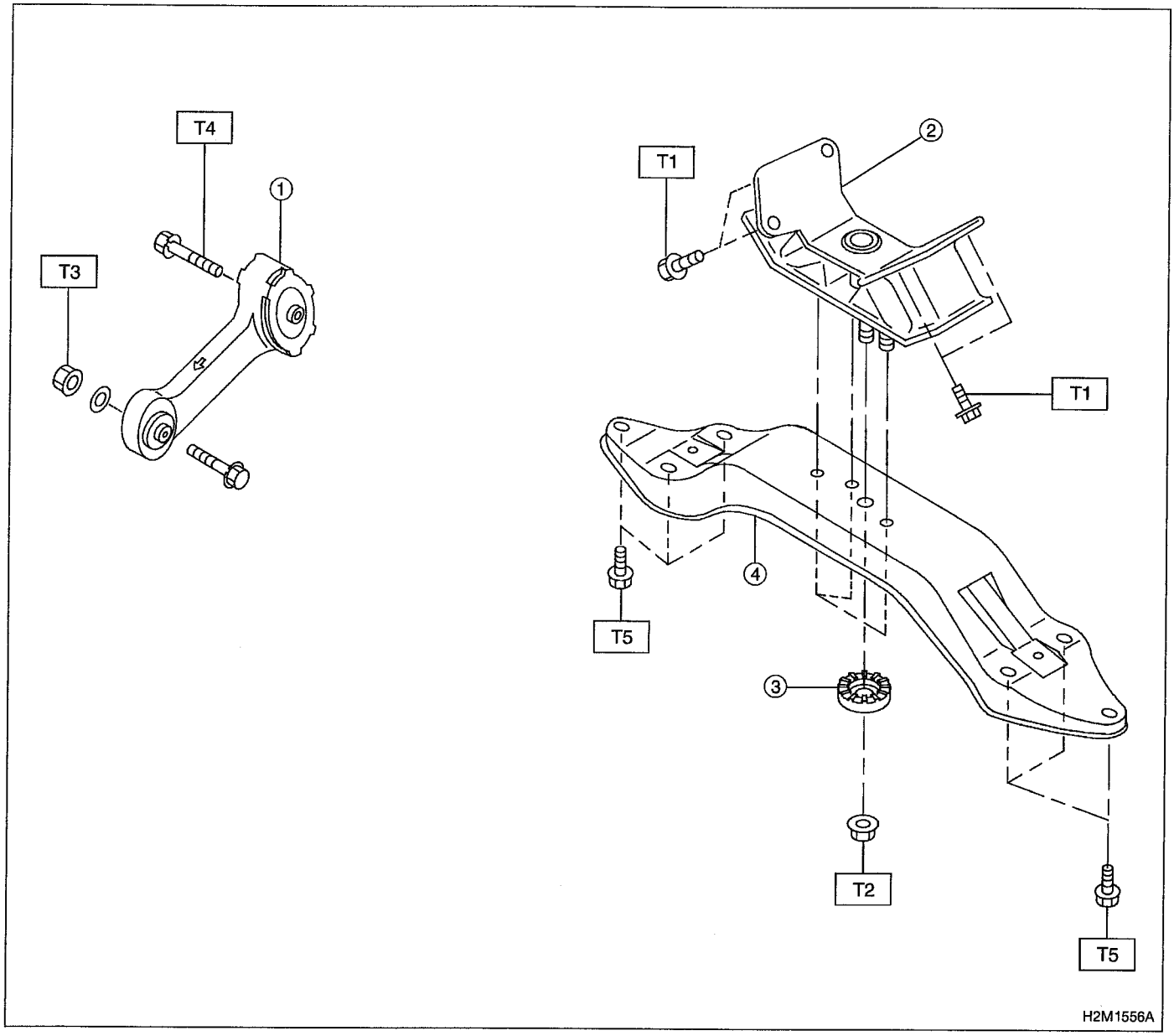


① Pitching stopper
② Rear cushion rubber
③ Rear crossmember
④ Stopper

Tightening torque: N·m (kg-m, ft-lb)
T1: 33 ± 5 (3.4 ± 0.5, 24.6 ± 3.6)
T2: 37 ± 10 (3.8 ± 1.0, 27 ± 7)
T3: 49 ± 5 (5.0 ± 0.5, 36.2 ± 3.6)
T4: 57 ± 10 (5.8 ± 1.0, 42 ± 7)
T5: 69 ± 15 (7.0 ± 1.5, 51 ± 11)

COMPONENT PARTS

B: AT MODEL



① Pitching stopper
② Rear cushion rubber
③ Stopper
④ Crossmember

Tightening torque: N·m (kg-m, ft-lb)
T1: 25 ± 7 (2.5 ± 0.7, 18.1 ± 5.1)
T2: 37 ± 10 (3.8 ± 1.0, 27 ± 7)
T3: 49 ± 5 (5.0 ± 0.5, 36.2 ± 3.6)
T4: 57 ± 10 (5.8 ± 1.0, 42 ± 7)
T5: 69 ± 15 (7.0 ± 1.5, 51 ± 11)

1. Engine

A: GENERAL PRECAUTION

1) Remove or install engine in an area where chain hoists, lifting devices, etc. are available for ready use.
2) Be sure not to damage coated surfaces of body panels with tools or stain seats and windows with coolant or oil. Place a cover over fenders, as required, for protection.
3) Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
4) Lift-up or lower the vehicle when necessary. Make sure to support the correct positions. <Ref. to 1-3 [0700].>

B: REMOVAL

1. Set the vehicle on lift arms.
2. Open front hood and support with a stay.

3. Release fuel pressure.
4. Disconnect battery cable and remove battery from vehicle.
5. Drain coolant.

6. Remove cooling system.

A/C equipped model

7. Collect refrigerant, and remove pressure hose.

8. Remove air intake system.

9. Remove canister and bracket. (2200 cc)

10. Disconnect connectors, cables and hoses.

11. Remove power steering pump from bracket.

12. Remove front exhaust pipe and center exhaust pipe.

13. Remove nuts which hold lower side of transmission to engine.
14. Remove nuts which install front cushion rubber onto front crossmember.

AT model

15. Separate torque converter from drive plate.

16. Remove pitching stopper and bracket.

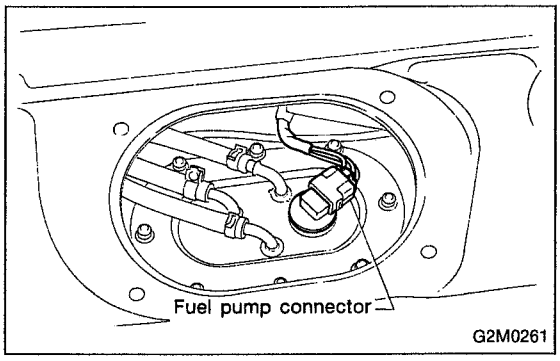
17. Disconnect fuel delivery hose, return hose and evaporation hose.

18. Support engine with a lifting device and wire ropes.
19. Support transmission with a garage jack.

20. Remove bolts which hold upper side of transmission to engine.

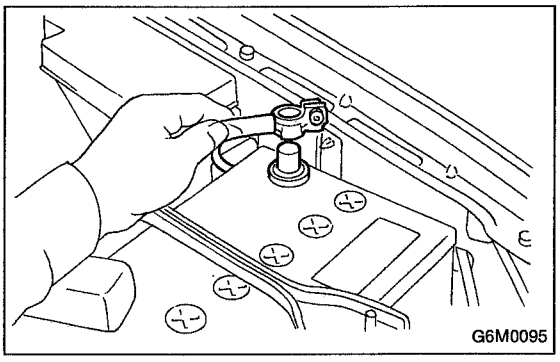
21. Remove engine from vehicle.

1) Set the vehicle on lift arms.
2) Open front hood fully and support with stay.

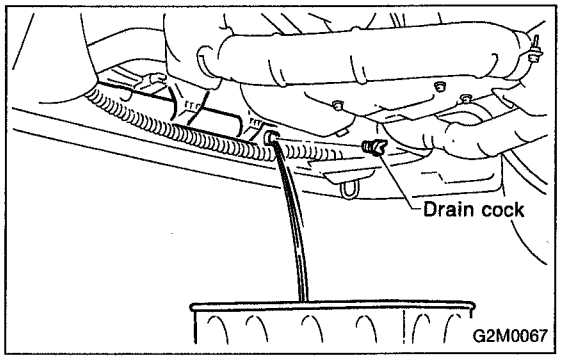


3) Release fuel pressure.
   (1) Disconnect fuel pump connector.
   (2) Start the engine, and run until it stalls.
   (3) After the engine stalls, crank it for five seconds more.
   (4) Turn ignition switch to "OFF".

<Ref. to 2-8 [W1B0].>

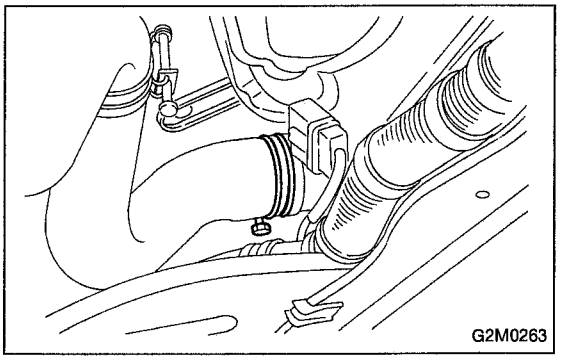


4) Disconnect battery cables and remove battery from vehicle.

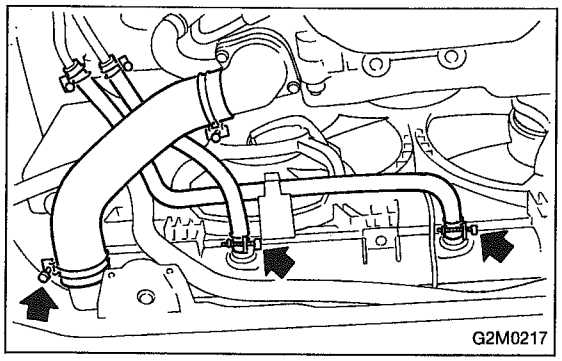


5) Drain coolant.

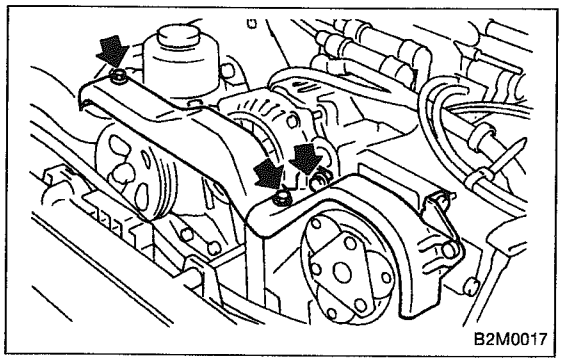
Set container under the vehicle, and remove drain cock from radiator.



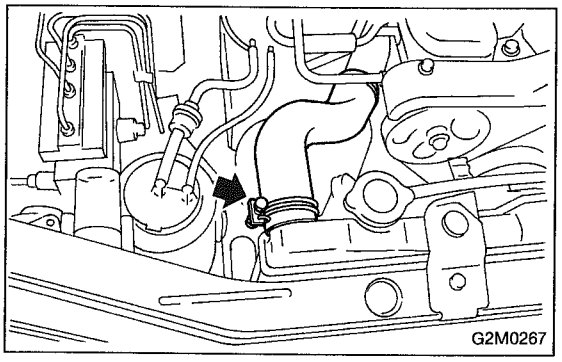
6) Remove cooling system.
   (1) Disconnect radiator fan motor connector.



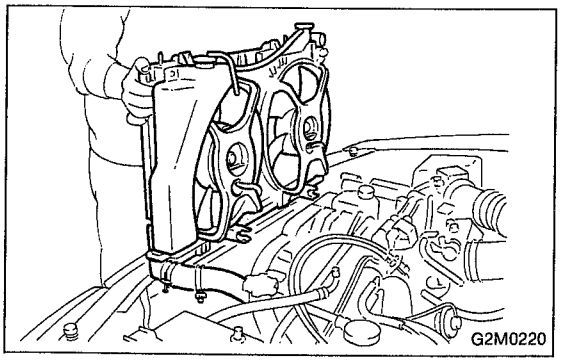
(2) Disconnect radiator outlet hose from thermostat cover.
(3) Disconnect ATF cooler hoses from pipes. (AT model)



(4) Remove V-belt cover.

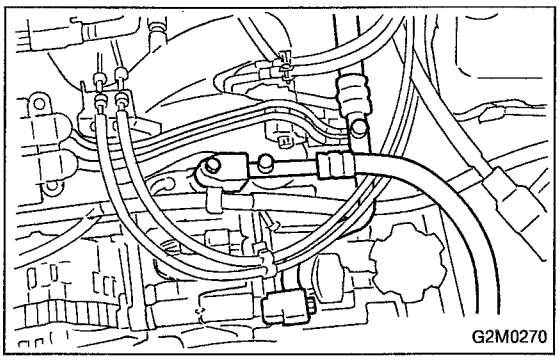


(5) Disconnect radiator inlet hose from radiator.

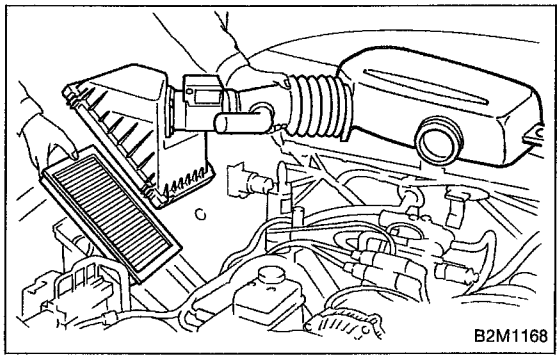


(6) Remove radiator upper bracket, and remove radiator assembly from vehicle.

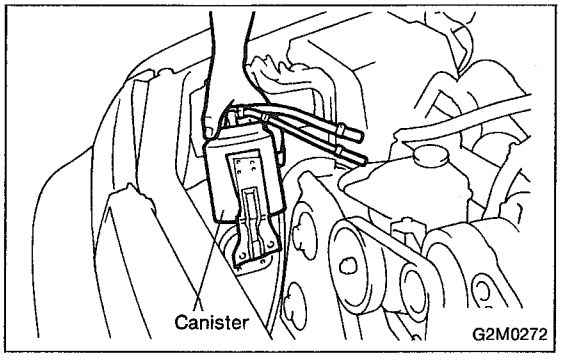
7) Collect refrigerant, and remove pressure hoses. (With A/C)
(1) Place and connect the attachment hose to the refrigerant recycle system.
(2) Collect refrigerant from A/C system.



(3) Disconnect A/C pressure hoses from A/C compressor.

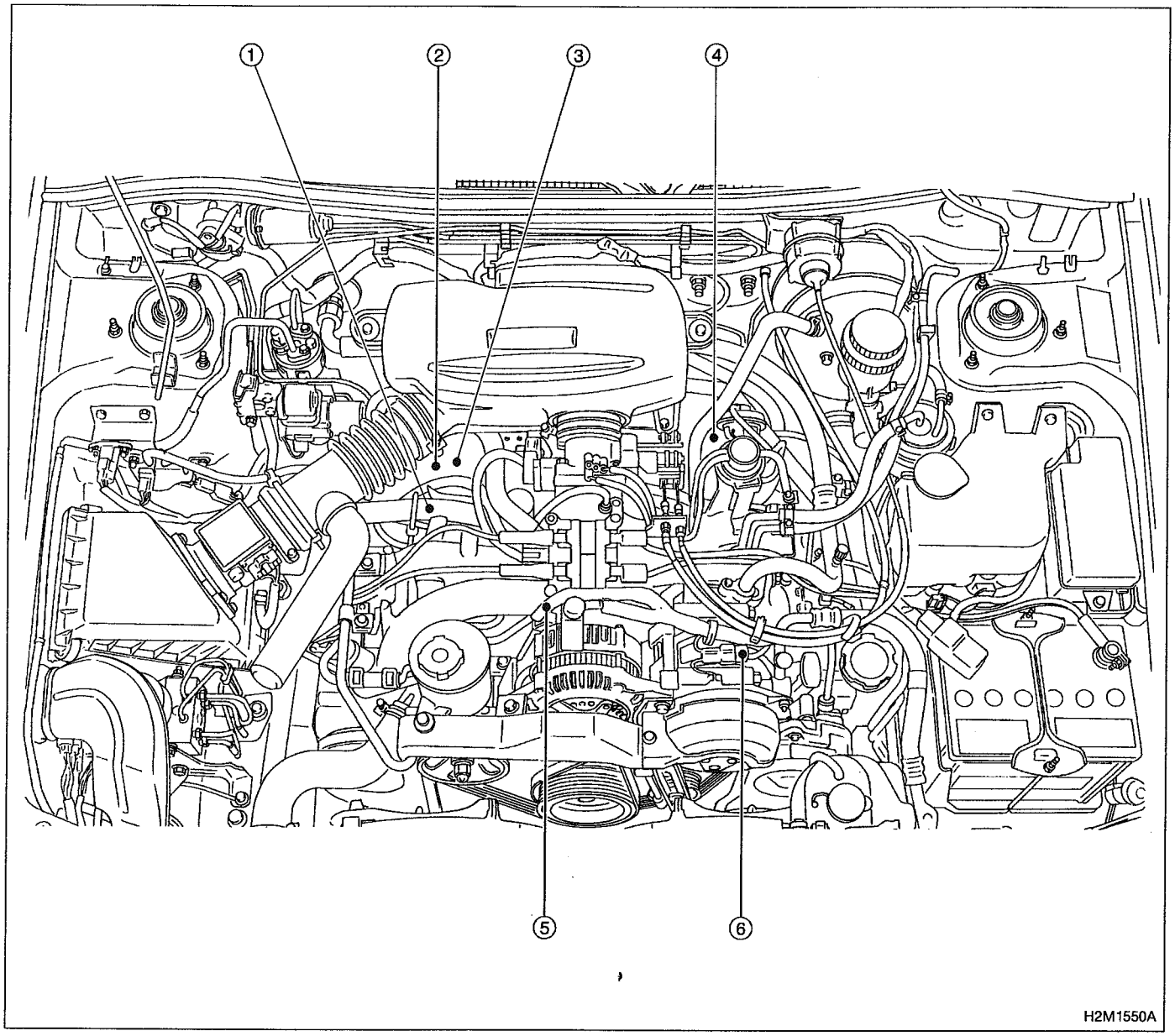


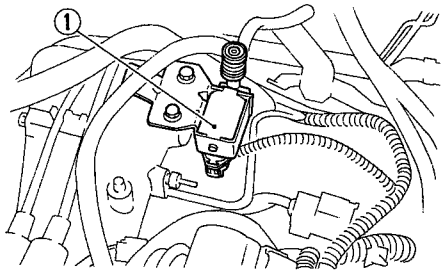
8) Remove air intake system.
(1) Disconnect connector from mass air flow sensor.
(2) Remove air intake duct with air cleaner upper cover, and remove air cleaner element.



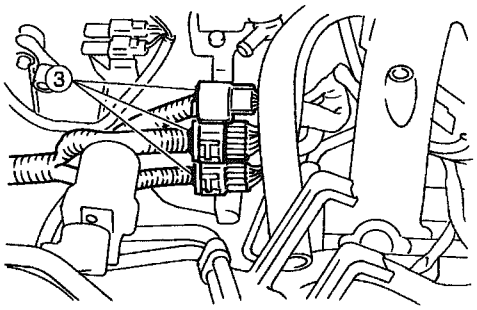
9) Remove canister and bracket. (2200 cc model)

10) Disconnect connectors, cables and hoses.
(1) Disconnect the following connectors.
① FICD solenoid valve (With A/C 1800 cc)
② Front oxygen sensor connector
③ Engine harness connectors
④ Engine ground terminal stay
⑤ Alternator connector and terminal
⑥ A/C compressor connectors (With A/C)

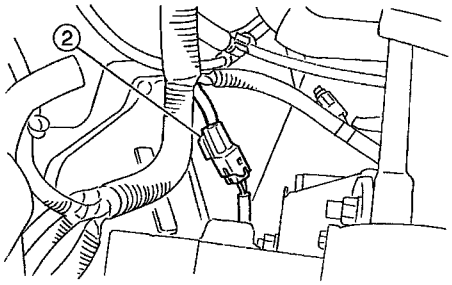




G2M0275



H2M1553A



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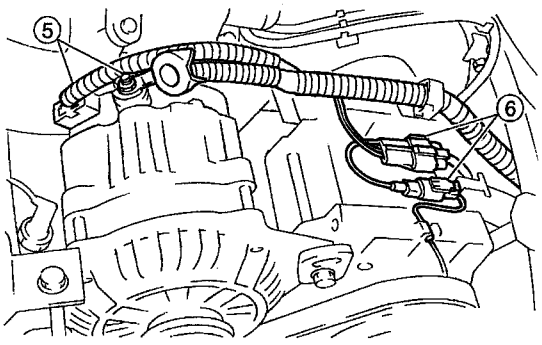

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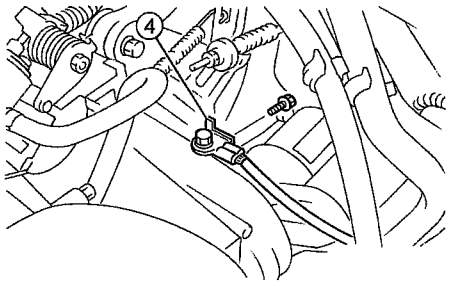
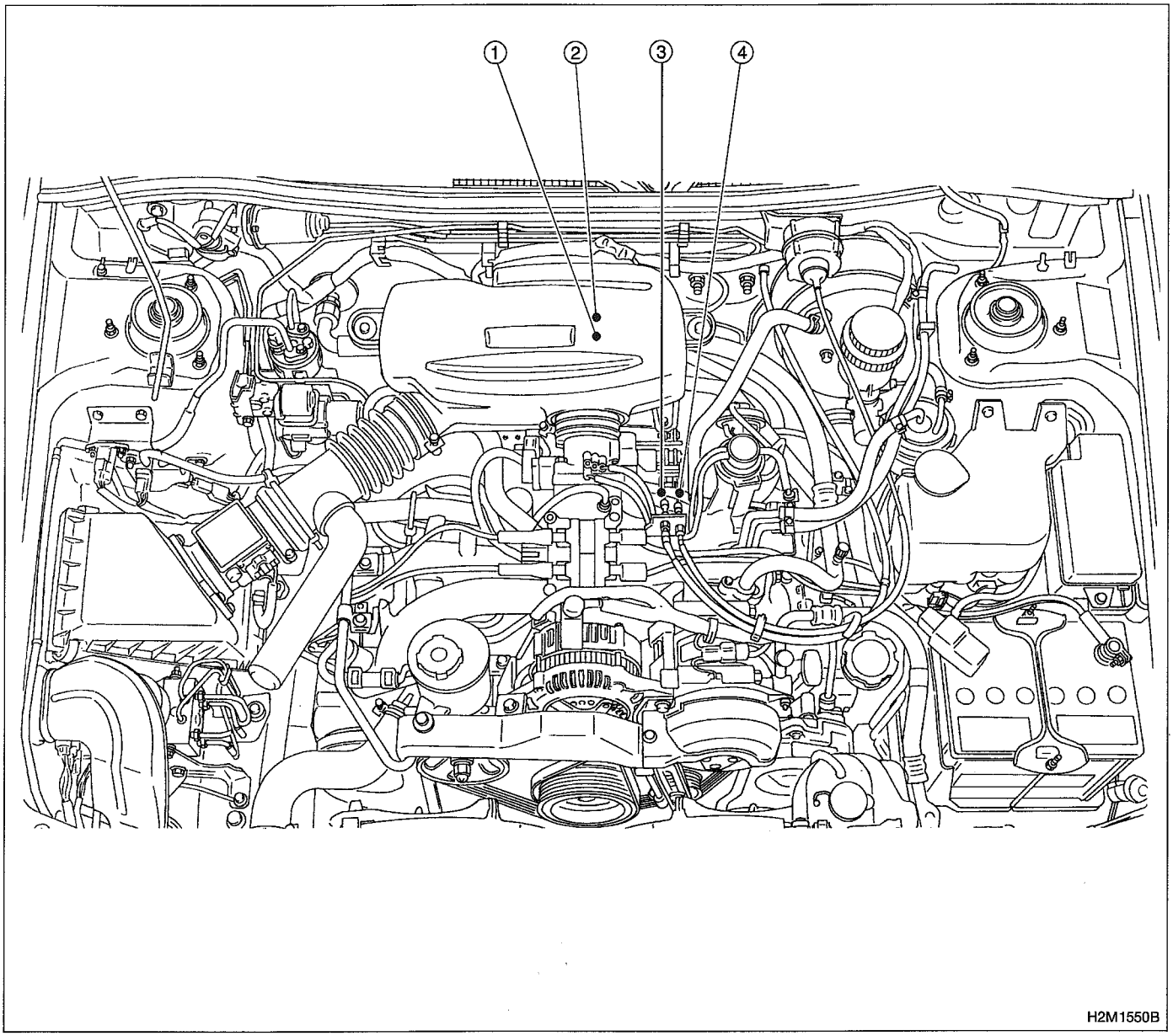
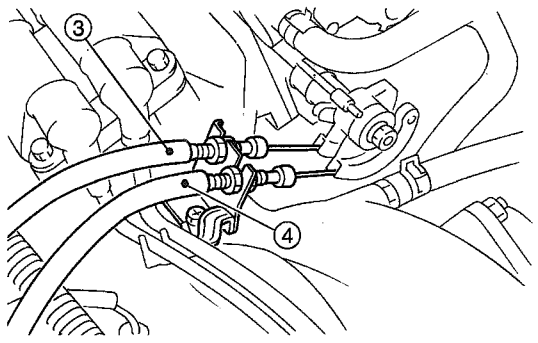


H2M1552A

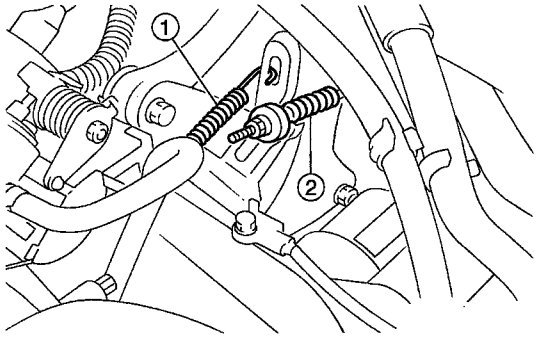
(2) Disconnect the following cables.
① Clutch release spring (MT model)
② Clutch cable (MT model)
③ Accelerator cable
④ Cruise control cable (With cruise control)



H2M1550B

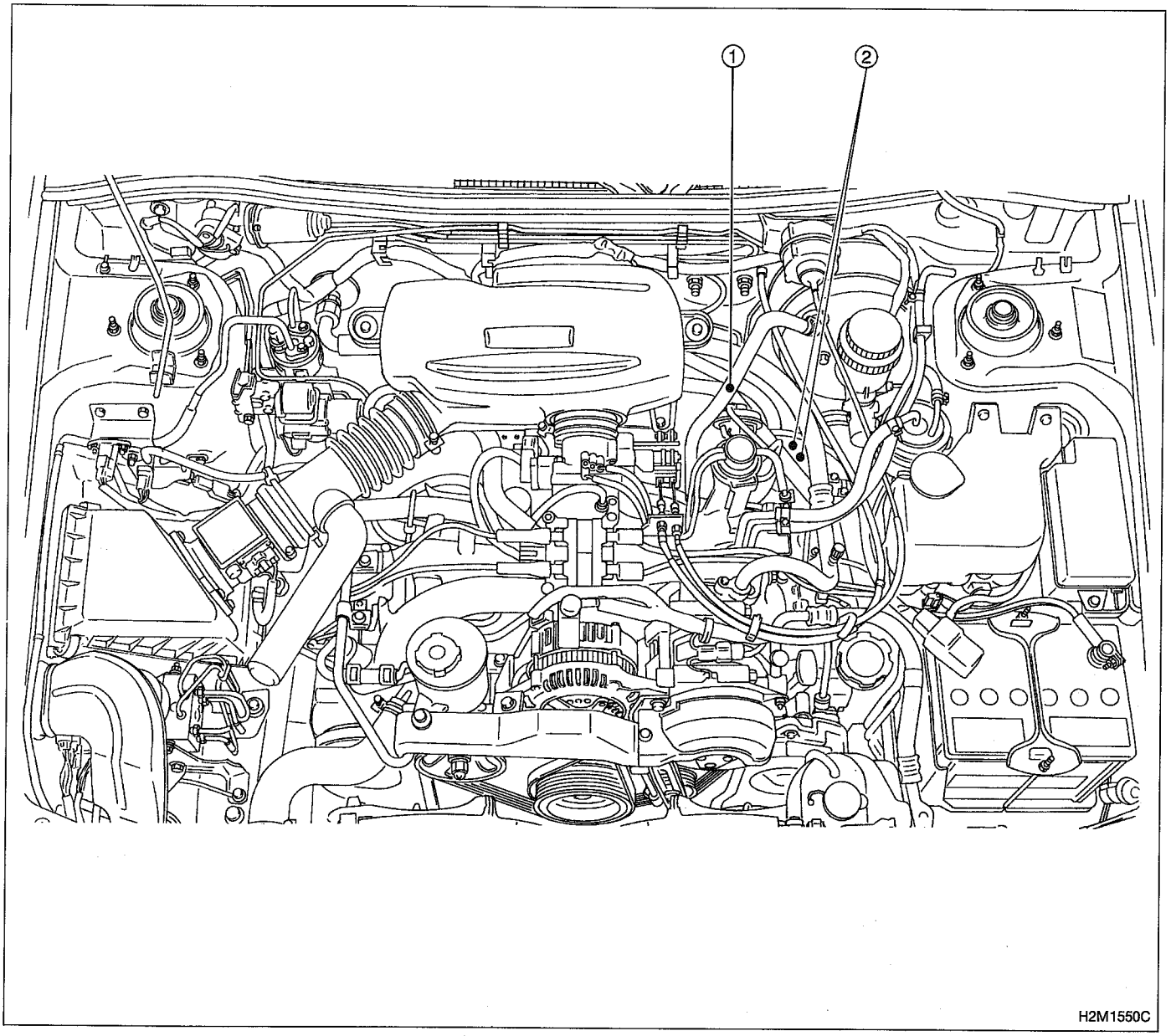


B2M1301A

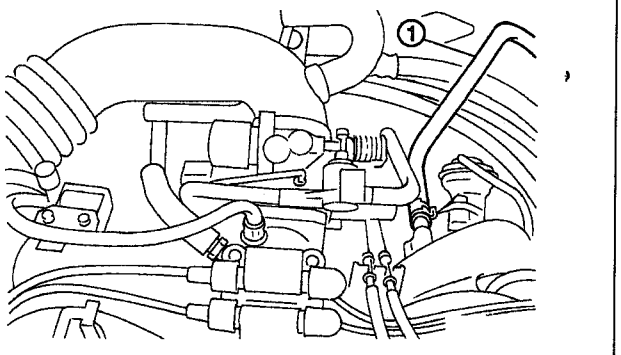


B2M1302A

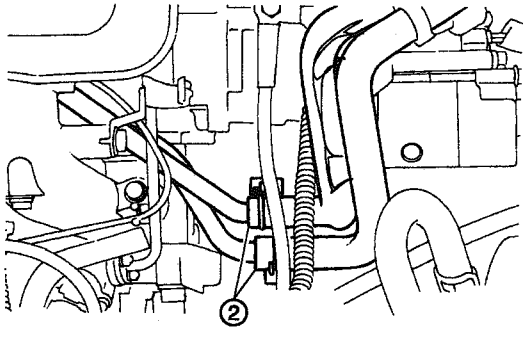
(3) Disconnect the following hoses.
① Brake booster vacuum hose
② Heater inlet and outlet hoses



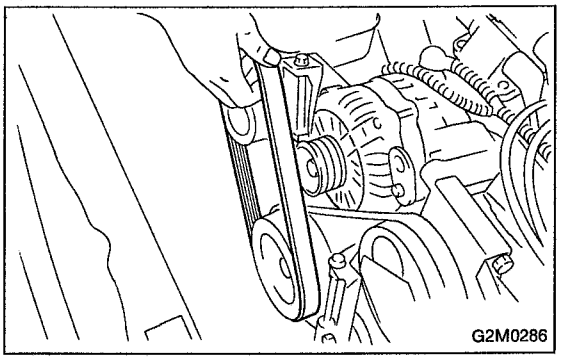
H2M1550C



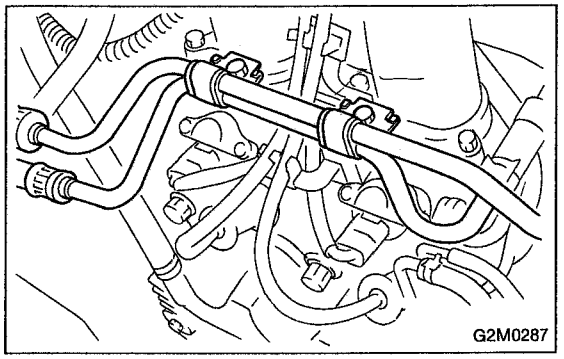
B2M0026A



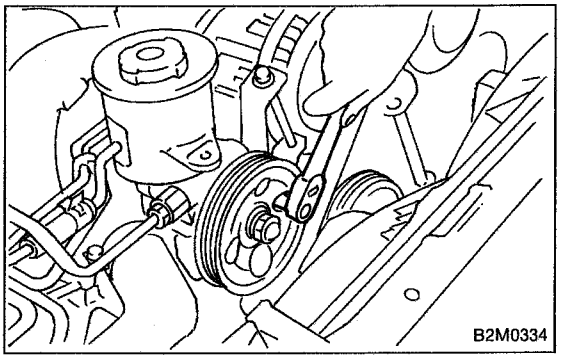
B2M0027



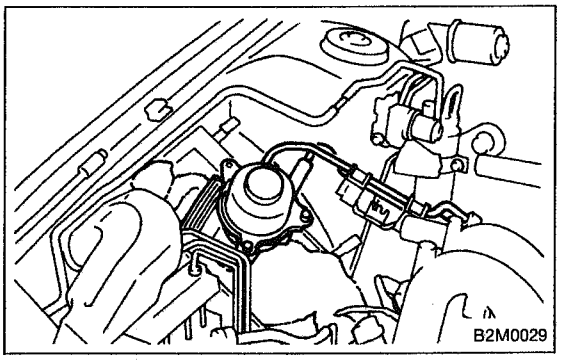
11) Remove power steering pump from bracket.
(1) Loosen lock bolt and slider bolt, and remove front side V-belt.



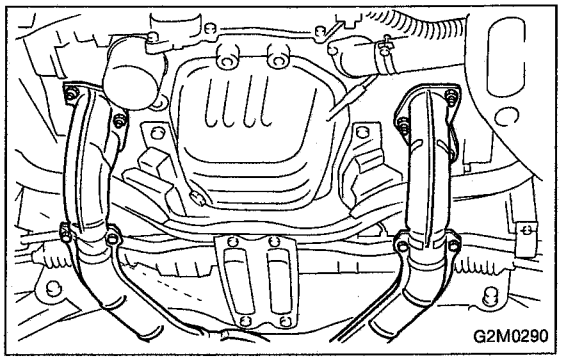
(2) Remove pipe with bracket from intake manifold.



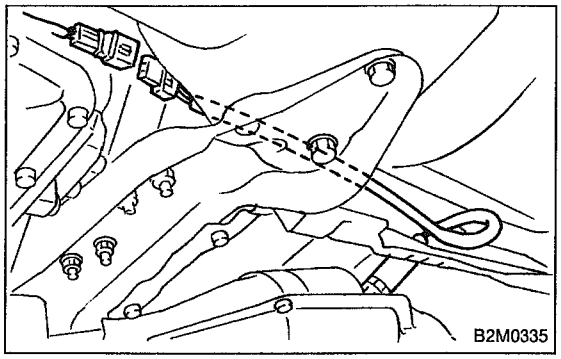
(3) Remove bolts which install power steering pump from bracket.



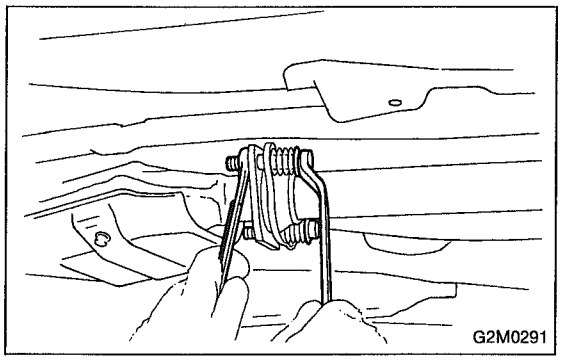
(4) Place power steering pump on the right side wheel apron.



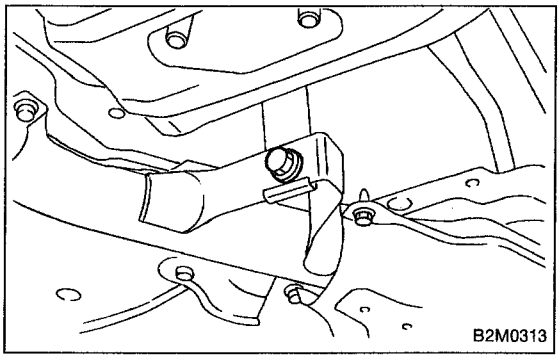
12) Remove front exhaust pipe and center exhaust pipe.
(1) Lift-up the vehicle.
(2) Remove nuts which install front exhaust pipe onto engine.



(3) Disconnect connector from rear oxygen sensor.

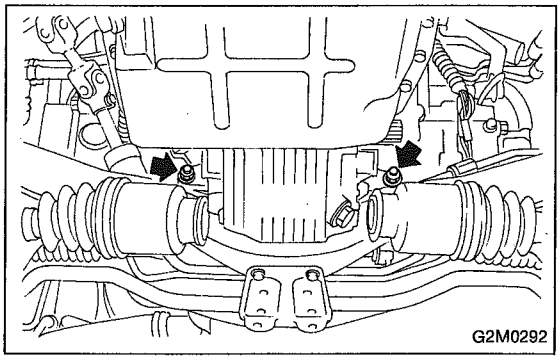


(4) Separate center exhaust pipe from rear exhaust pipe.

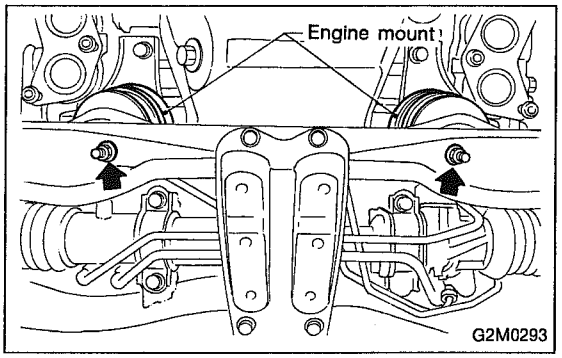


(5) Remove bolt which installs center exhaust pipe on hunger bracket.
(6) Take off front and center exhaust pipes.

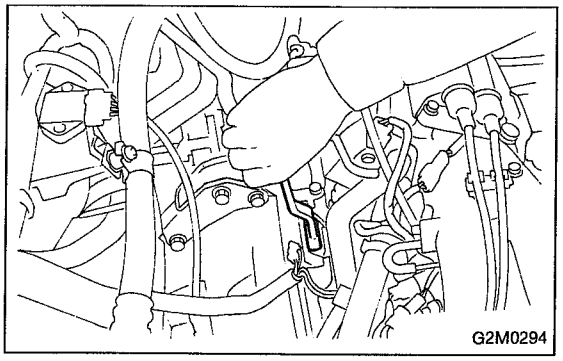
CAUTION:
Exhaust pipe will drop when all bolts are removed. So, hold it when removing the last bolt.



13) Remove nuts which hold lower side of transmission to engine.

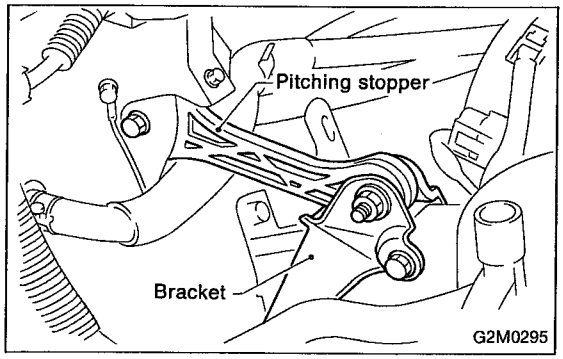


14) Remove nuts which install front cushion rubber onto front crossmember.


G2M0294

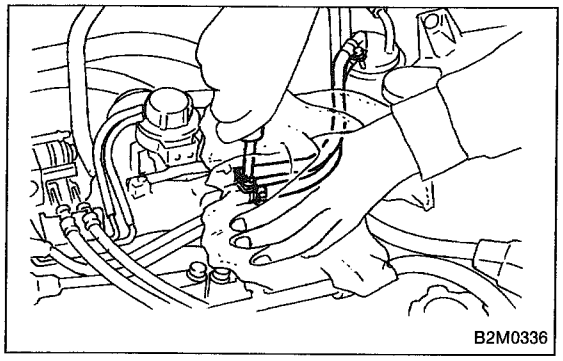
15) Separate torque converter from drive plate. (AT model)
(1) Lower the vehicle.
(2) Remove service hole plug.
(3) Remove bolts which hold torque converter to drive plate.
(4) Remove other bolts while rotating the engine using ST.

ST 499977000 CRANK PULLEY WRENCH



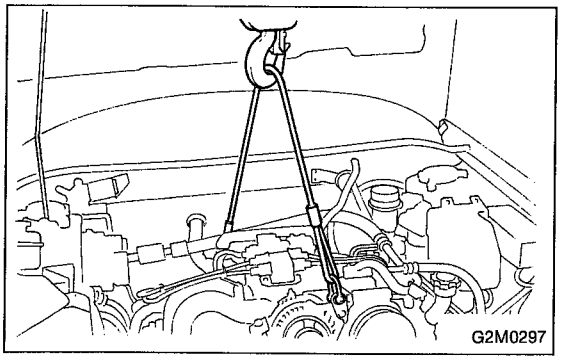
G2M0295

16) Remove pitching stopper.

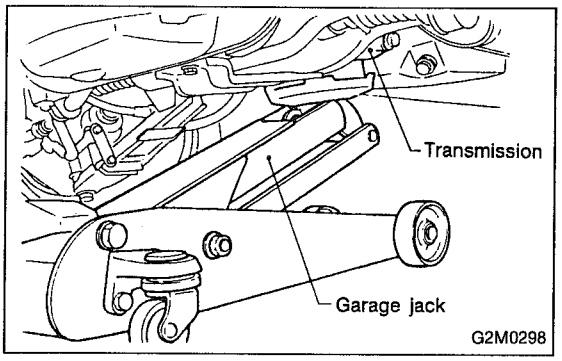

B2M0336

17) Disconnect fuel delivery hose, return hose and evaporation hose.

CAUTION:
- **Disconnect hose with its end wrapped with cloth to prevent fuel from splashing.**
- **Catch fuel from hose into container.**


G2M0297

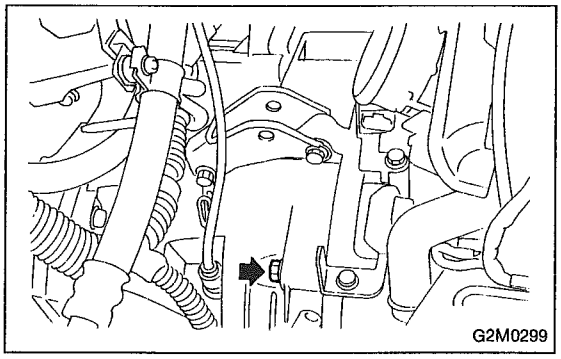
18) Support engine with a lifting device and wire ropes.



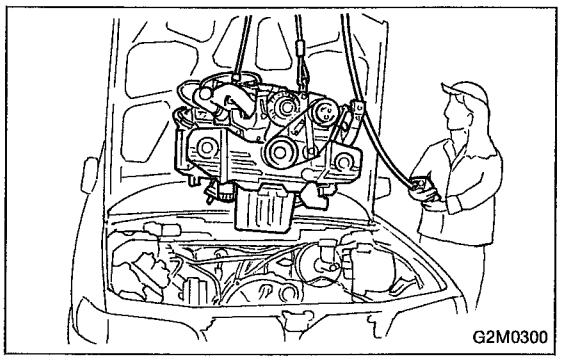
G2M0298

19) Support transmission with a garage jack.

CAUTION:
Before moving engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because transmission lowers under its own weight.


G2M0299

20) Remove bolts which holds upper side of transmission to engine.


G2M0300

21) Remove engine from vehicle.
(1) Slightly raise engine.
(2) Raise transmission with garage jack.
(3) Move engine horizontally until mainshaft is withdrawn from clutch cover.
(4) Slowly move engine away from engine compartment.

CAUTION:
Be careful not to damage adjacent parts or body panels with crank pulley, oil pressure gauge, etc.

C: INSTALLATION

1. Install engine to transmission.

2. Tighten bolts which hold upper side of transmission to engine.

3. Remove lifting device and wire rope.
4. Remove garage jack.

5. Install pitching stopper.

AT model

6. Install torque converter onto drive plate.

7. Install canister and bracket. (2200 cc)
8. Install power steering pump on bracket.

9. Tighten nuts which hold lower side of transmission to engine.
10. Tighten nuts which install front cushion rubber onto crossmember.

11. Install front exhaust pipe and center exhaust pipe.

12. Connect hoses, connectors and cables.

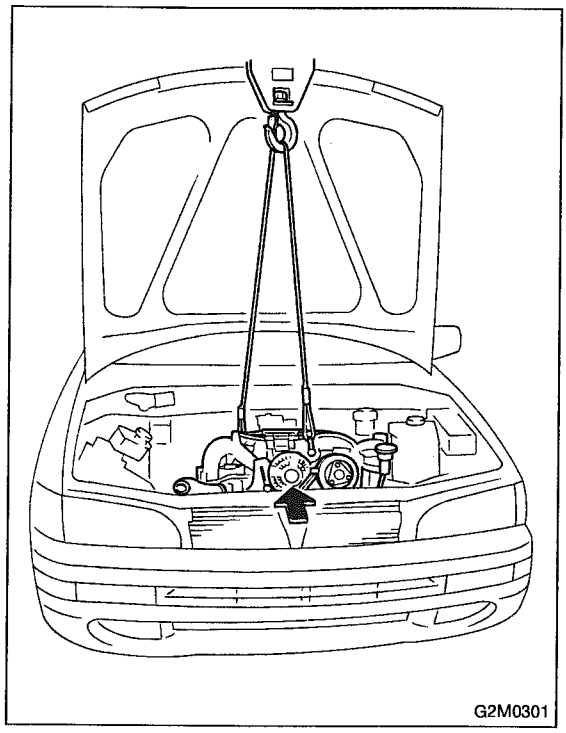
13. Install air intake system.
- Air intake duct
- Air cleaner element and upper cover.

With A/C

14. Install A/C pressure hoses.

15. Install cooling system.

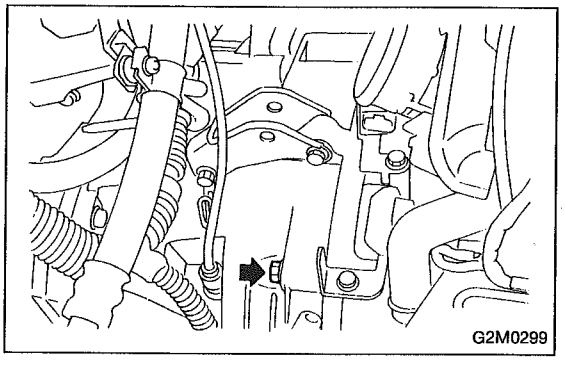
16. Install battery onto the vehicle, and connect cables.
17. Fill coolant.
18. Check ATF level, and connect if necessary. [AT]
19. Correct power steering oil, and bleed air.
20. Remove front hood stay, and close front hood.
21. Remove the vehicle from lift arms.


G2M0301

1) Install engine onto transmission.
   (1) Position engine in engine compartment and align it with transmission.

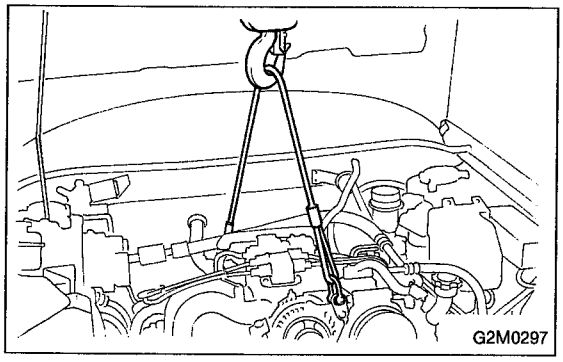
CAUTION:
Be careful not to damage adjacent parts or body panels with crank pulley, oil pressure gauge, etc.

(2) Apply a small amount of grease to splines of main-shaft.

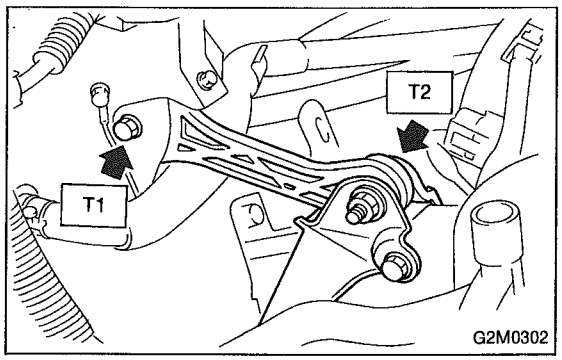

G2M0299

2) Tighten bolts which hold upper side of transmission to engine.

Tightening torque:
50 ± 4 N·m (5.1 ± 0.4 kg-m, 36.9 ± 2.9 ft-lb)

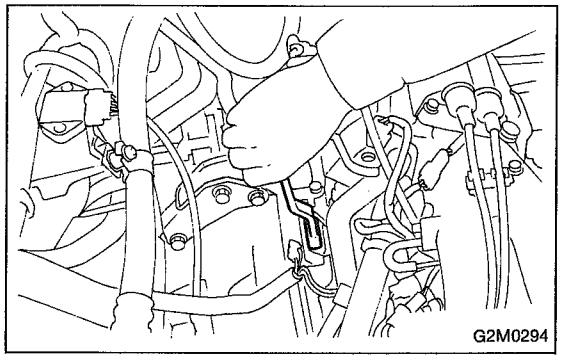

G2M0297

3) Remove lifting device and wire ropes.
4) Remove garage jack.



5) Install pitching stopper.

Tightening torque:
T1: 49 ± 5 N·m (5.0 ± 0.5 kg-m, 36.2 ± 3.6 ft-lb)
T2: 57 ± 10 N·m (5.8 ± 1.0 kg-m, 42 ± 7 ft-lb)



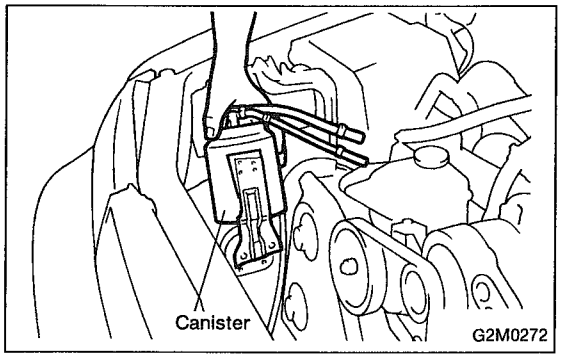
6) Install torque converter onto drive plate. (AT model)
(1) Tighten bolts which hold torque converter to drive plate.
(2) Tighten other bolts while rotating the engine by using ST.

ST 499977000 CRANK PULLEY WRENCH

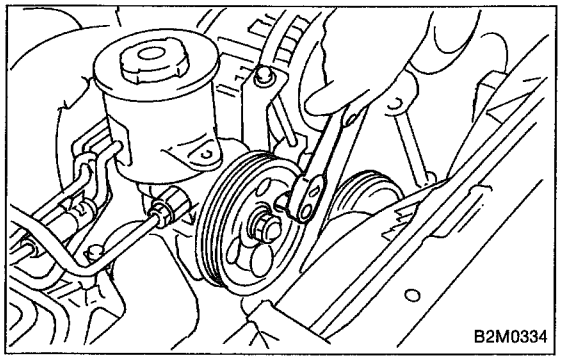
CAUTION:
Be careful not to drop bolts into torque converter housing.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

(3) Clog plug onto service hole.

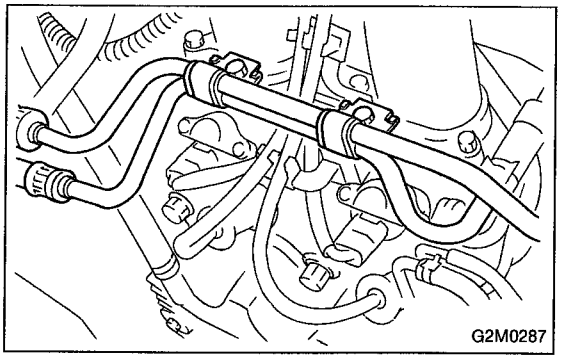


7) Install canister and bracket. (2200 cc model)

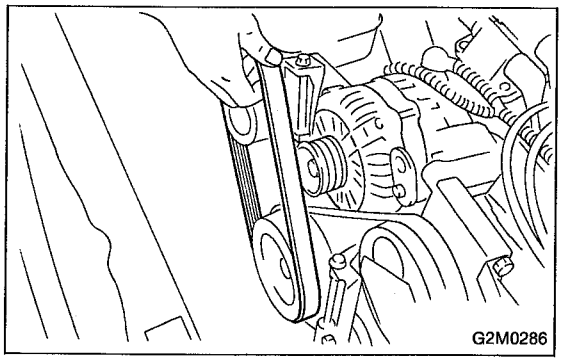


8) Install power steering pump on bracket.
(1) Install power steering pump on bracket, and tighten bolts.

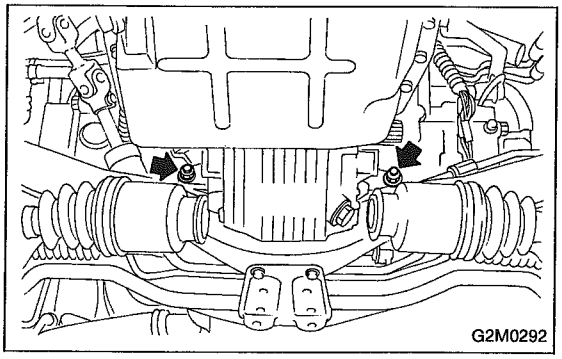
Tightening torque:
39 ± 10 N·m (4.0 ± 1.0 kg-m, 29 ± 7 ft-lb)



(2) Install power steering pipe bracket on right side intake manifold, and install spark plug codes.

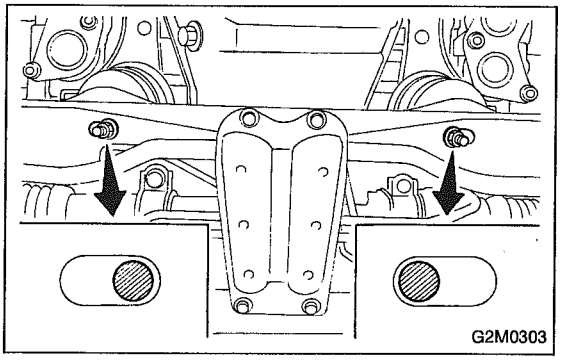


(3) Install front side V-belt, and adjust it.
<Ref. to 1-5 [0200].>



9) Tighten nuts which hold lower side of transmission to engine.

Tightening torque:
50 ± 4 N·m (5.1 ± 0.4 kg-m, 36.9 ± 2.9 ft-lb)



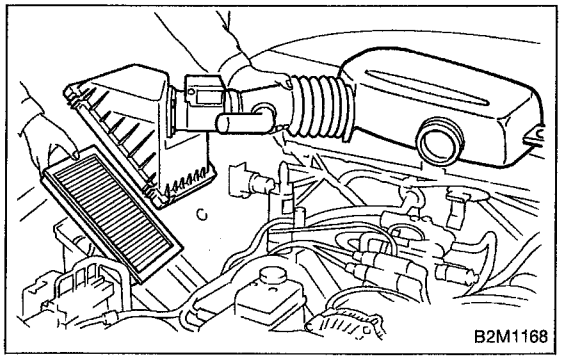
10) Tighten nuts which install front cushion rubber onto crossmember.

Tightening torque:
69 ± 15 N·m (7.0 ± 1.5 kg-m, 51 ± 11 ft-lb)

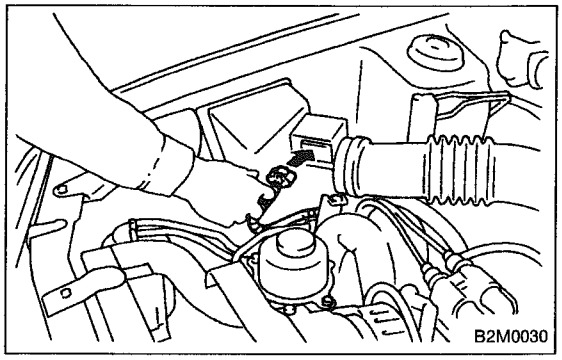
CAUTION:
Be sure to tighten front cushion rubber mounting bolts in the innermost elliptical hole in the front crossmember.

11) Install front exhaust pipe and center exhaust pipe.
12) Connect hoses, connectors and cables.
    (1) Connect the following hoses.
        - Fuel delivery hose, return hose and evaporation hose
        - Heater inlet and outlet hoses
        - Brake booster vacuum hose
        - Canister hoses (2200 cc)
    (2) Connect the following connectors.
        - Engine ground terminal
        - Engine harness connectors
        - Front and rear oxygen sensor connector
        - Cam angle sensor connector
        - Crank angle sensor connector
        - Alternator connector and terminal
        - A/C compressor connectors (With A/C)
    (3) Connect the following cables.
        - Accelerator cable
        - Cruise control cables (With cruise control)
        - Clutch cable
        - Clutch release spring

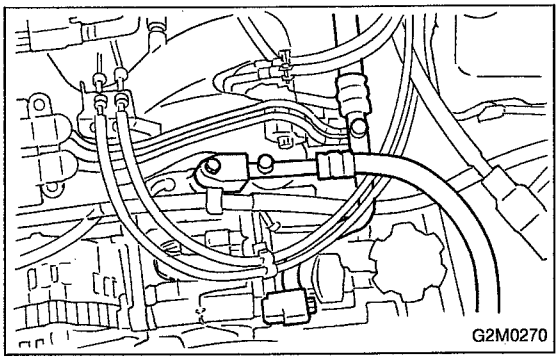
CAUTION:
After connecting each cable, adjust them.


B2M1168

13) Install air intake system.
    (1) Install air cleaner element.
    (2) Install air intake duct with air cleaner upper cover.


B2M0030

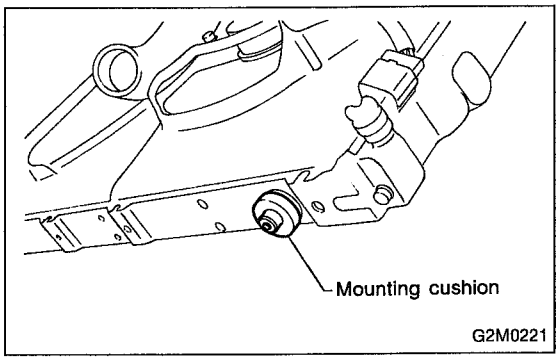
    (3) Connect connector to mass air flow sensor.


G2M0270

14) Install A/C flexible hoses. (With A/C)
<Ref. to 4-7 [W16B0].>

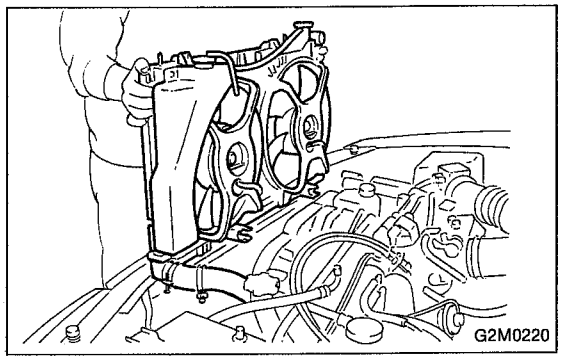
CAUTION:
Use new O-rings.

Tightening torque:
25 ± 7 N·m (2.5 ± 0.7 kg-m, 18.1 ± 5.1 ft-lb)

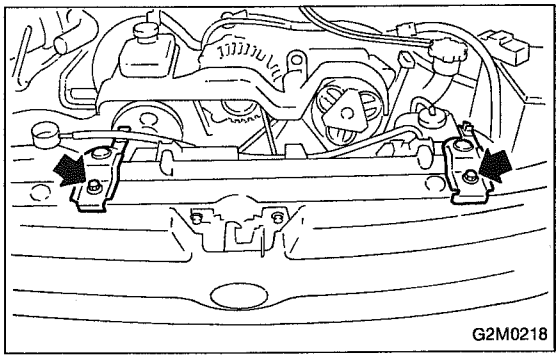


G2M0221

15) Install cooling system.
(1) Attach radiator mounting cushions to pins on lower side of radiator.

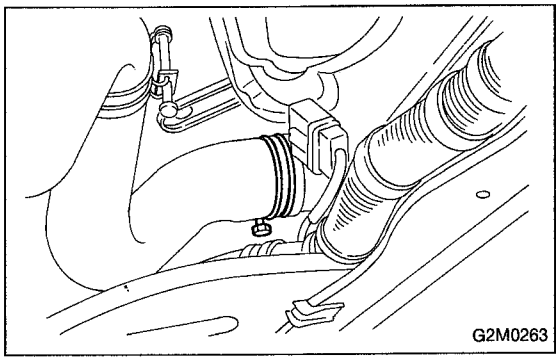

G2M0220

(2) Fit cushions on lower side of radiator, into holes on body side and install radiator.

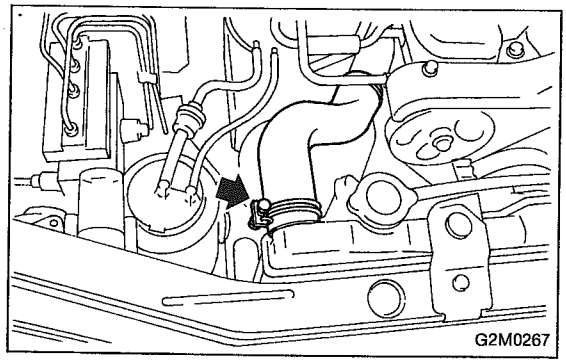

G2M0218

(3) Install radiator brackets and tighten bolts.

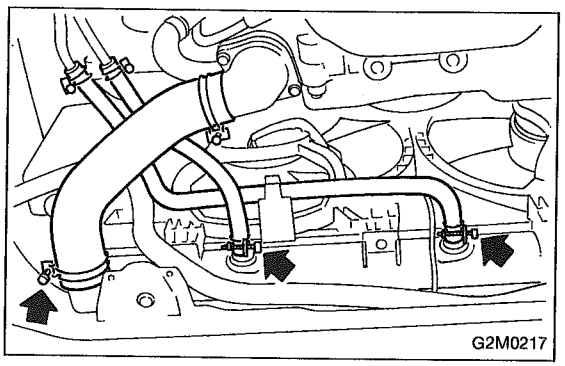
Tightening torque:
13.7 ± 1.5 N·m (1.4 ± 0.15 kg-m, 10.1 ± 1.1 ft-lb)


G2M0263

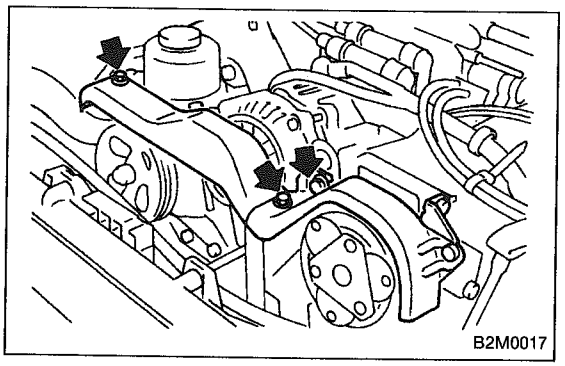
(4) Connect radiator fan motor connector.



(5) Connect radiator inlet hose.



(6) Connect radiator outlet hose.
(7) Connect ATF cooler hoses. (AT model)



(8) Install V-belt cover.

16) Install battery in the vehicle, and connect cables.
17) Fill coolant.
<Ref. to 1-5 [0600].>
18) Check ATF level and correct if necessary. (AT model)
<Ref. to 3-2 [W1B1].>
19) Charge A/C system with refrigerant.
<Ref. to 4-7 [W700].>
20) Remove front hood stay, and close front hood.
21) Remove the vehicle from lift arms.

2. Transmission

A: GENERAL PRECAUTION

1) Remove or install transmission in an area where chain hoists, lifting devices, etc. are available for ready use.
2) Be sure not to damage coated surfaces of body panels with tools or stain seats and windows with coolant or oil. Place a cover over fenders, as required, for protection.
3) Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
4) Lift-up or lower the vehicle when necessary. Make sure to support the correct positions. <Ref. to 1-3 [0700].>

B: REMOVAL

1. Open front hood fully, and support it with stay.
2. Disconnect battery ground terminal.

↓

3. Remove air intake duct and chamber.

↓

4. Disconnect connectors and cables.

↓

5. Remove starter.

↓

6. Remove pitching stopper and bracket.

↓

AT model

7. Separate torque converter from drive plate.
8. Remove ATF level gauge.

↓

9. Remove transmission connector bracket.

↓

10. Set special tools.

↓

11. Remove bolt which holds right upper side of transmission to engine.

↓

12. Remove exhaust system.
- Front exhaust pipe
- Center exhaust pipe
- Rear exhaust pipe
- Heat shield cover

↓

AT model

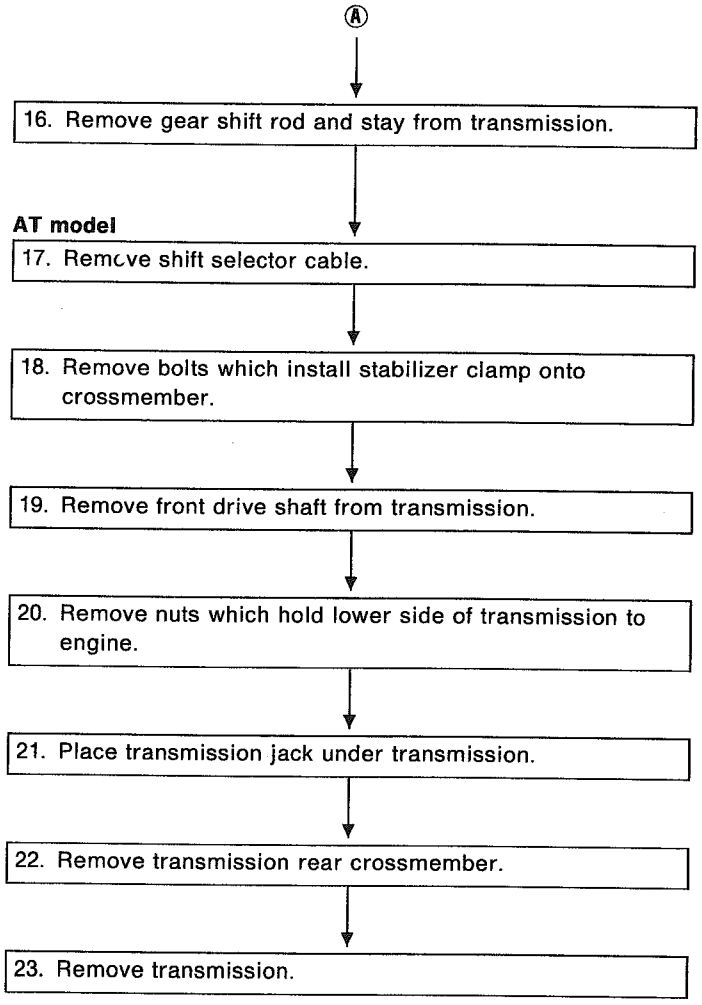
13. Drain ATF to remove drain plug.
14. Disconnect ATF cooler hose from pipe on transmission side, and remove ATF supply pipe.

↓

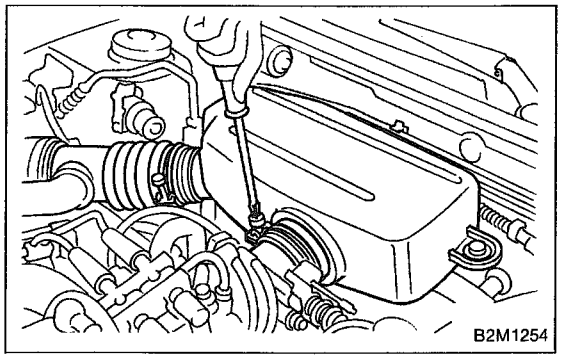
15. Remove propeller shaft.

↓

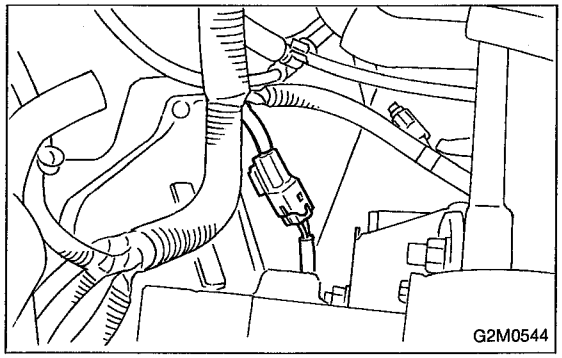
Ⓐ


Ⓐ
16. Remove gear shift rod and stay from transmission.
AT model
17. Remove shift selector cable.
18. Remove bolts which install stabilizer clamp onto crossmember.
19. Remove front drive shaft from transmission.
20. Remove nuts which hold lower side of transmission to engine.
21. Place transmission jack under transmission.
22. Remove transmission rear crossmember.
23. Remove transmission.

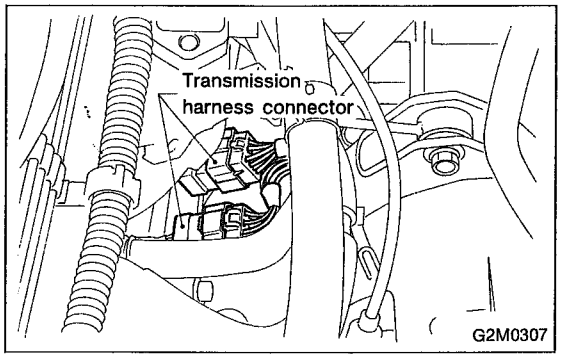
1) Open front hood fully, and support with stay.
2) Disconnect battery ground terminal.


B2M1254

3) Remove air intake duct and chamber.

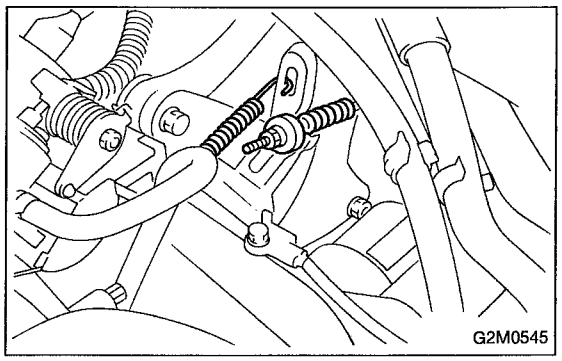

G2M0544

4) Disconnect connectors and cables.
   (1) Disconnect the following connectors.
   - Front oxygen sensor connector

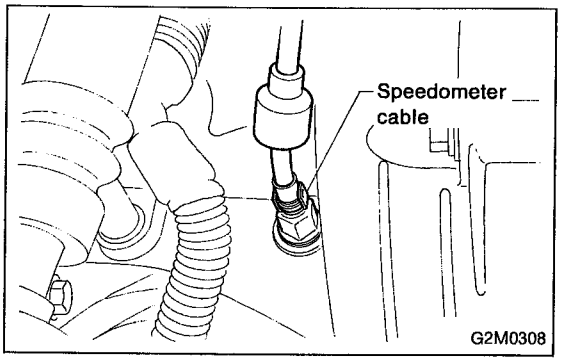


G2M0307

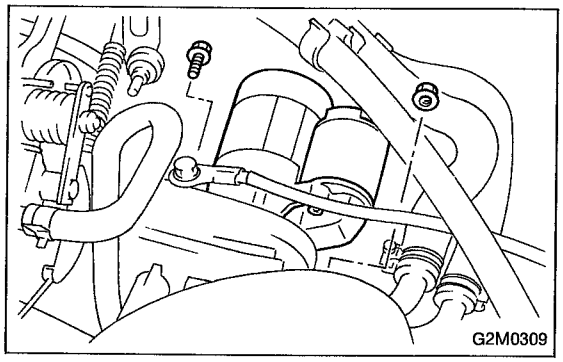
   - Transmission harness connector
   - Transmission ground terminal


G2M0545

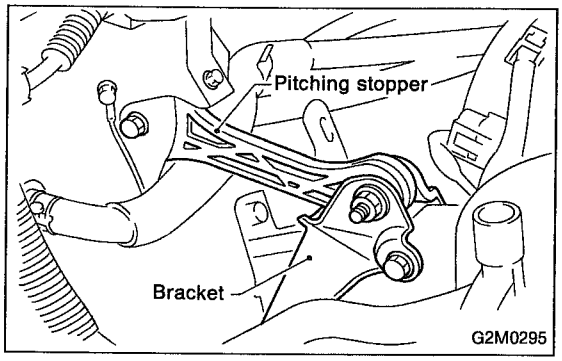
   (2) Disconnect the following cables.
   - Clutch release spring
   - Clutch cable
   - Hill holder cable



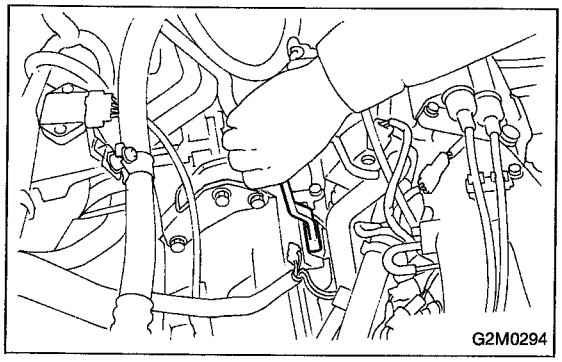
● Speedometer cable



5) Remove starter.
(1) Disconnect connectors and terminal from starter.
(2) Remove bolt which installs upper side of starter.
(3) Remove nut which installs lower side of starter, and remove starter from transmission.



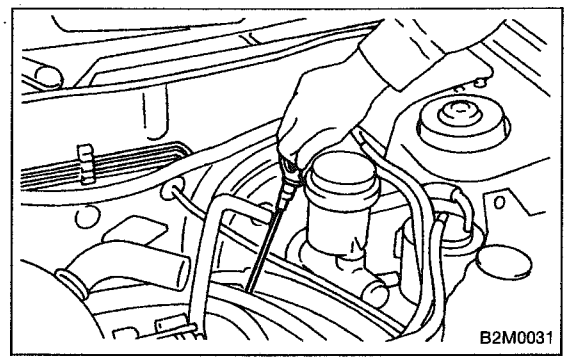
6) Remove pitching stopper.



7) Separate torque converter from drive plate. (AT model)
(1) Remove service hole plug.
(2) Remove bolts which hold torque converter to drive plate.
(3) While rotating the engine, remove other bolts using ST.

ST 499977000 CRANK PULLEY WRENCH

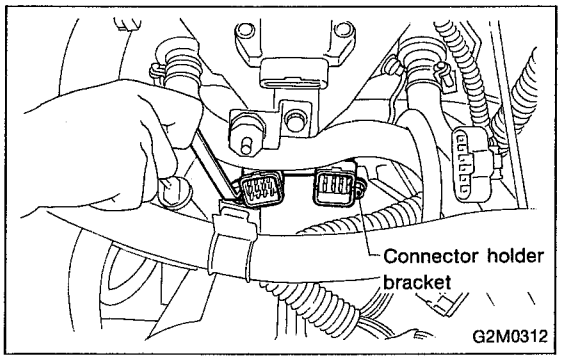
CAUTION:
Be careful not to drop bolts into torque converter housing.



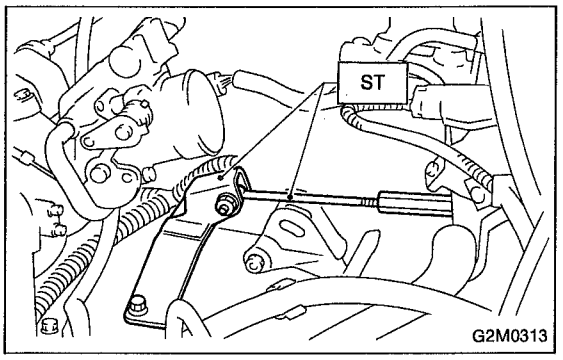
8) Remove ATF level gauge. (AT model)

CAUTION:

Plug opening to prevent entry of foreign particles into transmission fluid.



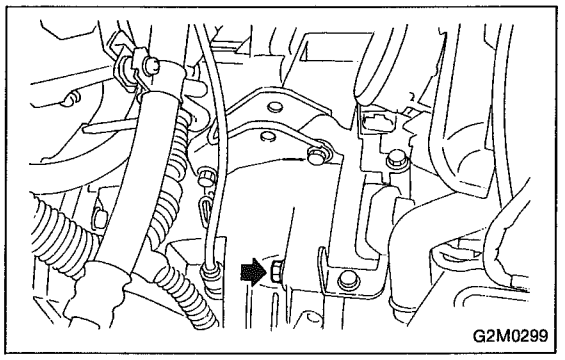
9) Remove transmission connector holder bracket.



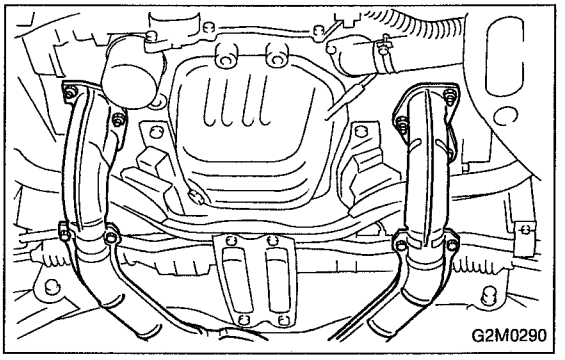
10) Set special tool.

ST 41099AA000 ENGINE SUPPORT ASSY

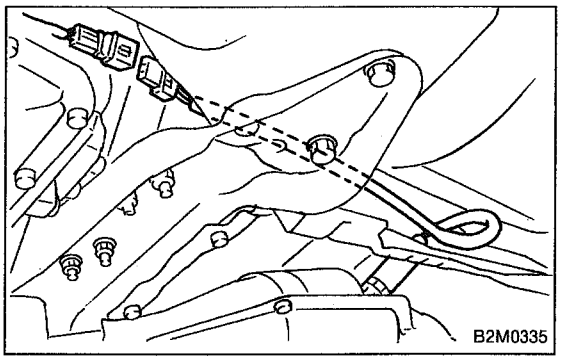
NOTE:
Also available is Part No. 927670000.



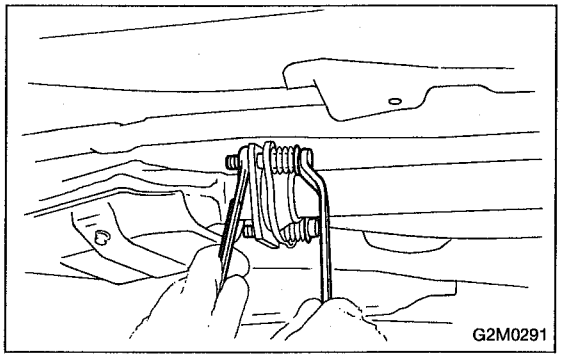
11) Remove bolt which holds right upper side of transmission to engine.



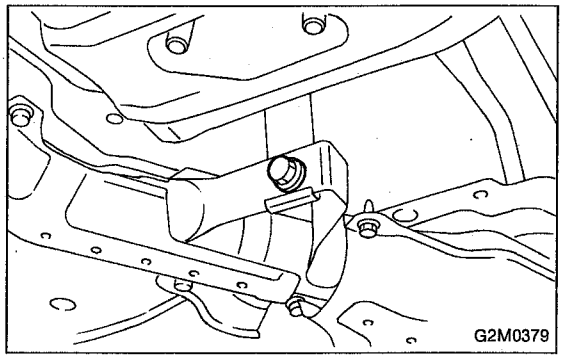
12) Remove exhaust system.
(1) Lift-up the vehicle.
(2) Remove nuts which install front exhaust pipe onto engine.



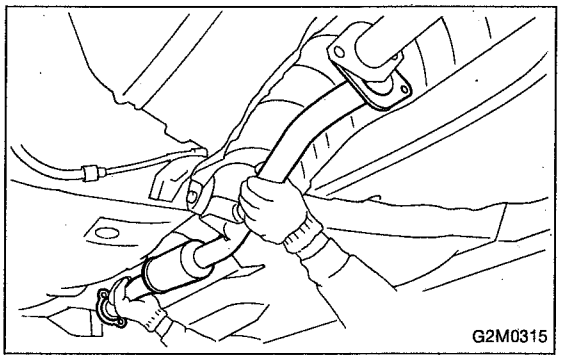
(3) Disconnect connector from rear oxygen sensor.



(4) Separate center exhaust pipe from rear exhaust pipe.

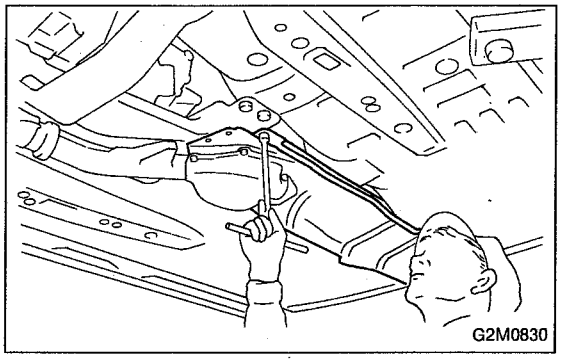


(5) Remove bolt which installs center exhaust pipe to hunger bracket then take off front and center exhaust pipes.

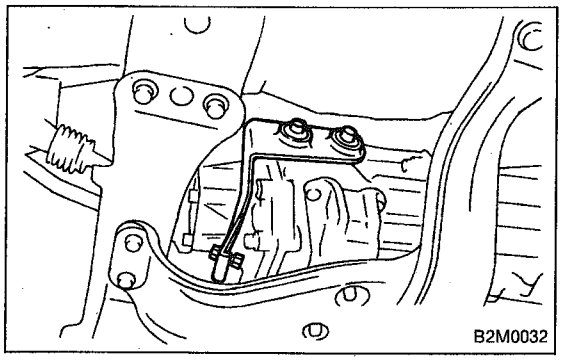


(6) Remove rear exhaust pipe.

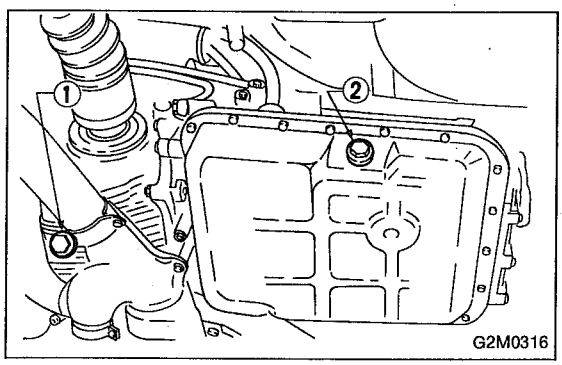
CAUTION:
When removing exhaust pipes, be careful each exhaust pipe does not drop out.



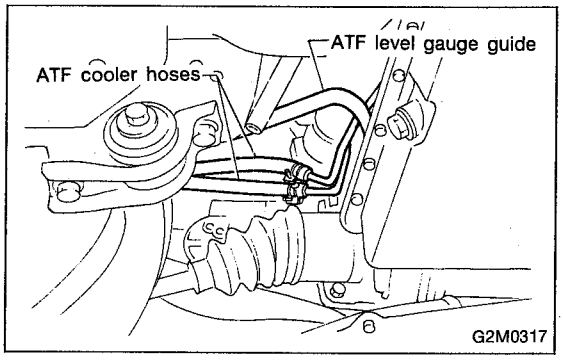
(7) Remove heat shield cover of rear exhaust pipe.



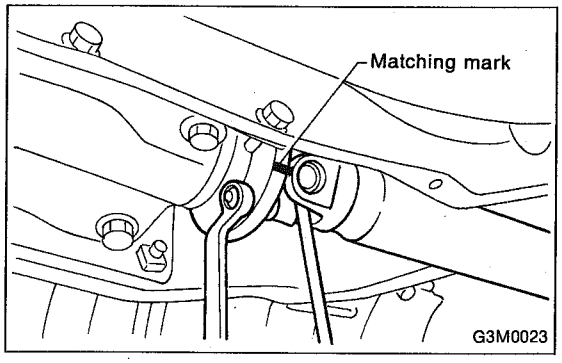
(8) Remove hanger bracket from right side of transmission.



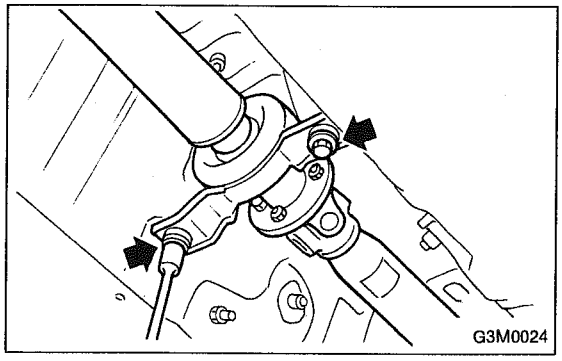
13) Drain ATF to remove drain plug. (AT model)
① Front differential oil drain plug
② ATF drain plug



14) Disconnect ATF cooler hoses from pipes of transmission side and remove ATF level gauge guide. (AT model)

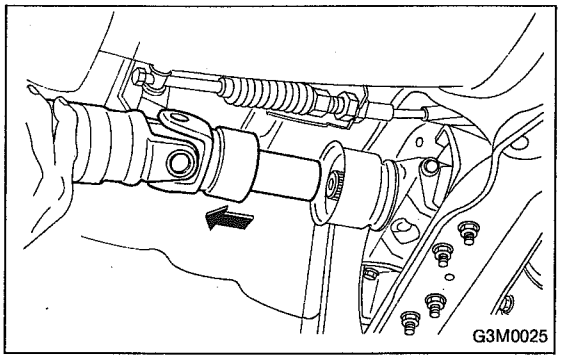


15) Remove propeller shaft.
(1) Remove front cover of rear differential mount.
(2) Separate propeller shaft from rear differential.



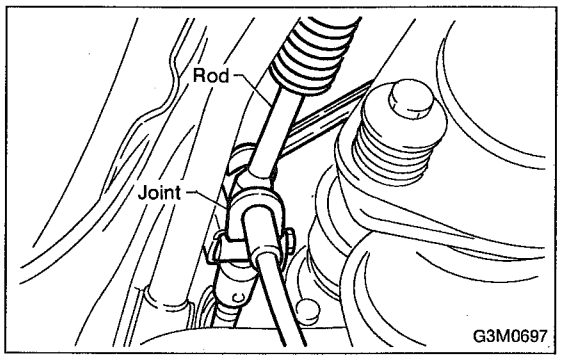
(3) Remove bolts which hold center bearing onto body.

CAUTION:
Be careful not to drop propeller shaft.

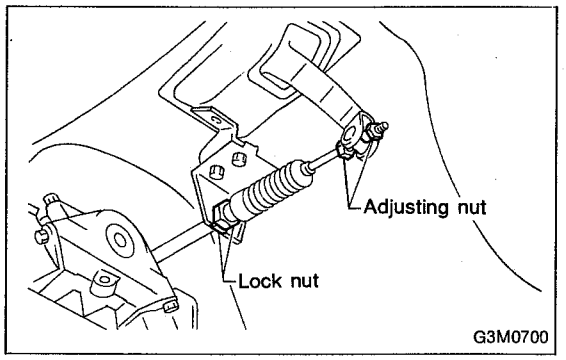


(4) Remove propeller shaft from transmission.

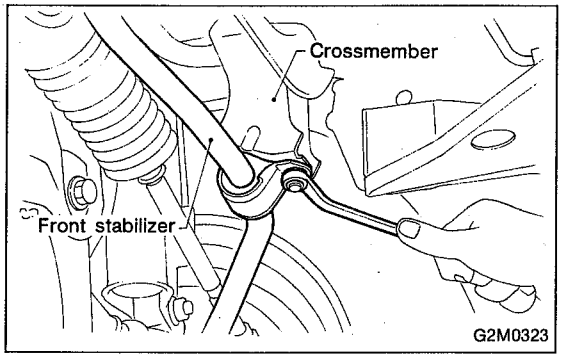
CAUTION:
● Be sure to use an empty container to catch oil flowing out when removing propeller shaft.
● Be sure not to damage oil seals and the frictional surface of sleeve yoke.
● Be sure to plug the opening in transmission after removal of propeller shaft.



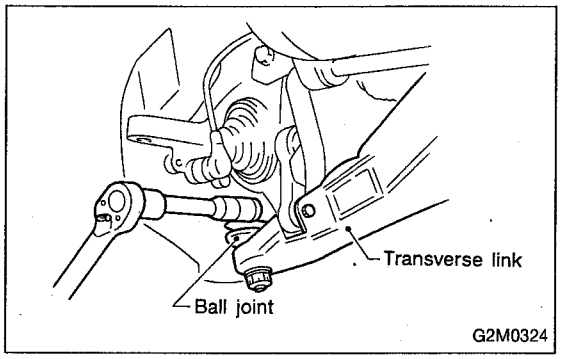
16) Remove gear shift rod and stay from transmission. (MT model)
(1) Remove spring.
(2) Disconnect stay from transmission.
(3) Disconnect rod from transmission.



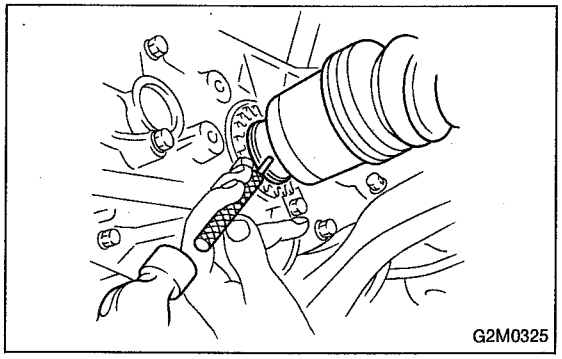
17) Remove shift selector cable. (AT model)
(1) Disconnect shift selector cable from selector lever.
(2) Remove cable bracket from selector lever assembly.



18) Remove bolts which install stabilizer clamp onto crossmember.

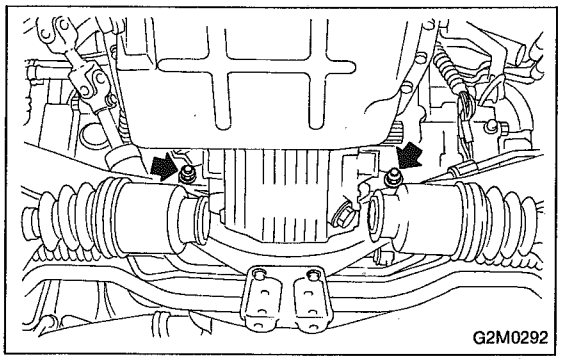


19) Remove front drive shaft from transmission.
(1) Remove transverse link from housing.
(2) Lower transverse link.

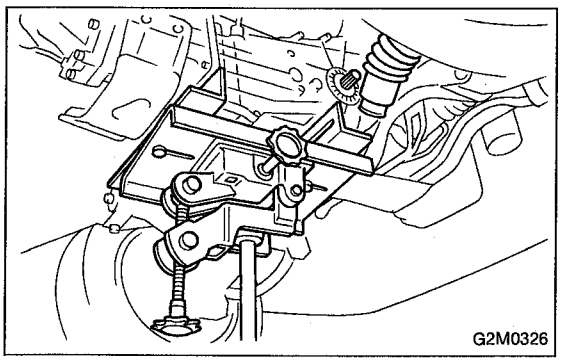


(3) Remove spring pin and separate front drive shaft from each side of the transmission.

CAUTION:
Discard removing spring pin. Replace with a new one.

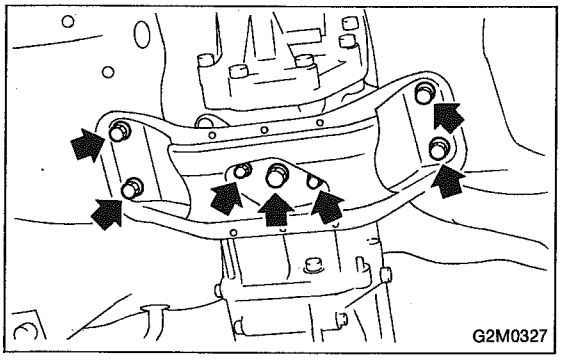


20) Remove nuts which hold lower side of transmission to engine.



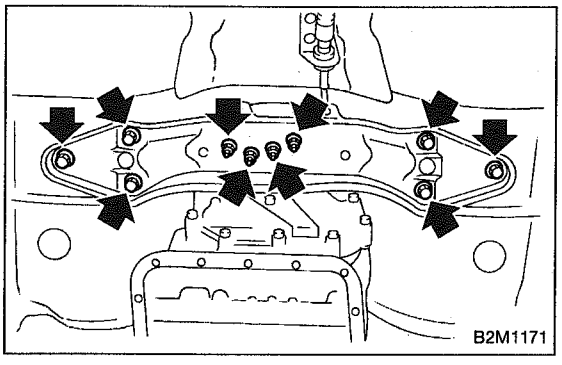
21) Place transmission jack under transmission.

CAUTION:
- **Always support transmission case with a transmission jack.**
- **On AT model, make sure that the support plates of transmission jack do not touch the oil pan.**

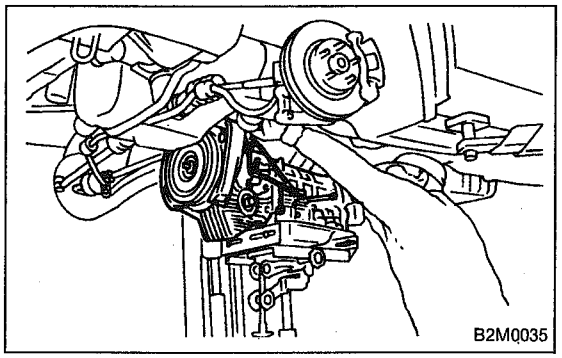


22) Remove transmission rear crossmember.

- **MT model**



- **AT model**



23) Remove transmission.

CAUTION:

- **Move transmission jack toward rear until mainshaft is withdrawn from clutch cover. (MT model)**
- **Move transmission and torque converter as a unit away from engine. (AT model)**

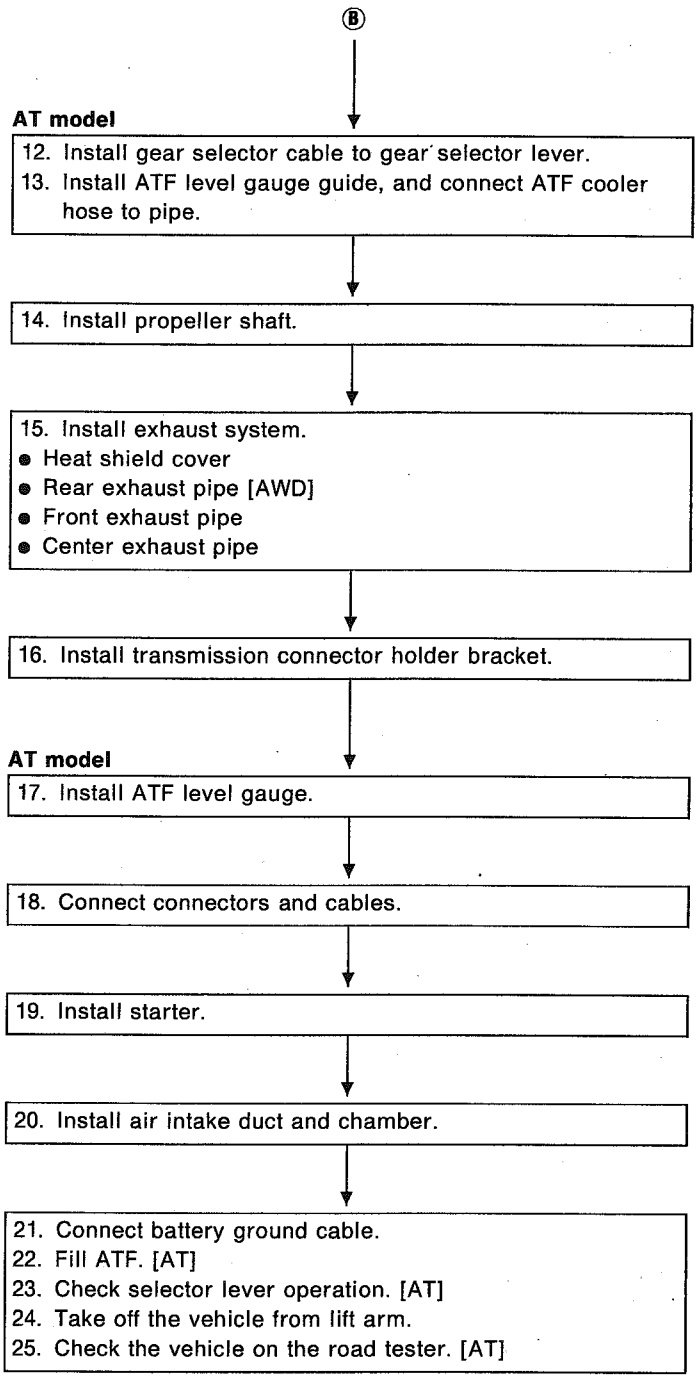
C: INSTALLATION

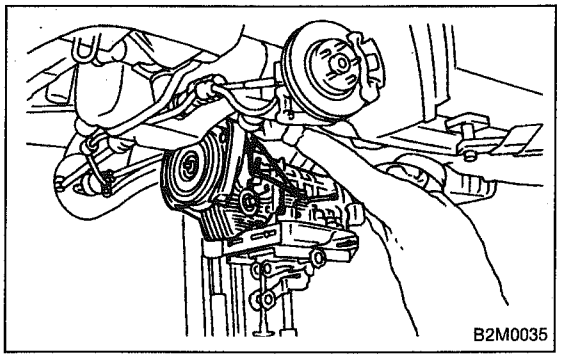
1. Install transmission to engine.
2. Install transmission rear crossmember.
3. Take off transmission jack.
4. Tighten nuts which hold lower side of transmission to engine.
5. Tighten bolt which holds right upper side of transmission to engine.

AT model

6. Install torque converter to drive plate.
7. Remove special tools.
8. Install pitching stopper and bracket.
9. Install front drive shafts into transmission.
10. Install stabilizer clamps onto front crossmember.
11. Install gear shift rod and stay.

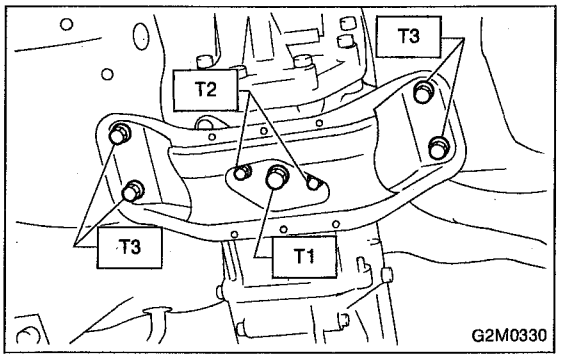
Ⓑ


Ⓑ
AT model
12. Install gear selector cable to gear selector lever.
13. Install ATF level gauge guide, and connect ATF cooler hose to pipe.
14. Install propeller shaft.
15. Install exhaust system.
● Heat shield cover
● Rear exhaust pipe [AWD]
● Front exhaust pipe
● Center exhaust pipe
16. Install transmission connector holder bracket.
AT model
17. Install ATF level gauge.
18. Connect connectors and cables.
19. Install starter.
20. Install air intake duct and chamber.
21. Connect battery ground cable.
22. Fill ATF. [AT]
23. Check selector lever operation. [AT]
24. Take off the vehicle from lift arm.
25. Check the vehicle on the road tester. [AT]


B2M0035

1) Install transmission onto engine.
   (1) Gradually raise transmission with transmission jack.
   (2) Engage them at splines.

CAUTION:
Be careful not to strike mainshaft against clutch cover. (MT model)

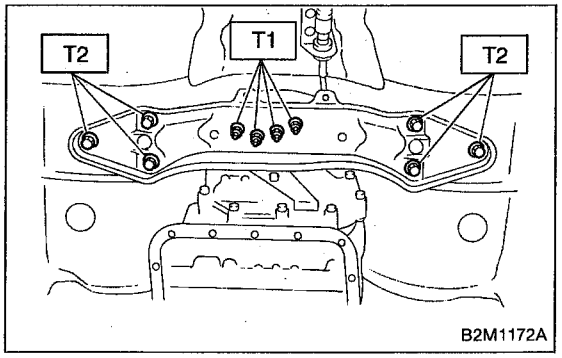


G2M0330

2) Install transmission rear crossmember.

- **MT model**

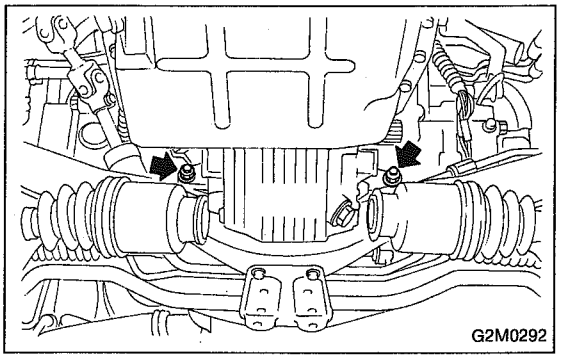
Tightening torque:
T1: 24.5 ± 1.5 N·m (2.50 ± 0.153 kg-m, 18.07 ± 1.11 ft-lb)
T2: 37 ± 10 N·m (3.8 ± 1.0 kg-m, 27 ± 7 ft-lb)
T3: 69 ± 15 N·m (7.0 ± 1.5 kg-m, 51 ± 11 ft-lb)



B2M1172A

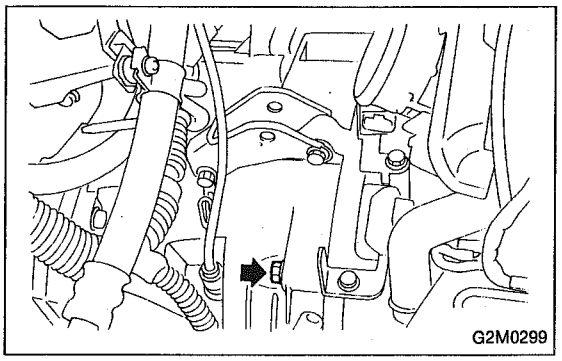
- **AT model**

Tightening torque:
T1: 37 ± 10 N·m (3.8 ± 1.0 kg-m, 27 ± 7 ft-lb)
T2: 69 ± 15 N·m (7.0 ± 1.5 kg-m, 51 ± 11 ft-lb)


G2M0292

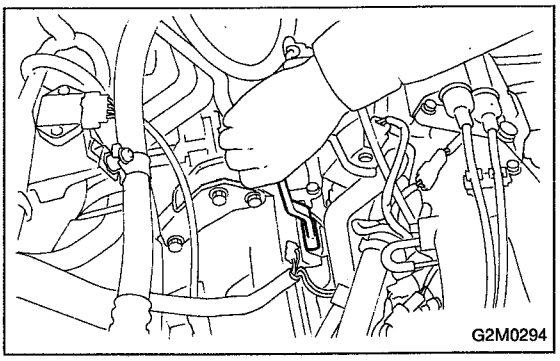
3) Take off transmission jack.
4) Tighten nuts which hold lower side of transmission to engine.

Tightening torque:
50 ± 4 N·m (5.1 ± 0.4 kg-m, 36.9 ± 2.9 ft-lb)


G2M0299

5) Tighten bolt which holds right upper side of transmission to engine.

Tightening torque:
50 ± 4 N·m (5.1 ± 0.4 kg-m, 36.9 ± 2.9 ft-lb)



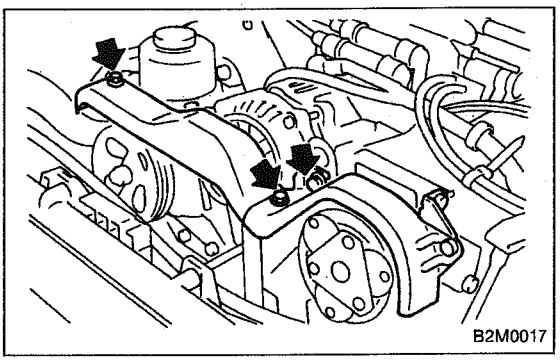
6) Install torque converter to drive plate. (AT model)
(1) Tighten bolts which hold torque converter to drive plate.
(2) Tighten other bolts while rotating the engine by using ST.

ST 499977000 CRANK PULLEY WRENCH

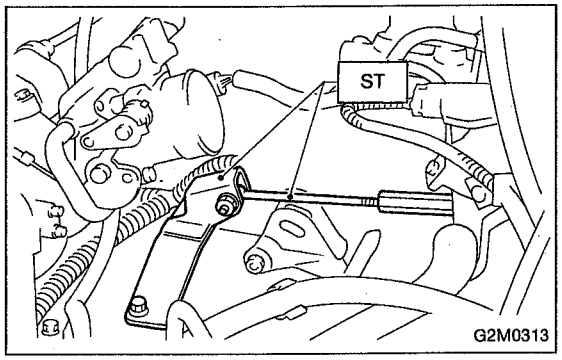
CAUTION:
Be careful not to drop bolts into torque converter housing.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

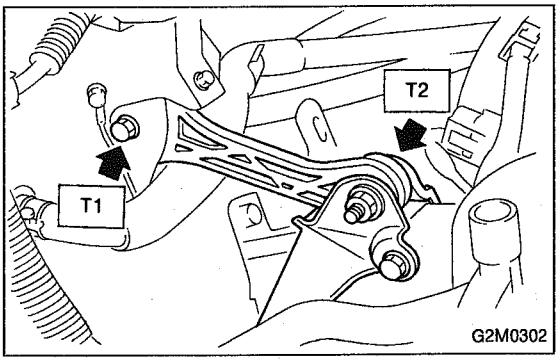
(3) Clog plug onto service hole.



(4) Install V-belt cover.

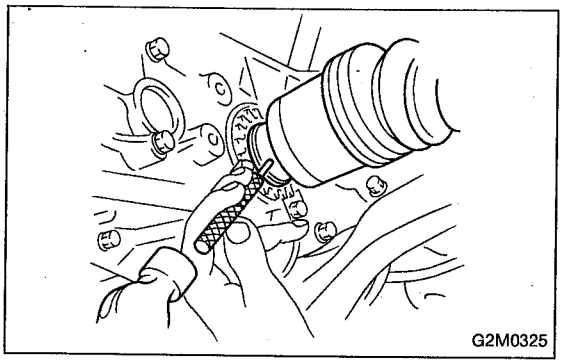


7) Remove special tool.



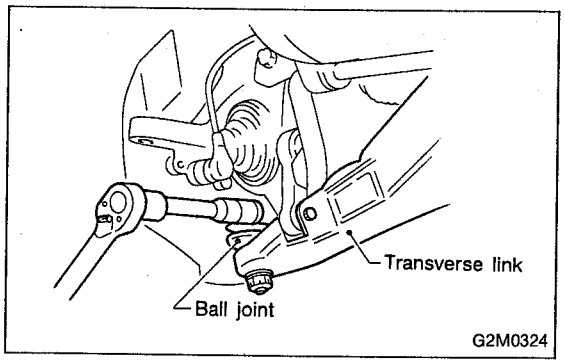
8) Install pitching stopper.

Tightening torque:
T1: 49 ± 5 N·m (5.0 ± 0.5 kg-m, 36.2 ± 3.6 ft-lb)
T2: 57 ± 10 N·m (5.8 ± 1.0 kg-m, 42 ± 7 ft-lb)


G2M0325

9) Install front drive shafts into transmission.
(1) Lift-up the vehicle.
(2) Install front drive shaft into transmission.
(3) Drive spring pin into chamfered hole of drive shaft.

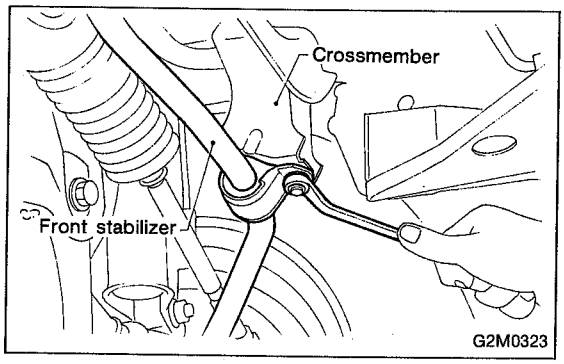
CAUTION:
Always use a new spring pin.



G2M0324

(4) Install ball joints of lower arm into knuckle arm of housing, and tighten installing bolt.

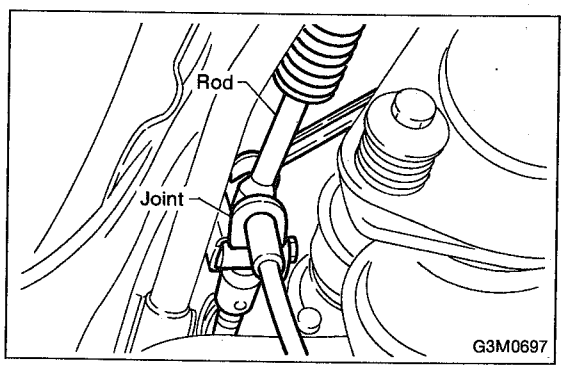
Tightening torque:
49 ± 10 N·m (5.0 ± 1.0 kg-m, 36 ± 7 ft-lb)



G2M0323

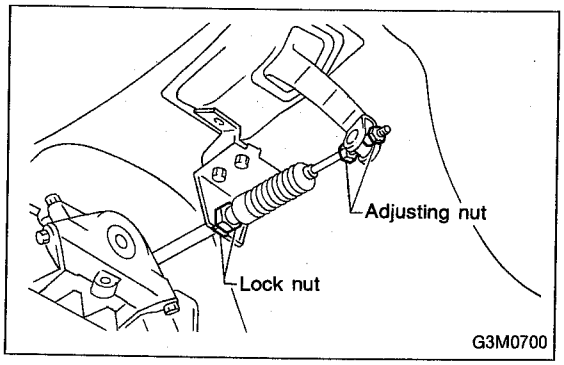
10) Install stabilizer clamp onto front crossmember.

Tightening torque:
25 ± 4 N·m (2.5 ± 0.4 kg-m, 18.1 ± 2.9 ft-lb)



G3M0697

11) Install gear shift rod and stay. (MT model)
(1) Install gear shift rod onto transmission.
(2) Install stay onto transmission.
(3) Install spring.

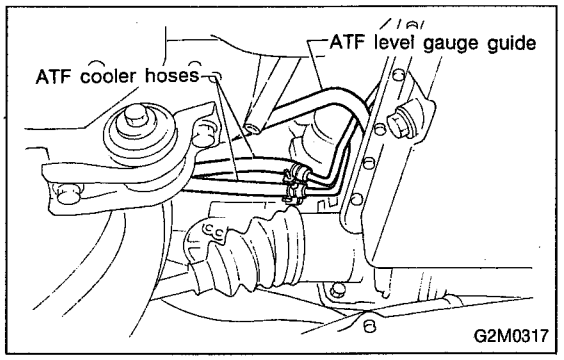


G3M0700

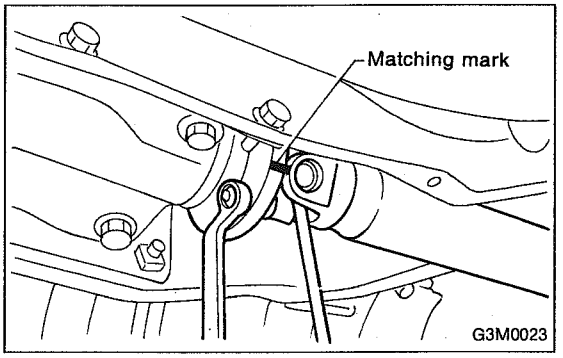
12) Install shift selector cable onto selector cable. (AT model)
(1) Install selector cable into selector lever.
(2) Install cable bracket onto body.

Tightening torque:
18 ± 5 N·m (1.84 ± 0.51 kg-m, 13.3 ± 3.7 ft-lb)

NOTE:
Tighten selector cable adjusting and lock nut after checking selector lever operation. <Ref. to 3-3 [W2E0].>

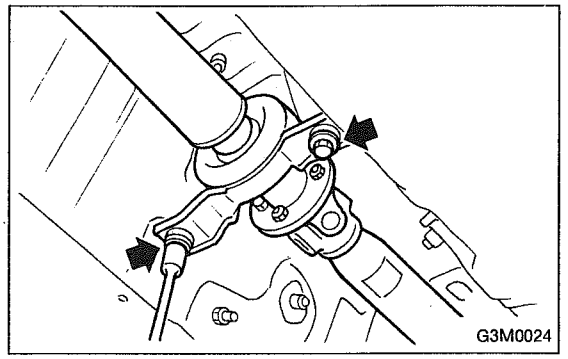


13) Install ATF level gauge guide, and ATF cooler hoses onto pipe. (AT model)



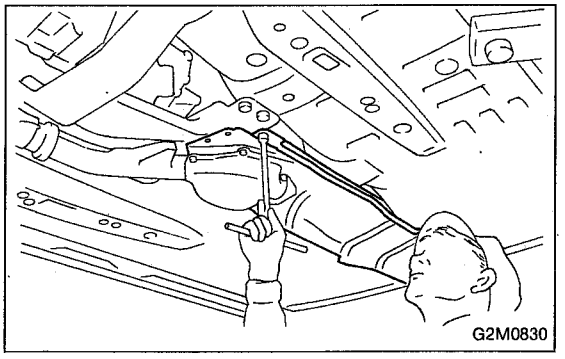
14) Install propeller shaft.
(1) Install propeller shaft into transmission.
(2) Tighten bolts which install propeller shaft onto companion flange of rear differential.

Tightening torque:
31 ± 8 N·m (3.2 ± 0.8 kg-m, 23.1 ± 5.8 ft-lb)

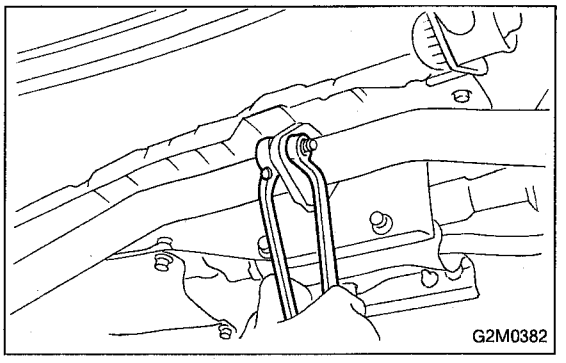


(3) Install center bearing bracket on body.

Tightening torque:
52 ± 5 N·m (5.3 ± 0.5 kg-m, 38.3 ± 3.6 ft-lb)

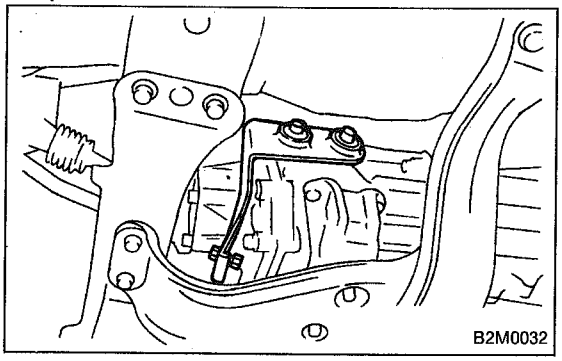


15) Install exhaust system.
(1) Install heat shield cover.

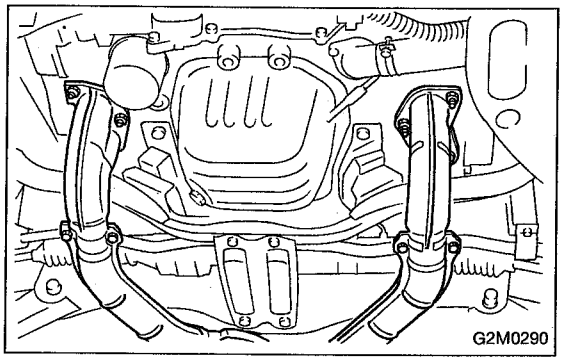


(2) Install rear exhaust pipe to muffler.

Tightening torque:
48 ± 9 N·m (4.9 ± 0.9 kg-m, 35.4 ± 6.5 ft-lb)

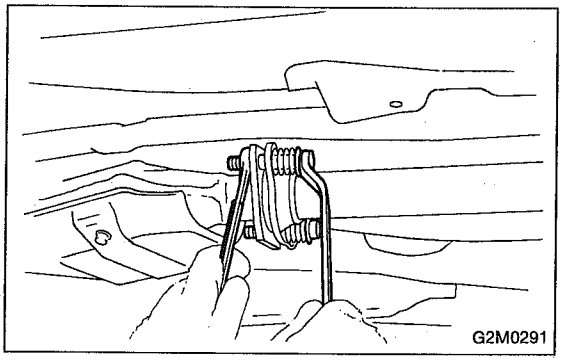


(3) Install hanger bracket on right side of transmission.



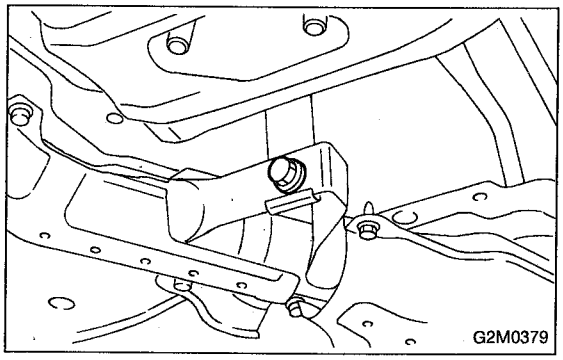
(4) Install front exhaust pipe onto engine.

Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)



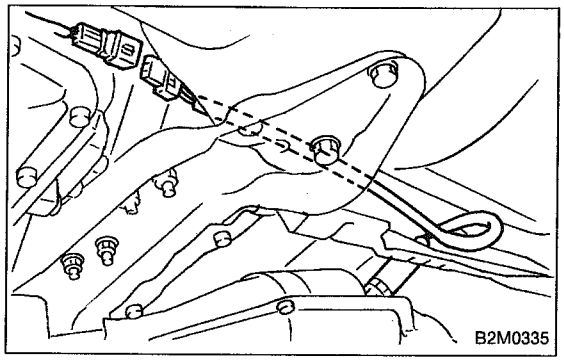
(5) Install center exhaust pipe to rear exhaust pipe.

Tightening torque:
18 ± 5 N·m (1.8 ± 0.5 kg-m, 13.0 ± 3.6 ft-lb)

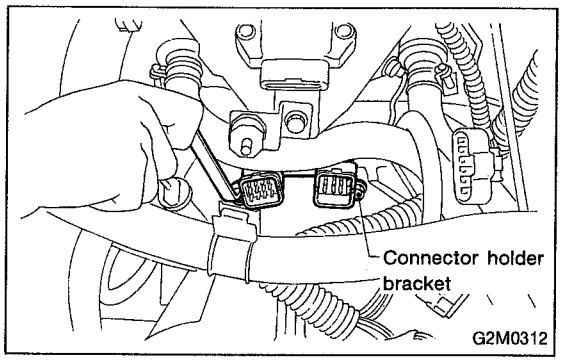


(6) Tighten bolt which installs center exhaust pipe to hunger bracket.

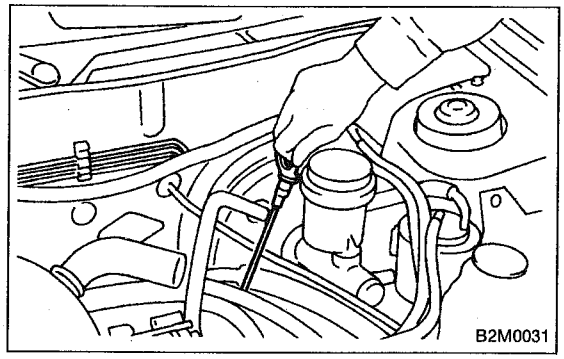
Tightening torque:
30 ± 5 N·m (3.1 ± 0.5 kg-m, 22.4 ± 3.6 ft-lb)



(7) Connect connector to rear oxygen sensor.



16) Install transmission connector holder bracket.

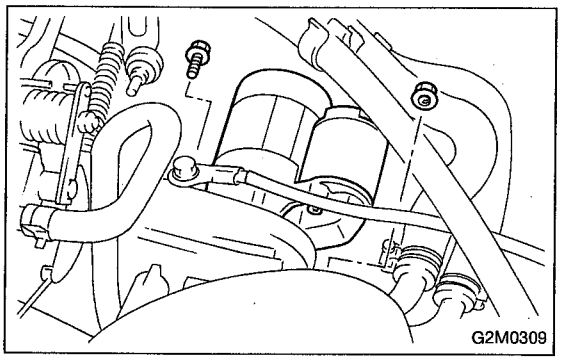


17) Install ATF level gauge. (AT model)

18) Connect connectors and cables.
(1) Connect the following connectors.
- Transmission harness connectors
- Transmission ground terminal
- Front oxygen sensor connector

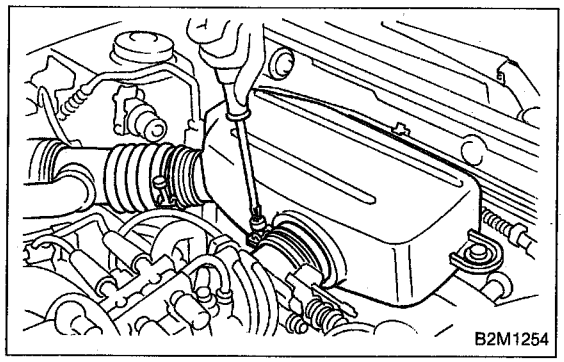
(2) Connect the following cables.
- Cruise control cable

(With cruise control model)
- Clutch cable
- Speedometer cable



19) Install starter.
(1) Install starter onto transmission case, and connect connectors and terminals.
(2) Tighten bolt and nut which install starter onto transmission.

Tightening torque:
40 ± 4 N·m (4.1 ± 0.4 kg-m, 29.7 ± 2.9 ft-lb)



20) Install air intake duct and chamber then connect connector to mass air flow sensor.

21) Connect battery ground cable.
22) Fill ATF. (AT model)
<Ref. to 3-2 [W1B1].>
23) Check selector lever operation. (AT model)
<Ref. to 3-3 [W2C0].>
24) Take off vehicle from lift arms.
25) Check the vehicle on road tester. (AT model)
<Ref. to 3-2 [W7A0].>